UNIVERSITY OF SOUTHAMPTON

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Measuring hand washing behaviour in low income settings: Methodological and validity issues

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ABSTRACT

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MEASURING HAND WASHING BEHAVIOUR IN LOW INCOME SETTINGS: METHODOLOGICAL AND VALIDITY ISSUES

Lisa Odoso Danquah

Significant global health attention and promotion has been focused on hand washing with soap due to the clear benefits observed in promoting and ensuring child health. However, the measurement and evaluation of hand washing behaviours remains complex. The Sanitation, Hygiene Education and Water Supply in Bangladesh Programme (SHEWA-B) is a large project being implemented by the Government of Bangladesh and UNICEF.

This research assessed methodological issues of measuring hand washing behaviours through comparison of structured observation and responses to cross-sectional survey measures (spot-check observation, self-reported hand washing and a hand washing demonstration) and discusses the suitability of indicators. Focus group discussions with fieldworkers were also conducted.

The results of this study indicate that hand washing behaviours were over-reported compared with structured observation findings. This implies that current estimates of hand washing from large scale surveys, for example, Demographic and Health Surveys (DHS) are also likely to be overestimates.

In about 1000 households, approximately 1% or less of female caregivers were observed to wash their hands with soap or ash before preparing food, before eating, and 3% before feeding a child. Hand washing with soap was higher for defecation related events with approximately 29% of female caregivers using soap two thirds or more of the time after cleaning a child's anus/disposing of a child's stools and 38% used soap two-thirds or more of the time after defecation. Soap was observed at the hand washing location in about 50% of the households but actual practice was much lower. Reported knowledge was high; approximately 90% identified the important times for hand washing as being before eating and after defecation and approximately 50% identified before preparing food and after cleaning/changing a baby.

The measurement of hand washing is complex and there has been limited research into the validity of different measurement methods. This research used an epidemiological style approach using the concepts of screening/diagnostic testing and calculation of kappa statistics to assess validity.

In conclusion, this research demonstrates that self report hand washing measures are subject to over reporting. Structured observation provides useful information on directly observed hand washing behaviours and the frequency of behaviours. Spot check methods of soap and hand washing locations also provide more optimistic data than observations and can be used as an alternative to structured observation. In addition, the use of questions on the 24 hour recall of soap and other self report questions on knowledge and the availability of spare soap demonstrate potential for use as potential indicators as an alternative to structured observation. Further validation of measurement methods is required in different country settings.

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Academic Thesis: Declaration of Authorship

I, Lisa Odoso Danquah

declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

Measuring hand washing behaviour in low incomes settings: Methodological and validity issues.

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;

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3. Where I have consulted the published work of others, this is always clearly attributed;

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Curtis, V.A., Danquah, L. O., and Aunger, R. V., **Planned, motivated and habitual hygiene behaviour: an eleven country review** Health Education Research Advance Access published on August 1, 2009, Health Educ. Res. 24: 655-673.

Signed:……………………………………………………………………………………

Date: ……………………………………………………………………………….....

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List of Abbreviations

ALRIs	Acute Lower Respiratory Infections
BDHS	Bangladesh Demographic and Health Survey
CHT	Chittagong Hill Tracts
DFID	Department for International Development
DHS	Demographic and Health Surveys
DPHE	Department for Public Health Engineering
DSS	Demographic Surveillance Site
EHP	Environment and Health Project
FP	False Positives
FN	False Negatives
FRAs	Field Research Assistants
FROs	Field Research Officers
GDP	Gross Domestic Product
GoB	Government of Bangladesh
GPPHW	Global Public Private Partnership for Hand washing
HAIs	Healthcare Associated Infections
HCAIs	Health Care Associated Infections
HIF	Hygiene Improvement Framework
HWWS	Hand washing with soap
ICDDR, B	International Centre for Diarrhoeal Diseases Research, Bangladesh
JMPWSS	Joint Monitoring Programme on Water Supply and Sanitation
LSHTM	London School of Hygiene and Tropical Medicine
MDGs	Millennium Development Goals

MICS	Multiple Indicator Cluster Surveys
NPV	Negative Predictive Value
PPV	Positive Predictive Value
PPS	Probability Proportional to Size
PPPHW	Public Private Partnership for Hand washing
ORT	Oral Rehydration Therapy
RHSWSP	Rural Hygiene, Sanitation and Water Supply Project
SHEWA-B	Sanitation, Hygiene Education and Water Supply in Bangladesh project
SHEWA-B HIS	Sanitation, Hygiene Education and Water Supply in Bangladesh Health Impact Study
TP	True Positive
TN	True Negative
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WHO	World Health Organisation

Executive Summary

The role and potential of hand washing, in particular hand washing with soap, is acknowledged as one of the most cost effective ways of preventing infectious diseases. Hand washing is regarded as a low cost intervention that reduces the incidence of two of the largest killers in children under five: respiratory infections and diarrhoea. Although hand washing in itself is a simple act and a key agent in reducing the transmission of infectious diseases evidence suggests that most mothers in developing and developed countries fail to wash their hands adequately after faecal contact. The WHO advocates for five critical times for which hands should be washed for diarrhoea prevention. The five times are before preparing food, before eating, before feeding a child, after defecation and after cleaning a child's stools.

Bangladesh has a long history of hand washing research and has made significant headway and improvement in infant mortality and other public health gains. However, significant challenges still exist. Diarrhoea and acute respiratory infections are amongst the leading causes of death in children under five years of age. It is estimated that approximately 110,000 children die each year of diarrhoeal disease in the country and in total, 65 million episodes of diarrhoea occur annually.

The role of hand washing as a key agent in the reduction of infection together with the global focus and significance of this practice in behavioural change programmes and interventions highlights the increased need for valid and reliable data on hygiene behaviours and practices. The fundamental feature underpinning this requirement is that valid data is essential so that the method of measurement of hand washing provides an accurate reflection of the normal hand washing practice of the individual.

The measurement of this behaviour and the methods used in the domestic and clinical context have focused on the use of direct observation techniques, survey methods through the use of questionnaires and the use of technological approaches to assess product usage. A variety of

methods and approaches to measuring hand washing behaviour have been adopted in the domestic household environment setting. Three main methods used are:

- Structured observation: this enables the observation of particular specified components of the hand washing process and the frequency of events. It has been widely used and has been identified as the “gold standard”, although there is contention around the existence of a gold standard measure for hand washing due to the presence of reactivity. Additionally, structured observation is labour intensive, requires highly skilled observers and has sample size constraints and may be subject to logistical issues
- Spot check: these are a list of pre-determined conditions observed at one point in time. It has been used widely and offered as a suitable alternative to structured observation, although it has not been well validated. Spot checks provide a “proxy” measure of hand washing behaviour with the advantage that it is less timely to administer than structured observation and less intrusive.
- Questionnaires and self-report methods: Interviewees are asked questions on various aspects of hand washing. The key advantages of this approach are that it can be used on a larger scale and more information can potentially be included. The fundamental criticism of this approach is that it is subject to over-reporting and bias, primarily due to social desirability bias.

The potential benefits and shortcomings of the different measurement methods have been examined, but few studies exist on validating measurement methods. In particular, measurement methods that can be used as an alternative to direct observation techniques are required that can be used on a large scale.

This thesis is focused on the measurement of hand washing behaviour in low income settings. There are two main aims of this research:

- To uncover and capture the important methodological and measurement issues regarding hand washing behaviour and practices in the context of a large scale international household survey, the Demographic and Health Survey (DHS).
- To provide a practical perspective and assess the methodological and validity issues in the context of a validation study of various hand washing measurement methods using a case study of Bangladesh.

Hand Washing in the DHS

Hand washing was measured in the DHS through spot check methods assessing for the availability of a hand washing facility and hand washing materials in households. A further method was the use of self report questions to females on hand washing behaviour after particular critical hand washing times. Data was available for approximately 17 countries overall with data on hand washing. The key finding was that self report questions were over-reported when compared to spot check availability of hand washing facilities and materials. In addition, there was limited focus on critical hand washing times; focusing only on before meal preparation and those that had a designated facility.

Hand washing practices in Bangladesh

The UNICEF Sanitation, Hygiene Education and Water Supply in Bangladesh project, (SHEWA-B) forms the foundation of the case study. This research focuses on the Health Impact Study (HIS) component of the project, and hand washing information collected using multi-method approaches was extracted from the HIS. Hand washing was measured using structured observations for five hours in approximately 1000 households, self report questions, spot check observations on the availability of hand washing facilities and materials and a hand washing demonstration. Additionally, qualitative data from focus group discussions with field workers who conducted the data collection components of the SHEWA-HIS were undertaken.

The methodology used for validating hand washing behaviour measures involved the quantitative assessment of the different hand washing measurement methods using two methods. This included one based on the principles of epidemiological screening/diagnostic testing approaches and the other based on the calculation of kappa statistics. The focus was on female caregivers only and the five critical hand washing times. Structured observation data was taken as the most suitable method, the reference standard, as this was the only method that observed hand washing practice. The other measurement methods were the alternative measures. The overall rationale was to assess whether any alternative indicators from the different measurement methods existed as an alternative to structured observation. The main aim of which was the correct classification of individuals in concordance with similar measurement indicators they were compared to.

Structured observation results: Key findings

- Hand washing with soap was a low priority particularly for food related critical times. Less than 1% of female caregivers were observed to use soap before preparing food and before eating.
- Washing hands with water only was the common practice for food related critical times, with over 95% of female caregivers performing this practice.
- Approximately 50% of female caregivers did not wash hands before feeding a child and approximately a third did not wash hands before preparing food. A further 14% did not washing hands before eating.
- Non compliance with hand washing was lower for defecation related critical times.
- Hand washing with soap was higher for defecation related events with approximately 29% of female caregivers being regular users of soap (greater than two thirds or more of the time) after cleaning a child’s anus/disposing of a child’s stools and 38% after defecation.

Key findings: Self report, spot check observation and hand washing demonstrations

The key findings from the different measurement methods (based on approximately 1000 female caregivers) were as follows:

- Self reported measures of hand washing were over reported compared with actual observed practice through structured observation.
- A greater number of defecation events were reported compared with the observed number of events during structured observation.
- The hand washing location identified for food and defecation related hand washing differed.
- Soap was observed at the hand washing location in about 50% of the households during the spot check observation; however, actual observed practice was much lower.
- Reported hand washing knowledge was high; approximately 90% identified before eating and after defecation as important times and approximately 50% before preparing food and after cleaning/changing a baby.

Validation of hand washing behaviour measures: Key results

- Structured observation indicators compared against the alternative measurement indicators for defecation related critical times fared better than food related critical times, particularly for hand washing events that involved soap use.
- Potential alternatives indicators to structured observation for before preparing food were two self report questions; knowledge of washing hands and the availability of spare soap. A self report event specific question on whether both hands were washed was identified for before eating.
- The self report indicator on the availability of spare soap (for those female caregivers with one and two events) was identified for before feeding a child and an event specific self report question on whether both hands were washed (stratified analysis, one event).
- Two self report indicators and a spot check indicator (soap availability at the hand washing location) were identified after cleaning a child's bottom/disposing of a child's stools:

whether hands were washed and whether soap was used in the past 24 hours after cleaning a child’s bottom

- All indictors identified for after defecation were self report questions (two event specific questions on whether both hands were washed and whether soap was used for hand washing and one on the use of soap in the past 24 hours).
- The same results were identified for the observation of washing both hands with soap for defecation related critical times compared to alternative indicators for after cleaning a child’s bottom/disposing of a child’s stools. The result for after defecation also identified two of the same indicators, both of which were self report questions.

This research demonstrates that the use of multi-method approaches to assess hand washing behaviour provides a key insight to validate different measurement methods. Hand washing behaviour is complex to assess and evaluate. Structured observation approaches provide important information on the frequency of hand washing and observation of hand washing behaviour. There are important factors to consider when capturing events, for example, the timing of the observation.

The use of spot check methods emerged as a useful indicator as an alternative to structured observation. The integration of this approach in DHS instruments has the potential to act as a useful proxy measure to assess hand washing behaviour. The self report indicator which assessed 24 hour recall of soap use also performed well. The approaches to validation require further development. Focus group discussions provide useful information to complement the other methodologies used.

The SHEWA-B HIS baseline data therefore provided a useful and unique opportunity to validate the different measurement methods. The results corroborated those from existing research that proposed the use of spot check methods and questions based on recall methods as alternatives to structured observation when observation is not possible. Structured observation and the use of multiple measurement methods are therefore advocated for to validate and triangulate the results from different approaches.

1 Introduction

Hand washing with soap is regarded as one of the most cost effective ways of preventing infectious diseases. It is now recognised as the “do- it yourself vaccine” when promoted on a large scale due to its ability to interrupt the transmission of infectious disease pathogens and it is cited as being more effective than any single vaccine (PPPHW 2003). Hand washing is regarded as a low cost intervention that reduces the incidence of two of the largest killers in children under five: diarrhoea and respiratory infections (Luby 2001). The importance of hand washing in reducing the transmission of infectious diseases cannot be underestimated.

Hand hygiene is cited as one of the key components of good hygiene practices in the home and community and has been identified to produce significant benefits in the reduction of infections (Bloomfield, Aiello et al. 2007). Its importance is recognised as one of the key criteria for child survival in the UNICEF *State of the World’s Children 2008 Report*. In this report, a number of key agencies, including the World Health Organisation (WHO), have proposed 12 key household practices for neonates and infants that can promote child survival and health and nutrition in communities. Hygiene is one of those practices, specifically better hygiene practices and particularly hand washing with soap (or ash) and the safe disposal of excreta. Hand washing is one of the ways of preventing these infections, therefore reducing diarrhoea by 35%, resulting in a large reduction in childhood diarrhoeal morbidity (UNICEF 2008g). The reduction in diarrhoeal morbidity and mortality is important in achieving the fourth Millennium Development Goal (MDG) of reducing child mortality by two thirds by 2015 (World Bank 2003b).

Every day, on average, more than 26,000 children under the age of five die from preventable diseases. Nearly all of these children live in developing countries. This is exemplified in recent statistics from 2000. Of the 10.9 million that died, almost all the children (99%) were from developing countries, 36% died in Asia and 33% in Africa (World Bank 2003a; UNICEF 2008g). Acute Lower Respiratory Infections (ALRIs including pneumonia, bronchiolitis and bronchitis) and diarrhoeal diseases are the second and third major causes of deaths in children under the age of five and neonates in the world at 19% and 17% respectively (WHO 2005a).

Although hand washing in itself is a simple act, evidence suggests that most mothers in developing and developed countries fail to wash their hands adequately after faecal contact. Estimates from studies conducted in the developing world indicate that on average less than 20% of mothers wash their hands with soap after cleaning up a child or going to the toilet themselves (Curtis and Cairncross 2003; PPPHW 2003). Studies have tended to be targeted at mothers and female caregivers as they are identified to be the primary caregivers of children less than five years of age. This is one of the fundamental reasons why the promotion of hand washing as a public health intervention has the potential to have an enormous impact on public health (Curtis and Cairncross 2003). The increased need for valid and reliable data on hygiene behaviours and practices is necessary in order to appropriately plan, monitor and evaluate hygiene promotion programmes and interventions (Alemdom, Blumenthal et al. 1997; Manun'Ebo, Cousens et al. 1997). This is in order to measure changes appropriately in hand washing behaviours and to estimate the health impact of programme interventions.

The need for valid data on hand washing is required so that the method of measurement of hand washing provides an accurate reflection of the normal hand washing practice of the individual. This also relates to validity of the measure. The study of hand washing behaviour is complex and the measurement approaches to examine the behaviour require validation. The use of direct observation techniques, such as structured observation is to date identified as the measurement method that best provides information on actual hand washing practice. Structured observation enables the observation of particular specified components of the hand washing process and the frequency of events (Bentley, Boot et al. 1994). This approach however is expensive to use on a large scale and may be subject to reactivity, whereby an individual modifies their behaviour due to the presence of an observer (The Hawthorne effect) (Environment and Health Project 2004). Other alternative measurement methods, for example, self report, spot check observations and hand washing demonstrations that could potentially be used to assess hand washing behaviour on a large scale have not been well validated against direct observation measures to identify whether they can be used as an alternative in large scale surveys such as the Demographic and Health Survey (DHS) and Multiple Indicator Cluster Surveys (MICS).

The first aim of this research is to examine the measurement and methodological issues of measuring hand washing behaviours used in Demographic and Health Surveys (DHS). The second aim is to validate and evaluate the different measurement methods used within a large-scale hygiene promotion programme, the UNICEF Sanitation, Hygiene Education and Water Supply in Bangladesh project (SHEWA-B). This programme uses data collected through direct observation in the form of structured observation and self report questions a spot check observation and a hand washing demonstration. The rationale is to identify whether there are any alternative measurement methods that can be used apart from structured observation. The outcome of this research is to improve and inform hand washing measures and hand washing promotion, particularly in low-income settings.

The role of hand hygiene in reducing Hospital Acquired Infections (HAIs) has received increased attention and widespread discussion within the field of public health. However, the role and promotion of hand washing in the domestic and community setting has not received as much attention. At the global level, hygiene for patient safety and reducing HAIs is endorsed by the WHO in the first ever Global Patient Safety Challenge that emphasises that “Clean Care is Safer Care” (WHO 2005b). The core message of this campaign is that simple measures can save lives and that hand hygiene is a simple action that can greatly reduce Health Care Associated Infections (HCAIs) and its risks (WHO 2005b). The measurement of compliance to hand hygiene protocols in the clinical setting is also subject to similar measurement and methodological issues as similar approaches are used, in particular direct observation techniques, self report methods through the use of surveys and through product usage (Haas and Larson 2007) . Therefore the outcomes of this research are also applicable within this context.

To date, four countries have national hand washing campaigns as part of the Global Public Private Partnership for Hand washing with Soap (PPPHW): Ghana, Nepal, Peru and Senegal. A number of other countries have conducted baselines studies and formative research to provide and initiate national hand washing campaigns bringing together the public and private sectors and some are in the process of implementing national hand washing campaigns (Health in Your Hands 2008a). The countries include Uganda, Tanzania, India (Kerala), Indonesia, Kenya, China, Vietnam, Columbia, Kyrgyzstan and a number of hygiene promotion activities are being conducted in Pakistan, Bangladesh and Nigeria. This highlights the recognition and attention on a global scale of the fundamental importance of hand washing and in particular, hand washing with soap (Curtis, Danquah et al. 2007). One of the main measurement approaches used to acquire information on hand washing practices is structured observation.

This introductory chapter provides a brief overview of the importance of hand washing and hygiene for child health, through a review of existing published and grey literature on the topic together with a discussion of survey approaches to assessing hand washing in DHS. A review of the indicators on hand washing behaviours introducing the measurement and methodological issues on hand washing follows. In addition, this chapter has a statement of the research problem underlying the rationale for the research and the research questions to be addressed.

1.1 Child health

Diarrhoeal diseases account for 4% of the global disease burden. An estimated 88% of this burden is attributable to unsafe drinking water, inadequate sanitation and poor hygiene (World Bank 2003b; UNICEF 2008g). There are approximately 4 billion cases of diarrhoea per year, resulting in 2.2 million deaths, and 1.7 million in children under the age of five. Diarrhoeal diseases account for almost 15% of all under five deaths in developing countries (World Bank 2003b).

Improvements in water supply, sanitation and hygiene promote notable reductions in diarrhoeal morbidity (Esrey, Feachem et al. 1985; Curtis and Cairncross 2003). Interventions resulting in improved water supply are identified to reduced diarrhoeal morbidity by between 6% and 25%. Improved sanitation reduced diarrhoeal morbidity by 32%, whilst interventions promoting hygiene, including hygiene education and the promotion of hand washing can lead to a reduction in diarrhoeal diseases of up to 45% (WHO 2004). Therefore, hygiene promotion, in particular hand washing, is one of the principal determinants in reducing diarrhoea morbidity.

Improvements in drinking water quality do not have the same effect. This is because most endemic diarrhoea is not water-borne, but transmitted via person to person contact by poor hygiene practices, therefore, an increase in the water quantity has a greater health impact than improved water quality because it makes it feasible for people to adopt safe hygiene behaviours (World Bank 2003b). Water supplies are likely to have an effect on diarrhoeal disease when they lead to behaviour change and the health benefits of water supply are most likely to be realised when the time saving benefit is the greatest. The example given is when the old source of water is farthest away and the new source is on the plot of the individual household (Cairncross and Valdmanis 2006).

1.2 Evidence from Demographic and Health Surveys

The importance of hand washing and access to hand washing facilities and materials has been recognised within the internationally renowned MEASURE DHS programme. This programme is responsible for collecting household survey data in a range of low income countries. The fourth phase of the programme (post 1998) was conducted by Macro International in partnership with a number of other agencies (MEASURE DHS 2008b). In this phase, data was collected on materials available for hand washing including the presence of a place for hand washing in the household, the presence of water/tap, the presence of soap/ash or another cleansing agent and the presence of a basin in the household. The connection between hand washing and diarrhoea is highlighted in the DHS literature, as access and proximity of hand washing materials increase the frequency of hand washing which in turn substantially decreases the occurrence of diarrhoea in young children (ORC Macro 2001a; ORC Macro 2001b).

However, the assessment and potential use of this data for analysis from a public health perspective has not been fully recognised or utilised. This research therefore seeks to utilise this data and critically assess the measurement methods used to obtain data on hand washing behaviours. The methods used to obtain data on hand washing materials and facilities in the DHS programme were obtained using both spot check observations by interviewers and self-report questions to mothers. Spot check methods refer to a list of pre-determined conditions observed at one point in time. They provide proxy information on behaviour. Spot checks methods are regarded as a useful proxy measure for hygiene behaviour and practice and are viewed as a reasonably reliable source of information to collect data on the availability of software and hardware for hand washing, and associated hygiene practices. On the other hand, self-report measures have received widespread criticism, as discussed in the next chapter. Self report methods are typically based on questions asked in questionnaires. This method enables an individual to report a particular practice or behaviour. There is increasing debate regarding how to measure hand washing behaviour due to the need for rapid, reliable and valid hand washing indicators (Ruel and Arimond 2002; IRC 2003).

Macro International have identified that they have experienced a number of problems and challenges in developing appropriate survey questions on hand washing and hand washing behaviour in their household surveys. These discussions indicate that the questions have been the most difficult to design due to there being little consensus on how to ask questions that collect reliable information on hand washing. This led to the development of new questions that were tested in the Nepal and Peru 2006 DHS (Arnold 2006; Arnold 2007).

The investigation of the validity of measurement methods to assess hand washing behaviour and associated methodological issues is of value as the questions on hand washing materials and facilities in the DHS questionnaire were obtained during the survey via the spot-check method. This method has not been well validated against other measurement methods. However, as stated above, the challenges and problems faced in the design and collection of questions on hand washing has led ORC Macro to change the questions on hand washing behaviour in the most recent Nepal and Peru 2006 DHS to questions that focused on respondent recall of hand washing and soap use in the past 24 hours and abandon previous spot check methods. Currently, there are no questions on hand washing in the most recent DHS due to the difficulties highlighted. The appropriateness, reliability and validity of hand washing measures therefore needs to be analysed, given the discussion on the measurement of hand washing in the next chapter and that there has been no formal evaluation of the DHS questions on hand washing and other measurement approaches in general (Arnold 2007).

1.3 Why is it important to focus on hand washing measurement and validate the different measurement methods?

To date, there is no available research that directly attempts to validate and evaluate DHS approaches on hand washing measurement in conjunction with other approaches. There appears to be a lack of available data on the methodological and practical issues facing fieldworkers when attempting to collect data on hand washing behaviours and practices. Structured observation is regarded as the most suitable method to collect information on actual hand washing behaviour. However, the use of this approach on a large scale presents challenges relating to cost, sample size and the labour intensiveness of the method. Spot check methods have therefore been proposed as a potential suitable alternative. Furthermore, technological innovations such as the use of smart soap bars fitted with electronic logger devices known as soap loggers, tested by Unilever in studies in India and Bangladesh to monitor soap use and behaviours, heightens the call for further research into appropriate methodologies to measure hand washing behaviours (GPPHW 2007b).

The investigation of the validity of measurement methods and indicators on hand washing has been limited. It is required in order to assess whether any suitable alternatives to structured observation exist that can be potentially used on a large scale to evaluate hygiene promotion initiatives and in international household surveys such as the DHS.

1.4 Contribution of this research

The contribution and purpose of this research is twofold. Firstly, in terms of originality and secondly to advance and contribute towards knowledge and understanding in the measurement and methodological issues of assessing hand washing behaviour. In terms of originality, this research successfully identified, communicated and involved working with and contributing to the implementation of a large-scale hygiene promotion programme in a low-income developing country setting, where morbidity and mortality from infectious diseases remains a significant public health issue. The focus of this research is on a topic that is of fundamental public health importance particularly for child survival and reducing the burden and effect of infectious diseases among children under five which is amongst the MDGs.

Importantly, this is an area of research that has not received significant attention until recently where the role of hand washing for improving and sustaining child health has observed clear health benefits. However, as previously stated, hand washing is a low cost intervention that can substantially reduce the burden of infectious diseases, particularly in low-income settings. The focus to date has been very much on hand hygiene and the role of hand washing in the clinical setting.

The potential and importance of hand washing in the domestic setting has only of late received attention on the global public health agenda. In addition, this research focuses on Bangladesh, where, despite a long history of hand washing and hygiene promotion efforts, particularly in the early 1990s, there have not been any indicators on hand washing included in any of the Bangladesh Demographic and Health Surveys (BDHS).

This point was raised with the implementer of the BDHS in Bangladesh, who stated that given the importance of diarrhoea and the history of this in Bangladesh that this is extremely surprising (Streatfield 2007). Furthermore, in terms of contribution, this research examined the existing DHS indicators on hand washing, argued, and advocated for the need to validate and evaluate these indicators within a large-scale hygiene promotion intervention project, the UNICEF SHEWA-B Health Impact Study. This research therefore goes beyond analysing existing DHS data to provide a thorough critique of the measurement methods and directly attempt to validate the measurement methods through involvement in large-scale public health research intervention in hygiene promotion. The purpose of this research, therefore, is to understand, improve and inform the development and design of hand washing measures and identify whether any other alternative measurement exist apart from direct observation techniques, in this case structured observation.

This research, therefore, puts the topic of hand washing into a real life context and goes beyond examining the available DHS indicators that pose particular difficulties and challenges regarding measurement and methodological issues discussed in Chapter 3. This research seeks to understand and investigate different methods used to measure hand washing, the methodological, practical issues and constraints, regarding not only survey design, but also implementation of the survey instruments in the field setting. This is achieved through focus group discussions with fieldworkers to advance understanding of the issues faced by them in the collection of high quality data in terms of the methodological aspects of measuring hand washing.

Secondly, this research not only focuses on the measurement and methodological issues but also involves the analysis of secondary data in the form of quantitative analysis of the SHEWA-B data. The rationale is to validate the different measurement methods using the concepts of screening/diagnostic testing through sensitivity, specificity, positive predictive and negative predictive values and the calculation of kappa statistics.

Overall, this research is aimed at improving and informing DHS indicators on hand washing behaviour and other large scale hand washing programmes and informing policy and initiatives on hand washing, in particular hand washing with soap. This will be undertaken through validating hand washing measurement methods obtained from a large scale hand washing programme. This will examine, explore and inform measurement and methodological issues pertaining to hygiene promotion programmes, particularly hand washing, and the way in which these issues are being addressed and issues pertaining to promoting hand washing in low-income settings together with policy recommendations.

1.5 Aims and objectives

The main aim of this research is to be able to uncover and capture the important methodological and measurement issues regarding hand washing behaviour and practices, particularly for child health. This research seeks to give a real life perspective of the situation and context and go beyond analysing the available data in the form of DHS to providing a critical assessment of the methods and measures used to assess hand washing. This study seeks to evaluate and validate DHS hand washing indicators in the context of a case study of Bangladesh and identify if alternative measurement methods can be used apart from structured observation.

This research seeks to demonstrate the issues and challenges of measuring and promoting hand washing behaviour and inform policy and initiatives within the field to improve research on hand washing, in particular, hand washing with soap as a global public health priority, particularly in low-income developing country settings.

The main research questions and statements are featured below. Firstly, the focus is to review and analyse whether existing methods of hand washing measurement are appropriate and discuss what constitutes appropriateness in this context. This is through the examination and review of existing DHS methods on measuring hand washing and assessment and discussion of data quality and methodological issues of the existing approaches from available country data.

Secondly, a validation and evaluation study of existing DHS hand washing measures. This is conducted through a case study approach using Bangladesh as an example, through the UNICEF SHEWA-B project. This case study seeks to provide a detailed analysis and form the basis to review and evaluate the DHS measures on hand washing survey methodology and other data collection procedures for example, structured observation. This case study provides an excellent platform for using and validating multiple measurement approaches assessing hand washing behaviours. The focal areas addressed include survey design, implementation, methodological/data quality issues and improving and informing approaches to measuring hand washing. This will ultimately result in a review of the possibility of incorporating existing and alternative measurement approaches into a cross sectional survey such as the DHS and how the findings from the multiple measurement methods of hand washing can be used to inform DHS methodology on measuring hand washing behaviour.

The main research questions and objectives proposed are as follows:

1. How valid and reliable are the DHS methods to measure hand washing and how feasible are the results obtained?
2. To examine and validate the measurement methods used to assess hand washing behaviour using Bangladesh as a case study through the UNICEF SHEWA-B project

The specific sub-questions are:

i. Are the DHS indicators and approaches to measuring hand washing behaviour accurately capturing hand washing behaviour?

ii. What are valid, reliable and useful indicators for hand washing that can be considered as an alternative to structured observation?

iii. What are the measurement, methodological and practical issues associated with the different measurement methods to assess hand washing behaviours?

The final feature of this research is recommendations as to how the measurement and methodological issues regarding hand washing can be addressed.

1.6 Structure of the thesis

This thesis is structured into nine chapters. The first chapter introduces the research and the rationale for the research and outlines the main research questions. The second chapter focuses on reviewing the literature on hand washing from the perspective of the importance of hand washing behaviour and practice for child health and ensuring child survival through reviewing current public health and epidemiological knowledge and public health initiatives aimed at promoting hand washing, particularly hand washing with soap. This chapter also examines the role of hand washing agents, methods for measuring hand washing behaviour and methodological issues associated with the various approaches, definitions of appropriate hand washing behaviours and lastly a discussion on the determinants of hand washing.

The third chapter focuses on the DHS, in particular, reviewing the history and development of questions and measurement methods on measuring hand washing and hygiene and the methodological issues of these measurement methods. Furthermore, a detailed assessment of the measurement methods for measuring hand washing in the various surveyed countries particularly focusing on data quality issues for available hand washing indicators. Lastly, an overview and discussion on the evaluation and validation of DHS data in the wider context focusing on research conducted to improve methodology and data quality of DHS data in general.

The fourth chapter introduces and provides an overview of Bangladesh, the case study area for validating and evaluating the DHS hand washing indicators and other measurement methods for assessing hand washing behaviours. This chapter mainly focuses on providing a review and insight on Bangladesh, the history of hand washing research in the country and introduces the SHEWA-B programme.

The fifth chapter examines the background and rationale of the project and examines the methodologies used in the SHEWA-B project together with the methods employed for this research of a mixed methodology case study design approach. It then provides a detailed description of the measurement methods used to measure hand washing behaviour and the integration of the DHS hand washing indicators into the SHEWA-B project. This chapter also focuses on the role of focus groups conducted in Bangladesh with fieldworkers to assess and examine data quality and methodological issues and data quality issues. Lastly, the two approaches taken to validate the different measurement methods are discussed. The approaches include an approach using the concepts of an epidemiological screening test style approach and calculation of kappa scores to assess reliability.

The sixth chapter provides an overview of the results of female caregiver hand washing behaviour from structured observations and the different methods used in the cross sectional survey consisting of self reported hand washing, spot check methods and a hand washing demonstration. The main focus will be on food and defecation related hand washing behaviour. The data in this chapter is analysed in two forms, firstly on a hand washing event only basis and subsequently through assessing the overall hand washing behaviour of the main female caregiver for the five critical times to acquire an overview of her overall hand washing practice.

The seventh chapter provides an investigation of the validation of hand washing behaviour measures and the utility of the different measurement approaches compared with structured observation. It aims to determine whether there are any suitable and valid measures from methods aside from structured observation that can be used to assess hand washing behaviours that replicates the results obtained from structured observation. This is achieved through using an epidemiological style approach using the concepts of sensitivity, specificity, positive predictive and negative predictive values and calculations of kappa statistics. This chapter assess the five critical hand washing times of before preparing food, before eating, before feeding a child, after cleaning a child’s bottom/disposing of a child’s stools and after defecation.

The eighth chapter focuses on the findings of the two results chapters and places the results within the context of the objectives of the research. Firstly, a discussion of the different hand washing measures in general will be conducted, followed by the results of the validation of the measures and framing this in the context of public health, hygiene promotion and policy implications. The discussion will be highlighted with results from focus group discussions with fieldworkers. The applicability of the findings in relation to DHS approaches to assess hand washing is also discussed. Lastly, this chapter discusses the limitations of the research and recommendations are made as to measurement and methodological considerations in the future design of indicators on hand washing behaviour and future work directions.

The final chapter of this thesis is the conclusion. This chapter will conclude on the overall findings of the research. Firstly, the rationale of the research is given. The purpose of the research is revisited and the importance of the role of measuring hand washing and validating measurement methods. The main approaches to the measurement of hand washing within the domestic and clinical setting are outlined along with the main measurement and methodological issues. The methods used in the DHS are examined together with a critique of the different measurement methods. The focus of this research, the validation of different measurement methods through a case study of Bangladesh is examined and the major findings. This is then discussed in the context of DHS measurement methods and how the findings implicate on the future design and adoption of hand washing measurement methods in future DHS and other large scale household surveys. Lastly, this chapter proposes future work and scope for development.

2 Literature Review

The role of this chapter is to assess existing literature on hand washing and provide a basis and aid for the development of this research. The first section of the review focuses on what constitutes valid data in the context of hand washing together with a discussion of survey definitions of hand washing from an international household survey perspective. The focus of the review then proceeds to current public health guidelines on hand washing and how it should be performed and a review of survey measurement issues more broadly.

A review of the measurement methods in the domestic setting forms the foundation of this chapter together with a wider discussion of the importance of monitoring and evaluation more broadly in the water and sanitation sector. The assessment of measurement methods used in the clinical setting is discussed. The focus then turns to current knowledge in latter sections of this chapter. The focal point of this section is the importance of hand washing in reducing infectious diseases. A review is given of hand washing research and activities in Bangladesh and survey approaches to assessing hand washing. Furthermore, to frame the research in the global context, an overview of formative research studies from around the world is given. Similarly, a review of studies focused on knowledge and determinants of hand washing is given. Lastly, a summary of the literature review is given, highlighting the role and purpose of this thesis based on the findings of the literature review.

2.1 Valid data requirements

The need for valid data is required so that the method of measurement of hand washing provides an accurate reflection of the normal hand washing practice of the individual. This also relates to reliability of the measure. This is fundamentally important given that available DHS hand washing data from a variety of countries is being used and cited within the international community. For example, the World Bank and other collaborating agencies recently produced a report based on environmental and social measures featuring an indicator on mothers' hand washing practice and access to hand washing facilities and materials based on existing DHS country data (Gwatkin, Rutstein et al. 2007). If such data has data quality issues regarding validity and reliability but is being used in such a way, this may influence policy initiatives and campaigns, and lead to misleading information regarding rates of hand washing and the availability of materials.

In addition, one of the Millennium Development Goals (MDGs) is to reduce infant and child mortality by two-thirds by the year 2015. The intermediate mechanism through which this acts is to reduce diarrhoea morbidity and mortality, with the target group being children under the age of five. Two of the key behavioural features to monitor the achievement of this goal, given by the World Bank, are hand washing with soap and sanitation. The interventions of importance are regarded as demonstrating good hand washing behaviour, education on when to wash hands, hygiene education and the provision of soap. The target group specified are people caring for children and preparing food for children under five years of age. The indicator used to assess this is the percentage of child caregivers and food preparers with appropriate hand washing behaviour. Appropriate hand washing in this context includes both washing after handling faeces and before food preparation and also the technique used (World Bank 2003b).

2.2 Survey definitions of hand washing

The correct technique is stated as the use of soap, ash or other aid, for long enough, using clean water. Most importantly, is that the measurement indicators used to assess this are given as DHS data and the second source used is the UNICEF Multiple Indictor Cluster Survey (MICS). Therefore, the data from the DHS and MICS on hand washing is contributing to the assessment of important milestones globally on child mortality and the reduction of diarrhoea morbidity and mortality. If the indicators used to measure hand washing in the DHS and MICS are of questionable quality and do not provide an accurate representation and interpretation of what constitutes hand washing and how and when it is practised then this is a very important issue. This can result in serious implications in the use of this data at such a level and assessment of how these targets are reached (World Bank 2003b).

Furthermore, from a monitoring and evaluation perspective, there is a need to assess changes in and sustainability of hand washing behaviour to examine the successfulness and effectiveness of hygiene promotion programmes. If inappropriate or misleading methods producing indicators that do not accurately reflect the true hand washing practice are used, then this results in inaccurate misleading results. In addition, other programmes and initiatives may adopt particular methods to measure hand washing that have featured in other large-scale surveys that have not been adequately validated, again resulting in highly questionable findings. For example, the MICS uses and bases many of its indicators on those used in the DHS as there has been an increased need towards the standardisation of survey questions, primarily for comparability purposes. This is again an issue regarding the validity and reliability of the data produced.

The need for appropriate measurement indicators in the field of water and sanitation at the global level has fuelled interest and reignited the debate on measurement issues. With 2008 being the International Year of Sanitation (IYS), the focus has been very much on sanitation issues globally. An editorial report featured in the Lancet argued that although 2008 was an important year in terms of the IYS, sanitation as a global health priority has languished at the bottom of the international policy agenda for far too long. The report concluded that the global community has been complicit in it staying there. The author urges that this is a global priority that now has to be taken seriously (The Lancet 2006; The Lancet 2008).

2.2.1 Defining appropriate hand washing behaviour

One of the most fundamental and crucial features of this research is the definition of what exactly appropriate hand washing behaviour is, and the measurement issues that surround this. The Hygiene Improvement Framework (HIF) defines appropriate hand washing as consisting of three main elements: hand washing supplies, hand washing technique and hand washing at critical moments. It defines that a person's ability to wash hands at appropriate times depends on whether households have immediate and easy access to all of the supplies that are necessary for hand washing and that are ideally located in the specific place. The supplies are water from a tap or container, soap, ash or other detergent, a device that facilitates unassisted hand washing, such devices are defined as a basin, sink, bucket or tippy tap and a clean towel or cloth, although air drying is cited as being acceptable.

There has been much debate about what constitutes appropriate hand washing. The HIF proposes the use of water, soap ash or other detergent, washing both hands and rubbing hands together at least three times with the appropriate drying of hands either by air of through the use of clean cloth (Environment and Health Project 2004).

The WHO defines five critical times to wash hands for the prevention of diarrhoeal diseases as:

- After defecation
- After handling child faeces or cleaning a child's bottom
- Before preparing food
- Before feeding a child
- Before eating (Environment and Health Project 2004)

2.2.2 Appropriateness and validity of hand washing measures and survey measurement issues

Within the hand washing field, there is widespread acknowledgement that evaluating hand washing behaviour is very difficult. To date there is no robust and well studied method for evaluating hand washing that is widely accepted as providing reliable results (ICDDR-B 2007b).

For a measure to be considered valid and appropriate, there are three fundamental features that should be taken into account. These are the reliability and validity of the indicator and also the reactivity (Ruel and Arimond 2002). Validity refers to whether the measurement actually reflects the truth, so in this case does the specific measure of hygiene behaviours and practices actually reflect what happens over a particular timeframe.

Reliability relates to replicability or representativeness of the data collected. In this instance, whether repeated measurements would provide the same answer. Reactivity influences obtaining a reliable picture of actual behaviour and is said to comprise both validity and reliability. Reactivity refers to when people may react or behave differently when they know that they are being observed. The issue here is that the person who is observing, the observer, cannot see the true usual practice. Therefore, the measure is not valid as the practice changes between visits, the measure is not reliable (Bentley, Boot et al. 1994; Ruel and Arimond 2002).

An assessment of the validity of water, sanitation and hygiene indicators was undertaken in work by Bostoen assessing access and practice. In this research, hand washing behaviour was assessed and hygiene behaviour indicators were created to distinguish between “improved” and “non-improved” behaviours. The approach taken was based on a screening/diagnostic test approach whereby the validation data taken as access or practice was assumed to be the “gold standard” through comparing structured observation with survey approaches. Other methods were also considered to assess the validity of the findings including focus groups discussions, key informant interviews and community mapping in addition to conducting surveys in an area where access figures were already known.

The main issue was that there was a limited number of hand washing observations from structured observation and a low prevalence of good hygiene behaviour. This made validation almost impossible, so it was difficult to reach any conclusion and calculate sensitivity and specificity. Also, the observations used in the validation did not provide a reliable gold standard to allow comparison with other indicator, in addition to the difficulty of how to define good hygiene behaviour (Bostoen 2007). This research therefore contributes through being able to assess the validity of the different approaches to measuring hand washing for the five critical hand washing times promoted.

2.2.3 Measurement considerations in survey research

The important issues of accuracy and consistency in measurement are key factors in the collection of high quality data. A major source of error in studies is the poor quality of measurement. Often, the only way to assess the accuracy and consistency of measures is post study. It is therefore important to conduct pilot studies prior to actual implementation of research. Pilot testing enables testing of measurement items. The main ways accuracy and consistency are assessed is through the assessment of validity and reliability. Validity relates to the accuracy of the measure. In general this means whether the measure is actually measuring the construct it should be measuring.

There are four main ways in which validity is assessed; face, content, construct and criterion validity. The first two ways are thought of as being subjective ways in which validity is assessed. Face and content validity are concerned with whether the measure obtained the desired result.

This is usually achieved through a consensus in the subject area of what constitutes the desired result. Content validity is generally concerned with whether the measure covered all of the areas of the data. This approach is again based on the consensus that has been established within the subject area. The two latter ways in which validity is assessed; construct and criterion validity are thought of as improved ways of assessing validity. This form of validity is based on the results of the data. In general this method of assessing validity assesses whether the construct being measured is generally aligned in the correct direction in terms of different measurement items.

Criterion validity is concerned with assessing whether results from an item or set of measures (scale) are similar to ones set by an external standard or criteria. This form of validity is useful for constructs that are difficult to measure. A further type of this form of validity is predictive validity. This form of validity is concerned with how accurately the measures used predict a future outcome. This method is useful when assessed on a statistical basis to see whether the measure was able to accurately predict a future outcome.

Reliability relates to the consistency of a measure. This is concerned with the repeatability of a measure. This refers to the same results being produced if a measure were to be used again. The ways in which reliability is assessed is through test-retest, parallel forms, split-half and interrater reliability. Test-retest reliability is concerned with the consistency each time a measure is tested and retested. Parallel form reliability is concerned with how consistently a construct is being measured. This is achieved through comparing it to a measure that is equivalent or a set of items externally or internally. A further extension of this is inter-item reliability. This is concerned with whether similar items in a questionnaire are compared. The purpose of which is to see whether there is consistency within the measurement.

Split-half reliability is concerned with internal stability of measurement items. This is achieved through selecting a group of items that have been used to measure a construct and then comparing the responses within this group. Interrater reliability typically refers to open ended questions which are then coded. In order to code this data, qualitative techniques are used. This form of validity assesses the degree to which the coder agreed. It is important to understand that a construct being valid does not necessarily mean that the construct is also reliable. In addition, validity is of limited value if a measure is not reliable (Nardi 2006).

The design and development of valid and reliable survey research is essential in the collection of high quality data. Therefore, it is necessary to develop survey instruments that are well written and manageable. The focus in the context of this research which relies on the use of survey instruments in the form of questionnaires, structured observation instrument and focus group interview schedules means that these important factors need to be taken into account. The nature of the research theme, hand washing behaviour, is one that is sensitive in nature. Such a behaviour results in the need for a different structure formats of questions, for example, open and closed ended questions, filtered and contingency questions, which are questions whereby the focus in on only those respondents that answer yes, knowledge based questions and leading questions. One of the most important forms of questions is that on measuring behaviour.

The complexity of measuring behaviour through the use of questionnaires is one that is of importance in this research and is later discussed. The important validity and reliability issues here are that the use of a questionnaire to assess such behaviour is in fact, a measurement of what people report that they do. There are issues related to recall and unwillingness to report undesirable behaviours. It is therefore important to discuss reporting on sensitive topics and areas pertaining to social desirability. This refers to the respondents answering questions in a nature that is within socially accepted norms or boundaries, which is not in fact in line with their actual behaviour (Tourangeau, Rips et al. 2000; Nardi 2006).

In order to assess the accuracy of survey reports, there are four basic methods. The first of which is to compare the estimates from survey reports with estimates from alternative forms of data, the second is to compare individual responses with external validation data, thirdly to assess the comparison between estimates based on two different survey sources and lastly to make comparisons between individual survey responses from two or more respondents who are expected to agree with each other (Nardi 2006).

Measurement error is the difference between the value of a characteristics provided by respondents and the true (unknown) value of that characteristic. The main sources of error in sample surveys include questionnaire, data-collection mode, interviewer and the respondent. The sources of measurement error through questionnaires are those based on the effect of the questionnaire design. Similarly, for data collection mode measurement errors, this is based on the how the questionnaire was administered to the respondent. The interviewer and respondent measurement errors are those based on the effect the interviewer had on the response to questions and the effect of the way in which the respondent may interpret the meaning of the question differently (Groves 1989; United Nations 2005). The approaches used to validate the different forms of data on hand washing data and assessment of measurement errors are discussed in Chapter 7.

2.3 Methods for measuring hand washing practices and behaviours

A range of methods and approaches have been used to measure hand washing behaviours and practices in the domestic household environment setting. The measurement of hand washing behaviour and practices has been widely discussed in the literature. In particular the validity, reliability and reactivity of methods for measuring hand washing behaviours and practices is of particular concern and has received much attention (Luby 2001). The study of such a behaviour is complex (Curtis and Cairncross 2003).This section reviews in greater detail the methods that have been used to measure hand washing behaviours and practices and discusses the measurement, methodological and practical issues associated with such methods.

2.3.1 Structured observations

The use of structured observation to assess hand washing behaviours provides an important and useful insight on the frequency in which hand washing events occur and what individuals do on specific occasions. Structured observation enables the observation of particular specified practices, for example, whether hands were washed, were both hands washed, whether soap was used or other hand washing materials and how hands were dried. Therefore, this provides a method of capturing an individual's behaviour on the day of observation over a specified time period (Bentley, Boot et al. 1994).

Structured observations refer to observers having a list of specific actions that act as a structure for observing people directly in their household environment. This can take place for several hours per day and with repeated observations on different days (Environment and Health Project 2004). This approach has been widely used and has been identified by some commentators as the gold standard until there are sufficient completed studies that have been conducted in a range of settings that have been able to validate new indicators (Schmidt, Bostoen et al. 2006). However, within the hand washing literature there is great contention regarding the existence of a gold standard measure for hand washing.

The contention appears to surround the feasibility of the use of structured observation as a standard approach to collect information on hand washing behaviour. Furthermore, there are issues that will be discussed later surrounding reactivity and the behaviour of those observed in the presence of an observer. Structured observations may be useful in particular settings and situations, but may not be suitable for example when information is required quickly. This is due to the reasons pertaining to the method being highly labour intensive and the requirement of intensive training of observers on how to conduct structured observations properly. What is advocated is a need for reliable and valid indicators that may involve the use of a variety of approaches (Bentley, Boot et al. 1994; Webb, Stein et al. 2006; Scott, Lawson et al. 2007)

There have been a number of studies that have used this method, in Ghana for the PPPHW, Burkina Faso, India, Botswana, and Zaire (Curtis, Cousens et al. 1993; Kaltenthaler and Drasar 1996; Manun'Ebo, Cousens et al. 1997; Curtis, Rabie et al. 2002; LSHTM and WHO 2005). Structured observations tend to be conducted in the morning between 6 am and midday as it is seen that the majority of hands washing events of interest take place during this time. This for example can be when people eat breakfast, have lunch, cook and perform other household chores and duties and other events that take place during the day that are not restricted to the time of day, for example, toilet related behaviours (Curtis, Kanki et al. 1995; Manun'Ebo, Cousens et al. 1997; LSHTM and WHO 2005).

Key findings from studies, for example that of Cousens et al (Cousens, Kanki et al. 1996) in Burkina Faso found that at the population level using this technique would be useful, however the repeatability at the individual level was found to be low. At the individual level, the study identified that repeated structured observations of mothers and children are required for studies examining hygiene behaviour and diarrhoea incidence. This is due to the difficulty of measuring behaviour during a single observation, leading to misclassification of exposure status, and resulting in bias that could mask any underlying association. The disadvantage cited is that such an approach would be costly.

A recent study conducted in India investigating the short-term effectiveness of a soap promotion intervention, based on hygiene education to increase hand washing with soap on key occasions, identified that structured observation in combination with other tools can be used to rigorously evaluate hygiene promotion campaigns and other behaviour change interventions. The paper highlighted some of the logistical problems such as timing and accessing study participants when conducting structured observations (Biran, Schmidt et al. 2007).

Structured observations have the disadvantage that they are highly time consuming and labour intensive as discussed above. They also require highly skilled observers, are expensive, difficult to design, require extensive training of observers and are intrusive. A further criticism of this approach is that structured observations are subject to reactivity, in that individuals who are being observed modify their behaviour due to the presence of an observer. Furthermore, within the literature this technique is criticised as it is affected by day-to-day variability, which is cited as being particularly common to types of behaviour, including hygiene behaviours. Practically in terms of sample size, the maximum number that can be carried out in one study is about five hundred and therefore the method is not considered as powerful (Ruel and Arimond 2002; Environment and Health Project 2004; LSHTM and WHO 2005; Schmidt, Bostoen et al. 2006).

2.3.2 Spot check observation methods

The use of spot checks refers to a list of pre-determined conditions observed at one point in time during a home visit. Spot check methods for assessing hygiene practices and behaviours are seen as a far less intrusive and rapid method of obtaining information than structured observations. It seeks to capture information on the product of hygiene behaviours rather than on the actual behaviour itself. Spot checks have been identified as providing information on "proxies" for behaviours (Ruel and Arimond 2002).

Spot checks are identified as being a proxy information on behaviour in that they provide information for example on whether a household has a designated hand washing place and the requisite hand washing materials. However, spot checks do not provide information on whether the actual behaviour took place. For example, having a designated place to wash hands does not necessarily imply that hands were washed after defecation or eating or that soap or another hand washing agent was used (Bentley, Boot et al. 1994; Environment and Health Project 2004).

Such an approach has gained increased popularity over recent years (Webb, Stein et al. 2006) and such methods have been used in major international surveys such as the Demographic and Health Surveys as one of their methods used to assess hand washing materials and facilities. In addition, UNICEF MICS use this approach to assess a range of environmental health indicators relating to water, sanitation and household hygiene. Due to the difficulties encountered when using structured observations in the study of assessing hygiene behaviours and practices, for example hand washing, the use of the spot check methods is suggested as a practical and reliable alternative (Environment and Health Project 2004). However, the identification of this method and the availability of water in further analysis conducted by Luby et al (2007) suggests that the spot check method may provide a proxy measure to assess hand washing promotion efforts (Luby and Halder 2007; Halder, Luby et al. 2008).

The Hygiene Improvement Framework (Environment and Health Project 2004) advocates that useful spot observations for assessing hygiene improvement should include the following:

- Presence of soap
- Storage containers for drinking water
- Presence of residual chlorine
- Type of and clear access to a toilet facility
- Food storage containers
- Clean cooking area, utensils and clothes of primary caretaker
- Cleanliness of yard and household floors (in particular a faeces free yard)
- Facial and fingernail cleanliness
- Presence of garbage and disposal facility
- Presence of livestock or other animals within or around the household
- Measurement of nutritional status

The following observations pertaining to hand washing include the presence of soap, fingernail cleanliness and to a particular degree the presence of residual chlorine.

A recent study measuring household hand washing compared a range of 27 tools and indicators in the district of Pune, India for the WHO. The results of this study were that two indicators were identified as valid and useful to correctly distinguish hand washing behavioural outcomes. The indicators were collected from the environmental spot check .The purpose of the study was to compare the results of structured observation with those obtained from a number of alternative tools including verbal questionnaire, pocket voting, a hand washing demonstration and an environmental spot check. The motivation of this comparison was to propose a workable, valid alternative to structured observation for the evaluation of hygiene promotion initiatives.

The hand washing indicators were identified and proposed through outlining the strengths and weaknesses of particular methods, particularly, the shortcomings of self-report measures and the rationale that direct measures, for example through structured observations are thought to be the most valid and reliable method currently in use for measuring hygiene behaviour. The usefulness of the different indicators was assessed through their ability to identify the high prevalence of non-hand washers. This meant that the indicator was able to identify correctly non-hand washers, specifically those who had a high negative predictive value. The two indicators that were identified as being useful were the presence of soap beside the latrine and the presence of soap in the yard (LSHTM and WHO 2005).

Furthermore, a paper published by Webb et al (Webb, Stein et al. 2006) concluded that hygiene indices created using the spot check method are a rapid and efficient method for assessing hygiene and are useful for predicting diarrhoea morbidity in young children. They advocate for the use of multiple spot check measures to estimate accurately the true hygiene patterns of a household. This is due to the high daily variability of spot check indicators, therefore, multiple assessments of domestic hygiene in a household need to be performed, in order to accurately capture a household's true hygiene practices.

The DHS questions asked within the surveys on hand washing materials and facilities, used the spot-check method to assess whether there was a designated place for hand washing in the household and to assess whether the requisite items of water/tap, soap, ash or another cleansing agent and a basin were present in the household as observed by the interviewer. In addition, surveys such as the Egypt 2003 Interim DHS also used this method to assess whether the designated place for hand washing was in the same room or in an adjacent room to the toilet facility, whether the toilet facility had faecal matter and whether a towel or cloth was present (ORC Macro 2001a).

The disadvantages of spot-check observations are that as with structured observations they are subject to day-to-day variability. In addition, they are proxies for behaviour and do not measure actual hygiene behaviours (Ruel and Arimond 2002).Spot check observations have other limitations; although, the limitations are noted as not outweighing the disadvantages of recall and structured observation methods. The limitations of the spot check approach are that they do not measure actual hand washing behaviour. Also if respondents know that an interviewer is coming there may be a greater level of compliance with hygiene practices than they would normally practice (Environment and Health Project 2004).

Furthermore, the interviewer's opinion may be subjective. The example given in the literature is that of whether the neck of a container for collecting water is narrow. Within the literature, it was suggested that such problems could be minimised by appropriate training of interviewers and the use of illustrative descriptions. In the case of hand washing, an example of this the assessment of the cleanliness of hands and fingertips. What one observer defines as clean or dirty differs to what another observer's definition is.

Lastly, an area mentioned that requires attention is the timing of the visit. This would reflect household and personal cleanliness conditions, therefore the timing of the visit is an extremely important factor as the conditions of some factors will be indicative of the time and not necessarily poor hygiene practices and behaviours (Environment and Health Project 2004). For example, if the timing of the visit is in the morning, people tend to perform certain activities such as bathing, eating breakfast and cooking, so hand washing may take place either directly or indirectly. An example of indirect hand washing is bathing. The consequence of this is that when a respondent is asked whether they washed their hands, they may not report that hands were washed during the bathing process. This could be important, for example, if a respondent defecated and then had a bath and hands were washed as part of the process, but the respondent may not directly report this as hand washing, rather they view it as bathing. This means that the practice is not captured.

2.3.3 Microbiological methods

The use of microbiological methods involves examining the hands for bacteria. Studies that have used such techniques include Kaltenthaler et al (1996) who assessed faecal indicator bacteria on the hands and the effectiveness of hand washing in Zimbabwe (Kaltenthaler, Drasar et al. 1996). A similar technique was applied in a study in north-east Thailand. This was a modification of an earlier technique used by the author. A microbiological indicator was developed which examined the fingertips for the presence of transient faecal indicator bacteria through a finger impression technique (Pinfold 1990). More recently, this approach together with other techniques was used to assess improvements in methods to measure hand washing in Bangladesh. The aim of this method was to measure hand contamination at random times using a hand rinse (this is similar to collection done via spot checks). The purpose of this was to examine whether hand contamination, as detected on random collections of hand rinse samples can predict hand contamination at critical times, for example before food preparation (GPPHW 2007a).

Microbiological methods have shortcomings, as with all methods discussed, insofar as they do not show specifically when hands were actually washed in relation to key activities (Pinfold and Horan 1996). Furthermore, a recent study from Bangladesh using an innovative approach to assess hand washing in the form of soap loggers and also included the use of hand microbiology to assess faecal coliforms and *Escherichia coli* (E.coli) on hands, toys and clothes. In the study, a toy ball was given to households to measure household contamination. One of important findings of this study was that rapid recontamination of hands after hand washing with soap was a fundamental problem. In addition, the possible cleaning of the toy ball by mothers before fieldworkers came back to the household was a problem raised during discussions on the findings from the study. A further disadvantage cited was that the use of this method at critical times requires an observer to be present when the times (hand washing) occur; therefore some form of structured observation is required (GPPHW 2007b).

2.3.4 Innovative technologies –Soap loggers, Smart Soaps and Smart Botna

New approaches to measuring hand washing involve the use of technologies in the form of smart soap sensors, developed and tested by Unilever in studies in India and Bangladesh. Although such technology is at an early stage, this approach enables an understanding of soap use behaviours by logging the time at which soap is used for practices such as bathing and hand washing. The development of this device was due to the growing concern regarding the measurement of hygiene behaviours. This was seen to be a problem given that a number of developing countries have campaigns that encourage people to wash their hands with soap, but it is difficult to judge how effective they are given the problems of measurement. The rationale to develop this technology was underpinned by the concerns of other hand washing measurement tools. In particular, the problems identified with standard approaches that have been typically used to measure the success and effectiveness of hand washing programmes.

Therefore, a team at Unilever invented a new way to measure hand washing practices. They developed what is known as a Smart Soap bar. This soap bar contains a microchip that records how and when the soap bar is used. The purpose of this is that it allows researchers to get an accurate picture of hand washing practices under normal conditions.

This method has been used from an evaluation perspective to evaluate Unilever's flagship Lifebuoy "Swasthya Chetna" (Health Awakening) hand washing campaign conducted in rural India. In conclusion, this development is seen to be part of a monitoring process for a world leading campaign and its use has been demonstrated in challenging environments(Unilever 2008). Similarly, in Bangladesh, the use of a similar device designed by Unilever involves the use of an accelerometer (motion detector) being embedded in soap bars and the accelerometer tracks and logs soap use events. One of the advantages of this method is that it enables the measurement of soap use without the presence of a human observer. In addition, recent innovative approaches used in Bangladesh involve the use of a Smart Botna developed by Unilever and this device is able to register anal cleansing after defecation. A logger is embedded into a water vessel that is used for cleaning oneself after defecation events and this enables defecation events to be tracked. This method involves a family being given a Smart Botna and a soap bar that is installed with a logger device. The two materials in conjunction with each other are able to register that a hand washing related event took place and subsequently whether hand washing occurred (Health in Your Hands 2007a; Health in Your Hands 2007b).

There were methodological issues that arose from using this approach. For example, study participants were aware that there was a logger inside the soap and botna. The issue of reactivity was also raised due to informing participants that the study was on hygiene and this may have resulted in increased use. This was identified as a problem in formative research studies conducted in Vietnam. In this study, participants were told during the introduction of the study through unauthorised inclusion by field workers before observation that the study was on personal hygiene, water and sanitation. This led to higher rates of hand washing being observed compared with other comparable studies. Furthermore, other issues from the Bangladesh study were issues in terms of attributing the use of the soap to a particular user, for example, the mother. Therefore, the study was only able to assess household per capita use of soap and not the assessment of individual use of soap and issues relating to the exposure of the logger from the soap bar. This could occur if the soap bar was misused by individuals or in some cases by animals (Health in Your Hands 2007a; Health in Your Hands 2007b).

There was also the problem of loss of data from some of the accelerometers and sample size constraints due to budgetary issues. In addition, the findings of this study highlighted the effect of events that were beyond the control of the study, in this case natural events. The data collection for this study was in July 2007. During this period there were floods across Bangladesh. This meant that data collection had to be ceased during the study and recommenced at a later date. The study author concluded that flooding might have affected hand washing behaviours. Furthermore, as this approach involves specifically giving households a bar of soap, these households may not use soap as their normal hand washing practice, therefore, the actual results obtained may not provide an accurate reflection of their normal hand washing behaviour (Health in Your Hands 2007a; Health in Your Hands 2007b).

2.3.5 Hand washing demonstrations

Hand washing demonstrations involve the observation of hand washing technique. The usual procedure involves the observer having a list of guidelines that list a range of relevant actions to observe whilst the hand wash demonstration is taking place. The primary caregiver of the child is usually observed. In a study that measured faecal coliforms on hands after different hand wash protocols, the two most effective characteristics were determined as the thoroughness of washing hands and the time taken to wash hands. The literature on this method is not as widely publicised as other methods discussed (Hoque 2003).

The use of hand washing demonstrations posed a number of issues. Firstly, asking people to demonstrate their hand washing technique may not be an accurate representation of how hands are usually washed as the individual is being observed and recorded whilst performing the act. This in itself may influence the person to wash hands in a different manner compared with their normal practice. Furthermore, such a technique involves the person simulating a hand washing act that is not a real life event. For example, the way in which a person washes their hand after defecation or food related practices may be highly dependent on the location in which the act takes places; this may have an influence on the availability of materials such as hand washing agents to wash hands such as soap and the availability of water. An example of this could be a person that washes their hands in a river/stream as that is near the place of defecation. However, when asked to perform how they wash their hands in a hand washing demonstration, the person may not want to take the observer to the river or stream and may use another source during the demonstration.

This example provides the observer with a misrepresentation of the actual practice that normally could be high risk if the person washes hands in a river/stream that is contaminated with faecal or another material. However, the stored water used during the demonstration or tube well may be clean and uncontaminated giving the observer a false sense that the person washes their hands or that they have access to this facility. In addition, hands may be washed differently for different hand washing events, for example after defecation and before and after hand ling food or feeding a child. Even more importantly, the person may not actually wash their hands at all, but because they have been asked to demonstrate their hand washing practice they do so.

2.3.6 Questionnaires

The use of questions to elicit information on hand washing practices and behaviours has been used commonly in research on hand washing behaviour (Manun'Ebo, Cousens et al. 1997). These questions ask about knowledge on the critical times to wash hands, soap use, hand washing behaviour and practices and access to sanitation and hand washing facilities. Such an approach has received widespread critique regarding the reliability and validity of the information acquired, as respondents tend to over-report hygienic practices (Manun'Ebo, Cousens et al. 1997). A few studies have examined the agreement between different methods to measure hygiene practices. Stanton et al (Stanton, Clemens et al. 1987) conducted a comparative study of twenty-four hour recall, knowledge, attitude and practice questionnaires and direct observation of sanitary practices and identified questionnaires to be a less reliable source of information.

A study by Manun’Ebo et al (Manun'Ebo, Cousens et al. 1997) measuring hygiene practices compared the use of questionnaires with direct observation in rural Zaire to measure the disposal of child faeces and various hand washing practices confirmed this further and identified bias to be a major issue with the use of questionnaires to obtain information on hand washing. This for example could be because of the wording of the question; the example given was for the question ***“Do you wash your hands before feeding your child?”*** It was felt that such questions were posed in an open and leading way would invariably invoke a positive response. The key findings of this study were that at the individual level the agreement between observed and reported behaviour was little better than expected by chance. Further findings indicated that mothers tended to over report desirable behaviours and the wording of questions may lead to under-reporting of certain behaviours. This is discussed in more detail later.

2.3.7 Pocket Voting

The use of pocket voting for measuring hygiene behaviours and practices has been offered as a suitable routine alternative together with spot checks for improving the reliability of measurements of hygiene behaviours. This method allows interviewees to respond in anonymity by using simple procedures such as inserting an object such as a pebble(s) or piece of paper(s) into a pocket that corresponds to a specific behaviour(s). One of the key aspects of this method is that the respondent is asked the question and then the vote is cast in privacy.

The Hygiene Improvement Framework discusses this approach in greater detail and states that such an approach can perform well when sensitive issues are being discussed when it would be unlikely that respondents would volunteer a true response in the presence of other household members or the interviewer (Environment and Health Project 2004). However, the use of this method has not been widely discussed in the literature.

2.3.8 Other techniques

Other techniques that have been cited in the literature include the use of semi-structured interviews whereby an interview schedule is prepared in advance. A semi-structured interview is a mixture of a structured and unstructured interview. The technique is guided by a list of questions that are asked in the exact order that they have been specified. However, the answers are open-ended for respondents to give their thoughts and insights on a particular topic (Bentley, Boot et al. 1994). The purpose of this technique is to ask specific questions on the subject in question but in a systematic fashion.

Focus groups typically involve a group of people usually those that have a similar background or shared experience being asked questions on a particular topic of interest (Alemdom, Blumenthal et al. 1997). Both techniques were used in studies in Botswana. The findings of the study were that combining low-cost methods was an effective and feasible way of collecting useful information on which to base hygiene education programmes and hygiene interventions. However, the questionnaires did not specifically ask questions on hand washing due to the disadvantages previously cited of over-reporting. The study therefore focused on hygiene behaviour. A further conclusion drawn from the study was that the use of a single type of method can distort the conclusions of a study by producing a premature focusing on the results (Kaltenthaler and Drasar 1996).

2.3.9 Monitoring and evaluation

The problem of finding appropriate indicators is not restricted to hand washing. The debate surrounding suitable indicators for water and sanitation led to the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMPWSS) adopting an increased role to improve the indicators and methods used for monitoring national and global sanitation and water supply. This work began in 2004 and involved the development of a series of questions relating to sanitation and water supply that are recommended for inclusion in all national household surveys. The purpose of this task was to increase the coherence among surveys over time and the comparability of estimates among countries (UNICEF and WHO 2008).

One of the fundamental problems was that in order for the JMPWSS to ensure that the data used to assess drinking water and sanitation coverage for national, regional and global estimates are of the best quality, different household surveys are used to estimate coverage. The problem with this approach is that when using data taken from a variety of different sources, it is difficult to make comparisons between the different survey results, as different surveys may use different questions and response categories. As a result, it is difficult to establish accurate trends over time within countries, and to compare data from different countries.

Therefore, solving these problems regarding comparability is crucial and underpins the rationale for the JMPWSS for developing harmonised survey questions and response categories in order to attempt to provide accurate coverage estimates. The outcomes of this standard are that two of the major household survey programmes in the developing world have adopted sets of questions. The two major programmes are DHS and the MICS. The set of core questions developed by JMPWSS were developed with the assistance and collaboration of national and international authorities on household surveys and academic and sector specialists. The work is expected to continue as additional indicators are developed and adopted at national and international levels.

The JMPWSS envisions that with the expanded use of the harmonised questions, this will increase the pool of reliable data, thus leading to higher quality estimates at country, regional and global levels. Many of these indicators from household surveys such as DHS and MICS are used to assess global access to safe drinking water and sanitation. Previously, the use of different survey methodologies to obtain data led to the problems discussed above regarding lack of comparability between estimates due to the different data collection methods (WHO and UNICEF 2006; UNICEF and WHO 2008).

The core set of questions designed by the JMPWSS provides a harmonised set of survey questions that act as "core questions" in order to help resolve the comparability issues that previously occurred using the different survey tools and methodologies. In addition, these questions have provided a systematic way to collect data in national surveys and censuses and are included in DHS and MICS. The questions have also been adopted for use in the World Health Survey. The survey questions focus on drinking water, sanitation and the safe disposal of child's faeces.

The need for accurate information on drinking water quality, sanitation and hygiene related issues is argued as being extremely important in facilitating the development of a set of core questions for inclusion in major household surveys as this information is invaluable to national leaders, decision makers and stakeholders when making policies decisions. The requirement for sound, evidence-based information is due to its use in a variety of ways;

- To assess progress towards national and international goals and targets
- To promote increased investments into the sector
- To focus attention on needy areas and the efficient allocation of resources (WHO and UNICEF 2006).

2.4 Measurement of hand hygiene in the clinical setting

The role of hand hygiene in reducing the transmission of infection in the clinical setting has long been noted and aligned with the work of Dr Ignaz Semmelweis, a Hungarian physician. Semmelweis is regarded as an early pioneer for the introduction of antiseptic procedures into the clinical setting and in particular the introduction of hand disinfection standards into obstetrical clinics. The role of Semmelweis's work was that by 1847 he discovered that the incidence of Puerperal fever (childbed fever) could be drastically reduced by hand disinfection in obstetrical clinics. This was achieved through hand washing with chlorinated lime solution before gynaecological examinations. Puerperal fever was common in hospital establishments during this period and was often fatal, with mortality rates ranging between 10% and 35%. Therefore, in 1847, Semmelweis hypothesised the theory of washing with chlorinated lime solutions whilst working in Vienna General Hospital's First Obstetric Clinic. At the time, the doctors' wards had three times the mortality rate of the midwives' wards. However, the work of Semmelweis only gained widespread acceptance after his death, even despite published results of his work on reductions in mortality to below 1% achieved through hand washing. His work on the role of hand disinfection was prior to the germ theory of disease developed by Louis Pasteur. The work of Pasteur therefore provided a theoretical basis for the work and findings of Semmelweis (Wyklicky and Skopec 1983).

On a global scale, Health Care Associated Infections (HCAIs) affects hundreds of millions of patients worldwide every year. These infections occur as an unintended result of seeking care with the resultant effect of serious morbidity, prolonged hospital stays and long term disability. The costs of such infections are not only a burden on patients and their families from a health and financial perspective, but also a substantial additional financial burden to healthcare systems and contribute to preventable patient deaths.

There is a large and inequitable gap in patient safety. This is demonstrated by some health care institutions and health systems being able to better manage and ensure patient safety outcomes than others. To appropriately assess the magnitude of the gap and the nature of the issue, there is a requirement for monitoring, surveillance and prevention to improve patient safety and reduce the risk and transmission of infection. In order to do this, suitable tools are required. These tools are available; however, they require testing, adaptation and implementation on a global scale.

It is well established that hand hygiene in the clinical setting is a primary barrier in reducing the transmission of infection. Similar to the challenges of low rates of hand washing in the domestic setting and the act of hand washing being a simple one, the challenges faced in the clinical setting remain the same, with the simplicity of the act not demonstrated in actual practice. In the clinical setting, levels of compliance with hand hygiene remain low and there is a lack of compliance and adherence to hand hygiene protocols. The task of trying to improve hand hygiene is a difficult and complex task.

The Global Patient Safety Challenge that is endorsed by the WHO has HCAIs and the reduction on infection as a core element of its programme. The Global Patient Safety Challenge 2005-2006 adopted the premise that “Clean Care is Safer Care”. The methodological approaches taken to measure hand hygiene in the clinical setting adopt similar approaches to those used to assess hand washing behaviour in the domestic setting. The use of direct observation techniques and self reported methods using questionnaire based approaches (Haas and Larson 2007; The Joint Commission Division of Quality Measurement and Research 2009).

Although this research focuses on the measurement of hand washing in the domestic setting, the complexity of measuring hand hygiene compliance and adherence in the clinical setting is also problematic in evaluating the effectiveness of programmes. This is due to the fact there being no standard measure or method of how to assess compliance. Similar methodologies to those adopted in the domestic setting focusing on three main methods of direct observation, surveys (self-report) and indirect measurement of hand hygiene product usage have been used in the clinical setting.

The use of observation is similar to structured observation used to assess hand washing in the domestic setting. Observation in the clinical setting involves directly watching and recording hand hygiene behaviour of health care workers and the physical environment. The use of indirect measurement is obtained through product measurement. This method indirectly assesses hand hygiene guideline adherence through enabling the calculation of the amount of liquid soap, alcohol-based hand rub and paper used in a given area of an organisation. Surveys are used to obtain information on the perceptions, attitudes and practices to hand hygiene of health care workers. This approach is also used to assess the perceptions and attitudes of families and patients to health care workers hand hygiene practices (The Joint Commission Division of Quality Measurement and Research 2009).

However, even in this context, the methods employed to date have not been well validated. In order to make comparisons over time, the same method needs to be employed and valid, practical and less costly methods are required. Direct observation is considered the best available method to measure hand hygiene behaviour of health care professionals. This measurement approach is considered the "gold standard" of measurement methods (Haas and Larson 2007). This is due to this technique providing information on the various components of the hand hygiene process. It includes the use of hand hygiene products, thoroughness of cleansing, the tools and techniques used for drying and the use of gloves. This approach also provides information on the opportunities for hand hygiene and specifically whether staff comply during those opportunities. This technique further provides information on who adheres to hand hygiene practices, enables the opportunity to provide feedback on practices and also allows health care professionals to uncover areas where there are facility-specific errors that impact on hand hygiene adherence.

This approach is not without problems. One of the fundamental drawbacks of the use of direct observation is that this method is subject to reactivity due to the use of the method resulting in changes in behaviour of those being observed. This is discussed in Section 2.3.1 which discusses structured observation that is also a methodology based on the use of a direct observation technique. Further drawbacks similar to the ones cited in Section 2.3.1 include the labour intensiveness of the method, and the need for well trained observers. The use of a direct observation method to assess adherence to hand hygiene therefore requires a clear outline of the requirements and purpose of the observation technique. This means that there should be clear guidelines relating to who will be observed, the personnel who will conduct the observation and where, when and how often the observation will be conducted.

The use of an indirect approach to measure hand hygiene adherence through assessing product usage has similar characteristics and strengths to that of the spot check method. This approach has the strength that it is less expensive than direct observation and is less resource intense, in that it requires less extensive training than the use of direct observation and fewer personnel to conduct the technique. Further strengths of this approach are that this method can be conducted at any time and is not constrained by location; therefore it can be conducted in any location. This method enables the assessment of trends over time. Fundamentally, this method is likely to be less subject to reactivity than the use of a direct observation approach. This is due to the method providing information in an inconspicuous manner whereby it is not immediately obvious to those using the product that they are being monitored.

This approach does have drawbacks due to its indirect nature. It is not possible with this method to determine whether hand hygiene protocols are being adhered to correctly. For example, this method does not identify which hand hygiene opportunity the product is being used for and whether the product is being used correctly in line with the advised protocol for use. This method is also often unable to determine who does or does not use the product. Factors that may be relevant to improve practice, for example, when hand hygiene protocols are not adhered to are not a feature of this method also.

There are also a number of factors that make this method prone to inaccuracy. This includes inappropriate usage, product spillage, use by family members and patients and the possibility of products being borrowed between units. A further issue cited is that due to variations in hand hygiene opportunities as a result of the setting and patient population, when calculating rates of adherence it is important to use realistic numbers of expected hand hygiene opportunities. The various systems available for implementation of product usage in the clinical setting further enhance the methodological and associated measurement issues.

The methodological shortcomings of particular methods to measure hand hygiene compliance in the clinical setting include over-reporting of hand hygiene adherence compared with actual practice have been documented in a number of studies from the clinical setting. The use of surveys using self report questions on hand hygiene adherence can be used to assess perceptions of health professionals hand hygiene behaviour and correspond it to the perception of patients and families. One of the main weaknesses of this method as discussed in Section 2.3.6 is that self reporting can be unreliable as health professionals tend to overestimate their hand hygiene practices when questioned and may also inaccurately recall their past hand hygiene behaviour (The Joint Commission Division of Quality Measurement and Research 2009).

A few studies have sought to assess the validity of hand hygiene measurement tools. One study in particular by Jenner et al (2006) focused on assessing the validity of self-report methods with direct observation in health professionals. The authors highlighted that there is a clear need to understand the link between self-reported and observed behaviours in hand hygiene behaviour. However, this has not been an area that has not been concentrated on within research studies. The authors went on to argue that the comparison of self-report and observation is important because if no association is identified, then interventions that are designed to improve intentions or self reported behaviours will not be effective in changing practice.

This study involved the use of questionnaires completed by participants compared with their actual observed behaviour, in addition to assessing intentions and attitudes towards hand hygiene. In conclusion, the use of self report methods to examine hand hygiene behaviours should be viewed with extreme caution as the results are unlikely to reflect actual practice. The role of timing of the questionnaire and the observation was put forward as one reason to explain the mismatch between observation and self report. The questionnaire that housed the self report questionnaires were often delivered to respondents during their break when they were more relaxed and had the opportunity to deliberate on responses. The observation on the other hand often took place when respondents were busy and were on “automatic pilot”. Observation as a method to assess hand hygiene behaviours was identified to be the only method to assess whether habits have changed .Therefore, it was concluded that the outcome of any training or implementation measures should be assessed by observation and not self report (Jenner, Fletcher et al. 2006).

The overall findings of this study were that staff poorly adhered to stated guidelines. Furthermore, there was poor adherence to hand hygiene even when patients were colonized with MRSA. In addition, observed hand hygiene practice was found to be unrelated to carers’ intentions and self-reported behaviours. The overall conclusion of the study was that hand hygiene interventions that tend to target changes in attitudes, practices and self-report practices are likely to fail in terms of changing behaviours.

The use of more than one method (multiple methods) at the same time to measure hand hygiene is advocated as this is seen to produce more reliable results than the use of a single method. The continued and heightened importance of hand hygiene for ensuring patient safety and reducing HCAIs at both global and national levels has led to the establishment of international hand hygiene measurement tools to enable a consensus and well validated tools and methods to assess adherence to hand hygiene. It is from such a consensus that the use of more than one measurement method to measure hand hygiene is advocated as this is seen to produce more reliable results than the use of a single method. This use of multiple measurement approaches also provides further opportunity to validate methods. As demonstrated in this discussion there are methodological challenges to all methods discussed

The use of a triangulated approach means that the information gleaned from the different approaches can be used to answer different aspects of the research objectives. To date, studies that have sought to assess the effectiveness of interventions have used observation and the measurement of product usage. In order to overcome the methodological shortcomings of the use of direct observation, it is suggested that the validity of direct observation can be improved through the use of other unobtrusive methods of data collections that can be used to corroborate or refuted findings (Gould, Chudleigh et al. 2007). This includes monitoring devices, assessing product usage and tracking rates of HCAIs. However, observation remains the only measurement method that provides direct information on hand hygiene adherence practices (The Joint Commission Division of Quality Measurement and Research 2009).

2.5 Current knowledge on hand washing

Hand washing with soap is vital for protecting health. However, existing research indicates that it is rarely practiced with most studies focusing on mothers and caregivers of young children for studies conducted in both developed and less economically developed countries (Curtis, Danquah et al. 2007). Improvements in water supply, sanitation and hygiene are identified to produce notable reductions in diarrhoeal morbidity (Esrey, Feachem et al. 1985; Curtis and Cairncross 2003). Interventions resulting in improved water supply are identified to reduce diarrhoeal morbidity by between 6 to 25%. A study by the WHO identified that improved sanitation reduced diarrhoeal morbidity by 32%, whilst interventions promoting hygiene, including hygiene education and the promotion of hand washing, can lead to a reduction in diarrhoeal diseases by up to 45% (WHO 2004).

Within the literature it is widely accepted that hand washing interrupts the spread of pathogens and so can significantly reduce diarrhoea, respiratory infections (including the recent SARS virus), skin infections and trachoma (Huttly, Morris et al. 1997; Cairncross 2003; Curtis and Cairncross 2003; PPPHW 2003; WHO 2004; Luby, Agboatwalla et al. 2005; Bloomfield, Aiello et al. 2007).A systematic review and meta-analysis by Curtis and Cairncross (Curtis and Cairncross 2003) confirmed existing knowledge that washing hands with soap can reduce the risk of diarrhoeal diseases by 42-47%. In the absence of adequate mortality studies, they extrapolated the potential number of deaths that could be averted by hand washing at about a million. The review mainly focused on developing countries in Asia, Africa and Latin America. A quantitative systematic review on hand washing and the risk of respiratory infections by researchers at the London School of Hygiene and Tropical Medicine (LSHTM) identified that results from eight eligible studies reported that hand washing lowered the risk of respiratory infection, with risk reductions ranging from 6 to 44%. The authors concluded that hand washing is associated with lowered respiratory infections and rigorous trials of the impact of hand washing on acute respiratory tract infection morbidity and mortality are urgently needed, especially in developing countries (Rabie and Curtis 2006).

A study conducted by researchers on behalf of the John Hopkins Bloomberg School of Public Health on maternal and birth attendant hand washing and neonatal mortality in Southern Nepal found a 19% lower risk of death among newborns in rural Nepal when birth attendants washed their hands with soap before delivery. The risk was reduced by 44% if mothers washed their hands before handling the newborn child. Approximately, 30,000 newborns die each year in Nepal and one of the authors of the study concluded that hand washing could substantially prevent a significant number of these deaths with routine hand washing practices. One of the concluding suggestions by the authors of the study was that measures should be taken to improve the understanding of the importance of protecting against infection during births and to promote hand washing among birth attendants and mothers (Rhee, Mullany et al. 2008).

The role of access to appropriate hand washing hardware technologies to improve hygiene behaviours is a critical to increase hand washing in households. The accessibility of a household to appropriate hardware technologies, for example, a place to wash hands, water and hand washing agents are extremely important in reducing the transmission of infectious disease pathogens that cause diarrhoea (IRC 2003).

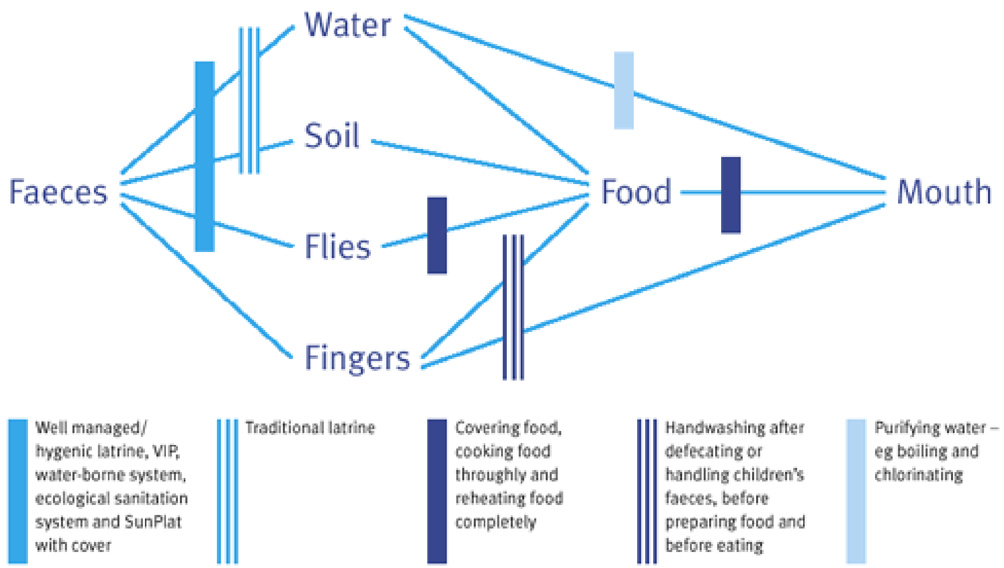
Hand washing is regarded as both a primary and secondary barrier against diarrhoeal disease. It is thought of being a primary barrier as it removes faecal matter after contamination with stools. The secondary barrier is where it promotes cleanliness before preparing foods, handling fluids, feeding and eating (Curtis and Cairncross 2003). Within the literature, there is widespread use of the term hygiene behaviour, domestic hygiene and household hygiene to define a range of behaviours including hand washing. Therefore, although this research explicitly relates to hand washing behaviour, the literature on hygiene behaviour, domestic hygiene and household hygiene are also examined as there is reference to hand washing.

The most effective ways of reducing disease transmission is to use primary barriers that prevent pathogens from entering the environment. This is achieved through washing hands with soap after defecation, after cleaning a child’s bottom after defecation and through the construction of sanitation facilities that prevent the transmission of disease. The first steps in improving hygiene practices are often found to be easiest to implement at the household level. This is because a large percentage of hygiene related activity takes place in the home or close to the home (IRC 2003). Globally, observed rates of hand washing at critical times are low: less than 20% of mothers in developed and developing countries are reported to wash their hands after cleaning up a child that has defecated (PPPHW 2003).

A study by Luby and Halder (2008) examining the associations among hand washing indicators, wealth and childhood respiratory illness in urban Bangladesh provided some evidence for the potential contribution of hand washing in preventing respiratory disease in a low-income setting. The study identified that after controlling for socio-economic status, children under five that lived in households that had a place inside to wash hands had a 5% reduced risk of respiratory symptoms in the seven days preceding the survey. The study further noted that although this is of a lower magnitude to that reported in other studies, it is found in the absence of a hand washing promotion programme (Luby and Halder 2007).

This diagram featured below (Figure 2), known as the F-diagram, shows the faecal-oral transmission that causes diarrhoea. The diagram was originally proposed by Wagner and Lanoix in 1958.

Figure 2.1: The F-diagram



Source: Water Aid 2008 (WaterAid 2008)

The F-diagram is widely referenced to and clearly shows the different transmission routes whereby pathogens can get from the faeces of an infected person to the host. The route goes through fluids (mainly drinking water), fields (soil), fingers, and food onward to the host. Some of the most effective primary and secondary (behavioural) barriers are shown, such as sanitary solutions using a latrine or toilet and hand washing. In Figure 2.1, the vertical bars in the diagram represent the different blocking actions, the primary and secondary barriers. The likelihood of diarrhoea can be significantly reduced by blocking the various faecal oral transmission routes (WaterAid 2008).

Although hand washing in itself is a simple act, evidence suggests that most mothers in developing and developed countries fail to wash their hands adequately after faecal contact. Estimates from studies conducted in the developing world indicate that on average less than 20% of mothers wash their hands with soap after cleaning up a child or going to the toilet themselves (Curtis and Cairncross 2003; PPPHW 2003). Studies have tended to be targeted at mothers and female caregivers as they are identified to be the most likely group to provide care to children less than five years of age. Therefore, there is a need for hand washing practices by women in these groups, hence, the rationale to focus on these women. This is one of the fundamental reasons why the promotion of hand washing as a public health intervention has the potential to have an enormous impact on public health (Curtis and Cairncross 2003).The increased need for valid and reliable data on hygiene behaviours and practices is necessary in order to appropriately plan, monitor and evaluate hygiene promotion programmes and interventions (Alemdom, Blumenthal et al. 1997; Manun'Ebo, Cousens et al. 1997).

2.5.1 The role of hand washing agents in reducing diarrhoeal morbidity

There appears to be little evidence to suggest that the type of agent for hand washing is of importance in the hand washing process and that antibacterial soaps or other hand sanitising technologies have no additional advantage over soap (Boot and Cairncross 1993; PPPHW 2003)). What is advocated in the literature is the use of any type of soap for hand washing and for the hands to be fully covered with soap and then rinsed off with water (PPPHW 2003). A study by Luby et al. (2004) reported similar findings of plain soap compared with antibacterial soap on reducing diarrhoeal morbidity (Luby, Agboatwalla et al. 2004).

The use of soil, mud and ash as agents for hand washing are commonly used in low income settings in developing countries as an alternative to soap. The use of these materials in Sub Saharan Africa and Asia are considered as zero cost alternatives to soap. One of the important factors of the usefulness of agents is the extent to which pathogens are removed from the surface of the skin. There are some studies that suggest that the use of soil and ash are effective in reducing contamination on hands following hand washing. However, these materials are considered less effective than using soap for hand washing and more data is required to evaluate the effectiveness of these materials. The use of these materials for hand washing needs to take account of certain important factors. Firstly, when soil is used it needs to be clean soil. The use of contaminated soil poses health risks when contaminated with microbial pathogens or other parasites. Additionally, the use of ash may contain elements with toxic properties (Bloomfield and Nath 2009).

A study by Hoque et al in Bangladesh on research methodology for developing efficient hand washing proposed that the key component of the hand washing process is the mechanical rubbing of hands and that soap is more effective than soil and ash. This was due to users of soap displaying the tendency to rub their hands more and use more water during the process to rinse away the soapy feeling on their hands (Hoque, Mahalanabis et al. 1995b).

Peterson et al. (Peterson, Roberts et al. 1998) investigated the effect of soap distribution on diarrhoea in the Nyamithutu refugee camp in Malawi. A total of 402 households were surveyed for diarrhoeal risk factors and interviewed twice weekly for 4 months regarding diarrhoea episodes and the presence of soap in the household (200 grams of soap per person were distributed monthly). The findings of this study were that the presence of soap in a household showed a significant protective effect: There were 27% less episodes of diarrhoea in households when soap was present compared with when no soap was present. This was the case even after taking into account potential confounding factors.

The cost-effectiveness of hygiene promotion has been examined in Burkina Faso. A review estimated the cost-effectiveness of a large-scale urban hygiene promotion programme in terms of reducing the incidence of childhood diarrhoeal disease in the city of Bobo-Dioulasso. The data was based on an intervention study of 37,319 mothers who were observed over a period to estimate the impact of hand washing with soap after handling child stools. In brief, the study concluded that hygiene promotion reduces the occurrence of childhood diarrhoea in Burkina Faso, at a cost that is less than 1% of the Ministry of Health budget and less than 2% of the household budget, and could be widely replicated at lower cost. The results of the study were that an estimated 8638 cases of diarrhoea, 864 outpatient consultations, 324 hospital referrals and 105 deaths were averted during the time of the programme (Borghi, Guinness et al. 2002).

2.5.2 Hand washing research and activities in Bangladesh

There is a long history of hand washing research in Bangladesh, particularly during the 1980's and 1990's where much of the regularly cited work and studies on hand washing originated. The studies conducted in the country have provided a useful and knowledgeable insight into understanding hand washing practices in the Bangladeshi context and the challenges that people face. For example, in Bangladesh, access to hand washing materials such as soap and affordability are barriers to soap use (Hoque 2003).

Interestingly, the Bangladesh 2004 Demographic and Health Survey (BDHS) and the BDHS 2006, do not feature any questions or spot check observations on hand washing practices or hand washing materials and facilities. The lack of questions on hand washing in these surveys was highlighted during a visit to Bangladesh in a conversation with the director of the BDHS. There was interest and concern that such questions were not featured in their survey, given the significance of public health issues in the country, was expressed (Streatfield 2007).

However, the Bangladesh Multiple Cluster Indicator Survey 2006 (MICS) included a question on hand washing. This asked the respondent how they usually washed their own hands or their child's hands after defecation. However, these questions were self-report questions and there was no assessment for hand washing materials and facilities. The results of the survey identified that 5.5% of households used only water for hand washing after defecation, 21.3% used water and soil, while 14.4% used water and ash. Approximately fifty-nine percent of households reported that they washed hands with using water and soap. The survey concluded that the variations between the six divisions of Bangladesh were large and that there were significant rural and urban variations. Furthermore, there was a strong positive relationship between hand washing and the education of the household head and the socio-economic status of the household. Given the discussions on the use of self-reported data presented in Chapter 2, concerning issues for example over-reporting of "desirable" practices, these figures should be assessed and interpreted with caution (UNICEF and Bangladesh Bureau of Statistics 2007).

Other studies have shown that the practice of hand washing with soap in Bangladesh remains low. Studies have identified that hand washing with only water tends to occur. Food and eating customs differ around the world. In Bangladesh, the norm is to eat with the right hand. The use of eating utensils is rarity (Hoque 2003). This is particularly important given that hands are one of the agents that facilitate the transmission of infectious disease pathogens in the transmission of diarrhoea and many other infectious diseases, as illustrated in the F-diagram (see Figure 2.1). In terms of hand washing, the left hand is used for anal cleansing and there are strict norms regarding the interaction of the right and the left hand.

The literature on hand washing practices in Bangladesh provides some insight into the role of hand washing in reducing diarrhoeal disease, the context in which hand washing takes place, the challenges to promote hand washing and issues surrounding research methodology on hand washing. From the mid 1980's there were a number of published studies on hand washing in Bangladesh that have been notable for hand washing research methodology. Much of the early work focused on the personal and domestic hygiene of mothers and childhood diarrhoea.

One of the notable studies by Alam et al (1989) was one of the earliest studies examining the effect of maternal personal and domestic hygiene on the incidence of diarrhoea in young children aged 6-23 months for rural areas around Tefnak, an area of rural Bangladesh. This was an intervention study, where intervention areas received an augmented water supply provided through hand pumps coupled with health education, while the control area received no such interventions. The incidence of diarrhoea was recorded weekly from July 1980 to June 1983 and the personal and domestic hygiene of mothers was recorded yearly consisting of the source of water supply, whether there were faeces in the yard, hand washing before food serving and after defecation. The annual incidence of diarrhoea in children from the intervention and control areas was analysed in relation to maternal personal and domestic hygiene. The analysis controlled for education and occupation of the household head and household size. The results of the analysis from both areas was that the use of a hand pump for drinking and washing, the removal of child's faeces from the yard, maternal hand washing before handling food and after defecation of the mother and child were identified to decrease the yearly diarrhoea incidence in children by more than 40% (Alam, Wojtyniak et al. 1989).

The context in which hand washing takes place is important to understand as discussed and identified in the formative research for Global Public Private Partnership for Hand washing with Soap programme (PPPHW). The context in which hand washing takes place is important. In Bangladesh, research studies have highlighted some of the facilitators and barrier to hand washing, in particular, hand washing with soap. A widely cited study is that of Hoque (2003) that examined hand washing practices and challenges in Bangladesh. The research highlights that perceptions and methods relating to hand washing varied widely across the country and socio economic factors were associated with hand washing practices (Hoque 2003).

The results of this study were that the practice of hand washing was poor; this was supported by the faecal coliform bacteriological counts on both right and left hands that were classified as high. The use of soap was low, with water being the preferred hand washing agent in both slum and rural areas; 85% of women in slum areas and 41% of women in rural areas were identified to use only water to wash their hands. For post defecation hand washing, most women were identified to rub their hands on the ground, or use soil and rinse them with water. Similar to findings from other studies, the cost of soap was identified to be a barrier to use. This study evaluated the effectiveness of different hand washing agents, the results of the experimental trials found that the performance of soap, ash and soil produced similar results when women washed their hands under the same conditions. The factors that were identified to be important in the bacterial count on hands were hands being washed, the rubbing of hands and the amount and quality of the water used (Hoque 2003).

The complex nature of understanding hand washing practices was further discussed by Zeitlyn and Islam (1991), where they highlighted the effectiveness of health education programmes to stress the importance of hand washing for the prevention of diarrhoea. They identified that this depends on the understanding of respondent's ideas and customs about hand washing. Their study reviewed perceptions of cleanliness and the role of soap and hand washing in two economically disadvantaged communities in rural and urban Bangladesh. The findings of the study were that respondent's ideas about cleanliness were not based on germ theory but generally, cleanliness was viewed in a larger socio-religious context with ideas surrounding purity versus impurity. Further results of this study were that washing was seen to serve the purpose of physical and spiritual needs and was performed according to defined patterns that were not necessarily based on interrupting the transmission of disease. Interestingly, the use of soap was identified to be more of a cosmetic agent rather than an agent to remove microorganisms (Zeitlyn and Islam 1991).

Similar to that of Zeitlyn, another study by Hoque (1995) identified and highlighted the complexity of hand washing behaviour. This study noted that the universal promotion of hand washing for health interventions requires an essential understanding of the factors related to hand washing behaviour in order to develop appropriate hand washing messages. The focus of their study was the assessment of the components of hand washing practices after defecation of 90 rural women in Bangladesh. The study combined a range of methods due to the complexity of collecting information on hand washing. The authors used in-depth interviews, a questionnaire, observation and the collection of bacteriological samples. The findings were that the practice of hand washing involved several components. This included the use of an agent, handedness as in which hand or whether both hands were washed, the frequency of rubbing, source and volume of rinsing water and drying of hands. Of the 90 rural women who were studied in relation to hand washing after defecation, 75% reported that they could not afford soap. The authors concluded that the use of a multi-method approach helped to understand and develop efficient hand washing options (Hoque, Mahalanabis et al. 1995b).

The role of hand washing with soap in reducing childhood diarrhoea is further demonstrated in a study conducted in a peri-urban slum in Dhaka city. In this study area, the practice of hand washing with soap was promoted and surveillance of the incidence of diarrhoea was conducted for a year. The rates of primary and secondary attack were compared to those from a non-intervention area that was similar to the intervention area in terms of demographic, socio-economic and other factors. In order to establish aetiologies, rectal swabs of cases and contacts were taken. The results of this study were that there was a large reduction, 2.6 fold, in diarrhoea episodes in the intervention area compared with the control area during the observation period.

Furthermore, the rates of bacteriological pathogens were lower in the intervention area. The study concluded that there was a significant reduction in the incidence of diarrhoea in all age groups for all pathogens except rotavirus (Shahid, Greenough et al. 1996).

2.6 Hand washing rates

The use of an observational methodology in the form of structured observation to assess hand washing behaviour at critical times was used to inform and provide baseline data for the Global Public Private Partnership for Hand washing with Soap (GPPHW). The partnerships conducted formative research and associated studies in 10 countries (Ghana, India, Madagascar, Kyrgyzstan, Senegal, Peru, China, Tanzania, Vietnam and Uganda) that sought to establish what is known about hand washing practices. The resultant information was then incorporated into a review that sought to provide a comprehensive account on current knowledge and rates of hand washing with soap. Overall, rates of hand washing and in particular hand washing with soap were low (Curtis, Danquah et al. 2007).

The data collected from the studies were collected using a variety of different methods and techniques. The data on current hand washing practices in the formative research studies were collected by structured observation in households prior to any intervention. The methodological issues relating to structured observation discussed previously are therefore relevant here. The studies aimed to establish the proportion of times that mothers washed their hands with soap after critical events. These were defined as:

- after using the toilet
- after cleaning up the index child (referring to after defecation)
- before feeding a child
- before handling foods

The overall results shown in Table 2.1 illustrate that hand washing with soap (HWWS) tended to be higher after defecation and after handling stools and lower before feeding the index child and before handling food/drinks.

Table 2.1: Hand washing with soap and water by mother or caregiver on key occasions

Country	N	HWWS after toilet (%)	HW with water only after toilet (%)	HWWS after cleaning a child (%)	HWWS after cleaning up a child's stools (%)	HWWS before feeding the index child (%)	HWWS before handling food (%)
Ghana	500	3	39	2	-	1	-
India-Kerala	350	42	-	-	25	-	-
Madagascar	40	4	10	-	-	12	-
Kyrgyzstan	65	18	49	-	-	-	-
Senegal	450	23	-	18	-	-	18
Peru	500	14	-	-	-	6	-
China- Sichuan	78	13	87	-	16	6	-
China- Shaanxi	64	12	14	-	-	16	-
Tanzania	30	13	33	13	13	4	-
Uganda	500	14	44	19	11	6	8
Vietnam	720	-	51	14	23	5	-
Weighted average		**17%**	**45%**	**13%**	**19%**	**5%**	**13%**

Source: Curtis et al (Curtis, Danquah et al. 2007)

Notes: **Tanzania- The figures quoted are the same as the observation was based on whether the person assisting the index child washed their hands after wiping a child's bottom or cleaning child's faeces. Peru-Figures have been added together for any type of soap product**

Overall pattern of HW

The overall pattern for HWWS tended to be after contact with faecal material compared with before handling food or feeding the index child. An important finding was that hand washing with plain water only after going to the toilet was in the order of three times more common than HWWS for the same exposure. This is demonstrated when the results are compared. The overall weighted average for HWWS after going to the toilet was 17% compared with the same event when hands were washed with water only, the weighted average was 45%. For some countries, the results were striking (Curtis, Danquah et al. 2007).

Hand washing elsewhere

The figures identified from the formative research studies are similar to those identified in other studies that the overall rate of hand washing with soap is low. The results of which are displayed in Table 2.2.

Table 2.2 Data about hand washing practices from other observational studies

Setting	Practice	Point Prevalence	Method/Study
Calcutta slums	Hand washing with soap after defecation	16%	(Sircar, Sengupta et al. 1987)
Shanty town in Lima, Peru	Hand washing after defecation	12% (soap use 'rare')	(Gilman, Marquis et al. 1993)
Rural Nigeria	Hands washed with soap after cleaning child	10%	(Omotade, Kayode et al. 1995)
Urban slums in Lucknow, India	Hands washed with soap after cleaning child	13%	(Curtis, Sinha et al. 1997)
	Hands washed with soap after using a toilet	20%	
Childcare centres Brazil	Hand washing after changing nappy	16%	(Barros, Ross et al. 1999)
Urban Burkina Faso	Hands washed with soap after cleaning child	13%	(Curtis, Kanki et al. 2001)
	Hands washed with soap after using a toilet	1%	
North of England	Hand washing with soap after changing dirty nappy	43%	(Curtis, Biran et al. 2003)

Source : (Scott, Lawson et al. 2007)

Further research conducted in rural Indian villages on hand washing using structured observation also identified that hand washing with soap on key occasions was rare (5.5%). Key occasions were defined as after faecal contact and before eating. Similarly low findings were observed for hand washing with soap after faecal contact, with less than 2% of respondents washing their hands with soap (Biran, Schmidt et al. 2007).

2.7 Knowledge of the importance of hand washing

A recent large-scale international survey conducted in 2007 of 10,000 people in ten countries in both developed and less economically developed countries, by international experts in the field of infectious diseases and public health was undertaken to assess public awareness of hygiene, particularly for family wellbeing. The results of the study were that a large proportion of people are ignoring basic practices in the domestic environment and are therefore exposing themselves unnecessarily to the risk of infection. One of the major findings cited of the study was that "hygiene advice is understood, yet ignored" by large sections of the general populace (Hygiene Council 2007).

The findings from the Hygiene Council survey identified that overall, for most of the ten countries that participated in the survey, in most countries the need for hand washing before eating and handling food and after using the toilet was recognised. Results from the survey in India indicated that 52% respondents thought the toilet basin was the site where most germs reside in the home while 17% selected kitchen surfaces, 10% selected germs on hands and only 7% selected door handles. However, the study reported that in reality most germs could be found on surfaces such as light switches, telephone receivers and TV remote controls. In this study, the type of households that the study was conducted on was not clearly specified. However, as the study outlines that TV remote controls were assessed this might point to households of a higher socio-economic status.

The study also identified that dirty laundry was generally overlooked as a reservoir for germs in the home; only 7% of respondents viewed dirty laundry as a reservoir for germs. Interestingly, the survey findings from India found that 48% of respondents did not wash their hands properly after sneezing or coughing and a further 21% said that they do not wash their hands before eating or handling food and after handling pets. In terms of hand washing after using the toilet, 13% of respondents said that they did not wash their hands properly after using the toilet. The survey did not directly state how hand washing was measured, however, it appears that the results were based on self-report measures due to the way in which the results of the survey were interpreted (Hygiene Council 2007). This is interesting as the results of very low reported hand washing are in contrast to the disadvantages cited of using self-report measures to assess hand washing as hand washing tends to be over-reported when self-report measures are used.

Formative research findings from Tanzania were consistent with findings from other studies. The findings from the research indicated that although knowledge about the importance of hand washing for hygiene purposes was high, actual practice of hand washing was much lower and when it did take place, the majority of those that washed their hands at critical times tended to wash hands with water and only one hand tended to be washed. A lack of awareness of proper hand washing was noted across all three study districts (LMS/Steadman International 2006). Research findings from India from a soap use study found that the most important times to wash hands were cited as after cutting/cleaning fish, after cleaning vessels and after defecation. The two most important reasons for hand washing with soap after defecation were germs and cleanliness, whereas the reasons for not washing hands were washing is not enough and that hand washing was not a habit (KRWSSA and IMRB 2002).

Cultural factors, particularly the custom to eat with one's hand were found to be an important factor in formative research from Tanzania for hand washing before and after eating. In addition, the choice of soap used was important, as most toilet soaps were identified to have a fragrance that is passed onto hands and food when eating. The study established, using structured observation, that several respondents did not wash their hands at key times. Furthermore, the study highlighted a number of practices that were deemed to be risk prone that could increase the risk of infection. One of the high-risk practices observed were all households' members washing hands in the same bowl of water before eating. Other high risk practices were hands not being rewashed after interruptions in activities where hands needs to be washed, for example, while feeding a child and then interruptions occur when a visitor arrives. Specific risk activities identified for children were children playing with toys while being fed and putting their hands that were unwashed into their mouth while being fed. In addition, children playing with mud while eating and touching and playing on the floor (LMS/Steadman International 2006).

2.8 Determinants of hand washing facilities and materials

Although there have been a number of studies on hand washing, in particular the importance of hand washing with soap, few studies have assessed how availability and access to hand washing materials and facilities influence hand washing behaviour. The formative research studies for the PPPHW programme and some other studies have collected data and briefly assessed available hand washing materials and facilities in households. However, there has been no real detailed analysis as to what determines access and availability of hand washing materials and facilities. Although, in the literature, access to hand washing hardware such as having a place to wash hands, available water and hand washing agents are identified as crucial for washing hands (IRC 2003).

A recent study examining hand washing promotion efforts in urban Dhaka concluded that specific efforts to provide hand washing facilities inside the household are more likely to improve hand washing behaviours than interventions that ignore this (Luby and Halder 2007). Furthermore, this study identified socio-economic status as an important factor in determining whether households had access to indicators for hand washing. Among the 6970 households, 92% had a bar of body soap in the household, 41% had a convenient place to draw water and wash hands inside their house and 40% had a bar of soap available at the most convenient place to wash hands. Further findings indicated that once socio-economic status was controlled for, having a place to wash hands in the household was strongly associated with the presence of soap at the hand washing location. The results of this study also identified that the further away the place for hand washing from the house, the less likely that soap was available.

In the univariate analysis, in households that reported usually washing their hands with soap, the following factors were found to be important: the presence of a bar of body soap, a convenient place to draw water and wash hands inside their house, or that had soap present at the most convenient place to wash hands. Households with these factors were significantly less likely to report a child in the household who had a cough or difficulty breathing in the preceding seven days than households that did not have these characteristics. However it must be noted that there are drawbacks of using self report methods, namely reporting bias, whereby respondents over report desirable behaviours.

The findings of the study identified that even after controlling for socio-economic status households that had soap at the most convenient hand washing location were 19 times more likely to have the hand washing station located inside their house rather than outside. Further findings of the study indicated that the availability of a hand washing station outside of the household often meant that the facility was shared between households, usually by more than one family. In this case, the study identified that if the hand washing facility was shared then a family that invests in soap risks losing some of or all of their investment in soap to their neighbour. This study provides the most in-depth analysis to date on how hand washing materials and facilities influence hand washing practice and morbidity outcomes (Luby and Halder 2007).

2.8.1 Facilitators and barriers to hand washing with soap

Formative research conducted in Uganda demonstrated that soap and water availability were key facilitators to HWWS. Furthermore, that many households keep soap at centrally located places, for example drying racks that may be convenient for HWWS. This was seen to be facilitator as soap could be located in a place that is convenient for use; therefore, it is more easily accessible to be used when hand washing occurs.

The findings from Uganda identified that socio-economic correlates of people who HWWS were living in an urban area, having larger houses with non-earth floors, having electricity, taps in the house or yard, a working TV set, radio and mobile phone. All of these were identified to be a measure of wealth, education or socio-economic characteristics. Qualitative research findings identified that socio-economic barriers to HWWS included poverty, where the cost of soap was perceived to be high. This was reported to hinder the sustainability of HWWS behaviour.

The physical barriers to HWWS were convenience in relation to hand washing facility and the availability of soap nearby, availability of water for hand washing, the physical amount of time spent on hand washing, especially when people were busy and that there were too many junctures for hand washing (Steadman International 2007).

In the study in Tanzania, poverty was found to impact on access to soap and water resulting in limited practice of hand washing. Fifty-six percent of the households visited had a hand washing facility and 29% of the households had soap. The findings identified that in most of the households the hand washing facility was mainly improvised using bowls and buckets to wash hands. The research identified that 62% of households had bowls of water placed outside the toilets. The research identified that in some households, household members would recycle water or that an individual would get fresh water to wash their hands. In some cases, there was another separate container for fetching water.

The research identified that for 49% of the households visited, soap was placed at a distance from the toilet, thus forcing anyone who wanted to use it to walk some way to fetch it. In only 10% of the households was soap placed next to the toilet. The exact distance was not specified in the study. The research was able to highlight some of the reasons why washing hands with soap was not practised. Reasons included hand washing not being a habit, ignorance of the importance of hand washing, the unavailability of soap, laziness and lack of time. Also of interest was the identification that some people lived in dirty environments and did not feel compelled to clean their hands. The research highlighted that soap was usually kept away for safekeeping and this can make retrieval difficult at times.

Geographic location was also identified as having an important role in hand washing, with different challenges to hand washing if the household was located in an urban area compared with a rural area. The challenges to hand washing identified in urban areas were found to be more related to factors such as accessibility to hand washing materials such as soap, a sink and water rather than affordability, which appeared to be more the case in rural areas.

A further interesting finding was that the process of hand washing in both urban and rural areas is likely to involve two people. The process was conducted by one person who had responsibility for pouring the water and giving the person washing their hands soap and the other being the hand washer. This was found to impact on the number of times people washed their hands in a day. This could be because the other person was not available to assist with hand washing.

Results from the study further implied that the higher the incidence of hand washing facilities, the higher the chance of soap being provided. Water shortages were also found to impact on hand washing practice. One of the major conclusions of the research was that access to soap and water is a prerequisite to any successful intervention programme on hand washing with soap and that there is a need to emphasis hand washing at key times, stated as after visiting the bathroom, before and after eating, before cooking and after changing a child (LMS/Steadman International 2006).

Results from the study in Peru indicated that indoor plumbing greatly facilitates the practice of hand washing with soap when there is contact with faeces. The study identified that the closer the hand washing place to the defecation site then the greater the presence of soap. Similarly, this was identified to be the case from research conducted in Tanzania. Results from this study were that the higher the incidence of hand washing facilities, the higher the chance of soap was provided. Water shortages were also found to impact on hand washing practice (LMS/Steadman International 2006).This is further supported within the literature that hand washing behaviour is strongly influenced by the presence or absence of a convenient water supply and soap. Widely cited is research by Boot and Cairncross that in-house water supplies were associated with reduced rates of diarrhoea. In particular, the findings indicate that if the water collection time exceeds 30 minutes then this substantially decreases the amount of water that a household uses (Boot and Cairncross 1993).

The research study conducted in Peru identified that there was a statistically significant relationship between unmet basic needs and the hand washing behaviour of mothers before preparing food. Furthermore, access to water was found to be associated with possibility of hand washing. In households where there was running water, a higher percentage of hand washing was observed than those that lived in households where there was a water source outside the home (A.B. PRISMA for EHP Lima 2004).

Research conducted in India on soap use identified that respondents that took a bath more than once a day tended to wash hands with soap. This may indicate a higher level of awareness and practice of hygiene amongst those that frequently practice other forms of hygiene behaviours. The exact number of times was not specified in the study. Important factors that were taken into account pertaining to purchasing a particular brand of soap highlighted from research in India were the price, availability and durability of the soap. Local grocers were identified as an important source for purchasing soap (KRWSSA and IMRB 2002).

In a multivariate analysis examining data from Ghana exploring the determinants of hand washing with and without soap at key junctures, a number of factors were found to be associated with hand washing in any form after defecation. This included the mother's education, knowledge of important times to wash hands with soap, the age of her children and a measure of quality of childcare. Weak relationships were identified between hygiene behaviours and explanatory variables such as education, health knowledge and wealth (Scott, Curtis et al. 2002). Similar findings were observed in India, whereby mothers in the household of clerks/skilled workers tended to wash hands with soap and those that claimed to wash hands with soap were identified to have above high school education (KRWSSA and IMRB 2002). Formative research in Kyrgyzstan identified an association between owning a wash stand and increased rates of hand washing following latrine use (Biran, Tabyshalieva et al. 2005).

Furthermore, the study conducted in India on soap use identified that most of the women in the study who had a separate bar of soap for hand washing washed their hands with soap. Although, this appears to be an obvious statement, having soap available does not necessarily mean that soap will be used for hand washing purposes. The most important times for HWWS were reported as after cutting/cleaning fish, after cleaning the vessels and after defecation, in the order. The reasons given for not washing hands were firstly an attitude that prevailed that washing hands was not enough and that hand washing was not a habit. Fathers tended to be responsible for buying soap, but mothers played a role in deciding on what soap to buy. The availability of soap inside the latrine and near the wash basin made a difference to hand washing with soap and there was a greater likelihood to wash hands with soap after defecation if there was spare soap in the household and storage of water inside the latrine made a difference to hand washing with soap (KRWSSA and IMRB 2002).

In 2007, the Water and Sanitation Programme (WSP) on behalf of the Ministry of Health in Kenya conducted a baseline and consumer study on hand washing with soap. The findings of the research were that hand washing with soap at the household level was low priority. This was identified as it was ranked fourth in terms of priority after bathing, laundry and washing dishes that were all given as higher priorities. The use of bar soap due to its ability to have multiple applications indicating that it could be used for various purposes other than hand washing, for example, washing clothes and other household tasks and applications. Overall, 97% of households had access to soap and women were identified to be the key decision makers for the use of soap at the household level.

One of the motivators for hand washing at the community level of the population studied was “disgust”. This was not elaborated on however and other studies conducted using the same format determine disgust as relating to being aware of contaminated matter on hands. This was identified to be the strongest motivator, particularly when there is a strong smell and physical dirt. This was a strong motivator after toilet use and contact with stools. The other two motivators were nurture and comfort. Nurture in terms of it being a strong emotional motivator in order to protect children from illness and to see them grow to achieve their parents’ dreams. The explanation given for comfort was that it is a motivator that gives a mother the flexibility and freedom to continue with her activities. In terms of comfort, results from other studies explained comfort in terms of a mothers enjoying the feeling of being clean and having fresh smelling hands from which dirt and sticky material has been removed (Curtis, Danquah et al. 2007; Health in Your Hands 2008b).

The importance of a hand washing facility was identified. Lack of access to a hand washing facility was a barrier to hand washing. In addition, the distance between the toilet and the water source was a barrier. This is in line with findings from other research studies that demonstrate that the further the distance between the toilet location and the hand washing facility, then the less likely it is that hands are washed (Health in Your Hands 2008b).

The formative research studies and other similar research studies discussed highlight the importance of access and availability of hand washing facilities and materials to facilitate hand washing practice. In addition, it also demonstrates the need to understand the barriers and motivators to hand washing and access to hand washing materials in order to successful promote and facilitate hand washing with soap. A better understanding of these factors is of benefit and necessary to appropriately measure, design, implement and evaluate hand washing and hygiene promotion initiatives and develop reliable and valid hand washing indicators.

2.9 Summary

In summary, this literature review highlighted the difficulties firstly of measuring hand washing and the methodological and practical issues associated with the various approaches. The importance of hand washing for child health and reducing the transmission of disease is an important feature and emphasis and underlies the rationale of hand washing becoming a global priority. The growing importance and recognition of hand washing, in particular, hand washing with soap to reduce morbidity and mortality from diarrhoeal diseases recognised through initiatives such as the Global PPPHW and the Global Scaling Up of Hand washing Behaviour Change project bringing together the public and private sector. In addition to the role and the use of hand washing indicators for the achievement of MDGs for child survival, this heightens the need for valid and appropriate indicators to monitor, evaluate and inform hand washing and child survival initiatives.

However, in light of the growing recognition of hand washing and its benefits, research studies on the area demonstrate that the actual practice of hand washing with soap is low in a number of countries as discussed in this chapter, particularly for food related exposures and after going to the toilet. These hand washing events being among the critical times at which hands should be washed. There is clearly much work to be done to promote the critical times. Formative research studies from over ten countries provide a basis to explore the facilitators and barriers to hand washing, in particular, hand washing with soap. The important facilitators are the availability of a place to wash hands and soap, particularly, the presence of soap in a conveniently located place and water. The barriers include poverty which is a key factor in the decision and ability to purchase soap, lack of knowledge on the importance of hand washing, hand washing not being a habit, lack of access to hand washing facilities and materials and lack of education.

The different measurement methods used in the domestic and clinical setting to assess hand washing behaviours and hand hygiene practice demonstrate the difficulties of the different methods and the lack of research in to the assessment of the validity of different approaches. Although direct observation techniques are viewed as the most appropriate method to provide information on actual hand washing practice or adherence to hand hygiene protocols, this technique is difficult and expensive to use on a large scale. Therefore there is a need for well validated measurement methods that provide information on how an individual washes hands. The results of which need to be reliable and valid and can be implemented and used on a large scale.

The literature review highlighted that a variety of approaches that use multiple methods are required to triangulate information on hand washing behaviour and hand hygiene practice in order to gain data that is more valid. The importance of validity of measurement tools and assessment that this is the missing, but needed element was highlighted in the literature review. This, therefore, forms the basis of this research. The purpose of which is to validate the different measurement methods for assessing hand washing behaviour and uncover the methodological and measurement issues of the different measurement methods. These results are also important and can be applied to assess hand hygiene in the clinical context.

The next chapter examines DHS hand washing measurement methods and critically assesses the measurement methods used in selected DHS countries.

3 Evidence of hand washing from Demographic and Health Surveys

The MEASURE DHS (Demographic and Health Survey) programme has provided technical assistance to more than 200 surveys in 70 countries since 1984. It has a worldwide reputation for collecting and disseminating accurate, nationally representative data on a range of population and health issues, including fertility, family planning, maternal and child health, child survival, HIV/AIDS, malaria and nutrition. The programme aims to advance global understanding of health and population trends in developing countries (MEASURE DHS 2008a). This chapter focuses on hand washing indicators featured in the MEASURE DHS programme. This chapter firstly provides an overview of the programme and then discusses available survey indicators on hand washing. There is then an examination of the measurement and methodological issues of the hand washing indicators, assessment of data quality of the available survey data from the programme and findings from country reports on hand washing materials and facilities. The final focus of this chapter is on studies that have attempted to evaluate and validate MEASURE DHS data and then a conclusion to summarise the findings of the chapter.

3.1 Demographic and Health Surveys

The basic approach of the MEASURE DHS programme is to collect information that is comparable across countries. In order to achieve this, a standard model questionnaire has been developed, along with a written description as to why questions have been included. The model questionnaires have been reviewed and modified in each of the phases of the programme. These questionnaires form the basis of the questionnaires that are applied to each country. These surveys are nationally representative population based surveys that collect data on monitoring and impact evaluation indicators that are important for countries and cross-cultural comparisons. DHS typically have large sample sizes of between 5,000 and 30,000 (Rutstein and Rojas 2006).

The MEASURE DHS Core Questionnaire emphasises basic indicators and flexibility. The questionnaire is designed to collect data from women of reproductive age (15-49). Women who are eligible to take part and to be interviewed are identified through the household questionnaires used. The core questionnaire consists of three questionnaires, a household questionnaire, a women's questionnaire and a men's questionnaire. All DHS surveys must have at least a household and women's questionnaire.

The questionnaires can be tailored to meet the needs of the host country and donor agencies. The typical scenario is that a country undertaking a MEASURE DHS survey is asked to adopt the entire questionnaire but can add questions that are of particular interest. Questions in the module can be deleted if they are not of interest to that country and special module questionnaires can be added to questionnaires to meet host country and USAID needs.

3.2 DHS and survey instruments on hand washing

The DHS programme is now in its fifth phase. This section provides an overview of the inclusion of questions on hygiene practices and sanitation, particularly focusing on hand washing in each of the phases.

In the first phase of the DHS, from 1984-1989, information collected within the core questionnaire focused on water and toilet facilities. The purpose of this was to elucidate the determinants of international variations in infant and child mortality. The questions asked respondents for information on the source of their drinking water and water for other uses such as hand washing and cooking. Such questions were identified as being useful in determining whether the water may be contaminated which was identified as an important determinant of early childhood mortality. Hygiene related practices were assessed by asking respondents whether they had a cake of soap on the premises. The absence of soap was used to indicate poor personal hygiene habits (Institute for Resource Development and Westinghouse Electric Corporation 1987a; Institute for Resource Development and Westinghouse Electric Corporation 1987b) .

In the core question, the question was asked as follows:

- ***Do you have, right now, a cake of soap on the premises?***

In the second and third phases of the DHS conducted from 1988-1993 and 1992-1997 there were no specific questions on whether there was soap in the household in the core questionnaire. The focus of the questions was on water and sanitation related practices (Macro International and Institute for Resource Development 1990a; Macro International and Institute for Resource Development 1990b; Macro International 1995b; Macro International 1995a).

The fourth phase of the DHS conducted from 1997-2003 specifically identified the importance of having a place for hand washing in the household. Having access to a designated place to wash hands was identified as being appropriate in order to carry out appropriate hand washing. In addition, there also needs to be a dedicated location that contains a clean water supply, a basin for containing water and a cleaning agent such as soap. In the absence of soap, hands may be cleaned using ash or sand. However, these were identified as being less satisfactory than soap. The purpose of the questions on hand washing materials and facilities was to ascertain whether the household had a designated place for washing hands and whether the requisite items were present. The following question was featured in the model household questionnaire:

- ***Where do you usually wash your hands?***

Respondents were given the choice of three answer categories of in the dwelling/yard or plot, somewhere else or nowhere. Respondents that answered the latter two were filtered onto a different section.

Respondents that answered that they had a designated place in the dwelling yard or plot to wash their hands were then asked whether they had the following requisite items present. The respondent was then asked to show the interviewer where household members usually washed their hands and the interviewer observed and recorded if the following items were present: water/tap, soap, ash or another cleansing agent and a basin.

The questions were asked a follows:

- ***Ask to see the place and observe if the following items are present:***

  Water/tap

  Soap, ash or other cleansing agent

Basin

Additional questions on hygiene practices were asked in the women's questionnaire. This included a question on the disposal of the youngest child's stools as it was noted that appropriate sanitation practices are linked with a decreased risk of diarrhoea. The question given in the core questionnaire was asked as follows:

- ***What is usually done to dispose of your (youngest) child's stools when he/she does not use any toilet facility?***

Furthermore, a question on hand washing before food preparation was asked. The rationale being that the washing of hands at appropriate times is one of the most important means of preventing the spread of disease through direct contact and through food contamination. The purpose of the question was to ascertain whether the respondent prevented food contamination by washing her hands before she last prepared food for her family, which was taken as her typical practice. The question given in the core questionnaire was asked as follows:

- ***The last time you prepared a meal for your family; before starting did you wash your hands? (ORC Macro 2001a)***

One of the issues noted with the available country data on hand washing in the MEASURE DHS programme was that it was extremely difficult to ascertain which countries had available data. To ascertain whether the question on having a designated place for hand washing in the household was asked in the survey the Stat Complier function was used. This compiles a range of statistics on various indicators used and searches through all country reports conducting during the fourth phase (ORC Macro 2001b).

In the latest phase of the DHS, the fifth phase conducted since 2003, no questions on the availability of hand washing materials and facilities were featured in the main model questionnaire. However, when the individual country level data was assessed and the country questionnaires, the questions on having a designated place observed to wash hands were sometimes asked as well as whether the requisite items of soap, ash or another cleansing agent, water/tap or a basin were present. This was also asked in the Egypt and Senegal DHS 2005 where only the question on having a designated place for washing hands was asked. Personal communication with ORC Macro, who conducts the surveys, indicates that they tested new questions on hand washing in two of their surveys. These surveys were the Nepal and Peru 2006 DHS (ORC Macro 2006).

The new questions included in the Nepal and Peru 2006 DHS were based on soap use, knowledge of the most important times to wash hands with soap and the purpose of soap use. The questions were as follows:

- ***Did you use soap today or yesterday?***

  The answers categories were "yes" and "no".

- ***For what purpose did you use soap?***

  For this, the following answer response categories were available:

  Hand washing

  Washing own body

  Washing child's hands

  Washing child's body

  Washing clothes

  Other

  Any other purpose?

  The interviewer had to record all mentioned

- ***How many times did you wash your hands with soap yesterday?***

  If the answer given was more than seven times, then the interviewer had to record seven as the answer or alternatively "don't know".

These questions were therefore more on soap use and hand washing recall in the last 24 hours and the purpose of soap use (Ministry of Health and Population (MOHP) (Nepal), New ERA et al. 2007).

In the main questionnaire, questions relating to housing characteristics such as the availability of water and toilet facilities in the household were asked. The rationale behind such questions was identified as the need for safe water and adequate sanitation as fundamental needs and basic human rights that improve health and survival, as well as social and economic productivity. The questions asked are used to measure "improved" coverage of water and sanitation. The response categories to these questions were in line with WHO and UNICEF definitions and such questions are recognised as being part of the measurement of MDGs. Further questions on the location, travel time, water haulage responsibilities and treatment of water were asked. There were questions on whether toilet facilities were shared to assess whether the facilities were likely to be kept in a hygienic condition. This was identified as being an important measure of the overall hygiene of the household. The question on the disposal of the youngest child's stools remained (MEASURE DHS 2006).

3.3 Standardisation of DHS questions

There does appear to be considerable variation in the degree to which the questions in the core questionnaire devised by the MEASURE DHS programme appear in the individual country level questionnaires. A systematic search using STAT Compiler and through searching available country reports of the English and French DHS identified fifteen countries from the fourth and fifth phases of the DHS (1997 onwards) that had data on hand washing materials and facilities in the household. Within these 15 countries, there appears to be considerable variation in the countries that have chosen to adopt the questions on hand washing materials and facilities. Only two countries were identified that asked questions on hand washing materials and facilities in two or more of their surveys. The subsequent surveys were special DHS modules focusing on education. However there were questions on hand washing included in these surveys alongside the full DHS information available. These countries were Nigeria who conducted a full DHS in 2003 and in 2004, the Nigeria 2004 survey collected data on Education only and the Uganda 2004 survey. Egypt appears to be the only country with three consecutive surveys featuring questions on hand washing materials and facilities and in full-scale DHS surveys.

3.4 DHS hand washing measurement and methodological issues

3.4.1 Measurement and methodological concerns on hand washing measures

The methodological issues and experiences by ORC Macro in the design and use of questions on hand washing practices in their surveys were discussed in a meeting on previous hand washing questions in DHS and the Environmental Health Project (EHP) in October 2005. The aim of this meeting was to summarise past and recent experiences using hand washing survey questions to decide the next round of questions to be pre-tested in upcoming DHS or other mechanisms. The findings from the meeting highlighted that ORC Macro have tried many different ways of asking questions on hand washing and the experience to date has not been satisfactory.

The EHP noted that in terms of hand washing measurement, in the past the focus had been on knowledge and attitudes about hand washing but not on measures of hand washing practices. The methods used had relied upon respondent recall. The disadvantages of this approach were discussed in terms of the poor agreement between what respondents report and actual hand washing practice. This was attributed to respondents over-reporting positive behaviours and under-reporting negative behaviours as discussed in the previous chapter.

The questions that were noted to result in over-reporting were:

- ***Did you wash your hands yesterday?***
- ***When did you wash your hands yesterday? (Asked immediately following the question above)***

The experience of the EHP project identified the lack of information about the validity and reliability of hygiene indicators, particularly questions on hand washing practices.

The approaches used to assess the validity and reliability issues were discussed. The methods included observational methods, specifically, observation of hand washing techniques, locations of hand washing facilities; looking specifically for hand washing materials such as soap. Soap was noted as very important as it was identified as the most important cleansing agent that is promoted and questions on the presence of soap in the household.

The disadvantages of observing hand washing practices were discussed. The key points raised were similar to the ones discussed in the section on the measurement of hand washing in Chapter 2. This includes issues of the “Hawthorne effect” whereby respondents being observed change their behaviour and reactivity. Respondents demonstrate different behaviour compared with their normal practice, termed within the discussion as “putting on a show”. A further criticism of hand washing observation was that it does not address the question of whether a respondent actually washes their hands at critical times. Critical times were cited as after defecation, after cleaning a child’s bottom, before preparing food, feeding a child and before eating. In addition, asking questions on soap availability needs to take account that most people may have soap for other purposes other than hand washing (Bentley, Boot et al. 1994).

Based on the experience of the EHP project, the following recommendations were proposed regarding hand washing indicators and measurement.

- Research should be conducted to establish the validity, reliability and reuse of questions to measure hand washing behaviours
- The use of the positive deviance approach should be explored. This approach is used to identify and promote what makes individuals perform desirable healthy practices
- The use of spot checks should be continued
- There should be inclusion of questions on the perceived hand washing behaviours of others
- Individual behaviours should be used for programme design and monitoring
- The use of clusters of behaviours should be explored and composite indicators to measure practices for impact and summative evaluations

The earlier experiences of the DHS on measuring hand washing were addressed. Discussions of the inclusion of questions on hand washing in the earlier DHS as part of their environment and health module were conducted. The following questions are the questions discussed earlier that were featured in the fourth phase of the MEASURE DHS programme. The questions were featured as follows:

- ***Where do members of this household wash their hands?***

  A further variation of this question was:

- ***Where do you usually wash your hands?***

The experience of ORC Macro identified that there were methodological issues with collecting this information. Difficulties were experienced in administering the questions in the field since the questions required a break in the interview to conduct the observations.

Further findings identified that poorer households may not have a specific hand washing area or basin for washing hands. The issue of soap availability was raised, pertaining to findings that the absence of soap in the hand washing area does not necessarily mean that soap was not used for hand washing. The example of Latin America was given to support this finding, in that people keep soap in a storage area in order to prevent misuse, i.e. children playing with it (Saadé, Bateman et al. 2001). This has also been identified in the formative research for the PPPHW programmes whereby soap is stored in a separate place for safety to prevent misuse. Therefore, soap is taken from the storage place to the hand washing facility when required (Curtis, Rabie et al. 2002).

The ORC experience also discussed the methodological issues with asking direct questions on hand washing that have been featured in previous DHS surveys. The discussion focused on the use of these questions as part of the initial phase of hand washing question in DHS. The questions used are featured below:

- ***The last time you prepared a meal for your family, did you wash your hands immediately before?***
- ***The last time you fed your children, did you wash your hands before feeding them?***
- ***The last time you cleaned your child (one of your children) after defecation, did you wash your hands immediately after?***
- ***The last time you prepared any food for your family, did you wash your hands right before you started preparing it?***

The questions featured above were described as using a direct interrogation approach. Consequently, ORC Macro reported that this led to acquiescence, over-reporting of washing hands. They cite the example and findings of the use of such questions in the Dominican Republic 1999 DHS, where 90% of the study participants reported that they washed their hands before feeding children and 95% reported washing their hands before food preparation. ORC Macro concluded that such high percentages were likely to be unrealistic and that the findings do not enable the discrimination of respondents. Furthermore, such questions are not able to distinguish whether soap was used during any of the instances.

The questions featured in the Egypt 2005 DHS were identical to the EHP questions featured in Madagascar stated above. The methodological issues identified from the use of this approach and the perception by interviewers was that the use of soap for hand washing at critical times was most likely to be under-reported due to these answers being mentioned after the third or fourth probe. The specific details of the first, second and third probes were not detailed in the discussion. The conclusion by interviewers was that further formative research should be conducted to enable a better understanding of hand washing practices and that this will subsequently lead to a better formulation of questions on hand washing.

The conclusions of ORC Macro on their experience of hand washing measurement and suggestions for possible ways forward were that in terms of inclusion of questions in DHS, questions on hand washing should be kept, with the comment given that “something is better than nothing”. The concluding comments were whether there is empirical evidence to suggest that the critical times that have been mentioned are the ones that should be addressed when promoting hand washing. As a result should these indicators be the ones that should be included in measuring the behavioural impacts of projects.

There was also the suggestion that the focus should remain on soap, and that no further questions should be added on other cleansing agents such as mud, sand etc. The rationale underpinning this was that the focus of researching in the hygiene community has been on the use of soap for hand washing. The thoughts of representatives from ORC Macro were that there is no interest in getting information on the use of soap for other purposes. Furthermore, the use of sales data on soap in order to infer the use of soap for hand washing purposes (at critical times) was thought to be limited.

In terms of methodological improvements, approaches used in nutrition programmes were thought to be useful to improve recall. The conclusion reached was that in these programmes, aided recall is obtained by breaking the time period of recall down into segments, for example morning, afternoon and evening and then asking specific questions about what occurred at each of those time periods. The use of such an approach would most likely facilitate exploring hand washing practices around the critical times and would possibly reduce the use of leading questions.

Approaches suggested to validate hand washing measures included a time-motion study. Such an approach was suggested as it would help to understand hand washing behaviour and validate findings. It was suggested that this should be part of a larger observation where families would not be told that hand washing or hygiene practices are the focus of the topic. Lastly, the suggestion of exploring the intensity of hand washing was suggested. Representatives proposed that it might be possible that the more that one washes hands, the more likely that one would wash hands at critical times. The way in which this would be measured was not specified.

They also highlighted that in terms of counting the events there are additional hygiene practices that include hand washing such as bathing. Questions on hand washing regarding the number of times that hands have been washed are likely to be estimates. In order to reduce error, approaches adopted in nutrition programmes would be most appropriate in reducing error. Therefore, the suggestion was to break up the recall period into sub-periods.

From a methodological perspective, only one study has rigorously sought to measure household hand washing and has compared different tools and indicators (LSHTM and WHO 2005). The results of this study were discussed in Chapter 2.

The appropriateness, reliability and validity of hand washing measures needs to be analysed, given recent findings of the Pune study and calls within the field of hand washing and hygiene behaviour research on the measurement and methodological issues of measuring hand washing (Arnold 2007).

3.4.2 Methodological shortcoming of DHS hand washing indicators

There are a number of key issues that collecting quantitative data on hand washing facilities and hand washing behaviours are unable to explain. The questions and observation methods are unable to address issues particular issues, importantly whether hands are washed at critical times. Some of the barriers to hand washing include hardware and infrastructural issues: access to clean water and a hand washing location, software issues: the availability of soap or a cleansing agent to wash hands and factors for example, poverty, lack of knowledge/habit of the importance of washing hands. The methods employed in the DHS to assess hand washing do not provide any information on households that do not have a designated hand washing facility or access to hand washing agents, for example soap, ash or another cleansing agent.

The questions and spot checks are based on a set of filter questions, firstly to ascertain households that had a designated hand washing place to wash their hands. Only those households that were identified to have a designated place were asked and observed about the availability of soap, ash or another cleansing agent, the availability of water/tap and a basin in the household. It would be beneficial to understand both how and why households with limited access to hand washing materials and facilities behave, and what methods and technologies, if any, they use to appropriately wash hands. This is important from a public health perspective in terms of promoting hand washing with soap. For example, in major hand washing promotion programmes, it is the people that do not wash hands appropriately who should be important targets in terms of hand washing promotion. Therefore, not having information on such individuals is an important issue for understanding how and why these individuals behave and ensuring child health and survival.

Furthermore, beliefs, knowledge, practices, and the context in which hand washing takes place and the availability and use of materials to wash hands appropriately may vary within countries and across countries. Therefore, standardised approaches to asking questions and collecting data through spot checks and other methods may not perform effectively in different cultural contexts where questions and observations may not be understood and the context in which the hand washing behaviour does or does not take place are different.

The use of broad and standard questions may not appropriately capture actual hand washing practice. For example, recent formative research conducted in Tanzania indicated that it is customary to eat with hands (LMS/Steadman International 2006). This is widespread throughout many cultures in many countries, and questions that do not incorporate and understand such cultural norms are of questionable value in terms of measuring and assessing hand washing practices if such factors are not taken into account. Eating with hands as opposed to using implements, for example, cutlery may increase the risk and transmission of infectious disease pathogens if hands are contaminated with faecal matter. In addition, in some religions, both hands and feet must be washed. Therefore, religious values may influence and impact on hand washing practices and beliefs surrounding notions of hygiene and cleanliness.

3.5 Assessment of DHS Data Quality

This section examines the available DHS data on hand washing with an overview of countries with questions on hand washing and spot check observations. In addition, there is also analysis and discussion of the data quality of the available data on hand washing indicators.

To date, there are 19 available surveys from 17 countries with questions and spot check observations on hand washing facilities and hand washing practices. There are 11 countries with data on both self-reported hand washing behaviour and observation of hand washing materials and facilities. The results of which are shown in Table 3.1.

Table 3.1: Survey questions on hand washing in DHS

Country	Year of survey	Place for hand washing	Hand washing materials	Hand washing before meal preparation	Other
Armenia	2000	√	√	√	x
Benin	2001	√	√	√	x
Burkina Faso	2003	√	√	√	x
Dominican Republic	1999	x	x	√	√
Egypt	2000	√	√	x	x
Egypt	2003	√	√	x	√
Egypt	2005	√	x	x	x
Ghana	2003	√	√	x	x
Madagascar	2003/04	√	√	√	x
Malawi	2000	√	√	√	x
Mali	2001	√	√	√	x
Morocco*	2003/04	x	√	x	x
Nepal	2006	x	x	x	√
Nigeria	2003	√	√	√	x
Rwanda	2000	√	√	√	x
Senegal	2005	√	√	√	x
Turkmenistan	2000	√	√	x	x
Uganda	2000/01	√	√	√	x
Zimbabwe	1999	x	√	√	x

Author's own analysis of DHS data files

3.5.1 DHS and hand washing materials and facilities

Fifteen countries were identified that had DHS data that collected information on hand washing materials and facilities available in the household, with 17 surveys with data since 1999. All of the data presented is based on data taken from the child file from the DHS with available hand washing data. Therefore, the unit of analysis is based on the child and findings need to be interpreted with this in mind, as there may be multiple children within one household and some households, for example, poorer households may have more children. In some countries, not all of the questions on the availability of hand washing materials and facilities were asked; this is why not all of the countries appear in the tables featured. In addition, all analyses were based on children born in the five years preceding the survey who were usual residents in the household.

The data displayed in Table 3.2 from 12 countries illustrates that there was marked country variation in household access to a designated place for hand washing. The number of children refers to the overall total for the question only, as does the number of missing cases. Mothers who responded that there was nowhere designated for hand washing in the household were highest in Benin where 98% of women had no designated place to wash their hands. This result seems highly questionable and may be indicative of the question asked as only 2% of respondents had a designated place in the dwelling, yard or plot and no respondents answered that they had somewhere else in the dwelling to wash hands. The problem with the high proportion of mothers responding that they have nowhere may indicate that there is no designated hand washing facility such as a sink or certain infrastructure built into the household structure and other implements might be used to assist with hand washing or act as the facility. This, for example, could be a communal water tap/pump or a bucket/basin where water is stored and used when washing hands. The high proportion of mothers that were observed by the interviewer to have access to a basin at the designated hand washing place indicates that the use of a basin is an integral part of the hand washing process in this context.

Table 3.2: Percentage of children living within households with a designated place for hand washing

Country	Year of survey	% Designated place in the dwelling/yard/plot	Total no. of children	Total no. of missing cases
Burkina Faso	2003	97.8	10643	24
Armenia	2000	96.3	1626	0
Malawi	2000	90.3	11864	5
Mali	2001	89.5	12899	59
Senegal	2005	85.2	10123	35
Nigeria	2003	81.7	6106	7
Egypt	2000*	80.4	10897	0
Egypt	2003*	83.1	5949	0
Egypt	2005	91.1	12734	35
Madagascar	2003/04	62.7	6184	1
Ghana	2003	57.2	3604	0
Uganda	2000/01	26.9	7319	3
Benin	2001	2.3	5148	1
Rwanda	2000	1.8	8102	25

Author's own analysis of DHS data files. Egypt 2000 and 2003* refers to whether the place for hand washing was in the dwelling, yard or plot not being specified in the survey.

A low proportion of mothers without access to a designated place were identified in Uganda where nearly half of the women reported that they did not have a designated place for hand washing. Mothers in Burkina Faso, Nigeria and Rwanda reported the lowest percentages of not having a designated place to wash their hands with approximately less than 3% of children having no designated place to wash hands. The finding from the analysis of the Rwanda DHS, where over 98% of mothers reported that they had somewhere else to wash hands was similar to that of Benin. With such a high proportion of respondents having somewhere else it would be very useful to know where they are washing hands or what other implements they are using to actually wash hands. The context of the question may again be the issue and the problem arising from the use of the term “designated place”. Respondents washing hands somewhere else may use a different water source or a communal tap to wash hands, they could also use other implements such as a bucket/container to wash hands in that they have near the toilet facility or in the kitchen. These implements can be used to store water in if water is not available nearby.

In four DHS, over 90% of children had mothers that reported that they had a designated place for hand washing in the household. The countries were Burkina Faso, Armenia, Egypt (2005) and Malawi. Other countries with a high percentage of women reporting that they had a designated place for hand washing over 80% were found in Egypt in 2000 and 2003, Mali and Senegal. These results are interesting. In Egypt for example, the proportion of mothers with access to hand washing facilities has increased to over 90% over the five year period from 2000. However, the results from the Egypt 2000 and 2003 surveys must be interpreted with caution as they refer to the hand washing place not being specified, so it is therefore unclear as to whether this facility is in the dwelling, yard or plot or somewhere else. The results from Malawi are of interest as similar data was collected in the UNICEF Multiple Indicator Cluster Survey (MICS) for Malawi.

The MICS obtained data from households in Malawi in 2006 using the spot check observation method for the presence of a hand washing facility outside the toilet. The questions are not directly comparable to the ones featured in the MEASURE DHS, where the interviewer observed whether there was a designated hand washing facility in the dwelling yard or plot. With the MICS, the observation was based on whether there was a hand washing facility outside the toilet.

The results of the MICS indicated that over 66% of household members had access to a hand washing facility outside the toilet, but when the facility was seen, it was not filled with water in all households. The observations were based on over 130,000 household members. The Uganda 2000/01 DHS identified that slightly over a quarter of women had a designated place for hand washing in the dwelling/yard or plot and a similar proportion reported that they had somewhere else.

The DHS approach to measuring hand washing has shortcomings in that it is unable to provide information about exactly where the place for hand washing is located or the type of hand washing facility present. This is important to know as there are many critical times at which hands should be washed. Therefore, identification of where the actual hand washing place is located, is of importance for ascertaining on what occasions hands were washed and distance to the toilet and kitchen facilities. Furthermore, not asking or observing what households with no hand washing facility use or those that reported that they have somewhere else to wash hands, limits the focus to only those that have the available facility.

Those that have no designated place or somewhere else may use other hand washing implements or other improvised technologies, or just have a water tap as the main hand washing place that they use to wash hands. This is not observed as only those that have a designated place in the dwelling, yard or plot are observed. As discussed, the term "*designated*" is problematic as can be seen from the high proportion of mothers that reported that they have nowhere or somewhere else to wash hands, for example in Benin and Rwanda.

The explanation given for the high proportion of mothers with nowhere or somewhere else to wash hands in Benin and Rwanda may be a further indication of the findings from the formative research in Tanzania. Results obtained from structured observations identified that in most of the households the hand washing facility was mainly improvised using bowls and buckets to wash hands.

Over 60% of households had bowls of water placed outside the toilet and for some households, household members would recycle water or that individual would get fresh water to wash their hands. In some cases, there was another separate container for fetching water. The results from Tanzania demonstrate that poverty was found to impact on access to soap and water resulting in limited practice of hand washing. Fifty-six percent of the households visited had a designated hand washing facility and 29% of the households had soap. The use of improvised hand washing facilities therefore provides some insight into what people with somewhere else or nowhere designated to wash hands use and do.

The need to clearly specify what is meant by the term "designated place" for hand washing is apparent in research on hand washing practices conducted in Peru. Hand washing locations were defined as places in the home where hand washing is practiced or where there was evidence that this practice takes place (through the presence of water, soap, a toothbrush, comb and/or mirror). The observations from this study demonstrates the difficulties of identifying one particular place for hand washing and that for different hand washing activities, hands were washed in different places. The hand washing locations identified in this study of 500 households were in the kitchen, this accounted for 71% followed by in the patio or courtyard, bathroom, living room, dining room, hallway and laundry area. The study focused on the first three hand washing locations featured as they represented the largest percentage of the sample. Of all the hand washing events observed for this study (2,037) most of them took place in the kitchen or patio and very few took place in the bathroom, with only 10% of hand washing events taking place there (A.B. PRISMA for EHP Lima 2004).

If the hand washing event took place in the kitchen, then it was usually far or very far from the location used for defecation. The exact distance was not specified in the study. Most of the respondents had a stored water supply, running water or a faucet. In terms of soap availability, 24% did not have any type of soap or detergent. The remainder had laundry or bar soap. If the designated hand washing place was located in the patio or courtyard, this was also identified to be far or very far from the location used for defecation but less so than those that used the kitchen. The majority of households that had this type of facility had running water. Twenty-seven percent did not have any soap or detergent available. Laundry or bath soap was identified more often than detergent or dishwashing soap.

If the hand washing location used was in the bathroom then this was identified to be very close to the defecation site. This was the case in most households, 96%. Again, the exact distance was not specified in this study. Most of the households that had the hand washing facility in the bathroom had running water, approximately 90%. However, in 22% of the cases there was no soap or detergent available. In the rest of the cases, bath and laundry soap (75 %) was observed much more frequently than detergent or dishwashing soap, which accounted for only 4% of cases (A.B. PRISMA for EHP Lima 2004).

3.5.2 Hand washing materials: Water / tap availability

The results displayed in Table 3.3 show the proportion of children living in households with water available at the designated place for hand washing as observed by the interviewer. For tables 3.3, 3.4 and 3.5 the total number of children and missing data relates to observations made for only those children living within households with access to a designated hand washing facility in the dwelling, yard or plot. The missing data refers to the specified question on hand washing materials. The overall trend is that there is a high proportion of households with water available. In nine countries, over 50% of households have water available at the designated hand washing place. However, in four countries, a very low proportion have water observed at the designated hand washing place, with approximately less than 30% having this amenity. Again, the results for Rwanda and Benin are based on small sample sizes of just over 100, as few children lived in households with a designated hand washing place and the questions and observation of a designated hand washing place was a filter question. This indicates that this question is not particularly appropriate. However, although the sample size was small, approximately 50% of households had water available.

Table 3.3: Percentage of children living within households with water/tap in the designated place for hand washing

Country	Year of survey	Water/tap available	Total no of children	Total no. of missing data
Egypt	2003	98.3	4912	0
Egypt	2000	94.9	8766	0
Armenia	2000	89.4	1566	0
Nigeria	2003	80.4	4955	31
Senegal	2005	78.3	8602	26
Mali	2001	60.2	11451	94
Rwanda	2000	55.8	139	4
Uganda	2000/01	52.3	1934	37
Benin	2001	49.8	102	14
Ghana	2003	48.4	2052	10
Malawi	2000	32.0	10674	37
Madagascar	2003/04	22.8	3864	15
Zimbabwe	1999	22.5	3402	13
Burkina Faso	2003	20.4	10398	5

Author's own analysis of DHS data files

The high proportion of households with water available at the designated hand washing facility may provide some indication about the type of hand washing infrastructure available. For example, in Egypt, Armenia, Nigeria and Senegal, a high proportion of children lived in households that had both a designated place to wash hands and water available. In all of these countries, over 80% of children lived in such households. However, in Burkina Faso, a high proportion of children live in households that had a designated place to wash hands (98%), but only 20% had water available at the designated hand washing facility. Similarly, in Malawi and Mali, approximately 90% of children live in households that had a designated hand washing facility and these observations are based on large sample sizes, over 10,000.

The results from Zimbabwe are of interest as in this survey no observation was made on whether there was a designated hand washing facility in the dwelling, yard or plot. There was only observation by the interviewer as to whether hand washing materials were available. This included the presence of water/tap, soap, ash or another cleansing agent and a basin. Approximately 23% of households had water available as a hand washing material. Interestingly, analysis of the available results of the survey identified that households with piped water were the most likely to have all of the three hand washing materials stated above and only one percent of other households had these materials. In addition, one in four households that had a water source in their dwelling had all of the required hand washing materials while only two percent or less of other households did.

These findings were in line with findings discussed in the previous chapter from research conducted in rural areas of Peru. In this study, the presence of indoor plumbing was found to greatly facilitate the practice of hand washing when there was risk of contact with faeces (A.B. PRISMA for EHP Lima 2004). Mothers who had access to a public water supply network outside the home increased the percentage of occasional hand washing. This was identified as hand washing not being a regularly practised habit. Mothers who were observed to never wash hands with soap for risk events involving contact with faeces were identified to be mainly concentrated in the group that did not have indoor plumbing facilities. Further findings of this study for hand washing events related to contact with faeces identified that having a nearby water supply facilitated hand washing with soap in a sporadic or regular manner compared with groups of mothers that required more than a minute to collect water, although this difference was not found to be statistically significant.

The complexity of understanding the motivators for hand washing are exemplified in findings from the Peru study. An important finding from the study was from a group of mothers who, despite requiring more time to collect water, always washed their hands. The conclusion given was that hand washing cannot be explained by structural factors alone and that these are not the principle motivators for the desired behaviours (A.B. PRISMA for EHP Lima 2004).

The results presented in Tables 3.2 and 3.3 are very interesting and highlight that children living in households that had a designated hand washing facility but had no water available at the designated place for hand washing. This raises the important issues as to where they acquire water from and may indicate that they use a different water source somewhere within the dwelling, yard or plot or outside this area.

3.5.3 Hand washing materials: Soap, ash or other cleansing agent availability

The results presented in Table 3.4 show the proportion of children living in households with soap, ash or another cleansing agent available at the designated hand washing facility. The results from the analysis demonstrate that there is wide variation across countries. The overall trend was that the majority of children live in households where soap, ash or another cleansing agent was available at the designated hand washing place. In eight countries, over 50% of children lived in households with this hand washing material available. The countries with children with the highest percentage availability of soap, ash or another cleansing agent available at the designated hand washing place were identified in Morocco and Armenia where over 90% of children lived in households where soap, ash or another cleansing agent was available. In addition, results from the Egypt 2000 and 2003 DHS also identified a high percentage of children living in households with this hand washing material available, with over 75% of children living in households with this hand washing material. The analysis of DHS data from Nigeria also identified a high percentage of children with this material in the household, with over 70% of children living in households with this material available.

Table 3.4: Percentage of children living within households with soap, ash or another cleansing agent in the designated place for hand washing

Country	Year of survey	Soap/ash or CA available	Total no. of children	Total no. of missing data
Morocco	2003/04	95.5	5890	0
Armenia	2000	92.3	1566	0
Rwanda	2000	88.4	134	9
Egypt	2000	85.6	8764	1
Egypt	2003	78.9	4912	0
Nigeria	2003	71.4	4958	28
Madagascar	2003/04	55.8	3876	4
Benin	2001	53.6	108	8
Senegal	2005	53.4	8586	42
Malawi	2000	42.7	10686	25
Uganda	2000/01	34.6	1934	36
Ghana	2003	19.9	2057	5
Mali	2001	16.6	11345	200
Burkina Faso	2003	11.5	10397	6
Zimbabwe	1999	10.6	3401	14

Author's own analysis of DHS data files

However, analysis of DHS data obtained from four countries; Ghana, Mali, Burkina Faso and Zimbabwe identified that less than 20% of children lived in households with soap, ash or another cleansing agent available, with particularly low results from two countries (Burkina Faso and Zimbabwe) at approximately 11%. The data from Rwanda and Benin were based on small sample sizes. Of this small sample size, over 50% had soap, ash or other cleansing agent available in Benin and nearly 85% had the material available in Rwanda. In Senegal, over 50% of households had the material available.

In the wider context, these results are of interest and formative research provides some insight into why the availability of soap varies. Research conducted in Peru provides an insight into the role of the hand washing location on the type of soap available at the hand washing facility. This analysis was based on observations from five hundred households in Peru. The findings of the research indicate that the farther apart the defecation and hand washing place, the greater the presence of detergents and dishwashing soap. This is because the type of activities conducted in these locations involves the use of cleansing agents. Likewise, the closer the hand washing location was to the defecation site, the greater the presence of soap and the lesser the presence of other products. The conclusion reached was that this was the case since these locations were designed for body care purposes. In addition, these locations were more likely to have running water than stored water (A.B. PRISMA for EHP Lima 2004).

3.5.4 Hand washing materials: Basin availability

The results presented in Table 3.5 displays the percentage of children living in households with access to a basin at the designated hand washing facility. The overall trend was high, particularly in Egypt and the West African countries consisting of Benin, Mali, Senegal, Burkina Faso and Nigeria. The exception was Ghana, where the availability of a basin was low, with less than 30% of children lived in households with access to a basin in the designated hand washing facility. The results were also high for Rwanda, Malawi and Uganda where over 60% of children lived in households with access to a basin at the designated place for hand washing. The availability of a basin was high in Armenia but not as high as other hand washing indicators.

Table 3.5: Percentage of children living within households with a basin in the designated place for hand washing

Country	Year of survey	Basin available	Total no. of children	Total no. of missing data
Egypt	2003	90.2	4912	0
Benin	2001	89.1	109	7
Mali	2001	87.6	11421	124
Egypt	2000	83.7	8764	1
Rwanda	2000	81.5	133	11
Senegal	2005	75.5	8578	49
Burkina Faso	2003	74.2	10400	3
Malawi	2000	71.3	10696	15
Nigeria	2003	66.7	4957	29
Uganda	2000/01	65.0	1961	10
Armenia	2000	62.2	1566	0
Madagascar	2003/04	33.7	3861	18
Ghana	2003	26.7	2055	7
Zimbabwe	1999	17.4	3397	18

Author's own analysis of DHS data files

This may indicate that due to the high presence of a hand washing facility and hand washing materials in Armenia, a basin was not required to wash hands compared with other countries. For countries where access to a hand washing facility was low, i.e. Benin and Rwanda, over 80% of children lived in households where there was access to a basin in the designated hand washing place. However it must be noted that the results in these two countries are based on small sample sizes.

This may indicate the use of a basin as an improvised hand washing facility, similar to the discussion given in Chapter 2 from the results of the formative research conducted in

Tanzania. In this case, a large proportion of households were observed to wash hands in buckets and bowls (LMS/Steadman International 2006).

The low availability of all hand washing materials in Zimbabwe, at approximately less than 20% for the presence of water, soap, ash or another cleansing agent and a basin may indicate that other sources of water are used to wash hands. This may act as the designated place for hand washing and there may be a number of other possible explanations. Furthermore, a basin or bowl may not be used but something similar such as a cup, jug or mug and these implements may not be situated in the designated hand washing place but near the sanitation facility. It may also be the case that water may be stored in such implements if water is scarce. If this is the case and there is no designated place to wash hands then such cases will be missed.

Figure 3.1: The availability of hand washing materials in DHS

Figure 3.1 displays the availability of hand washing materials in the thirteen countries with available data on the presence of water/tap availability, soap, ash or another cleansing agent and a basin located in the designated hand washing place as observed by the interviewer.

3.6 Self reported hand washing behaviour

This section reviews the available data on self-reported hand washing behaviour and cross classifies this data with the other hand washing observational measures of the availability of a designated place to wash hands, the availability of hand washing materials consisting of water, soap, ash or another cleansing agent and a basin at the designated hand washing place.

In the fourth phase of the MEASURE DHS programme (1997-2003), a direct question was asked to mothers on whether she washed her hands before preparing the last meal for her family. Table 3.6 shows data for 12 countries with available DHS data on self-reported hand washing behaviour. The results of this question demonstrate that in all 12 countries, over 90% of mothers reported that they washed their hands before preparing a meal for their family.

In the Dominican Republic 1999 DHS, two direct questions were asked to mothers about their hand washing behaviours. The two questions were on whether the mother washed her hands before feeding children and after cleaning stools. The results of the first question were that 91% of mothers responded that they washed their hands. For the second question 92% of mothers reported that they washed their hands after cleaning the stools of children. A similar question was asked in the Kazakhstan 1999 DHS where mothers were asked whether they washed their hands after their child had defecated, 98% of mothers reported that they washed their hands on this occasion.

However, from the literature on hand washing behaviour the consensus is that direct questions to mothers or caregivers on hand washing practices and behaviours tend to lead to over reporting. This was discussed in Chapter 2 in the section on hand washing measurement. ORC Macro have also recognised this as a major issue in DHS questions on hand washing in their surveys, whereby they give the example of the results from the Dominican Republic 1999 DHS as resulting in gross overestimates of behaviours. However, these questions remain in their surveys for use by other researchers with no discussion of the quality of this data.

Table 3.6: Direct questions on hand washing at critical times

Country	Year	Washed hands before meal preparation	Total number of children
Armenia	2000	98.9	1626
Malawi	2000	98.0	11868
Burkina Faso	2003	97.3	10667
Kazakhstan	1999	97.0	1382
Uganda	2000/01	96.9	7321
Nigeria	2003	94.2	6113
Senegal	2005	93.1	10157
Benin	2001	92.7	5149
Zimbabwe	1999	92.6	3415
Mali	2001	91.6	12957
Madagascar	2003/04	90.8	6185
Rwanda	2000	90.6	8127

Author's own analysis of DHS data files

The direct questions on hand washing featured in DHS only focus on hand washing before preparing a meal for the family. Within the literature, a number of other key critical times are mentioned as important for when hands should be washed, particularly for child health as discussed in the Chapter 2 on defining appropriate hand washing behaviour. The DHS does not feature any other questions on other critical times except for the appearance of questions in the 1999 Dominican Republic and Kazakhstan DHS where questions were asked about hand washing before feeding a child and after a child had defecated, as noted earlier.

For these surveys, with the exception of Kazakhstan and Ghana where data was unavailable in the DHS data file for self-reported questions Data was also available on the household's access to hand washing materials and facilities as observed directly by the interviewer at the time of the survey. The rationale for the DHS questions and literature on hand washing highlights that for hands to be washed appropriately, the necessary items, to ensure adequate hand washing are required. These were identified as hardware items such as a designated place to wash hands whether water/tap, soap, ash or another cleansing agent were available and a basin to wash hands in. To further identify and ascertain the direct questions asked to mothers on their hand washing practices before preparing a meal for her family across the 11 surveys, further investigation was undertaken of whether mothers who reported that they washed their hands had access to the necessary hand washing materials and facilities.

3.7 Self reported hand washing behaviour and available hand washing facilities and materials

3.7.1 Self reported hand washing behaviour and hand washing facilities and water availability

The comparison of the direct questions on hand washing before meal preparation and questions and observation of hand washing materials and facilities from available DHS indicates that there is a discrepancy between self-reported hand washing of the mother and available hand washing facilities and materials in the household.

Table 3.7 indicates that in Armenia, Burkina Faso, Malawi, Mali, Nigeria and Senegal where over 90% of mothers reported washing their hands before preparing a meal and over 90% of those women had a designated place for hand washing in the household in Armenia, Burkina Faso and Malawi. In Nigeria, Senegal and Mali over 80% of mothers who said that they washed their hands before meal preparation had a designated place for hand washing in the household. In Madagascar over 90% of mothers reported washing their hands before meal preparation, however, only 65% had a designated place to wash their hands in the household.

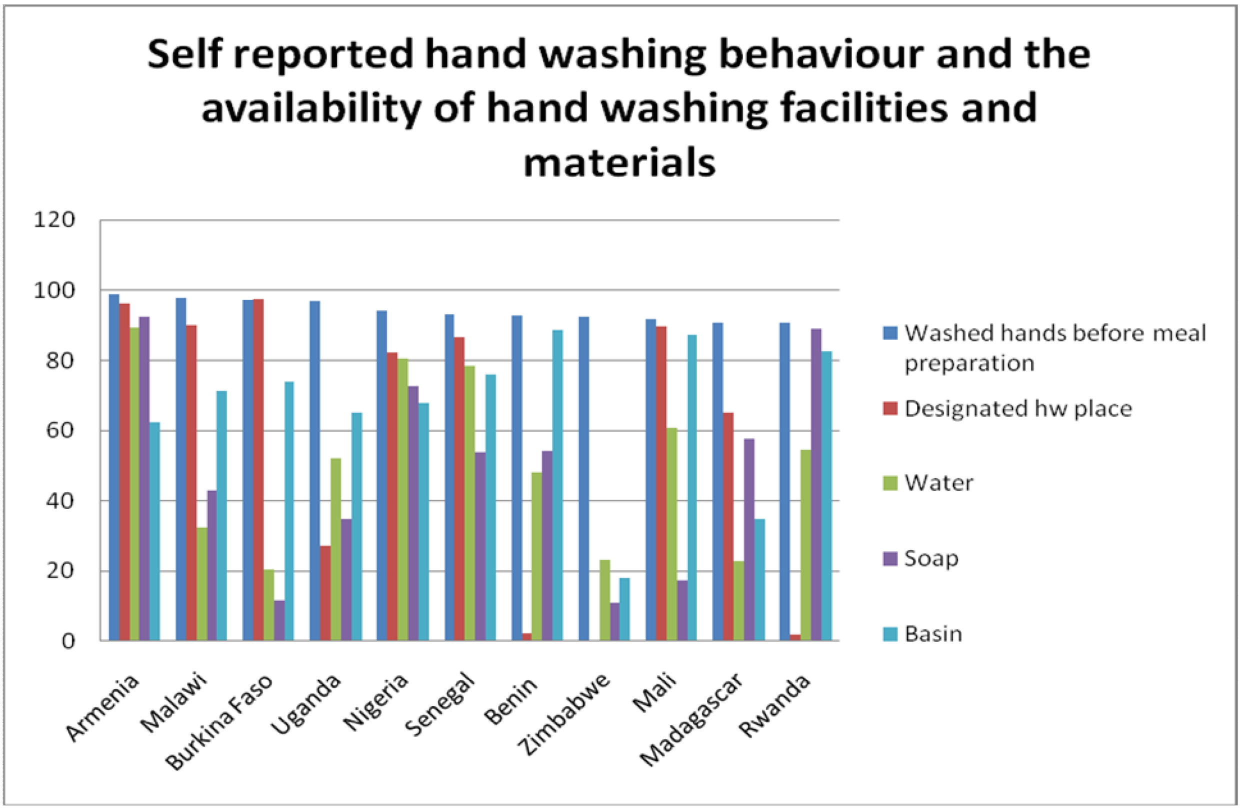
The availability of a designated place to wash hands in the household was particularly low in Uganda, Benin and Rwanda, where 26.9%, 2.3% and 1.8% respectively of mothers had a designated place to wash hands yet over 90% reported that they washed their hands before meal preparation. In Benin, of the 93% of mothers that reported washing their hands before preparing a meal, nearly 98% had nowhere to wash hands in the household. Only 2% had a designated place to wash hands in the household. With respect to materials which are necessary to wash hands, of the 93% of mothers that reported washing their hands before preparing a meal, less than 50% had water available. Similar findings were identified for soap availability with less than 55% of mothers having soap, ash or another cleansing agent available in the house. The availability of a basin was far more widespread with over 80% of mothers having a basin at the designated hand washing place.

Table 3.7: Washed hands before meal preparation by the availability of a designated place to wash hands and hand washing materials

Country	Washed hands before meal preparation	Dwelling/yard/ plot	Water/tap available	Soap available	Basin available
Armenia	98.9	96.3	89.4	92.3	62.3
Malawi	98.0	90.2	32.3	43.0	71.4
Burkina Faso	97.3	97.5	20.5	11.6	73.9
Uganda	96.9	27.4	52.2	34.6	65.2
Nigeria	94.2	82.1	80.4	72.6	67.7
Senegal	93.1	86.8	78.5	53.8	76.1
Benin	92.7	2.2	47.9	54.1	88.8
Zimbabwe	92.6	-	23.1	10.8	17.9
Mali	91.6	89.6	60.7	17.3	87.3
Madagascar	90.8	65.2	22.8	57.7	34.6
Rwanda	90.6	1.9	54.5	89.0	82.4

Author's own analysis of DHS data files

Figure 3.2: Self reported hand washing behaviour and the availability of a hand washing facility and hand washing materials



The comparison of questions on reported hand washing before meal preparation and the availability of hand washing materials and facilities indicated that there were discrepancies with what mothers were reporting in terms of hand washing behaviour and the actual availability of facilities and materials to wash hands. This is shown in Figure 3.2. There are a number of issues that need to be taken into account, for example when and whether hands are washed, how they are washed and the facilities and materials used. Data obtained from the direct measures of hand washing through self-reported hand washing before food preparation provide some indication that there is over-reporting of hand washing practice. Therefore, this direct question approach may not be the most appropriate method to gain information on hand washing practice. There are also marked differences between countries in the availability of a designated place to wash hands and hand washing materials.

The findings from the 11 DHS surveys demonstrate that over 90% of mothers report that they washed their hands before meal preparation. The question was not asked in the Egypt DHS. However, when further analysis is undertaken comparing the actual observed hand washing facilities and materials that are necessary to wash hands in, there is a lack of facilities to corroborate the high figures obtained from the self-reported questions on hand washing.

3.8 Self reported hand washing in UNICEF MICS

The UNICEF MICS does not explicitly feature questions on hand washing in all of their surveys. The countries that have surveys that have featured questions on hand washing include Bangladesh 2006 (UNICEF and Bangladesh Bureau of Statistics 2007). However, the questions asked in this survey were based on self-report. The Malawi 2006 featured both observation of hand washing facilities and soap availability in the household and self-report of the four key hygiene practices. These were given as hand washing after defecation, after cleaning a child, before feeding a child and before preparing food (National Statistical Office and United Nations Children's Fund 2008).

A few MICS have featured questions on self-reported hand washing practices of household members and mothers who have given birth in the two years preceding the survey. The prime focus of the questions has been on the use of soap for hand washing and the hand washing events that soap has been used for.

In the Somalia 2006 MICS, a question was included in the household questionnaire to ascertain whether soap was being used in households for hand washing and if so, in which situation. The results of this question were based on approximately 6000 households. Approximately 55% of all of the household respondents reported that soap was used for any of the hand washing events stated. The most common reasons given to wash hands with soap were given as after defecation, 48%, followed by cleaning babies' bottom, 45% and only 27% of household respondents reported using soap to wash hands before cooking (UNICEF 2006).

In the MICS Malawi 2006 survey, the importance of hand washing was highlighted. Hand washing was noted as being one of the most effective means of preventing diarrhoeal diseases and thereby significantly reducing child mortality. In particular, hand washing with soap was advocated for its potential in vastly improving public hygiene. The findings of the survey were that although the majority of households had soap available, hand washing with soap at key times was not widely practiced.

The conclusion was that if MDG 4 of reducing child mortality is to be achieved, hand washing practices must be achieved along with access to safe water and sanitation. In the survey, hand washing questions were posed to 8700 women aged 15-49 who gave birth in the two years preceding the survey. On the use of soap, mothers were asked (without prompting), to mention the occasions for which they had washed their hands with soap yesterday or today. The majority of the women mentioned the key reason as washing the body.

The current emphasis of the national programme in Malawi focuses on the promotion of four key hygiene practices. The primary focus of hand washing with soap for the four critical occasions were given as after defecation, after cleaning a child, before feeding a child and before preparing food. The data collected from the MICS 2006 on soap use related to the four key practices previously outlined. The results of which clearly demonstrate that the proportion of women practising the four key practices is nearly non-existent with less than 1% of mothers practicing all of the four key hygiene practice.

Table 3.8: UNICEF Multiple Indicator Cluster Survey: Percentage of household respondents that washed their hands with soap

Country	Wash body	Wash children	Washing child's hands	Before eating	Before feeding babies	After defecation	After cleaning babies bottoms	Wash after cleaning a child	Before cooking	After eating	For any of these reasons	Total
Somalia	-	-	-	38.7	37.4	47.9	45.4	-	27.2	38.5	54.9	5969
Malawi	88.9	51.2	1.0	1.0	0.6	1.6	8.8	0.8	0.8	-	-	8697*
Bangladesh						58.8**						62463

- ***This is the number of women who gave birth in the preceding two years or the number of households**
- **** In Bangladesh, the question only referred to after defecation**

The MICS 2006 Bangladesh featured a question on how the household head usually washed their hands after their child defecated. The rationale given was that washing hands after defecation (of each individual and after cleaning a child's stools) is an effective way of preventing intestinal diseases, cited as having been emphasised in hygiene promotion programmes in the country for several years. The results of this question when posed to household members were that 5.5% of the surveyed households who washed their hands used only water for hand washing after defecation. 21.3% used water and soil, 14.4% used water and ash and 58.7% used water and soap. Less than 1% cited other means.

The only country with both data from the DHS and MICS is Malawi. The questions, although not directly comparable, have very different results. The result of the question asked in the Malawi 2000 DHS were that over 90% of mothers reported that they washed their hands before preparing a meal for their family, The Malawi 2006 MICS asked the question specifically on the occasions for which was soap use in the last 24 hours. This question was based on women who had given birth in the two years preceding the survey, whereas the DHS is based on women who have given birth in the five years preceding the survey. In the Malawi MICS, less than 1% of mothers reported that they washed their hands before preparing food. The stark difference in these results may be because in the MICS survey the question was asked to mothers without prompting and specifically on the use of soap whereas in the DHS the question was asked directly, was rather leading in its format, and did not state whether soap was used.

The Malawi 2006 MICS also featured an observation by the interviewer of whether there was a hand washing facility outside the toilet. Sixty-six percent of household members had access to a hand washing facility outside the toilet but no water was observed in the facility. In 13% of households there was a hand washing facility that was observed and it was filled with water. Twenty one percent of households had no hand washing facility outside the toilet and less than one percent was based in the "not seen" category. These observations were made for over 100,000 household members.

Interestingly, comparing the data obtained from the Malawi 2000 DHS with the Malawi 2006 UNICEF MICS, overall, both of which obtained information through spot check observation by the interviewer on the availability of soap in the household. A higher proportion of household members, 68% were able to present soap to the interviewer on request compared with less than 40% of households participating in the Malawi 2000 DHS. In addition, approximately 7% of household members had soap but were unable to show the soap to the interviewer. The reason for this was not stated, however, it would be of interesting to know the reasons to aid understanding as to why this occurred.

The observations were based on over 100,000 household members. As with the observation of a hand washing facility that was also based on household members, it is important to note that the insight given here was based on findings from the report and not the actual data files. If data files were used then this analysis would have been restricted to households as assessing household members does not account for the fact that there is likely to be more than one member per household. Although the methods used to obtain the information were similar, using the spot check method, in the DHS, only households that were identified to have a designated hand washing facility were asked and the observation of soap availability was made. Whereas, in the UNICEF MICS all households participating in the survey were asked and observed whether soap was available regardless of whether they had a hand washing facility available (National Statistical Office and United Nations Children's Fund 2008). The observation of soap availability in all households regardless of whether they have a hand washing facility in my opinion is a better method to capture the availability of soap and by observing whether a hand washing facility is present enables one to distinguish between those that have a hand washing facility and soap and those that do not.

3.9 Evaluating and validating Demographic and Heath Survey data

Although, the MEASURE DHS+ programmes cites one of its fundamental goals as producing high quality data, within the published literature on their work there have been few studies that have sought to validate and evaluate survey approaches, particularly focusing on measurement and methodological issues.

Of the studies that have taken place specifically by the MEASURE DHS+ programme, the focus of evaluation and methodological studies on validation and reliability has largely been on reproductive and sexual health issues (Institute for Resource Development 1990; Macro International 1993; Kishor and Johnson 2004; Yoder, Abderrahim et al. 2004; Yoder and Nyblade 2004; Pullum 2006; Johnson 2007). In the early 1990’s, the MEASURE DHS programme conducted a number of studies to assess overall data quality and comparability of DHS surveys. In terms of data collection, the one study that has sought to specifically examine data collection procedures was the evaluation study of the Pakistan 1994 DHS based on a re-interview survey. One of the main purposes of the re-interview survey was to assess data reliability. A sub-sample of women interviewed in the main survey were re-interviewed sometime after the completion of the main survey. The purpose of this was to enable a direct comparison between responses from the main survey from those obtained during the re-interview, in order to enable an assessment of the consistency of responses at the national level.

The results of the re-interview highlighted the importance of studying response reliability, particularly in difficult settings such as Pakistan and the useful information that such an approach provides to inform survey findings and interpretation and understanding of the data collection process. The results of the study indicated that there were a number of problems with the 1994 DHS, in terms of implementation of the survey. Combined with the difficulties of obtaining high quality data that were influenced by the cultural and social context of the country, the influence was apparent on the data quality tables that appeared in the final report. The report highlighted that taking this into account, the reliability of the data obtained during the Pakistan 1994 DHS would be lower than what was obtained from most of the other DHS surveys (Curtis and Arnold 1994).

A study conducted by ORC Macro as part of the MEASURE DHS+ programme on the evaluation of the Tanzania AIDS Indictor Study specifically focused on the comprehension of the survey questions. The study was a rapid evaluation of respondents' comprehension of the questions that were asked in the Tanzania HIV Indicator Survey (THIS) in 2004. The purpose of the evaluation study was to guide the formulation of questions on sexual practices and HIV/AIDS in DHS and respondents understanding of the AIDS Indicator Survey (AIS) questions. The evaluation activities included observations of field teams, a workshop and pilot testing of the revised questionnaire (Yoder and Nyblade 2004).

Within the wider literature, several studies have sought to validate and evaluate DHS approaches and focus on measurement and methodological issues. This has included studies on caesarean section, child mortality indicators, such as verbal autopsy, maternal morbidity and mortality, induced abortion, birth weight, condom use, sexual behaviour and HIV/AIDS, reproductive health: obstetric fistula, nutrition assessment: food intake and complementary feeding, household wealth and income and health seeking behaviours. To date there have been no studies that have focused on environmental health indicators such as sanitation or hygiene indicators, for example, hand washing.

The analysis in this chapter highlights that there are data quality, methodological and measurement issues associated with the approaches taken within the MEASURE DHS programme on assessing hand washing and illustrates the complexity of attempting to measure and assess hand washing. The DHS measurement methods only focus on the mother's hand washing behaviour before meal preparation and did not ask questions about other critical occasions in which hands should be washed. There was no focus on knowledge of the importance of hand washing and appropriate ways in which hands should be washed. The data presented and discussed clearly highlights the differences between countries on the availability of hand washing materials and facilities. There could be a number of factors responsible as to why these differences exist, which the current methods employed are unable to explain.

The formative research for the PPPHW programme indicated that the reasons for hand washing differ between and within countries and the use of and availability of hand washing facilities and materials. The results demonstrates some of the complexities of studying hand washing behaviours (Curtis, Danquah et al. 2007). This indicates that due to the differences shown from the different available country data, a standardised approach taken by the DHS across countries on measuring hand washing behaviours, facilities and materials through direct questions and spot check observations requires further assessment and evaluation. The use of further methods to ascertain the methodological and measurement issues are required and ways in which the measurement of hand washing behaviour can be improved and better understood. This would highlight issues such as the barriers and motivators to washing hands, access and availability to hand washing materials and facilities, as the data from the direct questions on hand washing are not a valid indicator as to whether respondents actually wash their hands.

Research so far has identified that there are a number of shortcomings of the DHS approach to assessing and measuring hand washing behaviour. Most importantly, existing DHS approaches are not actually able to provide any information on whether actually having a place for hand washing and the required materials facilitates hand washing practice and also what are the critical times at which hands are and should be washed. In addition, whether the location of the hand washing place has any role in hand washing and as mentioned previously what people with no facilities and materials practise.

The location of the hand washing facility is extremely important as there may be different hand washing locations for different hand washing activities such as hand washing after defecation in comparison with hand washing before or after eating. The interviewer observing the designated hand washing place does not provide information for what type of hand washing related activity has taken place, similarly in terms of water availability, water may be used from elsewhere in the dwelling, yard or plot or within the community. The questions and observations conducted within the DHS are not clear as to the way in which the interviewer observed and classified this. What is defined as a hand washing facility in one country may be quite different from what it is classified as in another.

The availability of soap, ash or another cleansing agent in the household does not necessarily indicate they are used for hand washing. Research indicates that for most instances of hand washing only water is used (Curtis, Danquah et al. 2007). There was no available data on the location of soap in relation to the toilet facility for hand washing after defecation and other instances such as before food preparation. Within the literature, it is noted that the closer the soap is to the actual hand washing facility then the more likely that a person will use soap to wash hands as discussed in Chapter 2.

One of the major shortcomings of the DHS approach to measuring and assessing hand washing behaviour and practices is that the questions and spot check approaches used are unable to provide any information on mothers who firstly answer no to washing their hands and secondly to people who do not have a designated facility to wash their hands. The spot check observation questions are filtered; therefore, of the respondents' answering yes to having the facility, then further questions are asked about whether the respondent has the relevant hand washing materials. For those that answer no to this question, there is no information about whether they have any other type of hand washing place, soap, ash or another cleansing agent, water/tap and a basin to wash hands in. Therefore, the DHS provides no information on what this group of people do and how they wash their hands. This is very important in order to understand what this group of people do.

The specific limitation of the question on hand washing before preparing the last meal was that it is particularly limited in its focus. As previously stated, there are a number of other critical times at which hands should be washed. The question was not specific about asking about soap use for hand washing. One explanation of the high results could lie in the way in which the question is actually interpreted. In countries where soap use for hand washing was low, asking a question on whether hands are washed before meal preparation may indicate respondents washing hands with water only.

The high percentages obtained for this question may not be a reflection of actual hand washing practice but more about hand washing knowledge, so respondents know that it is important to wash hands although they do not actually practice it. There is also the case that hand washing is regarded as a sensitive issue, therefore, high results on this question may be an indication of social desirability and respondents feeling the need to answer yes to this question rather than feeling shame or embarrassment for not washing hands. For example, if other household members are around or there is lack of privacy, respondents may not be able to provide an answer that is representative of their actual practice. This discussion demonstrates the complexity of understanding and interpreting this information. Respondents may also consider indirect hand washing, for example washing foods as hand washing.

The assessment of the existing hand washing approaches used in the DHS demonstrates the complexity of studying hand washing. The next chapter examines the study case area, Bangladesh that forms the case study for this research. A description of the UNICEF-SHEWA-B programme is given.

4 Case study area

This chapter is primarily an overview of the case study area of Bangladesh. The main areas assessed in this chapter include a discussion of the population characteristics, economy, environment and health profile of the country. It then focuses specifically on child health indicators and sanitation and hygiene conditions. Lastly, a summary of the findings is given.

4.1 Study area

The People's Republic Bangladesh is situated in the northeast corner of South Asia and is located on the largest active delta in the world with a total area of 147,570 sq. km. The country gained its independence from Pakistan and emerged as a sovereign country in 1971. Bangladesh has a population of approximately 150 million (July 2008 est.) rendering it one of the most densely populated countries in the world. The geographical location of the country places it on one of the largest deltas in the world where three rivers, the Ganges, the Brahmaputra and the Meghna flow together before reaching the Bay of Bengal.

Figure 4.1: Map of Bangladesh

Source: Central Intelligence Agency (Central Intelligence Agency 2008)

As a result, most of the country, apart from the hills in the east and the highlands in the north, consists of a low, flat and fertile floodplain. The floodplain is crisscrossed by rivers, canals, and streams and is covered by watery meadows. The geographical location of the country makes the country extremely susceptible to natural disasters. The country has a long history of flooding and cyclones. Floods are particularly common during the monsoon period, when approximately half of the country is submerged. The country is divided into six administrative divisions consisting of Barisal, Chittagong, Sylhet, Dhaka, Khulna and Rajshahi (Central Intelligence Agency 2008; UNICEF 2008d).

A large proportion of the population is in the 15-64 age category with approximately 63.1% in this category. The population growth rate is two and the birth rate is 28.86 per 1000 live births (2008 est.). The death rate is eight deaths per 1000 live births. The total fertility rate is approximately three children per women. The majority of the population are Muslim (88%), and over 98% of the population speak Bangla, although English is also widely spoken. A large proportion (75%) of the population live in rural areas and the process of urbanisation has been rapid in recent decades. The main ethnic group is Bengali accounting for 98% of the population. The remaining 2% includes tribal groups and non-Bengali Muslims. The economy of Bangladesh is mainly agrarian. Agriculture is the single largest producing sector of the economy and contributes 22% to the Gross Domestic Product (GDP) of the country. This sector employs 48.1% of the labour force. The life expectancy at birth for the total population is 63.2 (males: 63.1 and females: 63.2) (2008 est.) The GDP per capita is $1400 (2007 est.) The literacy rate of the country obtained from the 2001 census was 37.7% for population of all ages (Bangladesh Bureau of Statistics 2008; Central Intelligence Agency 2008).

4.1.1 Health Profile

There has been a significant decline in infant mortality over the past decade in Bangladesh. This has been attributed to the control and prevention of diseases, for example, measles, poliomyelitis and diphtheria. Importantly, the use of Oral Rehydration Therapy (ORT) for the treatment of diarrhoeal diseases has significantly reduced childhood morbidity and mortality. There has also been great progress and strides to eradicate Polio and the country is on the verge of achieving this target. In addition, the country has already achieved the elimination goal for Leprosy. As a result, life expectancy has increased.

However, there are still a number of significant challenges. There are a number of new and existing infectious disease threats posing particular challenges for the country. Although there has been significant progress in disease prevention and control and a decline in childhood infectious diseases, malaria, tuberculosis and HIV/AIDS remain fundamental threats. The emergence of drug resistant forms of malaria and tuberculosis further increases the risk. The maternal death ratio remains high at over 300 per 100,000 live births. Non-communicable diseases are also on the rise. The major causes of death are heart diseases, diabetes, cancer and disability including mental health problems. In women and adolescent girls, anaemia is a major health concern and this is usually owing to iron deficiency (WHO 2003; WHO 2006).

Therefore, the main public health challenges that remain are as follows:

- Improving health care-seeking behaviour, for example, education and awareness particularly for recognition and treatment of pneumonia and obstetric emergencies
- The effects of rapid urbanisation resulting in inadequate conditions for slum dwellers making them particularly vulnerable to diseases as a result of inadequate sanitation, hygiene and the availability of clean water
- The emergence of arsenic in tube well water that leads to arsenic poisoning (discussed further in this chapter)
- The potential for HIV/AIDS to develop into a major public health issue
- Deaths from accidents and action to reduce this (UNICEF 2008b).

Table 4.1 shows the top ten causes of death for all ages in Bangladesh in 2002. Hand washing with soap and hygiene play an important role in the prevention of lower respiratory infections, diarrhoeal diseases and other infectious diseases such as Tuberculosis. It is of note that diarrhoeal diseases account for nearly a tenth of all years of life lost.

Table 4.1: Top ten causes of death, all ages, Bangladesh, 2002

Causes	Deaths (000)	Deaths (%)	Years of life lost (%)
Ischemic heart disease	130	12	6
Lower respiratory infections	124	11	13
Perinatal conditions	90	8	13
Tuberculosis	74	7	7
Diarrhoeal disease	68	6	9
Cerebrovascular disease	64	6	2
Chronic obstructive pulmonary disease	39	4	2
Measles	21	2	3
Road traffic accidents	19	2	2
Self-inflicted injuries	17	2	2

Source: WHO 2006 (WHO 2006)

4.1.2 Child health

Although Bangladesh has made significant progress in improving the health of women and children, a number of public health challenges continue to face the country. Diarrhoea, acute respiratory infection, low birth weight, birth asphyxia and injury are the leading causes of death for children under five years of age (Rahman, Rahman et al. 2005).

Bangladesh is one of the few developing countries that is thought to be on target to achieve Millennium Development Goals 4 and 5 (UNICEF 2008e). The specific targets for Bangladesh are to reduce the under five mortality rate to 51 deaths per 1000 live births by 2015 and maternal mortality ratio to 143 deaths per 100,000 live births by 2015 (UNICEF 2008e).

Table 4.2: Basic indicators on child and infant mortality

Basic indicators	
Under five mortality rank	**55**
Under five mortality rate, 1990	149
Under five mortality rate,2006	69
Infant mortality rate (under 1), 1990	100
Infant mortality rate (under 1) , 2006	52
Neonatal mortality rate, 2000	36

Source: UNICEF 2008 (UNICEF 2008c)

For the period 2000-2003, diarrhoeal diseases accounted for 20% and pneumonia for 18% of deaths in children under five years of age in Bangladesh. According to UNICEF between 1971 and 2004, the number of children under five who died annually in Bangladesh from diarrhoea reduced by 86%. However, diarrhoeal morbidity remains high, with children under five years of age experiencing on average, three to five episodes of diarrhoea annually. According to figures from Water Aid, 125,000 children die each year from diarrhoeal diseases in Bangladesh and UNICEF reports that approximately 100 children in Bangladesh die every day from diarrhoea related conditions.

The figures are further substantiated and outlined in the Bangladesh National Sanitation Strategy where is it estimated that approximately 110,000 children under five years of age die every year in the country due to diarrhoeal disease. In total, 65 million episodes of diarrhoeal diseases occur annually in children under five years of age. There has been no significant reduction in the morbidity rate of diarrhoeal diseases despite high levels of access to safe water. Other waterborne diseases are also prevalent across the country (Ministry of Local Government Rural Development and Cooperatives 2005).The 2004 Bangladesh Demographic and Health Survey identified that 7% of under-fives died of diseases related to diarrhoea from 1999 to 2003 (ORC Macro, National Institute of Population Research and Training (NIPORT) et al. 2005; Rahman, Rahman et al. 2005; UNICEF 2008f; UNICEF 2008e). The reason for the large discrepancies in the figures for diarrhoea mortality are unknown, however, it could be due to the way in which the data is collected and how the cause of death is reported.

Malnutrition is a major underlying factor and is a major cause of morbidity and debility in children in Bangladesh. A particularly common feature in children is micronutrient deficiency, with approximately 75% of a child's life spent in illness due to malnutrition related debility and infections. The impact of malnutrition on child development can result in impaired physical, cognitive and mental development. Furthermore, children of low birth weight are particularly susceptible to infections. This is signified by approximately two thirds of under five deaths being attributed to malnutrition and approximately 75% being associated with mild to moderate malnutrition (WHO 2003).

4.2 Sanitation and hygiene conditions

According to the Global Water Supply and Sanitation Assessment Programme figures from 2000, total water supply coverage in Bangladesh was 97 %, compared with 91% in 1990. The coverage in urban and rural areas was similar at 99 and 97% respectively. Figures for rural areas since 1990 demonstrate improvement in coverage. In 1990, water supply coverage in rural areas was 89%, while in 2000 the coverage was 97%. However, although significant improvements have been made, there are still major threats, particularly in obtaining safe drinking water. Arsenic in drinking water remains a major public health issue and is predicted to have major health effects and implications in the future. The effects of arsenic in drinking water on health are vast. Long-term exposure to arsenic in drinking water causes cancer of the skin, lungs, urinary, bladder and kidney, as well as other skin changes such as pigmentation changes and thickening (hyperkeratosis). According to some estimates, arsenic in drinking water will cause 200,000-270,000 deaths from cancer in Bangladesh alone (WHO 2008).

Coverage of sanitation remains low. In 1990, total sanitation coverage was 37% while in 2000 it had only risen to 53%. Hence, it remains a fundamental concern. There have been significant improvements in the 1990 coverage in rural areas. In 1990, sanitation coverage in rural areas was 27% while in 2000; it was 44%. The coverage in urban areas in 1990 was estimated at 78% and 82% in 2000. There is still significant inequality in coverage between urban and rural areas. However, what we do know is that there are a number of methodological issues in the way in which data and information on sanitation access and coverage is recorded and collated, although such issues exist, the fundamental issue is that sanitation coverage across the country is a major challenge (WHO 2000).

Unsafe excreta disposal practices such as open defecation remains a significant public health problem and concern. The Bangladesh 2004 DHS identified that 86% of Bangladeshi households had some type of sanitation facility, including 59% that had hygienic toilets (septic tank/modern toilets, water sealed/slab latrines and pit latrines). Unsurprisingly, access to sanitation facilities varied between rural and urban areas. Only 55% of rural households had access to hygienic toilets compared with 71% in urban households, and 16% of rural households had no facility at all, compared with only 4% in urban households. The results from the most recent Multiple Indicator Cluster Survey (MICS) in Bangladesh in 2006 identified that approximately 39% of the population of Bangladesh lived in households using improved sanitation facilities. Improved sanitation facilities were defined as flush toilets connected to sewerage systems, septic tanks or pit latrines, ventilated improved pit latrines (VIP), pit latrines with slabs and composting toilets. The lowest proportions with these toilets were in rural areas, where approximately 32% of the population used improved sanitation facilities. Most of the surveyed population had no facility and used rivers, ponds, fields or bushes for their sanitation needs (UNICEF and Bangladesh Bureau of Statistics 2007).

Approximately, 23% of mothers/caretakers were identified to safely dispose of their child's faeces. The urban-rural variation was again very significant, with approximately 15% of rural households compared with approximately 44% of urban households following safe procedures. Further findings indicated that there was a strong positive correlation between the safe disposal of child's faeces and both the education of the mother and the socio-economic status of the household (UNICEF and Bangladesh Bureau of Statistics 2007).

In summary, this section discussed the important public health concerns and challenges facing Bangladesh together with an overview of the country. In terms of child health, diarrhoea and respiratory infections are major threats to child health and survival, and are a significant cause of morbidity and mortality. In addition, malnutrition is a very important issue and underlying factor for other diseases. Access to adequate sanitation and hygiene remains a fundamental concern and the practice of open defecation is a public health hazard and is still widely practiced. Although there have been a number of studies in Bangladesh on hand washing and hygiene practices, there has not been that much attention paid to the methodological and measurement issues. Such issues underlie the rationale of this research and the focus of this thesis on the Sanitation, Hygiene Education and Water Supply in Bangladesh project (SHEWA-B) that forms the focus of the next chapter.

5 Data and Methods

This chapter introduces and focuses on the Sanitation, Hygiene Education and Water Supply in Bangladesh (SHEWA-B) project that forms the case study of this thesis. A description of the background and rationale for the SHEWA-B project is given alongside an explanation of the specific methods and overall study design used in SHEWA-B relating to this research. The mixed methodology case study design approach chosen for this research is then discussed. The focus is then on the data collection methods used in the SHEWA-B project, focusing specifically on the hand washing measures together with a description of focus groups conducted for this research. In addition, there is a detailed discussion on the hand washing measures and data quality issues. Lastly, this chapter focuses on the methods of analysis used to analyse and validate the different forms of hand washing behaviour measures that form the basis of the two results chapters.

It is important to differentiate between the SHEWA-B project and this study, as in the work conducted for this thesis. From here on in, the term SHEWA-B project refers to the specific range of components that formed the baseline activities for the Health Impact Study. The term study refers specifically to methods adopted and components that form the basis of this thesis as proposed by the author.

5.1.1 Background: The Sanitation, Hygiene Education and Water Supply in Bangladesh (SHEWA-B) project

On the 23 January 2007, the UK Department for International Development (DFID) and UNICEF signed an agreement worth US$ 62.8 million, together with contributions from UNICEF of US$9.3 million and investment by the Government of Bangladesh (GoB) US$16.9 million to support the GoB in implementing improved water supplies and sanitation. The programme aims to reach 30 million people who will receive improved sanitation or 42% of the population who are still living without adequate sanitation across Bangladesh from 2007-2011. The total sanitation coverage would thus be increased to 70% (UNICEF 2008a).

The agreement supported the joint implementation of the Sanitation, Hygiene Education and Water Supply in Bangladesh (SHEWA-B) project by the GoB Department for Public Health Engineering (DPHE) and UNICEF. The SHEWA-B project, through the partnership of UNICEF/DPHE, has the largest reach of any water supply and sanitation sector programme in Bangladesh and is conceivably the largest hygiene intensive hygiene, sanitation and water quality improvement programme ever attempted in a developing country. The expected outcomes of this programme are important for the people of Bangladesh, the sponsors of the programme and to the global public health community, as the effectiveness of such a large-scale programme has never been evaluated. The SHEWA-B project features a range of components and the focus is to encourage community hygiene promoters to encourage improved hand washing behaviour, sanitation and water quality to a population of 18 million people in the first phase of the programme (UNICEF 2008a).

The goal of the SHEWA-B project is to ensure that Bangladesh achieves the Millennium Development Goals (MDGs) pertaining to water and sanitation and makes a significant contribution to reducing under-five mortality and gender disparities, particularly in primary schools (ICDDR-B 2007b)

5.2 Study description

The SHEWA-B project is a five-year project (2007-2011) and is comprised of two phases. The first phase of the programme commenced in mid 2007 and will end in 2009. During this time the programme worked in 60 upazilas[1] (Tripatlas 2008) of 16 districts and 300 para centres from the 8 upazilas in the Chittagong Hill Tracts (CHT) districts. The first phase of the population of the 60 upazilas to be targeted in the programme is estimated to reach 18.2 million in rural areas and 0.2 million in urban areas. The programme will work in rural and urban slums/pourashavas and in each district the programme will work in half of the upazilas

[1] The districts of Bangladesh are divided into subdistricts (Upazilas). The Upazilas are the lowest level of administrative government in Bangladesh.

and will cover the entire upazila population with hygiene and sanitation promotion (ICDDR-B 2007b).

The second phase of the programme began in 2009 and covered an additional 44 upazilas in Plain land areas and an additional 300 para centres from 9 upazilas in CHT (ICDDR-B 2007b).

The evaluation of the impact of activities for the SHEWA-B project comprised several phases. In mid 2007, there were a number of activities that evaluated the baseline conditions, behaviours and health. These activities took place in randomly selected SHEWA-B intervention communities and matched nearby non-intervention communities. These activities were repeated in 2009 and will be compared with the same assessments made in 2007 to assess the difference at the midpoint of the SHEWA-B project. Overall, the end-line evaluation of the project is scheduled to take place at the end of 2011 (ICDDR-B 2007b).

The rationale of this research on the measurement of hand washing pre-dates the SHEWA-B project. The earlier work examining the DHS measurement methods on hand washing acted as a basis to investigate the measurement and methodological issues surrounding hand washing and apply and investigate different measurement methods in the practical context in a low income setting. This resulted in the successful identification of the commencement of a large scale hygiene promotion programme, the SHEWA-B project in early 2007 and involvement in the baseline activities for the Health Impact Study component of the SHEWA-B project commissioned by ICDDR, B.

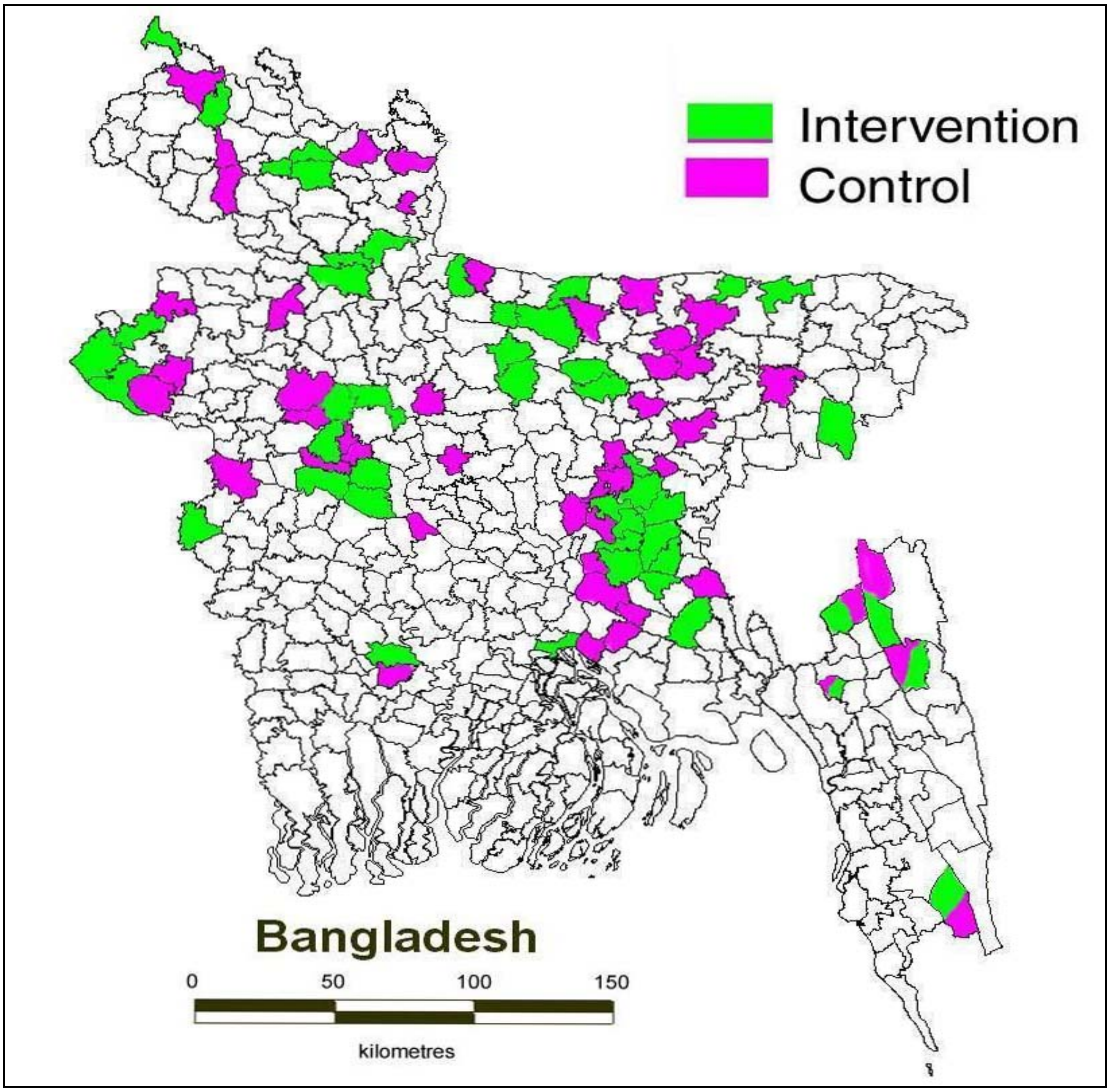
The measurement and methodological issues identified from the analysis of available DHS country data and the need for further enquiry into the validity of different approaches to measuring hand washing behaviour was advocated for. This resulted in permission from the study team to be involved in the development of the survey instruments at the initial stages of the project, specifically the hand washing measures and use of the baseline data. This enables one to be involved more practically from the onset of the project and the measurement methods and indicators on hand washing for this thesis to be embedded in the baseline data collection. The purpose of the SHEWA-B Health Impact Study baseline data was to provide available data on a range of water, sanitation and hygiene related conditions and behaviours together with information on demographic, socio-economic and child health and cost of illness outcomes. Therefore it was possible to extract information on hand washing from the specific components.

5.2.1 Study design

The SHEWA-B project is based on a clustered randomised study design. For the SHEWA-B intervention clusters, 50 intervention clusters were selected. This was conducted through selecting the communities from all of the 635 unions and 300 paras that are targets of the intervention. This was done using Probability Proportional to Size (PPS) sampling resulting in the probability of a specific union being selected being proportional to the size of the population of that union.

Figure 5.1 displays the SHEWA-B intervention and control communities. In each of the SHEWA-B upazilas where a cluster was chosen the upazila was matched with a nearby control upazila that had similar socio-economic conditions, selected on infrastructure, agricultural productivity and household conditions. The primary aim of the SHEWA-B Health Impact Study is to examine the improvements in health that are attributable to the SHEWA-B project, an important feature of the project was that the chosen control areas were specifically identified as ones that did not have Water, Sanitation and Hygiene (WASH) programmes taking place. There are several international agencies that have ongoing sanitation projects in Bangladesh and that hygiene promotion is a component of some of these projects, a list of upazilas with sanitation and hygiene projects including SHEWA-B were compiled and these upazilas were excluded from being selected as control areas (ICDDR-B 2007a).

Figure 5.1: UNICEF SHEWA-B Study areas



Source: ICDDR,B 2007 (ICDDR-B, DPHE et al. 2007)

5.2.2 Data collection

The SHEWA-B Health Impact Study used a range of data collection methods and activities to collect baseline data. From mid 2007 a range of baseline activities were conducted including structured observations, a cross sectional survey, sentinel surveillance and rapid screening. Each of these components will be discussed individually. However, the primary focus of this section will be on structured observations and the cross sectional survey as these form the major components focusing on hand washing measurement. Lastly, the focus group discussions will be described (ICDDR-B 2007b). The contribution of this research has been outlined in Chapter 1.

Given the shortcomings of the DHS questions in measuring hand washing assessed in Chapter 3 and the lack of validation of existing approaches, the SHEWA-B project (in particular the baseline studies conducted from mid 2007) enables the discussion of the DHS measures on hand washing. In addition, the assessment of the methodological and measurement issues associated with hand washing was discussed with colleagues at ICDDR, B and UNICEF.

This resulted in the inclusion of existing DHS survey indicators on hand washing in the SHEWA-B survey instruments; including the cross sectional survey instrument and additional hand washing indicators to be added including questions on:

- hand washing behaviour
- hand washing knowledge
- soap use and availability
- spot check observations
- hand washing demonstrations
- structured observations

The rationale of conducing focus group discussions with all fieldworkers involved in the collection of baseline data for the SHEWA-B Health Impact Study project was to assess the practicalities of implementing the methodologies in the field. This method provides a source of data that can be used to contextualise the results and some of the measurement errors and insights from fieldworkers. This approach is discussed in later sections.

5.2.2.1 Structured observations

The selection of study sites to conduct the structured observations involved the random selection of fifty unions from SHEWA-B intervention upazilas. The CHT districts were intentionally over-sampled with the rationale that this area would be under-represented if population was the only consideration. Given this, the study team decided that 10% of the clusters would be from CHT areas, resulting in the selection of five clusters from this area. These were selected as non-intervention control areas for upazilas that were located nearby to chosen intervention upazilas. Selected households were chosen as follows. Firstly, the household nearest to the centre of the village was chosen as the starting point. The ten eligible households situated closest to the starting point were included in the evaluation. The eligibility of the households was determined as those that included a child of less than five years of age, whose parent or guardian consented to participate and where the intervention assignment, taken as the SHEWA-B intervention or control area, was the same as for the starting point. In total, 1000 households participated in structured observations, 500 households in the intervention area and 500 households in the control area and observation were conducted for five hours (ICDDR-B 2007a).

5.2.2.2 Field worker selection and recruitment

For the structured observation component of the SHEWA-B project, 30 Field Research Assistants (FRAs) and six Field Research Officers (FROs) were recruited. Each team was comprised of approximately five to six FRAs with one FRO responsible for each team. Overall, 60% of the FRAs were female and over 40% had a postgraduate qualification such as an MSc/MA. For the FROs, there were five males and one female. From a geographical perspective, the fieldworkers were from across Bangladesh and this enabled an understanding of local areas, practices and customs (ICDDR-B 2007a).

5.2.2.3 Survey instrument design

The structured observation survey instrument was developed through consultation with national and international experts from ICDDR, B, UNICEF, the University of Buffalo, USA and the University of Southampton. My personal contribution involved providing assistance in the development and design of the survey instrument together with providing feedback as appropriate as previously discussed. The survey instrument was field tested at the MATLAB field site, a Demographic Surveillance Site (DSS) and one of ICDDR, B field sites. After the field testing of the instrument, the field work was conducted between July and August 2007 (ICDDR-B 2007a).

5.3 Methods

5.3.1 Mixed Methodology

This study employs the use of a mixed methodology within a case study design approach to examine the measurement of hand washing and the methodological issues behind this measurement. Mixed method research designs incorporate techniques from both the quantitative and qualitative traditions. Mixed method research is not thought of as a new concept, and has been used throughout the 20th century by social and behavioural scientists. However, it is seen that within the last decade of the 20th century that researchers begun to give unique names to their designs. Tashkorri and Teddlie (2003) argue that mixed methods design emerged through the notion of "triangulating" information from different data sources, which is a technique that they argue emerged first from psychology and sociology but has reached its greatest potential in applied research areas e.g. evaluation and nursing.

Mixed methods research designs are useful if they provide better opportunities for answering specified research questions and enable those undertaking such methods to meet the criteria for evaluating the "goodness" of their answers in a more appropriate way compared with single based approach research designs. The arguments put forward favouring the use of mixed method approaches compared with single method approaches is that mixed method research has the potential to answer research questions that other methodologies cannot and that this type of research provides stronger inferences as opposed to single approach designs. It is argued that mixed methods strategies enable special opportunities to use multiple sources of information from multiple approaches in order to gain new insights into the social world (Tashakkori and Teddlie 2003; Axinn and Pearce 2006).

Given that the measurement of hand washing behaviours and practices remains challenging and complex, the use of a multi method approach was adopted within the SHEWA-B Health Impact Study. The purpose of which was to provide an in-depth understanding of the issue using a number of different measurement methods. The different observational, cross sectional survey and other methodological approaches examined and discussed in Chapter 2 identified the various advantages and disadvantages of methods that have been employed to measure and assess hand washing behaviour. The discussion and assessment of the measurement of hand washing in DHS highlighted some of these issues. However, there were a number of issues and considerations that the DHS approach was unable to elucidate. The SHEWA-B Health Impact Study approach included specific components on hand washing behaviours and practices and identified the need for a range of indicators in order to meet the project objectives. The approaches adopted used and built upon a range of indicators used in the Rural Hygiene, Sanitation and Water Supply (RHSWSP) project (ICDDR-B 2007b; UNICEF 2008a). One of the notable features of approaches adopted in the SHEWA-B Health Impact Study was that the project specifically identified that the measurement of hand washing behaviour is extremely difficult to evaluate. The commonly discussed disadvantages of questionnaire based approaches, for example, differences in responses to questions on hand washing compared with actual hand washing behaviour were cited. Furthermore, that the use of structured observation data on hand washing behaviour has the disadvantage of reactivity as previously discussed, although in this context it suggests that reactivity reduces after the person being observed has been observed for a number of sessions. Also highlighted was the reactivity of such data collected from this approach as the person being observed may alter their usual practices. Further shortfalls, such as the use of hand microbiology for the assessment of hand washing behaviour are critiqued in terms of inconsistency between measures of hand contamination and hand washing (Bentley, Boot et al. 1994; Kaltenthaler, Drasar et al. 1996).

Due to these difficulties on how to measure and evaluate hand washing the SHEWA-B project employs the use of multiple measures of hand washing behaviour using different measurement methods. The main method employed for the evaluation was the use of structured observations. The way in which this research fits and contributes within the framework of the SHEWA-B Health Impact Study is that the focus of this research is on the validation of existing DHS measures on hand washing and how this compares with other measures e.g. direct observation and how this can inform and improve existing DHS approaches.

The International Centre for Diarrhoeal Diseases Research, Bangladesh (ICDDR, B) have been commissioned by UNICEF to conduct the Health Impact Study (HIS) for the SHEWA-B project as previously discussed. The team at ICDDR, B conducting the HIS is comprised of international experts with extensive experience in a range of sectors (ICDDR-B 2007b).

The approach taken therefore enables the triangulation and comparison of various methods in order to enable a more informed understanding of the complex issue of measuring hand washing using a range of different methods. These methods include direct observation of hand washing during a variety of different hand washing exposures, the assessment of hand washing facilities and materials during structured observation and spot check observation together with hand washing demonstration by mothers and children. Therefore this investigation used both structured observation data and data obtained from a cross sectional survey. These two components were conducted at different times and are explained later in more depth. Furthermore, the consideration of the methodological issues involved focus groups with field workers.

5.4 Methods applied

Measurement of hand washing

The survey instrument focused on nine core areas and was used to focus on the observation of hand washing and toileting behaviour. Firstly, the survey instrument focused on the specific type of hand washing exposure with nine specific exposure events for the field workers to observe whilst in households. The hand washing exposures can broadly be categorised into food related exposure events, defecation related events and "other" events. For food related exposure events, the hand washing exposure events included:

- before preparing food
- before serving food
- before eating
- after eating (to include self and child)
- before feeding a child.

For defecation events, the following exposures were included:

- after cleaning a child's anus

- after defecation.

For the “other” exposure events category, the following exposures were included:

- after returning from outside the compound
- others, where the fieldworker was instructed to specify the type of hand washing exposure.

In order to differentiate the person recorded as washing their hands, the household member that washed their hands was recorded, with ten categories distinguished by gender. These categories were:

- a person washing their hands who is the caregiver
- a child less than 3 years of age
- a child aged 3-5 years of age
- a child aged 5-12 years of age
- a non-caregiver adult aged 12 years plus.

The observation was also made as to whether hands were washed by the household member and the location of the hand washing place. This was of interest, as previous studies using structured observation have not collected information on the location of the hand washing place although studies have shown that the location of the hand washing facility can influence hand washing practice (See Chapter 2). There were nine categories featured that included in the toilet, outside the toilet, in the kitchen or outside the kitchen, in a plate, at a nearby tube-well, at a nearby pond/stream, in the yard and other. However, there were some shortcomings in the structured observation survey instrument.

The observation of hand washing was based on multiple household members. Given the discussions on structured observation in Chapter 2 on the rationale for observing mothers or female caregivers, it is interesting that in this study other household members were observed. This is because all of the results obtained from structured observations of hand washing from other studies were based on mothers and female caregivers. The observation of the hand washing practice of young children may be problematic as they may not have been taught how to routinely wash hands and are too young to understand the importance of hand washing at critical times. This research is restricted to the analysis of the main primary female caregiver who was the mother or the main caregiver of the youngest child. Table 5.1 provides an overview and description of the structured observation indicators.

Table 5.1 Description of structured observation indicators

Measurement tool	Indicator	Description
Structured Observation	Hand washing exposure event Household member observed Were hands washed? Location of hand wash Were both hands washed? Hand washing materials used (Any soap, ash/mud, only water) How were hands dried?	5 hour observation in eligible households (1000 households approx.)

An important feature of the structured observation tool was the observation as to whether both hands were washed and the use of hand washing materials such as any soap, ash or mud, only water or another material. The way in which hands were dried was also observed with the choice of seven categories. The categories were air-dried, not dried, the use of a clean towel, a dirty towel, clothing, *sharir anchal* and other. One of the shortcomings of the design of the structured observation survey instrument is that it does not provide information on the water source available. Although, the location of the hand washing place was assessed, this does not necessarily mean that water was available at that place. Therefore, this could have been improved by knowing where the water source was located, however this was observed in the cross sectional survey so the data can be linked and such an assessment would have been useful to assess the level of agreement between the two survey instruments.

The assessment of whether one hand or both hands were washed is also of interest as to how exactly this was observed. This is because it may be difficult to observe accurately whether one or both hands were washed without making it overt to the household member. It would have been interesting to have information on the type of hand washing facility and written observation on the problems and issues that arose with the observations and the survey instruments. This is where focus group discussions with those involved in the data collection process are of interest to provide information on these issues.

The structured observation instrument also focused on the location of the toilet facility in the case of a defecation event. The categories were broadly defined as unimproved or improved facilities. Improved toilets included:

- a flush or pour flush toilet
- a pit latrine (both facilities (pit and flush toilets) with varying facilities differentiated by design)
- a composting toilet

While unimproved facilities, again differentiated by design included:

- open defecation such as no facility
- in a bush/field (ICDDR-B 2007a).

5.4.1 Cross sectional survey

5.4.1.1 Sample size and household selection

The cross sectional survey was conducted in 1692 households split evenly between intervention and non-intervention areas during September-October 2007. The same sampling design described in the structured observation component was used. There were 17 sampled households per starting point and this included all of the 10 sampled structured observation households. An additional seven households were sampled, chosen using the nearest considering criteria.

The first component of the cross sectional survey covered a wide range of topics including, basic demographic information, background and socio-economic characteristics. Also included in the survey were questions on the ownership of assets, hand washing practices, household water treatment and arsenic awareness, hygiene and safe water treatment promotion and adolescent menstrual hygiene practices. The presence of Arsenic in water was tested for in selected households. The cross sectional survey component contained a face-to-face interview and spot check observations. The spot check observation component included the assessment and observation by the fieldworker of water handling behaviour, the household waste disposal system, household materials, sanitation and hand washing facilities and behaviours. A hand washing demonstration for mothers and children was also conducted. The second component of the study focused on the baseline status of disease burden and the cost of illness for children under five years of age (ICDDR-B 2008).

5.4.1.2 Survey instrument design and training

The design and development of the cross sectional survey instrument was similar to the development and design of the structured observation survey instrument. The training for the cross sectional survey instruments consisted of two weeks of intensive training that was provided in-house at ICDDR, B. The same field teams that administered and conducted the structured observation were trained. The survey instruments were field-tested at the MATLAB field site for four days. Following this, the survey instruments were then finalised (ICDDR-B 2008).

Measurement of hand washing

The cross sectional survey used a range of methods to measure hand washing behaviours and practices. Having liaised with the team during the development of the SHEWA-B cross sectional survey instruments, the latest DHS approaches to measuring hand washing as featured in the Nepal 2006 DHS that focused on recall of hand washing and soap use in the last 24 hours were included. The questions were asked in conjunction with the approaches used in the fourth phase of the MEASURE DHS programme including questions on hand washing at critical times and spot check observations of hand washing materials and facilities. However, as the SHEWA-B project is a large-scale project with specific programme objectives, some of the DHS approaches taken had to be reworded and answer categories expanded upon. These changes were minor in nature. Additional questions and spot-check observations were successfully added to the survey instrument that were not featured in the DHS approach to measuring hand washing. These questions and spot checks were developed in consultation with the research team based on previous studies and the requirements of the study. Other approaches and questions were also included in the study in relation to hand washing. These approaches will be featured in the analysis as they provide further measures and assessment of hand washing indicators (ICDDR-B 2008).

5.4.1.3 Questionnaire based approaches

Hand washing exposures

The cross sectional survey included a section on the hand washing practices of individual respondents. Respondents were asked about their hand washing practices using open-ended questions. These were coded by the interviewer into categories after the response. A range of answer related categories was clearly distinguished. This included food and defecation related behaviours.

In this section there were also questions on when food was last prepared in the house, whether the respondent ate their last meal with hands, whether a child was last fed a meal with hands, when the respondent last cleaned their child's anus with hands and when the respondent last defecated. Further sub questions were then asked to respondents that answered that they had performed such a practice. If respondents answered yes to any of the practices during the specified times stated they were then asked whether they washed their hands on that occasion, whether both hands were washed and whether soap or ash was used (ICDDR-B 2008). Table 5.2 provides a description of the self report questions featured in the survey.

Table 5.2: Description of self report indicators on hand washing

Measurement tool	Indicator	Description
Survey-Self report questions	When did you wash hands with soap? (Open ended) When do you wash hands with ash? (Open ended) When did you last _____ (critical time)? Did you wash hands before_____ (critical time)? Did you wash both your hands? Did you use soap? Did you use ash? How many times did you wash your hands throughout the day yesterday? Have you used soap today or yesterday? When you used soap today or yesterday, what did you use it for? Do you have separate soap available for hand washing? Do you have spare soap available in the household? How often do you buy soap (Body soap)? When do you think it is important to wash hands? (Open ended)	Conducted in 1692 households (For this analysis, approx. 1000 households)

DHS hand washing measures

The latest questions proposed and used by the MEASURE DHS programme in the Nepal 2006 DHS were then asked in the survey focusing on the number of times hands were washed throughout the previous day. Respondents were asked whether soap was used today or yesterday and if so, then regarding the purpose of soap use. If the respondent cited that the purpose of use was for washing her or her child's hands then the interviewer was instructed to probe what the occasion was. The interviewer was directly instructed not to specify the answers to respondents rather to ask respondents to be specific with their answers and to encourage the respondent to answer by saying "what else?" until the respondent was unable to provide any further answers. The answer categories were noted on the survey form to aid coding of the data.

This question was the same as the one featured in the Nepal 2006 DHS. The answer categories specified were also the same, including the washing of children, washing a child's hands, washing a child's anus, washing hands after defecation, washing hands after handling cow dung and hand washing activities related to food exposures, that included before feeding a child, before preparing food, before eating, after eating and other activities that the respondent was asked to specify (ICDDR-B 2008).

Soap availability, purchase and hand washing knowledge

Questions focusing on soap availability were successfully included. Respondents were asked whether they had separate soap available for hand washing, whether there was spare soap available in the household and how often soap was purchased. Knowledge of the importance of times to wash hands was also asked. The interviewer was instructed not to specify the answers, rather to allow the respondent to answer. The answers featured food related hand washing exposures of before preparing food or cooking, before eating, after eating, after cleaning/changing a baby, after defecation, other activities whereby the respondent was asked to specify and a don't know category (ICDDR-B 2008).

The self-report hand washing questions featured in the survey instrument may present similar issues to the ones discussed in Chapter 2, for example, over reporting of desirable behaviours. The ordering of the questions may affect the response obtained. In the cross sectional survey, there were a number of consecutive questions on exposure events, for example whether the respondent ate their last meal with hands, when the respondent last cleaned a child's anus and when the respondent last defecated. Directly after each of these questions were questions on whether hands were washed and the hand washing material used. The ordering may therefore influence the response given through respondents becoming aware of the type of question being asked resulting in a positive response. Some of the questions featured were leading and may result in a positive response. There may be issues with recall questions with respondents unable to accurately report soap use in the previous 24 hours.

5.4.1.4 Spot-check observations

The spot check observation component of the cross sectional survey addressed and examined a range of water, sanitation and hygiene related activities, in particular hand washing materials and facilities. Although, the focus of this is on the measurement of hand washing, there are some topics within the spot check observations that, although not directly on hand washing, featured areas that included a hand washing component, so they will be discussed accordingly. Table 5.3 provides a description of the spot check hand washing indicators.

Table 5.3: Description of spot check observation indicators

Measurement tool	Indicator	Description
Survey-Spot check (Observation only)	Can you show me where you usually wash your hands after coming back from the toilet? Is water available there for hand washing? Is there soap or detergent or a locally used cleaning agent? Can you show me where you usually wash your hands before you cook, eat or feed your child? Is this place different from the one used after coming back from the toilet? Is there soap or detergent or a locally used cleansing agent?	Conducted in 1692 households (For this analysis approx. 1000 households)

Water handling and waste disposal

Firstly, the spot check observations asked the interviewer to observe and record water handling and water handling behaviours. This included an assessment on how drinking water was stored, the type of container in which the water was stored and whether the container was covered.

The respondent was then asked to bring a glass of water for arsenic water testing and the interviewer observed whether the respondent washed the glass or container and whether the respondent washed their hands before water was obtained. Furthermore, notes were made on whether hands were washed with soap, whether hands came into contact with drinking water, the type of container used to obtain the water and whether water was taken directly from a tube-well or water source.

The spot check also observed the type and ownership of the water source available. There was also assessment of the water that was used by the household for cooking foods and for washing fruits and vegetables. If the water source was shared, then the respondent was asked and the interviewer checked how many other households shared the water source. There was also observation of the cleanliness of the water source. Cleanliness was assessed through whether the water source was water logged and the absence of faeces or dirt beside the water source. The interviewer asked and observed the person that was responsible for taking care and maintaining the water point at the household level, with care and maintenance defined as washing the surrounding area and cleaning.

Spot checks were performed to assess the waste disposal system of the household to assess whether the household had a fixed place for the disposal of solid waste. If the answer given was yes, then the interviewer observed what kind of facility it was and how the household disposed of waste there. The availability of a water drainage system was also assessed and the type of system available. The materials of the household were observed and used to assess socio-economic status of the household (ICDDR-B 2008).

Sanitation facilities

The spot check observation for sanitation focused on sanitation facilities of the household. This included an assessment of the type of toilet facility that the household usually used and whether the facility was improved. This was categorised by six defined facilities with specific characteristics or an unimproved facility. The ownership of the toilet facility was also asked and observed, however, observing ownership of a toilet facility may be difficult to ascertain if the toilet facility is in an open area and self-report measures may be flawed as respondents may report that they own the facility when actually they do not. This was used to ascertain whether the household owned the facility, shared the facility, whether someone else owned the facility, whether the facility was publicly owned or not applicable. If the sanitation facility was identified to be shared, then the interviewer was instructed to ask the respondent how many households shared the facility. The maintenance of the toilet facility at the household level was also investigated, relating to the washing and cleaning of the area surrounding the toilet.

An assessment of whether stools were visible on the slab or floor was made by the interviewer, alongside an observation of where children under five years of age mainly defecated. This assessment featured the same criteria and facilities specified for the sanitation facility for the household and were broadly distinguished into two main categories of improved sanitation facilities and unimproved sanitation facilities. Similarly, open defecation was categorised into defecating in the bush or field. Other categories included the use of a potty, nappy/diaper and no specific place (ICDDR-B 2008).

Location of the hand washing facility and hand washing materials

The use of the spot check observation method to assess the availability of hand washing facilities and materials in households in the SHEWA-B project differed to the approach used in the DHS. The DHS approach involved the interviewer asking the respondent whether they had a designated place in the dwelling, yard or plot to wash hands. The issues identified with this method are discussed in Chapter 3. The DHS question on whether there is a designated place does not define clearly, what is meant by the term “designated”.

The approach taken for the SHEWA-B Health Impact Study distinguished the place for hand washing, asking the respondent and the interviewer observing where the respondent usually washed their hands after coming back from the toilet. The interviewer was then given six predefined categories to observe and record the location of the hand washing facility, given as inside or near the toilet facility, inside or near the kitchen/ cooking place, elsewhere in the yard (within three steps of the latrine), elsewhere in the yard (> than 3 steps but ≤ 10 feet), outside the yard (> 10 feet from the latrine), no specific place or no permission to see. If there was no specific place or permission was not granted then the interviewer skipped onto another section. However, if there was a place for hand washing the interviewer then observed whether there was water available for hand washing and if there was soap, detergent or a locally used cleansing agent. If soap, detergent or a locally used cleansing agent was available, this either had to be in the designated place or brought to the interviewer by the respondent within one minute (reasonable time). If the item was not brought to the interviewer in that time then the interviewer had to state that there was no such item available, even if the item was provided later. The items were defined as soap, detergent, ash, mud/sand or other (ICDDR-B 2008).

The respondents that answered that they had no specific hand washing place after coming back from the toilet were asked a specific question on whether they had any other item to wash hands in, for example, a bucket, basin or container to wash hands in. A probe to find where this item was kept was also asked, given as in or near the toilet facility, in or near the kitchen, outside or elsewhere in the dwelling. A further series of questions and observations were then made to ascertain how the item was used, with questions on whether there was water in the item and the frequency in which water in the items was changed, given as daily, 1-2 days, 3-4 days or greater than 4 days or never. A further question was asked about how many household members used the item and whether the households had a water/tap available (ICDDR-B 2008).

The spot check observation also instructed the interviewer to ask and observe where the respondent usually washed their hands before cooking, eating or feeding a child. The same categories featured for the questions on the usual place hands were washed after coming from the toilet, were given. Importantly, a further question was asked after this question on whether the location usually used for washing hands before cooking, eating or feeding a child was different to the place used to usually wash hands after coming from the toilet.

Observations were made as to whether there was soap, detergent or another locally used cleansing agent available.

The same instructions given during the observation for the place used to usually wash hands after coming from the toilet were given, so either the item had to be in the hand washing place or the respondent had to bring the item to the interviewer within one minute. The items listed were the same. The problem with the questions in this section was that there may be contamination of questions, for example if the same hand washing is used for the above activities and soap availability. A further issue of the spot check observation was the question on *"Where do you usually wash your hands when you come back from the toilet?"* This question assumed that the respondent washed their hands in the first instance, therefore, if they did not wash hands routinely, they may show the place but they do not wash hands.

Hand and fingertip assessment

The interviewer asked the respondent whether they could assess and observe a child's hands (under five years of age). If there was more than one child under five years of age and at least one of them exposed visible dirt or had an unclean appearance, then the interviewer was instructed to put the necessary code for all children belonging to that specific household. An assessment was made of the child's fingernails, palms and finger pads and was assessed in terms of the following characteristics; visible dirt, unclean appearance, clean or the respondent refused for the child's hands to be assessed. The same assessment was then made of the mother's hands focusing on the fingertips, palms and finger pads (ICDDR-B 2008). However the visual assessment of hands does not provide any information on the degree of contamination on hands. In addition, the time of day of the assessment is a further issue. Hands may be dirty for other reasons, for example, a child playing in an unclean environment. Table 5.4 displays the hand and fingertip assessment indicators.

Table 5.4 Hand and fingertip assessment indicators

Measurement tool	Indicator	Description
Hand and Fingertip Assessment	May I look at (Child's name) hands? Areas assessed -Fingernails -Palms -Fingerpads May I look at your hands? (Mother of the youngest child) Areas assessed -Fingernails -Palms -Fingerpads Categories of interest (Visible dirt, unclean appearance, clean, refused)	Conducted in 1692 households (For this analysis, approx. 1000 households)

Hand wash demonstrations

A hand washing demonstration formed part of the spot check and was performed in all households. If the household had no children aged between 3-5 years, then the hand washing demonstration was conducted for the mother of the youngest child and if the household had a child aged 3-5 years old then the interviewer was instructed to conduct the demonstration with the eldest child and not the mother. If the mother/child refused or the child was unable to wash their hands or both the mother and child were absent then the hand washing demonstration was not conducted. For those that did agree to participate they were instructed to show the interviewer how they usually washed their hands after defecation and how hands were dried. The interviewer then observed whether the mother of the child used water to wash hands, soap, ash or mud, whether both hands were washed and the amount of time that the mother of the child rubbed their hands with soap. Lastly, how hands were dried was shown (ICDDR-B 2008).

The methodological issues associated with hand washing demonstrations were discussed in Chapter 2. The issue of the hand washing demonstration in the SHEWA-B Health Impact Study was that the location where the hand washing demonstration was conducted may have influenced the results obtained. For example, if the demonstration was conducted outside, then privacy may be an issue and respondents may not demonstrate their usual hand washing practice. The demonstration also assumes that the respondent usually washed their hands. Furthermore, with all of the other additional hand washing questions that were featured before the hand washing demonstration, this may have influenced the way in which hands were washed for the demonstration. Table 5.5 displays the hand washing demonstration indicators.

Table 5.5 Hand washing demonstration indicators

Measurement tool	Indicator	Description
Survey-Hand washing demonstration	Please show me how you usually wash your hands after you go to the toilet? Key points observed: -Used hand washing materials including water, soap, ash or mud -Were both hands washed? -How long (count seconds) the person rubs their hands with soap? How were hands dried?	Conducted with the mother and the youngest child in eligible households

5.5 Focus group discussions

Focus group discussions were conducted with FRAs and FROs directly involved in the collection of data for the SHEWA-B project. In total all fieldworkers, comprising 24 FRAs and 6 FROs, participated in focus group discussions to debrief, explore and discuss their experiences of conducting the structured observations, the cross sectional survey and regarding their training to date. Ethical approval was obtained to conduct the focus groups and this is included in Appendix 1. The focus groups focused on the methodological issues that fieldworkers faced whilst in the field administering the survey instruments and exploring the issues around survey methodology on the different hand washing measurement instruments.

The rationale for conducting focus groups with fieldworkers was that with their direct involvement and knowledge through administering the survey instruments in the field, focus group discussions provided an opportunity to evaluate and gain feedback regarding how survey instruments were administered and performed in the field. The focus group discussions focused on the following key areas: the difficulties that they faced when administering the instruments, how such issues were overcome, how data quality issues were addressed and ensured and suggestions for ways in which improvements could be made to the survey instruments.

Within the literature on hand washing, although the measurement issues and difficulties associated with assessing hand washing have been cited, there is no focused work on the methodological issues associated with various hand washing measures focusing directly on those that administer and collect the information. However, this is of great importance given that these individuals are directly involved and responsible for the collection of such data, their experiences and insight can enable a greater understanding of the methodological issues and enable ways in which such issues can be addressed and improved.

Survey instrument design

The focus group survey instrument was developed through assessing the survey instruments with consultation with the Research Investigator on the challenges and issues faced during data collection. The discussions focused on four main topics areas; training, teamwork and administration, field and methodological issues and learning. For training, the discussion focused on the fieldworkers' experience of training and preparation for the data collection in the field, the appropriateness of training, focusing on whether there were areas that were not covered in training that occurred in the field and suggestions for improvement. The topic on teamwork and administration involved the discussion of experience of teamwork/team administration including guidance and support, challenges and issues faced in the field and how such issues were overcome and lastly suggestions on teamwork and administration .

The discussion on field and methodological issues formed the core of the focus group discussion. This focused firstly on the general experience of working in the field during structured observations and the cross sectional survey, the challenges and issues faced and the ways in which they were overcome and suggestions for improvements. The discussion then focused specifically on the survey instruments for the structured observation, asking fieldworkers about the specific areas that the structured observation survey instrument assessed. This discussion focused on the methodological and practical issues and experiences that fieldworkers faced.

The second part of the discussion focused on the cross sectional survey, firstly on the questions on respondent's hand washing practices. This section of the focus group asked fieldworkers about their experiences when asking open ended questions on hand washing, for example how questions were understood, whether the respondent required probing, the fieldworkers experience of recall questions focusing on the three main areas featured for hand washing, soap use and soap availability. The fieldworkers were then asked about their experiences of spot checks during the cross sectional survey focusing on the observation of the hand washing location, soap and other hand washing implements, their experience of the fingertip assessment and the hand washing demonstration.

The final topic of the focus group discussion was on the learning experience from the project and how the study differed from other surveys they have worked on.

5.5.1 Data quality

Ensuring good quality data is a key feature throughout the SHEWA-B project. Strict data quality procedures were adhered to ensure the collection of high quality data. Survey instruments were pre-tested in the field, fieldworkers received extensive training on all aspects of the SHEWA-B survey instruments and in the field, FROs were able to assist FRAs with data related issues, as was the Senior Research Officer. For the structured observations, the ICDDR, B Trainer and Field Coordinator continuously visited the study sites and their role was to check through the data and provide feedback. Similarly, during data collection for the cross sectional survey a specially assigned qualitative field team, comprising three members whose duty it was to visit the study sites was conducted.

Their role involved checking all of the data, giving feedback, consulting, and liaising with ICDDR, B and the UNICEF Bangladesh team. In addition, one FRO was assigned full-time to five FRAs conducting the interviews. The role of the FRO was to check all of the data collected every day, identify and solve problems before leaving the clusters and coordinate with the team at ICDDR,B. As the focus of this research is on the measurement and methodological issues of hand washing, information on data quality was acquired through consultation with the Senior Field Investigator on the issues and challenges faced pertaining to data quality and interviewer debriefing through the use of focus groups with FROs and FRAs as discussed above (ICDDR-B 2007a; ICDDR-B 2008).

5.6 Methodology for validating hand washing behaviour measures

5.6.1 The principles of screening/diagnostic approaches

The assessment of validity was made using two methods. The first of which was through the use of a screening/diagnostic test approach to assess the validity of hand washing measurement methods. The second through an approach based on kappa statistics. The use of screening and diagnostic tests is widely used in the field of medicine, epidemiology and public health. Screening tests are designed to identify the possibility that disease might be present and the purpose of which is to prompt further valuation of those that test screen positive, i.e. the presence of a particular condition.

The conditions for a screening test are that they should be easy to administer, acceptable to those that the screening test is being performed on and have high sensitivity. High sensitivity means that most individuals with the disease are correctly identified. Screening tests should also importantly identify treatable disorders and identify a disorder where intervention improves the outcome. Diagnostic tests, on the other hand, are meant to provide the user with some surety that the disease is present. It is important to note that no diagnostic test is 100% accurate. The reference standard also referred to in some instances as the “gold standard” to which the test is compared may be another definitive or invasive test, questionnaire, structured interview or another type of interview. This is described as the external source of “truth” regarding the disease status of each individual in the population.

The validity of a screening test is defined as its ability to distinguish between those that have a disease and those that do not. The assessment of validity therefore has two main components. These components are sensitivity and specificity. These concepts are explained later in more depth. These features both relate to how accurate the test is. However, in brief, the sensitivity of a test is defined as the ability of a test to identify those who have the disease or condition of interest under study. The specificity of the test is the converse. It is the ability to correctly identify those that do not have the disease or condition of interest under study.

The ideal test is one that is identified to have both high sensitivity and high specificity. This is so that most true cases are identified and most of the non-cases are excluded. The positive predictive and negative predictive values, in particular the Positive Predictive Value (PPV) is one of the most important features of a diagnostic test approach. This value represents the proportion of patients with positive tests results who are correctly diagnosed. It is an important feature as it reflects the probability of individuals with positive test results actually reflecting the condition being tested for. The Negative Predictive Value (NPV) of a test refers to the proportion of individuals with negative test results who are correctly diagnosed.

A further aspect of diagnostic and screening tests to consider is the reliability of the test. The reliability refers to whether a test is reliable or repeatable. This means that the same results should be obtained if the test is repeated. This is important because if the results cannot be reproduced, then the value of the test and its use are identified to be minimal. The reliability of the test can be further assessed through assessing factors that contribute to variations in results. These factors include intrasubject variation that refers to variation identified within individual subjects. Secondly, intraobserver variation, this refers to variation in the readings of tests results from results taken from the same reader and lastly interobserver variation. This refers to variation between those reading the test results (Warner 2004; Gordis 2009).

The use of a screening test style approach to assess the validity of health behaviour has been used in studies in the field of public health and social science. This approach has been used to compare and assess the validity of different measurement methods. For example, studies into dietary habits and behaviours, sun-protections habits, physical activity psychiatry assessment methods, injury study and prevention, seatbelt use , drug and other risk taking behaviour such as HIV/AIDS, sexual health, quality of life, medical advice and patient experience and medical records. Some of these areas have also used kappa statistics to assess the reliability and validity of different measurement methods. However, the use of these approaches in the study of hygiene behaviour has been limited, in particular the use of epidemiological approaches using the concepts of screening. This may have been due to a lack of comprehensive data that included information on different methods of measuring hand washing behaviours (Hassey, Gerrett et al. 2001; Flocke and Stange 2004; Prochaska and Sallis 2004; Moshiro, Heuch et al. 2005; Bignami-Van Assche, Chao et al. 2007; Zambon, Fedeli et al. 2008; O'Riordan, Nehl et al. 2009; Rhew, Simpson et al. 2010).

Figure 5.2: A diagnostic/screening test approach

		Condition (as determined by the "reference standard") (reference) (Structured Observation)		
		Positive ***(Always)***	***Negative*** ***(Not always)***	
Test Outcome (Survey: Self report, spot check and hand washing demo.)	***Positive***	True Positive (a)	False positive (b) (Type I error, P value)	*Positive Predictive Value* (a/(a+b))
	Negative	False Negative (c) (Type II error)	True Negative (d)	*Negative Predictive Value* (d/(d+c))
		Sensitivity (a/(a+c))	*Specificity* (d/(d+b))	

The condition, which in this case was structured observation, featured in Figure 5.2 in blue, for which there are two outcome categories, positive and negative. Those that were defined as positive are those that always washed their hands while negative are those that sometimes did not. (In the case of this research and specifically the classification of structured observation indicators, structured observation indicators were classified as "always" and "not always" as denoted in Figure 5.1 corresponding to positive and negative).

The test outcome in this case was data collected from the cross sectional survey in the form of self report questions, spot check observation and a hand washing demonstration. The test outcome was also classified as positive and negative corresponding to a female caregiver answering yes or no to a self report question or referring to the presence or absence of hand washing materials. In the case of the hand washing demonstration this was whether a behaviour was performed or not.

The use of this 2 x 2 table format provides the format for sensitivity, specificity, positive predictive and negative values calculations denoted in the two rows at the bottom of the table. True positives are individuals with the condition of interest under structured observation; in this case, those that always washed hands for example, and who also reported that they washed hands in the test outcome in the survey (Sensitivity).

In brief, true positives are individuals with a condition correctly identified as having the condition. False positives on the other hand, are individuals who do not have the condition who are incorrectly identified as having the condition. In this case, individuals who do not always wash hands but report that they do when asked a self report question. True negatives are individuals without the condition who are correctly identified as not having the condition (Specificity). In this case, individuals that did not always wash hands during structured observation and reported that they did not wash hands when asked a self report question.

The last group are termed false negatives. These are individuals that have the condition but are incorrectly identified as not having the condition. In this case, this would be individuals that were observed to always wash their hands but reported that they did not wash their hands when asked a self report question. False positives are also known as a Type I error and false negatives are defined as a Type II error. A Type I error is the error of rejecting the null hypothesis when it is actually true whereas a Type II error is the error of accepting the null hypothesis when it is not true In the equation below, true positives are denoted as TP, false negatives (FN), false positives (FP) and true negatives (TN).

Sensitivity is defined as the proportion of diseased patients correctly identified and is given by the equation below:

$$\frac{TP}{(TP + FN)}$$

Specificity on the other hand is the proportion of healthy patients correctly identified and is given by the equation below:

$$\frac{TN}{(TN + FP)}$$

The PPV is the proportion of patients with positive test results who are correctly diagnosed. In this case and through the use of Figure 1, it can be explained as of all the female caregivers that were identified to be positive or report washing hands in the test outcome, it is the proportion of this sample that were observed to actually *(always)* wash hands. A worked example is given in Chapter 7. The PPV is considered the most important measure of a diagnostic method as it reflects the probability that a positive test reflects the underlying condition being tested for.

The NPV is the proportion of patients with negative results who are correctly diagnosed. Therefore, in this case and referring to Figure 5.2, it can be explained as all female caregivers that were identified to be negative or report not washing hands in the test outcome and the proportion of this sample that did not wash hands *(not always)* during structured observation.

The equation to calculate the PPV is given below:

$$\frac{TP}{(TP + FP)}$$

The equation to calculate the NPV is given below:

$$\frac{TN}{(TN + FN)}$$

5.6.2 Kappa statistic

The other approach to validation was the use of the kappa statistic. This approach is a statistical measure of inter-rater agreement for categorical items. The kappa statistic assesses the degree to which two or more raters, examining the same data, agree when it comes to assigning the data to categories. The equation of k is given as:

$$k = \frac{Pr\ (a) - Pr\ (e)}{1 - Pr\ (e)}$$

where Pr(a) is the relative observed agreement among raters and Pr(e) is the hypothetical probability of chance agreement, using the observed data to calculate the probabilities of each observer saying each category. When the raters are in complete agreement then k = 1. If there is no agreement among the raters (other than what would be expected by chance) then k = $\leq$ 0. One of the problems with the kappa is that of inconsistent results, as in it does not always produce the expected answer. In addition, the interpretation of the kappa statistic proposed by Landis and Koch is not universally accepted and is based on arbitrary categories (Landis. J.R. and Koch 1977). The exact figures are explained in Chapter 7.

6 Results

This chapter provides an overview of the results of female caregiver hand washing behaviour from structured observations and the different methods used in the cross sectional survey consisting of self reported hand washing, spot check methods and a hand washing demonstration. The main focus will be on food and defecation related hand washing behaviour. The five critical times for hand washing form the focus of this analysis, however other important times, for example before serving food, will also be discussed.

The results will be presented in the form of a univariate analysis. For the structured observation data, the results will be presented in two forms. The first form will be through the assessment of overall hand washing events and the second analysis will be presented through focusing on the overall mean score for female caregiver hand washing behaviour and the proportion of times hand were washed and the different components of the hand washing process. This will then provide the basis for the results second chapter, the validation of hand washing measures.

6.1 Structured observations

6.1.1 Overview of hand washing data

One of the components of the SHEWA-B programme was structured observation of hand washing behaviour (ICDDR-B 2008). In total, structured observations conducted observed 20546 hand washing events for household members in 1000 households. Of the household members observed, the largest number of observations was amongst female caregivers.

Female caregivers form the focus of this research as they are the ones that are mainly targeted in terms of public health and hygiene promotion, as they tend to be the primary caregivers of children and are thus responsible for preparing food and looking after children (PPPHW 2003). Therefore, in terms of hand washing it is important to assess their behaviour as they have prime responsibility for caring for children. Therefore, it is of great interest and importance to explore in greater depth their hand washing behaviours, with a focus on the critical times in terms of diarrhoeal disease reduction ensuring child health.

6.2 Overview and analysis of hand washing events for females

The results presented in Table 6.1 show the overall number of hand washing events by different hand washing exposure observed for female caregivers. Overall, there were 7583 events observed for female caregivers, accounting for 37% of the total number of events. The main hand washing events for this group were food related events with approximately 90% of events in this category. The number of defecation events was low, particularly after defecation. Of the 20546 events observed for all household members, washing hands after defecation was low.

In total there were 354 events where observation of hands being washed after defection occurred, constituting less than 2% of the total number of events (20546). The group where these events were most observed were for non-caregiver adult males aged 12 years plus, where approximately a quarter of events were observed, followed by the second largest number of observations of female caregivers.

Table 6.1: Overall hand washing exposure events for female caregivers

Hand washing exposure	Percentage	Overall no. events
Before preparing food	19.2	1455
Before serving	18.1	1369
Before eating	16.2	1229
After eating (self and child)	16.5	1253
Before feeding a child	20.5	1558
After cleaning a child’s anus/disposing of stools	4.8	367
After defecation	0.9	69
After returning from outside the compound	3.4	259
Animal related activities	0.3	24
Total	**100.0**	**7583**

Author’s own analysis of SHEWA-B Health Impact Study baseline data

The results in Table 6.2 present the results based on observation of whether hands were actually washed for the exposure event. Overall, of the 7583 hand washing events observed for female caregivers, hands were washed for 60.9% (n = 4621) of events. Therefore, there were 2962, 40% of events where hands were not washed. This included 27 observations where it was difficult to observe. The results for food related events varied. A higher percentage of events were for washing hands after eating, before serving food and before eating.

There were a large percentage of events where hand washing was not practised. This included before preparing food and before feeding a child, with approximately 50% of events before preparing food and approximately three quarters of events before feeding a child resulting in hands not being washed. This is not even taking into account how the hands washing task was actually performed, only whether hands were washed for that event. In comparison, observed hand washing for defecation related practices was high with over 80% of these events resulting in hands being washed. Hand washing appeared to be a low priority after returning from outside the compound. However, for hand washing activities related to animals that consisted mainly of activities such as cleaning a cow or handling cow dung, hands were washed for all events.

Table 6.2: Observed hand washing behaviour by hand washing exposure for female caregivers

Hand washing exposure	Were hands washed by respondent (%)	No. of events where hands were washed	Overall no. of events
Before preparing food	51.6	751	1455
Before serving	76.4	1046	1369
Before eating	64.5	793	1229
After eating (self and child)	91.2	1143	1253
Before feeding a child	26.8	417	1558
After cleaning a child's anus/disposing of stools	89.4	328	367
After defecation	97.1	67	69
After returning from outside the compound	20.1	52	259
Animal related activities	100.0	24	24
Overall	**60.9%**	4621	7583

Author's own analysis of SHEWA-B Health Impact Study baseline data

During structured observation, for the events that female caregivers washed hands, (n = 4612) observations were also made as to whether both hands were washed. Of the 4612 events where hands were washed, both hands were washed in only 28.2% (1302) of events, demonstrated by the results displayed in Table 6.3. This resulted in a large number of events, over 70%, where both hands were not washed (n = 3319 events).

In terms of food related events, the prevalence of washing both hands was low, particularly before and after eating and the critical time of before feeding a child. Even washing both hands before serving food was low, with less than 30% of hand washing events in this category. A slight improvement was seen before preparing food, with over 50% of events resulting in both hands being washed. Overall, washing both hands for defecation events was also low, although higher than food related activities. The events where both hands tended to be washed were after returning from outside the compound and for animal related activities.

Table 6.3: Observation of washing both hands by hand washing exposure for female caregivers

Hand washing exposure	Washed both hands (%)	No. of events where both hands were washed	Overall no. of events where hands were washed
Before preparing food	52.1	391	751
Before serving	28.0	293	1046
Before eating	11.3	90	793
After eating (self and child)	14.1	161	1143
Before feeding a child	20.1	84	417
After cleaning a child's anus/disposing of stools	52.4	172	328
After defecation	56.7	38	67
After returning from outside the compound	94.2	49	52
Animal related activities	100.0	24	24
Overall	**28.2%**	**1302**	**4621**

Author's own analysis of SHEWA-B Health Impact Study baseline data

6.2.1 Hand washing materials

The importance of hand washing, in particular hand washing with soap, has been highlighted in previous chapters. The use of hand washing materials is presented in Table 6.4. The use of soap for hand washing is critical in the removal of pathogens from hands. Ash has also been promoted as a hand washing agent. However, the results for female caregivers indicate that the use of hand washing agents was negligible. The use of a hand washing agent, in this case, any soap or ash/mud was observed for all events (n = 4621) where hands were washed regardless of whether one or both hands were washed.

Overall, soap was used for only 4% of events, representing 187 events in total. Further analysis of soap use by hand washing exposure identified that for food related events, soap use was a very low priority with approximately 1% or less of events using soap, although these exposures are amongst the most critical times. The food related event with the highest use of soap was before feeding a child, even in this case, soap was used in less than 4% of events.

Overall, the use of ash was very low with approximately 1% of events using ash for hand washing. In this case, the main use of ash was for defecation related events. In terms of hand washing materials used, the majority of hand washing events used just water for hand washing, with 95% of events using just water (n= 4384). This was the case for over 90% of food related events, where the use of other hand washing agents, for example, soap or ash was low and lowest for defecation related activities where soap or the use of ash was identified to be higher.

Table 6.4: Use of hand washing materials

Hand washing exposure	Any soap (%)	No. of events where soap was used	Ash/mud (%)	No. of events where ash was used	Only water (%)	No. of events where only water was used	Total no. of events where hands were washed
Before preparing food	1.1	8	0.1	1	98.8	742	751
Before serving	1.3	14	0.3	3	98.4	1029	1046
Before eating	0.8	6	0.0	0	99.2	787	793
After eating (self and child)	0.3	3	0.0	0	99.7	1140	1143
Before feeding a child	3.8	16	0.0	0	96.2	401	417
After cleaning a child's anus /disposing of stools	30.2	99	11.0	36	58.8	193	328
After defecation	40.3	27	13.4	9	46.3	31	67
After returning from outside the compound	21.2	11	1.9	1	76.9	40	52
Animal related activities	12.5	3	0.0	0	87.5	21	24
Overall	**4.0%**	**187**	**1.1%**	**50**	**94.9%**	**4384**	**4621**

Author's own analysis of SHEWA-B Health Impact Study baseline data

6.2.2 Hand washing locations

The location in which hands were washed was also observed during structured observation. As displayed in Table 6 5, there was a clear distinction between the locations observed for hand washing for food related activities compared with defecation related activities. For food related activities, the main hand washing locations were on a plate/in a pot, that overall constituted 66% of events where hands were washed followed by at a nearby tube-well.

The use of a plate/in a pot as the location for washing hands was used only for food related activities. For food related events, the use of a nearby tube-well was much lower compared with the use of the same location for defecation related activities, after returning from outside the compound and animal related activities. For defecation related events, the main location where hands were washed was at a nearby tube-well. This was particularly apparent after cleaning a child’s anus/disposing of stools. Other locations included in the yard, outside the toilet and at a nearby pond/stream.

Table 6.5: Hand washing exposure by hand washing location

Hand washing exposure	In the toilet	Outside the toilet	In the kitchen	Outside the kitchen	On a plate/pot	Nearby tube-well	Nearby pond/stream	In the yard	Bucket/basin	On the floor	Total %	Total no. of events where hands were washed
Before preparing food	0.1	0.1	24.4	2.1	48.9	19.6	2.4	2.4	0.0	0.0	100.0	751
Before serving	0.0	0.1	6.1	1.9	73.1	14.6	0.1	3.8	0.1	0.1	100.0	1046
Before eating	0.0	0.0	3.4	1.5	86.1	6.4	0.0	2.4	0.1	0.0	100.0	793
After eating (self and child)	0.0	0.2	1.0	1.3	83.6	9.4	1.0	3.5	0.1	0.1	100.0	1143
Before feeding a child	0.0	0.0	5.0	4.1	67.4	15.8	0.5	7.2	0.0	0.0	100.0	417
After cleaning a child's anus/disposing of stools	0.9	3.7	0.3	1.2	0.0	44.5	11.3	37.8	0.0	0.3	100.0	328
After defecation	9.0	22.4	0.0	0.0	0.0	58.2	4.5	6.0	0.0	0.0	100.0	67
After returning from outside the compound	0.0	0.0	0.0	1.9	0.0	65.4	26.9	5.8	0.0	0.0	100.0	52
Animal related activities	0.0	0.0	0.0	0.0	0.0	70.8	8.3	20.8	0.0	0.0	100.0	24
Overall (%)	**0.2**	**0.7**	**6.6**	**1.8**	**66.0**	**16.4**	**1.9**	**6.1**	**0.1**	**0.1**	**100.0**	**4621**
Total	**10**	**31**	**307**	**85**	**3051**	**760**	**88**	**283**	**3**	**3**	**4621**	

Author's own analysis of SHEWA-B Health Impact Study baseline data

6.2.3 Hand drying behaviour

The results displayed in Table 6.6 were based on observation of how hands were dried. For food preparation events with the exception of after eating, hands tended to not be dried. However, this may relate to the vigour with which hands were washed. If hands were washed sparingly and with only water, which tended to be the case for these events, then it may not have been necessary to dry hands extensively. After eating, hands tended to be dried on clothing or using a sharir anchal (the additional portion of the shari).

However, for other events including defecation related events, the way hands were dried varied, for example for defecation related events, hands tended to be dried on clothing or using a sharir anchal. However, there were also a number of events where hands were not dried and a dirty towel was used. Interestingly, after animal related activities that primarily consisted of cleaning a cow or handling cow dung, hands tended to be dried on clothing, not dried or dried using a sharir anchal.

The use of clothing and a sharir anchal to dry hands is of interest, as these two materials appear to be used to dry hands for different hand washing exposures, particularly defecation related and other exposures However there is still a small proportion of food related events, particularly before preparing food where these materials were also used.

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Table 6.6: Hand drying behaviour by hand washing exposure

Hand washing exposure	Air dried	Not dried	Clean towel	Dirty towel	Clothing	Sharir Anchal	Total %	Total no. of events where hands were washed
Before preparing food	13.6	74.2	0.4	0.4	7.3	4.1	100.0	751
Before serving	9.5	81.3	0.4	0.7	3.8	4.4	100.0	1046
Before eating	0.1	96.7	0.4	0.1	1.3	1.4	100.0	793
After eating (self and child)	8.7	13.6	4.7	3.5	36.0	33.4	100.0	1143
Before feeding a child	3.4	79.9	2.2	1.0	7.0	6.7	100.0	417
After cleaning a child's anus/disposing of stools	8.2	11.6	6.4	7.9	40.9	25.0	100.0	328
After defecation	1.5	13.4	1.5	4.5	47.8	31.3	100.0	67
After returning from outside the compound	9.8	13.5	21.2	1.9	19.2	34.6	100.0	52
Animal related activities	4.2	29.2	4.2	8.3	33.3	20.8	100.0	24
Overall (%)	**7.6**	**58.9**	**2.3**	**1.9**	**15.8**	**13.5**	**100.0**	
Total	**349**	**2724**	**107**	**87**	**730**	**624**		**4621**

Author's own analysis of SHEWA-B Health Impact Study baseline data

6.3 Overall female hand washing behaviour by hand washing exposure

The results presented in the previous section were based on the total number of hand washing events for female caregivers. However, focusing on the data in this format poses particular issues. In particular, there is the issue that there are multiple events for the same exposure for the same female. In this format based on events, analysing the data to obtain an overall overview of hand washing behaviour for different hand washing exposures for female caregivers becomes problematic, as hand washing events are being assessed as opposed to the overall behaviour of the female caregiver. In order to overcome this, and as only one female caregiver was observed per household, the analysis presented in the following section was based on the initial data from events, consisting of 7583 events in total that have been aggregated by household identification number and hand washing exposure.

To create this, new binary variables were created for whether hands were washed, if both hands were washed and each of the individual hand washing locations (11 in total), hand washing materials (3), soap, ash/mud and water and the six hand drying methods most of which were previously categorical variables. This data was then aggregated by household identification number and hand washing exposure. The means that the newly created binary variables were obtained and the total number of events for each exposure calculated.

This resulted in a new dataset that provided the overall average score of hand washing by hand washing exposure for female caregivers. So, for example, if a female had three hand washing exposures for before preparing food and was observed to wash hands for only two of the exposure events, then she would have a score of 0.67. For those two events where she did wash her hands, if she washed both hands then she would have a score of one and if she used soap for hand washing on only one of those occasions she would have a score of 0.50. Similar scores were also obtained for where hands were washed, hand washing materials used, the location where hands were washed and hand drying behaviour.

The data in this format overcame the issue of focusing on events and provides a clearer assessment of the behaviour of a female caregiver over different hand washing exposures. The focus was therefore on the female caregiver rather than the event itself. With the structured observation data in the format explained and a resulting proportion between zero and one, a value of zero indicated for example, that hands were never washed for that exposure event.

A value of one indicated that hands were always washed. All other indicators followed the same pattern, for example, whether both hands were washed, a value of zero indicating that a female never washed both hands and one indicating that she always washed hands. In total, there were 993 households the same number of female caregivers were observed. This result differs slightly from the overall 1000 households that were observed as in the remaining households the female caregiver was not present.

Figure 6.1a: Flow chart illustrating structured observation survey questions

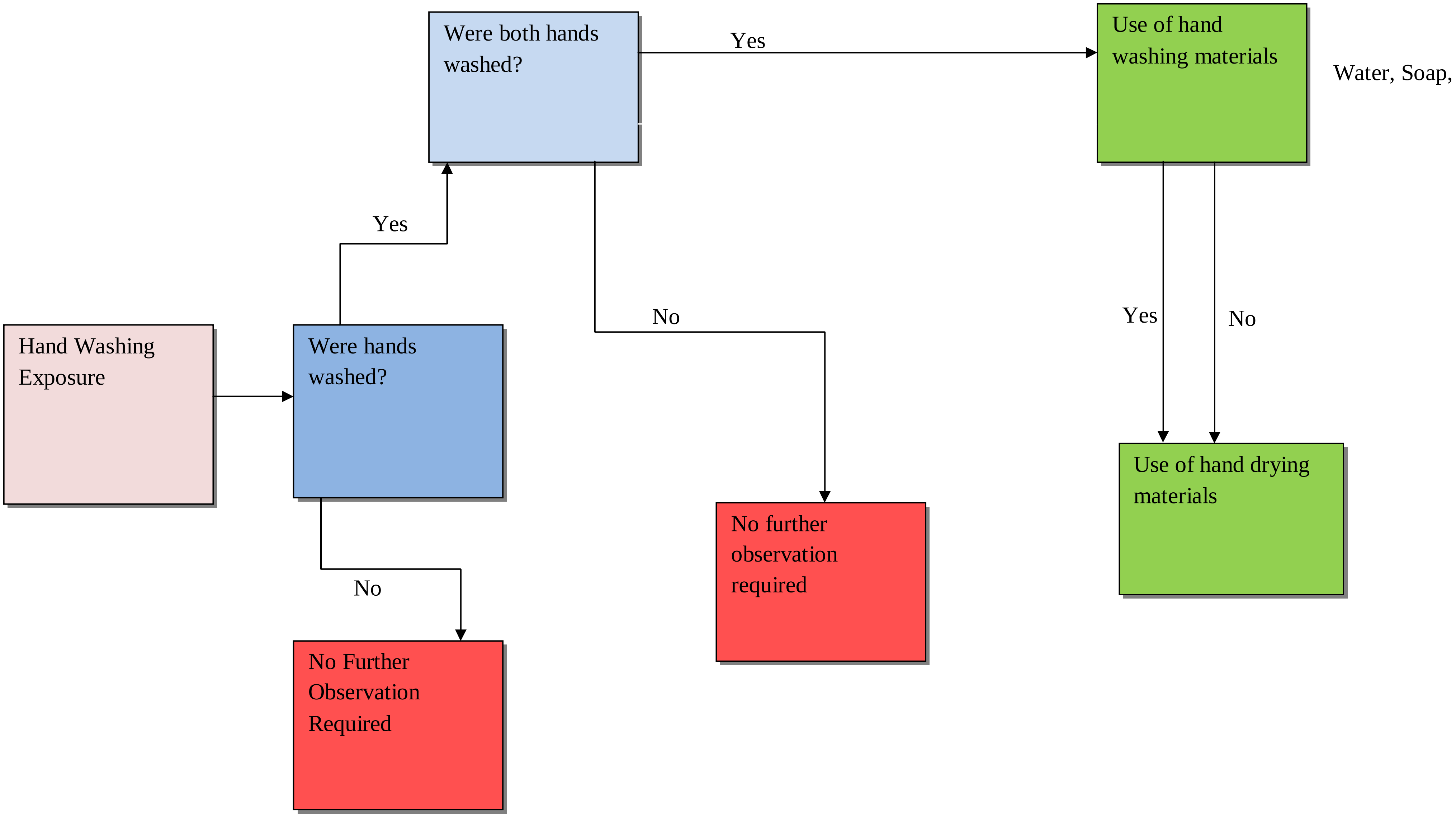


Figure 6.1b: Flow chart illustrating before preparing food for a single caregiver

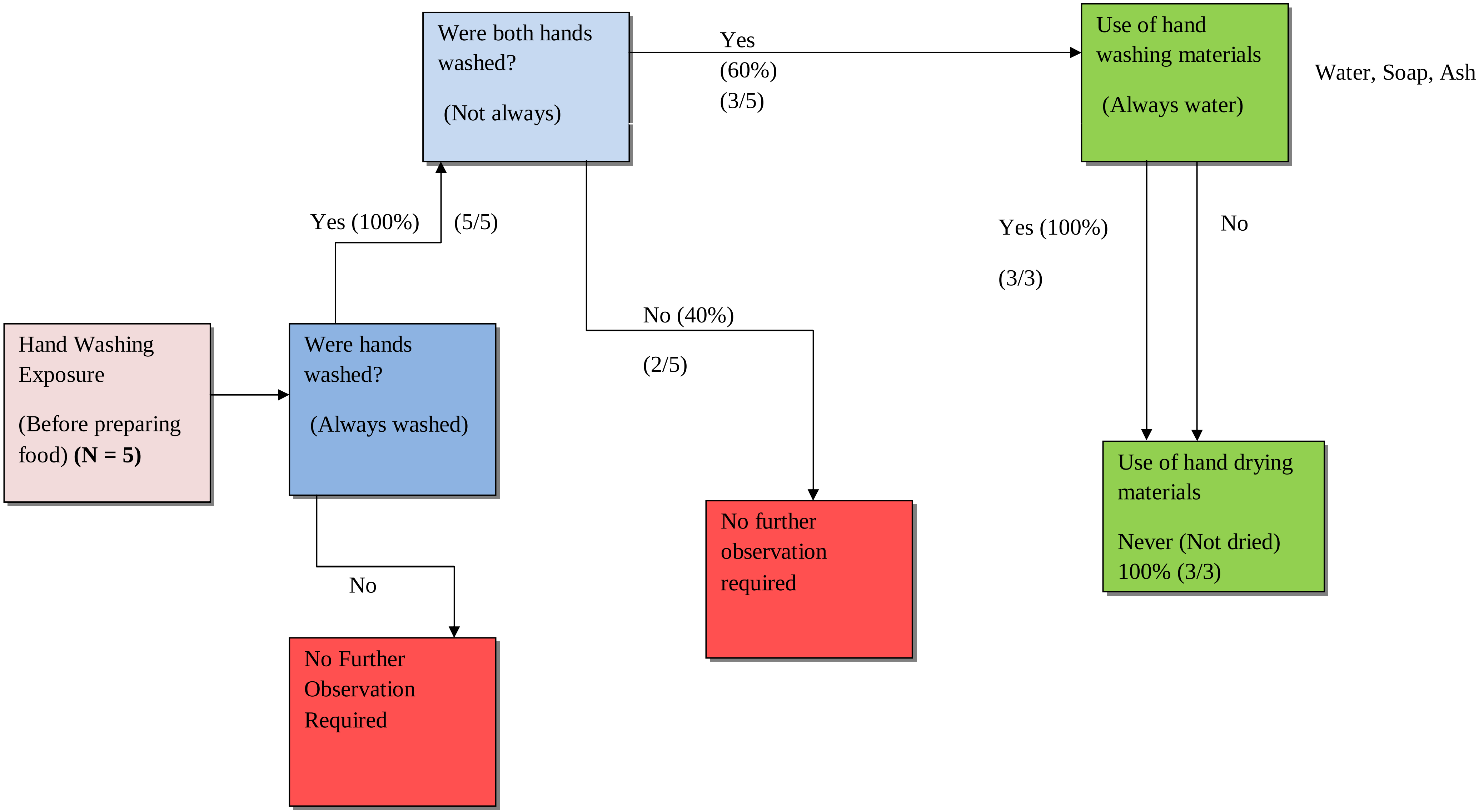


Figure 6.1a provides a flow diagram of the structure of the structured observation questions. A worked example of the hand washing process of a female caregiver is given in Figure 6.1b for a female who experienced five before preparing food events during structured observation. This example provides the basis for how event based hand washing data was used to later calculate overall female caregiver hand washing behaviour for the each of the five critical times. In Chapter 7 this is later explained in the context of how the data in this structure of overall behaviour was used and later coded to form the basis for the validation of different measurement methods compared to structured observation.

The example featured in Figure 6.1b illustrates that this female caregiver always washed hands for the five events experienced. Therefore, she had a value of 1 which meant that she washed hands 100% of the time, given throughout this research as always washing hands. This is displayed by the result 5/5 in the flow chart. However, when observed whether both hands were washed, this female caregiver washed both hands on only three of the five occasions observed. This meant that she washed both hands only 60% of the time. This is denoted by the figures 3/5 in the diagram. The arrow that denotes no to washing both hands represents that she was observed to not wash both hands 40% of the time. This was expressed in the dataset as a proportion, 0.4. This is further depicted by 2/5 in the diagram.

For the three occasions that she washed and washed both hands, this female always washed hands with water only. This is given by the figure of 100%, 3/3. This meant that the values for the use of soap and ash which are not expressed in this diagram were both 0%. Finally, this female never dried her hands. The result being that this practice is represented by a figure of 100%, 3/3 in the diagram. This meant that for all other hand drying methods results of 0% were obtained.

The results featured in Table 6.7 illustrate that the majority of females experienced food related hand washing exposure events with over 70% of female caregivers having at least one food exposure event. For defecation related events, in particular after defecation, the number of females experiencing an event was very low, with approximately 7% of female caregivers experiencing a defecation event. As discussed in the previous section on the event based data, this result is surprisingly low.

The observations were meant to start around 09.00 am for a period of five hours. The start and end time of the observation was recorded by each observer. This feature will be assessed in more detail later, however at this stage, it may be that the start time of the observation meant that particular activities had already taken place before the observer arrived, therefore the low number of women experiencing an event may be a reflection that the event was missed.

The low number of women with this event may also be due to other factors influencing the event. For example, if a household or female practise open defecation, such activities may be performed early in the morning or before a bathing event. Furthermore, as the female is primarily responsible for the child and other household responsibilities this might mean that she has to wake up early, therefore resulting in the defecation event taking place early. Alternatively if the toilet facility is shared with other households this might mean that there is a rota type system and to prevent overcrowding of the facility, certain households use the facility at a particular time.

This could ultimately result in events being missed if the observer arrives at 09.00 am or later. In addition, if formalities related to the study had to be conducted, for example, explaining the study and gaining consent from households members, events may also take place within this time that were not recorded as an event due to the observation starting later than the specified time.

A further reason could be the sensitivity of the defecation practice and the actual observation of a very private matter. Females being observed may feel uncomfortable being observed particularly as there was a gender mix of observers. In addition, multiple household members were being observed at the same time, this may result in events being missed as it may be difficult to observe a number of behaviours taking place at the same time.

Table 6.7: Overview of hand washing exposures

Hand washing exposure	% having a hand washing event	Total no. of females with event (0ne or more events)
Before preparing food	74.1	736
Before serving	79.2	786
Before eating	79.0	784
After eating (self and child)	81.2	806
Before feeding a child	65.5	650
After cleaning a child's anus/disposing of stools	30.7	305
After defecation	6.6	66
After returning from outside the compound	20.7	206
Animal related activities	2.2	22
Total no. of females		**993**

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results presented in Table 6.8 demonstrate that there were a substantial number of females that never washed hands particularly before preparing food, with over a third of female caregivers never washing hands. Similarly, approximately 50% of females never washed hands before feeding a child. For the other food related events, before serving food and before eating, a much lower proportion of females never washed hands, under 15%, however even these figures are sizeable.

The lowest number of females never washing hands was identified for the food exposure of after eating (self and child) with only 3% of female caregivers never washing hands for this exposure. This may be because hands are seen to be dirty. For defecation related exposures, the results were comparably lower, particular after defecation and after cleaning a child’s anus/disposing of a child’s stools, approximately 10% of female caregivers never washed hands. Overall, hand washing after returning from outside the compound appeared to be low priority with over 70% of females never washing their hands after this exposure. For animal related activities hands were always washed.

The results presented in this table also show the regularity of overall hand washing behaviour by hand washing exposure. Females that sometimes washed hands were categorised as washing hands less than 50% of the time, females that regularly washed hands were featured as those that washed hands greater than 50% of the time and lastly those that always washed hands 100% of the time. Focusing on food related exposures and defecation events, for the former there appeared to be variation in the degree to which hands were washed for certain exposures.

For certain food related exposures, a higher percentage of women always washed hands particularly before serving food, before eating and after eating. For the other food exposures, a far lower percentage of women always washed both hands, with less than a quarter before feeding a child and less than 40% before preparing food, which are again amongst the most critical times at which hands should be washed. For other critical times including defecation related activities, over 80% of female caregivers always washed hands. The last column shows the overall number of females washing hands for a specific exposure.

Table 6.8: Level of hand washing behaviour by hand washing exposure

Hand washing exposure	% that never washed hands (Not observed)*	% that washed between 0.1-0.49	% that washed between 0.50-0.99	% that always washed hands	Total no. of females with an event	No. of females washing hands
Before preparing food	34.9	6.1	19.8	39.1	736	**479**
Before serving	13.1	3.2	15.0	68.7	786	**683**
Before eating	13.6	6.6	18.0	61.7	784	**677**
After eating (self and child)	3.0	0.5	7.7	88.8	806	**782**
Before feeding a child	49.2	14.8	13.5	22.5	650	**330**
After cleaning a child’s anus/disposing of stools	9.5	0.0	1.0	89.5	305	**276**
After defecation	3.0	0.0	0.0	97.0	66	**64**
After returning from outside the compound	76.2	1.5	6.3	16.0	206	**49**
Animal related activities	0.0	0.0	0.0	100.0	22	**22**

Author’s own analysis of SHEWA-B Health Impact Study baseline data
*Not observed refers to those that had an event but did not wash hands

The results presented in Table 6.9 are categorised into three major groups and show the regularity of hand washing by whether the respondent was observed to wash both hands for different hand washing exposures. The first group featured are female caregivers that were observed to wash hands occasionally between 0.1 and 0.99% of the time and those that were observed to always wash hands 100% of the time and then the overall results. The results of these groups were then further distinguished by whether the caregiver always washed one hand, occasionally washed both hands between 0.1 and 0.99 or always washed both hands. The number refers to the number of caregivers in the given category.

The results for occasional hand washers illustrate that caregivers in this category tended to always wash one hand. This was particularly apparent for food related exposures. However, before preparing food, approximately 40% of female caregivers always washed both hands. For other non-food events the number of women was very small. The results for female caregivers that always washed hands illustrated that amongst this group, a high percentage of female caregivers always washed one hand particularly for food related exposures, with the exception of before preparing food events where behaviour tended to vary.

For defecation events, a greater number of female caregivers always washed hands compared with those that occasionally washed hands. For those that always washed hands for these exposures, slightly more tended to always wash both hands, however this was based on a small sample size. The results for other exposures including after returning from outside the compound and animal related activities females caregivers tended to always wash both hands.

Table 6.9: Regularity of hand washing by observation of whether both hands were washed for different hand washing exposures

	Occasional hand washing (0.10-0.99)				Always washed hands				Overall			
Hand washing exposure	**% Always washed one hand**	**% Occasionally washed both hands (0.10-0.99)**	**% that always washed both hands**	**N**	**% Always washed one hand**	**% Occasionally washed both hands (0.10-0.99)**	**% that always washed both hands**	**N**	**% Always washed one hand**	**% Occasionally washed both hands (010-0.99)**	**% that always washed both hands**	**N**
Before preparing food	44.0	16.8	39.3	**191**	39.2	18.8	42.0	**288**	41.1	18.0	40.9	**479**
Before serving	60.1	15.4	24.5	**143**	68.0	11.7	20.4	**540**	66.3	12.4	21.2	**683**
Before eating	85.5	4.1	10.4	**193**	88.4	3.5	8.1	**484**	87.6	3.7	8.7	**677**
After eating (self and child)	81.8	7.6	10.6	**66**	81.6	6.0	12.4	**716**	81.6	6.1	12.3	**782**
Before feeding a child	73.4	5.4	21.2	**184**	83.6	7.5	8.9	**146**	77.9	6.4	15.8	**330**
After cleaning a child’s anus	66.7	0.0	33.3	**3**	44.3	7.3	48.4	**273**	44.6	7.2	48.2	**276**
After defecation	0.0	0.0	0.0	**0**	42.2	3.1	54.7	**64**	42.2	3.1	54.7	**64**
After returning from outside the compound	0.0	12.5	87.5	**16**	3.0	0.0	97.0	**33**	2.0	4.1	93.9	**49**
Animal related activities	0.0	0.0	0.0	**0**	0.0	0.0	100.0	**22**	0.0	0.0	100.0	**22**

Author’s own analysis of SHEWA-B Health Impact Study baseline data

N/B No. refers to the number of women

6.3.1 Use of hand washing materials

The results presented in Table 6.10 display the results for the use of soap by hand washing exposure. The results of these questions were conditional on hands being washed and regardless of whether both or one hand was washed. Overall, the use of soap was very low, with approximately 4% of hand washing events involving the use of soap. Female caregivers that used soap more than two thirds of the time or always were defined as regular soap users, as from a public health perspective, the use of soap for hand washing is crucial for washing hands.

The use of soap for food related events was very low ranging between 1% and 3% of women using soap two thirds of the time or always to wash hands for these exposures. For defecation related events, a higher percentage of women were regular soap users, with over 25% of female caregivers using soap regularly to wash hands after cleaning a child's anus or disposing of a child's stools and approximately 38% after defecation. The results for after defecation are based on the majority of females experiencing one event. Therefore the results seen in Table 6.10 are similar to the ones featured for after defecation in Table 6.4.

Table 6.10: Use of soap or ash/mud for hand washing

Hand washing exposure	% that used soap between 66% of the time to 100% of the time	% that used ash/mud between 66% of the time to 100% of the time	Total no. of females washing hands for this event (One or more events)
Before preparing food	1.3	0.2	479
Before serving	0.9	0.0	683
Before eating	0.1	0.0	677
After eating (self and child)	0.3	0.0	782
Before feeding a child	3.0	0.0	330
After cleaning a child's anus/disposing of stools	28.6	9.4	276
After defecation	37.5	14.1	64
After returning from outside the compound	22.4	2.0	49
Animal related activities	9.1	0.0	22
Total no. of females	**141**	**37**	

Author's own analysis of SHEWA-B Health Impact Study baseline data

In total, 141 female caregivers used soap regularly for hand washing and this was mainly for defecation activities. Only 37 female caregivers used ash regularly for hand washing and the major use of this hand washing agent was for defecation activities and after returning from outside the compound.

The results featured in Table 6.11 demonstrate that for food related exposures a higher percentage of women used just water to wash hands always, with over 90% of women always using water only for those hand washing exposures. However, for defecation related exposures, a lower percentage of women just used water only for hand washing, with a higher percentage using soap or ash.

Table 6.11: Use of just water to wash hands for critical hand washing exposures

Hand washing exposure	Used another material to wash hands	Just used water 33% of the time	Just used water 50% of the time	Just used water 66% of the time	Just used water to wash hands always	Total no. females with a hand washing event
Before preparing food	1.5	0.0	0.4	0.0	98.1	479
Before eating	0.1	0.0	0.7	0.0	99.1	677
Before feeding a child	3.0	0.0	1.5	0.3	95.2	330
After cleaning a child's anus/disposing of stools	38.0	0.7	4.7	0.4	56.2	276
After defecation	51.6	0.0	0.0	0.0	48.4	64

Author's own analysis of SHEWA-B Health Impact Study baseline data

6.3.2 Major hand washing locations

The four main hand washing locations observed during structured observation were in the kitchen, on a plate/in a pot, at a nearby tube-well and in the yard. The tables below (6.12-6.15) are based on the four main hand washing locations by critical hand washing exposures. Overall, the results for the two hand washing locations of in the kitchen and on a plate/in a pot illustrate that for the three critical food related exposures featured as before preparing food, before eating and after feeding a child, a higher percentage of women used these locations often or always compared with defecation related activities where nearly all women used another location to wash hands.

A comparison of hand washing in the kitchen compared with on a plate/in a pot demonstrated that a higher percentage of women always washed their hands on a plate/in a pot compared with always washing hands in the kitchen, particularly before eating, or feeding a child.

Table 6.12: In the kitchen

Hand washing exposure	Used another location	Used this location sometimes (0.10-0.49)	Used this location often (0.50-0.99)	Always used this location	Total (%)	Total no. of females that used this location
Before preparing food	73.3	0.6	8.4	17.7	100.0	479
Before eating	96.0	0.1	0.1	3.7	100.0	677
Before feeding a child	93.9	0.3	2.1	3.6	100.0	330
After cleaning a child’s anus/disposing of stools	99.6	0.0	0.0	0.4	100.0	276
After defecation	100.0	0.0	0.0	0.0	100.0	64

Author’s own analysis of SHEWA-B Health Impact Study baseline data

Table 6.13: On a plate/besides a plate/pot

Hand washing exposure	Used another location	Used this location sometimes (0.10-0.49)	Used this location often (0.50-0.99)	Always used this location	Total (%)	Total no. of females that used this location
Before preparing food	42.6	3.1	12.5	41.8	100.0	479
Before eating	11.7	0.3	3.4	84.6	100.0	677
Before feeding a child	25.8	1.8	7.6	64.8	100.0	330
After cleaning a child's anus/disposing of stools	100.0	0.0	0.0	0.0	100.0	276
After defecation	100.0	0.0	0.0	0.0	100.0	64

Author's own analysis of SHEWA-B Health Impact Study baseline data

The hand washing location of a nearby tube-well tended to be always used for defecation related activities, although there were 10% of female caregivers before preparing food and before feeding a child that always used this location to wash hands. For the hand washing location of in the yard, over 35% of female caregivers always used this location for washing hands after cleaning a child's anus or disposing of a child's stools, but this location was used less frequently after defecation or for food related exposures where the majority of female caregivers tended to use another location.

Table 6.14: At a nearby tube-well

Hand washing exposure	Used another location	Used this location sometimes (0.10-0.49)	Used this location often (0.50-0.99)	Always used this location	Total (%)	Total no. of females that used this location
Before preparing food	73.7	2.3	9.6	14.4	100.0	479
Before eating	93.1	0.7	2.2	4.0	100.0	677
Before feeding a child	82.7	0.9	4.5	11.8	100.0	330
After cleaning a child's anus/disposing of stools	53.3	0.4	5.4	40.9	100.0	276
After defecation	42.2	0.0	0.0	57.8	100.0	64

Author's own analysis of SHEWA-B Health Impact Study baseline data

Table 6.15: In the yard

Hand washing exposure	Used another location	Used this location sometimes (0.10-0.49)	Used this location often (0.50-0.99)	Always used this location	Total (%)	Total no. of females that used this location
Before preparing food	96.5	0.2	2.3	1.0	100.0	479
Before eating	97.3	0.1	0.1	2.4	100.0	677
Before feeding a child	91.8	1.2	1.8	5.2	100.0	330
After cleaning a child's anus/disposing of stools	58.0	0.7	3.6	37.7	100.0	276
After defecation	95.3	0.0	0.0	4.7	100.0	64

Author's own analysis of SHEWA-B Health Impact Study baseline data

6.3.3 Hand drying behaviour

The results for hand drying behaviour are based on the main drying methods identified. In the previous section focusing on events, the results from Table 6.6 showed that hands were mostly not dried, while the use of clothing and a sharir anchal were also used. This analysis will focus on these methods and the critical hand washing exposures.

For female caregivers that did not dry hands, the majority tended to not dry hands for food related exposures in contrast to defecation events. For female caregivers that dried on clothing, a higher percentage of caregivers always dried hands on clothing for defecation events. Similar results were also identified for the use of a sharir anchal to dry hands.

Table 6.16: Hand drying behaviour

Hand washing exposure	Not dried					Clothing					Sharir Anchal				
	Used another method	Sometimes used this material	Used this material often	Always	Total %	Used another method	Sometimes used this material	Used this material often	Always	Total %	Used another method	Sometimes used this material	Used this material often	Always	Total %
Before preparing food	22.1	1.0	7.9	68.9	**100.0**	90.2	1.9	2.1	5.8	**100.0**	93.7	1.0	2.3	2.9	**100.0**
Before eating	1.9	0.0	1.9	96.2	**100.0**	98.5	0.3	0.3	0.9	**100.0**	98.4	0.0	1.0	0.6	**100.0**
Before feeding a child	16.1	0.3	6.4	77.3	**100.0**	91.8	0.9	2.7	4.5	**100.0**	92.1	0.6	2.1	5.2	**100.0**
After cleaning a child's anus	86.6	0.4	3.6	9.4	**100.0**	58.0	0.0	4.7	37.3	**100.0**	72.8	0.0	1.4	25.7	**100.0**
After defecation	85.9	0.0	1.6	12.5	**100.0**	51.6	0.0	1.6	46.9	**100.0**	68.8	0.0	0.0	31.2	**100.0**

Author's own analysis of SHEWA-B Health Impact Study baseline data

6.4 Cross sectional survey results

The cross sectional survey was conducted in a total of 1692 households and the survey was asked to mainly the female caregiver. In the initial study design, 1700 households were due to be included in the study, a total of 1692 were enrolled, 848 in the intervention area and 848 in the control area. The eight missing households were due to household members being absent even after repeated visits to the household. This female caregiver was the person who was primarily responsible for caring for the youngest child and this tended to be the mother of the youngest child. For this analysis, 995 households/ female caregivers were included who were also included in the structured observation component, so direct comparisons could be made.

The results presented in this section focused on the results obtained through self reported hand washing behaviour measures, recall questions on hand washing, spot check observations of hand washing locations and the availability of hand washing materials at the hand washing location, and lastly the results of a hand washing demonstration.

6.4.1 Self reported hand washing behaviours

The results featured in Table 6.17 were based on a response to an open-ended question that asked ***"When do you wash your hands with soap?"*** Respondents were asked without prompting or reading out responses when they washed hands with soap. Overall, the use of soap was very low, particularly for food related exposures.

The use of soap after cleaning a child's anus was moderate, with 37% of females reporting that they used soap. However, soap use after disposing of a child's stools was very low with less than 5% of caregivers reporting that they used soap for this. The use of ash was very low; with the highest self-reported use of ash after defecation. However, even this result was low, with less than 40% of mothers reporting that they used ash for washing hands.

Table 6.17: Hand washing with soap for different hand washing exposures

Hand washing exposure	% of females reporting washing hands with soap	% of females reporting washing hands with ash
Before preparing food	8.3	0.2
Before serving	-	-
Before eating	17.3	0.2
After eating (self and child)	12.0	0.1
Before feeding a child	4.9	0.0
After cleaning a child's anus	37.3	4.7
After disposing of a child's stools	4.8	0.2
After defecation	85.2	37.8
After returning from outside the compound	3.3	0.2
After cleaning/handling cow dung	25.4	-
Total no of households	**995**	**995**

Author's own analysis of SHEWA-B Health Impact Study baseline data

Overall, a general comparison of these results with the results obtained from the same households through structured observation demonstrated that self reported hand washing with soap tended to be over-reported compared with observation of the behaviour. Regular users of soap in the observation were defined as those that used soap between two thirds of the time and always. For example, female caregivers that were observed to be regular users of soap in the observation used soap on a regular basis less than 1% before preparing food and before eating and 3% before feeding a child. This was compared with approximately 8%, 17% and 5% for the same exposures identified through the self reported results for the same exposure featured in Table 6.17. The only result that seemed comparably similar was before feeding a child with both results at less than 5%, but the other exposure results were also subject to over-reporting.

For defecation related exposures, the general differences between self reported results and observed results were differentiated by different categorisations of after cleaning a child's anus and disposing of a child's stools. However, there appeared to be slight over-reporting of hand washing with soap from the self-reported results of 37% compared with what was observed during structured observation where 29% of female caregivers were regular users of soap. After defecation, approximately 85% of caregivers reported that they washed hands with soap.

The results obtained from structured observation identified that approximately 38% of female caregivers were observed to regularly use soap. It must be noted that the observations for after defecation were based on a small sample of women whereas for self report, the total number of women who reported that they washed hands after defecation was larger. The next chapter will assess and compare in further depth the results obtained from the different measurement tools.

6.4.2 Event specific hand washing recall questions

In the cross-sectional survey, there were also questions on event specific hand washing behaviour for different food and defecation related hand washing events. These questions were based on recall of whether an event occurred and subsequently whether hands were washed, if both hands were washed and the hand washing materials used. The questions were asked to all caregivers.

Table 6.18: Event specific food preparation questions

Timing of event	Last food preparation	Last ate with hands	Last fed child with hands
Today	73.3	90.6	54.9
Yesterday	21.2	9.3	22.2
Two or more days ago	2.8	0.1	6.6
Never	2.7	-	16.3
Total	**100.0**	**100.0**	**100.0**

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results for these questions are featured in Tables 6.18, 6.19, 6.20 and 6.21 and focus on the critical hand washing times. The results presented in Table 6.18 display the results to a question on the timing of the critical hand washing event. A comparison of the reports of an event taking place on the day of the survey compared with structured observation identified that a similar total of caregivers reported and were observed to have a before preparing food event, last ate with hands and last fed a child exposure event. For example, a total of 729 women (73.3%) reported that they last prepared food on the day of the survey compared with 736 female caregivers (74.1%) that were observed to have a food preparation event during structured observation. This takes into account that the comparison between structured observation and the cross sectional survey was based on households that were included in the structured observation component of the study.

Similarly, 901 (90.6%) caregivers reported in the survey that they last ate with hands compared with 784 (79%) observed females having this event during structured observation. However, the observation was based on hand washing before eating and not whether the caregiver actually ate directly with hands during the event. The number of caregivers that last fed a child with hands on the day of the survey was lower, 549 caregivers (54.9%) compared with 650 (65.5%) observed during structured observation.

Table 6.19: Hand washing behaviour for food related event specific questions

Hand washing behaviour and materials	Last food preparation	Last ate with hands	Last fed child with hands
Washed hands	91.1	99.6	98.9
Washed both hands	79.2	43.8	31.0
Used soap	26.3	14.7	15.1
Used ash	1.4	0.6	0.5
Total number of females	**968**	**995**	**833**

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results displayed in Table 6.19 indicate that a high percentage of mothers reported that they washed their hands for food related activities. However, when questioned as to whether both hands were washed, this was only reported to be high for hand washing before food preparation. The majority of females that last ate with hands did not wash both hands with less than 50% of caregivers doing so. The use of hand washing agents, for example, soap or ash was very low. Reported soap use for hand washing for the last food preparation event was low, approximately 30% and 15% for the other food related hand washing activities.

Comparing the results obtained in Table 6.19 with the observed use of these materials demonstrates that the use of soap in particular was over-reported for these exposures. The use of ash was low, with approximately less than 1% of mothers reporting that they used ash to wash hands for food related hand washing activities. The results of ash use were similar to the ones obtained from structured observation where the use of ash for washing hands for food related activities was very low.

The majority of defecation events reported took place either on the day of the interview or the previous day (Table 6.20). A further question was then asked to all respondents that had a valid response whether hands were washed, if both hands were washed and if soap or ash was used.

Table 6.20: Event specific questions for defecation events

Timing of event	Last cleaned a child's bottom	Last defecated
Today	58.5	57.1
Yesterday	25.1	39.8
Two or more days ago	6.9	3.1
Never	9.4	0.0
Total (%)	**100.0**	**100.0**

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results displayed in Table 6.21 indicate that nearly all women reported that they washed their hands for defecation related events. When asked if both hands were washed and if soap was used, approximately two-thirds of women reported that they washed both hands or used soap. The use of ash was low but higher than the reports obtained for food related exposures. In addition, comparison of reports for the use of soap for food related exposures with defecation related exposures illustrated that soap was used more for hand washing for defecation related events.

Table 6.21: Hand washing behaviour for defecation related event specific questions

Hand washing behaviour and materials	Last cleaned a child's bottom	Last defecated
Washed hands	99.6	99.6
Washed both hands	65.6	65.0
Used soap	63.2	66.1
Used ash	9.9	15.4
Total number of females	**901**	**995**

Author's own analysis of SHEWA-B Health Impact Study baseline data

To take this assessment further, a comparison of the results reported from these questions to those obtained through structured observation was undertaken. The result of this was that the use of soap in particular was over-reported by approximately half compared with actual use during observation. The observations were based on women that were regular users of soap.

A comparison of the number of caregivers reporting a defecation event compared with the actual number observed during structured observation revealed stark differences.

Comparing the result based on the day of the survey, 582 caregivers (58.5%) reported that they had last cleaned a child's bottom on the day of the survey compared with 305 (30.7%) female caregivers that were observed to have an event during structured observation. The starkest contrast was identified for the exposure event of after defecation where 568 caregivers (57.1%) reported that they defecated on the day of the survey. However, during structured observation, only 66 female caregivers (6.6%) were observed to have an event.

This indicates that the structured observations were potentially missing defecation events as discussed earlier. The results discussed here only pertain to female caregivers. The cross sectional data also illustrates that the number of caregivers who reported a defecation event was far greater than the total number of events observed for all household members during the five hour structured observation, which in total was 354 events.

6.4.3 Soap use

The cross sectional survey featured a question on whether soap was used in the past 24 hours. The question was featured as ***"Have you used soap today or yesterday?"*** Again, this question was posed to respondents without prompting or reading out the responses.

The results from this question indicated that approximately 98% of respondents used soap in the past 24 hours. A further question was then asked to all respondents about the specific activities for which soap was used in the past 24 hours. The results of this question are displayed in Table 6.22. The main activities for which soap was used included washing the body, after defecation, other activities and washing clothes.

The use of soap for the other critical times at which hands should be washed was a very low priority, for example, washing hands before feeding a child, before preparing food and before eating, all had reported soap use of less than 10%. Also, the question featured on washing a child's hands and the specific purpose of hand washing also resulted in low reported soap use at approximately 1%.

Table 6.22: Reported soap use activity

Soap use activity	% of females using soap
Washing clothes	55.0
Washing body	82.1
Washing children	39.7
Washing my children's hands	1.1
Washing a child's anus	43.1
Washing hands after defecation	62.1
Washing hands after handling cow dung	16.4
Washing hands before feeding a child	3.5
Washing hands before preparing food	7.6
Washing hands before eating	8.2
Washing hands after eating	7.3
Other (Specify)	63.9
Total number of females	**995**

Author's own analysis of SHEWA-B Health Impact Study baseline data

Comparison of these results with the results obtained through structured observation illustrated that the use of soap was over-reported compared with actual practice observed during structured observation, but the over-reporting was not as high as the results identified from previous self report questions discussed. The result obtained for the use of soap for hand washing with soap before feeding a child featured in Table 6.22 was similar to the result identified through structured observation (Table 6.10) but slightly lower than the result obtained in Table 6.17. The result of which was 4.9%.

Knowledge and importance of hand washing

An open-ended question was asked to respondents on when they regard it as important to wash hands. The question featured was asked as follows: ***"When do you think it is important to wash hands?"*** A number of pre-assigned answers were given which are featured in Table 6.23. Respondents reported that hand washing was important before eating and after defecation, over 80% of respondents identified that these were important occasions to wash hands. However, other important times at which hands should be washed, for example, before preparing food or cooking and after cleaning/changing a baby received a moderate response, with less than 50% of females citing these occasions as important times to wash hands.

It appears that caregivers have the knowledge regarding the importance of hand washing, particularly before eating and after defecation, but this is not reflected in observed hand washing practice. The wording of this question did not clearly state the use of soap for hand washing. Therefore, the high reported results could be a reflection of a respondent's practice of washing hands with only water that tended to be the case through the results based on structured observation.

Table 6.23: Hand washing knowledge

Hand washing activity	% of females reporting washing hands
Before preparing food or cooking	44.5
Before eating	86.0
After eating	64.2
After cleaning/changing a baby	48.3
After defecation	86.2
Others	80.6
Don't know	1.3
Total number of females	**995**

Author's own analysis of SHEWA-B Health Impact Study baseline data

6.4.4 Spot check observational methods

In the cross sectional survey, spot-check methods were used. In total, all female caregivers responded to the spot-check assessment. The interviewer asked and observed to see the place usually used for hand washing after the respondent used the toilet. The interviewer asked and observed whether water, soap, ash or another cleansing agent was available at the designated hand washing place.

Table 6.24: Hand washing locations usually used after defecation and before cooking, eating and feeding a child

Hand washing location	After using the toilet (%)	Before cooking, eating and feeding a child (%)
Inside or near the toilet facility	36.3	3.7
Inside/near the kitchen/cooking facility	8.6	49.5
Elsewhere in the yard (within 3 steps)	6.8	5.2
Elsewhere in the yard (> 3 steps < or equal to 10 steps)	18.6	13.8
Outside the yard (> 10 feet from the latrine)	25.1	11.0
No specific place	4.5	16.8
Total (%)	**100.0**	**100.0**

Author's own analysis of SHEWA-B Health Impact Study baseline data

The major hand washing locations reported and observed after using the toilet were inside or near the toilet facility, followed by outside the yard and greater than 10 feet from the latrine. For food related hand washing activities, the major hand washing locations were inside/near the kitchen/cooking facility, with approximately 50% of respondents reporting and were observed to have this hand washing location. The other major locations were elsewhere in the yard (greater than 3 steps or less than or equal to 10 steps) and outside the yard (greater than 10 feet from the latrine). A substantial number of women (17%) were observed and reported to not have a specific place for hand washing for food related events.

A further question was asked following the question on the hand washing location before cooking, eating or feeding a child. This question focused on whether this hand washing location differed to the one used by respondents when they came back from the toilet. The result of this question was that approximately 69% of respondents reported that the place was different to the hand washing location used when coming back from the toilet.

Further observations were made on the availability of hand washing materials for those that had a specific place for hand washing after using the toilet and food related activities. The results of these questions are featured in Table 6.25.

Table 6.25: Availability of hand washing materials at the hand washing location

Hand washing materials	After using the toilet (%)	Before cooking, eating and feeding a child (%)
Water	76.6	-
Soap	55.1	53.9
Detergent	2.1	2.3
Ash	17.4	6.1
Mud/sand	2.2	0.3
Others	0.2	-
Total number of females	**950**	**688**

Author's own analysis of SHEWA-B Health Impact Study baseline data

The questions and observations asked to respondents on the availability of hand washing materials for food related events were only posed to respondents that had a different hand washing location to the one used for hand washing after coming back from the toilet. This constituted 69.1% (688) of females. Observations were also made about available hand washing materials for those that had no specific hand washing place. However, this was not the case for the question and observation on the hand washing place used after defecation, where 45 women were identified to have no specific place for hand washing. There was also no observation made as to whether water was available in the hand washing location used for food related activities.

Overall, 53.9% (371) of women reported and were observed to have soap available at the hand washing location used for food related events and 55.1% at the hand washing location used after using the toilet. The major hand washing locations for the hand washing location used after using the toilet where soap was observed to be available were inside or near the toilet facility, outside the yard and elsewhere in the yard.

The Pearson Chi squared test was used to test the association between the hand washing location used after coming back from the toilet and the availability of soap. This was for those that had a specific place to wash hands. This result was highly significant (x^2 = 22.4, d.f. = 4, p = 0.000). A small number of females (n=20) were observed and reported to use detergent. Overall, 17.4% of respondents (165) had ash available.

The major hand washing locations where this tended to be available included outside the yard, inside or near the toilet facility and elsewhere in the yard (greater than 3 steps or less than or equal to 10 steps). The association between the hand washing location used after using the toilet and the availability of ash was significant (x^2 = 11.9, d.f. = 4, p=0.018). The hand washing locations whereby soap tended to be observed for the hand washing locations used for food related events were inside/near the kitchen or cooking facility and elsewhere in the yard.

Interestingly, women that had no specific place had the second highest observed and reported availability of soap. The association between the hand washing location used for food related events and the availability of soap was highly significant (x^2 = 24.2, d.f. = 5, p=0.000). This was based on those that had any of the hand washing locations specified and the place was different to the one used for hand washing after coming back from the toilet. The availability of detergent and ash was very low with only 16 and 42 women respectively reporting and were observed to have this hand washing material available.

Table 6.26: Availability of hand washing materials by hand washing location

Hand washing location	Soap available (%) Hand washing location after using the toilet	Soap available (%) Hand washing location for food related events	Ash available (%) Hand washing location after using the toilet
Inside or near the toilet facility	35.2	1.6	26.7
Inside/near the kitchen/cooking facility	12.6	64.4	10.9
Elsewhere in the yard (within 3 steps)	8.0	3.8	6.7
Elsewhere in the yard (> 3 steps < or equal to 10 steps)	20.1	8.9	23.9
Outside the yard (> 10 feet from the latrine)	24.1	3.2	32.1
No specific place	-	18.1	-
Total (%)	**100.0**	**100.0**	**100.0**

Author's own analysis of SHEWA-B Health Impact Study baseline data

Although at this stage the results have not been directly compared, it is interesting to note that the availability of soap particularly for the spot check assessment of the hand washing place mostly used for food related exposures, identified that approximately 65% of women reported and were observed to have soap available at this location. Furthermore, for some females in households that had no specific place to wash hands, soap was available.

Therefore, these results demonstrate that soap was available at the hand washing facility. However, assessment of the results obtained from observation indicated that the use of soap for hand washing was a low priority, particularly for food related hand washing exposures, where less than 1% of events involved the use of soap. This indicates that there was a clear discrepancy between the practice of hand washing with soap and the availability of soap at the hand washing location. The following chapter assesses in greater depth the results obtained.

6.4.5 Hand washing demonstrations

The last component of the cross sectional survey featured a hand washing demonstration. In total, 513 (51.6%) female caregivers participated in the demonstration, while 146 children (14.7) (eldest child aged 3-5 years) also participated. In 279 cases (28%) the children could not wash hands or the mother refused and in 57 cases the mother and child were both absent. Focusing on the results for the 513 female caregivers that participated in the demonstration, approximately 14% were observed to wash hands with just water, 71% were observed to use soap, approximately 10% used ash and 8% used mud.

During the demonstration, approximately 68% of women (n = 348) were identified to wash both hands. The duration of time that hands were rubbed with soap was observed and recorded during the demonstration. The duration of rubbing hands with soap ranged from 2 to 59 seconds. For hand drying, the vast majority of female caregivers, 84% dried their hands using their sharir anchal or kamiz, 7% used a dirty cloth, 3% used a clean towel and 6% air dried.

A general comparison of the demonstration results with those obtained during structured observation demonstrated that a higher percentage of women washed hands with other materials, particularly soap. Overall, soap was used in approximately 4% of structured observation events and for the results based on female caregivers in section 6.3, only 141 female caregivers regularly used soap and only 37 regularly used ash for hand washing for all exposures. For hand drying, during structured observation hands tended to not be dried, dried on clothing or using a sharir anchal compared with the majority of female caregivers in the hand washing demonstration drying their hands on their sharir anchal.

The next chapter focuses on validating the different hand washing measurement methods. The purpose of which is to examine whether there are any other indicators that are suitable alternatives to structured observation that could potentially be used on a large scale, for example, in DHS surveys. The validation of measurement methods focuses on the five critical times that are important for diarrhoea prevention and ensuring child survival.

6.4.6 Summary

This chapter provided an introduction and overview of the structured observation and cross sectional survey components of the SHEWA-B Health Impact Study. The focus was on the hand washing measures, firstly all hand washing exposures observed and then specifically on the five critical times. Firstly an illustration was given of the structured observation data in the form of events based on different hand washing exposures. This was then followed by focusing on the results in the form of overall hand washing behaviour for different hand washing exposures for female caregivers, a caregiver level analysis.

Overall, the results from structured observation for female caregivers demonstrated that hand washing with soap was a low priority amongst those females observed. Food related hand washing practice tended to be with water only and involved washing only one hand. However, for defecation related hand washing practice, the use of soap was higher and both hands tended to be washed. There was limited use of ash for hand washing for food related critical times and the use of this material was higher for defecation related critical times. The analysis of the hand washing location identified that the location where hands were washed for food and defecation related hand washing was different.

The analysis of results from the cross sectional survey component identified that the practice of hand washing with soap was over reported compared with actual observed practice identified through structured observation. Interestingly, a higher number of defecation events were reported for the two defecation related critical times. This was particularly apparent for after defecation where the number of observed events was substantially lower than the number of reported events that took place on the day of the survey. The level of knowledge regarding the importance of hand washing was very high, particularly for before eating and after defecation (over 80%), but moderate for before preparing food or cooking and after cleaning/changing a baby, where less than 50% of female caregivers reported that it was important to wash hands on these occasions. This was contrary to what was observed during structured observation. In line with the findings from the analysis of the hand washing location in structured observation, the results from a spot check observation also identified that the place for hand washing for food and defecation related purposes differed.

However, the spot check observation of the availability of soap identified a high presence of soap at the designated hand washing locations used after coming back from the toilet and for food related purposes. This was contrary to the low observed use of soap for hand washing for food related purposes. This indicated that soap was available for hand washing but was not routinely used. The results from the hand washing demonstration also observed a high use of soap, with over 70% of female caregivers using soap for hand washing and less than 20% using only water for hand washing. This is again contrary to what was observed during structured observation, where the use of soap for hand washing for food related purposes was minimal, over 95% of female caregivers washed hands with only water. For defecation related hand washing, soap use was moderate, but much less so than what was observed during the hand washing demonstration. Approximately two thirds of female caregivers washed both hands during the hand washing demonstration. This was far higher than what was observed during structured observation, particularly for food related hand washing where the tendency was to wash only one hand.

7 Validation of hand washing behaviour measures

7.1 Introduction

This chapter provides an investigation of the validation of hand washing behaviour measures and the utility of the different measurement approaches compared with structured observation. The aim is to determine whether there are any suitable and valid measures from methods aside from structured observation that can be used to assess hand washing behaviours.

Structured observation as a measurement method to assess hand washing behaviour as discussed in Chapter 2 provides results that have been argued to be more valid and reliable than other methods. The objective of this validation analysis is to assess the efficacy of the various measurement methods. This is achieved through applying an epidemiological style screening test approach, using the concepts of sensitivity, specificity, positive predictive value and negative predictive value. Further validation is conducted through the calculation of kappa statistics comparing structured observation indicators with the other indicators collected through self report, spot check observation and hand washing demonstration methods.

The first section of the substantive analysis focuses on validating overall female caregiver behaviour and is termed the “unstratified” analysis. This analysis focuses on all observed hand washing events for the five critical hand washing times of before preparing food, before eating, before feeding a child, after cleaning a child’s bottom/disposing of stools and after defecation with the three food related critical times firstly assessed. The analysis for each of these critical times compared structured observation hand washing measurement indicators with results obtained through self report, spot check and hand washing demonstration measurement indicators.

The second aspect of the substantive analysis is termed the “stratified analysis. This analysis is stratified by the number of hand washing events observed for female caregivers that experienced one, two and three plus events during structured observation for the three food related critical times. The aim of this analysis was to then compare the unstratified analysis with the stratified analysis to examine whether the number of hand washing events observed impacted on the validation of hand washing behaviour measures comparing structured observation with the other alternative measurement methods. A summary of the selected valid indicators is provided.

A further analysis was undertaken for defecation related critical times that focused on washing both hands with soap as observed through structured observation compared with all other data collection methods. A summary of valid indicators for this analysis is given together with a summary of the findings of this chapter.

7.1.1 Analysis of hand washing data

The data obtained through structured observation for female caregivers was directly comparable with hand washing data obtained from a cross sectional survey as this survey was administered to the primary caregiver of the child. This person was identified as the mother of the youngest child. The structured observation data discussed in the previous chapter was in the form of overall female caregiver hand washing behaviour. In this case, an overall average score of various hand washing behaviours by hand washing exposure for female caregivers was obtained and is discussed later. This was then merged directly with data from a cross sectional survey data that comprised the other measures including self report, spot check and hand washing demonstrations.

As discussed in the previous chapter, a large majority of respondents for the cross sectional survey were classified as the mother of the youngest child (930 women) constituting 93.5% of the cross sectional survey sample with the remaining 45 women identified as being female caregivers and 20 being male caregivers. The structured observation and cross sectional survey components were conducted in the same households, therefore the data could be directly merged through the presence of unique household identification numbers. Only households that were included in both the structured observation and cross sectional component of the study were included and analysed for this validation research. The data was based on the mother of the youngest child (930 women). The rationale for this being that this data could be directly linked and directly compared using the household identification number.

Data from 993 structured observation households and 995 cross sectional survey households that were included in the structured observation component were merged by household identification number. This resulted in a total of 993 households as two households had some missing information and were therefore omitted from the sample. The differences in sample size for the different components are explained later. The cross sectional survey, although primarily administered to the mother of the youngest child, when further assessed, identified 65 households where either another female caregiver answered the survey on behalf of the respondent or a male caregiver. Further assessment of the 45 female caregivers revealed that they tended to be older than the mother of the youngest child, and were possibly grandparents of the youngest child. Therefore, these females were excluded from the merged data sample and the same was performed for the 20 male caregivers. There were also seven households where information was available from structured observation but were not present in the cross sectional survey data, therefore, these households were also excluded from this analysis. Although the name of the female and her demographic characteristics were collected in the cross sectional survey, in the structured observation data, no such information was available on female caregivers that were observed.

Discussions with the design team identified that the females observed during structured observation were inclined to be the mother of the child, and therefore this was the same respondent that answered the cross sectional survey that included the self report, spot check observation and hand washing demonstration measures. This was further corroborated through the consent process to participate in the research as eligible households had to have a child less than five years of age and the female caregiver for this process had to be the mother of the youngest child. The implication of excluding other female caregivers, in particular, older female caregivers was that their hand washing practices may differ from those performed by the mother of the child.

Furthermore, the mother/main female caregiver was the person that was primarily observed during structured observation. Therefore, the assessment of observations from this group and the responses obtained from cross sectional survey measures of hand washing were assumed to be from the same respondent. One of the limitations of the structured observation component was that there was no way to ascertain the name or age or any unique personal information for respondents as this information was not collected. The reason being that when observing multiple people it becomes difficult for the observer to track all respondents and may also affect the nature of the study.

In total, 7070 hand washing events were observed during structured observation for the 921 females from the households included in this analysis. In order to compare observations with self report and other measures obtained from the cross sectional survey, women with the specific critical hand washing exposures were selected in the newly merged dataset and comparisons between structured observation methods and self report, spot check and hand washing demonstration methods were compared using 2x2 tables. In later analyses, self report measures, spot check and hand washing demonstration methods are validated against structured observation hand washing measures for the same exposures and the same or similar indicators.

7.2 Definitions and classification of hand washing behaviour

The structured observations were conducted over a five hour period observing pre-assigned categories of household members. Although the focus of this research is on female caregivers only, as the observations were continuous and all of the occurrences of pre-coded hand washing exposures were observed and recorded, this meant that there was the opportunity for repeated observation of hand washing behaviour for a female within a household. To overcome this, and as described in the previous chapter, the focus of this research was on female hand washing behaviour. The way in which this was overcome was that the data in the form of events was aggregated by hand washing exposure and household identification number. The specification of an average was given to give a proportion of times that hands were washed for different exposures and other hand washing variables. However, one important issue to consider before being able to appropriately validate structured observation as a tool for collecting information on hand washing behaviour, in order to make comparisons with other methods, was how to define female hand washing behaviour for the various different structured observation indicators. With the structured observation data in the format explained and a resulting proportion between zero and one, a value of zero indicated that hands were never washed for the exposure event and a value of one indicated that hands were always washed. All other indicators followed the same pattern. In order to validate structured observation indicators against the other methods, the way in which behaviour was classified is explained in section 7.3.

7.2.1 Multiple observations of hand washing exposures

This leads on to the important issue of partial/inconsistent hand washing behaviour for individuals that sometimes washed hands for a specific exposure. In particular, individuals that were observed to have more than one hand washing event that took place during the five hour observation period. This was particularly the case for the critical food related exposure events where the maximum number of events observed was 10.

A very important issue that has arisen through assessing data on hand washing, particularly with food related events, is that some female caregivers were observed to have multiple hand washing events. For example, a female could be observed to have only one or two hand washing events or could alternatively have had five events or more. This can result in quite different types of hand washing behaviour, as a female could wash hands for all five events or for a few or a selection of those five. However, if a female has just one event then she either does or does not comply with hand washing. From a policy perspective, it is also important to consider this as individuals with more than one event for the same hand washing exposure assessed may not consistently wash their hands with soap. Therefore they may potentially pose a greater public health risk than an individual that had ten events for the same hand washing exposure and consistently washed hands with soap for all of these events.

The results in this chapter are presented firstly based on all of the hand washing events observed during structured observation for an individual regardless of the number of exposures a female had for the five critical times assessed. This is then followed by the results obtained from the stratified analysis of critical hand washing events that were stratified by the number of hand washing events the main female caregiver experienced. The results displayed in Table 7.1a display the number of hand washing events observed by hand washing exposure. The maximum number of events before preparing food and before feeding a child was ten and seven before eating. For food related critical times, the majority of female caregivers had between one and two hand washing events.

However, before feeding a child, there were a substantial number of women that had three and four hand washing events. However, overall, after three events for food related events the number of female caregivers observed to have greater than three events declined. For defecation related hand washing practices, the majority of females were observed to have one hand washing event during structured observation, 81% of female caregivers were observed to have one hand washing event after cleaning a child's anus/disposing of a child's stools and 97% of female caregivers had one event for the critical hand washing time of after defecation.

The increasing number of events an individual was observed to have during structured observation provided an opportunity for variations in hand washing behaviour and practices. This assessment may also have important policy recommendations in terms of how to promote hand washing in individuals that consistently do not wash hands as opposed to those that always wash hands. It also raises important questions on how to target individuals that display varied behaviours "the partial hand washers" as they do not comply with a particular practice on every occasion. This assessment also raises the question on critical times and how important some times are over others.

Therefore, in this context, food related critical hand washing exposures took account of the multiple events experienced for these critical times through stratifying on the number of hand washing events experienced. The rationale was to assess in greater depth whether multiple hand washing events during structured observation compared with the other comparative indicators obtained through the other measurement approaches impacted on the validity of indicators compared with when all hand washing events were assessed together.

Table 7.1a: Number of hand washing events observed during structured observation by hand washing exposure

Hand washing exposure	One event	Two events	Three events or more	Total no. of females
Before preparing food	322	209	155	686
Before eating	469	173	92	734
Before feeding a child	211	169	231	611
After cleaning a child's anus/disposing of stools	230	50	5	285
After defecation	56	2	0	58

Author's own analysis of SHEWA-B Health Impact Study baseline data

Table 7.1b refers to commonly used acronyms featured in tables displaying the results of using a screening type approach and kappa statistics in this chapter and those featured in Chapter 8.

Table 7.1b List of commonly referred to acronyms

Acronym of indicator	Full description of indicator
ACCB	After cleaning a child's bottom
AD	After defecation
ADCS	After disposing of a child's stools
BE	Before eating
BFC (also abbreviated to BF)	Before feeding a child (BF stands for feeding)
BH	Both hands
BFC	Before feeding a child
HW	Hand washing
HWWA	Hand washing with ash
HWWS	Hand washing with soap
HHWS AD	Hand washing with soap after defecation
HWWS BE	Hand washing with soap before eating
HWWS BH	Hand washing with soap-Both hands
HWWS BFC	Hand washing with soap before feeding a child
HWWM	Hand washing with mud
HWWW only	Hand washing with water only

7.3 Assessing and validating overall (unstratified) hand washing behaviour indicators

In the analysis of overall hand washing behaviour indicators, this analysis focused on assessing the validity of indicators through assessing all hand washing indicators for the five critical hand washing exposures. As discussed, this took into account *all* hand washing events experienced by an individual for the critical hand washing behaviour event observed during structured observation.

Individuals that were observed to have experienced a particular hand washing event for each of the five critical times focused on in this analysis during structured observation were then selected and a comparison was made with their responses to cross sectional survey data components. This was done by calculating the sensitivity, specificity and associated positive and negative predictive values. However, firstly a female caregiver's behaviour was required to be classified.

The classification procedure was performed for all indicators for the structured observation indicators. In order to validate structured observation indicators against the other methods, the way in which behaviour was classified was based on an approach of "not always" and "always". This approach was necessary in order to have a binary classification system for the structured observation variables. Therefore, structured observation was defined as the "reference standard" indicator in terms of validating other methods. As all events observed for the five critical hand washing times were included in this analysis, the observation variables were classified as follows for all observation variables where a calculation of sensitivity and specificity was required. If, for example, a female caregiver never washed hands for a particular critical hand washing exposure or displayed inconsistent hand washing behaviour, this was classified as "not always" washing hands.

Therefore, this took account of females that fell within the range of 0-0.99 in the previously explained section on how overall female behaviour and indicators were computed. These individuals were coded as zero and were defined as "not always performing a particular behaviour". If a female caregiver always performed a particular behaviour, for example, always washed hands for a particular hand washing exposure, then that individual was defined as "always" washing hands. These individuals were therefore coded as one and defined as "always performing that behaviour".

This approach was taken for all observation indicators event that fell into the "sometimes" category (0-0.99). This approach was undertaken as coding them as always washing hands would have resulted in them being overestimated as "always washing hands", when in fact, they did not always wash their hands on all occasions experienced. The coding of the self report, spot check and hand washing demonstration indicators was straightforward as they were already coded as a binary response of yes or no.

7.4 Validation of hand washing behaviour measures

The data was analysed using the Statistical Package for the Social Sciences (SPSS), version 16.0 and STATA Data Analysis and Statistical Software package, version 10.0. These packages enabled the production of 2x2 contingency tables and calculation of sensitivity, specificity, positive and negative predictive values and Kappa statistics to compare structured observation indicators with the various cross sectional survey measures of hand washing behaviour.

7.4.1 Selection of indicators and statistical approach

The specific indicators compared involved the selection of the relevant hand washing exposure, for some comparisons there was also the further restriction on the selection of individuals. For example, for the event specific self report question on whether hands were washed for the various critical hand washing exposures, only females that self reported that they had had experienced a critical hand washing event on the day of the cross sectional survey and the previous day were selected.

Female caregivers who recalled the critical event happening longer than two days or never were excluded. This was due to recall bias and the longer the duration of recall then the less accurate the response as discussed in the literature review. The sample size of female caregivers in this category was small, with approximately 20 individuals in these categories.

The selection criteria for individuals was similar for the comparison of the structured observation indicator on whether both hands were washed with a self report event specific question on whether both hands were washed. This comparison was based on only females that were observed to wash both hands during structured observation and also those that responded to a self report question on whether both hands were washed for the same hand washing event. The self report question featured was based on the selection of female caregivers that self reported that they had experienced an event in the past 24 hours due to reasons discussed previously pertaining to recall bias.

The same principal was applied to whether soap was used by selecting only those individuals that were observed to hand wash with soap during structured observation and those that responded to a self report question on whether hands were washed with soap for the specified event. There was also further restriction for some of the cross sectional indicators, namely the selection of those that had a specific place for hand washing relating to the place used most often for washing hands before cooking and preparing food and after using the toilet.

This restriction was applied as those with no specifically defined place would find it difficult to wash hands. The comparison of structured observation with the hand washing demonstration followed the same principle, with only female caregivers that participated in the hand washing demonstration being selected as they formed the focus of this research. In addition, for all other indicators the focus was on comparing their behaviour using the different measurement methods.

The results tables featured in this chapter indicate the prevalence of hand washing for the indicator of interest. The prevalence stated relates to the percentage of female caregivers who washed their hands. This is used in estimating the positive and negative predictive values. Sensitivity and specificity estimates are also featured.

Figure 7.1 provides a diagrammatic illustration of the terms and concepts used to approach the assessment of the validity of hand washing measures collected through the different measurement methods. In all of the analyses conducted for this research, structured observation was taken as the reference standard (and not as a “gold standard”). This was due to the factors discussed within the literature review on structured observation. This method, although suitable to provide information on directly observed behaviour, is a method of capturing an individual’s hand washing behaviour over a specified time period. This approach is by no means a gold standard measure, although one of the most appropriate methods to date for the provision of information on direct hand washing practice in the absence of other well validated methods and measures.

The figures in Figure 7.1 are based on the results in Table 7.4 that assess the validity of before preparing food structured observation indicators compared with self report, spot check and hand washing demonstration indicators. This example relates to the comparison of the observation indicator with a self report question on whether hands were washed before preparing food. Overall, the total sample of female caregivers was 665. In this example 263 female caregivers were identified as always washing hands in the structured observation while 402 were identified as not always washing hands. In all subsequent tables, the total sample size and the total number of positives as identified by the reference standard are included.

In this example 249 female caregivers were identified as true positives while 14 were false negatives. (The calculation is featured in the table and takes the total number of true positives (249) and divides it by the total number of true positives plus false negatives (263); this gave a sensitivity of 94.7%. The number of false positives was 365 and true negatives were 37. Therefore, taking the number of true negatives (37) divided by the total number of false positives plus true negatives (402) gave a specificity of 9.2%. In this example, the sensitivity was 94.7%, specificity of 9.2%.

The PPV and NPV values were also calculated. The PPV was taken as the number of true positives (249) divided by the number of true positives (249) plus the number of false positives (365) giving a PPV of 40.6%. The NPV was the number of true negatives (37) divided by the number of true negatives (37) plus the number of false negatives (14). This gave an NPV of 72.5%. Subsequently, with these figures, the false positive rate and false negative rate could be calculated as featured below.

The false positive rate was the total number of false positives (365) divided by the total number of false positives (365) plus true negatives (37) giving a false positive rate of 90.8% or an alternative calculation of one minus the specificity. The false negative rate was the total number of false negatives (14) divided by the total number of true positives (249) plus false negatives (14) giving a false negative rate of 5.3% or one minus the sensitivity.

This example demonstrates that female caregivers had a very high false positive rate whereby they did not always wash hands before preparing food during structured observation; however, they reported that they did wash hands when asked a self report question on their behaviour. This is also indicated by the low specificity estimate of 9.2%. On the other hand, female caregivers that were observed to always wash hands also accurately reported that they washed hands before preparing food indicated by the high sensitivity estimate of 94.7% and low false negative rate of 5.3%. This then leads on to Table 7.2 that outlines the selection criteria for the selection of hand washing indicators.

Figure 7.1: A worked example: Observation of whether hands were washed before food preparation compared with a self report question

		Condition (Structured Observation)		
		Positive (Always)	***Negative (Not always)***	
Test Outcome (Survey: Self report)	***Positive***	**TP** 249	**FP** 365	*Positive Predictive Value* TP/ (TP + FP) 249 / (249 + 365) 249/614 = 40.6%
	Negative	**FN** 14	**TN** 37	*Negative Predictive Value* TN / (TN + FN) 37 / (37 +14) 37/51 = 72.5%
		Sensitivity = TP/ (TP + FN) = 249/ (249 +14) = 249/263 = 94.7%	*Specificity* = TN / (FP + TN) = 37/ (365 +37) =37/402 = 9.2%	

False positive rate (α) = FP / (FP + TN) = 365 / (365 + 37) = 90.8% (1 – specificity)   False negative rate (β) = FN / (TP + FN) = 14 / (249 + 14) = 5.3% (1 – sensitivity)

Table 7.2: Criteria for evaluating the performance and selecting hand washing indicators using an epidemiological style approach

Criteria	Sensitivity	Specificity	PPV and NPV	Identification	Interpretation
Selection of a potentially valid measure of hand washing behaviour	>50% *(Between 50% and 100%) ***indicates that figures set are arbitrary.**	>50% *(Between 50% and 100%)	Interpreted as per indicator (Both >50%)	Highlighted in yellow[2]	e.g. 100% Sensitivity and 100% Specificity-True positives and True negatives are successfully identified Low false negative rate Low false positive rate
Possible inclusion as a potential indicator	>50% *(Between 50% and 100%)	<50% *(Approx. 40%-50%)	Interpreted as per indicator (Both>50%)	Highlighted in blue[3]	Moderate/Low false negative rate Moderately high false positive rate
Possible inclusion as a potential indicator	<50% *(Approx. 40%-50%)	>50% *(Between 50% and 100%)	Interpreted as per indicator (Both >50%)	Highlighted in blue	High false negative rate Moderate/Low false positive rate
Underperforming indicators	Very high estimates *(70-100% approx.)	Very low estimates *(0-30% approx.)	Interpreted as per indicator	Not highlighted	Low false negative rate Very high false positive rate
Underperforming indicators	Very low estimates *(0-30% approx.)	Very high estimates *(70-100%)	Interpreted as per indicator	Not highlighted	High false negative rate Low false positive rate

[2] Figures highlighted in subsequent tables in yellow are indicators where both sensitivity and specificity estimates are >50%.
[3] Figures highlighted in subsequent tables in blue are indicators where either one estimate is >50% and the other <50% or vice versa.

The asterix featured in Table 7.2 indicates that the figures set are arbitrary and are subsequently discussed.

Ideally, from a diagnostic test perspective achieving both high sensitivity and specificity estimates is the desired outcome. In the case of this analysis, this means that female caregivers that hand wash and those that do not hand wash are also correctly identified. However, sensitivity and specificity estimates alone do not provide information regarding whether the probability of a test gives the correct diagnosis. This is achieved through assessing the direction of the test results through the use of predictive values, in particular, PPVs. The asterix in Table 7.2 denotes an arbitrary figure chosen to evaluate and select hand washing indicators. It is understood that high sensitivity and specificity estimates are ideal in selecting indicators when this approach is applied in the medical and epidemiological context. The use of this approach applied to behavioural public health data and validating observational data against other alternative measurement methods has not been as well evaluated or used.

The interpretation of the kappa statistic is outlined in Table 7.3. The values given and the significance of the values were put forward by Landis and Koch (Landis. J.R. and Koch 1977).

Table 7.3: Interpretation of kappa statistics

k	Interpretation
< 0	No agreement
0.0-0.20	Slight agreement
0.21-0.40	Fair agreement
0.41-0.60	Moderate agreement
0.61-0.80	Substantial agreement
0.81-1.00	Almost perfect agreement

7.5 Defining hand washing behaviour for food related critical times

For the critical hand washing times of before preparing food, before eating and before feeding a child, hand washing with water only was the practice mainly observed. In 99% of events before preparing food, hands were washed with water only. In over 50% of events were both hands washed as opposed to only one hand, and in approximately 1% of events involved the use of soap during the hand washing process.

The results for the other two food related critical hand washing exposures were similar, with approximately 11% of events involving both hands being washed, and about 1% of events using soap for hand washing before eating and 99% of events involving the use of water only. For the hand washing exposure of before feeding a child, the prevalence of washing both hands was low and only occurred in approximately 20% of events. Similarly, the use of soap, although higher than what was observed for the two other critical times, was also low, with approximately only 4% of events involving the use of soap. With the extremely limited use of soap and the majority of events involving washing one hand with water only for all of the critical food related hand washing exposures, the decision was taken to assess the relative merits and compare each indicator with the exact or similar indicator obtained from self report, spot check and a hand washing demonstration. This approach was taken rather than defining “gold standard behaviour” or the most widely regarded disease prevention behaviour, for example, washing both hands with soap which is promoted widely from a public health perspective. The practice of this behaviour was not common practice based on results obtained from structured observation as previously discussed.

Also, as the aim of this research was to assess the validity of indicators of hand washing behaviour. The assessment of the performance and validity of each indicator for all of the critical times was be useful to uncover if particular valid indicators existed for all critical times and if so, which indicators were more or less valid for the particular critical times.

7.5.1 Before preparing food

The results in Table 7.4 are for before preparing food. The prevalence of washing hands before preparing food was 39.5%, with only 41.1% of those washing both hands. Both of these indicators and their comparative self report indicators had high sensitivity and low specificity estimates.

This means that a high proportion of female caregivers that always washed hands and always washed both hands also reported that they performed these actions before preparing food from a self report question. On the other hand, results with low specificity estimates indicated that there was a high false positive rate and that female caregivers that did not always wash hands during structured observation misreported that they washed hands before preparing food and that they washed both hands. This was demonstrated by specificities of 9.2% and 18.9% respectively.

Therefore, false positive rates were 90.8% (as discussed previously in the example in Figure 7.1) and 81.1%. The prevalence of soap use as observed through observation as previously discussed was very low at 1.4%. For this reason, although sensitivities, specificities, PPVs and NPVs were calculated for the different observation with comparative self report, spot check and observation indicators for this hand washing exposure, the results were not discussed further.

Although a low prevalence of soap use was observed during structured observation and is demonstrated in particular for food related hand washing behaviours, the sample size of female caregivers observed was very large at over 500. This demonstrates that although hand washing was occurring in this sample of females, hand washing with soap was not a priority. The implications of this are discussed in greater depth in the discussion chapter. In addition, the occurrence of a sensitivity estimate of either 0% or 100% can be explained in the context of low responses to structured observation indicators and self report, spot check and hand washing demonstration methods in terms of those that were identified as true positives. This pattern was particularly apparent for structured observation compared with self reported indicators.

Table 7.4: Before preparing food

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	39.5	35.8-45.3	94.7	91.2-97.1	9.2	6.6-12.5	40.6	36.6-44.6	72.5	58.3-84.1
WBH and WBH (Event specific)	41.1	36.4-45.9	84.2	78.0-89.2	18.9	14.3-24.3	42.0	36.8-47.3	63.0	51.3-73.9
HWWS and used soap for HW (Event specific)	1.4	0.5-3.0	0.0	0.0-45.9	90.4	87.1-93.0	0.0	0.0-8.6	98.5	96.7-99.4
HWWS and HWWS BPF	1.4	0.5-2.9	0.0	0.0-45.9	90.6	87.5-93.2	0.0	0.0-8.6	98.5	96.8-99.5
HWWS and used soap (24hrs)	1.4	0.5-2.9	100.0	54.1-100.0	2.7	1.4-4.7	1.4	0.5-3.0	100.0	73.5-100.0
HWWS and use soap of HW BF	1.4	0.5-2.9	0.0	0.0-45.9	92.4	89.6-94.7	0.0	0.0-10.6	98.5	96.8-99.5
HWWS and separate soap available	1.4	0.5-2.9	0.0	0.0-45.9	73.9	69.5-78.0	0.0	0.0-3.2	98.2	96.1-99.3
HWWS and spare soap available	1.4	0.5-2.9	33.3	4.3-77.7	65.4	60.8-69.9	1.3	0.2-4.6	98.6	96.5-99.6
HWWS and knowledge HWWS BF	1.4	0.5-2.9	50.0	11.8-88.2	56.1	51.3-60.8	1.5	0.3-4.4	98.8	96.5-99.7
Observation vs. spot check										
HWWS and availability of soap at HW place	1.9	0.7-4.0	33.3	4.3-77.7	44.8	39.2-50.4	1.1	0.1-4.0	97.2	93.1-99.2
Observation vs. Hand washing demonstration										
HWWW only and HWWW only	98.4	95.8-99.5	11.3	7.6-16.0	75.0	19.4-99.4	96.4	81.7-99.9	1.4	0.3-4.0
WBH and WBH	40.3	34.1-46.8	68.4	58.2-77.4	40.0	32.0-48.5	43.5	35.5-51.7	65.2	54.3-75.0
HWWS and HWWS	1.2	0.3-3.6	33.3	0.8-90.6	28.3	22.7-34.5	0.6	0.0-3.2	97.1	90.1-99.7

Author's own analysis of SHEWA-B Health Impact Study baseline data

7.6 Stratified validation analysis of critical food related hand washing exposures

The results in Table 7.1a and discussion illustrate that for food related critical times, female caregivers were observed to have multiple hand washing events during structured observation compared with defecation events where the majority of respondents (over 80%) had only one event. The rationale for assessing food related critical times stratified by the number of hand washing events was to assess whether the number of events affected the calculated estimates of the compared indicators using the two approaches to assess the validity of indicators and subsequently the selection and choice of valid indicators.

The analyses in this section focused on the critical food related exposures and stratified according to whether a female caregiver experienced one, two or three or more events and validates the structured observation measures accordingly in comparison with self report, spot check and hand washing demonstration measures. These results are then compared to results from the food related critical times from the unstratified results that assessed the overall number of events.

7.6.1 Before preparing food

The results in Table 7.5 were based on female caregivers that were observed to have a single event of before preparing food during the structured observation. The results in this section will be discussed and compared with the unstratified analysis in Table 7.4. For female caregivers that experienced one event, the prevalence of whether hands were washed was higher in this sample of women compared with the results in Table 7.4 where the prevalence of whether hands were washed was 39.5%. Similarly, the prevalence was also higher for whether both hands were washed at 47.4% compared with 41.1% for the unstratified result. The sensitivity and specificity estimates were very similar to those identified in Table 7.4 and NPV estimates were slightly lower than the estimates in Table 7.4.

However, the prevalence of hand washing with soap was slightly higher amongst female caregivers that had one event at 2.6%. Although the prevalence was very low, the self reported indicators of knowledge of hand washing with soap before preparing food compared with the reference standard of observed hand washing with soap had moderately high sensitivity and specificity estimates but considerably wide confidence intervals for the sensitivity estimate. Although highlighted in blue as a potential indicator for structured observation compared with spot check indicators, the spot check indicator on the availability of soap at the hand washing place had a very low prevalence of hand washing with soap within the sample. The sensitivity estimate was very high and specificity estimate was moderate. However, the confidence intervals were considerable wide particularly for the sensitivity estimate.

This is unsurprising as only a small sample of female caregivers were observed to use soap in this sample. The other indicator highlighted in blue was the observation compared to the hand washing demonstration indicator on whether both hands were washed. This indicator was a potential indicator for assessing hand washing behaviour with moderate sensitivity and specificity estimates

Table 7.5: Before preparing food –One event

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	49.0	43.4-54.7	93.5	88.4-96.8	10.0	5.8-15.7	50.0	44.1-55.9	61.5	40.6-79.8
WBH and WBH (Event specific)	47.4	39.3-55.6	83.6	73.0-91.2	14.8	7.9-24.4	46.9	38.1-55.9	50.0	29.1-70.9
HWWS and used soap for HW (Event specific)	2.6	0.7-6.5	25.0	0.6-80.6	76.7	69.1-83.2	2.8	0.1-14.5	97.5	92.7-99.5
HWWS and HWWS BPF	2.6	0.7-6.5	0.0	0.0-60.2	88.7	82.5-93.3	0.0	0.0-19.5	97.1	92.1-99.2
HWWS and used soap (24hrs)	2.6	0.7-6.5	100.0	39.8-100.0	2.0	0.4-5.7	2.6	0.7-6.6	100.0	29.2-100.0
HWWS and use soap of HW BF	2.6	0.7-6.5	0.0	0.0-60.2	92.0	86.4-95.8	0.0	0.0-26.5	97.2	92.9-99.2
HWWS and separate soap available	2.6	0.7-6.5	0.0	0.0-60.2	71.3	63.4-78.4	0.0	0.0-8.2	96.4	91.0-99.0
HWWS and spare soap available	2.6	0.7-6.5	25.0	0.6-80.6	63.3	55.1-71.0	1.8	0.0-9.6	96.9	91.3-99.4
HWWS and knowledge HWWS BF	2.6	0.7-6.5	50.0	6.8-93.2	51.3	43.0-59.6	2.7	0.3-9.3	97.5	91.2-99.7
Observation vs. spot check										
HWWS and availability of soap at HW place	1.2	0.0-6.7	100.0	2.5-100.0	43.8	32.7-55.3	2.2	0.1-11.5	100.0	90.0-100.0
Observation vs. Hand washing demonstration										
HWWW and HWWW only	95.3	88.4-98.7	8.6	3.5-17.0	75.0	19.4-99.4	87.5	47.3-99.7	3.9	0.8-11.0
WBH and WBH	45.9	35.0-57.0	59.0	42.1-74.4	45.7	30.9-61.0	47.9	33.3-62.8	56.8	39.5-72.9
HWWS and HWWS	3.5	0.7-10.0	33.3	0.8-90.6	31.7	21.9-42.9	1.8	0.0-9.4	92.9	76.5-99.1

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results in Table 7.6 are based on female caregivers that were observed to have two before preparing food events. Overall, similar results and estimates were identified although the prevalence of whether hands were washed and whether both hands were washed was slightly lower amongst female caregivers that experienced two events compared with those that experienced one event.

The prevalence of hand washing with soap was lower at 0.6% amongst observation indicators that compared hand washing with soap with self reported indicators on soap use, the availability of spare soap, the availability of separate soap for hand washing and knowledge of the important times to wash hands (specifically before preparing food). There were two indicators (the availability of spare soap-a self report question and the availability of soap at the hand washing place-spot check observation) compared with the structured observation reference standard that demonstrated very high sensitivity estimates and moderately high specificity estimates. These two indicators were possible potential indicators for assessing hand washing behaviour. In particular, as discussed with the results in Table 7.5, the confidence intervals for the sensitivity estimates were considerably wide.

This leads on to an important point related to the prevalence, PPV and NPV estimates, when the prevalence is low as identified for hand washing with soap, this provides more surety that a self report of not having spare soap available actually indicates that female caregivers do not always wash their hands with soap indicated by the NPV estimate. Given this situation, one can be less sure that a positive test, in this case that a self report that a female caregiver reports that she washes hands with soap, actually indicates that she was observed to always wash hands with soap during structured observation indicated by the PPV estimate.

This was demonstrated by the particularly low PPV estimate of 1.8%. The only indicator calculated comparing observation with a hand washing demonstration indicator of washing both hands had a high sensitivity estimate and moderate specificity estimate. This was a potentially useful indicator for assessing hand washing behaviour. The PPV and NPV estimates were also moderately high. No results could be computed for observation versus two of the hand washing demonstration indicators due to restrictions in the sample resulting in no variation in the outcome for the 2x2 contingency table.

Table 7.6: Before preparing food-Two events

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	41.2	34.3-48.4	95.1	88.0-98.7	10.3	5.4-17.2	42.6	35.4-50.1	75.0	47.6-92.7
WBH and WBH (Event specific)	39.7	32.0-47.9	83.9	72.3-92.0	26.6	18.0-36.7	43.0	34.0-52.3	71.4	53.7-85.4
HWWS and used soap for HW (Event specific)	0.6	0.0-3.5	0.0	0.0-97.5	79.4	72.1-85.4	0.0	0.0-10.9	99.2	95.6-100.0
HWWS and HWWS BPF	0.6	0.0-3.3	0.0	0.0-97.5	91.5	86.1-95.3	0.0	0.0-23.2	99.3	96.4-100.0
HWWS and used soap (24hrs)	0.6	0.0-3.3	100.0	2.5-100.0	3.0	1.0-7.0	0.6	0.0-3.4	100.0	47.8-100.0
HWWS and use soap of HW BF	0.6	0.0-3.3	0.0	0.0-97.5	90.9	85.4-94.8	0.0	0.0-21.8	99.3	96.3-100.0
HWWS and separate soap available	0.6	0.0-3.3	0.0	0.0-97.5	72.0	64.4-78.7	0.0	0.0-7.7	99.2	95.4-100.0
HWWS and spare soap available	0.6	0.0-3.3	100.0	2.5-100.0	67.1	59.3-74.2	1.8	0.0-9.7	100.0	96.7-100.0
HWWS and knowledge HWWS BF	0.6	0.0-3.3	0.0	0.0-97.5	52.4	44.5-60.3	0.0	0.0-4.6	98.9	93.8-100.0
Observation vs. spot check										
HWWS and availability of soap at HW place	1.1	0.0-6.0	100.0	2.5-100.0	44.4	34.0-55.3	2.0	0.0-10.4	100.0	91.2-100.0
Observation vs. Hand washing demonstration										
WBH and WBH	37.1	27.1-48.0	72.7	54.5-86.7	41.1	28.1-55.0	42.1	29.1-55.9	71.9	53.3-86.3

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results in Table 7.7 are based on female caregivers that experienced three plus events. One of the major differences between the results presented in this table and Tables 7.5 and 7.6 is the prevalence of whether hands were washed. For female caregivers that experienced three or more events, the prevalence of whether hands were washed was low at 17.8% compared with all of the other estimates including the estimate in Table 7.4. The prevalence of washing both hands comparing observation to a self report question was lower at 34.7% but not markedly different from female caregivers that were assessed in the unstratified analysis in Table 7.4 and Tables 7.5 and 7.6.

The prevalence of hand washing with soap amongst this sample of female caregivers was low at 0.8. This reason for the lower prevalence may be due to the less consistent use of soap for those with three or more events and inconsistent hand washing practices. These results, as with those female caregivers that had one event, where the knowledge of hand washing before preparing food compared with the reference standard of hand washing with soap had a high sensitivity and specificity estimate. In particular, a higher sensitivity estimate than the one identified in Table 7.5 of 50%. Similarly, the sensitivity estimate had considerably wide confidence intervals.

Another difference identified was that the specificity estimate of the observation indicator compared to the hand washing demonstration indicator of washing both hands was lower compared with the estimates for those in the unstratified analysis in Table 7.4 and those with one and two events in Tables 7.5 and 7.6. No results could be computed for observation versus spot check and two of the hand washing demonstration indicators due to restrictions in the sample resulting in no variation in the outcome for the 2x2 contingency table.

Table 7.7: Before preparing food-three or more events

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	17.8	12.0-24.8	100.0	87.2-100.0	7.2	3.3-13.2	18.9	12.8-26.3	100.0	66.4-100.0
WBH and WBH (Event specific)	34.7	26.3-43.9	85.7	71.5-94.6	13.9	7.2-23.5	34.6	25.6-44.6	64.7	38.3-85.8
HWWS and used soap for HW (Event specific)	0.8	0.0-4.5	0.0	0.0-97.5	70.0	61.0-78.0	0.0	0.0-9.7	98.8	93.6-100.0
HWWS and HWWS BPF	0.8	0.0-4.4	0.0	0.0-97.5	91.9	85.6-96.0	0.0	0.0-30.8	99.1	95.2-100.0
HWWS and used soap (24hrs)	0.8	0.0-4.4	100.0	2.5-100.0	3.3	0.9-8.1	0.8	0.0-4.6	100.0	39.8-100.0
HWWS and use soap of HW BF	0.8	0.0-4.4	0.0	0.0-97.5	95.1	89.7-98.2	0.0	0.0-45.9	99.2	95.4-100.0
HWWS and separate soap available	0.8	0.0-4.4	0.0	0.0-97.5	79.7	71.5-86.4	0.0	0.0-13.7	99.0	94.5-100.0
HWWS and spare soap available	0.8	0.0-4.4	0.0	0.0-97.5	65.9	56.8-74.2	0.0	0.0-8.4	98.8	93.4-100.0
HWWS and knowledge HWWS BF	0.8	0.0-4.3	100.0	2.5-100.0	64.6	55.6-72.8	2.2	0.1-11.5	100.0	95.6-100.0
Observation vs. Hand washing demonstration										
WBH and WBH	37.7	26.3-50.2	76.9	56.4-91.0	32.6	19.1-48.5	40.8	27.0-55.8	70.0	45.7-88.1

Author's own analysis of SHEWA-B Health Impact Study baseline data

The figures in Table 7.8 display the number of true positives and the total sample size for before preparing food. The figures, particularly the number of true positives that assessed indicators involving soap use for the overall (unstratified) analysis (the first column) and the number of true positives female caregivers in the stratified analysis (for those females with one, two and three or more events) illustrates that the number of true positives analysed was very low. The total sample size was also given to illustrate the number of females featured in the analysis.

Table 7.8: Summary table of true positives and total sample size for before preparing food

Comparison Indicators	True Positives (TP)	Total sample size (TSS)	TP One event	TSS	TP Two events	TSS	TP Three plus events	TSS
Observation vs. self report								
WH and WH (Event specific)	249	665	144	314	78	199	27	152
WBH and WBH (Event specific)	149	431	61	154	52	156	36	121
HWWS and used soap for HW (Event specific)	0	431	1	154	0	156	0	121
HWWS and HWWS BPF	0	443	0	154	0	165	0	124
HWWS and used soap (24hrs)	6	443	4	154	1	165	1	124
HWWS and use soap of HW BPF (24hrs)	0	443	0	154	0	165	0	124
HWWS and separate soap available	0	443	0	154	0	165	0	124
HWWS and spare soap available	2	443	1	154	1	165	0	124
HWWS and knowledge HWWS BPF	3	443	2	154	0	165	1	128
Observation vs. spot check								
HWWS and availability of soap at HW place	2	321	1	81	1	91	-	-
Observation vs. Hand washing demonstration								
HWWW only and HWWW only	27	243	7	85		-	-	-
WBH and WBH	67	243	23	85	24	89	20	69
HWWS and HWWS	1	243	1	85	-	-	-	-

Author’s own analysis of SHEWA-B Health Impact Study baseline data

7.6.2 Analysis using kappa statistics

The kappa statistics from the analysis of unstratified and stratified hand washing events featured in Table 7.9 were on the whole consistent with the findings from those based on the use of a screening test approach. Overall, the kappa statistics results produced demonstrated very low levels of agreement between indicators, even for the indicators identified as potential alternatives to structured observation, which when interpreted based on Table 7.3 fell into the no to slight levels of agreement range.

Table 7.9: Kappa statistics for before preparing food events (Unstratified and Stratified)

Comparison Indicators	Before preparing food (BPF)	CI (95%)	BPF One event	CI (95%)	BPF Two events	CI (95%)	BPF Three plus events	CI (95%)
Observation vs. self report								
WH and WH (Event specific)	0.03	0.00-0.06	0.03	-0.03-0.09	0.05	-0.02-0.11	0.03	0.01-0.05
WBH and WBH (Event specific)	0.03	-0.04-0.09	-0.02	-0.13-0.1	0.09	-0.02-0.20	0.0	-0.10-0.09
HWWS and used soap for HW (Event specific)	-0.02	-0.04- -0.01	0.0	-0.08-0.09	-0.01	-0.04-0.01	-0.02	-0.05-0.02
HWWS and HWWS BPF	-0.02	-0.04- 0.01	-0.04	-0.08- -0.01	-0.01	-0.03-0.01	-0.01	-0.04-0.01
HWWS and used soap (24hrs)	0.0	-	0.0	-	0.0	-	0.0	-
HWWS and use soap of HW BPF (24hrs)	-0.02	-0.04- -0.01	-0.04	-0.07- -0.01	-0.01	-0.03-0.01	-0.01	-0.04-0.01
HWWS and separate soap available	-0.03	-0.05- -0.01	-0.05	-0.10-0.0	-0.01	-0.04-0.01	-0.02	-0.05-0.01
HWWS and spare soap available	0.0	-0.03-0.03	-0.02	-0.08-0.04	0.02	-0.02-0.07	-0.02	-0.05-0.01
HWWS and knowledge HWWS BPF	0.0	-0.02-0.03	0.0	-0.05-0.05	-0.01	-0.04-0.01	0.03	-0.03-0.08
Observation vs. spot check								
HWWS and availability of soap at HW place	-0.01	-0.04- -0.01	0.02	-0.02-0.06	0.02	-0.02-0.05	0.0	-
Observation vs. Hand washing demonstration								
HWWW only and HWWW only	-0.01	-0.02-0.01	-0.02	-0.06-0.03	0.0	-	0.0	-
WBH and WBH	0.08	-0.04-0.19	0.05	-0.16-0.25	0.12	-0.05-0.30	0.08	-0.10-0.26
HWWS and HWWS	-0.01	-0.04-0.01	-0.04	-0.11-0.03	0.0	-	0.0	-

Author's own analysis of SHEWA-B Health Impact Study baseline data

7.6.3 Before eating

The results in Table 7.10 demonstrate the comparison of before eating observation indicators with self report, spot check and hand washing demonstration indicators. The prevalence of washing hands was 62.2%, higher than the prevalence before preparing food. The sensitivity of the observation compared with the self report indicator of whether hands were washed was high with 99.8% of females who washed hands being correctly identified through self report (True positives). This indicator had very low specificity indicating that females that did not wash hands were not being correctly identified through the self report question.

This resulted in a high proportion of false positives (99.6%) equating to 276 women who said that they washed hands at this time but were not observed to do so. Only one woman equated to a true negative. There were no outcome variables for observation compared with respective spot check indicators. Therefore, no calculations could be computed.

Table 7.10: Before eating

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	62.2	58.6-65.7	99.8	98.8-100.0	0.4	0.0-2.0	62.2	58.6-65.8	50.0	1.3-98.7
WBH and WBH (Event specific)	9.1	7.0-11.6	69.0	55.5-80.5	56.8	52.7-60.9	13.8	10.0-18.3	94.8	91.9-96.9
HWWS and used soap for HW (Event specific)	0.2	0.0-0.9	0.0	0.0-97.5	84.9	81.9-87.6	0.0	0.0-3.8	99.8	99.0-100.0
HWWS and HWWS BE	0.2	0.0-0.9	0.0	0.0-97.5	83.5	80.4-86.3	0.0	0.0-3.5	99.8	99.0-100.0
HWWS and used soap (24hrs)	0.2	0.0-0.9	100.0	2.5-100.0	2.7	1.6-4.2	0.2	0.0-0.9	100.0	80.5-100.0
HWWS and use soap for HW BE	0.2	0.0-0.9	0.0	0.0-97.5	92.5	90.1-94.4	0.0	0.0-7.4	99.8	99.1-100.0
HWWS and separate soap available	0.2	0.0-0.9	0.0	0.0-97.5	74.5	71.0-77.9	0.0	0.0-2.3	99.8	98.8-100.0
HWWS and spare soap available	0.2	0.0-0.9	0.0	0.0-97.5	65.6	61.7-69.3	0.0	0.0-1.7	99.8	98.7-100.0
HWWS and knowledge HWWS BE	0.2	0.0-0.9	100.0	2.5-100.0	14.5	11.8-17.4	0.2	0.0-1.0	100.0	96.1-100.0
Observation vs. Hand washing demonstration										
HWWW only and HWWW only	99.2	97.5-99.8	14.2	10.8-18.3	100.0	29.2-100.0	100.0	92.9-100.0	1.0	0.2-2.9
WBH and WBH	9.6	6.7-13.2	76.5	58.8-89.3	32.8	27.7-38.3	10.8	7.2-15.4	92.9	86.5-96.9
HWWS and HWWS	0.3	0.0-1.6	100.0	2.5-100.0	28.6	24.0-33.6	0.4	0.0-2.2	100.0	96.4-100.0

Author’s own analysis of SHEWA-B Health Impact Study baseline data

The only comparison indicator that performed well for this exposure was the assessment of the validity of whether both hands were washed during observation and a self reported indicator of an event specific question on whether both hands were washed by the respondent. The prevalence of washing both hands was low at 9.1%. This indicator had relatively high sensitivity of 69% and high specificity of 56.8%. The 95% confidence interval for the sensitivity estimate was, however, quite wide (55.5-80.5).

Although the sensitivity was high at 69%, the PPV was very low at 13.8% indicating that of those women that reported that they washed both hands, only 13.8% of female caregivers were correctly observed to actually always perform this practice during observation. However, the NPV was very high at over 90% indicating that of those female caregivers that reported that they did not wash both hands during structured observation, 94.8% of female caregivers were correctly identified to not always wash both hands through structured observation. Therefore, a self report question on washing both hands is a potential cross sectional survey item that may be used to judge hand washing behaviour.

For the remaining indicators that assessed the validity of indicators of hand washing with soap compared with self report indicators on soap use, overall, the prevalence of soap use was very low at 0.2 for all of the specified indicators. Due to the very low prevalence of soap use for washing hands, these indicators will not be discussed any further as such a low prevalence is of limited interpretive value.

No results could be calculated for the comparison of observation with spot check indicators. In terms of observation compared with hand washing demonstration indicators only one indicator emerged as being potentially useful. This was the observation of whether both hands were washed compared to whether both hands were washed during the hand washing demonstration. All of the other indicators displayed either high sensitivity or high specificity estimates, but not both together.

7.6.4 Stratified results: Before eating

The results featured in Table 7.11 combine the results for female caregivers that had one, two and three or more before eating events during structured observation. No calculations could be undertaken for those with two and three or more events comparing structured observation indicators of hand washing with soap to similar self report, spot check and hand washing demonstration indicators. No outcomes of true positives and false negatives were available for calculations.

Interestingly, the prevalence amongst female caregivers for those with one hand washing event for whether hands were washed was extremely high at 84.6% compared to 62.2% in the unstratified analysis. Overall, the results were in the same direction as the results in Table 7.10 with particularly high sensitivity estimates for whether hands were washed and a low specificity of 0% indicating a 100% false positive rate.

The results for comparing observation with a self report indicator for washing both hands continued to emerge as a potential indicator for measuring hand washing behaviour with a high sensitivity and specificity estimate. However, the PPV estimate was low indicating that only 13.8% of female caregivers that reported that they washed both hands for this event were correctly identified to always wash both hands during structured observation. No results could be computed for observation compared with the relevant spot check indicator due to restrictions in the sample resulting in no variation in the outcome for the 2x2 contingency table.

Table 7.11: Before eating-Stratified results (One, two and three or more events)

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report-One event										
WH and WH (Event specific)	84.6	81.1-87.8	100.0	99.1-100.0	0.0	0.0-5.0	84.6	81.1-87.8	-	-
WBH and WBH (Event specific)	9.3	6.6-12.6	67.6	50.2-82.0	54.4	49.1-59.7	13.2	8.7-18.9	94.2	90.1-97.0
HWWS and used soap for HW (Event specific)	0.3	0.0-1.4	0.0	0.0-97.5	85.4	81.5-88.7	0.0	0.0-6.2	99.7	98.4-100.0
HWWS and HWWS BE	0.3	0.0-1.4	0.0	0.0-97.5	83.3	79.3-86.9	0.0	0.0-5.4	99.7	98.3-100.0
HWWS and used soap (24hrs)	0.3	0.0-1.4	100.0	2.5-100.0	2.8	1.4-4.9	0.3	0.0-1.4	100.0	71.5-100.0
HWWS and use soap of HW BE	0.3	0.0-1.4	0.0	0.0-97.5	92.2	89.1-94.6	0.0	0.0-11.2	99.7	98.5-100.0
HWWS and separate soap available	0.3	0.0-1.4	0.0	0.0-97.5	73.2	68.6-77.5	0.0	0.0-3.4	99.7	98.1-100.0
HWWS and spare soap available	0.3	0.0-1.4	0.0	0.0-97.5	66.2	61.3-70.8	0.0	0.0-2.7	99.6	97.9-100.0
HWWS and knowledge HWWS BE	0.3	0.0-1.4	100.0	2.5-100.0	14.4	11.1-18.2	0.3	0.0-1.6	100.0	93.7-100.0
Observation vs. Hand washing demonstration										
HWWW and HWWW only	99.6	97.7-100.0	14.5	10.3-19.7	100.0	2.5-100.0	100.0	89.7-100.0	0.5	0.0-2.7
WBH and WBH	9.4	6.0-13.8	77.3	54.6-92.2	32.4	26.2-39.1	10.6	6.3-16.4	93.2	84.9-97.8
HWWS and HWWS	0.4	0.0-2.3	100.0	2.5-100.0	28.6	22.9-34.9	0.6	0.0-3.3	100.0	94.6-100.0
Observation vs. self report-Two events										
WH and WH (Event specific)	31.8	24.9-39.3	98.2	90.3-100.0	0.8	0.0-4.6	31.6	24.7-39.1	50.0	1.3-98.7
WBH and WBH (Event specific)	9.0	5.0-14.7	85.7	57.2-98.2	63.1	54.6-71.1	18.8	10.1-30.5	97.8	92.3-99.7
Observation vs. Hand washing demonstration										
HWWW and HWWW only	98.8	93.3-100.0	12.5	6.2-21.8	100.0	2.5-100.0	100.0	69.2-100.0	1.4	0.0-7.6
WBH and WBH	8.6	3.5-17.0	100.0	59.0-100.0	31.1	20.8-42.9	12.1	5.0-23.3	100.0	85.2-100.0
Observation vs. self report-Three events										
WH and WH (Event specific)	4.4	1.2-10.9	100.0	39.8-100.0	0.0	0.0-4.2	4.4	1.2-10.9	-	-
WBH and WBH (Event specific)	8.2	3.4-16.2	57.1	18.4-90.1	56.4	44.7-67.6	10.5	2.9-24.8	93.6	82.5-98.7
Observation vs. Hand washing demonstration										
HWWW and HWWW only	97.4	86.2-99.9	16.2	6.2-32.0	100.0	2.5-100.0	100.0	54.1-100.0	3.1	0.1-16.2
WBH and WBH	13.2	4.4-28.1	40.0	5.3-85.3	39.4	22.9-57.9	9.1	1.1-29.2	81.3	54.4-96.0

The starkest difference in results was the difference in prevalence for the comparison of the reference of whether both hands were washed compared with a self report question on whether both hands were washed. This was indicated through a reduction in the prevalence from 84.6% for female caregivers with one event to 31.8% for those with two events and 4.4% for those with three or more events. All other estimates remained similar with the exception of the comparison of observation of washing both hands with the demonstration indicator for washing both hands where the sensitivity increased for female caregivers with two events but decreased for female caregivers with three or more events.

In line with previous findings, the observation indicator of washing both hands compared with a self report question on whether hands were washed had high sensitivity and high specificity, particularly for female caregivers with two events. For those with three or more events, the sensitivity and specificity estimates were moderately high, however, the confidence interval for the sensitivity estimates was considerably wide. Furthermore, for both of these indicators that were identified to be potentially valid, the PPV estimates were low at 18.8% and 10.5% respectively indicating that only 18.8% and 10.5% of female caregivers that reported that they washed both hands were correctly identified by structured observation to always wash both hands.

The figures in Table 7.12 display the number of true positives and the total sample size for before eating. The number of true positives for indicators that compared observation indicators with the alternative measures involving soap use for the overall (unstratified) analysis depicted in the first column and the number of true positives female caregivers in the stratified analysis for those females with one, two and three or more events illustrates that the number of true positives analysed was very low. The total sample size was also given to illustrate the number of females featured in the analysis.

Table 7.12: Summary table of true positives and total sample size for before eating

Comparison Indicators	True Positives (TP) Before eating	Total sample size (TSS)	TP One event	TSS	TP Two events	TSS	TP Three plus events	TSS
Observation vs. self report								
WH and WH (Event specific)	455	733	397	469	54	173	4	91
WBH and WBH (Event specific)	40	637	25	397	12	155	4	85
HWWS and used soap for HW (Event specific)	0	637	0	397	-	-	-	-
HWWS and HWWS BE	0	637	0	397	-	-	-	-
HWWS and used soap (24hrs)	1	637	1	397	-	-	-	-
HWWS and use soap of HW BE (24hrs)	0	637	0	397	-	-	-	-
HWWS and separate soap available	0	637	0	397	-	-	-	-
HWWS and spare soap available	0	637	0	397	-	-	-	-
HWWS and knowledge HWWS BE	1	637	1	397	-	-	-	-
Observation vs. spot check								
HWWS and availability of soap at HW place	-	-	-	-	-	-	-	-
Observation vs. Hand washing demonstration								
HWWW only and HWWW only	50	354	34	235	10	81	6	38
WBH and WBH	26	354	17	235	7	81	2	38
HWWS and HWWS	1	354	1	235	-	-	-	-

Author's own analysis of SHEWA-B Health Impact Study baseline data

7.6.5 Analysis using kappa statistics

The results in Table 7.13 illustrate the calculation of kappa statistics based on structured observation indicators compared with their respective comparative alternative measures. The results for the stratified analysis were consistent with those obtained through the use of a screening test approach, with the only indicator demonstrating agreement being the structured observation indicator of washing both hands compared with an event specific self report question on washing both hands before eating. However, the use of a screening test approach to assess the validity of methods to assess hand washing behaviour demonstrated that this indicator was an indicator that had particularly high potential to be used as an alternative to structured observation. The results obtained though the use of kappa statistics identified that this indicator fell into the slight level of agreement range when all of the levels of stratifications were assessed. All other structured observation indicators when compared with respective alternative methods demonstrated very low levels of agreement. This indicated no agreement between indicators.

Table 7.13: Kappa statistics for before eating food events (Unstratified and Stratified)

Comparison Indicators	Before eating food (BE)	CI (95%)	BE One event	CI (95%)	BE Two events	CI (95%)	BE Three plus events	CI (95%)
Observation vs. self report								
WH and WH (Event specific)	0.0	-0.01-0.01	0.0	-	-0.01	-0.03-0.02	0.0	-
WBH and WBH (Event specific)	0.09	0.04-0.14	0.08	0.02-0.14	0.19	0.07-0.30	0.14	-0.09-0.18
HWWS and used soap for HW (Event specific)	0.0	-0.01-0.00	0.0	-0.01-0.00	0.0	-	0.0	-
HWWS and HWWS BE	0.0	-0.01-0.00	0.0	-0.01-0.00	0.0	-	0.0	-
HWWS and used soap (24hrs)	0.0	-	0.0	-	0.0	-	0.0	-
HWWS and use soap for HW BE	0.0	-0.01-0.00	0.0	-0.01-0.00	0.0	-	0.0	-
HWWS and separate soap available	0.0	-0.01-0.00	-0.01	-0.01-0.00	0.0	-	0.0	-
HWWS and spare soap available	0.0	-0.01-0.00	-0.01	-0.01-0.00	0.0	-	0.0	-
HWWS and knowledge HWWS BE	0.0	-	0.0	-	0.0	-	0.0	-
Observation vs. spot check								
HWWS and availability of soap at HW place	0.0	-	0.0	-	0.0	-	0.0	-
Observation vs. Hand washing demonstration								
HWWW only and HWWW only	0.0	0.00-0.01	0.0	-	0.0	0.00-0.01	0.01	-0.01-0.03
WBH and WBH	0.02	-0.02-0.07	0.03	-0.02-0.07	0.07	0.01-0.13	-0.08	-0.28-0.12
HWWS and HWWS	0.0	0.00-0.01	0.0	0.00-0.01	0.0	-	0.0	-

Author’s own analysis of SHEWA-B Health Impact Study baseline data

7.6.6 Before feeding a child

The results in Table 7.14 are for the hand washing exposure of before feeding a child. The estimated prevalence of whether hands were washed and washing both hands was 23.8% and 15.8% respectively. The very high sensitivity estimate indicates that 98.4% of female caregivers that always washed hands as determined by structured observation reported via self report that they washed hands before feeding a child. However, the very low specificity estimate indicates that only 1.3% of female caregivers that were observed during structured observation to not always wash hands reported that they did not wash hands when asked a specific self report question. This very low specificity estimate indicates that there was a very high false positive rate of 98.7% and those female caregivers that self reported that they washed hands before feeding a child were misreporting that they did as they were not observed to always do so during structured observation.

The results for the comparison of washing both hands during observation compared with a comparative self report question on whether both hands were washed demonstrated a low/moderate sensitivity estimate and a high specificity as shown in Table 7.14. Amongst the observation indicators that assessed hand washing with soap compared with comparative self report questions on soap use for hand washing, the prevalence of hand washing with soap was approximately 3-4%. As this was the highest prevalence amongst the food related hand washing exposures analysed, it is for this reason that the results of the comparison of observation with comparative self report, spot check and hand washing demonstration indicators are discussed as an example.

The general result amongst all of these indicators was high specificity estimates, with the exception of the indicator of observed hand washing with soap compared with a self report indicator on whether soap had been used in the past 24 hours. A further exception was an indicator on observed hand washing with soap compared with a self report question on knowledge of the important times to wash hands which both had high sensitivity estimates.

The only indicator identified to be potentially useful was observed hand washing with soap compared with a self report question on whether spare soap was available in the household. The sensitivity was 50.0% and specificity was 67.6%. However, it should be noted that the confidence intervals for both estimates were considerably wide, particularly for the sensitivity estimate. The 95% confidence interval for the sensitivity estimate was 18.7%-81.3% and 61.9%-72.8% for the specificity estimate. Assessment of the PPV was very low at 4.9% whilst the NPV was very high indicating that 97.6% of female caregivers that were identified by the self report question to not have spare soap available were correctly identified through observation to not always wash hands with soap.

For the other indicators comparing observation with spot check and hand washing demonstration none of the indicators had both high sensitivity and high specificity. Either one or the other was high and this tended to be for the sensitivity estimate. Sensitivity and specificity estimates for the observation indicator of whether hand were washed with soap compared with the spot check indicator on the availability of soap at the place used most often for washing hands for cooking and before preparing food was moderate with both at approximately 40%. However, the PPV was very low but the specificity was very high at 93.8%.

Table 7.14: Before feeding a child

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	23.8	20.3-27.7	98.4	94.2-99.8	1.3	0.4-2.9	23.7	20.1-27.7	71.4	29.4-96.3
WBH and WBH (Event specific)	15.8	11.7-20.6	38.6	24.4-54.5	68.1	61.7-74.0	18.5	11.1-27.9	85.6	79.7-90.3
HWWS and used soap for HW (Event specific)	3.6	1.7-6.5	20.0	2.5-55.6	83.6	78.7-87.9	4.3	0.5-14.8	96.6	93.3-98.5
HWWS and HWWS BFC	3.2	1.6-5.9	0.0	0.0-30.8	91.6	87.9-94.5	0.0	0.0-13.7	96.5	93.6-98.3
HWWS and used soap (24hrs)	3.2	1.6-5.9	100.0	69.2-100.0	1.7	0.5-3.9	3.3	1.6-6.0	100.0	47.8-100.0
HWWS and use of soap for HW BFC	3.2	1.6-5.9	0.0	0.0-30.8	94.3	91.1-96.7	0.0	0.0-19.5	96.5	93.8-98.3
HWWS and separate soap available	3.2	1.6-5.9	20.0	2.5-55.6	73.9	68.5-78.8	2.5	0.3-8.7	96.5	93.2-98.5
HWWS and spare soap available	3.2	1.6-5.9	50.0	18.7-81.3	67.6	61.9-72.8	4.9	1.6-11.1	97.6	94.5-99.2
HWWS and knowledge HWWS BFC	3.2	1.6-5.9	90.0	55.5-99.7	14.7	10.9-19.2	3.4	1.6-6.4	97.8	88.2-99.9
Observation vs. spot check										
HWWS and availability of soap at HW place	4.6	1.9-9.2	42.9	9.9-81.6	41.1	33.0-49.5	3.4	0.7-9.5	93.8	84.8-98.3
Observation vs. Hand washing demonstration										
HWWW only and HWWW only	92.9	88.2-96.2	13.5	8.7-19.5	92.3	64.0-99.8	95.8	78.9-99.9	7.5	3.9-12.7
WBH and WBH	15.0	10.8-21.8	72.4	52.8-87.3	33.5	26.2-41.6	16.9	10.8-24.7	86.7	75.4-94.1
HWWS and HWWS	3.8	1.5-7.7	71.4	29.0-96.3	27.7	21.2-34.9	3.8	1.2-8.6	96.1	86.5-99.5

Author's own analysis of SHEWA-B Health Impact Study baseline data

7.6.7 Stratified results: Before feeding a child

The results featured in Table 7.15 are based on female caregivers that were observed to have one before feeding a child event during structured observation. A comparison of the results in this table with those in Table 7.14 indicated that there was a marked increase in the prevalence of whether hands were washed from 23.8% in the unstratified analysis displayed in Table 7.14 to a prevalence of 51.6% for those that had one event. Furthermore, PPV estimates increased from 23.7% to 51.1% when comparing the unstratified analysis to this analysis and the NPV estimate decreased from 71.4% to 0%.

The prevalence for whether hands were washed increased as outlined, although the prevalence of washing both hands focusing specifically on the comparison of observation with self report indicators revealed a decrease in the prevalence of 15.8% in the unstratified analysis featured in Table 7.14 to 5.3% in Table 7.15. In addition, the sensitivity estimate for the comparison of these indicators increased from 38.6% in the unstratified analysis to 60% in this analysis, whereas the specificity estimate remained relatively unchanged. The PPV estimate also decreased from 18.5% in the unstratified analysis to 8.8% in this analysis whilst the NPV estimate increased from 85.6% to 96.7%.

For all other indicators in this category that compared observed hand washing with soap with relevant self reported soap use availability and knowledge indicators, the prevalence of hand washing with soap was lower than the prevalence observed in the unstratified analysis. This ranged from 3.2%-3.6% amongst indicators in this category in the unstratified analysis featured in Table 7.14 to 1.0%-1.1% as shown in Table 7.15. Overall, amongst the stratified findings the sensitivity, specificity, PPV and NPV estimates were similar, although some of the PPV estimates were lower in the stratified analysis and this was a feature of the lower prevalence.

However, the indicator that compared observed hand washing with soap with a self reported question on whether spare soap was available displayed an increase in the sensitivity estimate from 50% in the unstratified analysis (Table 7.14) to an estimate of 100% as featured in Table 7.15. Although there are two indicators highlighted in yellow in this table indicating potential use as indicators for assessing hand washing behaviour, their worth has to be interpreted with caution as, in particular, for sensitivity estimates, the confidence intervals were considerably wide.

For the indicators comparing observation with spot check, the prevalence of hand washing with soap was lower for female caregivers that had one event compared with those in the unstratified analysis. The sensitivity estimate increased from 42.9% in the unstratified analysis to 100% in this analysis whilst the specificity, PPV and NPV estimates remained relatively unchanged.

For indicators comparing observation with hand washing demonstration indicators, the main difference observed was amongst the observation of washing both hands compared with whether both hands were washed during the hand washing demonstration. In this case, the prevalence decreased from 15% in the unstratified analysis to 6.3% in this analysis and the sensitivity, specificity and PPV estimates all decreased slightly whilst the NPV estimate increased slightly from 86.7% to 92.3%. With the comparison of the observation of hand washing with soap with the hand washing demonstration indicator of whether hands were washed with soap, the prevalence of hand washing with soap decreased slightly from 3.8% in the unstratified analysis to 2.1% in this analysis.

The sensitivity estimate increased from 71.4% to 100% whilst the specificity, PPV and NPV remained relatively unchanged with only a slight increase in the NPV estimate from 96.1% to 100%. This indicated that all females that reported that they did not wash hands with soap were correctly identified to not always wash hands with soap when observed through structured observation.

Table 7.15: Before feeding a child-One event

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	51.6	44.2-59.0	97.9	92.6-99.7	0.0	0.0-4.1	51.1	43.6-58.6	0.0	0.0-84.2
WBH and WBH (Event specific)	5.3	1.7-11.9	60.0	14.7-94.7	65.6	54.8-75.3	8.8	1.9-23.7	96.7	88.7-99.6
HWWS and used soap for HW (Event specific)	1.1	0.0-5.7	0.0	0.0-97.5	81.9	72.6-89.1	0.0	0.0-19.5	98.7	93.1-100.0
HWWS and HWWS BFC	1.0	0.0-5.2	0.0	0.0-97.5	91.3	84.2-96.0	0.0	0.0-33.6	99.0	94.3-100.0
HWWS and used soap (24hrs)	1.0	0.0-5.2	100.0	2.5-100.0	1.9	0.2-6.8	1.0	0.0-5.3	100.0	15.3-100.0
HWWS and use soap of HW BFC	1.0	0.0-5.2	0.0	0.0-97.5	95.2	89.1-98.4	0.0	0.0-52.2	99.0	94.6-100.0
HWWS and separate soap available	1.0	0.0-5.2	0.0	0.0-97.5	72.1	62.5-80.5	0.0	0.0-11.9	98.7	92.9-100.0
HWWS and spare soap available	1.0	0.0-5.2	100.0	2.5-100.0	63.5	53.4-72.7	2.6	0.1-13.5	100.0	94.6-100.0
HWWS and knowledge HWWS BFC	1.0	0.0-5.2	100.0	2.5-100.0	14.4	8.3-22.7	1.1	0.0-6.0	100.0	78.2-100.0
Observation vs. spot check										
HWWS and availability of soap at HW place	1.9	0.0-10.3	100.0	2.5-100.0	41.2	27.6-55.8	3.2	0.1-16.7	100.0	83.9-100.0
Observation vs. Hand washing demonstration										
HWWW and HWWW only	97.9	88.9-99.9	12.8	4.8-25.7	100.0	2.5-100.0	100.0	54.1-100.0	2.4	0.1-12.6
WBH and WBH	6.3	1.3-17.2	66.7	9.4-99.2	26.7	14.6-41.9	5.7	0.7-19.2	92.3	64.0-99.8
HWWS and HWWS	2.1	0.1-11.1	100.0	2.5-100.0	27.7	15.6-42.6	2.9	0.1-14.9	100.0	75.3-100.0

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results in Table 7.16 are based on female caregivers that were observed to have two before feeding child events during the structured observation. In comparison with female caregivers that were assessed in the unstratified analysis and those with only one event, the major findings emerging were that the prevalence of whether hands were washed for female caregivers with two events during structured observation was 17.2%, lower than the prevalence identified in the unstratified analysis featured in Table 7.14.

Similar to previously discussed findings was a very high sensitivity estimate of 100% for the comparison of whether hands were washed during observation with an event specific self report question on whether hands were washed and a very low specificity estimate of 0.9%. This indicated a very high false positive rate of approximately 99% indicating that female caregivers were misreporting that they washed hands when asked a self report question but were observed to not always wash hands during structured observation.

However, the prevalence of washing both hands specifically focusing on observation compared with a self report indicator was similar to the prevalence identified for female caregivers in the unstratified analysis where it was 15.8% and in this analysis it was 17.6%. This was in contrast to the much lower prevalence of 5.3% for female caregivers that experienced a single event. This indicates that those with a single event tended to wash one hand only and those with two or more events as displayed in the unstratified analysis were inconsistent in their behaviour and did not always wash both hands, tending to wash one hand more.

In addition, the sensitivity estimate for female caregivers with two events decreased compared with the unstratified analysis. Amongst the observation indicators that compared hand washing with soap with self reported soap use indicators in this category, the prevalence of hand washing with soap was 2.6% for most indicators and this was similar to the prevalence identified in the unstratified analysis.

Table 7.16: Before feeding a child-Two events

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	17.2	11.2-24.6	100.0	85.2-100.0	0.9	0.0-4.9	17.3	11.3-24.8	100.0	2.5-100.0
WBH and WBH (Event specific)	17.6	9.5-28.8	33.3	9.9-65.1	69.6	55.9-81.2	19.0	5.4-41.9	83.0	69.2-92.4
HWWS and used soap for HW (Event specific)	2.9	0.4-10.2	0.0	0.0-84.2	78.8	67.0-87.9	0.0	0.0-23.2	96.3	87.3-99.5
HWWS and HWWS BFC	2.6	0.3-9.1	0.0	0.0-84.2	93.3	85.1-97.8	0.0	0.0-52.2	97.2	90.3-99.7
HWWS and used soap (24hrs)	2.6	0.3-9.1	100.0	15.8-100.0	1.3	0.0-7.2	2.6	0.3-9.2	100.0	2.5-100.0
HWWS and use soap of HW BFC	2.6	0.3-9.1	0.0	0.0-84.2	90.7	81.7-96.2	0.0	0.0-41.0	97.1	90.1-99.7
HWWS and separate soap available	2.6	0.3-9.1	0.0	0.0-84.2	72.0	60.4-81.8	0.0	0.0-16.1	96.4	87.7-99.6
HWWS and spare soap available	2.6	0.3-9.1	50.0	1.3-98.7	66.7	54.8-77.1	3.8	0.1-19.6	98.0	89.6-100.0
HWWS and knowledge HWWS BFC	2.6	0.3-9.1	100.0	15.8-100.0	16.0	8.6-26.3	3.1	0.4-10.7	100.0	73.5-100.0
Observation vs. spot check										
HWWS and availability of soap at HW place	5.3	0.6-17.7	0.0	0.0-84.2	36.1	20.8-53.8	0.0	0.0-14.8	86.7	59.5-98.3
Observation vs. Hand washing demonstration										
HWWW and HWWW only	93.5	82.1-98.6	11.6	3.9-25.1	100.0	29.2-100.0	100.0	47.8-100.0	7.3	1.5-19.9
WBH and WBH	15.2	6.3-28.9	100.0	59.0-100.0	35.9	21.2-52.8	21.9	9.3-40.0	100.0	76.8-100.0
HWWS and HWWS	2.2	0.1-11.5	100.0	2.5-100.0	20.0	9.6-34.6	2.7	0.1-14.2	100.0	66.4-100.0

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results in Table 7.17 are based on female caregivers that were observed to have three or more before feeding child events during structured observation. The prevalence of whether hands were washed was lowest for female caregivers with three or more events at 2.5% compared with the prevalence identified in the unstratified analysis in Table 7.14 and female caregivers with one and two events in Tables 7.15 and 7.16. The prevalence of washing both hands was however, highest in this sample of females at 23.3% and the sensitivity and specificity estimates were similar to females with two events and those in the unstratified analysis. Overall, the prevalence of hand washing with soap was highest amongst those with three or more events at 5.5% for most indicators and 6.3 % (Observed HWWS compared with the spot check indicator on the availability of soap at the hand washing place).

Firstly focusing on observation compared with self report indicators, the main changes identified amongst this indicator was an increase in the sensitivity estimates compared with the unstratified analysis and the stratified analysis based on one and two events. The specificity estimates increased slightly for some indicators but decreased for others. For example, observed hand washing with soap compared with an event specific question on whether hands were washed with soap which had a specificity of 83.6% in the unstratified analysis compared with 81.9% for those with a single event and 78.8% for two events. The result for those with three or more events was 88.1%.

Conversely, specificity estimates decreased slightly for the observation indicator comparing hand washing with soap with a self report question on knowledge of the importance of hand washing with soap before feeding a child. The PPV estimates tended to increase.

The two results highlighted in blue in Table 7.17 signify that these indicators were identified to have moderately high sensitivity and specificity estimates (The observation indicator of hand washing with soap compared with the self reported indicator on whether spare soap was available in the household and the spot check indicator on whether soap was available at the hand washing location). However, the sensitivity estimates had considerably wide confidence intervals and this was similarly the case for the indicator in the unstratified and stratified analysis based on those with one and two events.

The main findings for the comparison of observation indicators with those from the hand washing demonstration was that the prevalence of hand washing with water only for those with three events decreased compared with those from the other analyses. The prevalence of washing both hands increased as previously outlined as did the prevalence of hand washing with soap for female with three or more events.

The sensitivity estimates decreased, particularly for observation indicators comparing washing both hands and hand washing with soap with similar hand washing demonstration indicators. The specificity estimates increased for both of these indicators but decreased for the observation indicator of washing hands with water only compared with the hand washing demonstration indicator. Overall, both the PPV and NPV estimates were slightly lower than in the other analyses.

Table 7.17: Before feeding a child-Three or more events

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	2.5	0.8-5.8	100.0	47.8-100.0	2.1	0.6-5.2	2.6	0.8-5.9	100.0	39.8-100.0
WBH and WBH (Event specific)	23.3	15.9-32.0	37.0	19.4-57.6	69.7	59.0-79.0	27.0	13.8-44.1	78.5	67.8-86.9
HWWS and used soap for HW (Event specific)	6.0	2.5-12.0	28.6	3.7-71.0	88.1	80.5-93.5	13.3	1.7-40.5	95.0	88.8-98.4
HWWS and HWWS BFC	5.5	2.2-11.0	0.0	0.0-41.0	90.8	84.2-95.3	0.0	0.0-28.5	94.0	88.0-97.5
HWWS and used soap (24hrs)	5.5	2.2-11.0	100.0	59.0-100.0	1.7	0.2-5.9	5.6	2.3-11.2	100.0	15.8-100.0
HWWS and use soap of HW BFC	5.5	2.2-11.0	0.0	0.0-41.0	95.8	90.5-98.6	0.0	0.0-52.2	94.3	88.5-97.7
HWWS and separate soap available	5.5	2.2-11.0	28.6	3.7-71.0	76.7	68.1-83.9	6.7	0.8-22.1	94.8	88.4-98.3
HWWS and spare soap available	5.5	2.2-11.0	42.9	9.9-81.6	71.7	62.7-79.5	8.1	1.7-21.9	95.6	89.0-98.8
HWWS and knowledge HWWS BFC	5.5	2.2-11.0	85.7	42.1-99.6	14.2	8.5-21.7	5.5	2.0-11.6	94.4	72.7-99.9
Observation vs. spot check										
HWWS and availability of soap at HW place	6.3	1.8-15.5	50.0	6.8-93.2	44.1	31.2-57.6	5.7	0.7-19.2	92.9	76.5-99.1
Observation vs. Hand washing demonstration										
HWWW and HWWW only	90.0	81.9-95.3	14.8	7.9-24.4	88.9	51.8-99.7	92.3	64.0-99.8	10.4	4.6-19.4
WBH and WBH	21.1	13.2-31.0	63.2	38.4-83.7	36.6	25.5-48.9	21.1	11.4-33.9	78.8	61.1-91.0
HWWS and HWWS	5.6	1.8-12.5	60.0	14.7-94.7	31.8	22.1-42.8	4.9	1.0-13.7	93.1	77.2-99.2

Author’s own analysis of SHEWA-B Health Impact Study baseline data

The figures in Table 7.18 display the number of true positives and the total sample size for before feeding a child. The figures particularly the number of true positives which assessed indicators involving soap use for the overall (unstratified) analysis (depicted in the first column) and the number of true positives female caregivers in the stratified analysis for those females with one, two and three or more events illustrates that the number of true positives analysed was very low. The total sample size was also given to illustrate the number of females featured in the analysis.

Table 7.18: Summary table of true positives and total sample size for before feeding a child

Comparison Indicators	True Positives (TP) Before feeding a child	Total sample size (TSS)	TP One event	TSS	TP Two events	TSS	TP Three plus events	TSS
Observation vs. self report								
WH and WH (Event specific)	121	517	93	184	23	134	5	199
WBH and WBH (Event specific)	17	279	3	95	4	68	10	116
HWWS and used soap for HW (Event specific)	2	279	0	95	0	68	2	116
HWWS and HWWS BFC	0	309	0	105	0	77	0	127
HWWS and used soap (24hrs)	10	309	1	105	2	77	7	127
HWWS and use soap of HW BFC (24hrs)	0	309	0	105	0	77	0	127
HWWS and separate soap available	2	309	0	105	0	77	2	127
HWWS and spare soap available	5	309	1	105	1	77	3	127
HWWS and knowledge HWWS BFC	9	309	1	105	2	77	6	127
Observation vs. spot check								
HWWS and availability of soap at HW place	3	153	1	52	0	38	2	63
Observation vs. Hand washing demonstration								
HWWW only and HWWW only	23	184	6	48	5	46	12	90
WBH and WBH	21	184	2	48	7	46	12	90
HWWS and HWWS	5	184	1	48	1	46	3	90

Author’s own analysis of SHEWA-B Health Impact Study baseline data

7.6.8 Analysis using kappa statistics

The results in Table 7.19 are based on the calculated kappa statistics for the unstratified results before feeding a child taking into account all of the hand washing events observed and the three stratified categories. The results for the analysis of stratified events were in the direction of the results obtained through the use of a screening test approach, although the kappa values were low. The exception was the identification of a slight level of agreement (kappa 0.11) for the self report indicator of an event specific question on using soap for hand washing before feeding a child compared with observed hand washing with soap through structured observation. The remainder of the results were in the categories of no to slight levels of agreement.

Table 7.19: Kappa statistics for before feeding a child food events (Unstratified and Stratified)

Comparison Indicators	Before feeding a child (BFC)	CI (95%)	BFC One event	CI (95%)	BFC Two events	CI (95%)	BFC Three plus events	CI (95%)
Observation vs. self report								
WH and WH (Event specific)	0.0	-0.01-0.01	-0.02	-0.05-0.01	0.0	0.00-0.01	0.0	-
WBH and WBH (Event specific)	0.05	-0.06-0.15	0.07	-0.06-0.20	0.02	-0.20-0.25	0.06	-0.12-0.24
HWWS and used soap for HW (Event specific)	0.01	-0.08-0.11	-0.02	-0.06-0.02	-0.05	-0.12-0.01	0.11	-0.12-0.33
HWWS and HWWS BFC	-0.05	-0.07- -0.03	-0.02	-0.05-0.01	-0.04	-0.08-0.00	-0.07	-0.11- -0.04
HWWS and used soap (24hrs)	0.0	-	0.0	-	0.0	-	0.0	-
HWWS and use soap of HW BFC	-0.04	-0.06- -0.02	-0.02	-0.04-0.01	-0.04	-0.09-0.00	-0.05	-0.08- -0.02
HWWS and separate soap available	-0.01	-0.07-0.04	-0.02	-0.05-0.02	-0.05	-0.11-0.02	0.02	-0.11-0.16
HWWS and spare soap available	0.03	-0.03-0.09	0.03	-0.03-0.09	0.02	-0.08-0.13	0.05	-0.08-0.18
HWWS and knowledge HWWS BFC	0.0	-0.01-0.02	0.0	0.0-0.01	0.01	0.00-0.02	0.0	-0.03-0.03
Observation vs. spot check								
HWWS and availability of soap at HW place	-0.02	-0.08-0.04	0.03	-0.03-0.08	-0.11	-0.25-0.04	-0.01	-0.12-0.10
Observation vs. Hand washing demonstration								
HWWW only and HWWW only	0.01	-0.02-0.03	0.01	-0.01-0.02	0.02	-0.01-0.04	0.01	-0.04-0.06
WBH and WBH	0.03	-0.05-0.10	-0.01	-0.10-0.08	0.15	0.03-0.26	0.0	-0.14-0.14
HWWS and HWWS	0.0	-0.04-0.03	0.02	-0.02-0.05	0.01	-0.01-0.03	-0.01	-0.08-0.06

Author’s own analysis of SHEWA-B Health Impact Study baseline data

7.6.9 Summary

Overall, the stratified analysis of food related hand washing events using the two different methods to assess the validity of hand washing indicators did not produce results that were markedly different to the analysis that assessed the validity of indicators taking into account all hand washing events experienced by an individual. Therefore, this suggests that the number of hand washing events does not pose any significant effect to the investigation of, or the choice and selection of indicators as the indicators that were chosen on the whole were consistently identified in both the stratified and unstratified analysis to represent indicators that were potential and possible indicators for assessing hand washing behaviour in the absence of structured observation methods.

The implications of this are that for food related exposures where the use of soap is a low priority, assessing all hand washing events together is recommended. However, although these findings are relevant to this research and setting, it may not be the case in other country settings where hand washing practices may differ. Therefore, it is recommended that when assessing indicators to use both approaches to assess whether the role of multiple events has any impact on the validity and choice of indicators.

This approach is also suggested for any events where there may be multiple events observed, including defecation related events. This approach may also be even more important in this context as soap use is higher as demonstrated from the results of this research. However, due to few hand washing events being observed after defecation, and only one hand washing event being observed per individual, limited knowledge existed about the consistency of hand washing practice for those with more than one event and whether soap is consistently used for hand washing. Therefore further investigation through stratification based on the number of hand washing events may identify different indicators that are valid for measuring hand washing behaviour compared with assessing all hand washing events together.

The results in Table 7.20 display a summary of all of the structured observation and comparative indicators assessed through the different methods where validity was assessed through applying an epidemiological screening test approach. The results demonstrate that the results using this approach were consistent across the three food related critical hand washing exposures regardless of the number of hand washing events observed during structured observation which were illustrated in the stratified analysis. The results of the analysis of food related critical times using kappa statistics were not included in the table as the results for all of the food related critical times demonstrated very low levels of agreement that fell within the no to slight levels of agreement range.

Table 7.20: Summary table for valid food related critical hand washing measures using an epidemiological screening test approach (Unstratified and Stratified)

Comparison Indicators	Before preparing food (BPF)	BPF One event	BPF Two events	BPF Three plus events	Before eating (BE)	BE One event	BE Two events	BE Three plus events	Before feeding a child (BFC)	BFC One event	BFC Two events	BFC Three plus events
Observation vs. self report												
WH and WH (Event specific)												
WBH and WBH (Event specific)					√	√	√	√		√		
HWWS and used soap for HW (Event specific)												
HWWS and HWWS BPF/BE/BFC												
HWWS and used soap (24hrs)												
HWWS and use soap of HW BPF/BE/BFC												
HWWS and separate soap available												
HWWS and spare soap available			√						√	√	√	◊
HWWS and knowledge HWWS BPF/BE/BFC	√	√		√								
Observation vs. spot check												
HWWS and availability of soap at HW place		◊	◊									◊
Observation vs. Hand washing demonstration												
HWWW only and HWWW only												
WBH and WBH	◊	◊	◊									
HWWS and HWWS												

Author’s own analysis of SHEWA-B Health Impact Study baseline data

7.7 Defining hand washing behaviour for defecation related critical times

The hand washing practice observed for defecation related hand washing exposures was rather different than those displayed for food related activities. The main difference between defecation and food related hand washing behaviour was that both hands tended to be washed for defection related events. The use of hand washing materials, in particular, the use of soap was also far higher for these events compared with food related critical hand washing exposures.

For example, approximately 59% of events used only water to wash hands for the critical time of after cleaning a child's anus/disposing of a child's stools and in 46% of events was only water used for washing hands after defecation. The same analysis was performed comparing the validity of each indicator with its comparable indicator from the other alternative measurement methods of self report, spot check and a hand washing demonstration.

7.7.1 After cleaning a child's bottom or disposing of a child's stools

The results in Table 7.21 are based on hand washing events that took place after cleaning a child's bottom or disposing of a child's stools. The results demonstrate that for some indicators, for example, whether hands were washed and its comparative self report indicator of a question focusing on whether hands were washed for the same event, the sensitivity estimate was very high, (100%). Similarly, sensitivity was 99% for the observation indicator of whether hands were washed with soap compared with a comparative self report indicator of whether soap was used in the past 24 hours. However, both indicators and their comparative self report questions displayed very low specificity estimates of 0% and 4.8% respectively.

The results demonstrate that all female caregivers that were observed to always wash hands during structured observation also reported that they washed hands for this event when asked a self report question on whether they washed hands. Similarly, nearly all female caregivers that were observed to hand wash with soap also reported that they had used soap in the past 24 hours.

The very low specificity estimates for both of these indicators demonstrates that no female caregivers fell into the category of not always washing hands during structured observation and subsequently reported that they did not wash hands when asked in a self report question.

In the wider context, these low specificity estimates illustrate that female caregivers that did not wash hands were incorrectly classifying themselves, i.e. they were not observed to wash hands but responded to a self report question that they had washed hands. The 29 female caregivers that did not wash hands during observation reported washing their hands in a self report question. This resulted in a false positive rate of 100%. The reasons for this may be due to courtesy bias whereby respondents feel obliged to offer responses that are thought to be socially acceptable. This can be further illustrated through the awareness of respondents that hands should be washed on this occasion, but this is not illustrated in their observed practice, demonstrated by the high level of misreporting indicated by the high false positive rate identified.

Table 7.21: After cleaning a child's bottom/disposing of a child's stools

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event spec.)	89.0	84.5-92.5	100.0	98.4-100.0	0.0	0.0-11.9	89.0	84.5-92.5	-	-
WBH and WBH (Event spec.)	49.8	43.3-56.3	60.2	50.7-69.1	30.3	22.2-39.3	46.1	38.1-54.3	43.4	32.5-54.7
HWWS and used soap for HW (Event spec.)	27.4	21.8-33.6	76.9	64.8-86.5	41.9	34.4-49.6	33.3	25.9-41.5	82.8	73.2-90.0
HWWS and used ash for HW (Event spec.)	8.9	5.6-13.2	14.3	3.0-36.3	93.1	88.8-96.1	16.7	3.6-41.4	91.8	87.3-95.1
HWWS and HWWS ACCB	27.1	21.8-33.0	57.1	44.7-68.9	64.4	57.1-71.2	37.4	28.2-47.3	80.1	72.9-86.2
HWWS and HWWS ADCS	27.1	21.8-33.0	12.9	6.1-23.0	94.7	90.4-97.4	47.4	24.4-71.1	74.5	68.5-79.9
HWWS and used soap (24hrs)	27.1	21.8-33.0	98.6	92.3-100.0	4.8	2.2-8.9	27.8	22.3-33.8	90.0	55.3-99.7
HWWS and used soap ACCB (24hrs)	27.1	21.8-33.0	64.3	51.9-75.4	57.4	50.0-64.6	36.0	27.6-45.1	81.2	73.5-87.5
HWWS and separate soap available	27.1	21.8-33.3	27.1	17.2-39.1	75.5	68.7-81.5	29.2	18.6-41.8	73.6	66.8-79.6
HWWS and spare soap available	27.1	21.8-33.0	41.4	29.8-53.8	70.2	63.1-76.6	34.1	24.2-45.2	76.3	69.3-82.4
HWWS and knowledge HWWS ACCB	27.1	21.8-33.0	51.4	39.2-63.6	45.7	38.5-53.2	26.1	19.0-34.2	71.7	62.7-79.5
Observation vs. spot check										
HWWW only and availability of water	57.0	50.5-63.3	74.1	66.0-81.2	21.0	13.6-30.0	55.4	47.9-62.7	37.9	25.5-51.6
HWWS and soap at HW place	27.9	22.3-33.9	67.6	55.2-78.5	54.0	46.3-61.5	36.2	27.9-45.2	81.2	72.9-87.8
HWWA and ash at HW place	8.6	5.4-12.9	28.6	11.3-52.2	85.7	80.4-90.0	15.8	6.0-31.3	92.7	88.3-95.9
Observation vs. Hand washing demonstration										
HWWW only and HWWW only	63.8	55.5-71.5	22.1	14.2-31.8	90.7	79.7-96.9	80.8	60.6-93.4	39.8	31.1-49.1
WBH and WBH	45.0	36.8-53.3	61.2	48.5-72.9	36.6	26.2-48.0	44.1	33.8-54.8	53.6	39.7-67.0
HWWS and HWWS	21.5	15.2-28.9	81.3	63.6-92.8	35.9	27.2-45.3	25.7	17.6-35.4	87.5	74.8-95.3

Author's own analysis of SHEWA-B Health Impact Study baseline data

*Numbers featured in brackets in the comparison indicators column refer to the number of female caregivers observed during structured observation and had comparable data for self report, spot check and the hand washing demonstration as assessed by a cross sectional survey

Conversely, two observation indicators and their comparative self report indicators were identified to have very high specificity estimates. One indicator had a specificity estimate of over 90% (hand washing with soap during the observation compared with a self reported question on hand washing with soap after disposing of a child's stools) and the other had a specificity of 75.5% (hand washing with soap during observation compared with a self reported question on the availability of separate soap). However, both of these indicators had low sensitivity estimates.

The high specificity estimates indicates that in this case, female caregivers that were observed to not always wash hands with soap also reported that they did not wash hands with soap after disposing of a child's stools. Similarly with the other indicator, female caregivers that did not wash hands with soap also reported that they did not have separate soap available for hand washing. However, in terms of the low sensitivity estimates, the interpretation is that a low proportion of female caregivers that were observed to wash hands with soap also reported that they washed hands with soap. This was also the case for those that also reported that they had separate soap available.

Two indicators were identified to be useful indicators for potentially providing a valid measure of hand washing behaviour. These measures had moderately high sensitivity and specificity. The two indicators (highlighted in yellow in Table 7.21) were the observation of hand washing with soap compared with a self reported indicator of whether hands were washed with soap, with sensitivity and specificity estimates of 57.1% and 64.4% respectively. Similar estimates were achieved for the observation indicator of washing hands with soap during observation compared with a self reported indicator on the use of soap for hand washing specifically after cleaning a child's bottom in the past 24 hours. The sensitivity and specificity estimates for this were 64.3% and 57.4% respectively. Also important to note were the false negative and false positive rates that ranged between approximately 35% and 45%. This indicated that there were a substantial number of females who misreported their practices. Positive predictive values for both of these indicators and their self report comparators were 37.4% and 36% respectively.

This indicates that of those female caregivers that were identified through self report question as washing their hands with soap after cleaning a child bottom (n = 107), 37.4% of female caregivers (n= 40) were correctly identified to wash hands with soap during structured observation. The interpretation is similar for the other PPV of 36% indicating that of the female caregivers that reported and gave a positive response for using soap specifically for cleaning a child's bottom is the past 24 hours (n=125), 36% of female caregivers (n=45) were correctly identified to wash hands with soap.

However, for both indicators compared with their comparative alternative measurement methods, NPVs of over 80% were obtained for both indicators indicating that in total, female caregivers that reported that they did not wash hands with soap were also observed to not always wash hands with soap after cleaning a child's bottom and did not always use soap after cleaning a child's bottom giving NPV values of 80.2% and 81.2% respectively.
The higher NPVs indicate that a higher proportion of female caregivers that were identified by self report to not perform a particular behaviour, for example, not washing hands with soap after cleaning a child's bottom were correctly identified by observation to also not always wash hands with soap after cleaning a child's bottom. This was opposed to correct identification among those that self reported that they performed a particular behaviour and who were correctly identified by observation to also perform a particular behaviour.

Results highlighted in blue indicate results that were potentially useful indicators as described in Table 7.2. For the other indicators comparing observation with spot check and observation with hand washing demonstration indicators, only one indicator emerged with moderately high sensitivity and specificity estimates. This was the observation of hand washing with soap compared with its comparative spot check indicator on the availability of soap near the designated place used to wash hands most often after coming back from the toilet.

The results were similar to the other indicators discussed with sensitivity and specificity estimates of 67.4% and 54% respectively. However, the associated 95% confidence intervals were quite wide indicating that the precision of the estimate was low due to the sample size. Similarly, the PPV and NPV values of 36.2% and 81.2% were similar to estimates achieved for the two other indicators that were identified in the observation compared with self report indicators discussed above. Other indicators within these two sections (Observation compared with spot check and the hand washing demonstration) achieved either very high sensitivity estimates or very high specificity estimates, but not both.

7.7.2 After defecation

The results featured in Table 7.22 refer to the comparison of hand washing indicators after defecation. Firstly, focusing on the comparison of observation compared with self report indicators, four indicators and their comparative self report indicators were identified to have very high sensitivity estimates of over 90%, with two of these indicators having sensitivity estimates that were close to and at 100%. Two indicators with particularly high sensitivity of 98.1% and 100% were whether hands were washed during observation compared with a self reported question on whether hands were washed and the observation indicator of whether hands were washed with soap compared with a self reported indicator on whether soap was used in the past 24 hours. However, they had very low specificity estimates of 0% and 2.9% respectively.

This indicates that female caregivers who washed hands during observation also reported that they washed hands when asked a self report question on whether they washed hands. However, the very low specificity estimates indicates that female caregivers that did not always wash hands during observation did not accurately report that they did not wash hands when asked a self report question on whether hands were washed. Therefore, the interpretation of this was that there was a high false positive rate of females that were observed to not always wash hands after defecation, but when asked a self report question on whether they washed hands they responded that they did, highlighted by a 100% false positive rate. This could also be attributed to factors previously discussed relating to courtesy bias and the knowledge and awareness of respondents that hands should be washed on this occasion, but the lack of demonstration of this practice during observation.

Table 7.22: After defecation

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
WH and WH (Event specific)	96.4	87.7-99.6	98.1	90.1-100.0	0.0	0.0-84.2	96.4	97.5-99.6	0.0	0.0-97.5
WBH and WBH (Event specific)	55.6	41.4-69.1	76.7	57.7-90.1	62.5	40.6-81.2	71.9	53.3-86.3	68.2	45.1-86.1
HWWS and used soap (Event specific)	35.2	22.7-49.4	73.7	48.8-90.9	57.1	39.4-73.7	48.3	29.4-67.5	80.0	59.3-93.2
HWWS and used ash (Event specific)	16.7	7.9-29.3	33.3	7.5-70.1	93.3	81.7-98.6	50.0	11.8-88.2	87.5	74.8-95.3
HWWS and HWWS AD	37.5	24.9-51.5	95.2	76.2-99.9	31.4	16.9-49.3	45.5	30.4-61.2	91.7	61.5-99.8
HWWA and HWWA AD	16.1	7.6-28.3	44.4	13.7-78.8	80.9	66.7-90.9	30.8	9.1-61.4	88.4	74.9-96.1
HWWS and used soap (24hrs)	37.5	24.9-51.5	100.0	83.9-100.0	2.9	0.1-14.9	38.2	25.4-52.3	100.0	2.5-100.0
HWWS and use of soap for HW AD (24hrs)	37.5	24.9-51.5	76.2	52.8-91.8	62.9	44.9-78.5	55.2	35.7-73.6	81.5	61.9-93.7
HWWS and separate soap available	37.5	24.9-51.5	28.6	11.3-52.2	88.6	73.3-96.8	60.0	26.2-87.8	67.4	52.0-80.5
HWWS and spare soap available	37.5	24.9-51.5	47.6	25.7-70.2	68.6	50.7-83.1	47.6	25.7-70.2	68.6	50.7-83.1
HWWS and knowledge HWWS ACCB	37.5	24.9-51.5	90.5	69.6-98.8	14.3	4.8-30.3	38.8	25.2-53.8	71.4	29.0-96.3
Observation vs. spot check										
HWWW only and availability of water	45.3	31.6-59.6	75.0	53.3-90.2	20.7	8.0-39.7	43.9	28.5-60.3	50.0	21.1-78.9
HWWS and soap at HW place	39.6	26.5-54.0	71.4	47.8-88.7	46.9	29.1-65.3	46.9	29.1-65.3	71.4	47.8-88.7
HWWA and ash at HW place	15.1	6.7-27.6	25.0	3.2-65.1	88.9	75.9-96.3	28.6	3.7-71.0	87.0	73.7-95.1

Author's own analysis of SHEWA-B Health Impact Study baseline data

*Numbers featured in brackets in the comparison indicators column refer to the number of female caregivers observed during structured observation and had comparable data for self report, spot check and the hand washing demonstration as assessed by a cross sectional survey

Conversely, two indicators had very high specificity estimates (the structured observation indicator of hand washing with soap compared with a self report indicator on whether ash was used for hand washing based on a series of event specific question on this exposure). The specificity estimate was 93.3%. In addition, the same structured observation indicator compared with a self report indicator on the availability of spare soap. In this case, the specificity was 88.6%. These indicators had low sensitivity scores indicating that in terms of high specificity a high proportion of female caregivers that were true negatives were identified by self report.

In terms of the indicators that were identified to be possible useful indicators for measuring hand washing behaviour, three indicators in the observation compared with self reported category displayed both high sensitivity and specificity estimates as highlighted in yellow in Table 7.22. In this case, sensitivity estimates were greater than70% and specificity estimates ranged between 57% and 69%. However, on closer inspection the associated 95% confidence intervals were wide, relating to the small sample size of defecation events observed.

In all three indicators and compared with their self report comparators, the NPV value tended to be high ranging from 68.2% to 81.5% indicating that there was a high probability (80%) of female caregivers that self reported that they did not hand wash with soap who were correctly identified through observation that they did not always use soap for hand washing.

In terms of observation compared with a spot check indicators the emerging theme from these indicators was either high sensitivity or high specificity estimates. Only one indicator highlighted in blue demonstrated some potential and this was hand washing with soap during observation and the spot check indicator on the availability of soap at the place used most often for hand washing after using the toilet with a sensitivity of 71.4%, and a specificity of 46.9%. Once again, the associated 95% confidence intervals were very wide. No calculations could be undertaken for the comparison of observation indicators with comparative hand washing demonstration indicators due to the very small sample size of female caregivers that participated in the hand washing demonstration who also had a defecation related exposure.

The figures in Table 7.23 display the number of true positives and the total sample size for defecation related critical times. The figures, particularly the number of true positives that assessed indicators involving soap use for the overall (unstratified) analysis depicted in the first column and the number of true positives female caregivers in the stratified analysis for those females with one, two and three plus events illustrates that the number of true positives analysed was low, but higher than those identified for food related critical times.

Table 7.23: Summary table of true positives and total sample size for defecation events

Comparison Indicators	(True Positives) After cleaning a child's bottom/ disposing of a child's stools	Total Sample Size	(True Positives) After defecation	Total Sample Size
Observation vs. self report				
WH and WH (Event spec.)	234	263	53	56
WBH and WBH (Event spec.)	71	237	23	54
HWWS and used soap for HW (Event spec.)	50	237	14	54
HWWS and used ash for HW (Event spec.)	3	237	3	54
HWWS and HWWS ACCB/AD	40	258	20	56
HWWS and HWWS ADCS/AD	9	258	-	-
HWWA and HWWA	-	-	4	56
HWWS and used soap (24hrs)	69	258	21	56
HWWS and used soap ACCB (24hrs)			16	56
HWWS and separate soap available	19	258	6	56
HWWS and spare soap available	29	221	10	56
HWWS and knowledge HWWS	36	258	19	56
Observation vs. spot check				
HWWW only and availability of water	103	244	18	53
HWWS and soap at HW place	46	244	15	53
HWWA and ash at HW place	6	244	2	53
Observation vs. Hand washing demonstration				
HWWW only and HWWW only	21	149	-	-
WBH and WBH	41	149	-	-
HWWS and HWWS	26	149	-	-

Author's own analysis of SHEWA-B Health Impact Study baseline data

7.7.3 Analysis using kappa statistics

The analysis using kappa statistics for defecation related critical times identified the highest results of all of the critical hand washing times assessed. The results are displayed in Table 7.24. The results for after cleaning a child/disposing of a child's stools were overall consistent with the results obtained through the use of a screening test approach method. However, the indicator with the highest kappa score of 0.35 comparing the observed practice of hand washing with soap with a self report question on the availability of spare soap was identified in the screening test approach to be moderately effective as a potential indicator. The other indicators that were identified to be possible indicators that could be used as an alternative to structured observation, on the contrary, had low kappa scores between 0 and 0.20 indicating only a slight level of agreement.

The highest kappa statistic identified of 0.39 was for after defecation, comparing observed practice of washing both hands with an event specific self report question based on the same exposure. The interpretation of this result on the kappa scale taken from Table 7.3 illustrates fair agreement. All other results were consistent with those identified though the application of a screening test approach. However, there were other indicators that were not identified by the screening test approach that were identified as being potential indicators by the analysis using kappa statistics. These included the use of separate soap for hand washing compared with observed practice of hand washing with soap and the availability of ash at the hand washing place compared with the observed practice of washing hands with ash as observed during structured observation.

Table 7.24: Kappa statistics for defecation related hand washing indicators

Comparison Indicators	After cleaning a child's bottom/ disposing of a child's stools	CI (95%)	After defecation	CI (95%)
Observation vs. self report				
WH and WH (Event spec.)	0.0	-	-0.02	-0.06-0.01
WBH and WBH (Event spec.)	-0.10	-0.22-0.03	0.39	0.15-0.64
HWWS and used soap for HW (Event spec.)	0.13	0.04-0.23	0.28	0.04-0.51
HWWS and used ash for HW (Event spec.)	0.08	-0.08-0.24	0.31	-0.03-0.65
HWWS and HWWS ACCB/AD	0.18	0.07-0.30	-	-
HWWS and HWWS ADCS/AD	0.10	-0.01-0.21	0.22	0.06-0.38
HWWA and HWWA	0.08	-0.08-0.24	0.21	-0.08-0.51
HWWS and used soap (24hrs)	0.02	0.00-0.04	0.02	-0.02-0.06
HWWS and used soap ACCB (24hrs)	0.17	0.06-0.28	0.36	0.13-0.60
HWWS and separate soap available	0.03	-0.10-0.15	0.19	-0.05-0.43
HWWS and spare soap available	0.35	0.24-0.47	0.16	-0.10-0.42
HWWS and knowledge HWWS	-0.02	-0.13-0.08	0.04	-0.10-0.17
Observation vs. spot check				
HWWW only and availability of water	-0.05	-0.17-0.06	-0.04	-0.26-0.17
HWWS and soap at HW place	0.03	-0.04-0.10	0.17	-0.07-0.41
HWWA and ash at HW place	0.10	-0.04-0.25	0.15	-0.18-0.47
Observation vs. Hand washing demonstration				
HWWW only and HWWW only	0.10	0.01-0.19	-	-
WBH and WBH	-0.02	-0.17-0.13	-	-
HWWS and HWWS	0.10	0.00-0.19	-	-

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results displayed in Table 7.25 provide a summary of potential and possible indicators based on the screening style analysis and analysis using kappa statistics. For indicators where there is a tick, this indicates that this indicator demonstrated potential as an indicator for use as an alternative to structured observation. The indicators where there is a diamond illustrates that these are possible indicators that achieved moderate estimates. For kappa statistics, a tick against an indicator illustrates a kappa value of greater than 0.20 indicating a fair level of agreement (0.20-0.40). If the tick is featured in bold this means that this indicator was at the high end of the kappa scale. The indicators that have a diamond featured against the indicator indicate that there was only a slight level agreement. For this category, only indicators that had a kappa value of 0.10 and above were taken as anything below this indicated very slight agreement.

Table 7.25: Summary table for selected defecation related hand washing indicators using an epidemiological style approach and kappa statistics

Comparison Indicators	After cleaning a child/ disposing of stools (Screening)	After cleaning a child's bottom/ disposing of stools (Kappa)	After defecation (Screening)	After defecation (Kappa)
Observation vs. self report				
WH and WH (Event spec.)				
WBH and WBH (Event spec.)			**√**	√
HWWS and used soap for HW (Event spec.)	◊	◊	√	√
HWWS and used ash for HW (Event spec.)				√
HWWS and HWWS ACCB	√	◊		
HWWS and HWWS ADCS		◊		√
HWWA and HWWA			◊	√
HWWS and used soap (24hrs)				
HWWS and used soap ACCB/AD (24hrs)	√	◊	√	**√**
HWWS and separate soap available				◊
HWWS and spare soap available	◊	**√**	◊	◊
HWWS and knowledge HWWS	◊			
Observation vs. spot check				
HWWW only and availability of water				
HWWS and soap at HW place	√		◊	◊
HWWA and ash at HW place		◊		◊
Observation vs. Hand washing demonstration				
HWWW only and HWWW only		◊		
WBH and WBH				
HWWS and HWWS		◊		

Author's own analysis of SHEWA-B Health Impact Study baseline data

7.7.4 Validating defecation hand washing indicators: Washing both hands with soap vs. other indicators

As previously discussed, washing both hands with soap for the critical food related times was rare. This behaviour was more prevalent for defecation related activities. Therefore, in this section of the analysis, the prime focus was on defecation related behaviours and washing both hands with soap recorded through structured observation. As this behaviour was more prevalent, the “reference standard” was taken as washing both hands with soap. All other indicators collected through the different measurement methods including self report, spot check and a hand washing demonstration were compared with this structured observation reference standard indicator.

The role and potential of washing both hands with soap or ash is what is promoted from a public health perspective. This analysis therefore places this as the reference standard to compare other indicators with. The rationale of this was to assess whether there were any other indicators that could be used aside from structured observation that correctly identify female caregivers that do and do not practice a particular behaviour, in this case, hand washing with soap.

The results in Table 7.26 are based on the comparison of the observation indicator on whether both hands were washed with soap or ash compared with self report, spot check and hand washing demonstration indicators after cleaning a child’s bottom/disposing of a child’s stools. Firstly, assessing observation compared with self reported indicators, the prevalence of washing both hands with soap was approximately 23% amongst all indicators in this category. As with the discussion of previous tables, comparison of the reference standard of washing both hands with soap with a self report question on whether hands were washed resulted in a very high sensitivity estimate of 100% and 0% specificity.

The result of this was a high false positive rate of 100%. The high sensitivity estimate indicates that all female caregivers that were determined by structured observation to always wash hands also responded positively to a question when asked whether they specifically washed their hands. However, a specificity of 0% indicates that no female caregivers were observed to not always wash hands and self reported that they did not wash hands when asked a specific question on whether hands were washed after cleaning a child’s bottom/disposing of a child’s stools. Therefore, there were no true negatives.

What this does illustrate, however, is that there was a high false positive rate as discussed above. These female caregivers misreported their practices in that they reported instead that they did wash their hands for this event but were not observed to always do so. The other main observation amongst the results featured in this category was that specificity estimates tended to be high. The exception of this was for the comparison of the reference standard with a self report question on whether soap was used in the past 24 hours which had a high sensitivity estimate.

The two results highlighted in yellow were indicators with the potential to be useful and valid indicators for assessing hand washing behaviour. In the case of the reference standard and the self reported indicators that they were compared with both the sensitivity and the specificity estimates fitted the criteria for selection of both being over 50%. The two potential indicators were a question on whether hands were washed with soap specifically after cleaning a child's bottom and a recall question on the use of soap in the past 24 hours for hand washing also after cleaning a child's bottom. For both of these indicators compared with the reference standard, the PPV and NPV estimates were approximately 30% and 80% respectively.

The indicators featured in blue in this category were potential indicators that may be useful for assessing hand washing behaviours. Amongst the other indicators comparing observation with spot check and hand washing demonstration indicators, one indicator, the spot check indicator was identified as having both high sensitivity and specificity estimates. The PPV and NPV estimates were similar to the two indicators discussed above. This was the observed presence of soap at the hand washing location used most often after going to the toilet. The general trend amongst the other indicators was high specificity estimates.

Table 7.26: Washing both hands with soap after cleaning a child's bottom/disposing of a child's stools

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
HWWSA BH and WH (Event specific)	23.2	18.0-29.1	100.0	93.5-100.0	0.0	0.0-2.0	23.2	18.0-29.1	-	-
HWWSA BH and WBH (Event specific)	23.5	18.9-29.4	58.9	45.0-71.9	33.0	26.2-40.3	21.3	15.1-28.6	72.3	61.4-81.6
HWWSA BH and used soap for HW (Event specific)	23.2	18.0-29.0	76.4	63.0-86.8	40.7	33.5-48.2	28.0	21.0-35.9	85.1	75.8-91.8
HWWSA BH and used ash for HW (Event specific)	23.2	18.0-29.1	0.0	0.0-6.5	90.1	84.8-94.0	0.0	0.0-18.5	74.9	68.9-80.5
HWWSA BH and HWWS ACCB	23.3	18.2-28.9	55.0	41.6-67.9	62.6	55.5-69.4	30.8	22.3-40.5	82.1	75.1-87.9
HWWSA BH and HWWS ADCS	23.3	18.2-28.9	13.3	5.9-24.6	94.4	90.3-97.2	42.1	20.3-66.5	78.2	72.5-83.3
HWWSA BH and HWWA ACCA	23.3	18.2-28.9	6.7	1.8-16.2	95.5	91.5-97.9	30.8	9.1-61.4	77.1	71.4-82.2
HWWSA BH and used soap (24hrs)	23.3	18.2-28.9	98.3	91.1-100.0	4.5	2.1-8.5	23.8	18.6-29.6	90.0	55.5-99.7
HWWSA BH and use of soap for HW ACCB (24hrs)	23.3	18.2-28.9	63.3	49.9-75.4	56.1	48.8-63.1	30.4	22.5-39.3	83.5	76.0-89.3
HWWSA BH and separate soap available	23.3	18.2-28.9	26.7	16.1-39.7	75.3	68.6-81.1	24.6	14.8-36.9	77.2	70.6-82.9
HWWSA BH and spare soap available	23.3	18.2-28.9	35.0	23.1-48.4	67.7	60.7-74.1	24.7	16.0-35.3	77.5	70.5-83.5
HWWSA BH and knowledge HWWS ACCA	23.3	18.2-28.9	53.3	40.0-66.3	46.5	39.4-53.7	23.2	16.4-31.1	76.7	68.1-83.9
Observation vs. spot check										
HWWSA BH and availability of water	23.4	18.2-29.2	87.7	76.3-94.9	27.3	21.0-34.3	26.9	20.7-33.9	87.9	76.7-95.0
HWWSA BH and soap at HW place	23.4	18.2-29.2	63.2	49.3-75.6	51.3	43.9-58.7	28.3	20.7-37.0	82.1	73.9-88.5
HWWSA BH and availability of detergent	23.4	18.2-29.2	3.5	0.4-12.1	97.3	93.9-99.1	28.6	3.7-71.0	76.8	70.9-82.0
HWWSA BH and ash at HW place	23.4	18.2-29.2	14.0	6.3-25.8	84.0	77.9-88.9	21.1	9.6-37.3	76.2	69.8-81.9
HWWSA BH and the availability of mud at HW place	23.4	18.2-29.2	5.3	1.1-14.6	98.4	95.4-99.7	50.0	11.8-88.2	77.3	71.5-82.5
Observation vs. Hand washing demonstration										
HWWSA BH and HWWW only	17.4	11.7-24.5	11.5	2.4-30.2	81.3	73.3-87.8	11.5	2.4-30.2	81.3	73.3-87.8
HWWSA BH and WBH	17.4	11.7-24.5	65.4	44.3-82.8	38.2	29.6-47.4	18.3	11.0-27.6	83.9	71.7-92.4
HWWSA BH and HWWS	22.2	15.9-29.4	82.9	66.4-93.4	34.1	25.8-43.2	26.4	18.4-35.6	87.5	74.8-95.3
HWWSA BH and HWWA	17.4	11.7-24.5	7.7	0.9-25.1	88.6	81.6-93.6	12.5	1.6-38.3	82.0	74.4-88.1
HWWS BH and HWWM	17.4	11.7-24.5	3.8	0.1-19.6	94.3	88.6-97.7	12.5	0.3-52.7	82.3	74.9-88.2

The results featured in Table 7.27 demonstrate that the overall prevalence of washing both hands with soap or ash ranged from 35.2% to 37.7% after defecation. With the exception of the results highlighted, the general trend amongst indicators comparing observation with self report was very high sensitivity estimates or very high specificity estimates, but not both. Some results were consistent with other findings. For example, comparison of the reference standard indicator of washing both hands with soap or ash with a self reported question on whether hands were washed displayed 100% sensitivity and a very low specificity estimate.

This was also the case for the comparison of the reference standard with a recall question on whether soap was used in the past 24 hours and knowledge of the importance of washing hands (specifically after defecation). These results indicated that a high proportion of female caregivers misclassified their responses giving a high false positive rate and very low specificity estimates. However, within this analysis there were three indicators when compared with the reference standard that were potentially useful for measuring hand washing behaviour highlighted in yellow in the table.

This included a specific question on the use of soap for hand washing, whether soap was used for hand washing specifically after defecation and whether spare soap was available compared with the reference standard. The two former indicators described had very high sensitivity estimates of over 70%. The PPV and NPV values were also high, and were amongst the highest values identified in all analyses described. An indicator that was identified to be a potentially useful indicator as highlighted in blue was a specific question on whether both hands were washed compared with the reference standard that had very a high sensitivity estimate of over 70% and a moderately high specificity estimate at nearly 50%. In addition, PPV and NPV estimates were also relatively high and in line with indicators that were identified and discussed previously.

Amongst indicators that compared the reference standard with spot check indicators the general outcomes were high specificity estimates and very low sensitivity estimates. This indicated that female caregivers that were observed to not always wash both hands with soap were also not observed during the spot check procedure to have specific items available, for example, detergent, ash or mud available at the hand washing location used most often for washing hands after coming back from the toilet. One indicator in this category appeared to be potentially useful and this was the availability of soap at the hand washing location as highlighted in blue in the table. No calculations were computed for indicators comparing observation with hand washing demonstration indicators due to the small sample size of female caregivers that participated in the hand washing demonstration.

Table 7.27: Washing both hands with soap after defecation

Comparison Indicators	Prev.	CI (95%)	Sensitivity	CI (95%)	Specificity	CI (95%)	PPV	CI (95%)	NPV	CI (95%)
Observation vs. self report										
HWWSA BH and WH (Event specific)	35.2	22.7-49.4	100.0	82.4-100.0	2.9	0.1-14.9	35.8	23.1-50.2	100.0	2.5-100.0
HWWSA BH and WBH (Event specific)	35.2	22.7-49.4	73.7	48.8-90.9	48.6	31.4-66.0	43.8	26.4-62.3	77.3	54.6-92.2
HWWSA BH and used soap for HW (Event specific)	35.2	22.7-49.4	73.7	48.8-90.9	57.1	39.4-73.7	48.3	29.4-67.5	80.0	59.3-93.2
HWWSA BH and used ash for HW (Event specific)	35.2	22.7-49.4	10.5	1.3-33.1	88.6	73.3-96.8	33.3	4.3-77.7	64.6	49.5-77.8
HWWSA BH and HWWS AD	35.7	23.4-49.6	95.0	75.0-99.0	30.6	16.3-48.1	43.2	28.3-59.0	91.7	61.5-99.8
HWWSA BH and HWWA AD	35.7	23.4-49.6	30.0	11.9-54.3	80.6	64.0-91.8	46.2	19.2-74.9	67.4	51.5-80.9
HWWSA BH and used soap (24hrs)	35.7	23.4-49.6	100.0	83.2-100.0	2.8	0.1-14.5	36.4	23.8-50.4	100.0	2.5-100.0
HWWSA BH and use of soap for HW AD (24hrs)	35.7	23.4-49.6	85.0	62.1-96.8	66.7	49.0-81.4	58.6	38.9-76.5	88.9	70.8-97.6
HWWSA BH and separate soap available	35.7	23.4-49.6	30.0	11.9-54.3	88.9	73.9-96.9	60.0	26.2-87.8	69.6	54.2-82.3
HWWSA BH and spare soap available	35.7	23.4-49.6	55.0	31.5-76.9	72.2	54.8-85.8	52.4	29.8-74.3	74.3	56.7-87.5
HWWSA BH and knowledge HWWS ACCB	35.7	23.4-49.6	90.0	68.3-98.8	13.9	4.7-29.5	36.7	23.4-51.7	71.4	29.0-96.3
Observation vs. spot check										
HWWSA BH and availability of water	37.7	24.8-52.1	90.0	68.3-98.8	30.3	15.6-48.7	43.9	28.5-60.3	83.3	51.6-97.9
HWWSA BH and availability of soap at HW place	37.7	24.8-52.1	70.0	45.7-88.1	45.5	28.1-63.6	43.8	26.4-62.3	71.4	47.8-88.7
HWWSA BH and the availability of detergent	37.7	24.8-52.1	0.0	0.0-16.8	93.9	79.8-99.3	0.0	0.0-84.2	60.8	46.1-74.2
HWWSA BH and availability of ash at HW place	37.7	24.8-52.1	10.0	1.2-31.7	84.8	68.1-94.9	28.6	3.7-71.0	60.9	45.4-74.9
HWWS BH and the availability of mud	37.7	24.8-52.1	0.0	0.0-16.8	93.9	79.8-99.3	0.0	0.0-84.2	60.8	46.1-74.2

Author's own analysis of SHEWA-B Health Impact Study baseline data

The figures in Table 7.28 display the number of true positives and the total sample size for defecation related critical times that involved washing both hands with soap compared with the other alternative measures. The figures, particularly the number of true positives which assessed indicators involving soap use for the overall (unstratified) analysis depicted in the first column and the number of true positives female caregivers in the stratified analysis for those females with one, two and three or more events illustrates that the number of true positives analysed was low, but higher than those for food related critical times.

Table 7.28: Summary table of true positives and total sample size for defecation events comparing washing both hands with soap with alternative measures

Comparison Indicators	(True Positives) After cleaning a child's bottom/stool disposal	Total Sample Size	(True Positives) After defecation	Total Sample Size
Observation vs. self report				
HWWSA BH and WH (Event specific)	55	237	19	54
HWWSA BH and WBH (Event specific)	33	238	14	54
HWWSA BH and used soap for HW (Event specific)	42	237	14	54
HWWSA BH and used ash for HW (Event specific)	0	237	2	54
HWWSA BH and HWWS ACCB/AD	33	258	19	56
HWWSA BH and HWWS ADCS/AD	8	258	6	56
HWWSA BH and HWWA ACCA/AD	4	258		
HWWSA BH and used soap (24hrs)	59	258	20	56
HWWSA BH and use of soap for HW ACCB/AD (24hrs)	38	258	17	56
HWWSA BH and separate soap available	16	258	6	56
HWWSA BH and spare soap available	21	258	11	56
HWWSA BH and knowledge HWWS ACCA/AD	32	258	18	56
Observation vs. spot check				
HWWSA BH and availability of water	50	244	18	53
HWWSA BH and soap at HW place	36	244	14	53
HWWSA BH and detergent at HW place	2	244	0	53
HWWSA BH and ash at HW place	8	244	2	53
HWWSA BH and the availability of mud at HW place	3	244	0	53
Observation vs. Hand washing demonstration				
HWWSA BH and HWWW only	3	149	-	-
HWWSA BH and WBH	17	149	-	-
HWWSA BH and HWWS	29	158	-	-
HWWSA BH and HWWA	2	149	-	-
HWWS BH and HWWM	1	149	-	-

Author's own analysis of SHEWA-B Health Impact Study baseline data

7.7.5 Analysis using kappa statistics

The kappa results for washing both hands with soap compared with the other alternative measurement methods for defecation related critical times were consistent with the results obtained through the use of a screening style approach. However, the results were in the range that indicates only a slight level of agreement between structured observation and indicators from other methods. The results are displayed in Table 7.29. The kappa results for after defecation were higher with most results indicating slight to fair levels of agreement. The indicator with the highest level of agreement at 0.47 indicated a moderate level of agreement. This was the comparison of the structured observation reference standard of washing both hands with soap with a recall question on whether soap was used for hand washing after defecation in the past 24 hours. This indicator also had the highest sensitivity and specificity estimates using the screening test approach method.

There were three indicators that were on the borderline as potentially useful indicators for assessing hand washing behaviour as they did not meet the criteria. The trend amongst these indicators was a high sensitivity estimate of 90% and a moderate specificity estimate of approximately 30% for two indicators: observation of washing both hands with soap compared with a self report question on whether hands were washed with soap after defecation and a spot check observation on the availability of water at the designated hand washing location. The third indicator compared the structured observation reference standard indicator of whether both hands were washed with soap with a self report question on whether separate soap was available in the household. This result had the opposite result to the two previously discussed. The kappa results for the former two indicated only a slight level of agreement between the indicators and for the third indicator a fair level of agreement between indicators was identified.

Table 7.29: Kappa statistics: Washing both hands with soap for defecation related critical times

Comparison Indicators	After cleaning a child's bottom/disposing of stools	CI (95%)	After def.	CI (95%)
Observation vs. self report				
HWWSA BH and WH (Event specific)	0.0	-	0.02	-0.02-0.06
HWWSA BH and WBH (Event specific)	-0.05	-0.14-0.04	0.19	-0.04-0.42
HWWSA BH and used soap for HW (Event specific)	0.11	0.02-0.19	0.28	0.04-0.51
HWWSA BH and used ash for HW (Event specific)	-0.13	-0.18-0.08	-0.01	-0.22-0.20
HWWSA BH and HWWS ACCB/AD	0.14	0.02-0.25	0.20	0.05-0.36
HWWSA BH and HWWS ADCS/AD	0.10	-0.02-0.22	-	-
HWWSA BH and HWWA ACCA/AD	0.03	-0.07-0.12	0.11	-0.14-0.37
HWWSA BH and used soap (24hrs)	0.01	-0.01- -0.03	0.02	-0.02-0.06
HWWSA BH and use of soap for HW ACCB/AD (24hrs)	0.14	0.04-0.25	0.47	0.25-0.69
HWWSA BH and separate soap available	0.02	-0.10-0.14	0.21	-0.04-0.46
HWWSA BH and spare soap available	0.02	-0.10-0.14	0.27	0.01-0.53
HWWSA BH and knowledge HWWS ACCA/AD	0.00	-0.10-0.10	0.03	-0.10-0.16
Observation vs. spot check				
HWWSA BH and availability of water	0.08	0.02-0.15	0.17	-0.01-0.35
HWWSA BH and soap at HW place	0.10	0.00-0.20	0.14	-0.10-0.38
HWWSA BH and detergent at HW place	0.01	-0.06-0.09	-0.07	-0.17-0.02
HWWSA BH and ash at HW place	-0.02	-0.14-0.10	-0.06	-0.26-0.15
HWWSA BH and the availability of mud at HW place	0.05	-0.03-0.14	-0.07	-0.17-0.02
Observation vs. Hand washing demonstration				
HWWSA BH and HWWW only	-0.07	-0.21-0.07	-	-
HWWSA BH and WBH	0.02	-0.08-0.12	-	-
HWWSA BH and HWWS	0.10	0.01-0.19	-	-
HWWSA BH and HWWA	-0.04	-0.18-0.09	-	-
HWWS BH and HWWM	-0.03	-0.14-0.09	-	-

Author's own analysis of SHEWA-B Health Impact Study baseline data

Table 7.30: Summary table of valid hand washing measures using an epidemiological style screening test approach and Kappa statistics: Washing both hands with soap for defecation related critical times

Comparison Indicators	Screening test approach: After cleaning a child's bottom/ stool disposal	Kappa statistic approach	Screening test approach: After defecation	Kappa statistic approach: After defecation
Observation vs. self report				
HWWSA BH and WH (Event specific)				
HWWSA BH and WBH (Event specific)			◊	◊
HWWSA BH and used soap for HW (Event specific)	◊	◊	√	√
HWWSA BH and used ash for HW (Event specific)		◊		
HWWSA BH and HWWS ACCB/AD	√	◊		◊
HWWSA BH and HWWS ADCS/AD		◊		
HWWSA BH and HWWA ACCA/AD				◊
HWWSA BH and used soap (24hrs)				
HWWSA BH and use of soap for HW ACCB/AD (24hrs)	√	◊	√	√√
HWWSA BH and separate soap available				√
HWWSA BH and spare soap available			√	√
HWWSA BH and knowledge HWWS ACCA/AD	◊			
Observation vs. spot check				
HWWSA BH and availability of water				◊
HWWSA BH and soap at HW place	√	◊	◊	◊
HWWSA BH and detergent at HW place				
HWWSA BH and ash at HW place				
HWWSA BH and the availability of mud at HW place				
Observation vs. Hand washing demonstration				
HWWSA BH and HWWW only				
HWWSA BH and WBH				
HWWSA BH and HWWS		◊		
HWWSA BH and HWWA				
HWWS BH and HWWM				

Author's own analysis of SHEWA-B Health Impact Study baseline data

The results in Table 7.30 display a summary of potential and possible indicators using the two validation approaches of a screening style analysis and analysis using kappa statistics. For indicators where there is a tick, this indicates that this indicator is a potential indicator for use as an alternative to structured observation. The indicators where there is a diamond illustrates that these are possible indicators that achieved moderate estimates. For kappa statistics, a tick against an indicator illustrated a kappa value of greater than 0.20 indicating a fair level of agreement (0.20-0.40). If the tick is featured in bold, this means that this indicator was at the high end of the kappa scale. The indicator that has two ticks indicates a moderately high kappa value of over 0.40 indicating moderate agreement. The indicators that have a diamond featured against the indicator indicated that there was only a slight level agreement. For this category, only indicators that had a kappa value of 0.10 and above were taken as anything below this indicated very slight agreement

7.7.6 Summary

The validation of structured observation indicators compared with the alternative measurement methods illustrated that validating indicators for defecation related critical times fared better than those food related critical times. This was particularly the case for hand washing events that compared structured observation indicators that involved the use of soap with the other alternative measures.

The assessment of hand washing events stratified by the number of events that a female was observed to have during structured observation did not demonstrate any distinct differences compared with assessing all of the events a female experienced during structured observation, the unstratified analysis. This demonstrated that in the case of this research, stratifying by the number of hand washing events did not impact on the choice of indicators that could be used as potential and possible alternative indicators to structured observation.

The choice of validation method through the use of concepts from a screening style approach (through using the sensitivity, specificity, positive predictive and negative predictive values) and through the calculation of kappa statistics demonstrated consistent results for both approaches. The alternative indicators that emerged to be potential indictors for before preparing food for both the unstratified and stratified analysis were a self report question on knowledge of washing hands and a self report question on the availability of spare soap in the household, although the kappa statistics illustrated only slight levels of agreement. The potential indicators identified for the food related critical time of before eating in both the unstratified and stratified analysis was a self report event specific question on whether both hands were washed before eating. The results from the analysis using kappa were also consistent with these findings, but indicated only slight levels of agreement.

For the critical time of before feeding a child, the indicator that demonstrated potential as alternative indicators to structured observation was a self reported question on the availability of spare soap. This indicator emerged in both the unstratified analysis and the stratified analysis for females that were observed to have one and two hand washing events. For females that were observed to have one event in the stratified analysis, the indicator that was identified to be a potential alternative indicator was a self report event specific question on whether both hands were washed before feeding a child. However, the results from the validation using kappa were low and only indicated slight levels of agreement.

The validation of the critical time of after cleaning a child's bottom/disposing of a child's stools identified three potential indicators for use as an alternative to structured observation. These indicators were a self report question on whether hands were washed with soap after cleaning a child's bottom, a self report recall question on whether soap was used in the past 24 hours after cleaning a child's bottom and a spot check observation indicator on whether soap was available at the designated hand washing location that was used most often after using the toilet. The results from the validation using kappa statistics were towards the upper end of the slight level of agreement range (0.0-0.20), but the result for the comparison of the structured observation indicator of whether hands were washed with soap with a spot check indicator on whether soap was available at the hand washing location used most often after using the toilet indicated only very slight agreement due to the kappa statistic being at the lower end of the slight level of agreement scale.

The results of the validation of structured observation indicators compared with the alternative measurement methods for after defecation also identified three indicators as potential alternatives to structured observation. These indicators were all self report questions. The first and second were an event specific question on whether both hands were washed after defecation, the second, a question on whether soap was used for hand washing after defecation and the third, a recall question on whether soap was used for hand washing after defecation in the past 24 hours. This latter result was also a potential indicator that emerged for the critical time of after cleaning a child's bottom/disposing of a child's stools.

The indicator that did display relatively good potential as a possible alternative to structured observation was a spot check indicator on whether soap was available at the designated hand washing place, although the sensitivity and specificity estimates were not as high as the three potential indicators selected. The results from the validation using the calculation of kappa statistics were in line with the findings from the validation approach using the concepts of screening. In particular, the results that compared structured observation with washing both hands and a recall question on the use of soap in the past 24 hours after defecation had kappa values at the high end of the fair agreement scale (0.20-0.40) whereas the structured observation indicator that compared hand washing with soap with an event specific question on whether soap was used after defecation were in the mid range of the scale.

The final validation focused on the two defecation related critical times. This compared the reference standard structured observation indicator of whether both hands were washed with soap with all of the alternative measurement method indicators. The results for after cleaning child’s bottom/disposing of a child’s stools identified all of the same alterative indicators that were identified and discussed above for the first analysis for the critical time of after cleaning a child’s bottom/disposing of a child’s stools. The results from the validation using kappa statistics indicated only slight levels of agreement, but were in the mid range and above (0.0-0.20).

The results for after defecation within this final validation identified two of the same indicators that emerged as potential indicators discussed above; an event specific self report question on whether hands were washed with soap after defecation and a self report recall question on the use of soap for hand washing after defecation in the past 24 hours. The difference observed in this validation compared with the other validation of after defecation discussed above was that a event specific question on whether both hands were washed that was selected as a potential indicator when structured observation indicators were compared with other similar alternative measures discussed above did not emerge in this validation as a potential indicator due to a reduction in the specificity estimate that fell below 50%. Therefore this indicator was a possible indicator as it had borderline sensitivity and specificity estimates. An indicator that did emerge here as a potential alternative was a self report indicator of whether spare soap was available in the household which in the validation analysis that compared structured observation with similar alternative measures appeared on the borderline. This was therefore offered as a possible indicator in that validation analysis.

The results from the validation using kappa statistics identified two alternative indicators compared with the structured observation reference standard of washing both hands with soap as having a fair level of agreement that were both mid range on the fair level of agreement scale (0.20-0.40). The two indicators were an event specific question on whether hands were washed with soap after defecation and a question on the availability of spare soap in the household. The indicator that demonstrated the highest result on the kappa scale was that of a self report recall question on whether soap had been used for hand washing after defecation in the past 24 hours. This result fell into the moderate level of agreement range.

The next chapter discusses the results from the two results chapters. The focus is firstly on the different measurement methods used and then the results of the validation analysis and how this impacts on the use of measurement methods in large scale surveys such as the DHS.

8 Discussion

8.1 Introduction

The discussion section focuses on the findings of the two results chapters and places the results within the context of the objectives of the research. Firstly, a discussion of the different hand washing measures in general will be conducted, followed by the results of the validation of the measures. This is then framed in the context of public health, hygiene promotion and policy implications. The discussion is then highlighted with results from focus group discussions with fieldworkers, used to discuss and illustrate the measurement and methodological issues of the different approaches. The limitations of the research are discussed and recommendations are made as to measurement and methodological considerations in the future design of indicators on hand washing behaviour and future work directions.

8.2 Structured observation

Hand washing with soap was identified to be a low priority particularly amongst female caregivers for food related critical times, where less than 1% of female caregivers were observed to use soap before preparing food and before eating. For the critical food related time of before feeding a child, a similarly low percentage of females (3.2 %) used soap for hand washing. For food related critical times hands, washing hands with water only was the common practice, with over 95% of female caregivers performing this practice for the three food related critical times. Furthermore, approximately half of all female caregivers did not wash hands before feeding a child and approximately a third did not wash hands before preparing food. A further 14% did not washing hands before eating.

However, for defecation related critical times, the percentage of female caregivers that did not wash hands was lower with approximately 10% not washing hands after cleaning a child's anus/disposing of a child's stools and 3% after defecation. Hand washing with soap was higher for defecation related events with approximately 29% of female caregivers using soap greater than two thirds or more of the time after cleaning a child's anus/disposing of a child's stools and 38% of female caregivers used soap greater than two thirds of the time or more for hand washing after defecation. The use of ash greater than two thirds or more of the time was 9% and 14% respectively for the events previously discussed. The results demonstrate that hand washing with soap was not the norm particularly for food related events and that these events were subject to multiple observations. Hand washing behaviour was therefore inconsistent and hands were not always washed for all events.

Structured observation therefore provides information on inconsistent hand washing behaviour and practices of individuals. This information is important from a public health perspective in order to identify and target risk practices and seek techniques and methods to improve hand washing behaviours. Structured observation can aid the identification of certain groups, for example, those that always wash hands and are consistent hand washers, those that use all of the necessary hand washing materials and wash both hands and those that are inconsistent hand washers and do not wash hands appropriately.

However, the use of structured observation to assess hand washing behaviour also demonstrates methodological and measurement issues. One of the fundamental issues raised previously in Chapter 2 is reactivity. Structured observation as a method to assess hand washing behaviour is subject to reactivity. Reactivity occurs due to the presence of an observer whereby an individual being observed modifies their behaviour due to the presence of an observer (Bentley, Boot et al. 1994).

This issue was raised during focus group discussions with fieldworkers. Fieldworkers identified that once some households became aware that the study was on hygiene due to the consent form, they would then rearrange their households before fieldworkers came. The concern about reactivity remains a fundamental feature of studies that use direct observation techniques. However, few studies have measured reactivity directly.

A research study by Harvey et al. (2009) conducted in Peru focused on the systematic measurement of reactivity during a malaria prevention study. The study focused on bed net use and malaria risk. In this study, sixty observations were assessed over a nine month period. Observers recorded all events that they perceived to be potentially reactive. In total, 339 reactive episodes were documented using iterative analysis and coding. However, of all the reactive events recorded, only two were identified to be related to the objectives of the study (Harvey, Olortegui et al. 2009).

The authors concluded that although reactivity is common, it need not bias results. In addition, of the few studies that have assessed reactivity, the majority of studies have found that it had less impact than intended (Harvey, Olortegui et al. 2009). For example, a study focused on hygiene behaviour in Burkina Faso assessed reactivity. In this study, two hundred households were assessed over two or more consecutive days using observation that lasted 3 hours.

The main findings of this study were that for certain behaviours, for example, the disposal of a child's stools in a latrine, which was a frequent behaviour; there was little evidence of reactivity. For behaviours that were uncommon, there was some evidence of reactivity, however, this diminished over time. Unhygienic behaviours were identified to multiple whilst hygienic behaviours decreased (Curtis, Cousens et al. 1993).

Figure 8.1: A women washing her hands at a tube well

Observing hand washing behaviour is difficult and one of the key issues is that it may be subject to reactivity due to the presence of an observer.

The use of a continuous monitoring approach whereby individuals were observed for a period of five hours provided useful information on hand washing behaviour over that time period. However, the start time of the observation was extremely important when assessing particular behaviours. For example, the assessment of defecation behaviours which was a particularly sensitive behaviour to observe, illustrated the importance of the start time of structured observation by fieldworkers.

The observations were noted to have started at 9.00 a.m. and finished at 14.00 hours. However, when the start time of the observation was assessed in greater detail within the structured observation data, it became apparent that there was inconsistency in the start time amongst fieldworkers with some commencing observations later than 9.00 am. There were some households where observations started at midday or later. There are two issues raised from this, firstly inconsistent start times of structured observation and secondly, the timing related to defecation. These features raise important questions as to whether structured observations in this context are appropriately and accurately capturing defecation events, as overall, the number of defecation events that were observed for female caregivers was very low compared with reports obtained through self reported methods and from other studies (Scott, Lawson et al. 2007). In addition, formative research conducted in Kenya for a public private partnership that used structured observation identified that defecation took place as soon as those observed awoke. In this study, observation commenced at 6.00 a.m. (Aunger, Schmidt et al. 2009). The results of defecation related hand washing behaviour are discussed in more depth later.

For particular types of events such as defecation which was a sensitive and rare behaviour in the context of this research, if observations were started later then such events may have been missed. For example, a comparison of observation with a self reported question posed to a female caregiver about whether she had defecated on the day of the survey identified that over 500 female caregivers had defecated on the day of the survey. This survey questionnaire was administered at approximately 9.00 a.m. and took between two to three hours to administer.

Although the timing of the survey was different to when the observations were conducted, only 58 female caregivers that had observation data from the same sample of households were observed to have a defecation event during structured observation. This could be due to several factors; firstly, that the behaviour itself was an issue and people were sensitive about performing such a practice, secondly, how the behaviour is actually defined and observed and methodological issues related to the start time of observations.

Other studies have used structured observation to assess hand washing behaviour and have observed defecation behaviour as one of the critical times in which hands should be washed. In these studies, a greater number of female caregivers were observed to have a defecation event occurring during the observation period. For example, in Ghana, 251 defecation events were observed and this study was based on a smaller size and a shorter observation period than the SHEWA-B Health Impact Study (Scott, Lawson et al. 2007).

Furthermore, in Pune, India, a study that assessed household hand washing practices identified that in order to appropriately capture defecation events, observations needed to started early in the morning, 5.00 a.m. was chosen to maximise the likelihood of an event occurring. In addition, the way in which defecation events were recorded and classified was given. For example, a defecation event was identified in the context of a women going to the toilet or defecation place with a jug or pot, similar to the bodna featured in Figure 8.2 (Biran, Rabie et al. 2008).

Figure 8.2: A young child playing with a bodna

The picture above illustrates a young child playing with a bodna. A “bodna” is a water type vessel/container with a sprout that is used to carry water for defecation practices. In the Indian sub-continent, the practice of cleaning with water after urination and defecation is the usual method for maintaining personal hygiene (Ahmed, Zeitlin et al. 1994).

Figure 8.3: A toilet facility obscured from the household location

The toilet facility in some rural locations was often hidden or obscured by bushes/trees away from the hand washing facility

An important point pertaining to the use of a single observation of a household is that even though the observations were conducted over a five hour period, this only provided a snapshot of what took place from the morning until the early afternoon. Therefore, structured observation only provides a small insight into an individual's behaviour during the observation period. This may be different from their behaviour generally and at other times of the day. Furthermore, there may be other factors that may influence a household's hand washing behaviour. For example, a household that has many household members may prepare food at particular times when all household members are available or limit the number of times food is prepared throughout the day.

There may also be socio-economic factors at play. This may include household accessibility to water and having to limit water usage. This may restrict water usage for hand washing practices. Further issues may include economic factors with households that are economically disadvantaged having to limit their food preparation practices to particular times and use soap for particular important activities, for example, bathing and washing clothes. The results of a study that compared ninety minute observations with five hour observations identified that reactive households were more likely to have higher socio-economic status and soap available at the designated hand washing place (Ram 2008).

There were a number of methodological and measurement issues that arose from focus group discussions with fieldworkers. Fieldworkers discussed within the focus group that they received extensive training on all of the survey instruments. This involved going through all aspects of the survey instruments on a point by point basis. Fieldworkers were then briefed on what the survey questions meant.

There was also an in-house interview demonstration for fieldworkers to understand the context of the questions. The fieldworkers then went to the field to practise administering the survey instruments, e.g. field testing instruments to ascertain if there were any issues/problems. Each fieldworker tested the instrument in 3 households before the actual survey took place.

A pilot study or field test of survey instruments is therefore essential. This is illustrated by a field test of the structured observation survey instrument that identified that hand washing before eating was commonplace on a food plate. This category was not previously given as one of the pre-assigned categories in the survey instrument; therefore, it was included after being identified in the field test. A further amendment made was the not possible to observe category for hand washing materials. The same field workers visited the structured observation households and cross sectional survey households. Some fieldworkers explained that soap use was over reported compared with what they observed during the structured observation.

One very important feature was the observation of multiple household members. There was a general consensus amongst fieldworkers during the focus group discussions that this was problematic at times and led to events being missed. In this case, the focus was then on observing the main female caregiver. In addition, there were occasions where hands were washed, but these were not recorded as a hand washing event as they were an indirect measure, for example, bathing and cleaning.

The excerpts featured below from focus group discussions illustrate the methodological and measurement issues observed pertaining to the use of structured observation. The first excerpt highlights that structured observation as a tool may miss certain events that were not pre-assigned in the questionnaire that also involved hand washing.

FGD1 "In the structured observation there were some exposures like washing hands before preparing food, serving food, before and after eating, after defecation and after cleaning a child's anus. There were some other exposures which were not included in our questionnaire. I think these points were related to hand washing."

FGD2 "In some households, we observed that the respondent sometimes cut fish and washed their hands with water and soap or ash. Then they would do other household work. After a while, she would cook fish and we included this observation in our questionnaire. But we couldn't include the observation when she cut fish and washed hands, as there was no option."

FGD1 "At the time of structured observation we observed some households. During the cross-sectional, we went to the same household. When we went through open questions, most of the time they over reported to us. We realised that they have knowledge but they haven't practiced as they reported to us"

There was also the issue that some field workers raised that hand washing tended to take place for events where dirt was visible on hands. This includes events, for example, after handling cow dung and cutting fish whereby an odour was present on hands. For these types of events, hands were washed and soap or ash was used. In some households, male fieldworkers faced problems where families were reserved and did not want to be observed by a male fieldworker. A further important issue raised was logistical difficulties in some areas. This constraint meant that in some rural areas it was very difficult for field workers to reach certain locations. Therefore, it was difficult to start observations early due to accessibility issues.

8.3 Cross sectional survey

8.3.1 Self reported hand washing behaviour

The use of self reported questions on hand washing behaviour included the use of open ended, recall and closed answer questions. The results of these questions compared with structured observation identified that there were certain questions where over-reporting was an issue. This was particularly the case for questions on whether hands were washed with soap for defecation related behaviours, although food related events were also subject to over-reporting.

For questions that focused on the five event specific critical hand washing exposures, the results demonstrated that over 70% of female caregivers had experienced the three critical food related events either on the day of the survey or the previous day. There was also a question on the direct use of hands for food related activities particularly for eating and feeding a child which demonstrated that hands were used to eat food directly.

The results showed that over 90% of female caregivers reported that they washed hands. However, compared with the results from observed practices these figures were much higher. This demonstrated that the practice of hand washing was over-reported. Furthermore, washing both hands and the use of soap was also over-reported compared with observed practice as approximately 1% of female caregivers used soap for hand washing before preparing food or before eating and approximately 3% before feeding a child in the observation. However, the self reported events specific results were that approximately 26% used soap before preparing food and 15% for the two other food related critical times.

For the two defecation related times, a higher proportion of female caregivers reported that they had last cleaned a child's bottom on the day of the survey or the previous day and defecated compared with observed events, with over 80% reporting that they had experienced these events. For defecation, this was of particular interest, as in total, 66 female caregivers were observed to have a defecation event and in total 69 events were observed, but for the validation analysis only 56 females were assessed due to eligibility for inclusion into the analysis. In total, 328 events for 305 female caregivers after cleaning a child's bottom/disposing of a child's stools were observed.

This discrepancy in reported defecation behaviour with the observed number of events may be due to a number of factors. Firstly, if we focus on the day of the survey, approximately 60% of female caregivers reported that they had last cleaned a child's bottom equating to 597 female caregivers. However, during observation 305 female caregivers were observed to have this event. This indicates that observation as a method may not be appropriately capturing all of the events or that there was over-reporting of an event occurring.

Structured observation and the cross sectional survey components took place at different times, approximately three months apart. The definition of cleaning a child's bottom/disposing of a child's stools was different in the cross sectional survey where only one of these categories was included. Therefore, there was a discrepancy in the definition. The reported results for a question on the timing of the defecation event identified that approximately 57% of female caregivers reported that they experienced an event on the day of the survey. This equated to approximately the same figure of 600 female caregivers as discussed in the previous paragraph. However, only 66 female caregivers were observed to have experienced an event during structured observation if all events were focused on. As with the reasons given in the previous paragraph this could be due to issues related to the use of observation to assess defecation related hand washing practice or that female caregivers were over reporting that an event had occurred.

However, a point that is important to take account of in both instances is that recall of an event included the previous day as well as the day of that the survey took place. Therefore, this discrepancy in numbers could be due inclusion of estimates from the previous day. This would possibly account for the difference in reported and observed events for after cleaning a child's bottom/disposing of a child's stools, but not for the discrepancy between reported and observed defecation events.

The discrepancy again could possibly arise due to the cross sectional survey component being conducted at a different time of the day than the structured observation. However this explanation is unlikely as the cross sectional survey was administered in the morning from approximately 9.00 a.m. onwards for a period of two to three hours and the recall questions of whether an event was experienced on either the day prior to the survey or the day of the survey was not as dependent on the start time as structured observation of an event was. However, it must be remembered that the structured observation was conducted over a five hour observation period, therefore, this means that it is likely to have encompassed the time that the cross sectional survey took place.

The very low prevalence of observed defecation events compared with self reported practices does, however, lead one to question the validity of the structured observation methodology on observing defecation events. The start time of the observation is crucial as previously discussed, in order to appropriately capture defecation events. The earlier that an observation took place, the greater the opportunity to capture the event. This is important as open defecation remains a challenge, particularly in rural areas of Bangladesh. The prevalence of washing hands was high for both self report and observation at 90% or higher, washing both hands was over-reported compared with observed practice by approximately 10%. The use of soap was also over-reported compared with observed practice. This was in the region of 2 to 2.5 times compared with observation. For self reported practices approximately 65% of females caregivers reported that they used soap for hand washing for these events. The selected excerpts featured below illustrate examples given by fieldworkers during focus group discussions on over-reporting of hand washing practices.

FGD1 "As an example, when we asked them "When do you think it is important to wash hands?" In this case, the majority of times they under reported. But when we asked them "Did you wash your hands after defecation or after cleaning child anus or before eating or before feeding child?" In those cases, most of the time they over reported"

FGD1 "When we asked the respondent "When you used soap today or yesterday, what did you use it for?" Most of the time they didn't mention before or after eating because they thought that it was normal matter. It wasn't an issue to say"

FGD1 "As an example, when we asked them "When do you wash your hands with soap", they reply us some point which was not their real practice. During structured observation we did not see those practices that they mentioned"

The use of soap greater than two thirds or more of the time by female caregivers during structured observation was approximately 30% and 38% after cleaning a child's bottom/disposing of a child's stools and after defecation for those that washed their hands. There was over-reporting for observation compared with a question that focused on soap use activity for defecation events. Although there was also over-reporting for the food related critical times, some of the results were in line with observed practice of hand washing with soap at approximately 3%.

The results for defecation related events suggested that female caregivers may be more inclined to over-report that they hand wash with soap after defecation related events more so than food related critical times. The questions that focused on knowledge of the importance of hand washing particularly after defecation was evident, with 85% of female caregivers reporting that hand washing after this exposure was important. This result was the highest for all of the exposures featured indicating that the level of knowledge was high. One drawback of this question was that it did not directly include the use of soap. Therefore, this question can only be interpreted regarding knowledge of the importance of hand washing and not knowledge of the importance of hand washing with soap. This is important and exemplifies the need to have clear wording of the question as the results from this research demonstrate that hand washing with soap was a low priority, therefore, when respondents are asked about knowledge of the importance of hand washing they may feel that hand washing with water only is adequate because that is what they regularly practice, when in fact, hand washing with soap is more effective for diarrhoea prevention.

There were a number of issues that emerged from the focus group discussions that highlighted some of the methodological issues and concerns with particular approaches used to assess hand washing behaviour. The use of recall questions on hand washing posed particular issues. There were particular difficulties for some respondents being unable to appropriately recall events when they hand washed with soap without asking the interviewer for assistance. This was also evident in questions that involved the recall of soap use.

In general, fieldworkers identified that there was over reporting of soap use compared with the spot check on soap availability. In addition, some respondents experienced difficulties understanding the nature and structure of the questions asked. A further important issue raised was that field workers felt that respondents tended to answer questions based on their knowledge rather than practice. This is a common phenomenon as featured in the literature review.

These results were consistent with results from other studies. For example, over-reporting of hygiene practices was identified in a study in Bangladesh. In this study, respondents were significantly more likely to report practising good hygiene in a questionnaire survey compared with practising good hygiene in an observer’s presence (Stanton, Clemens et al. 1987). In addition, studies from Zaire and Brazil identified the same conclusion (Manun'Ebo, Cousens et al. 1997; Strina, Cairncross et al. 2003). A suggestion was made from fieldworkers that it would be helpful in the future to divide the time of day into different segments when asking respondents about their hand washing behaviour.

This would mean that there would be a focus on morning and afternoon activities and this would aid recall. A further assessment by fieldworkers was that respondents generally reported that they washed hands with soap. However, when asked to produce soap during the spot check they were unable to do so. For some of the open ended questions, some respondents did not remember or think that particular hand washing events were important to mention, for example, after eating. A further observation from field workers was that most respondents did not have spare or separate soap available for hand washing.

The excerpt featured below illustrates the difficulty described by one fieldworker on the question on how many times soap was used in the previous day. This fieldworker felt that respondents were providing unrealistic answers. The estimates given even after probing also appear to be very high. This leads one to question whether this question is appropriate and fully understood by respondents and may require further clarification regarding the hand washing event.

FGD1 "When we asked them "How many times did you wash your hands throughout the day yesterday?" Sometimes they replied about 8/9 times, sometimes they replied 100 times. Even sometimes they replied, I wash my hands the whole day long. But when we probed more, we got the approximate value and that was about 25/26 or 30 times."

The role of privacy arose during focus group discussions. A common theme mentioned and agreed by field workers was privacy. It was felt that some respondents gave inaccurate answers in front of others. Privacy was a major issue particularly due to other people watching the interview. Others had the opportunity to watch, and at times, tried and participated in the interview. The two pictures below illustrate the environment in which the structured observation and cross sectional survey were conducted. The pictures illustrate that other individuals were openly watching the interviewer. Fieldworkers were sometimes interrupted and had to emphasise that they required privacy by asking those watching or trying to participate to leave.

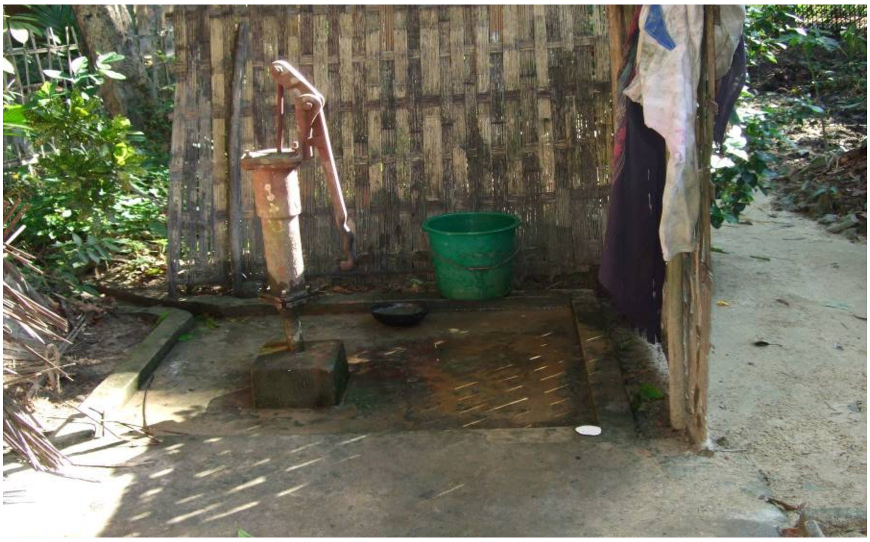
Figure 8.4: The cross sectional survey process, examples of the survey process being watched by others

Lack of privacy during the field work process was a key issue. Other household members and members of the community tried to watch or engage with the survey process. The above photographs were taken during the cross sectional survey component.

A further insight into the survey questionnaire process was the structure of questions. One fieldworker mentioned that the fingertip and hand assessment was affected by earlier questions featured in the survey instrument, for example, when the respondent was asked to bring a glass of water. On this occasion, there was the possibility that hands could come into contact with water and therefore the pads of hands could have appeared clean during the hand assessment when prior to that question they were not clean.

The main type of soap observed during the spot check was body soap and this was used for hand washing when the soap bar became too small to be used for bathing purposes. This soap was also often used for washing clothes. The use of soap for multiple purposes has been reported in other formative research studies (LMS/Steadman International 2006). This is very useful to know for policy purposes as it could potentially be used to work with the soap industry, for example, Unilever, who are involved in the Public Private Partnerships to increase hand washing with soap, to develop smaller soap bars that can be sold alongside the main soap bar for the household or a bar that could be cut into smaller pieces, so that it can be used specifically for hand washing purposes.

Figure 8.5: A tube well with a small bar of soap



A hand washing location featuring a tube-well and a small bar of soap. The soap often identified at the tube-well was small in size.

The excerpts below from two focus group members illustrate the previous points.

FGD1 "Actually when the body soap becomes too small, they use the soap for hand washing purposes"

FGD1 "Most of the family uses body soap for hand washing purpose when it becomes too small".

8.3.2 Spot check methods

Spot check methods were used to assess whether a household had a designated location for hand washing after using the toilet and before cooking, eating and feeding a child and the necessary hand washing materials. Spot check observations provided information on the presence or absence of a hand washing location or hand washing materials. Such information was as a "proxy" marker for hand washing behaviour and did not provide sufficient information on whether hands were washed for the relevant critical times and who washed hands. Spot check methods have been identified to be a suitable alternative to structured observation due to some of the difficulties previously discussed with other methods (Webb, Stein et al. 2006).

The main findings from the cross sectional survey component that included spot check observations were that the major hand washing locations for food and defecation related critical times differed. This was illustrated by a question asked to respondents on whether the hand washing location before cooking, eating or feeding a child was different to the one used by respondents when they came back from the toilet. The result of this question was that approximately 69% of respondents reported that the place was different to the hand washing location used when coming back from the toilet. The major reported and observed locations after using the toilet were inside or near the toilet facility, followed by outside the yard and greater than 10 feet from the latrine. For food related hand washing activities, the major hand washing locations were inside or near the kitchen/cooking facility, with approximately 50% of respondents reporting and were observed to have this hand washing location. The other major locations were elsewhere in the yard or outside the yard. A substantial number of women were observed and reported to not have a specific place for hand washing for food related events.

For the hand washing location used for food related activities, the main hand washing agent observed was soap with 54% of households having soap available, 2% had detergent and 6% had ash available. In terms of the availability of soap by hand washing location, the main locations where soap was observed for the hand washing location used after using the toilet was inside or near the toilet facility, elsewhere in the yard or outside the yard. For the food related hand washing location, 64% of households were observed to have soap inside or near the kitchen/cooking facility and 18% at the place that was described as no specific place.

There were four main hand washing locations observed including in the kitchen, on a plate/in a pot, at a nearby tube-well and in the yard for food related activities. A comparison of hand washing in the kitchen compared with on a plate/in a pot showed that a higher percentage of women always washed their hands on a plate/in a pot compared with always washing hands in the kitchen, particularly before eating or feeding a child. The importance of using multiple methods to assess hand washing behaviour uncovered that washing hands on a plate or in a pot was commonplace. This was not identified during the spot check observation, therefore, structured observation provided useful information on this practice and this may account for the 18% of female caregivers who were observed to not have a specified place in the household for hand washing for food related critical times. Although the presence of soap was moderately high at over 50%, results from structured observation demonstrated that the use of soap for the three food hand washing related critical times was low at approximately 3% or less. Therefore, this suggests that although soap and other hand washing agents were present, soap was not routinely used particularly for food related events. Therefore, from a policy perspective the emphasis should be to promote the use of soap in the hand washing process.

Furthermore, during the spot check observation the criteria was that soap had to either be at the designated hand washing location or brought to the interviewer within one minute. This means that soap was not necessarily at the hand washing location and had to be fetched by the respondent. This soap could have been used for purposes other than hand washing such as washing clothes or bathing. Therefore, the percentage of households with soap may not be a true representation of actual soap use behaviour. A further issue and one of the disadvantages of spot check methods which has similarities to structured observation in that this method is also subject to day to day variability and affected by the time when the observation was conducted. For example, if a spot check was performed at lunchtime when food is being prepared, then soap may be present compared with if the observation started earlier.

The main hand washing location after using the toilet observed during structured observation was at a nearby tube-well. This was compared with the main place identified during the spot check as being inside or near the toilet facility or in the yard. It was difficult to compare the locations as the terminology and definition given particularly for the spot check were not clear and did not include at a nearby tube-well. The impact of this was that it was difficult to compare the locations observed during structured observation with the other alternative measures particularly the spot check.

There was also the issue that some respondents felt embarrassed about the condition of their toilet facility and did not want to show the interviewer. One of the drawbacks of the spot check method was that it did not provide information on the individual of interest and only provided information on household level soap availability. Therefore, this method raises questions on the level of measurement that we are interested in.

Figure 8.6: An exposed tube-well

An exposed tube-well due to the protective fencing being in need of repair. Some respondents were embarrassed about the condition of their facilities.

Hand and Fingertip assessment

The hand and fingertip assessment was conducted for a child less than five years of age and the female caregiver that responded to the survey. In this assessment, the fingertips, palms and finger pads were assessed as to whether there was visible dirt, an unclean appearance, clean appearance or if it was not possible to observe. This assessment was subjective in nature and did not involve any microbiological testing, so it was therefore not corroborated scientifically. The feedback obtained from the focus group discussions highlighted that the assessment was potentially influenced by the time of day at which it was conducted.

One fieldworker mentioned the sequence of the questions on the survey having a potential impact, as previously noted. This assessment did not provide any information on the degree of hand contamination. However, cleaning fingernails is closely related to hand washing, although hand washing alone does not mean that fingernails are clean. From a health perspective, clean fingernails are particularly important when food is consumed or fed to infants using hands and also poses an aesthetic value (Bolt and Cairncross 2005).

The excerpts featured below illustrate the subjective nature of the hand and fingertip assessment and demonstrated some of the issues with this approach.

FGD3 "Most of the time, their fingernails were dirty and their palms and finger pads were clean" *FGD3 "It depended on what time we observed. Before lunch, most of the time we observed that their hands were dirty, specially their fingernails. But after lunch we observed that most of the times their hands were clean"*

8.3.3 Hand washing demonstrations

In general, the hand washing demonstration results compared with those obtained through from structured observation identified that a higher percentage of women washed hands with other materials, particularly soap. Overall, soap was used in approximately 4% of structured observation events equating to 141 female caregivers that were regular users of soap and only 37 were regular users of ash for hand washing for all exposures.

Therefore, this indicated that soap was over-used compared with observed practice, where for food related events over 90% of female caregivers washed their hands with water only. For hand drying during structured observation, hands were often not dried, dried on clothing or using a sharir anchal compared with the majority of female caregivers in the hand washing demonstration drying their hands on their sharir anchal. The hand drying process during the hand washing demonstration identified 84% of female caregivers dried their hands using their sharir anchal or kamiz and 7% used a dirty cloth. Only a small percentage air dried their hands.

8.3.4 Hand drying materials

The role and potential of hand drying materials in the transmission of diarrhoea is an area that has received limited attention in studies assessing hand washing behaviours and this research in terms of validation. This is due to hand drying only being assessed intensively during structured observation and to a much lesser degree during the hand washing demonstration. However, the results from this study demonstrate both from observation and the hand washing demonstration that drying hands on clothing, particularly, a sharir anchal and clothing were the main sources of hand drying. A study conducted in 51 slums in urban

Dhaka, Bangladesh, on 247 families examined the relationship between uses of the sari that pose a potential health hazard and the number of episodes of diarrhoea in children under six years of age. Mothers were observed at home to examine their usual hygiene practices.

The results of this study were that misuses of the sari were common, and that they were largely unrecognised by women as possible sources of disease transmission. There was extremely limited knowledge that all mothers believed to constitute misuse of the sari, including wiping a child’s bottom after it had defecated. An area that was identified by mothers as misuse of the sari was for purposes that made the sari wet.

Furthermore, a positive correlation was identified between the number of misuses of the sari and episodes of childhood diarrhoea. The authors advised that it was important to highlight the dangers of the misuse of the sari and convince mothers of the contamination and disease risk because they could easily change their behaviour and see results for themselves, unlike many other hygiene interventions (Stanton and Clemens 1986). The sari is commonly worn by women in India, Bangladesh and Pakistan and fairly widely throughout the rest of Asia (Healthlink Worldwide 1986). The SHEWA-B Health Impact Study survey instruments did not observe other high risk practices of individuals, this may potentially be an area to assess and include in diarrhoea prevention strategies. The relevance of this for this research could be additional questions in the survey that focus on hand drying for the five critical times. This would provide the opportunity for the comparison with hand drying practices observed during structured observation.

The main observation made from fieldworkers regarding the use of hand washing demonstrations was that they were not well received or taken seriously by respondents. Further elaboration on this from fieldworkers identified that respondents were observed to be acting and their behaviours were not in line with what was observed during structured observation. This was termed “abnormal behaviour” by fieldworkers. In terms of this, fieldworkers highlighted issues, for example, rubbing hands with soap for what appeared to be an excessive amount of time, washing one hand instead of the other and then reporting that they usually washed the other hand, for example, washing the right hand instead of the left hand which was used for defecation related practices.

Also reported, was an overuse of soap compared with what was observed during structured observation. This was similar to the findings that compared self report questions with structured observation. For example, some respondents did not wash hands with soap during the demonstration but reported that they usually used soap to wash hands. Some fieldworkers felt that conditions to perform a hand washing demonstration were not appropriate. This method has the further drawback that it requires time for the interviewer to observer the practice and may also present logistical difficulties, for example, having to go to the hand washing location and waiting for the interviewee to bring soap or other materials. In addition, this technique may only refer to a particular event, for example, hand washing after defecation which may not be how a person washes hands for other events, for example, food related events.

The excerpts below illustrates the challenges of using hand washing demonstrations to assess hand washing behaviour and potential reactivity occurrence due to the presence of an observer as previously discussed. These are taken from focus group discussions with field workers.

FGD3 "Sometimes the respondent performed the demonstration by washing their right hand. Then they said it was wrong, actually I wash my left hand after defecation."

FGD3 "Sometimes they rub their hands with soap for a long time which was artificial."

8.4 Validating hand washing behaviours

Structured observation enables the observation of particular specified hand washing practices. However, attempting to validate this data displays some particular difficulties when observation data is compared with other indicators, where it can be easier to classify the presence or absence of a specific behaviour.

The results from the previous chapter demonstrate that defining an individual as hand washing or non hand washing presents some challenges. This is exemplified for certain types of hand washing exposures where there are multiple observations of hand washing events during a specific observation period. This occurred for food related hand washing events where the maximum number of events observed before preparing food was ten. However, after three or more events the number of females experiencing more events decreased significantly, with on average, two events being experienced. The effect of these multiple events being observed was that individuals had inconsistent behaviours that resulted in sometimes washing hands with water only and sometimes with water and soap or not washing hands at all.

Furthermore, the structure of the observation data as described and illustrated in the overview and analysis of female hand washing events (Chapter 6) identified that focusing on the data on an event basis encountered the problem of multiple events for the same exposure for an individual. This format enables demonstration of the inconsistency of behaviour for certain types of hand washing events. The data in this format made it difficult to obtain an overall overview of hand washing behaviour for different hand washing exposures for female caregivers and subsequent use using methods to validate the different measurement methods.

8.4.1 Assessing the validity of critical hand washing behaviour indicators

In order to validate hand washing behaviour indicators comparing structured observation indicators with alternative measurement methods of self report, spot check and hand washing demonstration indicators, a screening/diagnostic test method approach was taken. The first analysis, the unstratified analysis, assessed all of the five critical hand washing exposures and assessed all hand washing events. In this analysis, like indicators from the structured observation were compared with comparable or similar to like indicators from alternative measurement method indicators. This section examines the findings and discusses the selection of potentially valid indicators for the five critical hand washing times.

8.4.2 Food related critical times-Unstratified analysis

In general, for food related critical times from structured observation data, it was apparent that soap use was a very low priority for the three critical hand washing times. This made it particularly difficult to assess and validate particular indicators as the prevalence of soap use was very low. For all food related critical times an indicator that performed poorly was a self report question on whether hands were washed. This indicator, when compared with structured observation, consistently demonstrated very high sensitivity but very low specificity estimates. As a result of this there were very high false positive rates.

With the exception of a few indicators, the overall results for the three critical times were either very high sensitivity estimates and low specificity estimates or low sensitivity estimates and high specificity estimates indicating a low false negative rate and a high false positive rate or a high false negative rate and a low false positive rate. This indicated that none of the self report, spot check and hand washing demonstration indicators performed effectively when compared with observation. Another combination identified was a moderately a high sensitivity estimate (70%) and moderate specificity estimate (30-40%) or vice versa. This meant that female caregivers that reported that they always washed hands and also reported via the alternative measures to perform a particular practice were correctly identified more than those that did not always wash hands and also reported via the other methods that they did not wash hands.

The indicator that was identified to be potentially useful before preparing food was a self report question on knowledge of hand washing before preparing food. However, the prevalence of hand washing with soap amongst this sample was very low at 1.3% as measured through structured observation.

Furthermore, the Positive Predictive Value (PPV) estimate was very low at 1.5%. The hand washing demonstration indicator of washing both hands was identified as a potential indicator. The only indicator identified amongst the comparison of before eating observation indicators with alternative measurement method indicators was a self reported indicator that was asked to female caregivers on whether both hands were washed before eating. However, the issue with this indicator again was the low PPV estimate of 13.8%.

8.4.3 Stratified analysis for food related critical times

For food related critical times, female caregivers experienced multiple events. In order to assess this further, an analysis was conducted stratified by the number of events experienced to assess whether there was any difference validating results taking into account all events compared with stratifying. Overall, the comparison of the unstratified results with the stratified analysis for the three food related critical times revealed that assessing all hand washing events in the unstratified analysis did not modify the results. The main difference was that the prevalence of whether hands were washed was slightly higher when assessed on a stratified basis for female caregivers that had a single event compared with those that experienced two and three or more events where the prevalence decreased.

In addition, for the food related critical time of before feeding a child, the prevalence of washing both hands increased with the number of events observed. One of the critical times that a particularly marked decrease was observed for was before eating whereby the prevalence of whether hands were washed was highest amongst those that experienced one event (84.6%) and decreased to a low of approximately 4% for those that experienced three or more events. The prevalence of soap use could only be calculated for those with one event. This was due to the small sample size of females washing hands with soap. A similar marked fall was also identified for the hand washing exposure of before feeding a child in terms of whether hands were washed.

One of the issues raised from this analysis is that by grouping those with three or more events there could be the potential for the dilution of results. However, there was still the feature that the prevalence of hand washing decreases with the number of events observed. This may indicate the “Hawthorne effect” relating to changes in an individual’s behaviour due to the presence of an observer diminishing. This may suggest in terms of policy initiatives that there is a need to promote sustained and consistent hand washing for all food related critical times. Overall, the results from the analysis of food related critical times using kappa statistics indicated only slight levels of agreement between the structured observation indicators compared with the alternative measurement method indicators that were identified from the validation using the concepts of a screening style approach. All other results demonstrated no to slight levels of agreement.

The results in Table 8.1 summarise selected indicators from the validation analysis for food related critical times that displayed potential as an alternative to structured observation.

Table 8.1: Summary table for valid food related critical hand washing measures using an epidemiological screening test approach

Comparison Indicators	Before preparing food (BPF)	BPF One event	BPF Two events	BPF Three plus events	Before eating (BE)	BE One event	BE Two events	BE Three plus events	Before feeding a child (BFC)	BFC One event	BFC Two events	BFC Three plus events
Observation vs. self report												
WBH and WBH (Event specific)					√	√	√	√		√		
HWWS and spare soap available			√						√	√	√	◊
HWWS and knowledge HWWS BPF/BE/BFC	√	√		√								
Observation vs. spot check												
HWWS and availability of soap at HW place		◊	◊									◊
Observation vs. Hand washing demonstration												
WBH and WBH	◊	◊	◊									

The only potential indicator identified amongst the indicators for before feeding a child was a self report question on the availability of spare soap. The prevalence of soap use was higher than the other two food related critical exposures, but was still very low at 3.2%. This indicator was also affected by a low PPV estimate of 4.9%. The importance of the role of the prevalence and its relationship with the PPV is an important issue when interpreting all results. If the prevalence for a particular condition is very low, the PPV will not be close to one even if the sensitivity and specificity estimates are both high (Altman and Bland 1994).

This was the case with all structured observation indicators for food related critical times that compared hand washing with soap with other similar self report, spot check and hand washing demonstration measures. The prevalence of hand washing with soap in this case was very low and this resulted in a low PPV even when both sensitivity and specificity estimates were high and this was due to the relationship between the prevalence of a particular condition and the PPV. This low PPV means that of those females that were identified as hand washing with soap through the alternative measure, a low proportion were correctly identified through structured observation to always perform a particular practice.

8.4.4 Defecation related critical times

The prevalence of whether hands were washed was higher for defecation related critical times, 89% after cleaning a child and 96% after defecation. The prevalence of hand washing with soap was also higher at approximately 27% after cleaning a child’s bottom/disposing of a child’s stools and 38% after defecation. The results for the unstratified analysis for the two defecation related critical times were similar for particular questions particularly the self report question on whether hands were washed. This could be possibly explained by there being fewer multiple hand washing events observed for defecation related events.

This question had very high sensitivity estimates close to or at 100% and specificity estimates of zero. These results indicated that female caregivers that were observed to always wash hands also reported when asked a self report question that they washed hands for these events. However, the very low specificity estimates indicated that there was a high false positive rate. This meant that female caregivers that were observed to not always wash hands when asked a self report question on their practices reported that they did wash hands for these events. This indicated that they were misreporting their practices.

The comparison of these results with the specificity estimates for the same alternative measures for food related critical times (which were also very low) demonstrated that for defecation related events, the estimates were the lowest. This may indicate that respondents felt more inclined to report that they washed hands for defecation related critical times compared with food related critical times.

Two indicators were identified to be potentially useful after cleaning a child's bottom/disposing of a child's stools for observation compared with self report indicators. This included a question on whether hands were washed with soap after cleaning a child's bottom and a question on whether soap was used for cleaning a child's bottom in the past 24 hours. The NPV estimate for both of these indicators was high but the PPV estimate was low at 30%. This indicated that of those female caregivers that reported that they did not wash hands, a high proportion were also observed to not always wash hands during structured observation.

For spot check indicators, one indicator was identified to be a potentially useful indicator, this was the availability of soap at the designated hand washing place. However, similarly, the PPV estimate was low at 36.2%. The low PPV estimates of all of these indicators indicated that a low proportion of female caregivers that were identified by self report and spot check to report that they performed a particular practice were not correctly identified during structured observation to always perform that practice. The results from the calculation of kappa statistics were also consistent with these findings.

The results discussed above, although affected by a low PPV, can be discussed in the context of Demographic and Health Survey (DHS) questions that have demonstrated potential for inclusion in future surveys. This includes the use of a 24 hour recall question on soap use for various different activities and the availability of soap at the designated place for hand washing through the use of a spot check method. From the results that emerged from the unstratified analysis for defecation related critical times, these are two indicators that were identified to be potentially useful indicators when compared with structured observation which was taken as the reference standard.

Furthermore, ORC Macro, the organisation responsible for the design of the hand washing questions in DHS, identified that self reported questions on hand washing behaviour were subject to over-reporting in their surveys. The results of this analysis indicated that self reported questions for all of the five critical times of whether hands were washed was consistently subject to misreporting. The result of this being a high false positive rate, as female caregivers misreported that they washed hands when they did not always wash hands during structured observation.

Three indicators were identified to be possible valid indicators amongst the observation indicators compared with self report indicators. This included self reported questions on the use of soap for hand washing based on an event specific question on hand washing for this event, the availability of spare soap and knowledge of washing hands after cleaning a child's bottom. These results had high NPV estimates but low PPV estimates similar to the other three potential indicators discussed.

The results for after defecation were based on the smallest sample size of the five critical times assessed. The sample size in this case was 58 females. For this exposure, three self report indicators were identified that were potentially valid indicators for assessing hand washing behaviours. These were whether both hands were washed, the use of soap based on an event specific question for hand washing after this exposure and a recall question on the use of soap for hand washing after defecation in the past 24 hours. However, these results needed be interpreted with caution due to the small sample size. The results from the analysis using kappa statistics were also consistent with these findings

For all of the three potential indicators, the sensitivity and specificity estimates were amongst the highest identified in the analysis for the five critical times. In addition, the PPV and NPV estimates were also high. The emergence of the potential of the recall question on the use of soap in the past 24 hours as an indicator for this exposure and after cleaning a child's bottom/disposing of a child's stools provides further weight to the potential use of this indicator to assess hand washing behaviour in the absence of structured observation or use in a household survey/evaluation on a large scale.

The results in Table 8.2 display the selected indicators that emerged from the validation analysis.

Table 8.2: Summary table for selected defecation related hand washing indicators using an epidemiological style approach and kappa statistics

Comparison Indicators	After cleaning a child/ disposing of stools (Screening)	After cleaning a child's bottom/ disposing of stools (Kappa)	After defecation (Screening)	After defecation (Kappa)
Observation vs. self report				
WBH and WBH (Event spec.)			√	√
HWWS and used soap for HW (Event spec.)	◊	◊	√	√
HWWS and used ash for HW (Event spec.)				√
HWWS and HWWS ACCB	√	◊		
HWWS and HWWS ADCS		◊		√
HWWA and HWWA			◊	√
HWWS and used soap ACCB/AD (24hrs)	√	◊	√	√
HWWS and separate soap available				◊
HWWS and spare soap available	◊	√	◊	◊
HWWS and knowledge HWWS	◊			
Observation vs. spot check				
HWWS and soap at HW place	√		◊	◊
HWWA and ash at HW place		◊		◊
Observation vs. Hand washing demonstration				
HWWW only and HWWW only		◊		
HWWS and HWWS		◊		

8.4.5 Washing both hands with soap for defection related critical times

From a public health perspective, the ideal behaviour advocated is washing both hands with soap. The results discussed thus far, demonstrate that this is not the case, particularly for food related critical times. For defecation related behaviours, a higher prevalence of female caregivers were identified to wash hands with soap. In this case, washing both hands with soap was taken as the reference standard in which all other self report, spot check and hand washing demonstration indicators were compared with. The purpose of this being to assess whether there were any other indicators apart from structured observation that were useful and had potential in determining whether both hands were washed with soap.

Firstly, focusing on the exposure of after cleaning a child's bottom/disposing of a child's stools, two self report indicators were identified to be potentially useful. These were hand washing with soap after cleaning a child's bottom and a recall question on whether soap had been used for hand washing in the past 24 hours. As with some of the previous findings, one of the issues was the low PPV estimates, although the NPV estimates for both indicators were high. The spot check indicator that emerged as a potentially useful indicator was the availability of soap at the designated hand washing place. However, this also had a low PPV estimate. There were two indicators that demonstrated possible inclusion and they were self report indicators including an event specific question on whether soap had been used and a question on knowledge of hand washing after cleaning a child's bottom/disposing of a child's stools.

The results featured in Table 8.3 are based on the selected indicators that emerged from the validation analysis comparing washing both hands with soap for defecation related practices with the alternative measurement approaches.

Table 8.3: Summary table of valid hand washing measures using an epidemiological style screening test approach and Kappa statistics: Washing both hands with soap for defecation purposes

Comparison Indicators	Screening test approach: AD/ACDS	Kappa statistic approach	Screening test approach: AD	Kappa statistic approach: AD
Observation vs. self report				
Washed both hands with soap/ash and WBH (Event specific)			◊	◊
Washed both hands with soap/ash and used soap for HW (Event specific)	◊	◊	√	√
Washed both hands with soap/ash and used ash for HW (Event specific)		◊		
Washed both hands with soap/ash and HWWS ACCB/AD	√	◊		◊
Washed both hands with soap/ash and HWWS ADCS/AD		◊		
Washed both hands with soap/ash and HWWA ACCA/AD				◊
Washed both hands with soap/ash and use of soap for HW ACCB/AD (24hrs)	√	◊	√	**√√**
Washed both hands with soap/ash and separate soap available				√
Washed both hands with soap/ash and spare soap available			√	√
Washed both hands with soap/ash and knowledge HWWS ACCA/AD	◊			
Observation vs. spot check				
Washed both hands with soap/ash and availability of water				◊
Washed both hands with soap/ash and soap at HW place	√	◊	◊	◊
Observation vs. Hand washing demonstration				
Washed both hands with soap/ash and HWWS		◊		

For after defection, three self report indicators emerged that were potentially useful indicators to assess hand washing behaviour. These were an event specific question on whether soap was used for hand washing after this exposure, a recall question on whether soap had been used in the past 24 hours and a question on the availability of spare soap. As with the other findings after defecation, the sensitivity and specificity were higher than other estimates, as were the PPV and NPV estimates. Two indicators were identified to be possible useful indicators as to whether both hands were washed with soap including whether both hands were washed and a spot check indicator on whether soap was available at the designated hand washing place.

For both of the defecation related critical times, the results from the analysis using kappa statistics were consistent with the results using the screening concepts. In the column that focuses on kappa statistics, results featured in bold and double ticks are results that were at the upper end of the fair agreement scale (0.20-0.40) and the double tick indicates the highest kappa score achieved in this whole analysis of 0.47 indicating a moderate level of agreement.

8.4.6 Measurement implications for DHS and other large scale surveys

This research sought to assess whether any alternative measures to structured observation could be used on a large scale for use in surveys such as the DHS. This result of this has implications for the use and adoption of measurement approaches in the DHS and other large scale surveys.

The results from validating structured observation indicators with alternative measures identified that particular self report questions on hand washing behaviour consistently underperformed across the five critical times. An example of such a question that was identified to have a high false positive rate indicating misreporting of hand washing practice was a question asked on whether hands were washed for the five critical times. In addition, another self report question that was demonstrated to underperform was a self report question on whether hands were washed with soap for a specified critical time. This was not only identified in the context of Bangladesh but was also seen in all countries with available DHS data featured in Chapter 3. Overall, hand washing demonstrations as an alternative to structured observation did not produce results that would suggest that this method should be considered as an alternative to structured observation. Furthermore, any question should focus on all of the five critical times.

In light of the findings of validating approaches, the recommendations are that if questions on hand washing are to be used in large scale surveys, a better approach would be to ask the question in different components to respondents. For example, firstly the respondent should be asked whether they experienced an event either on the day of the survey or the previous day. This should be followed by a series of sub questions on whether hands were washed for that event, whether both hands were washed and whether soap was used/whether ash was used. The rationale for this being that indicators featured in this manner, particularly washing both hands and the use of soap were indicators that demonstrated potential as an alternative to structured observation, particularly whether both hands were washed amongst food related critical times and the use of soap amongst the defecation related indicators.

A question on knowledge of when hands should be washed emerged as another potential indicator. The key feature of this question was that answers should not be offered to a respondent rather the respondent should offer their answers voluntarily. A self report question on the availability of spare soap was also an indicator that demonstrated potential for assessing the observed practice of hand washing with soap. This was identified for two food related critical times of before preparing food and before feeding a child. The use of a spot check method of whether soap was available at the designated location used most often for cooking purposes and before eating and feeding a child to assess hand washing with soap was also a possible indicator that emerged. However, one of the issues with this indicator amongst food related critical times was that the prevalence of hand washing with soap for food related critical times was low. This indicator may therefore work more effectively in a setting where the prevalence of hand washing with soap is higher.

The implications for the use and design of questions on defecation related critical times of after cleaning a child's bottom/disposing of a child's stools was that particular self report questions fared better than others. As discussed above, the usefulness of questions that asked whether hands were washed for a particular specified events are subject to gross over reporting compared with actual observed practice of behaviour. There were two self report questions that could be used as a potential alternative to structured observation after cleaning a child's bottom/disposing of a child's stools. This included a self reported question that asked whether hands were washed with soap after cleaning a child's bottom and a recall question that focused on the use of soap in the past 24 hours after cleaning a child's bottom. As discussed in Section 1.4.4, ORC Macro who run the DHS programme were interested in using a question on 24 hour recall of soap use in their surveys as they have demonstrated potential in different country settings. This is similarly the case for the use of a spot check method to assess whether soap was available at the designated place for hand washing. This indicator was identified as a potential alternative measure.

The results for after defecation indicated that event specific self report questions on whether both hands were washed and the use of soap for the specified event were potentially good indicators as an alternative to structured observation for assessing hand washing with soap. The recall question on 24 hour soap use also featured well and was a potential alternative indicator for this hand washing event. A possible indicator was the spot check indicator on the availability of soap at the designated hand washing place used most often after coming back from the toilet. These results were also indentified to be consistent in the validation analysis that assessed the structured observation indicator of washing both hands with soap compared with the alternative measures. An additional indicator was identified for after defecation. This indicator was a self report question on the availability of spare soap in the household.

This research therefore corroborates existing recommendations that a recall question on soap use in the past 24 hours and a spot check on the availability of soap at the designated hand washing place can be used as potential alternatives to structured observations. This is particularly important where structured observation cannot be offered or used on a large scale. The continued use of different methodologies such as self report and spot checks should be used in conjunction with each other in order to validate methods.

The standardisation of questions on hand washing and the need for valid behavioural outcomes measures in DHS and other large scale surveys and hygiene promotion programmes has resulted in expert consultations in the field of water, sanitation and hygiene. This work identified that hand washing is one of the more difficult hygiene practices to measure in the hygiene sector. The role of reactivity in structured observation was highlighted as one of the major drawbacks of this method and was discussed in Chapter 2. However, in some studies, structured observation was thought of as the “gold standard” approach.

The difficulties of measuring hand washing practices has led to the recent development and proposed used of indicators that are identified to provide valid and reliable indicators to assess hand washing behaviour and methodologies on how to collect information on hygiene practices. This work assimilated the evidence to date on how to measure these behaviours in a valid and reliable way due to their importance in the prevention of diarrhoeal disease and reduction in child morbidity and mortality. It is said to “promote a breakthrough given the prevailing difficulties in achieving an agreement on how and what aspects of hygiene practices should be measured and how they should be measured”. It highlights the importance of measurement as demonstrated by this research for project and programme evaluation purposes that includes baseline data collection, mid-term and final evaluations.

The importance of measurement for the role of monitoring the performance of programmes was also cited as important. The monitoring of programme indicators enables assessment of whether targets have been achieved during a programme. The collection of high quality data was also featured as important in terms of further decision making that may include strategies for programmes and funding allocation.

The chosen indicators are ones that fit the objectives and measurement outputs of international donor and development assistance agencies in the field of water, sanitation and hygiene. The indicators identified are said to track output and outcomes at the household level. The promotion of a triangulated approach to measurement was proposed through using different measurement methods to obtain the same information. In the case of the assessment of hand washing practices, it was advised that using different measurement methods is crucial.

The four indicators proposed to measure hand washing at the five critical times have different characteristics. The first indicator is one based on the assumption of knowledge of the five critical moments for hand washing with soap to prevent diarrhoeal disease. The remaining three indicators are proxies. These proxies are ones that have been considered reliable and valid and are based on the presence of hand washing supplies (soap and water) and the presence of a designated hand washing place. It is identified that these conditions are necessary in order to facilitate hand washing. The importance of soap for its health benefits was a further feature, but other cleaning agents (ash and sand) that are commonly used hand washing agents in some countries are also featured, although the emphasis is more on soap due to the demonstrated health benefits. The indicator on knowledge of the critical times in which hands should be washed is important for child survival programmes. The responses are not read out to respondents, the purpose is for answers to be volunteered (USAID Hygiene Improvement Project and Academy for Educational Development 2010)

The rationale for the choice of proxy measures to assess hand washing through spot check was based on findings from Biran et al (2008). This study sought to assess the validity of different hand washing indicators. The measures were compared to structured observation. The approach used kappa statistics to assess validity. In total, 27 measures were compared with the aim of assessing whether individuals could be classified as hand washers and non-hand washers as defined by structured observation. The overall results of the study were that it was possible to predict non-hand washers but not to predict hand washers. The measurement indicator that was associated with the selection of non-hand washers was through an indicator from an environmental spot check, specifically the lack of soap at different locations in the household, including the yard. Therefore, it was concluded that spot observation of the availability of soap at the hand washing location is a simple and important indicator to assess hand washing with soap. The requirement of water was also highlighted as it is required to wash hands; however, the quality of water was not thought to be important (Biran, Rabie et al. 2008).

The spot check observation proposed was the same as the ones used in the UNICEF-SHEWA-B programme featured in this research and adopted by DHS in previous surveys.

The questions proposed were as follows:

- ***Can you show me where members of your household most often wash hands?***
- ***Is water present at the specific place for hand washing?***
- ***Is soap or detergent present at the specific place for hand washing?***
- ***Is locally used cleansing agent present at the specific place for hand washing?***

A further question that was featured regarding the hand washing location and this was thought to possibly be dependent on the location of a latrine. There was also an additional sanitation question. The question was as follows:

- ***Where is your toilet facility?***

The questions and indicators proposed are accepted by the Monitoring and Evaluation Working Group of the Public Private Partnership for Hand washing Initiative. The conclusions of this work were that the use of inferred measures through the use of spot check observation may end up being more reliable and valid than observation. However, it is suggested that more validation studies are needed for confirmation (USAID Hygiene Improvement Project and Academy for Educational Development 2010). The indicators and measurement methods discussed are therefore in line and further corroborate the findings from this validation analysis. This re-emphasises, in particular, the use of the spot check observation methods as a means of collecting valid and reliable data on hand washing behaviours.

8.4.7 Methodological issues with a diagnostic test approach

The use of a diagnostic test approach includes the consideration of a number of important points. Diagnostic tests are seldom 100% accurate and false positive and false negatives will occur (Greenhalgh 1997). The results from validating the five critical times illustrated that this is the case for particular indicators. Furthermore, a test is identified to be valid if it detects most individuals with a specified condition, indicated by high sensitivity and excludes those without the condition, indicated by high specificity and subsequently if a positive test usually indicates that the condition is present, indicated by a high PPV (Greenhalgh 1997). This was not the case with the results obtained from validating the hand washing measures. The key aim of this analysis was to assess whether there were any other suitable indicators as opposed to structured observation that could be used to measure hand washing behaviour, or are an indicator for a particular practice. Therefore, in this case, there were certain elements that were required that relate to two questions:

1. Does the test, in this case, self report, spot check and a hand washing demonstration correctly identify female caregivers that both practice and do not practice a particular behaviour compared with the reference standard of structured observation?

2. From a targeting perspective, who do you want to be able to identify in terms of promoting hygiene practices?

With reference to the first question, this relates to the test having both a high sensitivity and specificity. The PPV and NPV also have to be assessed. Ideally, you would want to have moderately high estimates for both. However, as previously discussed the PPV is driven by the prevalence of a condition in a given population. From a targeting perspective, it is individuals that do not practice a particular behaviour that are of interest. In this case, a high specificity is necessary and a high NPV.

There are ten key criteria identified by Greenhalgh to consider when assessing the usefulness of a diagnostic test (Greenhalgh 1997). These are featured next and assessed in the context of the use of a validation approach using the concepts of diagnostic testing to assess methods for measuring hand washing for the five critical times (Chapter 7).

1. **Is the test potentially relevant to my practice?**

The first focuses on the relevance of the test to current practice. This is referred to as the utility of the test. In this respect, this relates to whether the use of other approaches, for example, self report, spot check and hand washing demonstration methods are preferable to the use of structured observation. This incorporates issues relating to affordability and consent. One of the fundamental drawbacks of structured observation is that it is difficult to use on a large scale as it requires time for the observation to take place and extensive training of fieldworkers. Furthermore, it is an expensive method to conduct on a large scale as it is labour intensive. In addition, there are sample size constraints due to the labour intensiveness of the method (Bentley, Boot et al. 1994). The choice, therefore, is to assess whether there is any other method that produces suitable results that is comparable with structured observation that can be conducted on a large scale. Therefore, the use of another method aside from direct observation would be useful and have utility for the above reasons specified.

2. **Has the test been compared with a true gold standard?**

The second point is whether the test has been compared with a true gold standard. Structured observation is however, the only available method that provides information on actual hand washing behaviour of female caregivers through direct observation. This method, although not 100% accurate due to the limitations previously discussed , cannot be referred to as a gold standard measure, it does provides a reference standard that is based on observed behaviour which none of the other methods described apart from the hand washing demonstration and the spot check, which are both based on observation.

However, with structured observation, information was provided on all critical hand washing exposures identified as important for diarrhoea prevention. The results demonstrate that hand washing with soap for food related critical hand washing times was low. The structured observation measures were compared with the nearest possible alternative measure to assess the validity of the different measurement methods.

3. **Did this validation study include an appropriate spectrum of subjects?**

The third point is based on whether the validation study included an appropriate spectrum of subjects. The spectrum of households included in the structured observation and cross sectional survey was obtained from a random selection of 100 communities. These households were from rural Bangladesh and differed in terms of their socio-economic status and household size. In addition, certain eligibility criteria were important, for example, having a child less than five years of age.

4. **Has work up bias been avoided?**

The fourth and fifth points relate to bias. The first is work up bias and whether this was avoided. In the context of this research, this means whether households that received the structured observation also received the cross sectional survey component. In this analysis on validating hand washing indicators, the focus was on households that participated in structured observation and the cross sectional survey component. Households that only had the cross sectional component were excluded from the sample. Furthermore, households that had both components but had an older female caregiver or male caregiver that responded to the cross sectional survey on behalf of the female caregiver were excluded from the sample. Therefore, the cross sectional survey component that was merged with the structured observation component included female caregivers only.

5. **Has expectation bias been avoided?**

The second form of bias to be addressed is expectation bias and importantly, whether this was avoided. The example given by Greenhalgh, for example, is when pathologists and others who interpret diagnostic specimens are subconsciously influenced by the knowledge of particular features of the case. For example, if they are aware of the presence of chest pain when interpreting an electrocardiogram. In the context of validating diagnostic tests against a gold standard, all such assessments should be "blind". In the context of this research, this feature was important. The same fieldworker who conducted the structured observation was the same field worker who conducted the cross sectional survey component that consisted of self report questions, the spot check and the hand washing demonstration. Therefore, fieldworkers may have remembered a female caregiver's hand washing practice.

However, importantly, this study was not designed in the form of a randomised control trial where the observer would be blind to the practice of the household when conducting the cross sectional survey component. The fieldworker did however observe multiple household members during structured observations and it would be difficult for an individual to remember all of the observed practices of an individual. Furthermore, the cross sectional survey component was conducted two to three months later than the structured observation. The implication of this was that it further helped to corroborate overall findings of over reporting. This related to the general overestimation of soap use that was reported in focus group discussions with field workers.

6. Was the test shown to be reproducible?

The sixth point relates to whether the test has been shown to be reproducible. In relation to this work, it demonstrates the role of variability of the methods of measurement used and the level of consistency of hand washing practices. For example, if an observer performs the same test on two occasions to a subject whose characteristics have not changed, they will get the same results in a proportion of cases. If the self report, spot check and hand washing demonstration were performed again, the results may be subject to change; however, it is possible that the similar results will be observed for particular questions, for example, hand washing with soap, as this question was subject to over reporting.

If the questions were asked on a different occasion, the person asked may not have experienced a hand washing event, therefore, the results may differ to a previous occasion. However, this would similarly be the case with structured observation in that if observations were conducted on two occasions for the same subject, then the subject will not always experience the same hand washing exposures compared with a previous occasion.

This is one of the key issues with both direct observation methods and the other methods, that they are both subject to variability. However, previous studies indicate that it is very difficult to change hand washing behaviour as habits are deeply entrenched and the sustainability of hand washing behaviour continues to exist long after a hygiene promotion programme has finished (Cairncross, Shordt et al. 2005). Therefore, if an individual does not practice hand washing with soap, it is unlikely that they will consistently wash hands with soap over a long observation period.

Reactivity as discussed may occur but the results of this study and others indicate that this decreases substantially after 30 minutes of observation and the effects are potentially not as biasing as previously thought (Ram 2008). The way in which this may be potentially overcome is through conducting repeated structured observation for female caregivers over different time periods. However, the purpose of the study stating that the research was assessing hand washing behaviours should not be disclosed to participants of the study as to minimise reactivity and increased hand washing practice.

7. What the features of the test are as derived from this validation study?

The seventh point is based on what the features of the test are as derived from the validation study. This relates to the sensitivity, specificity and other crucial features of the test, for example, the PPV. If these are too low, then the test is not valid. The results of this validation study as shown in the previous chapter are illustrative of this. For some indicators, namely self report questions on whether hands were washed, the sensitivity was high, but the specificity was very low, indicating a very high false positive rate. For other indicators comparing structured observation with other measures, the sensitivity and specificity estimates were moderate.

The ideal situation is that both estimates were high but the PPVs were low or moderately high and the NPVs were high. It is important to clarify the purpose and importance. For example, the f two points raised in section 8.4.7 outline the importance of what the indicators and the features of the diagnostic test approach are seeking to achieve. If, for example, the focus is on targeting, then it would be important to identify those female caregivers that were not performing a particular practice indicated by a high specificity and a high NPV. The purpose of this would be to promote improvements in their practice, for example, the incorporation of soap in the hand washing process. However, for the choice of an indicator or method that is a suitable alternative to structured observation, high sensitivity and high specificity is the desired outcome. However, the difficultly seen with the PPV is that it is influenced by the prevalence of a particular condition, as demonstrated with soap use for hand washing for food related critical times.

8. **Were confidence intervals given?**

The eighth point relates to the confidence intervals and whether they are given. This is particularly important as they relate to the sample size. The confidence intervals were provided for all analyses. The larger the sample size, the narrower the confidence interval and the converse for smaller sample sizes. Therefore, for certain events, for example, after defecation, where there were 58 events observed, the lowest sample size amongst the five critical times examined included in the validation analysis. Therefore, it is important that this is taken into account and confidence intervals are reported as the small sample size is particularly sensitive to minor changes that are magnified in other features, for example, the sensitivity and the PPV. This then affects the interpretation and selection of possible indicators.

9. **Has a sensible "normal range" been derived?**

The ninth point relates to whether a sensible normal range was derived. In this sense, this relates to whether the test gives a continuous result rather than a yes/no result. If a continuous result is given, then it becomes necessary to define what is meant by "abnormal". In the case of this research, the self report, spot check and hand washing demonstration were all based on a yes/no response; therefore, this was not an issue.

10. **Has the test been placed in the context of other potential tests in the diagnostic sequence?**

The last point refers to whether the test has been placed in the context of other tests in the diagnostic sequence. This point is not necessary in this analysis as this relates to, for example, how particular medical conditions are tested for and the differing sequence of how the conditions are assessed and tested for.

Therefore, in summary, all of the features of the test regarding this case study have been adequately assessed.

8.5 Research limitations

This research was not without limitations. The structured observation and cross sectional component were conducted within three months of each other. Therefore, the data compared was not collected at the same time, so although the hand washing exposures were the same, the same events were not compared, Furthermore, this research has highlighted the complexity of observing hand washing behaviour, particularly repeated observations for particular exposures, for example, food related critical times. In this case, an overall score of hand washing behaviour was required in order to account for multiple observations for the same hand washing exposure, in order to appropriately compare structured observation with the other survey methods. Therefore, there was a limitation in the sense that although the questions on different events were comparable, many were not the same. However, the closest measures were chosen. The diagnostic test approach used to assess the validity of the indicators is normally used in a public health/medical context where the choice of a well validated "gold standard" or reference standard exists. The use of this method to assess measurement issues from a behavioural aspect is difficult, due to the complexity of the measurement of hand washing behaviour. Furthermore, in this context the use of structured observation as the reference standard was the only method that provides information on directly observed behaviour.

The use of a diagnostic/screening test approach method does provide an insight into assessing the validity of measurement methods. One of the issues with this method is that the prevalence of the condition drives the positive predictive value as previously discussed, particularly when the prevalence of a condition is very low. This was one of the major limitations of this approach to validating methods. In addition, the use of this approach to assess behavioural public health data requires further development, for example, a more statistical approach to the determination and selection of indicators rather than an arbitrary figure.

A further issue with this approach is that it appears to work more effectively with defecation hand washing events where the number of true positives and true negatives was greater and better distributed. This approach does however offer a more detailed and comprehensive assessment of the validity of measurement methods compared with the use of kappa statistics.

This is because a kappa statistic only offers a single statistic that is then interpreted on a particular scale whereas a diagnostic test approach provides further information on the extent of misreporting and by whom.

The SHEWA-B programme only focused on rural Bangladesh so the results are not generalisable to urban Bangladesh and can only be interpreted in the context in which the study was conducted. There may be a number of key differences in hand washing practices in urban and rural areas that either promote or inhibit hand washing behaviour. For example, in urban areas there may be the issue of water scarcity. However, rural Bangladesh was chosen due to the programmatic purposes and project aims. In addition, a major issue was that the SHEWA-B programme, although interested in the measurement of hand washing behaviour, was not specifically designed to assess the validity of indicators. If measurement issues and particularly validation of methods was considered before, then certain additional criteria and requirements could have been included.

As this research has demonstrated, no particular method was without limitations. This needed to be taken into account when assessing and interpreting the results. The focus of this work was on the mother as she was primarily responsible for children and the primary caregiver of young children. In addition, hygiene behaviour programmes focus on and target the primary female caregivers for this reason (PPPHW 2003). Therefore, this research did not assess the behaviours of others which may be different.

8.5.1 Policy implications

Hand washing with soap is vitally important for maintaining and protecting health. The results of this research provide a key insight into hand washing behaviours in the rural Bangladeshi context. The results displayed illustrated that hand washing with soap for food related events were low priority for female caregivers. Therefore, increasing and promoting the importance of hand washing with soap or ash and its benefit for child health and survival should be an inherent part of any hygiene promotion initiative.

The use of structured observation demonstrated the complexity of hand washing behaviours and the different techniques and approaches to washing hands. This information was vitally important as it also provided information on individuals who did not wash hands at all for the five critical times. For those that wash hands with water only and wash one hand, particularly for food related events, the emphasis should also be to incorporate the use of soap or ash within the hand washing process and wash both hands. In terms of hand drying, hands should either be dried on a clean towel or through air drying.

The literature on the prevention of diarrhoea identifies that diarrhoea is primarily transmitted via the faeco-oral route, as demonstrated in the F-Diagram featured in Chapter 2. Therefore, washing hands with water alone does not remove infectious disease pathogens from hands and is therefore not adequate in reducing the transmission of pathogens from hands. Therefore, during the food preparation process if food is directly prepared with hands that have not been washed appropriately and this may then pose a risk during the food preparation process and subsequent consumption of food.

During structured observation, some individuals were observed to wash both hands with water only; this was not common practice during food preparation. This goes someway to show that both hands can be washed in this context, even though the literature suggests that in the South Asian context one hand tends to be washed for food related events and there are issues regarding the interaction of the left and the right hand due to cultural reasons (Hoque, Mahalanabis et al. 1995a). Furthermore, questions on hand washing behaviour identified that the vast majority of female caregivers eat with hands and the last time they fed a child they used their hands. Therefore, there is direct hand to food contact. From a hand washing promotion perspective, this can be used to promote and incorporate the use of soap in the hand washing process so that both hands are washed in accordance with current practice on how hands should be appropriately washed.

Hand washing with soap for defecation related practices is critically important as this is the event where the potential for faecal contact is greatest and the transmission of faecal bacteria on to hands. In this context, the practice of anal cleansing whereby the left hand is used for cleaning after defecation with water provides the opportunity for hands to come into direct contact with faeces, in addition to other faecal contact opportunities through handling of a child’s stools or cleaning a child’s bottom.

The practice of hygienic anal cleansing is important. However, discussions on the subject have been widely ignored in presentations on hygiene and sanitation. The reasoning given for this is that, in almost all cultures, to handle or discuss faeces is taboo. Therefore, it is deemed easier to forget about the topic. The reluctance to address this topic has led to the failure of some hygiene intervention programmes to understand the anal cleansing practices of young children in the school setting.

The result being the provision of inappropriate technologies, for example, flush toilets that become blocked due to children using materials for anal cleansing that blocks the toilet facility. The use of water is common in countries with Islamic traditions and in Asia, as demonstrated in this research. In Latin America, wiping materials are commonly used and may differ with respect to gender. Furthermore, socio-economic factors play a major role as wealthier individuals and many middle class individuals in developing counties use toilet paper. In addition, there may be differences due to geography based on urban and rural settings and the use of anal cleansing materials (World Bank 2005).

A baby or young child's faeces are often more hazardous than an adult's as there is a higher concentration of pathogens. However, in many societies, a child's faeces are not considered to be harmful (Sulabh International Social Service Organisation 2009). One gram of faeces however, contains on average 10,000,000 viruses, 1, 000,000 bacteria, 1,000 parasite cysts and 100 parasitic eggs (Curtis 2003; Sulabh International Social Service Organisation 2009). Therefore, if hands are not appropriately washed after defecation or after cleaning a child's anus/disposing of a child stools and before food preparation and then eating takes place soon after this poses a real public health risk in terms of the potential transmission of diarrhoea. Food preparation activities are therefore a potential source of contamination whereby faeces on hands have the potential to come into contact with food. Other food related times of before eating and importantly before feeding a child also present further opportunities as there is direct hand-food contact when food is eaten with hands or a child is fed with hands. Therefore, any public health strategy needs to address additional issues such as knowledge of the hazards of faeces, the promotion of hand washing with soap or ash and also the safe disposal of a child's stools.

Given all the factors discussed and the continued importance of the role of hand washing for diarrhoea prevention, the measurement of hand washing behaviour and methods employed should continue to be validated and tested in other settings. The use of a spot check method was therefore offered as a suitable alternative to structured observation for use on a large scale where the use of structured observation is not possible. This method acts as a proxy measure in that it does not provide information on actual hand washing practice. Furthermore, a self report question on the use of soap in the past 24 hours is also another potential alternative indicator.

Large scale surveys such as the Demographic and Health Survey (DHS) have already begun to integrate such questions into their household surveys as they appear to be providing encouraging results. The results from this work on validating the measurements methods offer further encouragement and corroborate the findings from the DHS further. The use of other self report questions, for example: “Did you wash your hands with soap before preparing food” and for the other critical times as questions in this format are subject and prone to over-reporting. The inclusion of such questions if absolutely required should be separated into different components for the five critical times, for example, firstly ask whether a respondent prepared food either on the day of the survey or the previous day and subsequent questions on whether hands were washed, if both hands were washed and the hand washing agents used, if any.

The context and environment in which the behaviour takes places is of importance. Washing both hands with soap and rubbing for a specified amount of time may work in a context where soap and water is readily available and behaviour norms regarding eating and defecation practices are different. However, in the Bangladeshi context, where eating with hands is commonplace and importantly where there is clear distinction between the interaction of the right and left hand, it may be difficult to define what appropriate hand washing behaviour is, and more importantly, how it should be targeted and promoted. Therefore, advocating strategies that may work in a particular cultural context or setting requires caution and understanding of cultural and societal norms. Furthermore, changing behaviour and habits is a complex process and science (Curtis, Danquah et al. 2007). The different critical times also need to be considered differently as different types of behaviour exist for food and defecation related behaviour. In terms of defecation behaviour, individuals either do or do not wash and the use of soap was higher in this context. However, with food related exposures, the behaviour is more varied and commonly involved the use of water only.

The SHEWA-B project provided an opportunity to address and improve hand washing behaviour on a large scale. The evaluation of this project is of importance to global public health and evaluating a project of such a large scale requires appropriate methodologies to assess hand washing behaviour. This research provided recommendations on how methodologies can be improved to provide quality information. A study using data focusing on defecation related hand washing behaviours from the SHEWA-B Health Impact Study data used multivariate analysis to assess hand washing behaviours in rural Bangladesh. The results from the final model identified that having water and soap available at the designated hand washing location after toileting were associated with washing both hands with soap after faecal contact (Halder, Luby et al. 2008). This was measured through structured observation. The conclusions of the study were that interventions that improve the presence of soap and water at the designated hand washing location would be expected to improve hand washing behaviour and health.

In conclusion, this research was thought to provide new evidence that the use of a spot check method to assess the presence of whether a hand washing location together with the availability of soap and water at that location was as described by the authors "a rapid, inexpensive, objective proxy measure associated with hand washing". The authors suggested that further research from other settings was required to corroborate this further, but if so, spot check methods may be a useful indicator for assessing progress in hand washing promotion efforts in communities in high need (Luby, Halder et al. 2009).

8.5.2 Future work

In the future, it would be useful to assess and compare the hand washing behaviour of young children in comparison with female caregivers to examine the extent to which a child's behaviour is influenced by the behaviour of the main female caregiver's practice. Further examination of the critical times and the level of compliance across the different hand washing exposure would be of interest to assess whether there is consistency of hand washing behaviours across critical times for female caregivers. For example, for female caregivers observed to have defecation related events, the sequence of events that followed this and subsequent hand washing behaviour.

It would also be useful to use the different measurement methods for assessing hand washing in different contexts and conduct the validation analysis on such results to determine whether the results hold true in different country contexts. Other potential work could include conducting the measurement methods on a larger scale and using structured observation for a longer duration of time. The use of formative research prior to the study would be useful to assess general hygiene practices and gain a better understanding in the context and way in which hygiene related practices take place. The assessment of other hygiene related practices may be of use to understand hand washing and further ways in which diarrhoea could be potentially prevented. In addition, it would also be useful to gain feedback from female caregivers on the barriers and facilitators to hand washing practices to complement the research. It may also be possible to assess nutritional hygiene as this is important in terms of weaning foods. Furthermore, food hygiene practices during this time may be important to evaluate as unhygienic practices may increase the potential for diarrhoea.

Further statistical investigation could assess the consistency of responses across the different measurement methods and the characteristics that determine respondents' reports and observed practice. The assessment of methodological issues could be possibly further substantiated by recording practice, for example, through video monitoring. However, there are ethical considerations to take account of and whether covert or overt techniques would be used as this could result in reactivity.

A further important area for future work is related to structured observation data. The way in which the data was collected and the potential of observing multiple events further complicated this data. This was particularly the case when validating this approach against different measurement methods. However, this data was very important in understanding hand washing behaviour and the format of data may make it difficult for those within the public health area to use. Therefore, it is proposed that incorporating a format that makes it more user friendly and accessible to those in this area to use and possibly the use of a more standardised instrument that has been validated in different contexts that can be used by researchers in this area.

The assessment of the determinants of hand washing behaviour was not the focus of this study. However, from a policy perspective it would be useful to know and gain insight into the factors that influence hand washing behaviours by assessing structured observation and the cross sectional survey components separately. As suggested in the recommendations, the role of reactivity should be further assessed given findings from Harvey et al's study that reactivity, although common, has the potential to be examined within a study that uses direct observation techniques. Furthermore, that it is not a major source of bias as previously thought, particularly when particular behaviours are focused on (Harvey, Olortegui et al. 2009). Therefore, building such initiatives into a research study would be important in order to assess this. Future research should take account of the recommendations proposed above based on the findings of this research. In addition, further statistical analysis could be conducted to assess the determinants and characteristics of respondents for the different measurement methods and model the consistency of the different measurement methods.

The complexity of hand washing behaviour means that this research was unable to assess other cultural and societal influences on hand washing behaviour. Other exploratory factors, for example, differences between geographical areas and the links this has to diarrhoea is also a further area, as certain geographic areas may be more diarrhoea prone. In addition, access to water differs markedly by zone and may potentially impact on hand washing behaviour. Therefore, further analysis could assess water sources and access to water. This research did not assess any differences between control and intervention areas as the data used was baseline data before any intervention occurred.

8.6 Summary

This research has identified that hand washing with soap was a low priority particularly for food related critical times. The use of a multi method approach to assess hand washing behaviours has provided useful information to validate the different methodologies. The findings of this research demonstrated the complexities and difficulties of assessing hand washing behaviour and that the different approaches were not without drawbacks. There DHS indicators displayed data quality issues and concerns regarding measurement, particularly self report questions on hand washing behaviour. This validation research provided further support to those findings and that self report questions were subject to misreporting and should be interpreted with caution.

Qualitative methodologies were very useful in informing and understanding indicators on hand washing and hand washing behaviour and practice. These methodologies provided useful information that could be assessed from a quantitative perspective. The quality of structured observation data differed regarding the exposure assessed. In addition, important factors, for example, the timing of observation was crucial for sensitive behaviours such as after defecation.

The use of a spot check method that assessed the availability of soap at the designated hand washing place was a potentially useful indicator for assessing hand washing behaviour. In addition, a self reported question on the use of soap in the past 24 hours was also another potential indicator. However, this method only provided proxy information and was not able to provide information on actual hand washing practice and by whom.

Therefore, from a survey perspective, for example, the DHS, integrating spot check methods as a potential indicator for assessing hand washing behaviour has the potential to provide proxy information on a large scale where the use of structured observation is difficult. A further indicator also assessed by ORC Macro was 24 hour recall of soap use. This indicator also demonstrated potential in the validation analysis.

Structured observation should continue to remain as a key technique in the study of hand washing behaviour. This is because fundamentally this method provided information on actual behaviour for the five critical hand washing times which no other technique discussed was able to provide. It was also able to demonstrate when used in conjunction with other methods the strengths and weaknesses of the different approaches. However, spot checks and 24 hour recall as discussed offer potential for use in large scale cross sectional survey, for example, the DHS, where it would be logistically difficult and expensive to use structured observation.

Approaches and techniques validating hand washing behaviours require further development and the use of a diagnostic/screening test approach identified some of the issues. The use of focus group discussions provided further complementary information on the strengths, limitations and other measurement and methodological issues that could not be acquired through the other methods used to assess hand washing behaviour.

The complexity of hand washing behaviours and the differences in technique and level of compliance means that targeting and promotion initiatives also have to take these important features into account. The emphasis should be on the use of soap and its importance in the removal of infectious disease pathogens from hands due to faecal contact. Furthermore, the hazards posed by faeces is fundamentally important to ensure reductions in child morbidity and mortality from diarrhoea, a disease which is highly preventable, but is unfortunately responsible for the loss of approximately two million children under five every year.

The simple act of hand washing with soap is a low cost intervention that if promoted at scale can promote notable reductions in diarrhoea morbidity and mortality together with interventions that promote the safe disposal of a child’s stools. This research demonstrated that although hand washing is simple, at the same time, it is a complex behaviour to measure (Jumaa 2005).

9 Conclusion

This chapter concludes the overall findings of the research. Firstly, the rationale of the research is given. This is then put in the context of the overall findings on hand washing with soap in the context of Bangladesh. The purpose of the research is revisited and the importance of the role of measuring hand washing and validating measurement methods. The main approaches to measuring hand washing within the domestic and clinical setting are outlined along with the main measurement and methodological issues. The approaches adopted by ORC Macro, the implementers of the DHS, are examined together with a critique of the measurement methods. The focal point of the research is then assessed in terms of the approaches taken to validate the measurement methods using a case study from Bangladesh through the UNICEF SHEWA-B programme. This is then discussed with relevance to how this implicates on the future design and adoption of hand washing measurement methods in future DHS and other large scale household surveys. Lastly, this chapter proposes future work and scope for development.

9.1 Role of hand washing and the importance of measurement

The practice of hand washing with soap plays an important role in reducing the transmission of infectious disease pathogens that cause diarrhoea. This research has demonstrated that in the context of Bangladesh, hand washing with soap remains a low priority particularly for food related critical hand washing times where approximately 1% of female caregivers were observed to wash hands with soap during structured observation in approximately 1000 households. The use of soap for defecation related critical times was higher with approximately 29% of female caregivers using soap two-thirds or more of the time after cleaning a child's anus/disposing of a child's stools and 38% used soap two-thirds or more of the time after defecation.

This research had two main objectives. The first of which was to assess the measurement methods and methodological issues of the methods used to measure hand washing behaviour in Demographic and Health Surveys (DHS) and provide a critical appraisal of the measurement methods that could then be used to build on in the next stage of the research that focused on the validation of measurement methods.

The second objective was to assess the methodological and measurement issues of measuring hand washing behaviours through the comparison of structured observation and responses to cross-sectional survey measures (spot-check observation, self-reported hand washing and a hand washing demonstration). This was achieved through the use of a unique data set from a large scale hygiene promotion study and used baseline data prior to any intervention to assess and validate hand washing behaviours focusing on the main female caregiver. The purpose of which was to validate the different measurement methods to identify whether any alternative measurement methods could be used as an alternative to structured observation on a large scale, for example, in an international household survey like the DHS. This was complemented through the use of focus group discussions with field workers that were used to shed light on any measurement issues, methodological problems and the appropriateness of indicators.

This research therefore assessed the suitability of measurement methods and the indicators that emerged from the different measurement approaches to identify whether any of the other alternative measurement methods used apart from structured observation produced reliable and valid results that were in line with observed practice as identified using a direct observation approach through structured observation.

9.1.1 Measurement methods used in the domestic and clinical setting

The study of hand washing behaviour is complex and difficult. The measurement of this behaviour is of importance in both the domestic and clinical setting for the prevention of infection. A variety of different measurement methods have been used to attempt to measure hand washing and hand hygiene behaviours. The approaches used in both the clinical and domestic context are similar. The use of direct observation approaches, for example, structured observation provide directly observed information on hand washing behaviour and adherence to hand hygiene protocols in the clinical setting.

This approach provides a useful insight on the level of hand washing in terms of the frequency of behaviour, but also information on the occasions on which hands were or were not washed, the components of the process; whether both hands were washed, the hand washing agents used, for example, the use of soap, ash or mud, the location in which hands were washed and how hands were dried. Therefore, from the perspective of this research, this approach was able to provide information on the five critical hand washing times advocated for diarrhoea prevention. This approach therefore provides a method of capturing an individual's behaviour on the day of observation over a specified time period.

This approach was not without drawbacks. The most commonly identified issue with this approach was reactivity. A further feature of this method was that it was difficult to use on a large scale. The other included a labour intensiveness and the requirement of highly trained observers and as a result is expensive to implement. The other commonly featured alternative methods included the use of self reported methods through questionnaires. The main disadvantage of this method was that it was subject to over-reporting whereby individuals over-report their behaviour. This method was therefore unlikely to provide an accurate reflection of true behaviour. Other methods included spot check methods. This method involves the observation of the presence or absence of particular items or facilities. This may include the availability of soap, a designated hand washing location with the presence or absence of water and other predefined items. This method has been offered as a potential suitable alternative to structured observation methods. This method only provides proxy information on hand washing behaviour, and not actual hand washing practice. The presence of a hand washing material such as soap at the designated hand washing place does not necessarily mean that soap is used routinely for hand washing.

In the clinical setting and a more recent approach used in the domestic setting to assess hand washing is through the assessment of product usage. In the clinical setting, product usage involves the assessment of the level consumption of a particular product, e.g. alcohol hand gel, antibacterial soap or hand towels. In the domestic setting, this involves the placement of electronic monitors, commonly known as accelerometers that are embedded within soap bars that are given to households and the accelerometers are able to monitor and track whether soap was used due to them being fitted with motion detectors. This approach was developed and tested by Unilever predominately in South Asia. This approach has the main disadvantage of being expensive to use at scale due to the costs associated with the development of the logger device. In addition, it has been required that households that have been given soap bars with loggers are informed that the soap given has a logger device and should therefore not be lost etc.

This can create similar drawbacks to those associated with the use of direct observation approaches whereby reactivity becomes an issue. In this case, it is not due to the presence of an observer, but knowledge that the soap bar contains a monitoring device that may subsequently promote hand washing in individuals who previously did not hand wash or hand wash with soap. In conjunction with the soap bars fitted with accelerometers, there has also been the development of “smart bodnas”. A smart bodna is a jug type container that is commonly taken for anal cleansing and hand washing. The smart bodna is fitted with an electronic device to assess whether it is used in conjunction with the smart soap bar after defecation. Other approaches used include pocket voting, but the most common approaches are those that involve the use of direct observation, the use of questionnaires through surveys using self report questions and additionally in the clinical setting, product usage.

A variety of measurement methods have therefore been offered to measure hand washing behaviour. The measurement of hand washing is important as is the need for valid and reliable data on hand washing behaviour. This is important as it is necessary to appropriately plan, monitor and evaluate hygiene promotion programmes and interventions. The need for valid data is required so that the method of measurement of hand washing provides an accurate reflection of the normal hand washing practice of the individual. This also relates to the reliability of the measure. In the clinical context, the measurement of hand hygiene practice is required in order to monitor adherence to hand hygiene practice and how subsequent action can be taken in order to improve practices through the identification of the both the facilitators and barriers to adherence.

Furthermore, the increasing awareness and importance of patient safety and use of hand hygiene as an important component of infection control in the clinical setting means that at national and global levels, it is important to be able to monitor and assess hand hygiene and compliance and adherence to protocol. In order to monitor progress and improvements at both national and global levels, effective measurement methods and tools are required that have been well validated and tested. There has been extremely limited validation of different measurement tools in both the clinical and domestic setting. The focus of this research was to therefore validate the measurement tools and indicators, critique the different approaches and provide recommendations as to the way forward for the selection of indicators that may potentially be offered as an alternative to direct observation techniques such as structured observation. The purpose of which was the potential use in large scale surveys, for example, the DHS.

9.1.2 Demographic and Health Surveys

The implementers of the DHS, ORC Macro, have experienced difficulties in the design of measurement methods on hand washing behaviour. The use of self report methods have been identified to produce serious over estimates of hand washing behaviour when tested in particular DHS countries as seen in Chapter 3. The use of spot check observation was used in some countries, but was removed from the DHS questionnaire as it was thought that the questionnaire was becoming too long. The use of questions that involved the 24 hour recall of soap use were tested and thought of to produce reliable results when tested in two countries with DHS surveys, Nepal and Peru. However, ORC Macro is aware of the need for well validated tools and measurement methods on hand washing behaviour.

The results of the analysis of DHS approaches to measuring hand washing behaviour identified that over-reporting of hand washing behaviours was apparent compared with the observation of actual hand washing facilities as identified through spot check. There was a clear mismatch identified in some countries between reported hand washing that focused particularly on hand washing before preparing food and spot check observation of whether a household had a designated place to wash hands, water available, soap, ash or another cleansing agent and a basin.

The spot check measures appeared to provide a far more realistic interpretation of available components for hand washing. In addition, the main focus on hand washing in the case of these questions was hand washing before preparing food. However, it is well established that there are five critical times in which hands should be washed for diarrhoea prevention. Therefore, the critique of the DHS indictors concluded that self report measurement methods were inappropriate as they were providing what appeared to be gross overestimates in all countries where the questions were used.

9.2 Validating hand washing behaviours: a case study of Bangladesh

This research then turned its attention to focus on Bangladesh. The focus of the research on this country was due to the availability and collaboration in a large scale hygiene promotion programme, the UNICEF SHEWA-B programme. This programme is a large scale hygiene promotion programme which is conceivably one of the largest hygiene promotion programmes ever attempted in a developing country. The SHEWA-B programme used a range of data collection methods to measure hand washing behaviours. From mid 2007, a range of baseline activities were conducted that included structured observation and a cross sectional survey that included self report, spot check observation and hand washing demonstrations in order to measure hand washing behaviours.

This research then used this unique dataset to assess and validate the different measurement methods used to measure hand washing behaviour. This involved using an epidemiological style approach that used the concepts of screening/ diagnostic testing using sensitivity, specificity, positive and negative predictive values and the calculation of kappa statistics to assess and evaluate the validity and reliability of measurement methods. This approach placed the reference standard as structured observation which all other measurement methods were evaluated against. The focus was on the main female caregiver who was mother of the youngest child.

The focus was on the five critical times for hand washing, three of which were food related and the remaining two were defecation related hand washing events. The occurrence of multiple observations of hand washing particularly for food related critical times meant that two approaches were taken to validate. The first approach focused on all of the hand washing events experienced by a female caregiver during the observation period and the second was a stratified analysis that validated using the two approaches of screening and calculation of kappa statistics by the numbers of hand washing events experienced. This took account of the number of hand washing events experienced for example, one, two and three or more events. The purpose of this was to assess whether the number of hand washing events affected the validity and potential choice of hand washing measurement methods and subsequent indicators from those measurement methods.

9.2.1 Findings from the validation of measurement methods

The results from the validation analysis identified that particular self report questions on hand washing behaviour consistently underperformed across the five critical times. An example of such a question that was identified to have a high false positive rate indicating misreporting of hand washing practice was a question asked on whether hands were washed for the five critical times. This also included another self report question on whether hands were washed with soap for a specified critical time. Overall, hand washing demonstrations as an alternative to structured observation did not produce results that would suggest that this method be considered as an alternative to structured observation. A recommendation that emerged from the findings was that if self report questions are to be used then it is more appropriate to focus on the five critical times.

In light of the findings of validating approaches, it was also recommended that if questions on hand washing are to be used in large scale surveys a better approach would be to ask the question in different components to respondents, for example, firstly whether they experienced an event either on the day of the survey or the previous day. This should be followed by a series of sub questions on whether hands were washed for that event, whether both hands were washed and whether soap was used/whether ash was used. The rationale for this being that indicators featured in this manner, particularly washing both hands and the use of soap were indicators that demonstrated potential as an alternative to structured observation, particularly whether both hands were washed amongst food related critical times and the use of soap amongst the defecation related indicators.

Further potential indicators included a question on knowledge of when hands should be washed and a self report question on the availability of spare soap. This was an indicator that demonstrated potential for assessing the observed practice of hand washing with soap. This was identified for two food related critical times of before preparing food and before feeding a child. The use of the spot check method of whether soap was available at the designated location used most often for cooking purposes and before eating and feeding a child to assess hand washing with soap was also a possible indicator that emerged. The issue for food related critical times and the effectiveness of this indicator was the very low prevalence of soap use. The recommendation was that this indicator may perform more effectively in a setting where the prevalence of hand washing with soap is higher.

The results and implications for defecation related critical times of after cleaning a child's bottom/disposing of a child's stools was that particular self report questions performed better than others. This validation of measurement methods called into question the usefulness of questions that asked whether hands were washed for particular specified events. This was due to such questions being subject to gross over reporting compared with actual observed practice of behaviour. The indicators that emerged were two self reported questions that could be used as a potential to structured observation after cleaning a child's bottom/disposing of a child's stools. This included a self reported question that asked whether hands were washed with soap after cleaning a child's bottom and a recall question that focused on the use of soap in the past 24 hours after cleaning a child's bottom. This question was the same as the one adopted by ORC Macro in the Nepal and Peru 2006 DHS. This indicator therefore has demonstrated potential in different country settings. This was also the case for the use of a spot check method to assess whether soap was available at the designated place for hand washing. This indicator was identified as a potential alternative measure for this critical time.

The results for after defecation identified that event specific self report questions on whether both hands were washed and the use of soap for the specified event were potentially good indicators as an alternative to structured observation for assessing hand washing with soap. The 24 hour recall question on soap use also performed well and was a potential alternative indicator for this hand washing event. A possible indicator identified was the spot check indicator on the availability of soap at the designated hand washing place used most often after coming back from toilet. These results were also indentified to be consistent in the validation analysis that assessed the structured observation indicator of washing both hands with soap compared with the alternative measurement measures. An additional indicator was identified for after defecation. This indicator was a self report question on the availability of spare soap in the household.

9.2.2 Implications for DHS and recommendations

The results of this research therefore corroborate existing recommendations that a recall question on soap use in the past 24 hours and a spot check on the availability of soap at the designated hand washing place can be used as potential alternatives to structured observations. This is particularly important where structured observation cannot be offered or used on a large scale. The implications for DHS include the further inclusion of a recall question on soap use and the use of spot check observation methods. In addition, if self report questions are to be used, the recommendation was that the question should be separated into different components for the five critical times. The continued use of different methodologies such as self report and spot checks should be used in conjunction with each other in order to validate methods.

The use of structured observation as a measurement method to assess hand washing behaviour has the potential to be affected by methodological issues as this research has demonstrated. This method continues to be the only method that provides information on directly observed behaviour. The timing of observation is crucial in the collection of high quality data for particular events, for example, hand washing after defecation where if observation started late then certain events can be easily missed. The role and importance of fieldworkers and thorough and extensive training on survey instruments is also crucial. Fieldworkers provide very useful information that can be used to identify potential problems and improve survey tools. The development and testing of more tools and replication of validation techniques in different settings would be useful in order to ascertain whether measurement methods for hand washing can be standardised and used universally in different settings.

9.2.3 Recommendations

The recommendations featured below are based on the findings of this research. They seek to provide direction to those using the measurement approaches assessed in this research.

- A well designed and field tested survey instruments is essential as is extensive training on the survey instruments prior to implementation in the field. This will help to uncover any difficulties and issues with the survey instruments which can then be rectified and improved upon before use on a large scale.

- The use of structured observation should continue to be used as an indicator to assess hand washing behaviour where possible. However, when it is not possible to use this method, spot check observation can be a useful proxy (see point below)

- The use of spot check observations is a potentially useful indicator for assessing defecation related behaviours; in particular, the availability of soap at the designated hand washing place so should be included in surveys. This indicator can be used as a potential alternative when structured observation cannot be used on a large scale particularly for defecation related behaviours. It should be remembered that this is a proxy indicator, so it therefore does not provide direct information on particular aspects of hand washing behaviour. This includes factors such as the frequency of hand washing and the use of hand washing materials and the location in which hands were washed.

- The timing of the structured observation is crucial for capturing particular events, for example, defecation events. Observations need to take place early with consistent start and finish consistent timings across different field locations.

- Build reactivity measures into the data collection process. For example, observers can note reactive behaviours that may or may not impact on the interpretation of measurement methods.

- Reactivity is an important issue for structured observation. Informing participants on the nature of the study may affect the validity of information collected. Therefore, where possible, the nature of the study when including hand washing components should not be disclosed to respondents unless absolutely necessary, for example, for ethical purposes.

- If self reported questions for particular critical times are included, it is useful to have different components of the question, for example, whether hands were washed, were both hands washed and whether soap was used and base them on the five critical hand washing times. Furthermore, if other self report questions are to be included they should not involve the respondent being given a choice of answers, rather respondents should volunteer answers and probing should not be undertaken unless absolutely necessary, only in the case of extremely unrealistic answers.

- The recording of the start and finish time of the event during structured observation would be useful to know. This would enable comparison of when particular events take place and the chronology of the hand washing events. This information would be useful to assess the level of adherence to hand washing across hand washing events.

- Observing multiple household members is difficult and hand washing events can be missed. The choice should be made as to whom to primarily focus on during observation in terms of the most important groups, for example, mothers of the child or the main caregivers and the youngest child. It would be useful to have for accuracy purposes the name of the mother of the youngest child or main female caregiver observed during structured observation so this can be corroborated against identification in other elements of the survey. However, there are ethical considerations to take account of if such an approach is adopted.

- Providing unique member identification numbers would be useful to ensure that individuals in the observation are those that are featured in other components of the study. This should only be done if there are various other aspects of the project that can be linked, e.g. a survey.

- Formative research to understand hand washing behaviour and a longer observation period may provide further information on hand washing practices that are missed and occur outside the observation window. This would provide useful information as to whether different hand washing practices take place outside the observation period and how this compares with the hand washing events observed during the observation period.

- Classification of hand washing behaviours should be the same in order to enable comparison between different measurement methods. This means that the definition of hand washing should be consistent across different measurement tools.

- The role of interviewers could be further assessed and including codes with gender and demographic characteristics of interviewers would be of interest to assess interviewer effects. For example, having two observers and then levels of agreements between observations could be assessed.

- A hand washing demonstration and hand and fingertip assessments are subjective assessments and could potentially be supported by microbiological methods in a selection of individuals/households. However, there are financial considerations to consider in order to implement this. If these methods cannot be corroborated with some scientific method they should be avoided.

- In order to assess the variability of hand washing behaviour, a selection of households could be assessed for a longer observation period over a week or more to assess their behaviour. This would be useful to assess factors such as reactivity. However, as with the above point the major constraint to this is the financial cost of such a task.

- Other opportunities that are missed when hands are not washed could be assessed and high risk practices identified and defined. This could include the inclusion of other questions on indirect hand washing behaviours, for example, bathing or washing clothes during structured observation.

- Potentially conducting the observation and the survey on the same day in order to make direct comparisons rather than a lagged time period. However, there is the potential that reactivity may be an issue.

- Obtaining feedback on how the components were understood by respondents and feedback from fieldworkers on the observation and survey process. This would enable improvements to be made where necessary.

- The continued use of multiple measurement methods at the same time in order to triangulate and validate data. The use of different measurement methods would mean that findings could be corroborated or refuted and the different measurement methods provide different information on different aspects of the hand washing process. For example, the use of structured observation provides information on the frequency and level of hand washing practices together with the use of materials and where hands are washed whereas a spot check provides information on the presence or absence of a hand washing location and hand washing materials.

9.2.4 Summary

This chapter summarised the results in the context of the objectives of the research. The importance of hand washing in reducing the transmission of infectious diseases was discussed. The two main objectives of the research were discussed. Firstly the focus was on the measurement and methodological issues of the DHS approaches to measuring hand washing. The second focused on the case study of Bangladesh and the different measurement methods used to assess hand washing behaviour and validating the different approaches. The focus of the discussion was then on the measurement methods used to assess hand washing behaviour in the domestic and clinical setting. This discussion highlighted that each of the different methods were not without drawbacks. This was then set in the context of this research, particularly the validation of the different measurement methods, which in the literature is advocated for, however, limited research has been conducted to assess this area further.

The DHS approaches to measuring hand washing and the difficulties faced in the design of questions on hand washing were discussed. The important feature was that there was a clear mismatch between reported hand washing behaviour and the actual spot check observation of the presence or absence of a designated hand washing location to wash hands and the necessary hand washing materials to facilitate such a practice. The conclusion reached was that the spot check observation provided a far reliable assessment of hand washing indicators than the self reports obtained through the use of direct questions.

The validation of hand washing measures through a case study of Bangladesh using the SHEWA-B Health Impact baseline data provided a unique opportunity to validate the different measurement methods. The focus was on the five critical hand washing times. The main findings were that self reported hand washing indicators for all of the five critical times assessed, consistently underperformed when assessed using a screening type approach and analysis using kappa statistics. The results from the validation analysis for food related critical times identified that the availability of spare soap and knowledge of the important times to wash indicators were potentially useful indicators for assessing hand washing behaviour as an alternative to structured observation.

The indicators that demonstrated good validity for hand washing as an alternative to structured observation for defecation related critical times were those identified through spot check observation, self report and recall questions. The specific indicators were the availability of soap at the designated place for hand washing after coming back from the toilet and a self report question on whether hands were washed with soap. A potentially useful indicator was an indicator that was based on an event specific question on whether both hands were washed. One of the main messages was that if self report questions needed to be used, then they should be asked in different components for the specified event. Some of the results corroborated those from existing research. In particular, the use of a recall question on 24 hour soap use.

The use of structured observation to assess hand washing behaviours was discussed. This approach remains the only one that provides information on directly observed hand washing practice. The role of fieldworkers and their important contributions through focus group discussions was discussed.

The final aspect of this chapter proposed recommendations on the different measurement methods to assess hand washing behaviour based on the findings of this research. The recommendations proposed highlighted the importance of piloting survey instruments and proposed the use of spot check observations as a valid indicator as an alternative to structured observation. A number of suggestions were proposed to improve the validity of structured observation indicators. This included factors related to timing, reactivity and instrument design. The ways in which self report methods could be improved was also proposed. Finally, the main recommendation was the continued use of a variety of different measurement methods. The purpose of which could be used to further validate measurement methods and corroborate findings.

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Appendix

Appendix A: SHEWA-B Health Impact Survey Instruments

Permission for use of SHEWA-B Health Impact Study data

RE: Shewa-B Health Impact Study

Steve Luby [sluby@icddrb.org]

Sent: 12 May 2008 09:41

To: Danquah L.O.

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Lisa:

You are welcome to use the SHEWA-B Health information study data as
part of your PhD research.

Steve

At 03:05 AM 5/11/2008, you wrote:
>Dear Steve,
>
>Thanks very much for your email and apologies for the delay in
>responding. I would be very grateful if you can provide some
>documents to help me with my University Ethics application as you
>suggested. I would also appreciate if you would email me copies of
>the consent forms administered to households before the survey
>instruments (Structured Observation, Cross Sectional Survey and
>Sentinel Surveillance and Rapid Screening) to include in my application.
>
>In addition, please would you be able to provide me with a separate
>email authorising permission from you to use the Shewa-B HIS data as
>part of my PhD research to include as written permission in my
>ethics application? I will acknowledge the use of all data in all
>work conducted.
>>
>Thank you very much for your help.
>Regards,
>Lisa
>
>________________________________
```

CROSS SECTIONAL SURVEY

Health Impact Study (HIS) 2007, ICDDR, B-UNICEF

PART A: QUESTIONNAIRE

Section 1. Questionnaire identification

1.1 Household ID: □□□□□□

(Please follow the specific code sheet)

1.2 Instrument Type (***Code: Cross Sectional Survey=02***): **0** **2**

1.3 Was the household included for Structured Observation? □

Yes 1

No 2

1.4 Was the household selected for arsenic test water sample collection? □

Yes 1

No 2

1.5 Cluster number (*starting point number*): □□□

1.6 Study group: □

Intervention 1

Control 2

1.7 District name & district geocode: □□□

1.8 Upazila name & code: □□

1.9 Union name:

1.10 Address: Name of household head:

Father's/ husband's name:

Bari Name:

Village:

Location (specify):

1.11 FRA name & code: □□

1.12 Date of data collection/observation/spot check: □□/□□/□□

Section 2. Respondent and household demographics

2.1. Name of respondent:

2.2.Status of main respondent □

Mother of youngest child 1

Male caregiver 2

Female caregiver 3

2.3. Age of main respondent: *(in years)* □□

2.4. Sex of head of household *(1=Male, 2=Female:)* □

(*By household, I mean all the people that eat food from the same cooking pot*)

2.5 Is the household head disabled? (1=Yes, 2=No) □

2.6 Age of household head (in years) □

2.7. Education of mother of the youngest child: ☐☐

(Years of education completed, DK=99)

2.8. Education of father of the youngest child: ☐☐

(Years of education completed, DK=99)

2.9. Main occupation of father of the youngest child: ☐☐

Occupation Code:

Farmer/Cultivator

Homemaker

Agri-labor

Non-agri labor

Salaried job (Govt./Private/NGO)

Mason (*Rajmistri*)

Carpenter

Van/Rickshaw puller

Fisherman

Boatman

Blacksmith

Goldsmith

Potter (soil smith)

Shoe polish /maker

Shopkeeper

Petty trader

Vendor (*Feriwala/howker*)

Business

Tailor

Driver

Cottage industry

Poultry /livestock rearer

Electrician

Homeopath

Spiritual healer/kabiraj/ Ojha

Professional practitioner (Doctor/lawyer)

Imam/priest

Retired service holder

Student

Unemployed

Disabled

Domestic maid / servant

Landlord (Provide land for farmers for sharecropping or others)

Staying abroad

Died/untraced

Don’t know

Others (specify …………………………………)

2.10 How many people in total live in your household at present?

☐☐

2.11 How many children less than five years old live in your household? 2.11.1 Male:…………..

☐☐

2.11.2 Female:………. ☐☐

Section 3. Respondent's Hand washing practices

3.1 When do you wash your hands with soap? (This is an open-ended question)

Note: After filling up answer of this open-ended question, check appropriate code to the boxes below.

Yes.....1, No.......2

3.1.1 Before preparing food ☐

3.1.2 Before eating ☐

3.1.3 After eating ☐

3.1.4 Before feeding a child ☐

3.1.5 After cleaning child's anus ☐

3.1.6 After disposal of child feces: ☐

3.1.7 After defecation ☐

3.1.8 After handling cow-dung ☐

3.1.9 After returning from outside compound

3.1.10 Never

3.1.11 Others (Specify)

3.2 When do you wash your hands with ash? (This is an open-ended question)

Note: After filling up the answer of this open-ended question, check appropriate code to the boxes below.

Yes.....1, No.......2

3.2.1 Before preparing food

3.2.2 Before eating

3.2.3 After eating

3.2.4 Before feeding a child

3.2.5 After cleaning child's anus

3.2.6 After defecation

3.2.7 After handling cow-dung

3.2.8 After returning from outside compound

3.2.9 Never

3.2.10 Others (Specify) ☐

3.3 When did you last prepare food? (If ”4 or 5”, skip to question 3.4)

……………………………..☐

Code: Today 1

Yesterday 2

Before 2 or more days back 3

Never/can’t remember 4

Refused 5

If answer of 3.**3** is 4 or 5, skip to question 3.4

3.3.1 Did you wash hands before preparing food? (Yes.....1, No.......2) ☐

3.3.2 Did you wash both hands? (Yes.....1, No.......2) ☐

3.3.3 Did you use soap? (Yes.....1, No.......2) ☐

3.3.4 Did you use ash? (Yes.....1, No.......2) ☐

3.4 When did you last eat with hands? ……………………………… ☐

Code: Today 1

Yesterday 2

Before 2 or more days back 3

Never/can’t remember 4

Refused 5

If answer of 3.4 is 4 or 5, skip to question 3.5

3.4.1 Did you wash hands before eating? (Yes.....1, No.......2) ☐

3.4.2 Did you wash both hands? (Yes.....1, No.......2)

3.4.3 Did you use soap? (Yes.....1, No.......2)

3.4.4 Did you use ash? (Yes.....1, No.......2)

3.5 When did you last feed your child with hands? …………………

Code: Today 1

Yesterday 2

Before 2 or more days back 3

Never/can't remember 4

Refused 5

If answer of 3.5 is 4 or 5, skip to question 3.6

3.5.1 Did you wash hands before feeding? (Yes.....1, No.......2)

3.5.2 Did you wash your hands? (Yes.....1, No.......2)

3.5.3 Did you use soap? (Yes.....1, No.......2)

3.5.4 Did you use ash? (Yes.....1, No.......2)

3.6 When did you last clean your child's anus? (If "4 or 5", skip to question 3.7)

Code: Today 1

Yesterday 2

Before 2 or more days back 3

Never/ can't remember 4

Refused 5

If answer of 3.6 is 4 or 5, skip to question 3.7

3.6.1 Did you wash hands after cleaning child's anus? (*Yes.....1, No.......2)* ☐

3.6.2 Did you wash both hands? (*Yes.....1, No.......2)* ☐

3.6.3 Did you use soap? (*Yes.....1, No.......2)* ☐

3.6.4 Did you use ash? (*Yes.....1, No.......2)* ☐

3.7 When did you last defecate? (**I**f "4 or 5", skip to question 3.8) …………..☐

Code: Today 1

Yesterday 2

Before 2 or more days back 3

Can't remember 4

Refused 5

If answer of 3.7 is 4 or 5, skip to question 3.8

3.7.1 Did you wash hands after defecation? (*Yes.....1, No.......2)* ☐

3.7.2 Did you wash both hands? (*Yes.....1, No.......2)* ☐

3.7.3 Did you use soap? (*Yes.....1, No.......2)* ☐

3.7.4 Did you use ash? (*Yes.....1, No.......2)* ☐

3.8 How many times did you wash your hands throughout the day yesterday? ☐☐

3.9 Have you used soap today or yesterday? (Yes.....1, No.......2)☐☐

3.10 When you used soap today or yesterday, what did you use it for?

Note: If for washing the respondent or child's hands are mentioned, probe what was the occasion. Don't read the answers, ask to be specific. Encourage 'what else' until nothing further is mentioned and check all that apply).

Yes.....1, No.......2

3.10.1 Washing clothes ☐

3.10.2 Washing my body ☐

3.10.3 Washing my children ☐

3.10.4 Washing my children's hands ☐

3.10.5 Washing child's anus ☐

3.10.6 Washing hands after defecating ☐

3.10.7 Washing hands after handling cow-dung ☐

3.10.8 Washing hands before feeding child ☐

3.10.9 Washing hands before preparing food ☐

3.10.10 Washing hands before eating ☐

3.10.11 Washing hands after eating ☐

3.10.12 Other: Specify: ☐

3.11 Do you have separate soap available for hand washing? ☐

Code: Yes 1

No 2

DK 9

3.12 Do you have spare soap available in the household? ☐

Code: Yes 1

No 2

DK 9

3.13 How often do you buy soap (Body soap)? ☐

Code: Weekly 1

1-2 weeks 2

2-4 weeks 3

Greater than a month 4

Never 5

DK 9

3.14 When do you think it is important to wash hands? <u>Open ended question</u>

Note: Don't read the answer, encourage by asking if there is anything else until he/she mentions there in nothing else and check all mentioned?

Yes 1

No 2

3.14.1 Before preparing food or cooking ☐

3.14.2 Before eating ☐

3.14.3 After cleaning/changing baby ☐

3.14.4 After defecating

3.14.5 After eating

3.14.6 Other: specify

3.14.7 DK

Section 4: Household water treatment and arsenic awareness

(Note: Before asking the following questions of this section, please fill up spot check questions of Section-8)

4.1 Do you treat your water in any way to make it safer to drink?

Code: Yes 1

No 2

DK 9

If 4.1 is 2 or 9, skip to question # 4.4

4.2 What do you usually do to make the water safer to drink? Anything else? (check all mentioned)

4.2.1 Boil (Yes=1, No=2)

4.2.2 Add bleach. (Yes=1, No=2)

4.2.3 Add chlorine solution (Yes=1, No=2)

4.2.4 Add chlorine tablets (Yes=1, No=2)

4.2.5 PuR[4] (Yes=1, No=2) ☐

4.2.6 Fitkiri (Yes=1, No=2) ☐

4.2.7 Use ceramic filter (Yes=1, No=2) ☐

4.2.8 Use bio-sand filter[5] (Yes=1, No=2) ☐

4.2.9 Solar disinfection (Yes=1, No=2) ☐

4.2.10 Other (specify) (Yes=1, No=2) ☐

4.3 When was the last time you treated your water? ☐

Code: Today 1

Yesterday 2

In a week 3

In two weeks 4

A month 5

Don't remember 6

Never 7

4.4 Have you heard of arsenic in water?

Yes. ……………… 1

No 2

N/A ………………. 8

DK …………………. 9

[4] **PuR**: this is a product made by Procter and Gamble that combines flocculation, coagulation, and disinfection. Essentially, it binds organic matter (including many microoganisms) and then releases chlorine. I am not aware of whether Pur is sold commercially in Bangladesh. However, it may have been distributed in response to floods a couple of years ago.

[5] **Bio-sand filters:** these use sand for filtration, similar to the way that water is filtered through the ground before it reaches underground aquifers from which water is then pulled up using tubewells or pumps, etc.

If answer of 4.4 is other than 1, skip to section 5

4.5 Do you know what health problems can be caused by arsenic? (Open –ended question, then check with following appropriate codes)

Yes 1

No 2

4.5.1 Spots on skin ☐

4.5.2 Hardening of hands/feet ☐

4.5.3 Cancer ☐

4.5.4 Can die ☐

4.5.5 Weakness ☐

4.5.6 Other: Specify ☐

4.6 Do you know, if arsenic disease is contagious?

☐

Yes. ……………… 1

No 2

N/A ………………. 8

DK …………………. 9

4.7 (***Ask and check***): Was the water source (Question # 8.5) ever been tested for arsenic?

☐

Yes (safe). ……………… 1

Yes (Unsafe). ……………… 2

No 3

N/A ………………. 8

DK …………………. 9

4.8 Have you ever changed your main drinking water source because of arsenic? ☐

Yes . ……………… 1

No 2

N/A ………………. 8

DK …………………. 9

If answer of 4.8 is other than 1, skip to section 5

4.9 What change did you make? (Open –ended question, then check with following appropriate codes)

Yes 1

No 2

4.9.1 Take drinking water from a different existing shallow tubewell ☐

4.9.2 Re-sank own shallow tubewell to deeper layer ☐

4.9.3 Take drinking water from a deep tubewell ☐

4.9.4 Take drinking water from river/dam/lake/ponds/stream/canal/ irrigation channel ☐

4.9.5 Take drinking water from dug well (‘*kua*’) ☐

4.9.6 Collect rain water for drinking ☐

4.9.7 Treat drinking water to remove arsenic ☐

4.9.8 Other: Specify ☐

Section 5: Hygiene & safe water messages

5.1. Did anyone tell/teach you/your household members about messages of how and why to use safe water? ☐

Code: Yes 1

No 2

DK 9

If answer of 5.1 is 2 or 9, skip to 5.3

5.2. If answer of 5.1 is 1, then who told you about it?

5.2.1 Name of CHP (ex: Shirin Apa, from PPD NGO) ☐

5.2.2 Other NGO: specify ☐

5.2.3 TV ☐

5.2.4 Radio ☐

5.2.5 Poster ☐

5.2.6 Micking ☐

5.2.7 Mela ☐

5.2.8 Natok/drama ☐

5.2.9 Govt. health assistant ☐

5.2.10 DPHE tube well mechanics ☐

5.2.11 Imam/ religious leader ☐

5.2.12 Others (specify ☐

5.3 Did anyone tell/teach you/your household members about the messages of hygienic behavior and its practices (**please follow the list of messages in the footnote to verify the answer**)[6]?

☐

Code: Yes 1

No 2

DK 9

If answer of 5.3 is either 2 or 9, skip to section 6.

5.4 If answer of 5.3 is 1, then who told about it? ☐

5.4.1 Name of CHP (ex: Shirin Apa, from PPD NGO) ☐

5.4.2 Other NGO: specify ☐

5.4.3 TV ☐

5.4.4 Radio ☐

5.4.5 Poster ☐

5.4.6 Micking ☐

---

[6] The messages are: 1. Washing both hands with soap before eating, 2. washing both hands with soap/ash after defecation, 3. washing both hands with soap/ash after cleaning child's anus, 4. confirming excreta in pit/water sealed/ low cost latrines, 5. using sanitary latrine by all family members including children, 6. disposal of children's feces into sanitary latrines, 7. maintaining sanitary latrines properly by men and women, 8. safe collection and storage of drinking water, 9. drawing drinking water from arsenic safe tube wells, 10. washing fruits and vegetable with tube well water before eating and cover food properly and 11. maintain proper hygiene during menstruation.

5.4.7 Mela ☐

5.4.8 Natok/drama ☐

5.4.9 Govt. health assistant ☐

5.4.10 DPHE tube well mechanics ☐

5.4.11 Imam/ religious leader ☐

5.4.12 Others (specify ☐

Section 6. Adolescent menstrual hygiene

Note: Respondent for this portion is adolescent girl (If more than one adolescent girl, we can ask any one of them)

Definition of adolescent: ***Age group 10-19 years, and no matter she is married or unmarried.***

Interviewer criteria*:* ***Only female FRAs are going to ask this section.***

6.1 Is the household selected to ask this section? ☐

Code: Yes 1

No 2

If answer of 6.1 is 2, skip to Section 7

6.2 Do the household have any adolescent girl? ☐

Code: Yes 1

No 2

If answer of 6.2 is 2, skip to Section 7

6.3 Do you have any problem if I ask you to share us regarding your menstrual hygiene practices?

☐

Code: Yes 1

No 2

If answer of 6.3 is 1, skip to Section 7

6.4 Mainly what do you use during menstruation? ☐

Cloth (rag) 1

Pad 2

Cotton 3

Tissue paper 4

Refused to say 5

Other: Specify:………………… 6

If answer of 6.4 is not 1, skip to Section 7

6.5 If answer of 6.4 is cloth (rag, code 1), then what type of cloth do you used?

☐

New cloth 1

Old cloth 2

Refused to say 3

Other: specify………………….. 4

If answer of 6.5 is not 2, skip to Section 7

6.6 If answer of 6.5 is 2=Old cloth-

Then for how long (months) do you preserve the cloth for repeated use? Months: ☐☐

(Code: 98=refused to say)

6.7 Generally how many times the cloth used for menstruation you usually change per day?
(98=refused to say) times:

□□

6.8 For repeated use of menstrual cloth, where do you dry the menstrual cloth? □

Inside the house but not in sunlight 1

Inside the house and in sunlight 2

Outside the house and in sunlight 3

Other: specify………………….. 4

6.9 Where do you store the menstrual cloth (**spot check**)? □

Dirty place 1

Clean place 2

Refused to observe 3

Other (specify:…………………. 4

Section 7: Household asset

7.1. Does your household (or any member of your household) have:

Yes.... 1, No....2, DK..... 9

Electricity □

Almirah or wardrobe (number) □□

Table (number) □□

Chair or bench (number) □□

Watch or clock (number)

Khat (number)

Chouki (number)

A radio that is working

A television (B/W) that is working

A television (Color) that is working

A refrigerator

A bicycle (commercial purpose)

A motorcycle

A sewing machine

Mobile phone (number)

A land phone

7.2. How many rooms are there in the households have (exclude bathroom and Kitchen?)

7.3 Status of living house

Self-owned 1

Rental 2

Govt. land 3

Owned by a landlord 4

Others (Specify ……) 5

If answer is not 2 then skip to 7.5

7.4 If 7.3 answer is 2 (rental) then do the area is less than 200 sq. ft.? □□

Yes 1

No 2

7.5. What type of fuel does your household mainly use for cooking?

□□

Wood 01

Crop residue / grass 02

Dung cakes 03

Coal / coke / lignite 04

Charcoal 05

Kerosene 06

Electricity heater......................................07

Liquid gas / gas 08

Bio-gas 09

Other: Specify...10

Don't know 99

7.6 Does your household own any homestead land? □

Code: Yes.. 1

No. ....….......................... 2

Refused…................................. 7

Don't know.…..............….......................... 9

7.6.1 *If 8.6 YES,* How much land (decimal) does your household own (other than the homestead land)?

□□□□

Total local land unit: AMOUNT: ________________ SPECIFY UNIT:_____________

Total local land unit: AMOUNT: ________________ SPECIFY UNIT:_____________

7.7 Does your household own any land, other than homestead land? □

Code: Yes 1

No 2

Refused 7

DK 9

7.7.1 *If 7.7 YES,* How much land (decimal), other than homestead land, does your household own?

□□□□

Total local land unit: AMOUNT: ________________ SPECIFY UNIT:_____________

Total local land unit: AMOUNT: ________________ SPECIFY UNIT:_____________

7.8 How would you describe your economic status?........ □

Dhoni 1
Uchho modho bitto 2
Modho Bitto 3
Doridro or Nimno motho bitto 4
Hotodoridro 5

That is the end of part A interview.

PART B: SPOT CHECKS

May I take a look around your home to look at some of the items related to water, sanitation, and hygiene?

Section 8. Water-handling

8.1 How do you store drinking water? (Ask the question please and observe then fill up) ☐

In containers (bucket, jerry can, jerkin, bottle, drum, *kalash, Hari, Matka* etc.) 1

Roof tank or cistern 2

No water stored 3

Refused to say 9

If 8.1 is 2 or 3 or 9, skip to question 8.4

8.2 IF IN CONTAINERS, may I see the containers, please? ☐

Code: Yes 1

No 2

If no, skip to question 8.4

8.3 Types of water container observed and its covering status -

1= Completely uncovered

1=Yes 2= Partially covered

<u>2=No</u> <u>3= Completely covered</u>

<u>4= Water not observed</u>

a. Bucket ☐……………………..……☐

b. Jug ☐……………………..……☐

c. Matka ☐………………….....……☐

d. Cooking pot ☐………………….....……☐

e. Jerry can ☐………………….....……☐

f. *Hari* (Wide-mouthed container) ☐……………………..…….☐

g. Other wide-mouthed container ☐……………………..…….☐

h. *Kalash* (narrow-mouthed container) ☐……………………..…….☐

i. Bottle ☐……………………..…….☐

j. Other narrow-mouthed container ☐……………………..…….☐

k. Other (Specify ☐……………………..…….☐

8.4 Could you please get a glass of water that you give your child to drink? (After getting water, please check the following questions with appropriate code, and ***collect a water sample for arsenic test if the household was not selected as part of sentinel surveillance***):

Yes =1

No =2

8.4.1 Washed the glass/container before water obtained? ☐

8.4.2 Hands washed before water obtained? ☐

8.4.3 Hands washed with soap before water obtained? ☐

8.4.4 Did hands come into contact with that drinking water? ☐

8.4.5 Glass dipped into water container? ☐

8.4.6 Ladle used to obtain water? ☐

8.4.7 Water poured from container? ☐

8.4.8 Brought directly from tube-well/water source? ☐

8.4.9 Other (Specify ☐

8.5 What is the source of the water that was offered to you for drinking? ……………………….. ☐☐

(Check the source of water point for the water that was offered by the respondent to you for drinking)

Shallow tube well. ………………01

Deep tube well. ……………… 02

Protected ring/dug well (*Kua*)………………….. 03

Unprotected dug well (*Kua*)……………….. 04

Tara pump 05

Arsenic free treatment plant 06

Water from protected spring… 07

Water from unprotected spring… 08

Surface water:

Rainwater……………………………….. 09

Tanker truck………………………….. 10

Cart with small tank………………… 11

Pathogen treatment plant (Pond Sand Filter):

River/dam/lake/ponds/stream/canal/irrigation channel. 12

Directly from:

River/dam/lake/ponds/stream/canal/irrigation channel. 13

Distilled bottled water…………………..…….. 14

Boiled water ……… 15

Piped water into dwelling………… 16

Piped water into yard/plot… … 17

Public tap/stand pipe…………………. 18

Other (specify) __________________.. 99

8.6 (***Ask and check***): Ownership type of the water point? ☐

Only for the household 1

Shared 2

Someone else 3

Public 4

8.7 What is the source of the water that usually used by the household for cooking foods (follow code list of 8.5)?

………………☐☐

8.8 What is the source of the water that usually used by the household for washing fruits and vegetables (follow code list of 8.5)?

………………☐☐

If answer of 8.6 is 1 or 4, skip to section 8.10

8.9 (***Ask and check***): If 8.6 is 2 or 3, how many households sharing the water point? ☐

(Put code 3 if more than 2)

8.10 Did the source of water point observe looked clean? ☐

Note: Clean means no water logging, no faeces besides, no dirt besides, etc.

Yes 1

No 2

8.11 (***<u>Ask and if possible then observe):</u>*** If answer of 8.6 is 1 or 2 or 3, who take care/maintain (washing surrounding area and cleaning) the water point at household level? ☐

Male 1

Female 2

Both 3

Does not clean 4

Skip note**: Skip to section 4 and after filling up all those sections from section-4 to section-7 start from section-9 and onward**

Section 9: Waste disposal

9.1. Does the household have a fixed place for solid waste disposal? ☐

Yes 1

No 2

Refused 3

If 2 or 3, skip to 9.4.

9.2 If 9.1 is 1 (yes), what kind of fixed place is it? ☐

Drum 1

Pit 2

River/dam/lake/ponds/stream/canal 3

Road side 4

Drain 5

Besides homestead/ besides kitchen 6

In Jungle 7

Other (Specify: 8

9.3 Does the household dispose solid waste there? ☐

Completely/rightly (no waste outside).. …………………………………………………………....1

Partially (Wastes are disposed partly inside and partly outside)……………………......……..2

Doesnot (no garbage inside and no symptoms of waste disposal on the way or inside)……….3

9.4. Does the household have any water drainage system? ☐

Yes 1

No 2

Refused 3

9.5. If 9.4 is 1 (Yes), what kind of drainage system it is? ☐

Pukka drain/ piped 1

Katcha drain 2

Broken drain 3

Soak pit 4

Other: Specify: 8

Section 10: Materials of the living household **(Required for SES categorization)**

10.1. *Main material of the roof* (***Interviewer: Record your observation)*** ☐☐

Natural roof

Kaccha (bamboo / thatch) 11

Rudimentary roof

Tin 21

Finished roof (pukka)

Cement / concrete / tiled 31

Other 41

Specify ____

10.2. *Main material of the walls* (***Interviewer: Record your observation)***

Natural walls

Jute / bamboo / mud (kaccha) 11

Rudimentary walls

Wood 21

Finished walls

Brick / cement 31

Tin 32

Other 41

Specify ____

10.3. *Main material of the floor* (***Interviewer: Record your observation)***

Natural floor

Earth / bamboo (kaccha) 11

Rudimentary floor

Wood 21

Finished floor (pukka)

Cement / concrete 31

Other 41

Specify ____

Section 11: Sanitation and Hand washing

11.1 What kind of toilet facility do members of your household usually use?

Improved sanitation facilities-

Flush or pour flush toilet flushed to:

Piped sewer system 01

Septic tank 02

Flush to pit latrine (Off set)…………………………… 03

Pit latrine with slab & water seal……………………… 04

Pit latrine with slab & no water seal but with a lid……………… 05

Composting toilet …………………………. 06

(Composting toilet ensure separation of urine, water and excreta)

Unimproved sanitation facilities-

Flush or pour flush toilet connected to somewhere

else (canal, ditch, river, etc.) 07

Pit latrine without slab/open pit… 08

Pit latrine with slab & no water seal/broken water seal and no lid……… 09

Hanging toilet/latrine…………………………………………………..10

<u>Open defecation-</u>

No facility/bush/field…………………. 11

Others (Specify…………………. 99

11.2 (***<u>Ask and check</u>***): Ownership type of the toilet facility? ☐

Only for the household 1

Shared 2

Someone else 3

Public 4

Not applicable 8

11.3 (***<u>Ask and check</u>***): If 11.2 is 2, how many households sharing the toilet facility?

☐☐

11.4 (***<u>Ask and if possible then observe):</u>*** If answer of 11.2 is 1 or 2 or 3, who take care/maintain

(washing surrounding area and cleaning) the toilet facility at household level? ☐

Male 1

Female 2

Both 3

Do not clean 4

11.5 Is stool visible on the slab or floor? ☐

Yes. ……………… 1

No 2

Not applicable …… 8

11.6 Please show me where children (≤ 5 years) mainly defecate? ☐☐

(If the household has more than one child then observe for the eldest one)

Improved sanitation facilities-

Flush or pour flush toilet flushed to:

Piped sewer system 01

Septic tank 02

Flush to pit latrine (Off set)…………………………… 03

Pit latrine with slab & water seal……………………… 04

Pit latrine with slab & no water seal but with a lid……………… 05

Composting toilet …………………………. 06

(Composting toilet ensure separation of urine, water and excreta)

Unimproved sanitation facilities-

Flush or pour flush toilet connected to somewhere

else (canal, ditch, river, etc.) 07

Pit latrine without slab/open pit… 08

Pit latrine with slab & no water seal/broken water seal and no lid……… 09

Hanging toilet/latrine…………………………………………………..10

Open defecation-

No facility/bush/field…………………. 11

Potty 12

Nappy / diaper 13

No specific place..................................... 14

Don't know 98

Others (Specify…………………. 99

11.7 Can you show me where you usually wash your hands after you come back from the toilet? ☐

(ASK TO SEE AND OBSERVE)

Inside/near toilet facility 1

Inside/near kitchen/cooking place 2

Elsewhere in yard (within 3 steps from the latrine) 3

Elsewhere in yard (>3 steps but ≤ 10 feet) 4

Outside yard (>10 feet from the latrine) 5

No specific place 6

No permission to see 7

If answer is 7, skip to 11.10

If answer is 6, skip to 11.8

11.7.1 Observation only: Is water available there for hand washing? ☐

Yes 1

No 2

11.7.2 Observation only: Is there soap or detergent or locally used cleansing agent?

(THIS ITEM SHOULD BE EITHER IN PLACE OR BROUGHT BY THE INTERVIEWEE WITHIN ONE MINUTE [REASONABLE TIME]. IF THE ITEM IS NOT PRESENT WITHIN THAT TIME CHECK NONE, EVEN IF PROVIDED LATER)

Yes. ………..1

No ……...2

a. Soap ☐

b. Detergent ☐

c. Ash ☐

d. Mud/sand ☐

e. Other: specify: ☐

11.8 Do you have any other item (e.g. bucket, basin or container) to wash hands in?

☐

Yes 1

No 2

DK 9

If answer is 2 or 9, skip to 11.10

11.9 If 11.8 is yes, where is this item situated? ☐

In or near the toilet facility 1

In or near the kitchen 2

Outside 3

Elsewhere in the dwelling 4

11.9.1 Did you observe water in the item shown in 11.9? ☐

Yes 1

No 2

11.9.2 When do you change the water in this item shown in 11.9? ☐

Daily 1

1-2 days 2

3-4 days 3

>4 days4

Never 5

11.9.3 How many household members (number) use the item (shown in 11.9)? ☐☐

11.9.4 Do you have water/tap for your household? ☐☐

Yes 1

No 2

11.10 Can you show me where you usually wash your hands before you cook, eat or feed your child?

☐

(ASK TO SEE AND OBSERVE)

Inside/near toilet facility 1

Inside/near kitchen/cooking place 2

Elsewhere in yard (within 3 steps) 3

Elsewhere in yard (>3 steps but ≤ 10 feet) 4

Outside yard (>10 feet from the household) 5

No specific place 6

No permission to see 7

11.10.1 Is the place is different from the answer of 11.7? ☐

Yes. ……………… 1

No 2

If answer is 2, skip to 11.11

11.10.2 Observation only: Is there soap or detergent or locally used cleansing agent?

☐

(THIS ITEM SHOULD BE EITHER IN PLACE OR BROUGHT BY THE INTERVIEWEE WITHIN ONE MINUTE [REASONABLE TIME]. IF THE ITEM IS NOT PRESENT WITHIN THAT TIME CHECK NONE, EVEN IF PROVIDED LATER)

Yes. ………...1

No ……...2

a. Soap ☐

b. Detergent ☐

c. Ash ☐

d. Mud/sand ☐

e. Other: specify: ☐

11.11 May I please look at (**<u>Child's name</u>**) hands (if more than one under-5 children existing in a household and at least one of them exposed visible dirt or unclean appearance then put that relevant code to the right box for all children to that specific household)?

(Visible dirt=1, Unclean appearance=2, Clean=3, Observation was not possible/refused=4)

a. Fingernails ☐

b. Palms ☐

c. Fingerpads ☐

11.12 May I please look at your hands?

(Visible dirt=1, Unclean appearance=2, Clean=3, Refused=4)

a. Fingernails ☐

b. Palms ☐

c. Fingerpads ☐

11.13. (**<u>Hand washing demo</u>**): Hand washing demo was conducted for ☐

<u>Note</u>*: If the household has no child aged 3-5 years old, conduct the demo for mother of the youngest child and if the household has a child aged 3-5 years old then conduct the domo for eldest child but in this case don't conduct demo for the mother.*

Caregiver (mother of the youngest child)…………… 1

Eldest child (age 3-5 years) 2

Child not able to wash/mother refused 3

Mother and child both absent 4

If answer is 3, Part-B is finished, thanks

11.14 Please show me how you usually wash your hands after you go to the toilet for defecation? (Please note in the blank space about how did she washed her hands and later on how did she dry and fill up the following questions with appropriate code)

Please check this based on answers of the open question.

11.14.1 Used only water (Yes......1, No......2) ☐

11.14.2 Used soap (Yes......1, No......2) ☐

11.14.3 Used ash (Yes......1, No......2) ☐

11.14.4 Used mud (Yes......1, No......2)

11.14.5 Washed both hands (Yes......1, No......2)

11.14.6 How long (count seconds) the person rub hands with soap? (N/A=999)

11.14.7 Dried with

Dried hands on clothing that she was wearing:

Sharir Anchal, shalwer/ kamiz etc. 1

Lungi / gamsa / others (not wearing) and looked dirty 2

Clean cloth 3

Air dry 4

Thank you. Part-B is finished.

Name, signature and date of data collector :

Checked by (FRO/SRI) :

5-HOURS STRUCTURED OBSERVATION, 2007

Health Impact Study (HIS), ICDDR, B-UNICEF

1. Household ID (***Follow codes from instruction manual***): □□□□□□

2. Instrument Type (***Code: 5-hours structured observation=01***): **0** **1**

3. Cluster number (*starting point number*): □□□

4. Study group: □

Intervention 1

Control 2

5. District name & district geocode: □□□

6. Upazila name & code: □□

7. Union name:

8. Address: Name of household head:

Father's/ husband's name:

Bari Name:

Village:

Location (specify):

9. FRA name & code: □□

10. Date of observation: □□/□□/□□

11. Date of birth of the youngest child of the household: □□/□□/□□

12. Age of the youngest child: □□day □□month □□year

13. Time of arrival (24 hrs): □□:□□

Please show me where I may sit to observe you and your household. I would like to be able to see what you and others are doing but do not want to be in your way.

14. Observation of Hand Wash Opportunity and toileting behaviour

	<u>Exposure</u>: Before preparing food 1 Before serving of foods ……. 2 Before eating 3 After eating (self & child-fed) 4 Before feeding a child 5 After cleaning child's anus 6 After defecation 7 After returning from outside compound 8 Others (specify 9	**<u>Household member:</u>** Caregiver (M) 1 Caregiver (F) 2 Child < 3 y.o (M) 3 Child < 3 y.o (F) 4 Child 3-5 y.o (M) 5 Child 3-5 y.o (F) 6 Child 5-12 y.o. (M) 7 Child 5-12 y.o. (F) 8 Non-caregiver adult (M) 12 years+ 9 Non-caregiver adult (F) 12 years+…………….10	**Were hands washed by household member?** Yes 1 No 2 Was not possible to observe……3 Please follow the note for this column below.	**Location of hand wash** In toilet 1 Outside toilet 2 In kitchen 3 Outside kitchen 4 In plate 5 Nearby tube-well 6 Nearby pond/stream 7 In yard 8 Other 9 (specify)	**Were both hands washed?** Yes 1 No 2 Was not possible to observe…3	**Hand washing materials:** Any soap 1 Ash/mud 2 Only water 3 Was not possible to observe………4 Other 9 (Specify)	**How were hands dried?** Air dry 1 Not dried 2 Clean towel 3 Dirty towel 4 Clothing 5 *Sharir Anchal*…6 Other 9 (Specify)	**In case of defecation event (Exposure variable code 7) the location of toileting:** Please write down appropriate code from the code box below the table.
Col =1	Col=2	Col=3	Col=4	Col=5	Col=6	Col=7	Col=8	Col=9
1								
2								
3								
4								

5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

Note: **<u>Column-4</u>**: If column-2 is 7 and this column is 2 or 3 then skip to col-9. For any other answer in column 2, if the answer in this column is no then skip rest observations for this specific row and go for the next event.

<u>Column-9:</u>

Improved sanitation facilities-

Flush or pour flush toilet flushed to:

Piped sewer system 01

Septic tank 02

Flush to pit latrine (Off set)…………………………… 03

Pit latrine with slab & water seal……………………… 04

Pit latrine with slab & no water seal but with a lid……………… 05

Composting toilet …………………………. 06

(Composting toilet ensure separation of urine, water and excreta)

Unimproved sanitation facilities-

Flush or pour flush toilet connected to somewhere else (canal, ditch, river, etc.) 07

Pit latrine without slab/open pit… 08

Pit latrine with slab & no water seal/broken water seal and no lid……… 09

Hanging toilet/latrine………………………………………………...10

Open defecation-

No facility/bush/field…………………. 11

Not applicable. …………………………………………………….. 99

15. Observation of faeces disposal for <3 years old child

(The table is applicable if the household has minimum 1 child less than 3 years)

	Household member	**Location of faeces disposed:**	**Comments**
	Caregiver (M) ……………………….1 Caregiver (F) ……………………….2 Child 3-5 y.o. (M) ……………………….3 Child 3-5 y.o. (F) ……………………….4 Child 5-12 y.o. (M) ……………………….5 Child 5-12 y.o. (F) ……………………….6 Non-caregiver adult (M) 12 years+ …………..7 Non-caregiver adult (F) 12 years+……………8	In toilet 1 In yard 2 In jungle/Bush 3 In a open place outside yard 4 In a pond/lake/stream 5 Besides tube-well/well 6 Specific pit 7 Other 8 (specify)	
1			
2			
3			

4			

16. Time of departure (24 hrs): □□:□□

Supervisor: **Interviewer:**

Signature: **Signature:**

Date: **Date:**

Informed consent for Cross Sectional Survey

ICDDR,B and UNICEF, Bangladesh

Project Title: SHEWA-B Health Impact Study

Principal Investigator: Dr. Steve P. Luby

INTRODUCTION: Scientists at ICDDR,B are conducting a health research study in the randomly selected communities from selected 30 districts (some are UNICEF SHEWA intervention communities and some are out of UNICEF SHEWA intervention communities) to collect information about water, sanitation, and hand hygiene practices at home. You are free to decide whether or not to take part in the study.

OBJECTIVE: We are trying to understand water, sanitation, and hand hygiene practices of people in rural parts of Bangladesh. We will identify a total of 10 households randomly from this community those have children less than five years. In all of the households, we would like to spend a longer time now, around 2 (two) hours, interviewing and observing the general routine in your home.

PROCEDURES: If you agree to take part, I will spend around two hours with mother of the youngest child and will ask several questions and observe about household water, sanitation, hand hygiene practices, household asset status and disease information of the child. I will take some notes on paper. I will be here for a total of about two (2) hours.

BENEFITS: There is no immediate benefit to you from this study. But, the study will help us to better understand the water, sanitation, hygiene conditions and disease burden here in rural Bangladesh so that we can work to improve conditions.

COSTS and COMPENSATION: There is no cost to you for participation in this research. You will not receive any compensation for being in the study.

RISKS: There is no risk from participation in the study. We will only collect information related to use of water, your toilet facilities, handwashing, asset status and disease information of your child. The process of having someone in your home for a longer time may be uncomfortable to you. However, we do not expect any harm to come to you or your family during this time.

CONFIDENTIALITY: We will secure all information collected from you in a locked cabinet, and none other than designated staff of this research study will have access to that information. We would, however, like to inform you that disclosure of your information is subject to the laws of Bangladesh. Your name and identity will not be used in reporting and presenting study findings.

VOLUNTARY PARTICIPATION: You are free to decide whether or not to take part in the study. If you decide against participating in the study, and also if you withdraw your consent at any time after participation, you and your family will continue to receive the same benefits that you have otherwise been eligible for.

If you have any question about this research study you may contact Mr. Amal Krishna Halder (Study Coordinator) at the mobile number 01712206711 or at the telephone number 988-1761. If you have questions about your right in the study, you may call Mr. M A Salam Khan, Committee coordination secretariat at ph. 9886498 (Direct), Mobile # 01711428989 located at 68, Shaheed Tajuddin Ahmed Sarani Mohakhali, Dhaka 1212. If you agree to be interviewed for our study, please indicate that by putting your signature or left thumb impression at the specified space below. Thank you for your cooperation.

________________________ _______________ ___/______/________

Name of study representative Signature of Investigator Date:

____________________ ________________________________ ___/____/__

Name of study participant Signature/thumb impression of participant Date:

Household ID: □□□□□□

Informed consent form for 5-hours structured observations

ICDDR,B: CENTER FOR HEALTH AND POPULATION RESEARCH, BANGLADESH

and UNICEF

Project Title: SHEWA-B Health Impact Study

Principal Investigator: Dr. Steve P. Luby

INTRODUCTION: Scientists at ICDDR,B are conducting a health research study in the randomly selected communities from selected 30 districts (some are UNICEF SHEWA intervention communities and some are out of UNICEF SHEWA intervention communities) to collect information about water, sanitation, and hand hygiene practices at home. You are free to decide whether or not to take part in the study.

OBJECTIVE: We are trying to understand water, sanitation, and hand hygiene practices of people in rural parts of Bangladesh. We will identify a total of 10 households from this community those have children less than five years. In all of the households, we would like to spend a longer time now, around 5 (five) hours, observing the general routine in your home.

PROCEDURES: If you agree to take part, I will find a place to sit in your home or courtyard so that I will not be in your way. I will observe the activities in your home and take some notes on paper. I will be here for a total of about five (5) hours.

BENEFITS: There is no immediate benefit to you from this study. But, the study will help us to better understand the water, sanitation, and hygiene conditions here in Bangladesh so that we can work to improve conditions.

COSTS and COMPENSATION: There is no cost to you for participation in this research. You will not receive any compensation for being in the study.

RISKS: There is no risk from participation in the study. We will only collect information related to use of water, your toilet facilities, handwashing. The process of having someone in your home for a longer time may be uncomfortable to you. However, we do not expect any harm to come to you or your family because of being observed.

CONFIDENTIALITY: We will secure all information collected from you in a locked cabinet, and none other than designated staff of this research study will have access to that information. We would, however, like to inform you that disclosure of your information is subject to the laws of Bangladesh. Your name and identity will not be used in reporting and presenting study findings.

VOLUNTARY PARTICIPATION: You are free to decide whether or not to take part in the study. If you decide against participating in the study, and also if you withdraw your consent at any time after participation, you and your family will continue to receive the same benefits that you have otherwise been eligible for.

If you have any question about this research study you may contact Mr. Amal Krishna Halder at the mobile number 01712206711 or at the telephone number 988-1761. If you have questions about your right in the study, you may call Mr. M A Salam Khan, Committee coordination secretariat at ph. 9886498 (Direct), Mobile # 01711428989 located at 68, Shaheed Tajuddin Ahmed Sarani Mohakhali, Dhaka 1212. If you agree to be interviewed for our study, please indicate that by putting your signature or left thumb impression at the specified space below. Thank you for your cooperation.

______________________	______________	___/______/________
Name of study representative	Signature of Investigator	Date:

___________________	______________________________	___/____/__
Name of study participant	Signature/thumb impression of participant	Date:

Unique ID: □□□□□

EVALUATION AND FEEDBACK

Health Impact Study (HIS) 2007, ICDDR, B-UNICEF

FOCUS GROUP DISCUSSION SCHEDULE

As part of the UNICEF SHEWA-B project and my PhD research, I am interested to gain feedback from your experience of the project to date and your insight into your work in the field. This is to understand the methodological issues and experience of administering the HIS instruments. The focus group will last between 45 minutes to one hour. I would like to ask for your consent to participate and I will bring a consent form for you to complete acknowledging your participation in this discussion.

This discussion will be confidential and your views will remain anonymous. Please feel free to be open and give your views and opinions as this will be particularly helpful for improving future research.

Topics to be discussed

Training

Experience of training/Preparation for the field

Were there any issues that were not raised in training that arose in the field?

Suggestions for improvement

Team work/administration

Experience of team work/team administration-including issues of advice/guidance, support

Did you face any issues and/or challenges? / How were they overcome?

Suggestions for improvement

Field/Methodological issues

Experience of working in the field-e.g. during Structured Observation, Cross Sectional Survey

Did you face any particular challenges/issues?

How did you deal with these issues?

Suggestions for improvement

HIS Survey instruments/topics-Structured Observation and Cross Sectional Survey

Experience of the HIS instruments and topics e.g administration, logistics

Did you face any particular challenges/issues?

Strategies to overcome this

Suggestions for improvement, e.g. any other areas that you think should be addressed

Structured Observation

Cross Sectional Survey

-Part A Questionnaire and Part B (Spot Checks)

Questionnaire -Water sample collection for Arsenic testing, (Part C or Arsenic lab)

C1 Disease Burden and cost of illness (Child Module A&B)

C2 Disease Burden and cost of illness (Child Module C)

Measurement of hand washing

Particularly interested in the measurement of hand washing and the methodological issues:

Areas of discussion-experience, problems/issues, suggestions

Structured Observation

-Exposure

-Washing of hands/drying of hands

-Location of hand washing

-Hand washing materials

-Observation of faeces disposal

Part A Questionnaire and Part B (Spot Checks)

Section 3: Respondents hand washing practices

-Experience of open ended questions e.g. understanding of questions, probing

-Experience of recall questions e.g. washing hands after defecation, before and after food prep, soap use, availability

-Suggestions for improvements

Part B

Section 11: Sanitation and hand washing

-Experience of spot checks-problems, issues e.g. observation of hw place, soap, other hand washing implements

-Experience of Fingertip assessment

-Experience of hand washing demonstration

-Suggestions for improvements

Administrative support

Experience of administration support

Did you face any particular challenges/issues?

Suggestions for improvement

Difference between this study and any others

How does this study differ from others that you have worked on?

Learning

What have you learnt from the UNICEF SHEWA-B project?

Other/additional areas

Appendix B: Ethical Procedure Documents

Dear Sir/Madam,

I am writing with regard to my Ethics Committee application form and following consultation and advice from Professor Sue Heath at the recent Ethics drop-in session held on 4 June 2008. I require the advice of the Ethics Committee pertaining to a particular aspect of my research and the committee's decision if necessary.

My PhD research examines the measurement and determinants of hand washing practices. This research examines secondary data sources such as Demographic and Health Surveys and data obtained from a large scale hygiene, sanitation and water improvement programme in Bangladesh. This programme is called the UNICEF Sanitation, Hygiene Education and Water Supply in Bangladesh programme (SHEWA-B), jointly implemented by UNICEF, the Government of Bangladesh and the Department for Public Health Engineering, Bangladesh. There are a number of elements to the SHEWA-B programme, one of which is the SHEWA-B Health Impact Study (HIS) which forms part of my research.

Demographic and Health Surveys are large scale surveys that collect a wealth of information on demographic and health issues including reproductive health, child health, nutrition, fertility and marriage. Data obtained from countries participating in the fourth phase of the DHS, conducted between 1997 and 2003 specifically identified the importance of having a place for hand washing in the household to prevent the spread of disease.

However, the collection of data on hand washing practices and behaviours within these surveys is problematic and complex, and there has been little validation of existing indicators. The main aim of my research is to validate and evaluate DHS hand washing indicators in Bangladesh within the context of the UNICEF SHEWA-B project. The methods used to achieve this aim are through the use of a cross sectional survey, structured observations and spot check observations. The methodological and measurement issues associated with the various approaches will also be reviewed.

As part of my PhD research, I became involved in the implementation phase of the SHEWA-B programme and consequently went on an Overseas Institution Visit sponsored by the Economic and Social Research Council (ESRC) to the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B) for 12 weeks from August to November 2007. The role and purpose of this visit was to gain insight into the work and role of the institution and in particular, the Infectious Disease and Vaccine Sciences Unit. This unit is led by Dr Steve Luby and who is also the Principal Investigator at ICDDR, B for the SHEWA-B HIS. He is closely involved with the work on hand washing, hygiene and sanitation. Prior to my visit, I became involved in the discussion, design and review of the survey instruments and successfully enabled the inclusion of DHS indicators on hand washing and other indicators into the SHEWA-B HIS questionnaire.

Whilst on my visit, baseline data collection for the SHEWA-B HIS had actively commenced in the field. This involved structured observations in one thousand households and the implementation of the cross sectional survey. In mid November, before I returned to the United Kingdom, the fieldworkers who conducted the structured observations and the cross sectional survey came back to the main ICDDR, B office based in Dhaka.

During discussions with the Principal and Senior Research Investigators it was clear that there were difficulties in conducting data collection and many methodological issues relating to the survey instruments. In consultation with both Research Investigators, I discussed the usefulness of acquiring feedback from fieldworkers who due to their presence and involvement in the data collection process were able to gain firsthand experience of the methodological issues and other fieldwork issues. These experiences would be extremely informative for the survey design and interpretation of the findings. After agreement from both investigators, I was able to conduct feedback sessions with fieldworkers focusing particularly on evaluating data collection issues, survey instruments, training and learning outcomes. As this was unplanned and I was given limited advance warning (1-2 days notice) I designed a discussion topic schedule based on the survey instruments, focusing specifically on hand washing measures and survey instruments.

The feedback sessions were conducted with 30 fieldworkers in three separate sessions. The topic discussion guide was reviewed by the research investigators and the feedback sessions were mainly conducted in Bengali. The structure of the sessions was that the topic discussion guide was read out to fieldworkers by the Senior Research Investigator and feedback was given in both Bengali and English. I was present for all of the feedback sessions and they were recorded. Fieldworkers' participation in the feedback sessions was voluntary and they were given a consent form outlining the research.

The opportunity to conduct feedback sessions was unplanned and there was not enough time to gain ethics approval from the University, as I was only given short notice to conduct the sessions myself. The fieldworkers are usually not in one place at the same time and are situated across Bangladesh for extended periods for data collection purposes. Therefore it is difficult logistically to gather the fieldworkers together at one location. Furthermore, I felt that this opportunity does not occur often and would not only be beneficial to me, but to the overall programme, in terms of how improvements can be made. The sessions were very well received and led to an improved understanding of the survey instruments and the methodological issues associated with them and aided interpretation of the findings.

The main use of the SHEWA-B HIS data within my PhD will be as secondary data sources for analysis. Although, I was involved in the design, review and discussion on survey instruments for inclusion in the study prior to my departure; my role did not extend to actual collection of data in the field setting. Approved and trained fieldworkers collected this.

Given the circumstances of the feedback sessions and the opportunity to conduct these following the short notice period I received, I would be extremely grateful if the Ethics

Committee would carefully consider whether the inclusion of data from feedback sessions is possible to complement my existing secondary data sources in my research. The feedback sessions provided extremely useful information on the methodological aspects of observation and cross sectional survey data and the measurement of hand washing in a low-income setting where morbidity and mortality from infectious diseases, e.g. diarrhoea and respiratory infections are a significant public health issue.

I am happy to provide further information if required.

Yours faithfully,

Lisa Danquah

University of Southampton

School of Social Sciences

October 2007

Postgraduate Ethics Review Checklist

This checklist should be completed by the research student (with the advice of the research supervisor) for all research projects.

Research Title:

Measurement and determinants of hand washing practices: Evaluating Demographic and Health Survey approaches

Research Student:

Lisa Danquah

Supervisor:

Professor Jane Falkingham and Dr Amos Channon

	YES	NO
Will the study involve human participants?		√
Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g. covert observation of people)		√
Does the study involve participants who are unable to give informed consent? (e.g. children, people with learning disabilities)		√
Does the study involve participants who are commonly viewed as 'vulnerable'? (e.g. children, elderly, people with learning disabilities) CRB check needed if YES		√
Will the study require the co-operation of a third party for initial access to the groups or individuals? (e.g. students at school, residents of a nursing home)		√
Will the study involve discussion of sensitive topics (e.g. sexual activity, drug use)?		√
Could the study induce psychological stress or anxiety, cause harm or have negative consequences for the participants beyond the risks encountered in normal life?		√
Will deception of participants be necessary during the study?		√
Will blood or tissue samples be taken from participants? Are drugs, placebos or other substances		√

(e.g. foods, vitamins) to be administered to the participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind?		
Will the study involve prolonged or repetitive testing or physical testing?		√
Is pain or more than mild discomfort likely to result from the study?		√
Will financial or other inducements (other than reasonable expenses) be offered to participants?		√
Will the study involve recruitment of patients or staff through the NHS?		√
Is the right to freely withdraw from the study at any time made explicit?	√	
Where secondary data is to be used, is the risk of disclosure of the identity of individuals minimal?	√	
If you are using secondary data, are you obtaining it from any where other than recognised data archives?	√	

Please refer to the School Guidance Notes for completing the Ethics Review Checklist before completing this form.

If you have answered YES to any of the questions (other than 13, 14 & 15), your research proposal will be referred to the

School Ethics Committee. You will need to submit your plans for addressing the ethical issues raised by your proposal using

the Research Ethics Approval Form, available on the School intranet. If you have answered Yes to Question 13, you will have

to submit an application to the appropriate external NHS Ethics Committee. If this is the case, your application will not need to

be reviewed by the School Ethics Committee.

Please note that it is your responsibility to follow the University of Southampton's Ethics Policy and any relevant academic or professional guidelines in the conduct of your study. This includes providing appropriate information sheets and consent forms, and ensuring confidentiality in the storage and use of data.

Signature of Research Student ….………………………………………………….
Date..…………………………

Signature of Supervisor……………………………………………………………..
Date…………………………..

Lisa Danquah

PGR student

Division of Social Statistics

26th June 2008

Dear Lisa,

Approval from School Research Ethics Committee

I am pleased to confirm that the Research Ethics Committee of the School of Social Sciences has given your research project ethical approval:-

Application Number: SOC20078-40

Research Project Title: Measurement & determinants of hand washing practices: Evaluating demographic & health survey approaches

Date of consideration: 24th June 2008

Thank you for advising the Committee and making a good case for this retrospective approval of feedback sessions with fieldworkers. The Committee members appreciate that such opportunities can arise whilst conducting field work and that advance approval may not always be possible.

Yours faithfully,

Professor S J Heath

Chair, School Research Ethics Committee

School of Social Sciences

Direct tel: +44 (0)23 80592578

E-mail: Sue.Heath@soton.ac.uk

Cc: File

Appendix C: Focus Group Discussion Transcripts

Focus Group Discussion – 1

Topics to be discussed

1. Training:

a) Experience of training/Preparation for the field:

Question: Firstly, we will talk about the training. You have already received training before administrating different types of instrument in the field. So what's your experience about training? Was the training appropriate that you receive before starting your work in field? Sometimes these trainings take long time, and sometimes they take short time. It is possible that you don't get along well with the facilitator. Tell me about any issues or concerns you had about your interactions with the facilitator? Did it happen that he/she could not understand you? Did it ever happen that the facilitator did not respond properly when asked a question? Let us discuss about these matters if you want..

Answer: The five hour structured observation went well and we did not face any problems when we did structured observation. The fill-up process of structured observation was clear and we collected the data accurately from field. It was our first instrument and our second instrument was cross-sectional. Cross-sectional questionnaire was so simple and the training was also very good. We were able to receive the required training easily and this helped us in collecting the data from the root level. Answer: There was no problem in training.

Answer: Training was good. We learned some helpful techniques during the training. The training was useful in solving the problems we encountered in the field.

Question: Tell us openly about the good side and bad side of the training.

Answer: Actually the training was too good. We haven't had any problem in understanding the questionnaire at the time of training.

b) Were there any issues that were not raised in training but in the field?:

Question: Were there any issues that were not raised in training but during in the field?

Answer: No, the training was ok. We didn't face that kind of problem.

c) Suggestions for improvement:

Question: Do you have any suggestion for the improvement of training?

Answer: I think that structured observation was relatively short and we received quick training. However, cross-section was too long. Also, the instrument was different. . Our training was too intense in a short span of time. Hence, it was difficult to understand and remember all the instructions. For the same reason, we faced some problems in the field. It would have been beneficial to have a longer training period.

Answer: Yes, in our team all of us have to face the same problem. We initially face problems. However, we are able to solve the problem subsequently.

Answer: Training about anthropometry measurement was too short. For example, we were told that there was no need to measure MUAC for children aged below 1. We forgot the instructions and measured MUAC of infants. At the time of field visit, Sheuli apa identified the mistake. After that incident, we collected the data as per the instructions.

2. Team work/ administration

a) Experience of team work/team administration-including issues of advice/guidance, support:

Question: Tell me something about your team work. How was the co-operation with FRA and FRO? Did you get proper support, guidance and advice from the supervisors? If not, can you explain the problems you have faced?

Answer: When we worked in a team we helped each other. Team members were good.

Answer: In our team all of the members were supportive. We helped each other.

Answer: Supervision of our supervisor was fine. If we had any problem, we solved it by working together.

b) Did you face any issues and/or challenges? How did you overcome them?

Answer: In the field, we sometimes have to work with conservative families that do not prefer male FRA.

Answer: But the numbers of such cases were few.

Answer: When I was working in the field during structured observation, I faced a challenging situation. The husband of my respondent had some mental issues and he did not allow me to work in the house initially. I had to convince him with the help of my FRO. However, when I revisited the house during the cross sectional study, I faced similar problem. I had to convince him again. Also, occasionally we had to walk about 3-4 miles due to the lack of availability of vehicle.

Answer: Yes, in some rural areas it was extremely difficult to reach our field. Despite of these transport and other issues, we have finished our work successfully. .

Answer: During Ramadan, when we finished our work it was time for our meal “ifter” and we had our meal on the way. We could reach our places after one or two hours of ifter.

Question: Did you face problems regarding your food?

Answer: Sylhet, unfortunately, is an expensive city and the hotel and food bill was expensive.

c) Suggestion for improvement:

Answer: If we respect each other and have mutual helping nature, there will be no problems. We need to be sacrificing to do this kind of work.

3. Field/Methodological issues:

a) Experience of working in the field-e.g. during Structured Observation and, Cross Sectional Survey:

Question: How was the experience of working in the field during Structured Observation and Cross Sectional Survey?

Answer: About questionnaire I want to say that at first we asked the respondent, did you wash your hand before preparing food, eating food, feeding child, after cleaning child anus and after defecation. After they answered these questions, we asked them the frequency of their hand wash. However, the women refused to answer as they felt that we were repeating the same question though we were asking this time about the number of times they have washed their hands the day before that day.

Answer: When we asked the respondent "when you used soap today or yesterday, what did you use it for?" often they didn't mention it was before or after eating as it is a typical thing to do

4. HIS Survey instruments/topics-Structure Observation and Cross Sectional Survey:

a) Experience of the HIS instruments and topic e.g. administration, logistics:

Answer: We get various kinds of support from the head office. Logistic support was also good. For example- during the spot check part, there was a demo of hand washing for which it was required to have a wrist watch. We were all given wrist watches for the same purpose.

Answer: Actually, we received proper administrative support.

Answer: Though we receive our salary on time, it takes about 2 to 3 months to get TA and login allowance.

Question: What is your experience?

Answer: We get everything on time.

Answer: We would like to have torch lights.

Answer: It is especially required in CHT area.

5. Part A Questionnaire and Part B (Spot Checks):

a) Experience of open ended questions e.g. understanding of questions and probing:

Question: Tell us your experience about open ended questions.

Answer: During structured observation we observed some households. During our cross-sectional, we visit the same household. When we asked them open ended question, they had a tendency of over reporting. Though they had knowledge about hand washing, they have not practiced though they gave us a positive response.

Question: For example?

Answer: For example, when we asked them "when do you wash your hands with soap", they gave us false replies. During the structured observation we did not see the practices they have mentioned.

Question: Did they say that they wash their hands with soap?

Answer: Yes, they said that they wash their both hands with soap. Though we tried to probe, they always responded in a similar way.

Answer: During cross-sectional, it happened in several occasions.

Answer: When I asked the respondent "When you used soap today or yesterday, what did you use it for?" she told me some points which was not true. I understood that she didn't use soap for that purpose. But when I asked the respondent, please show me the soap that you use for hand washing purpose; she wasn't able to show me the soap. Then she changed her statement and responded that for the last two ways, she did not have any soap in her house.

Question: When you asked them open ended questions could they understand? Did you help them a lot?

Answer: Sometimes we have to help them.

Answer: There were two question- Did anyone tell/teach you/your household members about messages of how and why to use safe water? And another one was did anyone tell/teach you/your household members about the messages of hygienic behavior and its practices? When we asked them these two questions, most of the respondents couldn't understand. We had to explain the question again and again.

Answer: Educated respondents were able to understand but we had to help non-educated or low educated respondents.

b) Experience of recall questions e.g. washing hand after defecation, before and after food preparation, soap use, availability:

Question: Now tell about recall questions. Was it easy to get the answer?

Answer: We easily got the answer for the recall questions.

Answer: Yes, the respondent understood the questions easily.

Section 11: Sanitation and hand washing:

a) Experience of spot checks-problems, issues e.g. observation of hand washing place, soap, and other hand washing implements:

Question: During the spot check you checked soap availability in the household. What was the result?

Answer: Sometimes, we found that they used body soap for all proposes of hand washing.

Answer: Actually when the body soap becomes too small, they use the small soap for hand washing.

Question: There was another question, “How often do they buy soap?” What was the answer of this question?

Answer: We got various answers.

Answer: They bought cloth soap weekly.

Question: What kind of soap did they generally buy?

Answer: Ball soap, Chaka soap, and powder.

Answer: Majority of the respondents use lifebuoy as body soap.

Answer: They also use other body soaps like- Lux, Keya, Aromatic, Lifebuoy Gold.

Question: Do they have spare soap in their household?

Answer: Most of the households did not have extra soap.

Question: Do they have separate soap for hand washing?

Answer: It was rare.

Answer: It is typical to use leftover body soap for hand washing purpose.

Question: You had to check hand washing place after defecation and before cooking, eating, or feeding a child. Was the hand washing place different?

Answer: Yes, in most of the cases it was different.

Answer: Sometimes it was in yard and the other times it was near a tube well.

Answer: After defecation, generally, they use a specific place for washing hand but there was no specific place for washing hand before cooking, eating or feeding child.

Question: You had to observe respondents and their child hands. What did you see in these cases?

Answer: Generally their fingernails were dirty. However, their palms and finger pads were clean.

Answer: when we observe the respondents after they clean themselves with a cloth or bath, their hands were generally clean.

Question: Did they allow you to observe their hands?

Answer: Yes, generally they smile.

Answer: They were interested to know what we were observing.

Question: Do you have any suggestions or recommendation for this project.

Answer: From some households, we collected water for arsenic test. Most of them wanted to know the results and I recommend providing them with the report of the arsenic test.

6. Difference between this study and any others:

Question: How does this study differ from others that you have worked on?

Answer: Hand washing part is a different part which we did in this study. This study in general does not focus on hand washing practices.

Answer: It was also different to have anthropometry measurements.

Answer: This study is different in a way that we got step-by-step training.

Answer: Volunteer training was also different.

7. Learning:

Question: What have you learnt from the UNICEF Shea-B project?

Answer: Before this study I never did Structured Observation. It's a new experience for me.

Answer: I learned anthropometry measurement. Now I know how to measure anthropometry of a child.

Focus Group Discussion – 2

Topics to be discussed

1. Training:

a) Experience of training/Preparation for the field:

Question: Let us start our discussion today by focusing on your training experience. Do you think the training you received prior to field visits helped you in the field? How do you rate our training material and facilitation? How was the feedback session? Let us talk openly about the merits and demerits of the training.

Answer: The first training I ever received was the training of structured observation. Hence, it was slightly difficult for me to understand the training process in the initial stage. However, over time I got used to training. Our second training was the cross-sectional instrument, which was long and good. When I faced any problem in the training, we could discuss with the trainer. But the training period for anthropometry was short. It would have been beneficial if the training would have been longer. The other "child module" instrument was difficult in the initial phase. However, it was very clear to us by the end of the training.

Answer: Let me first thank you and Lisa for arranging this FGD session. We have received three instances of training. Our first training was structured observation and our trainer was Shilpi apa. Though she expressed it well, she did not have controlling power that was present in Shamima apa's training. The overall training was good and the venue selection was also fine.

Answer: Let me first thank you for this arrangement. We have received 3 trainings. The first one was on structure observation which was problematic initially. However, when I started to work in the field in a practical way, I was able to solve the problems. Later, we received cross-sectional training which was very good. The last one was child module and we were trained by Dr. Shamima. Though there were some complex issues during the training, we could overcome these problems in the field. We have nothing to say about venue of training and the management. They were obviously fine.

2. Team work/ administration

Question: Now we will talk about our team work. How do you feel about our team work? Did you have a good cooperation with FRA, FRO, me and the other team? Do you have any concerns, suggestions, or problems relating to team work and administration?

Answer: We worked in 17 clusters in 5 districts. There were 5 FRAs and 1 FRO in our team. When we worked in a team we helped each other. Team members were good.

Answer: In our team all the members were supportive. When a problem aroused, we discussed among us to solve the problem.

Question: Did you face any problems directly? Sometimes we change a FRA from one team to another. What do you think of these changes?

Answer: There were two Chakma FRAs and a Marma FRA in our team. At the time of structure observation in CHT area they setup us in the front household of the village and then they went to the next household.

When we did structured observation in the CHT area, we were lodging in the front household of the village and they went to the next household. When we worked in vacant land, we asked them to stay in the front or the suitable household and we worked in the next house. We had a good understanding in our team and we always tried together to solve our problems. Regarding change in team members, all I want to say is it has pros and cons. The positive aspect is that we can work with a different community and we get a chance to know the culture and behavior of this community.

Answer: As a matter of fact, we are FRA and our main duty is to collect data from field. It is also our duty to face the new situation and we are able to do this. I do not think that we had any problems.

Answer: I don't favour team change. When we work in a community, we understand the situation of the community well. At the same time, the community and our respondents know us well. I think this is a plus point for us and it helped us during the field work.

3. Field/Methodological issues:

a) Experience of working in the field-e.g. during Structure Observation, Cross Sectional Survey:

Question: How was your experience of working in the field during structured Observation and cross sectional survey?

Answer: When we did structured observation we had to observe had washing before food preparation, serving food, before and after eating, after defecation and after cleaning children's anus. However, other possible hand washing events were not included in the questionnaire though these events were related to hand washing.

Question: Can you explain these events?

Answer: Some of the respondents washed their hands after cutting fish with water, soap or ash before doing other household activities. We could not include their hand washing after fish cutting as there was no option.

Also, we faced problems when we had to collect water sample for arsenic test.

For the water collection purpose some water pots containing acid were provided to us. The cork of the bottle very tight and it always spilled on our skin and burned our skin when we opened the cork. The gloves provided to us were not protecting us from this acid burning and this was very dangerous. Moreover, the microbiology team informed us that they would be collecting the water sample for arsenic testing within 7 days. But they collected the sample sometimes after a week which has spoiled the affectivity of the test.

Answer: I want to share a few issues about guideline or manual. During cross-sectional we got two types of manual. First one was for the cross-sectional questionnaire and another one was for the child module. I personally read those manual 5 times and noticed that the important instructions were not included in the manual. The manual and guideline were not useful.

4. HIS Survey instruments/topics-Structure Observation and Cross Sectional Survey:

a) Experience of the HIS instruments and topic: administration and logistics

Answer: Logistic support was appropriate. We have no issues about administration or logistic support.

Answer: Yes, we received proper administrative support.

Part A Questionnaire and Part B (Spot Checks):

a) Experience of open ended questions: for example. Understanding of questions and probing

Question: What is your experience about open ended questions? Did you get an easy response for the open ended questions?

Answer: When we asked respondent "Did anyone tell/teach you/your household members about messages of how and why to use safe water?" or "Did anyone tell/teach you/your household members about the messages of hygienic behaviour and its practices?" some of the respondents initially thought for a couple of minutes to respond that they were not informed by anyone and they knew it themselves. When we asked them again how they learned it themselves, they answered that their parents informed them about these issues.

Answer: There was another question "When do you think it is important to wash hands?" Before asking this question, we had to ask several questions related to hand washing. Hence, when this question was asked they did not repeat the answers they gave earlier.

Question: When you asked your respondent open ended questions, how was it? Did you help them a lot?

Answer: Sometimes we have to help them. Also, we have to lead them also if necessary in few occasions.

b) Experience of recall questions e.g. washing hand after defecation, before and after food preparation, soap use, and soap availability:

Question: Let us talk about recall questions. Was it easy to get the answer?

Answer: We easily got the answer for the recall questions. We didn't have to lead them in this instance.

Question: There was also another recall question: "How many times did you wash your hands throughout the day yesterday?" Did you face any problem when you asked this recall question?

Answer: When we asked them "How many times did you wash your hands throughout the day yesterday?" sometimes they replied us about 8/9 times. Occasionally they would report that they have washed 100 times. They even said rarely that they wash their hand too often: literally “the whole day”. However, when we probe more and ask more questions, we get the approximate value which is 25, 26 or 30 times.

Question: Could they answer when you asked them “when you used soap today or yesterday, what did you use it for?”

Answer: Yes, there was no problem.

Section 11: Sanitation and hand washing:

a) Experience of spot checks-problems and issues relating to observation of hand washing place, soap, and other hand washing implements:

Question: What was the result of soap availability?

Answer: Soap was available in most of the households. The most frequent soap is cloth soap and body soap was the other available soap.

Question: Do they have separate soap available for hand washing?

Answer: Yes, but the proportion of people using separate soap was low.

Answer: Actually when the body soap or cloth soap becomes too small, they use the left over soap for hand washing purposes.

Question: There was another question, “How often do you buy soap?” What was the answer for this question?

Answer: It is difficult to generalize the answers as we got several answers.

Answer: They bought cloth soap weekly.

Answer: Generally, the answer is weekly or in 2 weeks.

Question: Which one was often?

Answer: Weekly.

Question: Do they have a spare soap in their household?

Answer: Majority of the households didn’t have any extra soap.

Question: Do they have a separate soap for hand washing?

Answer: Yes, but it was reported rarely.

Answer: Several families use body soap or cloth soap for hand washing purpose when it becomes too small.

Question: You had to observe respondents and their child hands. What did you see in these cases? Did they refuse?

Answer: No, the respondents didn't feel any type of hesitation.

Answer: There was definitely a problem. Before observing the hands of the respondents, we asked them to give us a glass of water. During this time, normally our respondents washed their hands. Hence, when we observe their hands, they would have clean palms and finger pads. However, their nails were dirty.

Answer: Yes, often their fingernails were dirty.

Answer: When we observe the respondents just after their bath or cloth washing, their hands were always clean.

Question: There was also a hand washing demonstration. How was the observation? What was your experience?

Answer: Often, the respondents did not want to demonstrate hand washing. They often hesitated.

Answer: Instead of demonstrating hand washing, some of the respondents enacted hand washing without soap and water to show us how they generally wash their hands.

Answer: Some of the respondents demonstrate hand washing by washing their right hand. After demonstration they would say that their demonstration was wrong as they normally wash their left hand after defecation.

Answer: Sometimes they rub their hands with soap for a long time which is artificial.

Answer: Majority of the respondents hide their real practice as washing hands with soap was not their general practice.

Focus Group Discussion – 3 (FRO)

Topics to be discussed

1. Training:

a) Experience of training/Preparation for the field:

Question: We will address different topics, beginning with a discussion about training. We completed structured observation and cross-sectional training. How was the training style? Was the training effective? Was there any issues that addressed in training but later you faced problems in the field? How was the training module? Tell of your experiences in detail~~s~~.

Answer: Training of structured observation was our first training and in that time I was a newcomer in ICDDR, B. During training I saw that everybody participated willingly. Another good side was the field practice. It was so effective.

Answer: Yes, there were so many opportunities for field practice and it was more effective then discussions. In training we discussed about different types of problems and tried to build up a common understanding.

Answer: In training everybody wanted to learn. When we went to field practice, we faced some problems. In the training session we had a discussion about the problem and solved it. It helped to build up our skills.

Answer: Not only that, our trainer was well known by us. So we were able to accept the training a lot more.

Answer: Shamima apa's training was excellent.

b) Were there any issues that were not raised in training that arose in the field?

Question: Were there any issues that were not raised in training that arose in the field?

Answer: No, the training was good. Every type of issues was addressed in training. There were no gaps in the training. Although there were some new situations or problems created in the field, it was but possible to know about those problems during training or before the field work. So the training was okay.

c) Suggestions for improvement:

Question: Do you have any suggestion for the improvement of training?

Answer: For the improvement of training I want to suggest, if we reduce training time I think it will be better. After lunch sometimes we felt tired and sometimes-we became unmindful.

Question: So your suggestion is to make the training period from 8:30 am to 4:00 pm.

Answer: Yes.

2. Team work/ administration

a) Experience of team work/team administration-including issues of advice/guidance, support:

Question: Now we will talk about team work. What type of problem did you face in the field? Did the FRAs co-operate with you? Were they able to complete their assignment? Try to mention these types of issues.

Answer: When I gave them any assignment they were able to complete that. They co-operated with me when I needed. Though in the beginning there were some problems in our team but day by day the understanding level was increasing in our team. I also faced another type of problem. This was regarding the maximum time and our FRAs did not take our feedback easily or positively. They took it as a sensitive or personal issue. So it was tough to give them feedback.

Answer: In our team all of the members were supportive. We helped each other. In the field we have to face a conservative family who didn't allow male FRAs. So in that particular family we set up a male FRA.

Question: Kafia what is your experience?

Answer: It's my first experience of going to different parts of Bangladesh with a team. There was no problem in my team. Though we faced some problem in the field but we were able to overcome the problem later. Our entire team was supportive.

c) Suggestions for improvement:

Question: Do you have any recommendation? Sometimes I change FRAs from one team to another team. Did that cause a problem for your team management?

Answer: I think it was a good decision.

Answer: It has a positive side. We can share our experience each other or with new FRAs.

Answer: But too much change can sometimes cause problems. When we work in a community, we know about the situation of the community well. Community people or our respondents know us well. It's a plus point for us and it helps us to work in the field appropriately.

Question: Was the change too much?

Answer: Though there was some change, it wasn't too much.

Question: According to you there was both a positive and a negative side. Which one was more?

Answer: Maximum time it was positive.

4. HIS Survey instruments/topics-Structure Observation and Cross Sectional Survey:

a) Experience of the HIS instruments and topic e.g. administration, logistics:

Question: Now tell me something about the administrative support.

Answer: In the CHT area it was impossible to work without administrative support.

Question: Did you get enough administrative support?

Answer: Yes, that was enough.

Question: Was there any problem?

Answer: There was no problem.

Question: Do you have any money problems?

Answer: About money we have some internal problem. I am talking about the TA bill. In the field we bear our travel allowance our selves. When we come back to Dhaka we submit TA bill and about after 2 month we get the money. When we get our salary, we have to calculate the maximum amount of money required for family purposes. But when we went to the field we did not have enough money in our hands. This is why it was tough for us to bear the accommodation cost, food cost and also travel allowance cost.

Question: Do you want an advance?

Answer: It will be better if we get some advance

5. Part A Questionnaire and Part B (Spot Checks):

a) Experience of open ended questions e.g. understanding of questions, probing:

Question: Tell us about your experience of open ended questions. How can we improve this section? How can we reduce over reporting?

Answer: At the time of structured observation we observed some households. During cross-sectional, we go to the same household. When we threw them open questions, maximum time they over reported us and sometimes they also under reported to us.

Question: As an example?

Answer: As an example, when we asked them "When do you think it is important to wash hands?" In this case maximum time they under reported us. But when we asked them "Did you wash your hand after defecation or after cleaning the child's anus or before eating or before feeding the child?" In those cases maximum time they over reported us.

Question: How can we improve it? Do you have any suggestion?

Answer: Respective FRAs have to be alert. It will help to minimize over reporting or under reporting.

Answer: Rapport build up with respondent is also important. It helps to collect real data from the respondent.

Section 11: Sanitation and hand washing:

a) Experience of spot checks-problems, issues e.g. observation of hand washing place, soap, other hand washing implements:

Question: Did you face any problem in the spot check section? Were there any cases where the respondent reported one thing but when you check you observed another thing? What was your finding? Did they allow you to check their toilet, hand washing place and others?

Answer: We didn't face these types of problems and they allowed us to check their toilet and other places willingly.

Answer: Sometimes they felt uneasy because in maximum cases condition of their toilets was not well.

Answer: Yes, they felt shy.

Question: In the spot check section you have to check the soap availability. What did you find?

Answer: In about 90% of cases soap was available.

Question: How frequently did they buy soap?

Answer: Weekly.

Answer: After 15 days or after 1-2 weeks.

Question: Which one was more?

Answer: After 1-2 weeks.

Question: Do they have spare soap in their household?

Answer: In maximum household they didn't have any extra soap.

Question: Do they have separate soap for hand washing?

Answer: It was rare.

Question: Did they have separate soap for bathing and hand washing?

Answer: In maximum cases they haven't.

Answer: Most of the family uses body soap for hand washing purposes when it becomes too small.

Question: Do they have any other item (e.g. bucket, basin or container) to wash hands in?

Answer: Yes, but its percentage was low.

Question: Did they change the water of the pot every day?

Answer: Yes, they changed the water every day.

Question: Did they change the water of the pot every day in CHT area?

Answer: Yes, they also change the water every day.

Question: You have to observe respondents and their child's hands. What did you observe?

Answer: Maximum time their fingernails were dirty and their palms and finger pads were clean.

Answer: It depended on the time that we observed them. Before lunch we observed that maximum time their hands were-dirty especially their fingernails. But after lunch we observed maximum time their hands were clean.

Answer: Comparatively child hands specially fingernails and palms were dirty.

Question: There was also a hand washing demonstration. How was the observation? What was your experience?

Answer: Actually maximum respondent didn't show us their real practice. Sometimes they rub their hands with soap for a long time which was artificial.

Answer: Maximum time they didn't want to show the demonstration, they felt hesitant.

Answer: Sometimes they show the demonstration by acting.

6. Difference between this study and any others:

Question: How does this study differ from others that you have worked on?

Answer: Before this study I worked on another project but this study is totally different.

Answer: There were different types of instrument and maximum was new. Structure observation was so interesting. I never did it before.

Answer: Another different side of this study was that our supervisors always follow up us.

7. Learning:

Question: What have you learnt from the UNICEF SHEWA-B project?

Answer: Every component of this project was new. Actually SHEWA-B project was totally new for me.

Answer: Before this study I never did Structured Observation. It's a new experience for me.

Answer: In this project we worked in a team. From the team I also learn many things. We have to face different situations, have to arrange accommodation place and transport. All of these were challenging and my learning was enough.