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Preconception Health and the Life Course Approach to Prevention of Non-Communicable Diseases: Implications for Informing Policy and Practice

By

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Thesis for the degree of Doctor of Philosophy

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Abstract

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The life course approach and developmental origins of health and disease (DOHaD) concepts suggest that early intervention in critical periods reduces the risk of developing non-communicable diseases (NCDs) in later life and prevents the intergenerational transmission of this risk. The preconception period is increasingly cited as a platform for preventive interventions, however, while international health organisations have recognised the importance of such early prevention, specific recommendations have not been made. This mixed-methods thesis aimed to explore the use of evidence from life course epidemiology in policy-making and health care practice, with a focus on the preconception period to prevent NCDs in later life and the transmission of risk across generations. The two main streams of implementation that underpinned this thesis were clinical practice and policy.

For the clinical stream, a narrative review of reviews of preconception interventions highlighted that intervening in the preconception period can potentially prevent the intergenerational passage of risk of NCDs. In contrast, a rapid review of published and grey literature showed that most studies and policies adopting the life course approach targeted the pregnancy or early childhood periods. Additionally, there was a need for better measurement strategies as a range of indicators have been proposed to measure health outcomes for different life stages or diseases risks, but with no clear guidelines on how the life course approach can be operationalised through interventions or programmes.

These reviews above informed the development of three subsequent studies. First, a qualitative study of obstetricians and midwives explored their understanding of DOHaD concepts and identified barriers and opportunities for intervening through routine clinical care for NCD prevention. Though understanding of the scientific findings from the field of DOHaD was high, practical factors such as lack of time, practitioners' views on their role in preconception care and a lack of resources hindered translation in routine care. The second study comprised an online survey to test the acceptability of i.) a nutritional risk assessment tool and ii.) the routine discussion of nutrition and pregnancy intention between reproductive-aged women and healthcare practitioners in the UK. Results showed high acceptability for the tool. The discussion of nutrition and pregnancy intention was considered important, provided that the reasons for doing so were communicated clearly, in a non-stigmatising manner. Finally, a document analysis of meeting minutes and observations of five advocacy groups in the field of DOHaD showed that policy translation has been affected by the lack of a clear message on what needs to be done when communicating to the public and policy-makers. The study also revealed insights into several opportunities with recommendations on framing messages, key stakeholders, and the need to acknowledge the influence of wider determinants of health e.g., economic policies and the environment.

Overall, the findings contribute to the understanding of how opportunities before and during pregnancy can be harnessed to prevent NCDs, improve women's health and wellbeing and provide a better start to life for the next generation. A framework for implementing the life course approach is discussed and along with an overview of future work needed to address evidence gaps and improve the translation of evidence to policy and practice.

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Research Thesis: Declaration of Authorship

Print name: Chandni Maria Jacob

Title of thesis: Preconception health and the life course approach to prevention of non-communicable diseases: implications for informing policy and practice

I 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.

I confirm that:

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3. Where I have consulted the published work of others, this is always clearly attributed;
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5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Parts of this work have been published.

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Definitions and Abbreviations

AAI..Active Ageing Index

cSES ....Childhood socioeconomic scale

COREQ.................................Consolidated Criteria for Reporting Qualitative Studies

DOHaD ....Developmental Origins of Health and Disease

EBPM....................................Evidence-based policy-making

ECD.......................................Early Childhood Development

FIGO ....International Federation of Gynaecology and Obstetrics

GDM ....Gestational diabetes mellitus

GDP ....Gross Domestic Product

HCP.......................................Health Care Practitioner

LCHD.....................................Life course health development

LMICs....................................Low and Middle-Income Countries

MNCH...................................Maternal, Neonatal and Child Health

MCH ....Maternal and child health

MD..Mean difference

NCDs.....................................Non-communicable diseases

NICE......................................National Institute for Health and Care Excellence

PCC ....Preconception care

PCOS.....................................Polycystic ovarian syndrome

PLA ....Participatory learning and action

PPI ....Patient and Participant Involvement

SGA ....Small for gestational age

SDGs ....Sustainable Development Goals

UK PP....................................UK Preconception Partnership

WHO ....World Health Organisation

Chapter 1 Introduction: A life course approach to prevention of non-communicable diseases and improving the health of the next generation

Non-communicable diseases (NCDs) such as cardiovascular diseases, diabetes and stroke have now become the number one cause of death and disability worldwide.[1] Attention has recently shifted from adult lifestyle and associated risk factors as a cause for NCDs to early life experiences that influence adult health and mortality risk.[2] The 2030 Sustainable Development Goals (SDGs) promote commitment to health through the goal "Ensure healthy lives and promote well-being for all at all ages". In addition, the significance of the growing problem of NCDs is brought out in SDG 3 as it aims to "reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being", by 2030.[3]

The life course concept suggests that early intervention in critical periods such as preconception, pregnancy, childhood and adolescence reduces the risk of developing NCDs in later life and prevents the intergenerational transmission of risk. Key stages in people's lives have particular relevance to their health and the life course approach acknowledges the importance of these stages. The growing interest in the relationship between adverse circumstances across the life course leading to an increased risk of chronic diseases such as heart disease and diabetes and mortality led to research that explains disease aetiology within a life course framework.[4]

The call for addressing NCDs using a life course approach by preventing risk factor exposure, beginning in early life and continuing with interventions for adults and the elderly, is supported by multiple recent strategies and recommendations. These include the World Health Organisation's Global status report on non-communicable diseases, [5] the World Report on Ageing and Health, [6] the Every Woman Every Child Global Strategy for Women's, Children's and Adolescents' Health (2016–2030)[7] and from the UK Department of Health.[8]

This chapter introduces the definitions, models and methods of the life course approach and key concepts in life course epidemiology. The recent evidence for a focus on the life stage of preconception and an overview of evidence-based policy-making (EBPM) is also discussed as it is

central to the focus of this PhD. Finally, the aims and research questions of the thesis are presented as a guide to the subsequent chapters.

1.1 What is a life course approach?

The life course is a socio-culturally defined sequence of age categories that people are normally expected to pass through as they progress from conception to death.[9] Life course epidemiology investigates the long-term effects of physical and social exposures during pregnancy, childhood, adolescence, young adulthood and later adult life on health and disease risk in later life.[10] It also encompasses pathways (biological, behavioural and psychosocial) influencing the development of chronic diseases and operating across an individual's life course or generations. A temporal and social perspective is adopted which looks back across an individual's or a cohort's life experience(s), or across generations, to understand current patterns of health and disease. The life course approach thus recognises that both past and present experiences are shaped by wider social, economic and cultural contexts. This indicates that health and well-being at any time are not only dependent on current conditions but on the trajectory of risk factors and their consequences over a longer period. This leads to the use of the life course concept in a prospective manner, to devise predictors of later health or disease and to develop preventive interventions.

The life course approach incorporates key components such as the role of developmental influences on risk and protective factors, multiple determinants of health outcomes and representing aspects of health development as functional trajectories.[11-13] The rapidly growing science of Developmental Origins of Health and Disease (DOHaD) has shown the transgenerational nature of risk factors for NCDs.[14] This has also led to a shift in focus towards the need to attain optimum health from the embryonic period and thus for parents in the preconception period.[15]

While the life course approach is applicable within the context of infectious diseases, reproductive health and general health and well-being, conventionally, the approach has been utilised for understanding chronic disease epidemiology.[4] For the purpose of this thesis, the life course approach will be used as the theoretical framework for NCD risk reduction.

1.1.1   Origins of life course epidemiology

The idea that exposures early in the life course may have long-term effects on the development of chronic diseases became strengthened towards the end of the twentieth century.[11] The causative models of NCDs that mainly focused on adult lifestyle factors such as smoking, poor diet and lack of exercise were challenged by the increasing amount of research supporting the importance of health in early life, leading to the emergence of life course epidemiology.[10] In the 1990s, work from medical and social research converged to bring the concepts of biological 'programming', risk accumulation and health inequalities into life course epidemiology.[16]

Birth cohort studies and prospective longitudinal studies have been widely used to study life course phenomena in humans.[16] Studies in Hertfordshire, UK, were the first of a series of cohort studies that used historical records, combined with later follow-up, to explore the association of early life with chronic disease in adulthood.[17] In Hertfordshire, 16,000 men and women born between 1911 and 1930 were traced from birth to the present day. Death rates from coronary heart disease were two-fold less between those at the lower and upper ends of the birth weight distribution. Findings of the Swedish cohort study that followed up 14,611 babies also support the inverse association between later cardiovascular disease and birth weight.[18] Further studies from low and middle-income countries (LMICs) have shown that the relationship is U-shaped, as the risk of later chronic disease also increases at the high birth weight end of the spectrum – a particular concern with the rising prevalence of obesity and diabetes in women of reproductive age.[19] In chapter 3, I discuss in further detail the risk factors for NCDs in mother and offspring, before and during pregnancy. Advances in human genomics had led to increasing support for the notion that variations in risks were dependent on genetic predisposition or fixed genetic factors that cannot be modified. However, while some rare genomic variations associated with an increased risk of NCDs have been found recently (e.g., cardiovascular disease with predisposing factors such as obesity),[20] this does not explain the high proportion of NCDs in the population as a whole. Thus, the "heritability" of NCDs may not be necessarily through genetic risk factors alone.[13] Studies from the field of DOHaD and life course epidemiology have helped in understanding the wider biological and sociocultural factors that influence the risk of NCDs, contributing to the wider development and acceptance of the field and of DOHaD.

1.1.2   The Developmental Origins of Health and Disease paradigm and the life course approach

The fetal 'programming' hypothesis (also called the Barker hypothesis) proposed that fetal undernutrition, resulting from a poor maternal diet and/or problems with the mobilisation and transfer of nutrients from mother to fetus,[21] would induce phenotypic changes in the fetus, enabling survival in the short-term but having longer-term health consequences. It also suggested that early development can determine the maximum functional capacity an individual can attain, setting the limit for the life course. Animal studies have shown that alterations in the diet of pregnant animals can produce lasting changes to offspring physiology and metabolism.[22] Such studies also show that maternal overnutrition, achieved in animals by feeding mothers high-energy diets or making the mother obese/diabetic, also causes insulin resistance and diabetes in the offspring.[23,24] Recently there has been accumulating evidence that paternal diet, body composition and health can also affect the health of the offspring (in both animals and humans).[25,26] Together, these studies provided the basis for the well-established field of science known as the developmental origins of health and disease (DOHaD).

Research from DOHaD shows that events before birth can have life-long consequences,[11,12] brought about through adaptive responses that the fetus or infant makes to cues from the environment in utero or in early life.[24] These responses may not be just for fetal survival, because they can be induced even within the normal range of developmental environmental influences. These so-called predictive adaptive responses are suggested to have evolved to optimise Darwinian fitness.[27]

The DOHaD concept is thus complementary to that of a life course approach [28] and the "first 1000 days of life" concept (from conception to two years of age) [29] - all of which suggest that preventative interventions in early life could help improve later physical and mental health.[30-32] While initially focused on cardiometabolic disease, DOHaD now includes other non-communicable diseases (NCDs) such as cancer, osteoporosis and mental illnesses. Recent evidence has also shown the impact of early environment on educational attainment and economic productivity.[33] Thus, considering early life factors has now become imperative to address the increasing burden of NCDs globally and is key to limiting the passage of NCD risks to the next generation. [34]

For this thesis, the DOHaD paradigm and the life course approach will be considered as complementary concepts that have similar aims for the long-term prevention of NCDs and

preventing the transgenerational passage of risks. Studies from both fields have not only shown the importance of individual biological risks, particularly in the period before and during pregnancy, but also bridged the biological and socio-ecological models of disease causation and linked long-term health and disease with adverse events historically such as wars and famines.[35,36]

1.2 Common terms and conceptual models used in life course epidemiology

Some terminology commonly used in life course studies includes:[28,30]

- Plasticity: the potential for change in intrinsic characteristics as a response to environmental stimuli is called plasticity and is measured by variability between people. Developmental plasticity also uses cues from the environment to optimize the life course strategy for attaining maximum Darwinian fitness and preparing for a future environment.[37] The epigenetic mechanisms such as DNA methylation, changes in histone structure and small non-coding RNA activity provide a basis for the process of developmental plasticity. The emergence of epigenetics is giving insights into the molecular mechanisms that underlie such developmental changes.

- Resilience (or robustness): the ability of a phenotype to resist change without changing its initial stable configuration.

- Trajectory: the path established after an initial impetus, by analogy with a ballistic model. It may nonetheless be altered by subsequent influences, in which case a different trajectory is followed, so there is little flexibility.

- Path dependency: a life course where the response to a challenge, or the next step on the trajectory, depends on the previous one(s). Thus, future responses to a challenge or a particular level of risk will differ in individuals depending on the path they followed to the present point.

An understanding of the natural history and physiological trajectories of normal biological systems, along with biological and social pathways is needed when using the life course approach. Several models have been described to suggest pathways linking exposures across the life course to later-life health and include the temporal ordering of exposure variables, their inter-relationships (directly or through intermediary variables) and the outcome measures.

The most commonly used approaches to studying life course processes are defined in terms of four, relatively overlapping models from Ben-Shlomo and Kuh.[4] These explain ways in which

different factors may act to cause chronic diseases across the life course: they focus on a critical period (with or without effect modifiers), an accumulation of risk model and a chain of risk model. Hertzman and Power propose a similar three-fold model of life course influences on health – using the terms latency, cumulative effect and pathway.[38]

1.2.1 The critical period model

The critical period model (Model (a) in Figure 1.1) is when an exposure acting during a specific (sensitive) period has lasting or lifelong effect on the structure or physical functioning of organs, tissues and body systems, which are not modified in any way by later experience, and which results in disease later.[4] Also referred to as "biological programming" or a "latency model", this model forms the basis of early versions of the fetal origins of adult disease hypothesis. A critical period is a period in which an environmental influence causes irreversible metabolic consequences that alter susceptibility to later adverse outcomes.[39] A critical period is thus a limited time window when an exposure can have adverse or protective effects, and outside this period there may be no excess risk. For instance, poor growth in utero leads to a variety of chronic disorders such as cardiovascular diseases, but other exposures in later life may still influence disease risk. The latency model [38] (including the concepts of critical and sensitive periods) involves relationships between exposure at one point in the life course and the probability of health outcomes years or decades later, irrespective of intermediate events in life. The critical period model also includes key social transitions such as the transition from primary to secondary school, the transition to parenthood, etc.[40] A sensitive period[4] is a period when an exposure has a stronger effect on development, though the same exposure outside this time period would still produce an effect that may be weaker, and there may be scope to reverse these changes outside this period.

1.2.2 The critical period model with later effect modifiers

This is an extension of the critical period model, including the possibility that later life factors (physiological or psychological stressors) may modify the effect of exposure during a critical period of development on later disease risk.[10] The influence of exposures acting later in life may enhance the effects on disease development (synergism) or diminish them (antagonism), as seen in model (b) in Figure 1.1 Risk exposures may be independent as in model (a) or clustered as seen in model (b). clustering may occur around a single factor. For example, low childhood

socioeconomic status is associated with other risk factors for poor health in later life such as low educational attainment, family stress, inadequate diet, passive smoking etc. This is suggested to be the case for the associations of birth weight with some chronic diseases in which associations are stronger among those who become obese during adolescence or adulthood.[41]
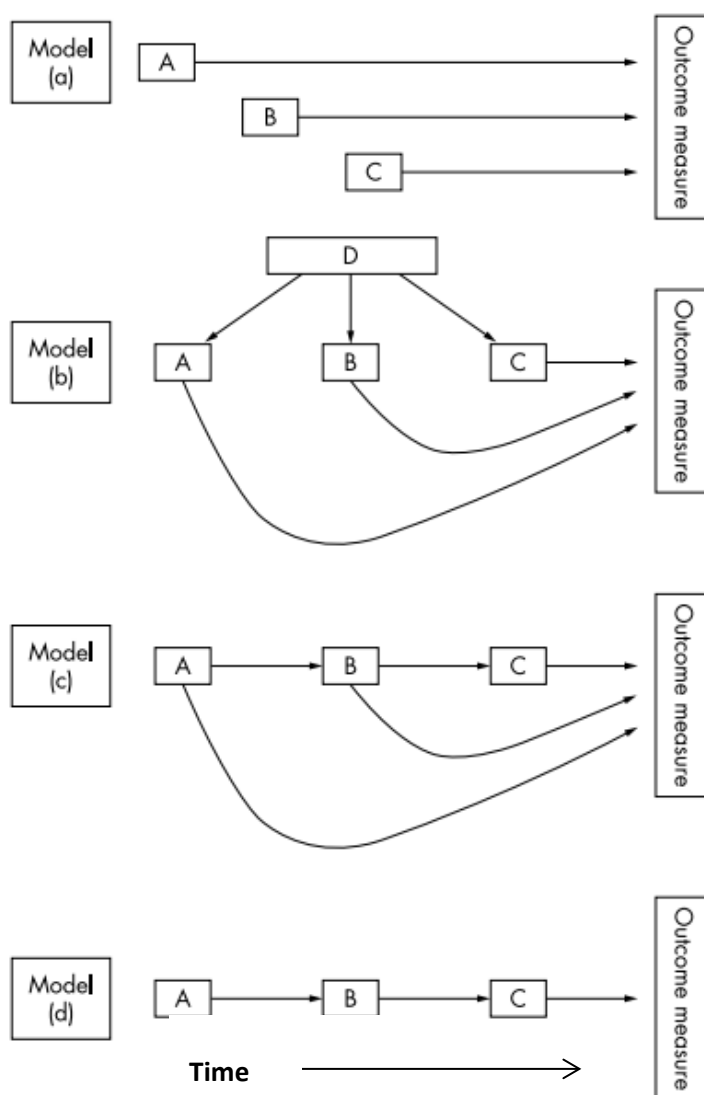
Figure 1.1 **Life course causal models Figure produced with permission from Kuh et al (2003) [42]**

In the critical period model, risk exposures may be independent as in model a or clustered as seen in model b. Model c depicts the accumulation of risk model which can also be due to clustering of exposures. Model d depicts the pathways model

which recognises that the timing of exposures may affect disease risk in many ways.

1.2.3 Accumulation of risk model/ Cumulative model

This model focuses on the total amount and/or sequence of exposure, suggesting that multiple effects accumulate over the life course. However, it also allows for developmental periods during which susceptibility may be greater, so the sequence or trajectory of accumulation may also be important.[10] As the number, duration and severity of exposures increase, there is cumulative damage to biological systems (Model (c) in Figure 1.1). For example, children from poorer socioeconomic backgrounds are also more likely to be of low birthweight, to have poorer diets, to be more exposed to passive smoking and some infectious agents, and to have fewer opportunities for physical activity. The accumulation model has been considered to be more useful in life course epidemiology as it has better predictive power, can provide aetiological insights and addresses social inequalities in health.[16] For instance, the model suggests that an individual's health is related to the proportion of their life spent exposed to disadvantages; thus a person's position in the social structure controls the risk for mortality.

1.2.4 Pathway model/Chain of risk model/Trigger model

The fourth model refers to a sequence of linked exposures where one leads on to the next.[10,40,41] It suggests that various intermediate factors (e.g., lifestyle, educational attainment, socioeconomic status and health behaviours) between early life and adult health may all play roles. It shares similarities with the accumulation model, but differs on the timing of aetiological exposure, with early advantage or disadvantage setting a person on a pathway to a later exposure that is the aetiologically important event (Model (d) in Figure 1.1). For instance, a child from a disadvantaged background might encounter fewer educational opportunities. This in turn restricts socioeconomic wealth and resources, and later influences health behaviours and results in poorer health in later life.[40] The pathways model also supports the notion that early events influence the life course trajectory, leading to particular social destinations and ultimately influencing health outcomes.[38]

1.2.5   Other conceptual models in life course epidemiology

Research has suggested other models, which have similarities to the above models, to explore the influence of the life course on chronic diseases.

The Meikirch model of health suggests that an individual's health is the result of the interactions between their personally acquired potential (the sum of all physiological, mental and social resources a person acquires during life) and biological potential (the biologically given finite potential a person has from birth, influenced by genetics and the quality of pregnancy) along with the interaction between all three determinants – environmental, social and individual. Figure 1.2 [43] illustrates three possible time courses of the two potentials during a person's life. Such models look outside a disease-focused model for life course health and wellbeing.
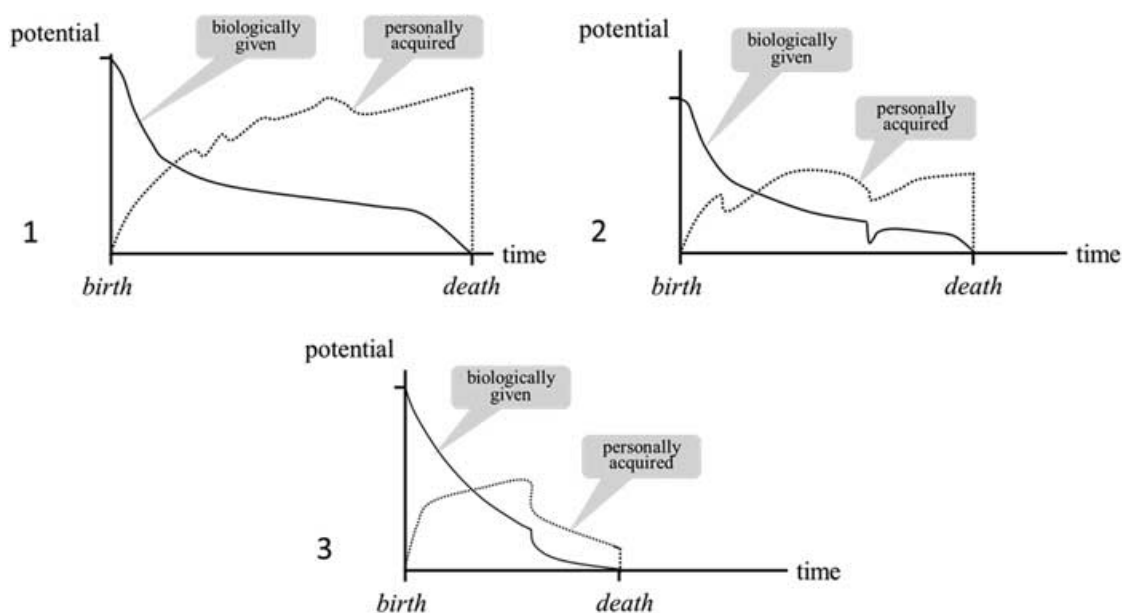
Figure 1.2   Examples of different time courses of an individual's biologically given and personally acquired potential Reproduced with permission from Bircher J, Kuruvilla S. 2014 [43]

These general conceptual models are, however, representations of life course processes that are likely to be more complex, and even such simple models may be difficult to distinguish empirically. Recent human studies in DOHaD and developments in epigenetics have influenced new models.

1.2.6   New model based on the pathways model

The models described above while helpful in understanding the pathophysiology of diseases across time, provide little guidance for intervention development and addressing the increasing burden of NCDs. The model in Figure 1.3 developed by Hanson *et al*. 2016 suggests that the rate of decline of an organ system depends on the level of peak function attained earlier in life, which also depends on developmental processes and early environmental influences. [30]
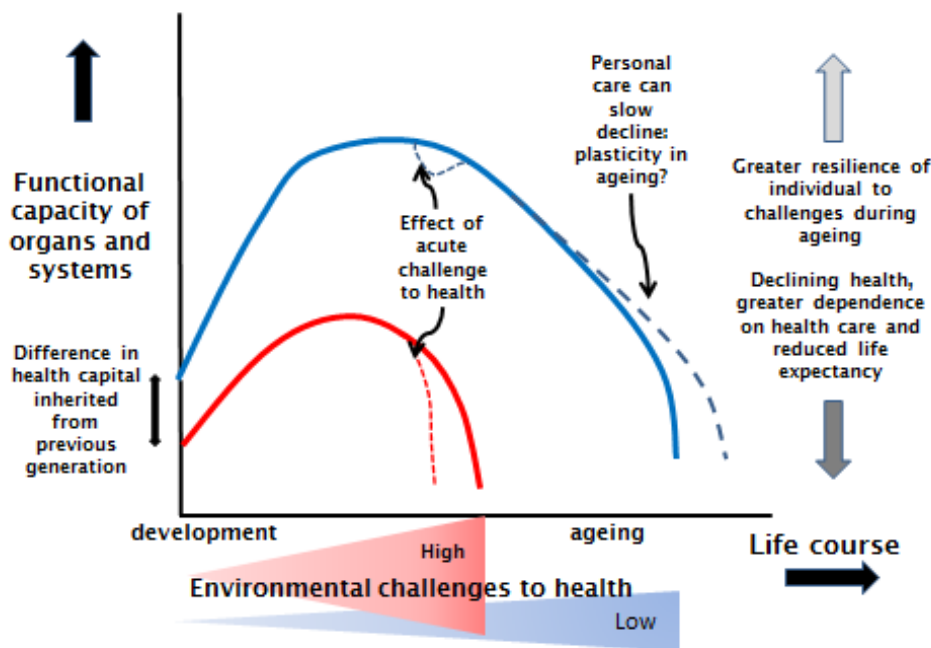
Figure 1.3   The life course model showing average hypothetical trajectories of functional capacity for organs and systems in individuals. Trajectories vary for low- (red) and high- (blue) income settings. Low-income settings are associated with a poorer start to life in terms of inherited health capital. An acute challenge such as an accident or infection in mid-life may produce a dip in function followed by recovery in a high-income setting, but a drastic loss of function in a low-income setting (broken red line). Provision of personal care and preventive interventions for NCDs, most often in high-income settings, can slow the rate of decline, sustaining resilience in a manner similar to plasticity (broken blue line). Figure produced with permission from Hanson et al. 2016[44]

This model can be further refined by stressing that what matters for an individual or population group at any point in the life course is not so much the level of risk as the response to an acute challenge in the form of a more rapid increase in risk. A key feature of this model is that it includes parameters affecting the health of an individual, even before birth, and suggests that interventions in early life could focus on building the resilience to withstand insults to capacity later in the life course. This model is now commonly used to describe the inter-generational risk for NCDs and the role of the critical period before pregnancy in the passage of risk to offspring, as well as the long-term risk for the health of the parent.

1.3 Preconception as a critical period in the life course for embryonic and fetal development

The way an embryo and fetus obtains and allocates nutritional resources has profound consequences for the individual's lifelong health. Influences in early life on risk factors such as obesity and later NCDs fall into biological, behavioural and contextual domains.[45] The biological factors affecting fetal development include maternal nutrition (under and overnutrition) and hyperglycaemia, and recent studies have shown that prenatal exposure to gestational diabetes mellitus could lead to epigenetic alterations that increase the risk for type 2 diabetes later in life for the offspring.[46] Intrauterine growth retardation (including low birth weight), premature delivery, over-nutrition in utero and intergenerational transmission of risk are all known risk factors for chronic diseases such as ischemic heart disease, stroke and diabetes.[47] Optimum fetal and child nutrition provides several benefits such as cognitive, motor and socio-emotional development; healthier adult stature; better work capacity and productivity; and a decreased risk of obesity and NCDs throughout the life course.[48,49] A recent umbrella review by Daly *et al*. (2022) [50] looked at exposure-outcome associations in the preconception period. The study found high quality evidence linking maternal folate supplementation and the reduced risk of neural tube defects. For risk factors such as obesity/ high BMI and interpregnancy weight change, moderate grade evidence was seen for outcomes such as fetal distress, miscarriage and maternal hypertension respectively. For paternal risk factors such as higher paternal age (more than 40 years), moderate evidence suggested an increased risk of miscarriage. Associations were also seen for short interpregnancy intervals and outcomes such as low birthweight, but they were of low quality.

Issues such as deficiencies of essential nutrients (e.g., iron, vitamin B12, and folic acid) often exist before conception, and other conditions such as diabetes and increased maternal age are all known risk factors for so-called congenital anomalies. However, as many pregnancies are unplanned (globally unintended pregnancies estimated to be 44% in 1990-2014),[51] and in many LMIC settings the first antenatal visit may be delayed, these risks may track on into pregnancy. Hence improved nutrition and lifestyles of women of childbearing age are generally required.[52] In addition, the period before and during pregnancy, is a time when more women access healthcare services, thus presenting a window of opportunity to identify some of the above risk factors such as obesity or uncontrolled diabetes for a woman's life course health.[53]

DOHaD research has shown that multiple developmental factors operate from preconception through early life to affect the risk for later NCDs.[34] Evidence from LMICs has also supported these findings. Ethnic differences also exist in developmental strategies for the conservation of resources, and hence differences in body composition through life, and this could underlie ethnic health disparities. In India, a link was found between low birth weight and insulin resistance in children along with adverse total serum cholesterol and low-density lipoprotein cholesterol levels.[54] Findings of the Pune Maternal Nutrition Study suggest that micronutrient deficiencies (such as vitamin B12) can also lead to low birth weight and later risk of diabetes in the offspring.[55] Factors in the preconception period such as maternal overnutrition and obesity, maternal undernutrition, related paternal factors, and assisted reproductive treatments such as in-vitro fertilisation, - have been recognised as influencing the phenotype and potential of both maternal and paternal gametes (sperm and oocyte) with enduring effects on chronic diseases in adulthood. These factors lead to metabolic stress and hormonal dysregulation in the parents and oocyte and embryo responses such as epigenetic modifications and gene expression changes, and altered intracellular signalling.[26]

Traditionally, preconception care (PCC) has focussed on women and couples motivated to conceive. The seminal *Lancet* series in 2008 [56] stressed that though the first 1000 days are crucial, the period before pregnancy also plays an important role in the health of the next generation, and also the woman's life-long health. This call was further strengthened through the *Lancet Diabetes and Endocrinology* series on Maternal Obesity (2016) and on preconception health (2018).[34,57] Globally, increasing nutritional issues among women in the reproductive age group (usually considered as 15 – 49 years) such as micronutrient deficiencies, obesity and prediabetes, coupled with the high rates of unplanned pregnancies, call for an increased focus on PCC. Hill *et al.* 2020[58]

described a model of PCC, underpinned by the life course approach, which recognises that preconception populations can be recognised and targeted throughout the life course, including populations that do not meet the criteria for other life stages such as adolescents (Figure 1.4)
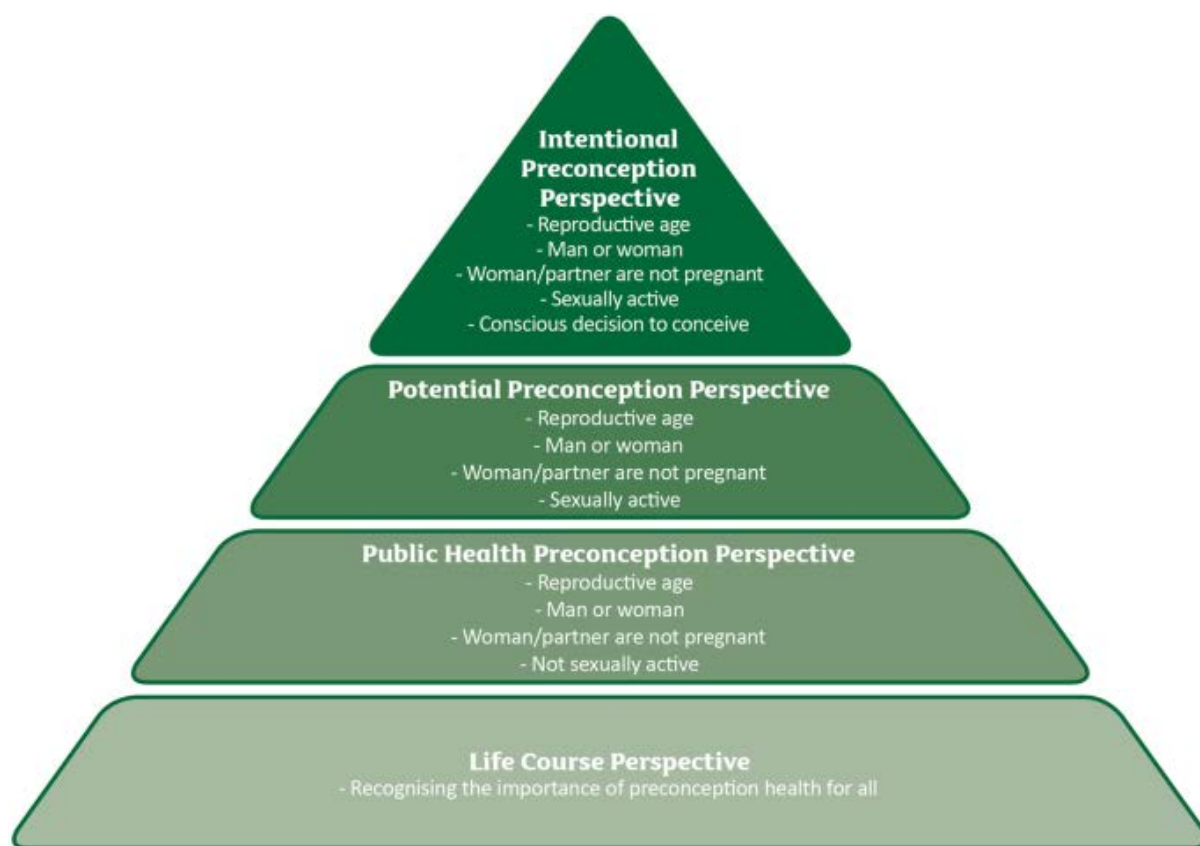
Figure 1.4   Four perspectives to define the preconception population
Figure from Hill *et al.* 2020 [58]

1.3.1   Definition of concepts in the preconception period

There is a lack of consensus in terms of defining the population to be included in the preconception period. While this period is commonly defined as "3 months prior to pregnancy", Dean *et al.* propose that 'the preconception period should be defined as a minimum of 1-2 years prior to the initiation of any unprotected sexual intercourse that could possibly result in a pregnancy.[59] This would extend through the care provided in early pregnancy (peri-conception care) and the postnatal period until the next pregnancy. Other authors have used the first trimester (<12 weeks of gestation) to select their target populations as part of PCC programmes and highlighted this as a pragmatic critical period to access women from LMICs who often do not seek antenatal care before 12 weeks.[60]

More recently, *The Lancet* series on preconception health called for a new definition that considers multiple perspectives – biological (days to weeks before embryo development), individual (weeks to months before pregnancy) and public health (months to years).[34]

As discussed in fig 1.4 Hill *et al.* 2020 additionally included the life course perspective which encompasses the public health perspective defined by Stephenson et al (2018). Thus, improving the health of women in the reproductive age group acts as a cross-cutting theme to achieve good health across multiple life stages and generations. Healthcare professionals often meet women with different perspectives on pregnancy [58] - 'potential' (sexually active individuals without effective contraception or contraceptive failure); 'intentional' (men and women making a conscious decision to conceive); and 'public health' (a wider range of individuals and couples not sexually active). With the growing realisation that efforts to optimise the health of women and children should begin before conception, healthcare practitioners (HCPs) need to be aware of these perspectives.

Preconception care is defined as -

"a set of interventions that aim to identify and modify biomedical, behavioural, and social risks to a woman's health or pregnancy outcome through prevention and management, emphasizing those factors that must be acted on before conception or early in pregnancy to have maximal impact."[61]

This includes care provided regardless of pregnancy status or intention. [62] A limitation in delivering PCC has been the focus on women and couples motivated to conceive. For example, early marriage and early age at childbirth are common in LMICs such as India. [63] In addition, even in high-income countries (HICs), a significant proportion of pregnancies are unplanned: 45% of pregnancies in the UK, similar to the global rates discussed earlier. [64]

Studies often include the post-partum period, early pregnancy and peri-conceptional periods as part of PCC. The post-partum period in particular (also called the interconception period) provides the potential for interventions aiming to support recent mothers with issues such as excess weight gain to have positive outcomes in the next pregnancy.[65-67] So the overarching aim of PCC is to improve short and long-term maternal and child health outcomes by intervening before pregnancy. It also includes interconception care which is delivered between the end of a

women's pregnancy to the start of her next pregnancy or in the first 24 months postpartum to improve outcomes for potential future pregnancies. [68,69]

Studies have also highlighted the adolescent period as part of the preconception period, as health during adolescence can have a tremendous impact on health as future parents.[70,71] Major transitions and developmental changes make this a time of immense potential for preventive interventions and provide opportunities to address risk factors that exist since childhood.[7,72]

1.4 The life course approach and DOHaD in policy-making - an important opportunity

1.4.1 The need to include life course and DOHaD messages in policy-making

During the last two decades, the life course approach has become a powerful organising framework for the study of health and its determinants, disease and mortality, and is now frequently considered the leading theoretical platform for the study of patterns of lives as they unfold across time. [10] The need to control NCDs using a life course approach by preventing risk factor exposure, beginning in early life, through childhood and adolescence and continuing with interventions for young and older adults and during ageing, is supported by multiple recent strategies and recommendations. In *Health 2020 the WHO European policy framework for health and well-being*, the life course approach was recognised as a fundamental principle for how the WHO Regional Office for Europe and its Member States seek to approach health and health policy. Risk factors for NCDs such as obesity present a difficult problem for policy-makers due to a range of interrelated causal risk factors (food policies, industry, trade, climate change, poverty, education, etc.).[73] A recent analysis[74] showed that, globally, most countries implemented just under half of the WHO-recommended NCD prevention and control policies in 2017, [75] and that most of these were high-income countries. It is therefore now important to raise awareness of the relevance of the DOHaD concept to reducing NCDs. [76-78]

There are however examples of DOHaD-related messages being fundamental to incorporating the life course approach in policy. [79-81] The recent WHO-UNICEF-Lancet Commission highlights the importance of DOHaD concepts such as health and nutrition in the preconception period, pregnancy and early childhood.[82] The economic case for DOHaD was presented in the Global Strategy for Women's, Children's and Adolescents' Health, suggesting that investing in the health

and nutrition of women, children and adolescents would lead to a 10-fold return in the form of better educational attainment, workforce participation and social contributions. [83] The DOHaD framework provides added advantage in that it can be applied to the evaluation of existing policies to estimate their long-term effects and model outcomes related to NCDs and maternal and child health.[84] Efforts to achieve the SDG targets such as "zero hunger" and "reduce premature mortality from NCDs" can be strengthened by implementing the multi-faceted life course framework to improve health and wellbeing across all life stages.

From these considerations, it would appear that the life course model and messages from DOHaD about NCD prevention should fall on fertile ground in the policy-making arena. However, the adoption of DOHaD in such policies has not always been sustained. Although the 2011 UN Political Declaration on the Prevention and Control of NCDs [85] stated that "maternal and child health is inextricably linked with NCDs and their risk factors", the recent UN task force on NCDs [86] and the 2018 WHO report on NCDs [87] make little reference to improving women's and children's nutrition and young people's health as a strategy – even though these factors may influence the attainment of multiple SDGs. [71,78]

The application of life course and better preconception health is not limited to the prevention of NCDs and has been used for wider societal and intergenerational benefits. The interventions indicated by DOHaD research appear easy to communicate to stakeholders such as policy-makers and the general public – e.g., to improve BMI, physical activity and diet in people before conceiving a baby, to improve nutrition in pregnancy, prevent excess gestational weight gain and screen early for pregnancy complications such as gestational diabetes, to increase breastfeeding rates, and to improve infant weaning foods. [78,88-90] Yet these challenges remain (or are worsening) in most countries. [57] One of the reasons could be that, though widely credited for highlighting NCD risk factors across the life course and between generations, so far DOHaD-based intervention studies have shown only small effects, and long-term longitudinal intervention studies are lacking. [57,88,91] Similarly, the operationalisation of the DOHaD agenda in the real world has not been contextualised and communicated clearly to national-level policy-makers, healthcare systems or local governments, to help them implement measures in different settings. A challenge now for DOHaD and life course research is to identify if and how their findings have been reported in policies to prevent NCDs (both long term and in the next generation) and develop strategies to increase the uptake and communicate the message more clearly.

Employment of the life course approach is often through public health promotion programmes by national level and international health agencies. This has predominantly been in the context of NCD prevention strategies such as increasing physical activity and prevention of childhood obesity, and tends to recommend using a multi-sectoral approach that is based on the social-ecological model.[92] Though theories and models related to life course perspectives have advanced over the past two decades, there remains a gap in the literature describing a strategy to implement or operationalise the life course approach at a national level.

1.4.2   Defining a policy informed by the life course approach and/ or DOHaD for this thesis

At the WHO European Ministerial Conference on the life course approach in the Context of Health 2020, held at Minsk in October 2015, member states signed a declaration in which they agreed that using a life course approach was an essential step toward the implementation of Health 2020 and the SDGs.[93] The report itself was informed by evidence from the DOHaD field. Through the declaration European nations committed to the utilisation of the life course approach in healthcare policies. The declaration described the adoption of the life course agenda as encompassing three key criteria – i. acting early (main focus on childhood cognitive and physical development) ii. appropriately to transitions in life (inclusive of the preconception, pregnancy and adolescent period) iii. together as the whole of society (recognising the interconnectedness of human lives and effects of deprivation and disadvantage on intergenerational health). Using gender-sensitive perspectives, promoting social justice and contributing to sustainable development and growth were also considered the benefits of using the approach. These factors from the Minsk declaration were used as a guide in later chapters to identify how policies and guidelines were using the life course approach.

1.4.3   Identifying approaches to influence policy

Public health policy has a deep impact on the health status of people, in particular, to prevent NCDs by influencing the physical activity patterns and dietary habits of a population. The life course perspective encourages policy-makers and service providers to integrate services across a continuum of care, as currently recommended by the WHO, and places healthy development and disease prevention at the forefront.[93] It goes beyond targeting only high-risk groups. While international organisations and departments of health have recognised the importance of adopting a life course approach, they have fallen short on specific recommendations.

The term 'evidence-based policy-making' (EBPM) is now commonly used in the context of governance for health issues. EBPM uses research methods such as systematic reviews, evaluation, policy experiments and randomised controlled trials (RCTs) to provide information on effectiveness (using a "what works" approach) and evaluation of policy outcomes.[94,95] Evidence-informed policy-making, is a concept similar to EBPM, but recognises that there are many types of evidence suggesting different conclusions. EBPM and evidence-informed policies work on the assumption that high-quality evidence will lead to better decision-making by policy-makers.[96,97] However, for evidence to manifest as policy, an awareness of how to implement policy in a timely manner using knowledge translation mechanisms is necessary.[96-99] WHO has defined knowledge translation as "the synthesis, exchange and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people's health".[100] Thus translation could happen at multiple interfaces such as science-policy, science-clinical or clinical-patient. Clinical medicine and health policies made by national and international organisations that provide practice guidelines for healthcare workers often consider explicit clinical research or meta-analyses (e.g., Cochrane reviews). To constitute evidence, however policy-makers adopt a wider view that may include health information, expert opinion, stakeholder's experiences, the prevailing historical and political context and even anecdotal accounts.

However, the notion that provision of evidence would lead to increased utilisation has been challenged over time. Dobrov et.al (2006) highlight the impact of contextual factors such as varying policy objectives, varying skills of expert group members in using tools to support decisions and resource constraints and political interests on the utilisation of evidence.[101] Pawson and Tilley (2004) have suggested that the "what works" approach often manifested in EBPM needs to be expanded to be based on a realist evaluation which further asks *'What works for whom in what circumstances and in what respects, and how?'*.[102] Over objective evidence, policy decisions are often influenced by values, interests, timing, circumstance and happenstance. [103]

1.4.4 Bridging the divide between evidence and policy-making

Factors such as varying policy objectives, resource constraints and political interests at a high level, along with public opinion and values, timing and circumstances at the population level, can affect the use of DOHaD research in national-level programmes.[78,95,101] For example, Cairney and Oliver (2017) have highlighted that researchers are often limited in engagement with policy and

providing actionable options due to restrictive notions related to the hierarchy of evidence. While a value-based approach is crucial to policy-making, it is not considered so often in DOHaD research.[104] In addition, pragmatism, knowledge and consideration of governance principles and the ability to develop simple, compelling stories are key to successful engagement. A systematic review by Oliver et al (2014) showed that mere dissemination of research findings by researchers does not prompt action from policy-makers.[105] Because scientific evidence alone (even using robust gold standard methodologies) may not be sufficiently persuasive by itself in prioritising an issue, researchers may have to develop recommendations while recognising that policy-makers may make judgements based on their beliefs, and that to gain attention, short-term agenda/ outcomes may have to be considered.[105] In addition, building relationships with policy-makers requires time, skill and effort, and the provision of timely and relevant evidence. Finally, as DOHaD researchers may predominantly be from a biomedical/ basic sciences background, restrictions of the evidence-based medicine agenda (which does not draw from policy theory or knowledge of the policy process) influence their efforts in policy engagement.[106]

One model that researchers often adopt to increase the impact of research is the advocacy model which involves the development of policy solutions by the researchers, and where efforts are focussed on convincing the policy-maker.[107] This has however been critiqued for altering policy discussions without considering the underpinning factors that influence the policy processes. Studies have shown that research has a higher impact when researchers have a better understanding of the policy process and the context of political priority setting.[105,108] A more 'facilitational' model using participatory methods and through shared responsibilities is now recommended and is increasingly practised in healthcare policy-making for production and communication of knowledge.[109,110] Such facilitation is often conducted through collaborations between scientists, academics and policy-makers and by forming networks or working groups. Such coalitions have been developed for DOHaD and life course research across the globe, with a range of agendas. However, their impact on policy has not been formally explored.

1.5   Research questions

Though the use of the life course approach has been recommended by the WHO Minsk declaration using loosely defined criteria, it is yet to be examined if and how countries have adopted and utilised this approach. While the specific frameworks among the models above all have different implications for policy, in this thesis an overarching view is adopted to explore

which models have been used, if there are advantages of one over another and how they can be operationalised to improve health and wellbeing across generations. A plethora of issues has been explored by using a life course lens as discussed above. However, for this thesis, the focus will be on NCD-prevention and exploring how the preconception health agenda fits into the life course approach. At the time of commencing this my research, recommendations for interventions and policies from DOHaD research were increasingly focusing on "preconception" as an object of intervention and highlighting the need to use these concepts in practice, outside the realm of research studies and interventions and birth cohorts. Thus, from the big picture of operationalising the life course concept, the thesis aims to develop actionable recommendations for use in clinical practice and policies.

The aims of this thesis are:

1. To explore critically the methods used in implementing the life course approach, with a focus on prevention of NCDs in later life and the intergenerational passage of modifiable NCD risk factors.
2. To develop actionable recommendations for the preconception period to be incorporated within the life course approach for prevention of NCDs and the transgenerational passage of risk of NCDs

The latter includes assessing current strategies being implemented during the preconception (and peri-conceptional) periods through interventions and clinical care. The study highlights the evidence for interventions that are likely to be effective and aims to understand the factors that influence policy-making related to DOHaD and the life course approach.

The specific research questions to achieve the aims of this PhD are listed in order of the chapters below.

1. What can be done in the preconception period through interventions and healthcare to prevent the transgenerational passage of NCDs and their risk factors (Chapter 3)

2. What is the awareness among healthcare practitioners in contact with women in the preconception period about DOHaD-related concepts and what are the barriers to provision of PCC? (Chapter 4)

3. What is the acceptability of a nutritional risk assessment tool and routine screening for pregnancy intention to identify at-risk women, among women in the reproductive age group and among healthcare practitioners in the UK? (Chapter 5)

4. How is the implementation of the life course approach being measured and reported through policies? (Chapter 6)

5. How can the preconception period and the life course approach be implemented through policies and practice? (Chapter 7)

This chapter introduced the background and rationale for the PhD and some of the research questions (chapter 3, 6 and 7). The structure of the thesis and development of the empirical studies are discussed further in Chapter two. The thesis is organised in a logical format following two key streams – clinical practice and policy.

Chapter 2   Structure of the thesis and methodological approach used

2.1   Structure of thesis

The thesis is formed of eight chapters. Chapter 1 introduced the concepts of the life course approach, DOHaD and how the preconception period lays the foundation for future health. The Chapter also highlighted how countries and international organisations have committed to the use of a life course approach. Chapter 2 explains the thesis structure and describes the research approach and methodology used. The theories and frameworks that were used for the empirical data chapters are also summarised in Chapter 2. Methods and materials used for individual empirical research studies are discussed within the respective chapters. Figure 2.1 illustrates the chronological order in which the studies were conducted. The sequencing of the chapters is arranged in a logical flow to first discuss the clinical stream followed by the policy stream. While Chapter 2 is not a chapter on methods it presents my epistemological position, the rationale for how the research questions were developed for each chapter along with other activities that influenced the thesis such as stakeholder engagement and patient and participant involvement (PPI). The limitations and quality assurance considerations for the methods are described at the end of each individual chapter.
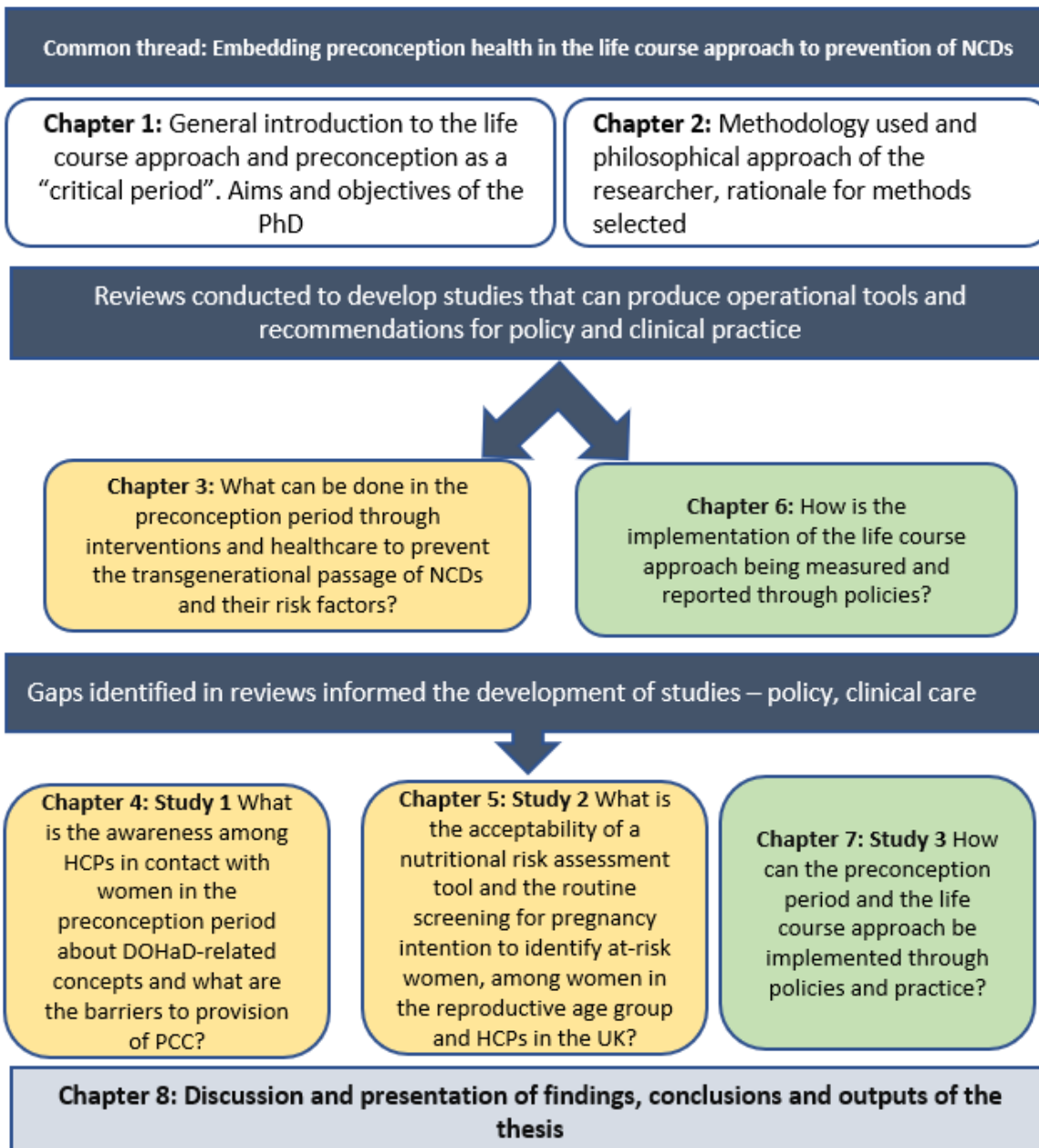
Figure 2.1   Structure of the thesis The yellow boxes illustrate the chapters in the clinical stream and the green boxes, for the policy stream. The main research question addressed in the respective chapter is presented in the boxes

Two reviews were conducted at the onset of this thesis to develop the research questions for the subsequent studies. The first review in Chapter 3 presents the state of evidence for preconception interventions through a review of reviews and outlines key international clinical guidelines that have focused on PCC as a platform to prevent NCDs across the life course. A systematic review was not deemed appropriate for this chapter as the thesis did not focus on intervention

development in the preconception period, and due to existing good quality recent reviews on issues related to PCC. The reviews in this PhD were conducted at the onset between 2018-2019, during which period I was aware of, or collaborating with experts, working on reviews related to PCC and long-term health [50,111-113] and *The Lancet* series on preconception health provided an overview. Considering these factors in the context of the aims of the PhD, and to avoid excessive replication, Chapter 3 provides a critical and narrative overview of the state of preconception interventions and clinical guidelines which helped develop the research questions for the empirical studies in the subsequent chapters and provides a background of the field to the reader.

Continuing with the clinical stream, two chapters following the review present the methods and findings from a qualitative study (Chapter 4) and a mixed-methods online survey (Chapter 5). Discussing DOHaD-related concepts, such as pregnancy planning and preconception nutrition, may not accord with HCPs' perception of their roles, and competing clinical priorities, lack of resources and time constraints may hamper its uptake. The qualitative study in Chapter 4 aims to explore this further to seek possible solutions through a qualitative study of obstetricians and gynaecologists (OBGYNs) and midwives in different countries exploring their understanding of DOHaD and life course concepts, and how they use it in practice. Along with this, barriers to implementing PCC in routine work are also addressed.

Comprehensive educational material for HCPs can help them have 'healthy conversations' about behaviour change in a non-stigmatising manner. [114] International organisations such as the International Federation of Gynaecology and Obstetrics (FIGO) have developed tools for clinicians such as a nutrition checklist. The acceptability of such a tool and the routine discussion of pregnancy intention was explored in Chapter 5. While the thesis takes a global approach, in Chapter 5, a national-level study was conducted to test the acceptability of a nutrition checklist among women and clinicians in the UK.

For the policy stream, first, a review of published and grey literature was conducted to address the knowledge gap on how the life course approach can be implemented and measured/ monitored at a national level, presented in Chapter 6. It presents an overview of the methods in which policies based on a life course framework can be monitored and highlights the stages of the life course on which policies have not focussed.

Chapter 7 presents the methods and findings of a document analysis of a series of meetings that focussed on the life course approach and preconception health. Key advocacy groups were selected and observed during the period of the thesis to explore research question 5. Finally,

Chapter 8 integrates the study findings and draws together the recommendations to develop a conceptual model for the life course approach in policies and integrating PCC. Outcomes from this thesis including publications are detailed in chapter 8 along with a list of references for the papers published based on the work in this thesis.

2.2 Researcher position and epistemology

2.2.1 Justification of my ontological and epistemological position

Before conducting a qualitative study, it is necessary to make explicit the philosophical position of the researcher. Ontological positions describe the relationship between the world and human interactions. [115,116] Epistemology describes what counts as knowledge, the way knowledge is produced, the nature of knowledge and how it influences the way research is conducted.[117]

For authenticity and transparency in the analysis, I shared my background and experiences. I originally trained as a doctor in India and worked in the clinical setting for two years before moving to the UK to specialise in public health. At the time of inception of this study, I was not involved in any clinical work but was working closely with organisations such as the WHO and FIGO which develop public health and clinical guidelines. I also realise that though my research focuses on obesity and NCDs, I am not obese, nor have I been diagnosed with an NCD. However, I do have a special interest in the field having close family members living with obesity, diabetes and heart disease. Thus, I may hold the assumptions and preconceived notions of a former clinician and a public health professional while interpreting the findings of my work throughout this thesis. I also expect to have had experiences in common with the HCPs I interviewed to some extent, particularly those I interviewed from India. Hence, I do not believe that I will be able to uncover an "absolute truth" that is not influenced by my experiences, as would be assumed in a realist view. Instead, I will adopt a critical realist position that is conducive to the approach that underpins this thesis.

A key assumption in the critical realism perspective is that I will be creating an understanding of the data jointly with the information provided by the participants. Thus, though commonalities among the stakeholders being interviewed are explored, individual perspectives are also valued.[118,119] Critical realism is a philosophical approach that describes both ontological and epistemological position. It is situated between realism (the belief that a pre-social reality exists

that we can access through research) and relativism/ constructivist view (the belief that reality is dependent on the ways we come to know it). Thus, the researcher may attempt to gain an understanding of the topic, but it is bound to be limited.

Finally, as common in qualitative and mixed-methods research, the thesis will use first-person language where appropriate. This additionally helps with reflexivity and transparency.

2.2.2 Context for the research

The rationale and the impetus for the research were shaped by three key factors – the need for translating evidence from life course and DOHaD fields into practice and policy, the need for research on stakeholders who would carry out this implementation (HCPs and policy stakeholders) and my knowledge and personal experiences working in the field of DOHaD since 2015. Before and during the PhD (undertaken part time), I was working full time with the LifeCycle project (project aims described in Chapter 7) which aims to develop recommendations from birth cohorts in Europe for policy-making, intervention development and clinical practice, with a key focus on NCDs and childhood obesity. I was also part of projects in collaboration with the WHO (Geneva and regional office Copenhagen) that arose from the Minsk declaration in 2015 and the World Report on Ageing discussed in Chapter 1. The focus on clinicians' perspectives in supporting the life course agenda built on my interests in how decisions are made in practice, and from working with organisations such as the FIGO-Pregnancy Obesity and Nutrition Initiative (PONI).[120]

The studies for the thesis were conducted within the 5-year LifeCycle programme, and I was the primary investigator for all the research presented in this thesis. Along with the supervisory team who provided input for the thesis, publications included other members from the research group who helped with conceptualisation of the studies or provided comments on the methodology or findings. The project was also impacted by COVID-19 pandemic, during which pragmatic decisions to continue the studies with modifications in sample size, target groups and study designs were made – discussed in the individual chapters.

The work of this thesis resulted in published papers and these are discussed in detail in Chapter 8 (outcomes of the PhD) along with a statement of contribution of my work for each output. Finally, I shadowed several advocacy networks and organisations for the study in Chapter 7, and the interpretation of the findings are my own and do not necessarily represent the views of the networks.

2.3 Research approach and methods

2.3.1 Rationale for mixed methods approach

In qualitative research, the methodology (philosophical position) influences the methods (tools) adopted for the research. [116] The thesis adopts a mixed-methods approach using both qualitative and quantitative methods to answer the research questions. These include – scoping and rapid review methodologies (Chapter 3 and 6 respectively), interviews with thematic analysis (Chapter 4), an online cross-sectional survey collecting quantitative and qualitative data (Chapter 5) and a document analysis with observations (Chapter 7). The critical realism approach provided the basis for selecting the appropriate scientific method as applicable to the questions, and as policy analysis does not always use scientific approaches from the hierarchy of evidence, appropriate methods were used as recommended from the fields of social and political sciences. In using critical realism, the researcher acknowledges the unobservable mechanisms (interactions among participants, events and structures) that may or may not influence some outcomes. [121,122] Unobservable mechanisms have the potential to condition participants' health behaviours and thoughts, for example while responding to a survey. Thus, critical realism attempts to unearth mechanisms underlying the outcome of interest and to answer *how* and w*hy* a certain phenomenon may occur.[122,123]

Both quantitative and qualitative analytical techniques were used on data collected from a range of participants throughout the study. Adopting an online survey, for example, provided the advantage of collecting a larger number of participants during the pandemic. I did not develop a fully-quantitative study limited to closed questions to assess the acceptability of the checklist or explore why women and HCPs may not want to discuss nutrition/ preconception at every visit, which is often seen in a positivist approach. Instead, I adopted a pragmatic attitude towards designing the study, with the understanding that reality is socially constructed. The narrative presented by the study sample is influenced by the participants' motives and by social norms. This is also reflected in the analytical techniques and interpretation of results, for example where the open-ended responses were not converted into quantitative responses for statistical analysis, rather qualitative content analysis was performed (more details below).

2.3.2   Approach adopted in the thesis to answer the research questions

While individual behaviour change is a key component to reducing the prevalence of NCDs and preventing the intergenerational passage of risk, several theories have been developed to highlight the importance of factors external to the individual's behaviour or biology. The COM-B model described by Michie et al (2011) proposes that individuals need the Capability, Opportunity and Motivation to adopt a particular Behaviour.[124] Hanson *et al*. 2016 while describing the COM-B model (Figure 2.2) to improve preconception health and develop interventions for reducing maternal obesity rates state that *"a top-down approach involving policy initiatives has to be complemented by a bottom-up mobilisation of communities and individuals"*[57] The domains are also connected through actions and interventions such as advocacy to improve policy priorities related to maternal and child health. A top-down approach to policy-making often starts with a policy decision, following the stages of formulation, implementation and reformulation.[125] The approach is however limited by its tendency to neglect other stakeholders such as the target group, bureaucrats and practitioners, and the strategies they use to navigate problems related to the issue. A bottom-up approach on the other hand begins with the analysis of stakeholders' needs at the operational level (e.g., HCPs).[126]
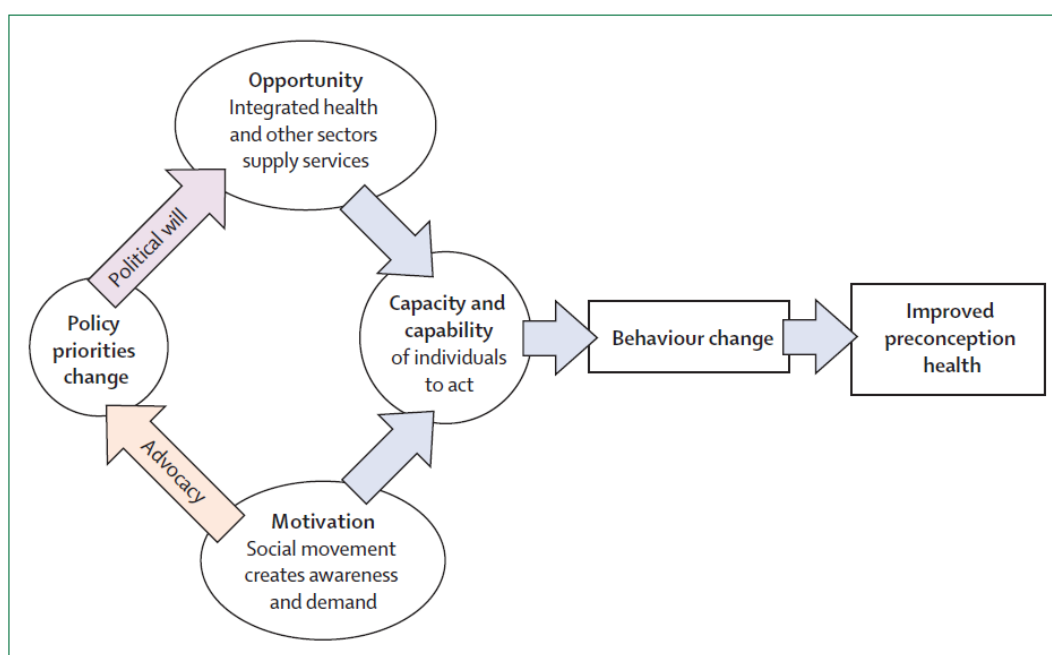
Figure 2.2   COM-B model demonstrating components of new initiative required to achieve improved preconception health (reproduced with permission from Hanson *et al*. 2017)[57]

While a complete stakeholder analysis of both top-down and bottom-up groups is beyond the scope of this dissertation, this thesis mainly focuses on the top-down approach to implementing PCC in the life course framework. Hence the two streams of providing top-down services – policy-making in the life course approach and guidelines from international organisations will be explored. To include bottom-up stakeholders, clinicians are the key stakeholders in two of the chapters, and women's voices have also been included in Chapter 4 to understand their views on how nutrition and the risk of NCDs can be discussed in the clinical setting. In addition, a stakeholder mapping is conducted throughout the thesis.

2.3.3　　Qualitative analytical techniques used in the thesis

Naturalistic enquiries using qualitative methods use a range of analytical techniques. Two main approaches used in this thesis were thematic analysis (Chapter 4) and qualitative content analysis (Chapters 5, 7). Both of these are also useful for descriptive research designs. However, depending on what researchers are looking for in their data, the appropriate method can be selected for the analysis and presentation of data. Thematic and content analysis have often been used in literature interchangeably, with similarities such as looking across the data and individuals to identify patterns and themes, and also the ability to use inductive/ deductive methods.

While several definitions of content analysis exist, the commonly accepted definition described by Hseih and Shannon (2005) is *"… the process in which a researcher interprets the meaning or usage of written (text) or visual data*".[127] Content analysis has been used in the health and social sciences effectively to analyse large amounts of short qualitative responses [127] and it can range from interpretive and intuitive to strictly textual. The researcher's understanding of the data can be classified into codes which are umbrella terms or statements that capture the meaning of multiple points of data, allowing them to be further developed into themes or categories [128] Content analysis has also been used for the analysis of policy documents to organise and interpret data with high heterogeneity. Experts have discussed how the philosophical position of critical realism is suitable to the use of content analysis especially for research looking into deeper latent meaning underlying a phenomenon. [122]

Hseih *et al.* (2005)[127] describe three distinct approaches to content analyses to interpret meaning from the content of textual data – 1. Conventional (coding categories derived inductively from the text data) 2. Directed approach (deductive approach guided by a theory/ prior research findings)

3. Summative approach (counting and comparisons of keywords). The steps of content analysis are decided by the research question, theoretical interests of the researcher and nature of data. I selected conventional analysis for (Chapter 5), as it is appropriate for the research questions of understanding acceptability, barriers and enablers to discussing nutrition and pregnancy intention routinely and was not limited to only counting the frequency of responses within each section. Similarly, for Chapter 7, it helped organise and critically examine the discussions of multidisciplinary meetings. An inductive approach was used for Chapter 5, and a deductive approach for Chapter 7 – discussed in detail in the respective chapters. The summative quantification method is traditionally used to explore the usage of terms, rather than meanings and although more quantitative in nature was not suitable for this study.

Studies with content analysis often report code counts (number of times a code appears in the data) or frequencies of responses (number of participants contributing to the category). Depending on the underpinning epistemological approach, studies in healthcare have also presented findings of qualitative content analysis without presenting any counts, [129] an approach I have adopted for Chapters 5 and 7. As a critical realist, I aimed to understand - as far as possible - the factors that influence the perspectives of women and HCPs based on their subjective experiences of preconception and perinatal care in the UK (Chapter 5). The positivist approach views reality as objective, observable and measurable.[122] Counting the percentage of codes within the responses and ranking them would be positivist attributes that I did not adopt.

Thematic analysis, while also a descriptive qualitative technique, focuses on identifying, analysing and reporting patterns/themes.[116] In contrast content analysis describes the document's content by exploring "who says what, to whom and with what effect".[130,131] Thus, for the Chapter 4 on interviewing HCPs, analysis using thematic analysis described by Braun and Clarke (2006)[115] was considered appropriate, while for the women's survey responses, content analysis was used. The techniques used for thematic analysis are discussed in Chapter 4. For consistency, in this thesis the findings from thematic analysis are described as "themes/ sub-themes" and from content analysis as "categories/ sub-categories".[131]

Rigor in analysis

While evaluating qualitative studies, the use of terms such as rigor, reliability and validity has been widely debated in the literature.[132] Conformability takes the place of objectivity in qualitative research, and it is acknowledged that even positivism and quantitative research is

never objective or free from bias. During the study design all attempts were hence made to conform to protocols of qualitative research. Additionally, the generalisability and replicability of results may be poor due to differences in contexts. These concepts, rooted in a positivist approach, will be considered in this mixed-methods study for the quantitative elements.

Content analysis has been described as *"An interpretive and naturalistic approach. It is both observational and narrative in nature and relies less on the experimental elements normally associated with scientific research (reliability, validity and generalizability)".*[133] Though experts have suggested that content analysis can be assessed for reliability and validity (based on the philosophical stance of the researcher, research questions and methods), the most commonly used methods to evaluate it have been qualitative.[132] The key parameter considered for this purpose is trustworthiness (developed by Lincoln and Guba 1985). [134,135] This is of particular relevance when inductive approaches are used. Other criteria recommended for non-positivist paradigms such as transparency (disclosure of all aspects of the research process), reflexivity (the researcher's acknowledgement of assumptions and critical examination of own work)[136] and triangulation are also helpful in adding to the trustworthiness of the study. I used these criteria throughout the qualitative studies to allow a consistent, organised and transparent analysis of the data. An iterative approach was taken to develop the coding frameworks for each question and test the codes, in collaboration with a second reviewer, who had expertise in nursing, qualitative methods (Chapter 4) and health psychology (Chapter 5). In addition, the checklist presented by Elo *et al*. 2014 was reviewed to improve the trustworthiness of the results for Chapter 5 [132] and the COREQ (Consolidated Criteria for Reporting Qualitative Studies) checklist for Chapter 4.

2.3.4   Triangulation and comparison

Triangulation has been defined as "*a technique to analyse results of the same study using different methods of data collection".*[137] Considering the thesis overall, in the final chapter triangulates the accounts from the studies conducted to develop a broader understanding of how the life course approach can be used in policies and ways to embed PCC into the approach. In addition, the discussion sections of each chapter also triangulate the findings with existing literature, and the findings collected through different methods for the same research question. For example, a comparison of findings from the open text responses and quantitative data was carried out during the analysis of Chapter 5, and this is presented in Section 5.6 along with a comparison of findings with existing literature and those from the interviews in Chapter 4. During triangulation, the data

are compared for convergence, complementarity, or divergence.[138] While similarity in results of different methods helps to validate each method (i.e. convergence), complementarity provides an acceptable overview of "reality".

2.3.5 Participant involvement in study design

Before designing the protocol for the studies in this thesis, I also had multiple discussions with clinical stakeholders (consultant midwives, OBGYNs) at University Hospital Southampton about issues related to talking about weight and nutrition in the periconceptional period and possibilities of testing the FIGO nutrition checklist at the hospital. Lack of time during consultations, resources and training were common barriers mentioned, which were also reflected in the literature discussed above. They also provided feedback regarding the need to modify the checklist based on guidelines in the UK from the National Institute for Health and Care Excellence (NICE) and suggested including a question on physical activity, which was not part of the main FIGO checklist. The discussions also revealed that, in the UK, antenatal services do not provide a universal screening programme to identify nutritionally at-risk pregnant women. Hospitals in some areas have developed their own systems for nutritional assessment for the first booking appointment during early pregnancy. A new checklist, based on the FIGO checklist, was thus designed for Chapter 5, and co-created with stakeholders in the UK such as midwives who would be a key target group to use it in their routine practice.

A parallel PPI project about appropriate language for use in the preconception period (led by Dr D Schoenaker), along with discussions by the UK Preconception Partnership (details on the organisation are given in Chapter 7) also informed the work of this thesis. As HCPs often do not have the time or may lack appropriate communication skills to ask about pregnancy intention with members of the public, the study conducted by Dr D Schoenaker developed two prototype questions that could be used in clinical settings routinely in discussion with PPI members, which were tested for acceptability among reproductive-aged women and HCPs in Chapter 5.

2.3.6 Stakeholder mapping

Finally, one of the aims of the thesis was to identify the key stakeholders who play a role in the interfaces for translating DOHaD evidence discussed in Chapter 1. Principles from stakeholder theory (developed in the field of organisational management and business ethics) were used to guide the mapping conducted during this thesis. According to Freeman (2010),[139] the most

important aspect of success in business strategies is stakeholder involvement. While several definitions exist, for this thesis Freeman's definition of a stakeholder as *"any group or individual who can affect or is affected by the achievement of the organisation's objectives"* was used. This definition was used in the context of operationalising the life course and DOHaD concepts as the objective.

First, the three steps described by Schiller et al (2013) [140] for stakeholder mapping in health research were used to identify stakeholders to involve as participants in this dissertation. The steps are - 1. Begin with the relevant research discipline 2. Supplement with collaborative networks 3. Solicit feedback from expert informants. Preliminary pragmatic mapping done through the literature reviews, personal knowledge of the field and discussions with key experts in the field informed the selection of stakeholders for the studies in Chapters 4, 5 and 7. Next, along with purposive and targeted sampling for the first set of interviews and while disseminating the surveys, a snowballing technique was applied to include more stakeholders. Further exploration was conducted during the study to understand "who or what really counts" for the translation of DOHaD. Finally, the stakeholders (called actors in chapter 7) were mapped using the stakeholder grid for stakeholder mapping and analysis recommended by the Overseas Development Institute guidelines [141] and the WHO[142] (figure 2.3 adapted based on ODI and WHO guidelines).

High (10)

Keep satisfied	Engage closely and influence actively – **Key players**
Interest *Low (0)*	*High (10)*
Monitor (minimum effort)	Keep informed and address interests

Influence/ Power

Low (0)
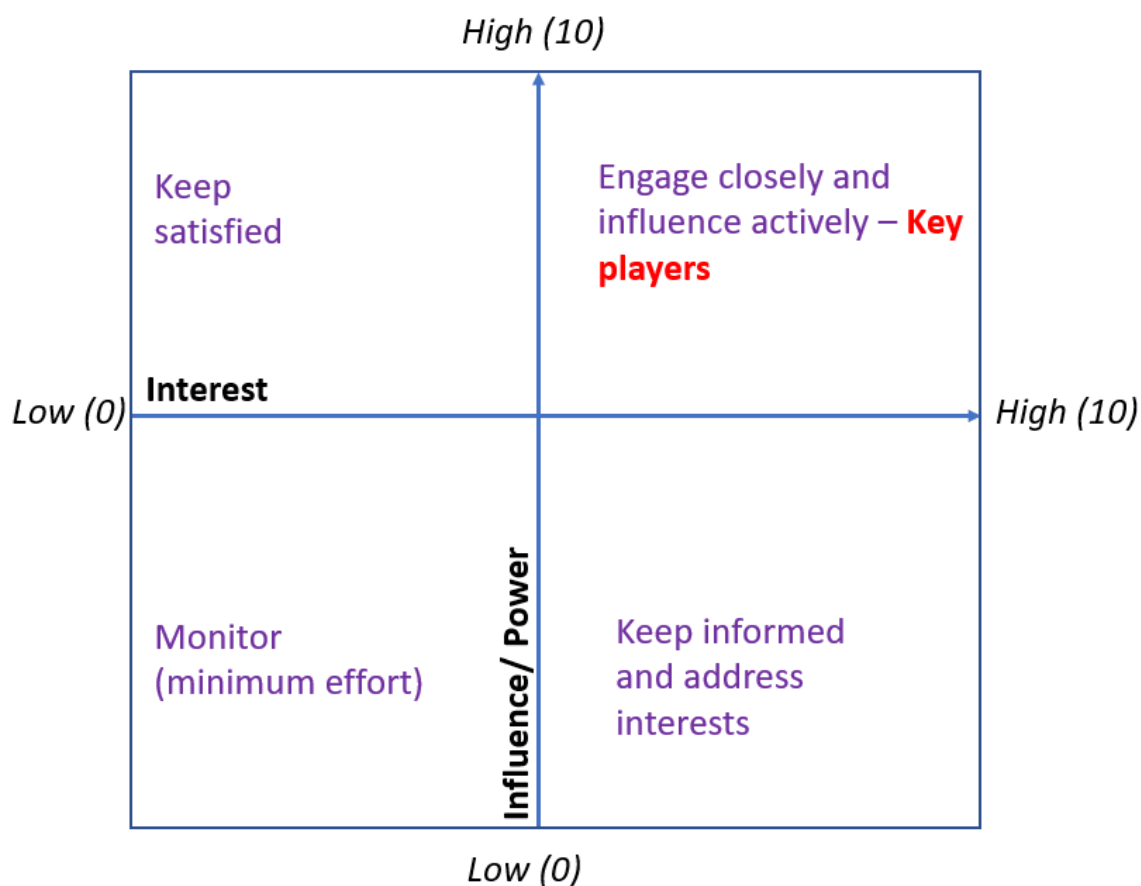
Figure 2.3   Stakeholder grid used for mapping in Chapter 8

Stakeholder analysis techniques are commonly used in health policy research to provide new knowledge for implementation studies.[143] The position of the stakeholder on the grid was determined by a scoring system between 0-10 assessed for both influence and interest.[142] The grid considers the power and interests (the degree to which the stakeholder is affected by the policy change) of the stakeholders at the time of the study, and their ability to influence (support/ block or change) a policy.[141] As recommended by the ODI and WHO toolkits, the score initially listed by me were then discussed with the supervisory team to reach a consensus. The scoring could have been influenced by pre-conceived notions and assumptions from literature and knowledge of the field, as well as data from the thesis. The final map is presented in Chapter 8 of this thesis, as a recommendation for future research and practitioners, as it draws from the findings of all the empirical research in this thesis.

2.4 Theories and frameworks used in the thesis

Several theories and frameworks were used in this thesis to guide the analysis which helped describe and interpret the data in this thesis. Cairney (2013)[144] describes theory as "a set of analytical principles designed to structure our observations and explanations of the world'. A framework is "one which identifies concepts and helps organise analysis and theoretical comparisons". Health research has however used these terms interchangeably particularly in the context of the life course approach which has been called life course model/ theory/ framework. Both theories and frameworks aided to explain the empirical research of this thesis. For example, theories and frameworks were used for analysing results deductively (Walt and Gilson's framework, framing theory) and to describe findings from the qualitative research (biopsychosocial model).

As authors may attach different meanings to concepts, [144] and different theories may refer to the same terminologies in multiple ways, the concepts considered for this thesis are defined and explained in Table 2.1.

Table 2.1 **Description of key concepts considered, key stakeholders and how they have been applied in this thesis**

Concept	Definition and application for this thesis
Actor	Stakeholders/ persons representing organisations or institutions involved in the policy-making process.[145] This thesis focused on actors to explore the role, capacity and influence they hold to implement the life course approach. The range of power (ability of one actor to influence another) differs significantly between stakeholders and can change with time.
Context	Context is the setting (national or international) in which the policy process occurs, and includes the macro-context (socio-cultural and economic determinants, historical traditions, characteristics and ideologies of the political system/ regime, laws and institutions) and the micro-context (sectoral politics and finances, health systems) [145,146]
Evidence	From the perspective of the public and policy-makers, science is not the only form of evidence. This could include tradition/ folk knowledge, anecdotal evidence, experience and observation along with case-studies using methodologies that rank low in the hierarchy of evidence[147]

Concept	Definition and application for this thesis
Framing	Framing has been defined as the way in which meaning is constructed that "*enables individuals to organize experience, to simplify and make sense of the world around them, and to justify and facilitate collective action*" [148]
Governance	Governance in this thesis refers to the formation of collaborative/ co-productive institutions. The primary modes of governance include- i. shared decision-making ii. A lead organisation with participating members iii. With a separate entity established to govern the network and its activities. [148]
Knowledge broker/ Evidence broker	Actors linking policy-makers and scientists/ academics. They translate the science to the policy-maker, and also the policy-maker's need to the scientists. In this thesis, academics and academic bodies act as knowledge synthesisers or generators, while knowledge brokers may themselves be scientists/ academics within political or government agencies and science councils. Sometimes, actors such as the WHO may have multiple roles ranging from research, knowledge brokerage as well as policy-making. [149,150]
Network	Group of individuals and/ or organisations with a shared concern or agenda for a particular condition or policy issue (Shiffman 2017)[148]
Policy	A policy can be a plan, course of action, or set of regulations adopted by government, businesses, or other institutions designed to influence and determine decisions or procedures. Acting as a deliberate system of principles to guide decision-making, this could thus include guidelines by governments or ministries, but also by clinical bodies with authority to influence healthcare systems (e.g., NICE, Royal colleges, WHO) [151]
Policy-maker	A broad term covering all people responsible for or involved in formulating or amending policy. This includes official scientific advisors to governments, civil servants, parliamentary committee members, ministers etc.
Process	Process is the way in which policy-making is initiated, developed, formulated, negotiated, communicated, implemented and evaluated. It considers factors from the problem identification as a policy issue, agenda-setting, efforts for engagement and reactions to the policy change. [145,152]

Several theories exist for policy analysis and understanding how the impact of a programme or a concept can be increased. For example, the widely used Kingdon's multiple streams theory [153] discusses how three factors – the problem, the politics and the policy, which usually run independently of each other, need to converge to form a window of opportunity for action. However, for this thesis, the theories described below were used as they were relevant to the

research question, and as DOHaD and life course in policy were still in their early stages and hence needed an exploratory theory before evaluating impact.

2.4.1 The health policy triangle

To organise the information for the primary research questions in Chapter 7 and priority areas identified for research, interventions, clinical practice and policy, the Health Policy Triangle developed by Walt and Gilson 1994 was followed.[145] This helped classify and map all the discussions during the meetings related to implementing the life course approach, DOHaD and the preconception agenda. As shown in Figure 2.4 below, Walt and Gilson's triangle consists of four factors that influence policy-making – actors, process, context and content. Complex inter-relationships exist between these factors (definitions introduced in 7.1) influencing health policy. The authors argued that, traditionally, the focus was largely on the content (from evidence, policies) and it neglected the other components, which interact with each other and the content to shape policy-making.
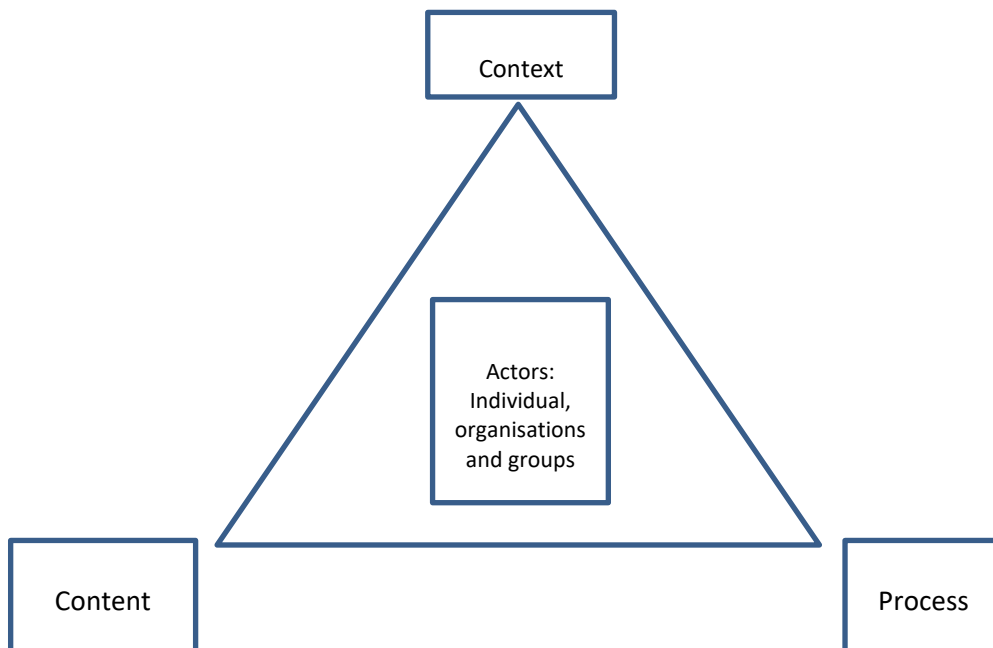
Figure 2.4   The health policy triangle

(Adapted from Walt and Gilson 1994)[145].

Though the model was initially designed for health policies in LMICs, it has been extensively used in other sectors such as reproductive health, infectious diseases and NCDs.[154]

2.4.2   Framing theory

A frame can be a label used to describe ideas, values, social problems metaphors or arguments. [155] Frames have been an important unit of analysis in policy research with its use spanning general ideological orientations to the framing of specific policy problems. Framing is a post-positivist theory, meaning that it does not use a positivist lens, but acknowledges that values of the researcher can influence what is observed. The concept of framing and the theoretical and methodological approaches from science and technology studies have been used as a tool to understand how science shapes, and is shaped by, the context in which it is produced.[156,157] Institutional cultures (e.g., academic incentives for publication in peer-reviewed journals), assumptions of researchers on public and policy makers' understanding of science, and communication with mass media can also influence how knowledge is produced and disseminated.[104]

A lack of incentive to engage with or communicate directly with the public may lead to other agents such as the media acting as a bridge to provide scientific evidence to the general public, at the risk of distorting the key messages and level of importance. Policy research has shown that framing findings on a simple, persuasive and an emotional scale could garner attention from the policy-maker. This could be challenging considering that uncertainties also have to be communicated while providing an unambiguous solution for action.[104,158]

The frames adopted can highlight specific aspects of the issue or solution, or also make moral judgements.[159] Experts have also argued that scientists have the "professional duty" to engage with policy-making, recommending framing the evidence into a dominant policy narrative, which would address the issues that policy-makers care about, at the right time.[160] This is highly relevant to this thesis as policy-making is value-based, and stakeholders involved in the policy process can shape the perceptions and understandings of the policy problem and solutions.[104,161] Policy-makers need to provide practical and acceptable solutions to the public, often within a short timeframe and are limited by 'cost-benefit' and popularity considerations.

To explore how messages within the life-course and DOHAD field are framed and the considerations that go into their development, the variables discussed by Shiffman (2017) were adopted, namely - problem definition (also called internal framing) and positioning (external framing).[148] Problem definition is concerned with how actors internal to the network view or conceptualise the issue and its solutions. There may be a common understanding of the primary rationale for why an issue is important, or tensions within the group about what the central issue should be. An internal consensus on framing is important as it increases credibility. Positioning on the other hand deals with how the messages are communicated to an audience external to the network, to inspire them to act.

2.4.3   Models considering wider determinants of health

Health behaviours before and during pregnancy such as diet and physical activity play a role in outcomes such as maternal obesity in the mother and obesity in the offspring, discussed in Chapter 1. Several studies have shown the link between these outcomes and socio-economic inequalities and contextual factors, which have been fundamental to the life course approach[162] such as the biopsychosocial model commonly discussed in health care and the socio-ecological model. The biopsychosocial model is discussed further in Chapter 4. The socio-ecological model is based on systems theory, and originated from the concept of the ecology of human development.[163] This includes the environmental, interpersonal and individual factors and the interactions between them. The model (figure 2.5) has been adopted for various DOHaD-issues such as maternal obesity and to identify stakeholders from each level.[57]
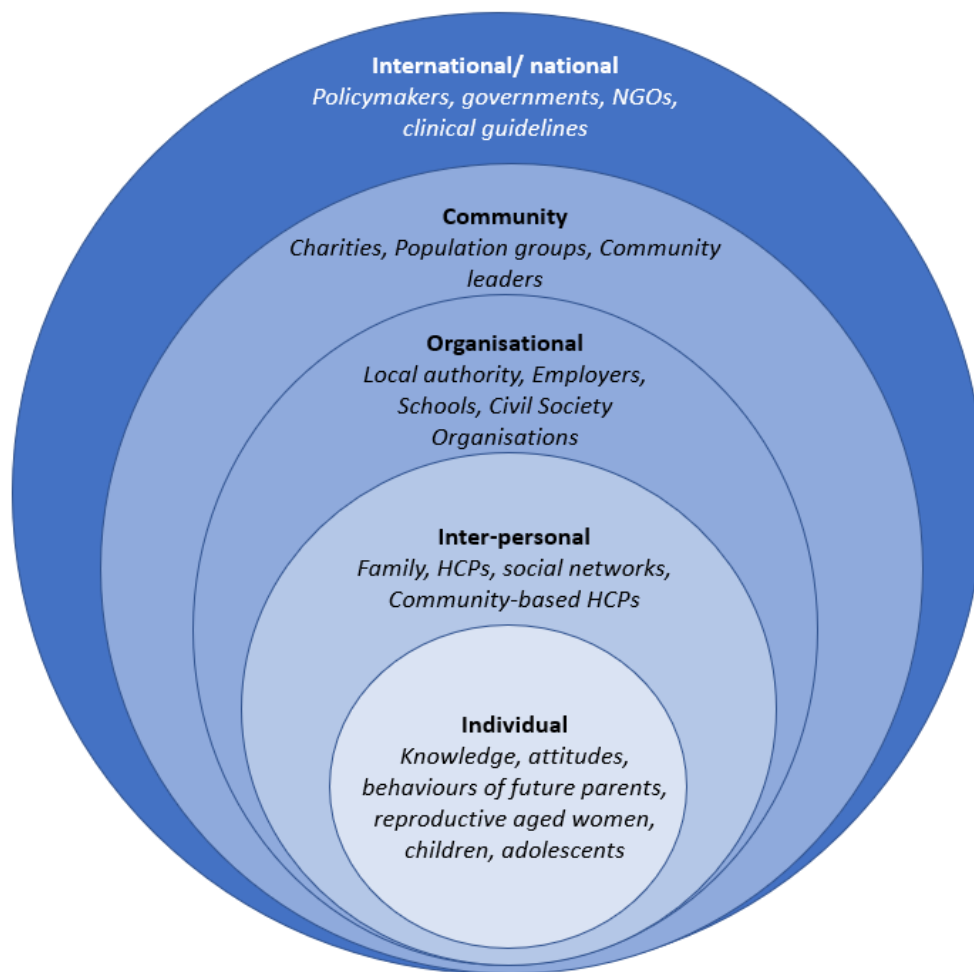
Figure 2.5   Socio-ecological model and corresponding stakeholders

Figure modified based on Hanson *et al.* 2017[57]

The conceptual models discussed above will be revisited in chapter 8 to contextualise the findings

of the thesis.

Chapter 3 Review of interventions and clinical guidelines in the preconception period to prevent the intergenerational passage of risk of NCDs

Chapter 1 defined the preconception period and explored some of the risk factors for NCDs in this period. Adopting healthy habits before conception has also been associated with a reduced risk of GDM and its complications.[164] This chapter provides an overview of interventions to prevent the transgenerational passage of risk of NCDs through intervention in the preconception period. Finally, the status of global clinical guidelines available for HCPs with a focus on preconception prevention of NCDs and intergenerational health are presented. The content of this Chapter was developed through two literature reviews – one for interventions and one for clinical guidelines with the aim of answering the research question - *What can be done in the preconception period through interventions and clinical care to prevent the transgenerational passage of NCDs and its risk factors*?

Table 3.1 presents common risk factors in the preconception period and their impact on immediate outcomes during pregnancy, and potential long-term outcomes for the baby and mother.[26,50,53,165]

Table 3.1   Risk factors related to nutrition in parents in the preconception period and possible outcomes during pregnancy, childbirth and childhood

Preconceptional risk factors for future NCDs	Increased risk of complications during pregnancy and childbirth	Risk to babies
Overweight and obesity	• Before pregnancy: reduced fertility, polycystic ovarian syndrome (PCOS) • During pregnancy: pregnancy loss, GDM, pre-eclampsia, gestational hypertension, higher risk of Caesarean or instrumental delivery, induction of labour, thromboembolic disorders, preterm birth • Post-partum: Unsuccessful breastfeeding	Low birthweight[1], small for gestational age (SGA), macrosomia, congenital anomalies (e.g., neural tube and cardiac defects), childhood obesity, and higher risk of adult chronic disease. Allergy and immune dysfunction in offspring (e.g., atopic dermatitis)
Underweight/ undernutrition	Complications during pregnancy and delivery, associated nutrient deficiencies	Preterm birth, low birth weight, stillbirth, type 2 diabetes, neurodevelopmental issues, and cardiovascular disease in later life
Pre-existing conditions e.g., Diabetes mellitus High blood pressure	Spontaneous abortion, preterm labour, caesarean section, hypertension in pregnancy, preeclampsia, GDM	Birth defects, stillbirth, macrosomia with shoulder dystocia/nerve palsy if delivered vaginally, hypoglycaemia after birth, type 2 diabetes in later life
Micronutrient deficiencies e.g., Iron, Folic acid, Vitamin D, Calcium, Iodine	Eclampsia/ Pre-eclampsia, Preterm birth, Pregnancy loss, stillbirth, increased risk of maternal morbidity and mortality	Neural tube defects and other birth defects, Increases risk of neonatal/ infant mortality, Low birth weight, Low child cognition (intelligence quotient)
Risky behaviours e.g., Smoking, alcohol	Poor fetal growth, Preterm birth	Low birthweight, fetal alcohol syndrome, childhood obesity, impaired neurodevelopment

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[1] For the purpose of this thesis, the following accepted definitions have been used: Low birthweight defined as weight at birth < 2500g. A Small for Gestational Age (SGA) infant is an infant born with a birth weight less than the 10th centile and Large-for-Gestational-Age (LGA) infant is an infant whose weight is > the 90th centile, for gestational age. Macrosomia is birth weight > 4000g, irrespective of gestational age.

Preconceptional risk factors for future NCDs	Increased risk of complications during pregnancy and childbirth	Risk to babies
Paternal factors such as suboptimal nutrition and obesity, smoking, advanced paternal age	Reduced fertility, greater risk of pregnancy loss	Cardiometabolic disease risk

Intermediate outcomes to assess the risk of long-term NCDs

Childhood obesity can increase the long-term risk of conditions such as adult obesity, type 2 diabetes, cardiovascular disease, respiratory disorders, certain cancers along with the impact on emotional and social development. [166] In collating evidence for prenatal programming of childhood obesity, Huang et al[167] found that prenatal exposure to maternal smoking was significantly associated with an increased odds of childhood overweight and obesity, with most odds ratios ranging between 1.5 to 2.0. Other factors related to childhood overweight included maternal diabetes, paternal overweight and children not exclusively breastfed. In addition, as discussed above, neonatal outcomes also influence the risk of childhood obesity. Moschonis *et al.* (2008) [168] analysed data from a survey of 2374 Greek children (aged 1-5 years) and found that LGA babies were 4.6 times (95%CI 2.9 – 7.19) more likely to be overweight at 6 months of age than children born at a weight appropriate for gestational age. At 12 months, the risk was 2.2 times higher (95%CI 1.18-4.09). These issues are relevant in transitioning populations such as India and China where low birthweight is still a pressing issue, rapid urbanisation and development has led to changes in lifestyle and diet with increased mortality and morbidity due to NCDs and an increase in childhood obesity.[92,169,170] For the reviews, as this PhD focuses on the life course model, only studies that explore outcomes with long-term impact (including those using proxy measures) were included for both reviews below.

3.1 Narrative review of reviews of preconception interventions to prevent an increased risk of obesity and non-communicable diseases in the next generation

It is essential to determine what type of interventions have already been implemented, which outcomes have been explored, what were the appropriate settings/ context for such interventions, and most importantly, whether these interventions helped in preventing adverse outcomes.

3.1.1 Aim

The primary aim of Section 3.1 is to prepare a narrative review of existing evidence for preconception interventions to prevent risk factors for non-communicable diseases in children, based on previous reviews. This review, as explained earlier in Chapter 2, aimed to guide the development of the research questions in the clinical stream of my research.

3.1.2 Methods

An initial scoping review suggested that there were few studies with the primary aim of evaluating the effect of interventions to prevent preconception risk factors that have included long-term outcomes such as childhood obesity, so I considered intermediate outcomes (e.g., birthweight) discussed above that were associated with future NCD risk and obesity in children. Childhood obesity was selected as a proxy measure for long-term risk of NCDs.[80] Similarly, a review of reviews was conducted as good quality reviews were already published in the period considered for preconception interventions, though not considering long-term outcomes such as childhood obesity.[88,112,171] As a range of outcomes were selected for the primary research question, and as it was estimated that there would be many studies (including systematic reviews on those outcomes), conducting a review of reviews helped to streamline the identification of publications which had a focus on NCD-related risk factors. A recent review of prediction models for childhood overweight and obesity identified 25 risk factors, 13 of which could be measured in the preconception period.[172] Some modifiable risk factors for childhood obesity included maternal BMI, birthweight and diabetes, which are often outcomes considered by preconception

interventions, unlike factors such as maternal education and income, which were modifiable but are not part of PCC.

Search strategy

A search was conducted in January 2018 on PubMed, Medline and CINAHL, and the Cochrane Library, including the Cochrane Database of Systematic Reviews and the Database of Abstracts of Reviews of Effects to identify pertinent systematic reviews published between 2006 and 2018. Four search strings were developed for each of the sites, with a limit applied for identifying review articles only (in English). The main search terms were "preconception", "preconception care", "systematic", "pregnancy outcome", "behaviour", "lifestyle", "obesity", "gestational diabetes" and "offspring". Full details of search terms and the results from each string are provided in Appendix A.1. Reference lists of relevant articles were manually searched for potential articles not identified by the database search, experts in the field were contacted and an additional search on google scholar was performed in 2018.

3.1.2.1 Outcomes considered, inclusion and exclusion criteria

Appendix A.2 discusses the detailed inclusion and exclusion criteria for this review (based on the PICOS criteria). Studies reporting outcomes such as a change in maternal weight and body composition, gestational weight gain, birth weight and others which were associated with a risk of NCDs in the future for the baby and the mother were included. Reviews that evaluated observational and experimental studies, focusing on prevention of maternal risk factors such as GDM, and management of type 1 and 2 diabetes in the preconception period maternal malnutrition (under- and over-nutrition), maternal weight and pregnancy outcomes such as birth weight, were also included. Reviews with a primary focus on the prevention of congenital anomalies were excluded, however, if data on folic acid supplementation was reported in the included review, they were extracted.

3.1.2.2 Data extraction and quality assessment

Data extraction and quality assessment of all included reviews were conducted by me. While several quality assessment frameworks are available for review articles, a ROBIS (Risk Of Bias In Systematic Reviews) evaluation[173] framework was adopted as it is an accepted method. The risk of bias during the review process was conducted to (1) Assess the

relevance of the review (2) Identify concerns with the review process and (3) Judge the risk of bias in the review. The final phase consists of judging the overall ris of bias based on the answers to the signalling questions in Phases 1 and 2 (Appendix A.3). A meta-analysis was not feasible due to differences in populations considered for each outcome, multiple outcome variables and in the settings of interventions.

3.1.3   Results
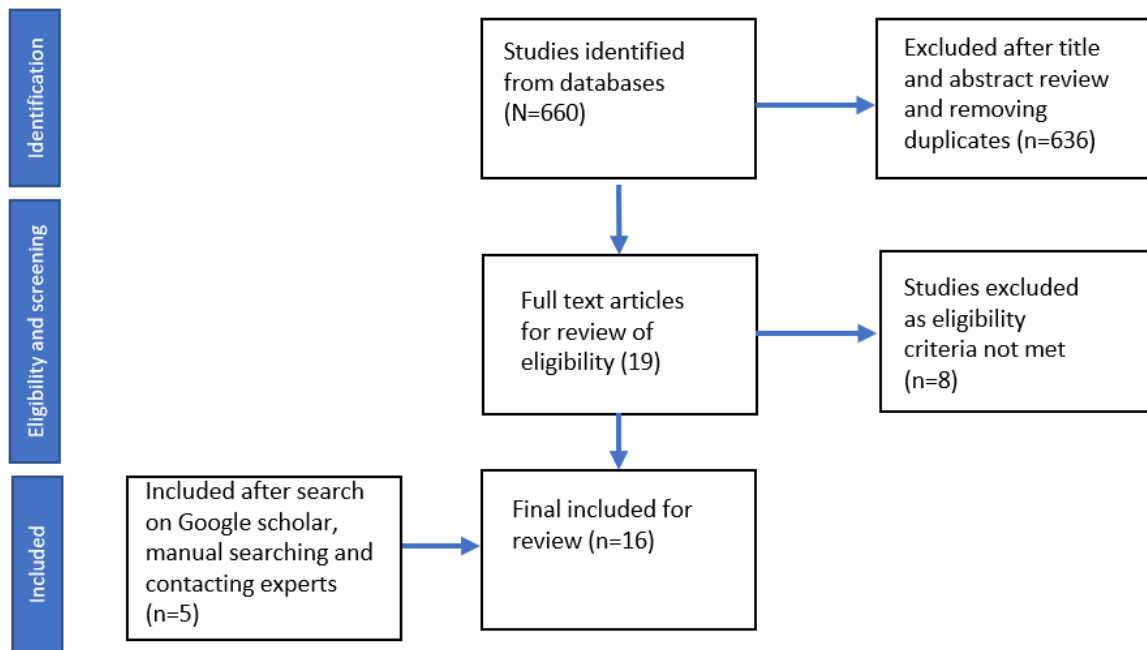
Figure 3.1   Flow chart depicting results of the search strategy

Of the potential articles found from the databases (figure 3.1), 16 reviews were identified[60,66,67,174-186] and two of the papers [59,176] were part of the same systematic review. Not all reviews were systematic reviews of interventions, thus integrative and narrative reviews of observational studies [60,176,182] also formed a part of this report. Table 3.3 provides a summary of the selected reviews along with the interventions and outcomes considered. The most variation was in terms of outcomes considered (maternal, fetal and neonatal). As anticipated, none of the studies included in the 16 reviews directly addressed the aim of the present review – preventing childhood obesity and the passage of risk of NCDs using preconception interventions, or long-term outcomes such as childhood obesity.

A narrative synthesis of studies based on the type of interventions that were identified is presented below. Results of the ROBIS evaluation are presented in Table 3.2 and the criteria used for quality assessment is presented in Appendix A.3. Overall, the reviews had a low risk of bias as they reported appropriate review methodology for their research questions, with only two of the reviews suggesting a high risk of bias.[60,66] While a GRADE assessment of the interventions included within each review was not conducted, several reviews included observational studies,[60,176,182] leading to overall low quality of evidence. The narrative synthesis presented below is structured based on the outcome (e.g., GDM, weight management) targeted by the interventions.

Table 3.2   Characteristics of reviews included

Citation (Year), (n = number of studies included in the review)	Intervention	Population	Outcomes considered	Key findings and pooled results (if meta-analysis was carried out)
A R. A.Adegboye et al. (2013)[65] (n=14)	Nutritional and exercise interventions, community-based and individual	Women in the post-partum period (up to 24 months after childbirth).	1. Change in body weight 2. Percentage of women who returned to pre-pregnancy weight or lost weight retained after childbirth 3. Women who achieved a healthy weight or weight loss of clinical significance 4. Change in percentage body fat 5. Change in fat-free mass 6. Change in cardiorespiratory fitness	Pooled analysis was not possible due to heterogeneity and variation in interventions. Results of subgroup analyses: i. Change in body weight in kgs: *Usual care versus Diet:* mean difference (MD) -1.70 kg (95% CI -2.08, -1.32) *Usual care versus Exercise:* MD -0.10 kg (95% CI -1.90, 1.71) *Usual care versus Diet + Exercise:* MD -1.93 kg (95% CI -2.96, -0.89) *Diet versus Diet plus exercise:* MD 0.30 kg (95%CI -0.06, 0.66) ii. Percentage of women who returned to pre-pregnancy weight or lost weight retained after childbirth: RR 2.00 (95%CI 1.31, 3.05) Other results included a change in percentage of body fat (not significant) in the diet groups and significant improvement in cardiorespiratory fitness (MD in VO2 max 6.73 mL/kg/minute 95% CI 4.28, 9.17) in the exercise groups.

Citation (Year), (n = number of studies included in the review)	Intervention	Population	Outcomes considered	Key findings and pooled results (if meta-analysis was carried out)
M. Agha et al. (2014)[175] (n=15)	Behavioural interventions for weight management during pregnancy	Women of child-bearing age planning to get pregnant and/or those who were already pregnant	Primary outcome measure was gestational weight gain. Secondary measures included postpartum weight retention, postpartum weight loss, infant birth weight and gestation week of delivery.	Compared with standard care, women in intervention groups gained lesser weight during pregnancy. Pooled results for gestational weight gain: MD -1.66 kg (95% CI -3.12, -0.21)
S. V. Dean et al. (2014)[59] (n=146)	Any form of PCC	Women in the reproductive age group (aged 15 to 49)	Nutritional risk factors for adverse birth outcomes – maternal pre pregnancy weight, congenital anomalies	Maternal overweight before conception were significantly associated with perinatal outcomes such as macrosomia, large-for-gestational age babies (OR 1.63, 95% CI 1.51, 1.76) Pooled results of 3 RCTs suggest a protective effect of Folic acid supplementation to prevent neural tube defects: RR = 0.31 (0.14, 0.66) Multivitamin supplementation to prevent NCDS: RR = 0.51 (0.31, 0.82)
DiNallo et al. (2007)[66] (n=24)	Exercise related interventions, biological interventions (Exercise with insulin therapy)	Studies included pregnant, postpartum and non-pregnant adult women	GDM risk reduction	Pre-pregnancy exercise was associated with GDM risk reduction

Citation (Year), (n = number of studies included in the review)	Intervention	Population	Outcomes considered	Key findings and pooled results (if meta-analysis was carried out)
N Hemsing et al. (2017)[177] (n=29)	Any preconception/ interconception intervention	Women of childbearing age	No exclusion criteria for outcomes or population	An intervention based on risk assessment delivered by a midwife suggested that PCC prior to conception was associated with less weight gain reported prior to conception. Web-based interventions showed an increased knowledge of preconception behaviours at 6 months follow up. Overall, group health education interventions showed promise with significant improvements in preconception health knowledge, and in obesity and diabetes knowledge.
N. Hussein et al. (2016)[178] (n=8)	Advice on nutrition, lifestyle, folate intake, smoking or alcohol; screening for genetic disorders or diabetes	Women of reproductive age including women who had existing medical, obstetric, or genetic risks	1. Improvement in knowledge 2. Improvement in self-efficacy and health locus of Control 3. Improvement in maternal risk behaviour 4. Improvement in adverse pregnancy outcomes	Results were not significant for adverse pregnancy outcomes. Improvement in self-efficacy along with eating healthier food (OR: 1.757, P=0.008) being physically active (OR: 2.185, P=0.0001) and perceived higher preconception control of birth outcomes (OR: 1.916, P=0.031) Significant improvement in exercise self-efficacy was seen (difference in score 15.4; 95% CI: 13.74, 17.06) and internal health locus of control (HLOC) scores (difference in score 6.4; 95% CI: 5.41, 7.39) No pooled analysis due to heterogeneity

Citation (Year), (n = number of studies included in the review)	Intervention	Population	Outcomes considered	Key findings and pooled results (if meta-analysis was carried out)
A. Imdad, Z. A. Bhutta (2012)[179] (n=16)	Interventions including dietary advice to increase protein intake or supplementation of protein	Women in reproductive age group, including pregnant women	1. Birthweight 2. SGA 3. Low birthweight	1. Birthweight Mean difference 73.78g [30.42, 117.15] 2. SGA RR 0.68 [0.51, 0.92] 3. Low birthweight RR 0.68 [0.51, 0.92] Results of a subgroup analysis show that balanced protein energy supplementation was more effective in malnourished women (for birthweight) (MD 100 g [95% CI 53, 147]) than in adequately nourished women (MD 37 g [95% CI -34, 99]).
L. Lan et al (2017)[180] (n=8)	Lifestyle interventions for dietary modification, weight management, physical activity and psychological support	Non-pregnant women of childbearing age with intention to conceive	Primary: Live birth, birthweight, pregnancy rate Secondary: anthropometric and metabolic profile, fetal and child development outcomes	n=8 Reduction in weight (MD -3.48kg [95% CI -4.29, -2.67; I^2=0]) and BMI (MD -1.4 [95% CI -1.95, -0.84]) were reported on meta-analysis Other findings include increase rate of conception after lifestyle interventions, but no effects seen on birthweight, preterm births

Citation (Year), (n = number of studies included in the review)	Intervention	Population	Outcomes considered	Key findings and pooled results (if meta-analysis was carried out)
N. Opray et al. (2015)[181] (n=0)	Interventions for improving pregnancy outcomes for women who are overweight or obese	Women who are not pregnant, but of reproductive age with BMI >/=to 25 kg/m².	Large for gestational age infants, maternal and infant outcomes	Zero studies were included in the final report.
S. Temel et al. (2014)[182] (n=44)	Any form of PCC	Not specified	Behavioural outcomes related to folic acid supplementation, Smoking, Alcohol, Nutrition, physical activity. Birth outcomes – low birthweight, preterm births	A supplemental food programme among women with low income and nutritionally at risk in their inter-pregnancy interval showed a positive effect on birth weight and birth length[187]
J. Tieu et al. (2013)[67] (n=0)	Any type of interconception intervention for women with GDM	Women in the reproductive age group who have been diagnosed with GDM in a previous pregnancy	Primary outcomes were Maternal GDM, mode of birth and neonatal outcomes such as LGA, macrosomia, perinatal mortality	No completed trial met the inclusion criteria, and one ongoing clinical trial was identified. Results of the ongoing trial were not available

Citation (Year), (n = number of studies included in the review)	Intervention	Population	Outcomes considered	Key findings and pooled results (if meta-analysis was carried out)
J. Tieu et al. (2010)[183] (n=1)	Any type of PCC for diabetic women	Women of reproductive age with pre-existing diabetes mellitus (type I or type II) who were not pregnant during the trial	Metabolic control by HbA1c levels	Results of one trial: Reported as mean change from baseline: -1% (no 95% CI reported).
D.K. Tobias et al. (2011)[184] (n=12)	Physical activity before and during pregnancy	Women in the reproductive age group	Diagnosis of GDM	Pre-pregnancy physical activity OR = 0.45 (95% CI 0.28, 0.75) and early pregnancy physical activity OR = 0.76 (95% CI 0.70, 0.83) was associated with lower odds of GDM (pooled results of subgroup analyses)
U. Ramakrishnan et al. (2012)[60] (n=45)	Nutritional interventions	Periconceptional women	SGA Low birthweight Birthweight Birth defects	An increased risk of delivering an SGA infant (adjusted RR: 1.7 [95% CI 1.1, 2.6]) among underweight women (BMI < 18.5 kg/m^2) was reported in one study No significant differences were found between women receiving folic acid supplementation 12 weeks before gestation and those who received other trace elements for risk of low birth weight

Citation (Year), (n = number of studies included in the review)	Intervention	Population	Outcomes considered	Key findings and pooled results (if meta-analysis was carried out)
H. A Wahabi et al. (2010)[185] (n=24)	PCC for diabetic women	Women of reproductive age group with type I or type II diabetes	1. First trimester mean value of Glycosylated Haemoglobin 3. SGA 4. Macrosomia 5. Congenital Malformations	When compared with groups with no PCC: 1. PCC lowered HbA1C in the first trimester of pregnancy by an average of 2.43% (95% CI 2.27, 2.58) 2. Macrosomia RR = 1.03 (95% CI 0.81, 1.30) 3. Small for Gestational Age RR = 0.26 (95% CI 0.05, 1.41) 4. Congenital Malformations RR 0.25 (95% CI 0.15, 0.42)
M. Whitworth et al. (2009)[186] (n=4)	Health promotion (education, advice and health assessment)	Women of childbearing age	SGA, preterm births, maternal and infant deaths, maternal health behaviours (e.g., alcohol intake, folic acid supplementation)	Lower risk of SGA babies for women in intervention group (One trial) RR=1.30 (95% CI: 0.83, 2.04) Other results included improved maternal behavioural outcomes such as risky drinking and smoking (non-significant)

Table 3.3   Results of ROBIS assessment for risk of bias

REVIEW	Relevance (PICO)	Study eligibility criteria	Identification and selection of studies	Data collection and study appraisal	Synthesis and findings	Risk of bias in the review
A R. A.Adegboye et al. (2013)[174]	Yes	Low	Low	Low	Low	Low
M. Agha et al. (2014)[175]	Yes	Low	Low	Low	Low	Low
S. V. Dean et al. (2014)[176]	Yes	Low	Low	Unclear	Low	Low
J. M DiNallo, D. S Downs (2007)[66]	Yes	High	High	High	High	High
N Hemsing et al. (2017)[177]	Yes	Low	Low	Unclear	Low	Low
N. Hussein et al. (2016)[178]	Yes	Low	Low	Low	High	Low
A. Imdad, Z. A. Bhutta (2012)[179]	No	Low	Unclear	Low	Low	Low
L. Lan et al. (2017)[180]	Yes	Low	Low	Low	Low	Low
N. Opray et al. (2015)[181]	Yes	Low	Low	N/A*	N/A	Low
S. Temel et al. (2014)[182]	Yes	Low	Low	Low	Low	Low
J. Tieu, et al.(2013)[67]	Yes	Low	Low	N/A	N/A	Low
J. Tieu, et al.(2010)[183]	Yes	Low	Low	Unclear	Low	Low
D.K. Tobias et al. (2011)[184]	Yes	Low	Low	Low	Low	Low
U. Ramakrishnan et al. (2012)[60]	Yes	Low	High	Low	high	High
H. A Wahabi et al. (2010)[185]	Yes	Low	Low	Low	Low	Low
M. Whitworth et al. (2009)[186]	Yes	Low	Low	Low	Low	Low

N/A – Not applicable as no eligible studies were found

3.1.3.1 Neonatal birth outcomes

Nine reviews [60,67,178-182,185,186] considered parameters related to weight or size of the newborn as a primary outcome (e.g., low birthweight, SGA, Macrosomia). Pooled results from five studies[179] showed a reduction of 32% in the risk of low birthweight in the intervention group (balanced protein-energy supplementation) compared with control [Relative Risk = 0.68 (95% CI 0.51, 0.92)]. There was also a significant reduction of risk for SGA babies [RR 0.66 (95% CI 0.49, 0.89)] in the intervention groups (nine studies reporting data). While a positive effect on birth weight compared with control groups [MD 73g (95% CI: 30, 117)] was seen, a subgroup analysis based on the nutritional status of the mother (which would have pertained to pre-pregnancy) showed that benefits of supplementation on birth weight were more prominent in undernourished women (MD 100g [95% CI 53, 147]) than adequately nourished women (MD 37g [95% CI -34, 99]).

However, some reviews did not find major beneficial effects of PCC on birth outcomes. The Cochrane review by Whitworth *et al.* (2009), found a non-significant reduction in risk of births where babies were SGA in the intervention group after PCC.[186] This result is based on the finding of one inter-pregnancy RCT[188] that included multicomponent counselling with a discussion of health and lifestyle issues, preparation and timing for pregnancy. The study, conducted in Australia, did not find any beneficial outcomes, and birth weight in the second birth (post-intervention) was lower (-97.4 g) among infants in the intervention arm. The results could partly be attributed to the non-significant increase in preterm births in second births in the intervention group. Finally, the results of four trials (n=2300 women) included in Temel *et al.* (2014) showed no strong evidence of a difference between groups for congenital anomalies or weight for gestational age when compared with women who received no preconception interventions.[182] The interventions consisted of health education, varying in the number of sessions and duration of each session.

3.1.3.2 Gestational weight gain and weight loss

Seven reviews included outcomes related to obesity prevention, appropriate gestational weight gain and or weight loss.[66,174,175,177,179,182] Three of these reviews[175,177,178] assessed the effectiveness of interventions with the objective of weight loss or achieving a healthy weight for women before and during pregnancy. There is evidence supporting the findings for cardio-respiratory fitness, return to pre-pregnancy weight and change in fat-free mass,

moderate evidence supporting interventions that helped women achieve a healthy BMI post-partum, change in body weight and change in the percentage of body fat (Table 3.2).

A Cochrane review[65] evaluated the effectiveness of diet and exercise-based interventions for weight reduction in women after childbirth and found significant results among the diet, exercise or diet plus exercise groups compared with standard care. Diet-based interventions influenced maternal body weight post-pregnancy compared with those in the control groups [MD -1.70 kg (95% CI -2.08, -1.32)]. Agha *et al.* report that preconception interventions based on behaviour change techniques could be effective in reducing gestational weight gain in women with obesity, but no evidence was found for women who were overweight or had severe obesity.[175] Though Dean *et al.* 2014 found studies showing an increased risk of preterm births among underweight, no interventional studies targeting improvement in gestational weight gain for women with pre-pregnancy underweight were found. [176] The review by Lan *et al.* 2017 found significant effects of weight loss interventions on weight reduction and improving BMI, however, the review mainly included women who had subfertility or were overweight/ obese at baseline. [180] The PCC interventions included mostly consisted of single session counselling, or structured weight loss regimen (multicomponent with a focus on diet, physical activity) and of varying durations. Hence, specific components on what would have influenced weight loss cannot be demarcated.

3.1.3.3 Gestational Diabetes and interventions for women with type 1/ type 2 diabetes mellitus

Five reviews[66,67,184] considered outcomes related to GDM of which two considered women with pre-existing diabetes mellitus (type 1 or 2) as their target population,[183,185] one included women a history of GDM.[67] Results of a meta-analysis[185] suggested that PCC is effective in lowering HbA1c in the first trimester of pregnancy by 2.43% (95% CI -2.58, -2.27). A Cochrane review included only one trial assessing the effectiveness of an intervention (n=53 adolescents) for diabetic women and found a lowered HbA1c level compared with baseline (low-quality evidence as outcome data addressed in case of metabolic control was incomplete). A review of exercise-based interventions in preventing GDM[66] reported that among women with GDM, exercise decreased the need for insulin and improved cardiorespiratory fitness. A 45% reduction in risk of GDM (pooled OR 0.45; 95% CI

0.28–0.75) was found among pre-pregnancy exercise groups. The authors identified seven pre-pregnancy and five early pregnancy studies that looked at the effect of physical activity on risk of GDM (however, none of the studies were RCTs).[184] However, pre-pregnancy exercise is a strong predictor of exercise during early pregnancy and this could have influenced the findings in the early pregnancy studies.

3.1.3.4 Behavioural outcomes

Four reviews [177,178,182,186] reported studies that had outcomes related to maternal behaviour change. The Strong Healthy Women behaviour change intervention[189,190] (USA) was included in the review by Agha *et al.* (2014) and looked at behavioural and weight loss outcomes.[175] The intervention provided bi-weekly small group sessions to motivate women by linking current health-related behaviours and the future health of the woman, her child, and her family generally. Short-term results suggested that women in the intervention group were significantly more likely than controls to report higher self-efficacy for eating healthy food (OR=1.9; p=0.01), greater intent to eat healthy foods (OR=1.75; p= 0.008) and be more physically active (OR=2.18; p<0.001) (Confidence intervals not reported). Results of the long-term follow up (6- and 12-months) suggested that participants were significantly more likely than controls to use a daily multivitamin with folic acid and to have lower weight and BMI. Among those who gave birth to singletons during the follow-up period, women who participated in the intervention had lower average pregnancy weight gain compared with controls. Although the intervention effect was no longer significant when controlling for pre-pregnancy obesity, the adjusted means show a tendency towards lower weight gain during pregnancy in the intervention group.

Studies included in the reviews also suggest that women were three times more likely to quit smoking, five to six times more likely to consume a folic acid supplement and 71% more likely to breastfeed if they had been part of a preconception lifestyle modification intervention.[176,178,182,186] There is moderate evidence for increased knowledge following preconception interventions.[178] Significant improvement in self-efficacy (for exercise), along with healthier food intake (OR = 1.757, P=0.008) was also observed. Temel *et al.* assessed a multiple risk factor approach for interconceptional women preparing for the next pregnancy and suggested that PCC (in any setting) was associated with maternal behaviour

change such as increased intake of multivitamins one month before pregnancy (self-reported) and cessation of alcohol consumption three months before pregnancy. [182]

3.1.4 Discussion

The reviews identified and included support the aim of the present Chapter, which was to collate evidence on preconception interventions to prevent future childhood obesity and NCD risk. Though mainly intermediate measures related to pregnancy and neonatal outcomes, and none of the studies looked at childhood obesity. PCC has been successfully used for interventions related to folic acid and iron supplementation, micronutrient intake and balanced protein and energy supplementation. Only very few interventions targeted prevention of maternal obesity before pregnancy to prevent adverse pregnancy outcomes. Outcomes such as low birthweight or GDM, which previous studies have associated with high risk of future NCDs, were reported in the reviews included.

One of the challenges faced by studies to prevent childhood obesity or NCD risk factors by using a life course approach is the difficulty in determining the primary outcome measure. Most studies included in this review used birth weight and maternal body weight as primary outcome measures. Increased birth weight could be due to increased neonatal fat mass (associated with maternal obesity), and hence birth weight is a crude marker of prenatal development.[191] For example, studies have shown that Indian babies with a lower birth weight can have lower lean mass and higher abdominal fat mass compared with Caucasian babies, leading to the unusual 'thin-fat' body composition associated with insulin resistance.[192] Another challenge is the lack of a standard definition of limits for excess weight retention after pregnancy, along with the recommended period to achieve a healthy weight post-partum. Although weight loss would ideally be achieved before pregnancy, most studies focused on the pregnancy and post-partum periods for achieving weight loss.[65,175] Long-term follow up studies have shown that women who achieved pre-pregnancy weight within six months post-partum had gained less weight 10 years after childbirth than women who retained postpartum weight (2.4 kg gain vs. 8.3 kg gain).[193]

Interventions at a population level such as mass information campaigns or food fortification are seen to be effective, especially for nutritional outcomes.[59,176,182] Since large-scale food fortification is a cost-effective method in LMICs, Dean *et al.* (2014) recommended that

fortification trials (folic acid, iron and other micronutrients) should also consider MNCH outcomes while evaluating effectiveness.[59,176] The techniques used in the successful interventions consisted of physical activity and diet counselling by trained professionals, supplemented by motivational talks on weight management, feedback on the progress of participants and weight monitoring during pregnancy. Multi-component interventions usually take a while to improve outcomes but have shown better results when personal counselling was included.

Providing balanced protein energy supplementation has also shown promise in improving maternal and neonatal outcomes in LMICs. A three-arm trial (n=7387) to study the effect of nutrition supplementation (micronutrient, polyunsaturated fatty acids, protein and energy) on newborn size in four LMICs (India, Guatemala, DCR and Pakistan).[194] The three arms were – supplementation >/=3 months before conception (Arm 1), compared with the same supplement commenced late in the first trimester of pregnancy (Arm 2) or not at all (control Arm 3) in 7387 non-pregnant women. The study (not included in the 16 reviews above) showed promising results for newborn length-for-age z score for Arm 1 compared with Arm 3. Thus, in resource-poor rural populations, supplementation programmes could potentially improve birth outcomes. However, the study did not find differences between the preconception and antenatal arms, and intake of the supplement was self-reported. Though pre-pregnancy underweight was a significant risk factor for adverse neonatal outcomes, a shortage of evidence for studies targeting undernourished and underweight women before pregnancy is noted.[176] While there is a need for educational programmes, especially in low-income settings, knowledge, awareness and beliefs about PCC do not necessarily lead to improved preconception health practice.[195]

Though the reviews included in this study show potential for prevention of GDM and other body composition outcomes, recent trials (not included in the reviews) have shown mixed results and highlighted the difficulty is using lifestyle and nutritional interventions for NCD risk prevention. The Mumbai Maternal Nutrition Project[196] was an RCT to improve women's dietary micronutrient status before conception and throughout pregnancy, intending to increase birth weight in a high-risk Indian population. This intervention included the provision of a daily snack made from green leafy vegetables, fruit and milk (treatment group) or low-micronutrient vegetables (control group) from before pregnancy until delivery, in addition to the usual diet. Results showed no significant effects on birth weight

although its distribution appeared to change: there was a 48g increase in mean birth weight and a reduction in low birthweight incidence of 24%. The intervention effect was larger on birth weight in mothers of higher BMI. There was also a significant protective effect against GDM (prevalence of 7.3% in intervention group vs. 12.4% in controls [OR: 0.56; 95% CI: 0.36, 0.86]). The RADIEL study in Finland (n=228) to assess the effect of a preconception intervention to prevent GDM in high risk women (BMI>30 or previous history of GDM) found no effect on the incidence of GDM.[197] After following up women who became pregnant, the incidence of GDM among women was 60% (n=39/65) in the intervention group and 54% (n=34/63) in the control group (p=0.49 and 0.61 respectively). The intervention consisted of preconception lifestyle counselling, structured education, individualised dietary and physical activity counselling provided by nurses and a session with the dietician. Wekker *et al.* 2019 evaluated long-term cardiometabolic health and found no evidence of improved cardiometabolic outcomes 6 years after a preconception lifestyle intervention among women with pre-existing overweight or obesity. However, reduced waist circumference and fasting glucose were seen in women who lost > /= 5% body weight or reached a BMI <29 during the intervention (n=22).[198] Results of the 5.5 year outcomes of the LIFEstyle intervention showed no significant difference in BMI between the intervention and control group (-0.5 (95%CI: -2.0, 1.1)) [199] or other outcomes such as perceived stress or sleep quality.[200] However the intervention group reported a lower energy intake of -206 kcal/day (95%CI -417, -16).

Several observational studies were limited by a lack of baseline measures, or measures taken at least at two-time points. Studies evaluating preconception interventions must consider post-pregnancy follow-up by adopting a life course approach, to assess differences in outcomes between women who became pregnant over the course of the study and those who did not. A long-term study (n=2392) has suggested that provision of a protein-energy supplement from conception to two years of age was associated with an increased risk of obesity (OR 1.94; 95% CI 1.11, 3.40) and increased body fatness (1.73%; 95% CI 0.20, 3.26), but the odds of diabetes in adulthood (assessed between ages of 37-54 years) were reduced.[201] Long-term follow-up is thus beneficial in understanding the effects of nutritional interventions in the first 1000 days on the incidence of NCDs. In addition, process evaluations of preconception interventions have shown that the prevalence

estimate for engagement with preconception services ranged between 18.1% and 45% depending upon the chronic health condition examined. [202]

Although certain interventions had a robust study design, it is still not clear how replication in another setting might be accomplished. Strong cultural influences are associated with lifestyle behaviours, and quality of delivery of an intervention depends on the mode of its delivery, content and dosage.[186] Studies were often of low quality with small sample sizes.

The paucity of intervention trials, especially in LMIC settings is significant. Studies have recommended that PCC should address the overall socioeconomic and cultural barriers/ structural factors along with biological, medical and lifestyle risk factors.[203] Overall, interventions for obesity prevention and weight management focused on individual-level behaviour change through counselling, often using clinical stakeholders such as nurses, midwives or general practitioners.[174,175,177,180] The interventions in the USA, Netherlands, Australia, and Hungary were mainly based in healthcare facilities with trained staff delivering services; whereas community-based services targeting women in the reproductive age group and providing health education about pregnancy and child health, with help from women's support groups, were more common in LMICs such as India, Pakistan and Nepal. Other risk factors for low birthweight and preterm delivery that are common in LMICs such as indoor air pollution from cooking stoves and tobacco consumption also need to be addressed. [204,205]

3.1.4.1   Limitations of this review

The chief limitations of the findings from this review of reviews stem from the small number of trials identified for preconception preventive interventions for childhood obesity and NCDs. As a review of reviews, relevant experimental studies that were not included in the original reviews were potentially omitted from this report too. Some key recent publications have been included in the discussion above. In addition, only one reviewer performed screening and full-text selection, data extraction and quality assessment. Address issues related to this, any queries or discrepancies were discussed with the supervisory team. However, this chapter provides a useful overview of preconception intervention for various target groups that have shown promise globally and offers key insights for those providing care to women in the reproductive age group, including adolescents.

3.1.4.2   Implications for public health strategies

Pregnancy and planning for pregnancy provides the motivation to adopt a healthy lifestyle among women, and the studies included in this review demonstrate a lack of knowledge regarding the impact of malnutrition on pregnancy outcomes in many women and communities. Since pregnancies are often unplanned, improving women's nutritional and weight status in the early reproductive years becomes vital. Birth cohort studies providing longitudinal data will be helpful in assessing changes in behaviour and health outcomes throughout the childbearing years. However, preconception interventions need to be incorporated into efforts using a life course approach, and addressing other environmental and socioeconomic determinants of health, and must not rely on women's individual responsibility and cause further stigmatisation. [206]

Two reviews by Dean *et al.* (2014) draw attention to the gap in PCC in Sub-Saharan Africa and South Asia and recommend that providing comprehensive care could help overcome the lack of uptake of routine services due to issues such as gender inequality.[59,176] Providing adequate care for adolescent girls and women before and between pregnancies in LMICs is also linked with improving women's empowerment along with healthy pregnancy outcomes.[60] It is important to note that with economic, technological and social transformations taking place in LMICs such as India, the burden of under- and over-nutrition is increasing, and interventions developed in such countries must be culturally specific and based on nationally relevant evidence.[207] Studies identified in this review have not followed up the participants with outcomes such as low birthweight, and have issues such as incomplete outcome data and a lack of data on long-term effects of interventions. Although this review focused on quantitative studies, incorporating qualitative methods in the initial stages would help in including women's preferences and needs regarding PCC service delivery, including availability and access. Finally, only one review in this study explored PCC for male partners. [180] However, no studies were found, highlighting the need for further research on PCC for males.

3.1.5 Conclusions of review of preconception interventions to prevent the passage of risk of NCDs using the DOHaD framework

A key finding of this review is the paucity of interventions in the preconception period in contrast to the myriad of interventions during pregnancy for NCD risk reduction. There is substantial evidence for maternal underweight and overweight, diabetes and smoking in the preconception period leading to negative outcomes such as low birthweight, macrosomia and congenital anomalies. Weight gain during pregnancy is an important risk factor for future NCDs in the mother and child, and this review provides moderate evidence supporting the effectiveness of diet and exercise-based interventions in the preconception period for weight-related outcomes.

Adopting a life course approach by providing simple interventions before pregnancy can prevent a significant proportion of adverse birth outcomes such as low birthweight, preterm labour and congenital anomalies. It also provides the potential to prevent the risk of obesity in children, which further affects their growth, and physical and mental development. Ways to sustain preconception interventions through pregnancy, postpartum, infancy and childhood need to be explored further. The remit of PCC also includes interventions to promote adolescent health and prevent teenage pregnancies, encourage contraceptive use, optimise weight and micronutrient status, and screen for and manage NCDs – all of which have been effective in multiple settings. HCPs are key stakeholders in implementing these activities and understanding the knowledge attitude and barriers and facilitators to deliver these services among these stakeholders is essential. Most of the evidence for the effectiveness of preconception interventions in this review comes from the primary care setting. It is possible that much of this learning can be transferred to other settings (such as community settings). Existing platforms such as family planning services can be utilised to identify women preparing for pregnancy and to provide health education and counselling related to healthy diet and lifestyle, and to optimise maternal, neonatal and child health outcomes.[206] This is especially relevant in LMICs and should include young mothers and newlywed couples. This also further highlights the opportunity HCPs have in providing PCC in a range of settings. However, whether these messages are communicated to clinicians through clinical guidelines or curriculum is unknown.

3.2 Review of international clinical guidelines for prevention of NCDs through interventions in the preconception period

3.2.1 Rationale

Higher preconception BMI carries a significant risk for excessive gestational weight gain and childhood obesity, perpetuating the intergenerational cycle of NCDs.[208] Addressing maternal obesity before pregnancy is challenging and calls for a greater emphasis on prevention and providing support for weight loss before pregnancy. This can have added benefits for women with subfertility who are trying to conceive, and those with co-morbidities such as PCOS or pre-existing diabetes.

Preconception interventions and counselling during clinical visits have shown a very clear benefit in the prevention of neural tube defects and reducing the risk of fetal alcohol syndrome.[209,210] Increasing evidence discussed in the review above suggests that PCC can help modify dietary and physical activity behaviours and control medical conditions, e.g., diabetes, and reduce sequelae such as congenital anomalies. Despite this, dedicated preconception clinics are rare in most countries. In addition, as a significant proportion of pregnancies are unplanned, experts and healthcare organisations have called for maximising routine contact between HCPs and young women.[88] In many cases, the onus for PCC is on HCPs who see women in their routine practice, for reasons other than pregnancy planning. Elements of PCC can occur whenever a clinician meets a woman of childbearing age [211] and this would include offering support for pregnancy planning and addressing nutritional and weight management.

3.2.2 Aim

This section summarizes key evidence and international guidelines on preconception health related to NCDs, nutrition and obesity. The findings from this Section 3.2 were published with FIGO in 2020 as a position paper calling for action. The target audience of the position paper included all HCPs, healthcare delivery organisations and public health policy-makers. While this section focuses on providing recommendations for good clinical practice, it is acknowledged that obesity and malnutrition are chronic conditions influenced by lifestyle, health behaviours, public health policies and other factors outside the clinical domain (i.e. the social and environmental determinants of health) [212] discussed in the introduction. This Chapter is not a systematic review

of all clinical guidelines for PCC globally, but a scoping review of clinical guidelines that have directly addressed NCD prevention for women and their future offspring in the preconception period.

3.2.3 Methods

A literature review of published articles and grey literature for clinical guidelines was conducted on PubMed along with a web-based search of international health organisations (Appendix A.4 search strategy and selection flow chart). As clinical guidelines are updated continuously, the search was limited to papers published between 2010-and 2020 to include recent relevant guidelines. Review articles were also screened, as guidelines are not often published as academic papers, however, several reviews have been conducted to summarise similar PCC guidelines. Recommendations were extracted from documents published by key maternal and reproductive health organisations and relevant systematic reviews. While this review was not an exhaustive compilation of all PCC guidelines in all countries, it presents an overview of existing recommendations for PCC in clinical care that use a life course approach. A list of key organisations was developed with the FIGO pregnancy and NCDs committee members who were consulted for any additional documents/ guidelines to be included. A quality assessment was not conducted as it was not relevant to the current research aim. The inclusion criteria were – documents or review articles with a focus on the prevention of NCDs during pregnancy or for the baby, through action in the preconception period by HCPs. Articles and guidelines for general PCC and risk factors for medical conditions pre-pregnancy (e.g., genetic screening) were excluded. The findings are summarised as a narrative synthesis of existing recommendations for HCPs. The full summary of each included document is presented in Appendix A.5.

3.2.4 Synthesis of PCC guidelines by international organisations

Overall, 24 documents were included in the review, including seven review articles.[210,213-218] Summarised below are key NCD, weight and nutrition-related issues in the perinatal period which could be addressed during preconception visits and clinical guidelines for the same, organised by the primary focus of the intervention. The concluding recommendations target clinical stakeholders such as OBGYNs, general practitioners and midwives in this period, providing simple clear guidelines on what aspects of PCC can be targeted to prevent NCDs and their risk factors.

3.2.4.1 Achieving a healthy weight before pregnancy and preventing excess gestational weight gain

While obesity in reproductive aged women has been rising globally, it is estimated that in certain regions such as Polynesia, the Caribbean and Middle Eastern countries, over 50% of women who become pregnant have overweight or obesity.[219] Several national guidelines have recommended that consultations with preconception women should include a discussion on achieving a normal BMI (18.5–24.9 kg/m^2), thus giving them an early opportunity to discuss potential risks and management of weight with an HCP.[220-222] Furthermore, HCPs are advised to convey the obstetric risks of being under or overweight during pregnancy. Though improved outcomes are seen after a weight loss of about 5-10% of original body weight, goals for weight loss need to be personalised considering the woman's circumstances. Any weight loss before pregnancy may be beneficial.[223] HCPs also need to consider the guidelines in their regions while discussing the risks of NCDs. For example, guidelines in some Asian countries (e.g., India) have used lower BMI cut-off points than in other populations.[221] Strategies for improving BMI include behavioural strategies combined with dietary modification and physical activity. An important point to be considered is that improvement in nutrition and physical activity will improve women's overall health and wellbeing and future pregnancy, even if clinically significant weight loss is not achieved. As discussed in section 3.2, overall, evidence is stronger for dietary interventions, and diet supplemented with exercise compared with physical activity alone, though the latter has additional cardiovascular benefits. [174]

Bariatric surgery is a recommended treatment for women with marked obesity to achieve a healthy BMI before pregnancy. However, the BMI cut-offs vary depending on the existence of co-morbidities and between countries. [221,224]. Although recommendations for the safe minimal period after metabolic surgery differ, [225] it was suggested that conception after surgery should be delayed until weight has stabilised. HCPs also need to consider that being underweight also has adverse obstetric and neonatal outcomes, such as low birth weight, placing the offspring at a higher risk of NCDs in the future.[226] Screening for low BMI was advised where the local prevalence of undernutrition is high. In other settings, underweight women should be screened for suspected eating disorders and treated as necessary.[221,227]

Risks and strategies for weight loss or gain must be communicated in a supportive and non-stigmatising manner, setting realistic goals for weight management, with appropriate referrals to

a dietician/ nutritionist when indicated. Resources such as the FIGO Nutrition Checklist as a tool to address weight in practice [228,229], the Think Nutrition First guidelines [230] and the FIGO Guidelines for the Management of Obesity Pre-pregnancy, Pregnancy, Postpartum for further information [223] are available for HCPs such as OBGYNs and midwives, but their current uptake is not known.

3.2.4.2   Nutrition and micronutrient supplementation

A healthy diet during preconception is recommended to reduce pregnancy complications such as GDM and hypertension. [231,232] The nutritional guidelines for women contemplating pregnancy show great diversity between countries and local dietary practices based on personal or religious beliefs should be taken into consideration when providing nutrition advice. While dietary advice to consume more fruit and vegetables and whole grains is common across most countries, certain countries have guidelines for particular food items, e.g., restricting coffee (Italy), and avoiding specific types of fish (Sweden, Italy). [216]

Most countries have guidelines for folic acid supplementation for women planning a pregnancy. FIGO guidelines suggest that folic acid (at least 0.4mg daily) should be taken for a minimum of one month before conception and the first 3 months of pregnancy. Where there is an increased risk of neural tube defects (anticonvulsant medication, pre-existing diabetes mellitus, previous child or family history of neural tube defects, BMI >35), consideration should be given to using a higher dose (at least 4 mg daily). [233] However, the guidelines for folic acid may vary across countries, for example, in the UK, 5mg of folic acid is recommended for women with BMI>30kg/m^2 who are planning pregnancy. [227]

Micronutrient deficiencies (folate, iron and vitamin B12) can result in issues such as anaemia with severe consequences in pregnancy such as spontaneous abortion low birthweight and contributing to perinatal and maternal mortality globally.[230] Routine supplementation of nutrients varies between countries, likely due to differences in diet based on access, availability and cultural or societal factors. The specific nutritional deficiencies to be evaluated in routine care must therefore be considered in the context of the nutritional status of the relevant population and reviewed based on the HCPs' practice. In India, for example, approximately a third of women are vegetarian or have low meat, poultry, eggs and fish consumption, placing them at risk of iron and vitamin B12 deficiency. [230] It is therefore recommended that all women in the preconception period be screened for anaemia. In addition, Indian guidelines recommend weekly supplementation with iron (100mg) and folic acid (500mcg) with de-worming (400mg

Albendazole) for all women in the preconception period based on evidence to prevent anaemia.
[221] Dietary iodine supplementation (150mcg) before a planned pregnancy is recommended in
Australia and New Zealand. [224] In countries where there is a low habitual intake of vitamin D or
where the potential for endogenous production is limited due to location or skin covering, women
of reproductive age may have vitamin D deficiency. [230] This is especially important for women with
obesity who are at high risk of vitamin D deficiency due to sequestration of the vitamin in adipose
tissue.[222] Though the evidence as to whether routine vitamin D supplementation improves
maternal and offspring outcomes remains inconclusive, it has been recommended that, when a
deficiency is suspected, HCPs advise on supplementation as appropriate. Women who have
undergone bariatric surgery will require additional supplementation (e.g., vitamin B12, other
vitamins, trace elements) and hence screening and treatment must be provided appropriately.[234]
Detailed guidance on micronutrient supplementation in the perinatal period is provided in recent
the FIGO report. [233]

3.2.4.3   Management of diabetes and preconception prevention of GDM

FIGO recommends that PCC should include risk assessment for GDM for all women along with
assessment for risk factors such as obesity.[235] This aims to identify pre-existing or undiagnosed
diabetes and initiate timely treatment for optimal glycaemic control, as evidence suggests that
women seeking preconception medical care and achieving good glycaemic control before
pregnancy and in early pregnancy have fewer complications such as congenital malformations and
perinatal mortality.[235] Women of childbearing age visiting diabetes clinics, irrespective of
pregnancy intention, should be given routine preconception counselling and information on the
effective use of contraception and optimal timing of pregnancy.[236] Dietary advice and weight
reduction are also recommended for women with obesity.[215,237] Women also need to be informed
of the risks and complications of GDM, and how these can be reduced. Post-partum follow-up and
glycaemic evaluation of women with GDM are also of utmost importance.

3.2.4.4   Chronic medical conditions before pregnancy

Often women visit HCPs such as gynaecologists and endocrinologists for issues related to
subfertility and existing conditions such as thyroid disorders or PCOS. Several guidelines have
suggested that screening, assessment, and management of such conditions could include
opportunistic evaluation of preconceptional issues. Guidelines from the USA and African nations
have recommended that women should be screened for hypertension before conception and

those with hypertension should be informed about the risks of pre-eclampsia and offered effective contraception if they so choose. [218,238] Women with PCOS should be screened for hypertension and diabetes and counselled for weight loss before conception (though there is limited data for benefit of weight loss). [238] Similarly, blood pressure should be optimally managed with medications adjusted to those appropriate for pregnancy prior to conception. Pollutants and toxic chemicals such as endocrine disruptors can accumulate in the maternal body to affect fetal growth and development and sperm quality. Hence preconception counselling to limit exposure from potential airborne, food and water sources is recommended, however, this needs to be linked to wider political initiatives to reduce the burden of toxic substances and endocrine disruptors. [239]

3.2.4.5 Guidelines supporting incorporating PCC into routine maternal and child health services and public health strategies

National PCC guidelines often provide recommendations without focusing on women with unplanned pregnancies and identifying those at high risk of NCDs. [210] While evaluation of screening for risk factors routinely is still needed, PCC for planning pregnancy and achieving optimum nutrition has been recommended universally for all women and couples to prevent complications and NCD risks. [240] The American College of Obstetricians Gynaecologists for example recommends that women who are on contraception or planning a pregnancy could be asked about reproductive intentions through questions such as "*Would you like to become pregnant in the next year*?". [220]

Ideally, PCC would comprise risk identification, education and intervention provided by a range of HCPs, supplemented by specialist referrals where necessary.[241] The four approaches for preconception healthcare delivery proposed by de Weerd's include – universal primary care (opportunistic delivery within the primary care context via GPs, pharmacies and nurses); hospital-based opportunistic care (including interconception care after delivery); specialised PCC clinics with targeted interventions; and high-risk outreach PCC.[241]

Of course, efforts to address malnutrition cannot be shouldered by HCPs alone, but need to be supported by public health policies for good nutrition such as food fortification, and community engagement to increase physical activity and improve dietary habits.[230] Public health policies such as food fortification with folic acid have led to around 50% reduction in neural tube defects in many countries.[242] Investment in national level community-based interventions for PCC show

promise, such as China's National Free Preconception Health Examination Project which was expanded to all rural areas nationwide in 2013.[243] The project included pregnancy planning and healthy lifestyle advice delivered by trained staff and achieved more than 85% coverage of the population. Similarly, specific PCC clinics have been established in several countries (e.g., Netherlands, Hungary) and their development requires prioritisation by public health agencies and governments in other countries.[210] Such PCC programmes for planning pregnancy and lifestyle modification before conception could be helpful in countries where there is an increasing prevalence of adult and adolescent obesity and with high adolescent fertility rates to prevent unplanned pregnancies.

The review by Atrash and Jack 2020 provides a comprehensive overview of all risk factors that can be addressed in a clinical setting and developed a checklist to aid all HCPs who meet women in the reproductive age group.[213] The authors state that

> *"Every provider should use every opportunity to educate women, men and the community about the importance of being healthy especially if planning pregnancy, and the importance of effective contraception if not planning pregnancy."*

The authors urge all HCPs from general practitioners, obstetricians/gynaecologists, paediatricians, endocrinologists, cardiologists, surgeons, psychiatrists, etc. to ask about pregnancy intentions when approached by women in the reproductive age group. Evaluating risk and personal history using the checklist is then recommended for women who are considering a pregnancy, along with referral for services such as dietician for women at higher nutritional risk and management or referral of contraceptive needs for those who are not.

3.2.4.6 Postnatal and interconception care

The postpartum period provides a platform for preparing for a possible next pregnancy and identifying women with, or at higher risk of, NCDs such as type 2 DM/ GDM, addressing contraceptive needs, the reversal of excess gestational weight gain and addressing nutritional requirements.[210,244] For example, a study from the USA detected low rates of follow-up glucose testing in women with GDM, especially in the postpartum period (5.8%), although this improved slightly after a year (21.8%) and at 3 years (51%). [245] Contact with primary care after delivery was also very low. Key service providers for infant health such as paediatricians, GPs and health visitors have an important role in discussing interconception health, not only for the next

pregnancy but also for the long-term health of the mother. Not addressing these issues before the next pregnancy, especially for mothers with a history of outcomes such as low birthweight or medical comorbidities is a missed opportunity for improving the woman's health and outcomes of subsequent pregnancies.[244] The extension of PCC into the postpartum stage has been recommended to increase the window of opportunity and access women with nutritional needs, thus providing an integrated continuum of care for women.[34]

A review of interconception interventions and clinical guidelines for the period,[113] found that opportunities exist in routine services in the postpartum period such as family planning, routine general practice, and risk assessments. Guidance is usually focused on post-partum care, without taking a life course perspective to include potential future pregnancies. Most interventions and guidelines predominantly focused on nutrition-specific approaches (e.g., counselling by HCPs exclusive breastfeeding, dietary advice, supplementation for the mothers) along with a follow up for women with a history of GDM to offer blood sugar testing and lifestyle support. Nutrition-sensitive interventions are also recommended which indirectly address the underlying determinants of fetal and child nutrition and development, such as nutrition security, caregiving resources, access to health services and safe and hygienic environments. The review concludes that HCPs would need further training and resources to provide the recommendations in the guidelines as they include the need to be able to communicate effectively, support goal setting and adopt a person-centred approach.

3.2.5   Discussion and conclusions

While several public health models of PCC delivery have been described, most agree that a patient-centred approach is needed as part of a continuum of care, taking into consideration the woman's socioeconomic circumstances and encouraging the involvement of her partner when suitable. [34,209] Though dedicated preconception clinics have great value in improving maternal and fetal outcomes, people attending such services often consist of highly motivated individuals who are planning a pregnancy. Such services also require investment in staff education, time and resources.[246] Antenatal visits often focus on fetal health and immediate pregnancy outcomes. Including PCC in routine visits provides an opportunity to improve women's overall health and nutrition across the life course using a woman-centred approach. [247] Low health literacy is another barrier to the effective translation of health messages and adoption of healthy behaviours. To help overcome this issue, studies have suggested that HCPs utilise clear communication and plain

language techniques with all women and their partners who approach them for nutrition counselling. [248] However, to support behaviour change, passive provision of information in the hospital setting may not be enough, as seen from multiple weight-loss trials. [88] Active strategies such as discussion and counselling are suggested, along with techniques such as motivational interviewing and healthy conversation skills, which show promise among HCPs for inducing lifestyle behaviour change. [114,249]

A review of models of PCC by Hall *et al.* (2022; in preparation for publication) developed a comprehensive model of universal community-based PCC based on the available evidence. The model looks beyond healthcare, to schools and social media, and adopts a life course approach to be implemented by a range of HCPs, particularly those in primary care. To monitor outcomes, indicators such as key health behaviours at antenatal booking (e.g., smoking, folic acid intake) and increase in uptake of long-acting reversible contraception could potentially demonstrate the effectiveness. Such models, are based on the three broad interventions categories of risk screening, education and intervention suggested previously by de Weerd [241] and Shannon *et al.* (2014)[250]. I explore this further in Chapters 4 and 5 to provide recommendations for adopting such as approach linked with the life course model in Chapter 8.

The key recommendations for PCC and NCD risk prevention in routine care that HCPs can consider supporting women in improving nutrition, weight management and lifestyle before pregnancy are listed below in Table 3.4

Table 3.4   Recommendations for clinicians to support the prevention of NCD risk factors in the preconception period

1. Preconception consultations should include the measurement of height and weight and the calculation of body mass index (BMI). Where appropriate, all women should be encouraged to attain a BMI as close to the normal range (BMI 18.5–24.9 kg/m^2) as possible before conceiving.

2. All women who have a BMI greater than 30 kg/m^2 should be counselled about the risks of obesity for their health and that of their baby.

3. Women who are underweight before pregnancy (BMI less than 18.5 kg.m^2) should be counselled about the risk of being underweight during pregnancy along with the benefits of good nutrition as relevant to their socioeconomic status. Where relevant, women who are underweight should be screened for suspected eating disorders and treated as needed

4. Counselling for physical activity should be provided when required. Pre-pregnancy, during pregnancy, and post-partum – where possible, women should exercise moderately for at least 30 minutes a day, 5 days a week, or achieve a minimum of 150 minutes of moderate exercise per week.

5. Clinicians should support women with known pre-existing diabetes to achieve glycaemic control (HbA1c <6.5%) before pregnancy along with optimal weight management and dietary advice. When feasible and indicated (e.g., Type 1 DM), screening for thyroid dysfunction and coeliac disease should be performed.

6. Chronic conditions such as high blood pressure and polycystic ovarian syndrome (PCOS) should be optimally managed with medication appropriate for pregnancy as required before conception. Women should be counselled regarding the risk of cardiometabolic co-morbidities during pregnancy.

7. Folic acid: to ensure protection against neural tube defects, all women of reproductive age are advised to consume 0.4 mg (400 mcg) of synthetic folic acid daily, obtained from fortified foods and/or supplements. For all women planning a pregnancy, a dietary supplement of at least 0.4 mg (400 mcg) of folic acid per day is recommended at least 1 month before conception and continuing during the first trimester of pregnancy.

8. Women at a higher risk of neural tube defects – e.g., on anticonvulsant medication, with pre-pregnancy diabetes mellitus, a previous child or family history of neural tube defects, and women with a BMI of 30 kg/m^2 or greater wishing to become pregnant should be advised to take at least 4 mg folic acid as a dietary supplement daily, starting at least 1-3 months before conception and continuing during the first trimester of pregnancy.

9. Nutritional deficiencies (e.g., of Iron, Iodine and Vitamin D) should be assessed and treated and advice given as appropriate

10. Where applicable, discussion on nutritional risks should include the diet and health of the partner too.

3.2.6   Implications of this chapter for the next stage of research

Overall, the guidelines and risk factors show that clinicians have the opportunity for implementation of PCC and address risk factors for DOHaD-related outcomes through routine practice. However, the opinions of stakeholders providing these services need to be included. This is explored further in Chapter 4 and 5.

Chapter 4   Can midwives and OBGYNs be agents of change for preconception health and prevention of NCDs in early life? A qualitative study

4.1   Background and rationale

As discussed in Chapters 1 and 3, there is now increased emphasis on the importance of the preconception period, with studies suggesting that intervening during pregnancy in the mother and offspring may be too late to prevent outcomes such as preterm birth, macrosomia, and childhood obesity.[34,208] However, the benefits are more likely to be manifest when public health programmes and policies are supported by practices in clinical settings. Furthermore, the first antenatal visit may be delayed in some pregnancies, especially in LMICs and disadvantaged socioeconomic sections of a population. Many intervention studies of DOHaD outcomes have hence focused on intervening during pregnancy, as women often access healthcare services after they are pregnant or face health issues during pregnancy. Thus, it is essential to include HCPs who meet women during pregnancy in the conversation on improving preconception health. The interconception period also provides an opportunity to provide women with access to a history of adverse pregnancy outcomes such as GDM through post-partum interventions, but few studies have explored using this period to deliver PCC as seen in Chapter 3.[251]

OBGYNs and midwives play a crucial role in implementing preventive strategies during the pregnancy and interconception periods along with the preconception period and are well-placed to integrate early life risk reduction into a life course approach to health care. According to a study of Dutch obstetricians and physicians, uncertainty among HCPs about the need and effectiveness of PCC interventions appears to influence the decision to discuss preconception issues.[252] Often PCC is discussed at the end of consultations with general practitioners, and covering all risks that could affect future pregnancies is a challenge. [253] The delivery of PCC can be influenced by the variety of risk factors requiring communication between specialities, poor organisation of PCC systems and the clinician's views on their professional roles and responsibilities. HCPs also want to respect the patient's right to choose autonomously whether or

when to become pregnant, which may sometimes be seen to present ethical barriers to discussing the issue of planning for pregnancy or reducing weight before conception. [252]

4.1.1   Barriers to PCC for women of reproductive age

It has been shown that while women realise the importance of improving health before pregnancy, they do not recall receiving relevant information or support for preparation during the preconception period. [165,254] In addition, receptivity (which precedes action) to information on preconception health also depends on whether women were thinking about getting pregnant in the near future.[254] The low uptake of preconception interventions could be related to women's emotions and beliefs, unplanned pregnancies, perceived absence of risk, knowledge, and accessibility.[255] Overall, community awareness of the benefit of preconception health and nutrition can be low [252] with most women seeking medical care in the antenatal period. [34,230] 'Generally healthy' women in the population often do not engage with sexual and reproductive healthcare or primary care for preconception advice or to discuss pregnancy intentions, thus missing out on important information, increasing unplanned pregnancy and the risk of adverse maternal and fetal outcomes.[256] Conversely, it has been reported that women who planned pregnancy were more likely to take folic acid supplementation, access information and get appropriate immunisations compared with those not planning pregnancy and who had limited healthcare engagement. [257]

4.1.2   The need to explore HCPs' views on implementing DOHaD concepts

Implementation of DOHaD-related findings relevant to NCD prevention such as better nutrition before and during pregnancy usually occurs through counselling and health education provided by the practitioners verbally or using resources such as leaflets and information sheets. Apart from NCD risks, the benefits for the next generation through interventions related to micronutrient status (e.g., Vitamin D) before and during pregnancy should be communicated. International organisations such as FIGO have stressed the importance of translating DOHaD evidence on early life risk factors through the antenatal settings for OBGYNs.[120,230] However, for these guidelines to be translated into practice, it is important to know if HCPs such as OBGYNs and midwives are aware of and utilising these messages in practice.

A cross-sectional survey in Australia suggested that the general concepts of DOHaD were widely accepted by HCPs with almost all (98%; n=208) accepting the link between early exposure and NCDs. [258] Results showed that 25% of participants described themselves as confident to give

DOHaD-related advice. However, such survey methods are unable to capture practitioners' awareness and attitudes towards DOHaD, which is essential to implement the concept in routine practice. Awareness of DOHaD concepts has been explored previously among medical students in Japan and New Zealand .[259] Results suggest that on entry most students had no awareness of DOHaD or the first 1000 days concepts. However, this improved to 60% by year 3, which is however less than ideal to address the increasing burden of NCDs.

The understanding of DOHaD among HCPs who provide care during the preconception, pregnancy and post-partum periods, influences how they discuss and deliver PCC to future parents. A better understanding of the views that midwives and obstetricians hold about their role and responsibilities towards NCD prevention in the next generation and for the long-term health of women may help to explain if and why the discussions for pregnancy preparation and preventing risk in the next generation do not take place. Thus, this chapter will address the aim of the PhD to integrate the life course approach to preconception health through healthcare settings. The work in this chapter explored HCPs' perspectives on the barriers to delivering PCC, as key stakeholders in preconception health.

4.1.3   Aim and research questions

The barriers to PCC have been explored previously and discussed in Chapter 3. [252-255] However, there has been relatively little research on the barriers to PCC in the context of prevention of chronic conditions such as diabetes and cardiovascular disease, or implementing DOHaD through healthcare. Overall, the current chapter aims to explore the existing barriers to delivering PCC and understand how HCPs conceptualise the implementation of DOHaD-related concepts such as preventing the intergenerational transmission of risk, through healthcare settings, and if they have been using these principles in practice.

The biopsychosocial model described by George Engel [260] is based on systems theory and recognises the hierarchical nature of natural systems and considers behavioural, psychological and social factors as crucial to understanding the heath of an individual. The model, developed to break the siloes of the biomedical model of clinical practice has been particularly useful in understanding how clinicians approach patients and how their knowledge is organised. In this Chapter, the biopsychosocial model is used to understand how HCPs in this study viewed the life course and DOHaD concepts. The results of the study are further described in relation to the model (section 4.4) to understand if and how HCPs consider these factors.

Research questions

1. How do the concepts of life course health, DOHaD and intergenerational transmission of risk of NCDs underpin maternity care and practice by midwives and OBGYNs in selected countries?

2. What do midwives and OBGYNs see as the barriers and facilitators to implementing these concepts in maternity care (preconception including the interconception period, antenatal and postnatal care)?

3. How can midwives and OBGYNs be engaged effectively to increase awareness of the need to improve health in the preconception period and to prevent the intergenerational passage of NCD risk?

4.2 Methods: a qualitative study using semi-structured interviews

A qualitative exploratory study design was used with data collected from telephone interviews. This method captures the complex, experiential and context-based issues that are relevant to clinical care, which are not captured through quantitative survey methods. [116] In developing the project, the International Confederation for Midwives (ICM) and FIGO were also consulted for collaboration and recruitment of participants.

4.2.1 Study sample and recruitment

The main aim of this study was to explore if HCPs were using DOHaD-related findings in their practice for the prevention of NCDs, and hence clinical stakeholders from antenatal services such as OBGYNs and midwives were selected pragmatically as a starting point. As the aim of the PhD has a focus on the preconception period, I intended to reach out to wider stakeholders depending on the initial response from OBGYNs and midwives.

A purposive sampling strategy was carried out by emailing participants through lists provided by regional representatives of FIGO and ICM. This was followed by a snowball sampling strategy to seek information from the participants about the categories of clinicians who come into contact with women in the preconception period. The countries initially selected were Ghana, India, Pakistan, Brazil, the UK and USA, to give a global perspective and due to the rising trends in NCD-related issues such as maternal and childhood obesity and GDM in these regions [261,262] *(see the impact of COVID-19 section below for further details)*. Risk factors for NCDs such as low birthweight and preterm labour are highly prevalent in LMICs such as India and Pakistan. [263] Within each country, either midwives or OBGYNs were selected to take part in the study based

on the local models of maternity care, as the roles and remit of midwives and OBGYNs vary greatly between countries.[264] For example, in the UK, midwives are the main point of contact throughout routine antenatal care. The USA, on the other hand, has an obstetrician-led antenatal care system [265] while India has a mixed model with predominantly OBGYNs in urban areas, and other community workers such as auxiliary nurse-midwives and OBGYNs working in rural areas. The aim was not to produce a sample matched to the general population. The stratification by country and role of HCP helps incorporate variation into the sample and thus enable the exploration of diversity within the data.[266] This was an important consideration in a qualitative study of this nature. Recruitment in selected countries was done via professional bodies (ICM, FIGO). Information sheets and consent forms (Appendix B 1) were circulated before interviews via e-mail which included the University of Southampton GDPR data protection privacy notice.

4.2.2   Methods

I adopted the approach of 'critical realism' to guide the methods used in this study [267] and for the analysis, as discussed in Chapter 2. This approach suggests that the HCPs' knowledge, beliefs, and attitudes about DOHaD and its effects on health (individual factors) along with extrinsic factors such as healthcare systems, cultural and social norms and environment can influence the implementation of preventive interventions for NCD risk and PCC in practice. The aim of the study is not to find an absolute 'truth', but to describe the phenomena considering the real and complex environments in which participants live and work. [268]

The methods used for data collection were semi-structured interviews, lasting about 30 minutes, with midwives and OBGYNs by telephone (due to geographic barriers). Interviews were planned to be conducted until data saturation was reached. Theoretical saturation is the point during code development when no new information emerges during analysis, [269] at which point there is little to be gained by arranging more interviews with the same stakeholder group. Inductive analysis and coding were initiated early in the project before the completion of interviews. Saturation was planned to be achieved if three consecutive transcripts did not present any new ideas, codes, or topics.

4.2.3   Impact of COVID 19

Data collection for the first two countries (UK and India) was conducted till Jan 2020 along with one interview from South Africa. Many HCPs in 2020 were busy and overwhelmed by workload during the pandemic. Hence, on invitation they explained that while they were happy to take part

in the future, they did not have the capacity at the time. After discussion with the supervisory team, it was decided that the interviews would be temporarily halted for 2020 and the study would focus on UK, India and South Africa only as contacts were already made in these settings. Though attempts to resume the study were made between Feb-April 2021, and one additional interview was arranged, the HCP had to cancel the appointments due to other commitments and further interviews could not be conducted. It was deemed appropriate to conclude the study based on findings from the 8 interviews (three countries). Thus, saturation was not achieved, and a sample large enough to capture a range of perspectives may not have been captured. The findings are discussed in light of these limitations in section 4.4.

4.2.4 Development of study materials

A semi-structured interview guide was developed (Appendix B.2), piloted in 2019 with midwives in Southampton General Hospital, UK to ensure the questions were easily understood by participants and contribute to answering the study questions. The questions were designed in discussion with the supervisory team, based on the research questions and were written as exploratory open discovery questions, beginning with 'what' or 'how'. This encouraged participants to speak freely and avoid yes/no answers during interview. The discussion guide was updated to revise questions that were unclear to participants and add new ones based on previous participants' responses.

Vignettes (brief written accounts) were included in the participant information sheet that is provided before the interviews to promote discussions focused on situations encountered by the participants (See Appendix B.3). Vignette-based methods have been frequently used to explore judgement and decision-making in HCPs [270] and consist of short narratives about fictional patients that will simulate a real-world scenario. The vignette was intended to stimulate discussion on DOHaD and maternal NCDs during the interview and to explore if these principles are being put to use during routine maternity care, for example, while discussing the prevention of complications of GDM with a pregnant woman. However, the questions did not focus on how a patient will be clinically managed.

4.2.5 Interviews

The interviews consisted of open-ended questions and the discussion guide contained questions on preconception, pregnancy and postpartum periods, with questions about the level of awareness among the clinicians about DOHaD concepts. It also included a discussion of

intergenerational transmission of risk of NCDs, the barriers and facilitators to implementing these concepts in practice and ways to engage HCPs to initiate the conversation about preconception health with young couples and women. All interviews began with the question "What to you would be a health pregnancy and a healthy baby?", after which the semi-structured discussion guide was loosely followed. The vignettes, in combination with the semi-structured interview guide, allowed me to ask follow up and probing questions as appropriate, using a conversational pattern and all topics in the interview guide were covered though not sequentially.[271]

4.2.6   Data protection and ethical approval

During transcribing, data was anonymised and stored securely. Names mentioned in interviews were replaced by ID numbers in all reports. Ethics approval was granted by the Faculty of Medicine Ethics Committee, University of Southampton (48281) in June 2019. Participants were provided with information about the purpose and method of the study, emphasising that participation was voluntary, that they can withdraw at any time, and that confidentiality would be guaranteed.

4.2.7   Analysis

I transcribed all the interviews verbatim. An inductive thematic analysis was conducted according to the six steps outlined by Braun and Clarke to generate a new theory emerging from the data [115] with no preconceived notions or theories about what results will be found. The six steps described are – familiarisation, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report. Familiarity with the data was achieved through transcribing and repeated readings of the data. Coding and later theme development were directed by the content of the data. Thematic analysis is a data-driven bottom-up method widely used in qualitative research that focuses on identifying patterned meaning across a dataset. [115,116] The coding process involved generating short labels that identify features of the data that may be relevant to the research question. Some excerpts of text were also coded into two different code labels if they were making separate points. Later, these codes were examined to identify broader patterns (called themes) in discussion with the research team. The themes helped develop the analytic narrative for presenting the results of the study. Themes were formed from the code based on how they reoccur or appear central to the research question, guided by salience for issues that are conceptually relevant and important, not just those emerging frequently. In addition, notes/ memos were made to code emergent sub-themes and implicit factors, which

were then included in an appropriate theme. Qualitative data management software (NVIVO 12) was used to facilitate analysis. To ensure rigour while creating the coding framework, a third of randomly-selected transcripts were double-coded by another researcher with expertise in qualitative research and health psychology. Any disagreements were reviewed and resolved through discussion with a third reviewer from the supervisory team. An inter-rater variability score was not calculated as I did not adopt a positivist approach. An iterative process of coding and theme development was conducted along with a constant reflective process by the researcher.

4.3   Results

4.3.1   Characteristics of study participants

A total of eight HCPs were interviewed between 2019 and 2020. Interviews lasted an average of 37 minutes (range 22-52 minutes). Participants had clinical experience in maternity care ranging from six to 27 years. While some participants had a purely clinical role, others were also involved in academic or research activities. The participants from LMICS (India and South Africa) were based in urban tertiary health care centres, but most of them had experience of working in the rural areas of their respective countries. Key characteristics to provide an overview of the participants' background are summarized in Table 4.1.

Table 4.1   Key characteristics of study participants

Participant ID	Occupation	Gender	Country	Additional notes
101	Midwife	Female	UK	Midwifery lecturer based in a tertiary hospital in a city
102	OBGYN	Male	India	Lead OBGYN in a private maternity care hospital in urban India, also experienced working in government and rural settings
103	OBGYN	Male	India	Lead OBGYN in a private maternity care hospital in urban India, also experienced working in government and rural settings
104	Midwife	Female	UK	Specialist midwife in Diabetes care, with experience in community midwifery and working in low-income areas
105	OBGYN	Female	India	Professor of OBGYN at a medical institute in an urban area, additionally working in a private maternity clinic

Participant ID	Occupation	Gender	Country	Additional notes
106	Midwife	Female	UK	A clinical midwife working in a city in Northern England with a high proportion of minority ethnic groups
107	OBGYN	Female	South Africa	Professor of OBGYN with a clinical and academic role in tertiary care hospital in Urban SA
108	Midwife	Female	UK	Midwife with experience working in clinical trials on nutrition in pregnancy and childhood based in an urban maternity hospital

4.3.2 Themes identified from the data

Though only eight participants were included, the discussions covered a range of issues related to PCC and DOHaD and provide rich data to examine the research questions. Thematic analysis of the interview data yielded a total of four themes with three to five sub-themes each. While sub-themes were exclusive to each theme, several interlinkages were found between the themes too, which are discussed below. A description of the themes and sub-themes included in the final coding frame is shown in Table 4.2.

Table 4.2   Final coding frame resulting from thematic analysis

Themes and sub-themes	Descriptors
I. HCPs show awareness of concepts related to DOHaD and NCD-prevention using a medical frame for implementation	Level of awareness, how that awareness is manifested in the HCP's practice and how they frame these issues during interview
IA. Awareness and understanding of concepts in HCPs	Explicit and implicit discussion on DOHaD-related knowledge
IB. Translation through practice	Their views and practice habits for the prevention of NCDs using a life course approach can be implemented in routine care,
IC. Medical model of prevention	The implementation of life course and DOHaD concepts were conceptualised in clinical care using a predominantly medical model and framing
II. Motivational and communicational challenges for translation in clinical care	Participants describe how they communicate with patients, issues faced and their views on their role as a practitioner (implicit and explicit)
IIA. Prioritisation of issues during routine care	Discussion on immediate and life-threatening outcomes taking precedence
IIB. Lack of ownership to deliver PCC	HCP's views (implicit and explicitly stated) on their job roles and remit and other issues they face in delivering PCC.

Themes and sub-themes	Descriptors
IIC. Barriers to communication	Views on how health information is provided and issues during delivery
IID. Clinician-patients power dynamics influencing communication	Emergent sub-theme of how HCPs view their relationship with the woman
III. Factors within and outside the healthcare systems affect implementation through clinical care	Factors (external to the clinician-patient interaction) influencing healthcare delivery and women's health and health behaviours during the perinatal period (both positively and negatively).
IIIA. Context-specific factors affecting the healthcare system	Contextual factors (country-specific, related to settings and health care systems) affecting practice and health care systems
IIIB. Practical issues in clinical care	Participants describe issues related to day-to-day clinical care affecting the NCD prevention and PCC agenda
IIIC. Difficulties for patients to access services for different stages of the life course	Barriers affecting the provision of a continuum of care
IIID. Considerations of wider determinants of health influencing preconception, antenatal and postpartum health	Discussion on wider societal and economic factors affecting health
IIIE. Patient's awareness of and engagement with preventive services and pregnancy preparation	HCP's perceptions on awareness and attitudes related to NCDs/ DOHaD in general public
IV. Overcoming barriers to provide PCC and prevent NCDs	Recommendations, gaps and opportunities for NCD prevention in the perinatal period, stakeholders suggested
IVA. Involvement of male partners	Discussion on the importance and how this can be included in current practice
IVB. Wider public engagement and advocacy	Call for publicising the issue in the general population
IVC. Need for wider interventions and resources	Gaps in evidence, information, tools and resources for both HCPs and patients
IVD. Opportunities for provision across multiple clinical settings (outside maternity care)	Wider engagement with healthcare stakeholders

The themes identified are summarised in this section, with illustrative quotes drawn from the transcripts. Some quotes were edited for clarity, ensuring the original meaning was not affected. Each quote is labelled with the participants' country (IND=India; SA=South Africa; UK = United Kingdom), job role (MW=midwife; OBGYN) and ID number to provide context and show the spread of data. ID numbers were given chronologically as interviews were conducted.

4.3.2.1   Theme I. HCPs show awareness of concepts related to DOHaD and NCD-prevention using a medical frame for implementation

Overall, when discussing common NCDs encountered in practice, and how they addressed the risk factors or treated the condition, all HCPs showed a good understanding of the basic principles of the DOHaD paradigm - even if they did not always use terms such as "developmental origins" or "life course". Discussions showed awareness of both intergenerational risk of NCDs and childhood obesity and long-term risk of conditions such as GDM for maternal health. While referring to the vignettes provided before the interviews, HCPs also identified the intergenerational risk factors, showing consideration for both maternal and child health.

"So, we just saw, it can obviously increase the chance of child, having diabetes. Yeah. uh, type two, obviously. Yeah. Um, heart disease. Mm-hmm <affirmative> yeah. And obesity again" (UK MW 101)

Awareness was mostly expressed in the form of increased risk for clinical conditions e.g., diabetes, infertility, pre-eclampsia. Some HCPs also added that recent curriculum and training for specific issues has improved the knowledge of DOHaD, which was not common when they were junior doctors/ in training.

"The OBGYNS are very much aware of it, because we have been hammering the GDM thing for the last 10 years or so." (IND OBGYN 103)

OBGYNs in India and midwives with experience in the community settings however seemed to have more in-depth discussions on the medical history of the woman, particularly family history. Though HCPs discussed "family history" it was unclear if the distinction between fixed genetic effects and the probabilistic nature of DOHaD outcomes was communicated to the patient. Only one midwife (UK 104) explicitly mentioned that she communicated how some modifications in risk factors such as weight loss could reduce future risk of diabetes to reassure the patients.

In practice, only one midwife from the UK was involved in PCC, while OBGYNs encountered patients with several preconceptional issues. Preconception issues such as infertility due to PCOS, and hypothyroidism are increasing in Indian urban settings along and patients present with multiple nutritional issues such as anaemia and obesity. OBGYNs also mentioned discussing birth history with adolescent patients and their parents, while discussing issues related to menarche, puberty and PCOS. However, when HCPs discussed the management of these conditions in

practice, the focus was mainly on medical management and treatment of conditions. HCPs acknowledged that discussions with the parents may not always cover long-term risks to the baby.

"Unless the baby is unwell and we say it could be because of this, but routinely you don't say, oh, by the way, you had diabetes, your child more likely to have (diabetes)… Antenatally it is probably mentioned more in clinics. Because, they're seen quite regularly in clinic." (UK MW 101)

"Mother had a C-Section so…yes, future diabetes, obesity, respiratory disease (referring to baby). Yeah, that's not communicated. And that's quite key to the whole sort of passing the risk of the next generation, isn't it? … that needs to be modified periconceptually" (SA OBGYN 107)

Overall, during conversations on prevention and treatment, a medical model of prevention and framing was dominant in the discussions. Most OBGYNs discussed the treatment of issues such as pre-eclampsia and GDM with drugs first, before probing questions on lifestyle were asked. While wider factors related to stress, and mental health were also discussed, they were not usually raised in the conversations on management. Plans for the management of weight included lifestyle modification and weight loss.

"…I think obesity is a big issue in South Africa. So, try and optimize the pre pregnancy condition, modify or reduce weight, encourage exercise, ensure that the pre pregnancy glucose levels are adequate HBA1C is monitored. Yeah, so in terms of non-communicable… and then if your patient is hypertensive, to see that she's on antihypertensive treatment, and that high blood pressure is controlled." (SA OBGYN 107)

For the opening question on what the HCPs perceived as a healthy pregnancy and baby, a majority of the HCPs mentioned "growth and development" of the fetus and clinical parameters, particularly related to immediate outcomes of pregnancy.

"So antenatally, so obviously things like scans, (if) they were normal, um, fundal height, if that's been normal and consistently what we expect, you know, the growth to be, um, movements, Is mum feeling movements? Bloods, mum's bloods. If they're normal, um, bonding again, how mum's feeling emotionally, mentally" (UK MW 101)

While acknowledging that risk factors were best addressed before pregnancy, in a practical sense, the antenatal visits were highlighted as an important period to address issues related to drug intake, existing Type 2 Diabetes and hypertension, blood thinners, and aspirin to prevent preeclampsia. This was particularly relevant in LMICs due to contextual barriers, discussed in theme III.

4.3.2.2   Theme II. Motivational and communicational challenges for translation in clinical care

The HCP's perception of their job roles influenced how they prioritised issues in routine care and how motivated they were to discuss issues related to NCD prevention.

Most HCPs, described healthy pregnancies in the context of immediate/ short-term parameters such as fetal growth, heart rate, birth weight etc. Some even discussed how the impact on obstetric outcomes and delivery were the main reasons why they focused on being underweight or overweight during pregnancy.

"We've had a couple of patients who were just 32/ 34/ 35 kilograms which is roughly underweight. And they require special care and we as obstetricians are worried about what will happen to her during labour." (IND OBGYN 103)

Such prioritisation of short-term outcomes, particularly with a focus on fetal and maternal survival was raised as complications seen during antenatal consultation would always take precedence over discussions on weight management or nutrition. This was also linked with the practical issues related to time discussed in Theme III.

"And then unfortunately, we are still seeing a lot of complications of preeclampsia and antenatally and intrapartum. So, we need to deal with those complications first, before I think we even look at it beyond pregnancy in the first two years." (SA OBGYN 107)

Prioritisation of the government and health agencies within a country could also influence the programmes delivered at the clinical level. In India, HCPs mentioned their focus was predominantly on communicable diseases and prevention of anaemia before pregnancy, which competed with the NCD prevention messages. Preconception risk factors in India included rheumatic heart disease and unvaccinated (for Rubella in particular) women who often presented late in pregnancy, with severe complications. Similarly, HIV testing and screening programmes were also a high priority for public health agencies in South Africa.

"We have routine… everybody gets tested (for HIV). Non-communicable diseases, I think it's probably less of a priority. Because there's more influence placed on TB, HIV, and getting everyone tested and treated and reducing the mother to child transmission rate in South Africa" (SA OBGYN 107)

While HCPs were keen on delivering PCC, due to systemic barriers in the healthcare models discussed above, healthcare-seeking behaviours of patients along with limitations of their job roles, they felt unable to deliver PCC routinely. Overall, none of the HCPs considered preconception as part of their main role as midwives/ OBGYNs and the focus was significantly on antenatal and to an extent, postnatal care.

"Quite a lot of pregnancies are unplanned, and they don't tend to approach the midwives before getting pregnant" (UK MW 108)

"But we, for example, if a woman is diabetic, um, she straight away gets referred into diabetic clinic and then we don't see her again. Yeah, so your role is very limited in that sense." (UK MW 106)

HCPs also felt that other stakeholders were better placed for PCC.

"There must be more... preconception women who are thought to be uncomplicated but may develop compilations will probably see their GP or family health clinic. And this advice or the preaching must be done by the GP. They are the ones looking after these women and should assist in providing advice." (SA OBGYN 107)

Two of the OBGYNs discussed participating in outreach programmes and advocacy campaigns for improving knowledge of preconception factors. These were usually related to specific topics such as increasing awareness of preeclampsia and anaemia prevention. Though the OBGYN workforce overall would have a high acceptance to use the DOHaD agenda in routine care, they may not be the best stakeholders for the PCC agenda. The role of higher-level authorities in clinical care such as FIGO and WHO were also raised as the key stakeholders for advocacy with a stronger influence compared with individual HCPs.

Possibly influenced by their previous role as a community midwife, one participant mentioned community midwifery presents a platform for the prevention of NCDs as they link GPs with other services.

"As midwives we are also an instrument in public health. So, there is definitely a window for midwives to do that…As a community midwife much of your work is public health and prevention "(UK MW 104)

Several other opportunities to address this through stakeholders are elaborated in theme IV.

Misconceptions on the impact of gestational weight gain in women with obesity on fetal growth were also discussed. HCPs needed to reassure patients that gestational weight gain within the suggested range in the guidelines would not affect fetal growth. While most participants expressed being confident or comfortable having the discussions related to weight management, some midwives mentioned a focus on weight could be misinterpreted by the women as "being fat". As this could have negative consequences, they added that empowering messages and discussions were needed and this was also linked with the health literacy discussed above.

"You can't be a midwife, unless you have communication skills. So yeah. I never really had an issue with that. There's ways to say it and bring it about and sort of thing." (UK MW 106)

"We don't talk about being fat or overweight, but we remind them that the BMI is to understand their health and risk of type 2 diabetes and cardiovascular disease" (UK MW 104)

An emergent subtheme in the domain of factors affecting communication was the power dynamics between the clinicians and patients and how messages were communicated, implicit in the data. Overall, OBGYNs from India and SA used a mode of providing information, focusing mainly on negative risks to encourage patients (for weight management, NCD prevention) and viewed their role as mainly advisory. A hierarchical tone was seen in some of the narratives related to providing counselling for exclusive breastfeeding, weight management and physical activity.

"And... not all of them comply… because of "oh we don't have the time" so I say you have to make time for yourself. So, I am very strict with them. So, when they come next time, they are very scared when they stand on the weighing scale again." (OBGYN IND 103)

However, a lack of tools to support conversations was also highlighted

"I think they (doctors) can advise them verbally, but in terms of tools for support. I'm not sure if we have much capacity" (SA OBGYN 107)

Overall, midwives were more likely to discuss consideration of wider factors affecting lifestyle when developing an action plan. A more supportive approach based on cultural factors was also expressed.

"You have to be mindful of that (religious factors affecting diet), because otherwise, they are not going to work in partnership with us, are they?" (UK MW 104)

"The "telling" to, is a very outdated notion. erm, but I think it is about navigating women to know what they need to do, and you can build up and sustain behaviours really that will hopefully provide longevity in any of the interventions we provide. Diet or lifestyle choices infant feeding etc. and encouraging women to be inquiring and curious and to questions" (UK MW 101)

Possible reasons for these differences are explored in section 4.4.

4.3.2.1   Theme III. Factors within and outside the healthcare systems affect implementation through clinical care

This was a major theme covering a range of positive and negative factors that impacted how DOHaD outcomes could be addressed both in preconception and the pregnancy period. Country-specific barriers within the health systems affected the delivery of NCD-prevention interventions and PCC. For example, UK clinicians expressed they usually have to follow the guidelines set by NICE, which could affect screening and how high-risk women are identified or managed. However, some HCPs proactively used alternative measures such as using WHO guidelines for GDM risk screening to ensure patient care. A senior specialist midwife, discussing the barriers related to guidelines for BMI and GDM, added that the guidelines should be considered in the context of other risk factors that the patient may have.

"What has happened is, with the NICE guidelines … women are slipping through the net. The boundary for fasting is higher. And a number of those women do go on to need support, even medication. Then you have lost the window of opportunity to actually be proactive in prevention rather than cure." (UK MW 104)

In other settings, a lack of clear guidelines presented an additional barrier.

"So, our screening protocols… even internationally, there isn't much consensus on good screening protocols for preeclampsia. A lot of them are quite labour intensive. So, we can try and get a good screening protocol that one can use in low or middle-income countries." (SA OBGYN 107)

In India and South Africa, all HCPs deliberated on the differences in private practice and public facilities. The private sector clinicians had organised PCC to cover issues ranging from NCDs, to pre-pregnancy vaccinations. This was also linked with the socioeconomic status of the people approaching the private sector described below. Similarly, women who were able to access specialist services through the NHS, such as diabetes/ obesity specialist midwives also received added support for behaviour changes, however, access was dependent to a large extent on guidelines and funding at the local level.

Health organisations within the country, such as the NHS and NICE in the UK, may also prioritise issues and interventions based on cost-effectiveness of interventions. Wider issues influencing national health policy were also raised as this could affect the uptake of community-based services – which several HCPs agreed was a key to prevention. Referring to the recent defunding of community-based programmes (e.g., Sure Start centres in the UK, local programmes providing vouchers/ discounts for weight loss agencies such as Weight Watchers UK), a midwife added that the closure of services that had good uptake and acceptability among parents, especially in deprived populations was an obstacle to person-centred and family-focused care.

"It is not a political thing, I don't care which government it in power… it's just that we don't have the facilities to do that now" (UK MW 104)

Additionally, the model of care in a country and which HCPs routinely meet women during the periconception period also influence the delivery of PCC.

"Yes, we don't have a midwifery model at all. In India, it is the general practitioners or physicians, but the physicians may not be aware… about preconception or what the HbA1C should be for pregnancy." (IND OBGYN 103)

While routine policies in countries (e.g., provision of free iron and folic acid tables in India) have supported improvement in malnutrition, compliance from the patients also acted as a barrier, discussed in theme II above. Overall, a lack of robust screening protocols in routine care for nutrition and NCDs were highlighted as a barrier within health systems. Indian OBGYNs reported how screening for HIV and hepatitis B in pregnancy routinely in all antenatal booking visits is an example of how it could be normalised.

Practical issues in day-to-day provision such as excessive workload, lack of time in appointments were also emphasised by all participants.

"It is a big role I'd say also - It should be. But, um, in reality do you really get time to discuss it in as much depth as we would want to? Probably not" (UK MW 101)

Other practical issues related to a lack of training among HCPs for NCDs, and the need to cover nutrition in the curriculum, were also highlighted as participants felt that clinicians may not be able to translate the guidelines to examples for dietary sources of proteins, healthy fats etc.

"The curriculum has so much focus on rare diseases which you have not seen, and not day-to-day practical ones that affects the next generation" (IND OBGYN 102)

Country–specific issues within health systems also included barriers to providing a continuum of care, linking services across life-stages and a lack of dedicated preconception clinics.

"Everywhere is different, (name of town), erm, for example, we see them at booking, and then we see them every few weeks. If you're in the hospital, you might not see them until they are in labour. And then that's it, you don't see them again." (UK MW 106)

Short term risk factors such as preterm births or macrosomia were often communicated between midwives/ OBGYNs and neonatologists in case of complicated pregnancies. However, participants stated that long term risks were not always addressed.

Though a medical framing was used by most HCPs to address the issues, an acknowledgement of the effect of wider determinants of health outside the healthcare sector that affected patients' lives was seen.

"It is no good telling women you need to do this, this and this… I need to have a profound knowledge of the socioeconomic background of that woman, the demographic where she lives, ethnicity and any religious background." UK MW 104

While some barriers were country-specific, some common factors such as lack of health literacy, low education and lower socioeconomic status were reported to influence the uptake of health messages. Cultural and familial issues also affected health in pregnancy, particularly in the LMICs, and appeared to be mediated by religious norms and wider issues such as gender inequality. Affordability was an added obstacle, even if the women are receptive to making dietary changes.

"So that keenness to know about diet and exercise is not that great (among patients). Because they have these mothers and mothers-in-law telling them "Oh I did this"" (IND OBGYN 103)

"Now about folic acid, there is a class of people, you know well educated, and well -to-do-people, in their case they are aware of folic acid. If not before, the minute they are diagnosed or their pregnancy test comes positive they do use it. But somebody coming preconceptionally or for planning pregnancy is still pretty low" (IND OBGYN 102)

While discussing the impact of low literacy levels, the problem that NCDs are usually asymptomatic, and the normalisation of gaining excess weight during pregnancy, an Indian OBGYN added –

"If the woman is not very well educated, they may not understand… that they are gaining weight too fast. And they have the (high) blood pressure of 170/110... in pre-eclampsia this can be a challenge to create awareness among people" (IND OBGYN 102).

Health literacy, marketing and food environment were discussed as an issue in all countries, adding that wider food policies played a role in the prevention of NCDs.

"General knowledge (on health) is not good… And there's a lot of sugary drinks consumed, we now have a tax on sugary drinks, and the companies have reduced the volume of these fizzy drinks… So, the government is trying to create awareness. But I'm not sure that it's filtered down properly to a lot of the population" (SA OBGYN 107)

Other barriers related to language were described by UK midwives, while specific issues in LMICs included lower maternal age and teenage pregnancies. Legal and policy changes along with the involvement of schools were recommended to address these, described further in theme IV. Differences in the urban and rural contexts were key and mentioned by all participants from LMICs as a significant factor that not only influences access to PCC and antenatal care and the type of services available but also affects health behaviours and knowledge.

Finally, it must be noted that though wider issues were acknowledged while discussing ways to overcome the barriers, most participants framed the issues in terms of individual responsibility for weight loss, smoking cessation and responsibility for the health of the baby. Maternal blame and responsibility were also implicit in the discourse by some participants.

"Well, a health mother would produce a healthy child" (IND OBGYN 103)

"I *am extremely disappointed with the breastfeeding uptake… this could be because of the high educational status (of the mother) and nuclear families" (IND OBGYN 105).*

The latter was referring to the cultural shifts of fewer multi-generational families and an increasing number of urban working mothers, which according to the participant may have contributed to lower breastfeeding rates. Similar framings of maternal blame were seen while discussing advanced maternal age, occupational stress, and desire for a Caesarean section due to concerns related to vaginal births among two of the OBGYNs. These discussions arose while the participants were reporting how clinicians are limited in the scope of risk factors they are meant to address during pregnancy.

4.3.2.2   Theme IV. Overcoming barriers to provide PCC and prevent NCDs

Study participants reported a variety of ways to overcome the barriers (both clinician and patient-level) discussed above.

While a majority of the participants referred to couples in the discussion, consideration of fathers or male partners was specifically highlighted by two of the participants, with particular relevance in the Indian context with a high incidence of diabetes.

"Now-a-days we have started even talking to the husband you know, if they are obese. They must get to the proper BMI. Because many of these youngsters who come, at 30/31 (BMI) many of them are pre-diabetic." (IND OBGYN 103)

Support from male partners was low in the rural parts of India and among low-income groups where women often visited antenatal clinics with female relatives. In the UK, consideration for diverse cultural groups was emphasised.

"Invite them in, the lead male members of their family, so we can have a group discussion… because these women are going to go back and live with their family members and cultural beliefs" (referring to gender roles in certain ethnic minority groups)" (UK MW 104)

Wider engagement and dissemination of evidence-based messaging were recommended by all participants using different techniques such as advocacy campaigns, school health programmes, media and social media. This could also help normalise pregnancy preparation.

"See, in general, what I have seen publicity is needed in the general public, and something like… when you plan to get married, you must also plan to visit a doctor." (OGYN IND 103)

A midwife from the UK was involved in discussing awareness of sexually transmitted diseases among adolescents and recommended school-based educational platforms for nutrition and improved understanding of the impact of nutrition on pregnancy.

The need for resources both for patients and HCPs was highlighted. Considering the vast amount of misinformation on the internet, easy to access and understand guidelines on what to eat or avoid during pregnancy and sources of specific vitamins (e.g., vitamin D) were recommended. Support for low-income women was also needed.

"Maybe more patient information leaflets, which we haven't done, but we should consider doing that. And then I know some countries even give allowances. For healthy food, some antenatal

clinics for women attending, so some kind of food allowance in pregnancy I think that may be beneficial" (SA OBGYN 107)

HCPs from LMICs discussed how PCC could also be linked with the agenda for preventing teenage pregnancies through contraceptive services, and nutritional information particularly for improving anaemia could be disseminated here. As risk-based screening could lead to under-diagnosis of issues, routine screening for nutritional problems was recommended by most HCPs. This additionally helps overcome issues related to compliance. For example, in the UK, midwives discussed how mandates related to testing for other issues (e.g., household CO_2 monitoring) have been in practice used to identify and counsel patients about smoking during pregnancy as routine screening is conducted during antenatal visits. HCPs also tried to discuss preconceptional issues when approached by women for other problems such as irregular periods, and early pregnancy loss (IND OBGYN 105).

Several stakeholders were identified along with the platforms discussed above for the provision of PCC. In India, the private sector has a better continuum of care, however, community base HCPs had great potential in delivering PCC in rural areas.

"There is a routine follow up after two years for infants of diabetic mother with the neonatologist… even for women with pre-eclampsia (referring to their hospital practice)" (IND OBGYN 102)

"So, we have ASHA (accredited social health activists) workers who go to these (rural) areas. And in urban areas, we have the USHA (urban social health activists). So, the urban slums are very well mapped out… they (USHA) have a lot of interaction with the general public. I think that it a good medium for preconceptional care family planning, vaccination, general health". (OBGYN IND 103)

Finally, good quality primary care particularly through GPs was considered the key to the provision of PCC and addressing risks in the general public. Other HCPs such as health visiting programmes (post-partum) and community-based interventions were also discussed in the UK context. HCPs also added that dietitians were key players with potential for discussion of PCC, however, most interactions with nutritionists and dietitians were related to weight loss.

Overall, the four themes generated from the data that reflect various factors influencing the translation of DOHaD evidence, prevention of NCDs and PCC through clinical practice. As shown in figure 4.1, the clinician-patient relationship is central to the figure, with HCPs showing awareness of concepts related to DOHaD and NCD prevention using a medical frame for implementation

(theme I). Motivational and communicational challenges for translation in clinical care reflected in theme II also influence the interactions and how NCD prevention and PCC are conducted. Barriers within the health system and external factors such as policies and socioeconomic factors also affect implementation through clinical care (theme III). Opportunities to overcome these issues and key stakeholders to involve in the conversation for PCC discussed in theme IV can help improve the existing state of affairs.
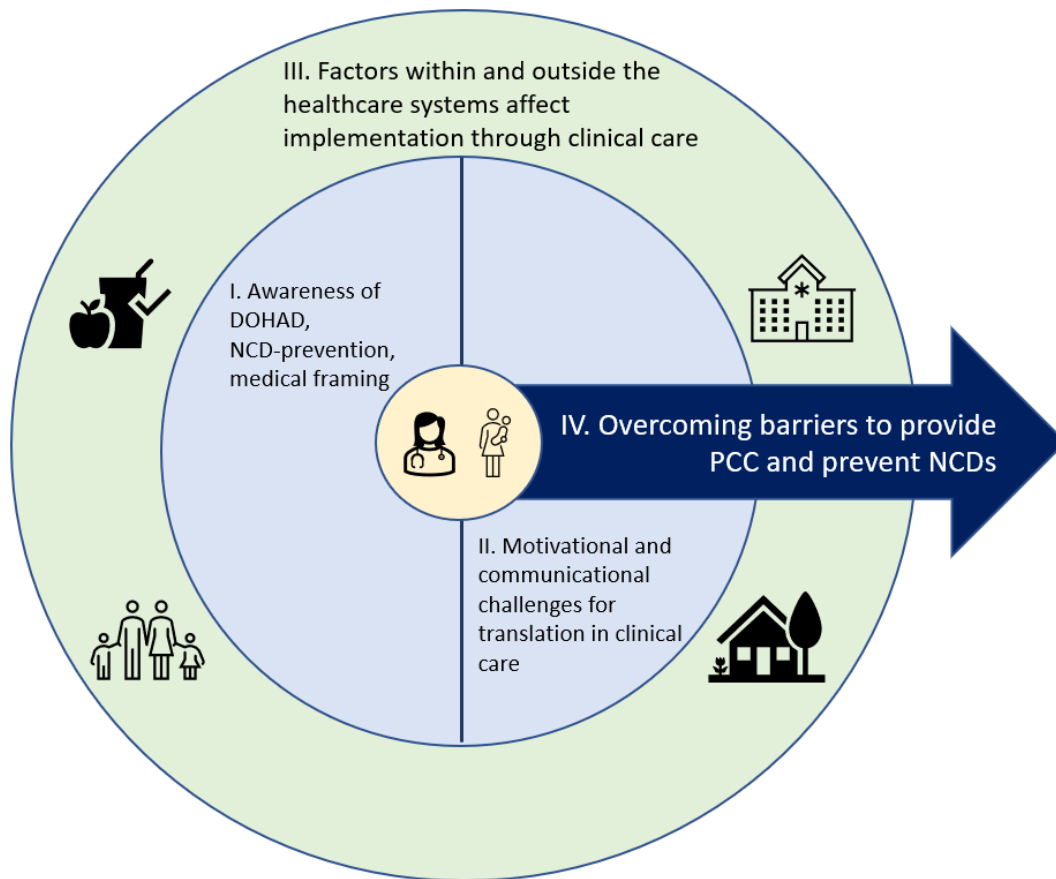
Figure 4.1   Thematic Diagram

4.4   Discussion

4.4.1   The current state of translation of evidence on NCD prevention through maternity care

This qualitative study explored if evidence from DOHaD and the life course approach underpins existing maternity care services in selected countries. Though only three countries were included in this study, as the overall thesis adopted a global approach, the findings have been

contextualised here with examples from multiple high and low-middle income countries to examine opportunities and wider barriers.

While the HCPs showed good knowledge and awareness related to risk factors for NCDs, intergenerational implications of DOHaD and preconception health, the translation into practice from bench to bedside appeared fragmented. In routine care, the focus was predominantly on short-term medical outcomes due to priority setting and current practice guidelines, increasing workload and time constraints in the healthcare systems. Similar issues were found in a study of general practitioners in Australia where time constraints, lack of resources and competing priorities influenced the delivery of PCC [253].

In contrast to the growing body of interventional and observational studies focusing on NCD prevention, no in-depth qualitative analysis of awareness and attitudes of HCPs towards DOHaD had been conducted at the time of inception of this study. However, a recent study by Molinaro *et al*. [272] (2021) examined how HCPs (OBGYNs, midwives, physicians and paediatricians; total n = 23) counselled patients about DOHaD-related outcomes, in particular intrauterine programming and future health. The Canadian study focused on DOHaD outcomes and inter-generational health as a concept, not limited to NCD prevention or PCC. The authors also added that non-modifiable factors such as age and family history should particularly be communicated without causing alarm – a finding similar to this study. Though HCPs found merit in translating the evidence through counselling the patients, they also questioned the value of communicating long-term effects such as childhood obesity or risk of diabetes in the baby to the mother, when the evidence was based on probability and not definitive, and some HCPs explicitly mentioned communicating to their patients that some risks (e.g., obesity) could be reversible. Studies have shown that knowing health behaviours in pregnancy could harm the fetus, could increase stress and anxiety in the mother.[273] Thus, such communication should be considered in the context of the effects of maternal stress on the unborn fetus and increased risk of depression and conducted without causing guilt or stress to the mother.[274] While the Canadian study provides complementary findings from a high-income multi-disciplinary perspective, this study further looked into the implementation of PCC and the perception of job roles of HCPs and how that affects the implementation in real-life settings.

Overall, HCPs agreed there was low awareness in the general public about preconception health (theme III) and how factors such as obesity can impact pregnancy. This affected healthcare seeking behaviours among people in the reproductive age group. A 2019 Canadian survey of pregnant women (n=330) explored knowledge of DOHaD in the general public along with

knowledge of guidelines related to pregnancy health.[275] The researchers found that women from higher socioeconomic status and older age had higher knowledge of DOHaD, which was assessed through questions on core concepts of DOHaD about early life and intergenerational health – with a focus on diet. In addition, better knowledge was also associated with higher diet quality (adjusted for sociodemographic factors). Respondents who were familiar with pregnancy health guidelines, showed low awareness of long-term risks and intergenerational risks, suggesting that though general guidelines are widely disseminated, the messages from DOHaD are not being communicated adequately. However, the survey was mainly completed by women from less deprived groups – similar to my findings in chapter 5.

HCPs endeavoured to implement PCC through routine opportunities when possible, such as visits post-miscarriage or adolescent health issues. However, the participants expressed several barriers to delivering PCC through maternity care, mainly related to unplanned pregnancies (globally) and practical issues related to healthcare services in Theme III. While pregnancy was viewed as a 'teachable moment' both in literature and by the participants, where women are motivated to improve their health behaviours, it is important to acknowledge that it is also a time when it can feel particularly difficult to change. For example, weight loss during pregnancy can be hard and is also not always recommended.[120] Given this, supportive interventions would have to take a wider focus outside maternity care services – some suggestions are detailed below in 4.4.3.

From a theoretical perspective, the study findings highlight that HCPs were considering elements of the biopsychosocial and socioecological approaches to health. Though their remit was limited in terms of providing action, HCPs act as trusted sources of information particularly before and after pregnancy. In figure 4.2, key factors discussed by the HCPs that influence NCDs in the perinatal period and preconception health are illustrated in the three domains of the biopsychosocial model of health.
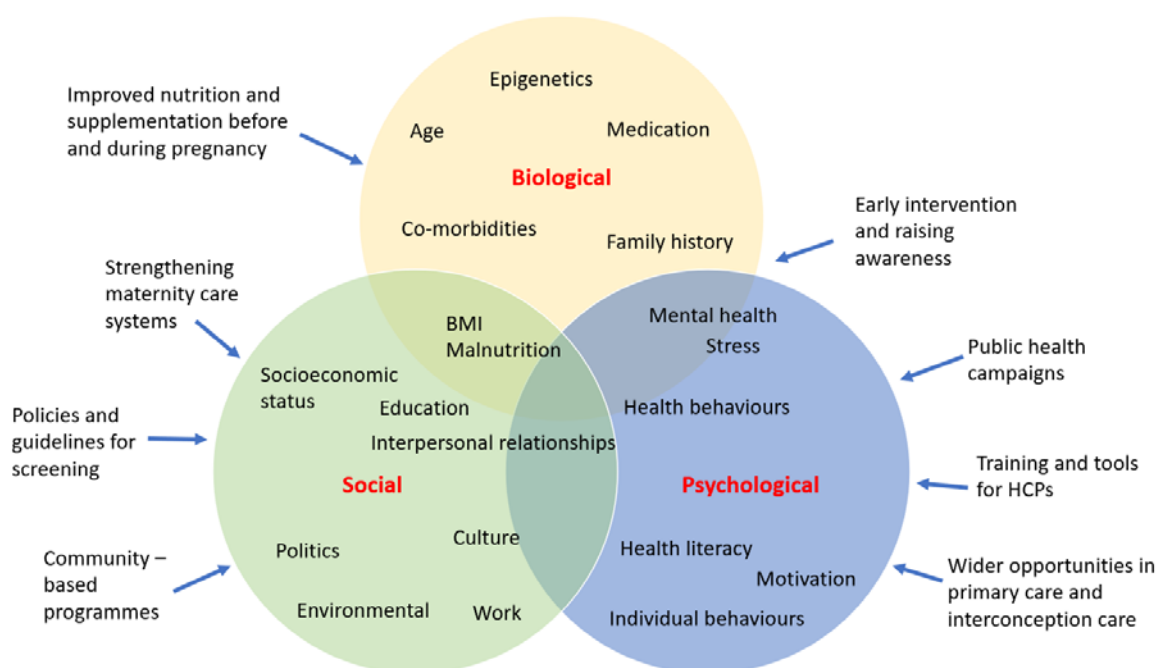
Figure 4.2 **Key factors discussed by the HCPs depicted in the biopsychosocial model of health In addition, suggested opportunities to address the modifiable risk factors in the three domains are also presented.**

Women and their partners live in an environment where biological, psychological (including factors affecting individual behaviours) and social factors exist as depicted in the diagram above. The recommendations provided in this chapter draw from this framework suggesting that systematic consideration of how these factors interact, through relationships, communities, wider policies affecting diet and the food environment is needed. An approach that includes the disciplines from medical and social sciences is thus needed when developing interventions for prevention of NCDs and improving health and wellbeing in PCC. An understanding of the person's relationship with their environment, society and networks was demonstrated, which researchers have called the "ecology of the sick person". [276] Such considerations of an individual's lived experiences and the wide determinants of health are crucial to development of strategies for DOHAD-implementation.

4.4.2 **Barriers and opportunities for engaging with women in the preconception period for prevention of NCDs**

Despite the mounting evidence on the importance of the preconception period, and the availability of clinical guidelines from international organisations such as WHO and FIGO, the translation of guidelines into clinical and public health practice remains inadequate. [210,277] HCPs in

this study expressed several barriers in the themes discussed above, but a key point was related to the task-shifting needed for other HCPs who are not part of the periconceptional continuum of care such as general practitioners and dietitians. While general practitioners have been considered the ideal stakeholders for discussing preconception risks, an Australian qualitative study showed that they too faced issues similar to the OBGYNs such as unplanned pregnancies, time constraints and competing priorities.[253] However, enabling factors were seen to be the availability of resources that could be used in waiting rooms such as checklists and handouts. Another challenge is the resources available to general practitioners. A systematic review of HCPs' perceptions of PCC services showed that while OBGYNs and midwives attempt to provide interconception care when patients present to them, physicians view PCC as a specialist service.[277] A scoping review of the implementation of guidelines for obesity prevention in the general population showed that recommendations for nutrition and weight loss are not regularly adopted by HCPs in primary care. [278] This is influenced by perceptions of HCPs (from hospital and community settings) of the causes of obesity, especially that it results from personal behavioural choice. Such attitudes were also seen in some of the discussions with the OBGYNs in the current study. Thus, a negative outlook regarding the effectiveness of behavioural interventions along with the HCP's understanding of the scope of their professional responsibility can also influence the delivery of PCC with a focus on obesity prevention. [252,278] The above findings call for a sensitive, patient-centred approach, described in detail in Section 5.6. incorporating findings from this chapter, and chapter 5

Though pregnant women were not included in this study, from the patient's perspective, a range of issues have been explored in literature that act as barriers to women approaching healthcare services. UK midwives emphasised the need to include hard-to-reach groups such as language minorities. Other studies from the UK focusing on ethnically diverse communities revealed that women (aged 18-45) had modest to poor awareness of existing services for PCC. Even among pregnancy planners, socio-cultural factors such as maintaining secrecy while trying to conceive and a preference for female professionals was raised.[279]

Contextual differences in the countries, affect the prevalence and presentation of DOHaD risk factors such as obesity and malnutrition. For example, the nutritional transition in India presented additional problems related to over and under-nutrition and micronutrient deficiencies such as Anaemia (discussed in Chapter 3). In India and South Africa, area of residence (urban or rural) can present difference to access to care, as well as health behaviours, mediated by several factors such as education and poverty.[280] The scenario in India presents complex layers of inequalities

including the urban-rural difference, as well as the inequalities within urban areas and stark differences in practices that were also seen between private and public sectors in India. A qualitative study of reproductive-aged women in rural India showed that though women know the importance of healthy dietary behaviours such as fruit and vegetable consumption for themselves and their children, several barriers such as household dynamics, cultural beliefs about foods to avoid during pregnancy, workload and affordability exist.[281] The status in urban slums in India was comparable where women consumed low quantities of leafy vegetables due to financial reasons and due to low decision-making power in their household.[282] Such findings illustrate how HCPs operate within complex systems influencing health and using the DOHaD concepts in practice would require a system-wide approach, getting beyond the clinical boundaries.

Several opportunities also exist to act through a range of stakeholders such as health visitors in the post-partum period and engaging with schools for adolescent health, discussed in the themes. The awareness of the relationships between the different domains in the model (figure 4.2) could support HCPs develop a sustainable care plan for pregnant women and potential parents. Models of delivering PCC in the community settings and through routine care have been explored previously.[111,210] Shannon *et al.* (2014)[210] presented four public health models of delivery based on a global review of existing modes of delivery, which can be considered by HCPs depending on their remit, influence and location in the continuum of care. The first universal primary care model is composed of opportunistic PCC through physicians, nurses and local pharmacies. The hospital-based care (presented in figure 4.3) provides the opportunity for health education, counselling and interconception care in particular. The final two models of specialised preconception clinics and high-risk outpatient care (also called community outreach) provide appropriate support for women who may have preconception needs different from the general population and required added support from the healthcare system for financial and human resources. The three key components of each model included – risk screening, education and intervention when indicated – discussed previously in Section 3.2.4.5. In summary, these models present a pathway for resourceful provision of PCC and overcoming barriers related to unplanned pregnancies.
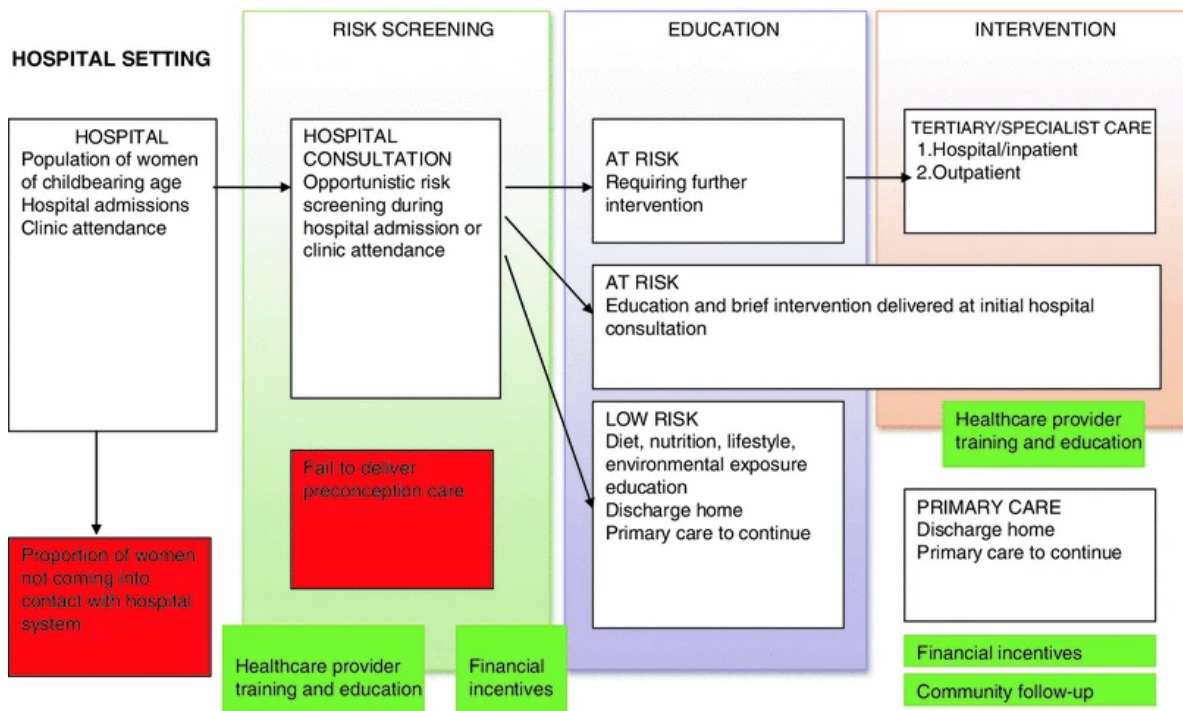
Figure 4.3   **Model of hospital-based PCC proposed by Shannon *et al* (2014). Figure produced with permission[210].**

4.4.3   Improving the uptake of messages through better communication

Sensitive and effective communication of messages from DOHaD research is key to improving the uptake of information by women and their partners. Midwives in this study stressed the need to avoid stigmatising conversations, particularly for weight loss and obesity prevention. Women have reported feeling stigmatised and offended after consultations, especially when the risks of obesity were discussed without offering structured support to address the issue.[283] A recent US-study of pregnant and postpartum women (online survey; n=501) found that almost one in five women reported experiencing weight stigma, with OBGYNs being the most cited source.[284] Such experiences can further lead to healthcare avoidance by the patient. [285] Lack of planned nutrition discussions during the consultation, low priority for lifestyle and weight management and a perceived lack of training and skills often hinder HCPs from discussing weight management, diet and physical activity with patients. [286] However, HCPs in maternity services are a group perfectly positioned to discuss preconception nutrition. Though a large proportion of women seek information related to nutrition on the internet, they consider clinicians as reliable sources of information and hence having conversations related to diet and lifestyle in the clinic can help overcome other barriers such as misinformation or poor quality nutritional information on the

internet. [287] In light of these findings, Chapter 5 explored issues related to discussion of nutrition further in routine practice.

In addition, the mere provision of information may not result in behaviour change. [288] In particular, research has found that viewing oneself as a 'healthy eater' (health identity of the women) and self-efficacy can predict healthy eating behaviour.[289] In addition, a barrier such as not weighing patients during pregnancy routinely (in the UK), could be overcome through self-weighing during pregnancy by the woman, which has shown some benefit in developing an action plan for gestational weight gain and empowering the women to take action.[290] This was based on a UK-study of 25 participants, many of whom expressed concerns related to lack of knowledge on ideal gestational weight gain and had experienced stress and anxiety related to their own weight gain during pregnancy. HCPs such as OBGYNs and midwives are thus key agents to address these issues and providing appropriate support for weight gain during pregnancy.

Several HCPs in this study, particularly OBGYNs, appeared to communicate their messages through one-way communication channels such as *"telling her to lose weight"* without setting specific goals. As the current study did not include observations of interactions, it is hard to evaluate if this was reflected in routine practice. The power dynamics between HCPs and the patients also differed in the discussions with midwives and OBGYNs. The former seemed more involved and aware of wider familial influences while developing plans and could reflect the influence of the training which includes a strong community-based focus. However, the sample size in this study and the distribution across job roles and countries makes it difficult to comment on what could cause this difference in the mode of communication. In this study, all UK participants were midwives and female, and whether the differences were due to cultural factors, gender or professional roles is not clear. Whether there is an effect of these dynamics on nutrition, weight management and DOHaD outcomes needs to be studied further.

Programmes for training HCPs in "Healthy Conversation Skills" show promise in supporting the initiation of conversations about the prevention of NCD risk and improving nutritional status at every interaction.[114] Some UK-based HCPs showed awareness of these techniques, perhaps due to being based in parts of England where the government's "Make Every Contact Count" agenda had been delivered by the Healthy Conversation Skills programmes. Recommendations for developing better communications skills through such techniques and training of HCPs are discussed in detail in Chapter 5 (Section 5.6) based on findings from the clinical care stream of this thesis to suggest a model that sues an empowering, patient-centred approach.

4.4.4   Implications for intervention development, policies, and future research

The findings of the present study have several implications and recommendations that could support HCPs, healthcare organisations such as ICM and FIGO in developing resources and continuing professional development programmes to increase the translation of DOHaD in practice. Some key points are mentioned below.

   i. **For healthcare professionals and international healthcare organisations**

- Medical curricula and training for recent evidence and how to communicate the evidence as non-deterministic is needed. DOHaD related knowledge also needs to be included and available through practice guidelines and recommendations by clinical organisations, as done in the recent FIGO guidelines for obesity. [120]

- A shift in thinking and action among HCPs for improving the health of future parents and children is needed to identify and act on opportunities related to PCC during routine visits. However, this needs to be done in a culturally sensitive and non-stigmatising manner.

- The expansion of existing primary care services for PCC will have cost-effectiveness implications for human resources. Further research is needed to understand the benefits, as well as make the case for investing in early life for healthcare decision-makers. In addition, such task-shifting to less specialised health workers have been successfully demonstrated e.g., for HIV prevention, child survival and immunisation programmes in LMICs.[291] A model to shift some of the PCC duties from maternity care to wider community-based health workers (e.g., accredited urban and rural social health activists in India), who have good knowledge of the socio-cultural context of the women could potentially address some of the barriers discussed in this chapter.

- As information-seeking behaviours are low especially in low-income settings, screening routinely though other interventions provides an opportunity. However, the acceptability of routine screening needs to be explored and this issue is partly addressed through the work in Chapter 5. Targeted screening and intervention for women with co-morbidities and other high-risk groups are recommended as discussed in figure 4.3.

  ii. **Individuals (women, partners, future parents) and households**

- In addition to the recommendations provided in Chapter 3 for intervention in the preconception period, this study adds to the evidence that the aims of behaviour change interventions should include the development of an enabling environment to address personal, familial, and community-related barriers. Due to lack of information and support, women in LMICs often turn to elder members of the family and community.[280] Thus included interventions that educate communities about good affordable nutrition for preconception,

pregnancy and post-partum and other risk factors for NCDs need to include male partners and community elders as key decision-makers, especially in LMIC settings, whilst taking and empowerment and person-centred approach.

- Studies in high-income settings have shown that both men and women often view fertility as a women's health issue, but male partners were overall open to improving their knowledge on fertility and childbearing.[292] Further research on male partners and factors influencing pregnancy planning in couples need to be explored.

- Finally, to support behaviour change in the pregnancy period, experts have recommended the development of interventions based on the COM-B model described in Chapter 2.

iii. Wider community and public engagement

- To address issues related to gender roles, knowledge and availability of healthy foods and create a societal shift in attitudes related to pregnancy planning and postpartum care a combination of community-based interventions and advocacy campaigns (e.g., for folic acid) are recommended. Knowledge of PCC and pregnancy intention are significantly associated with the utilisation of PCC and public health campaigns in LMICs and have been effective in improving knowledge related to risks such as smoking.[293] For the campaigns, careful framing of the messages will be required, explored in-depth in Chapter 7.

iv. Policies influencing health

- Few of the barriers discussed in this Chapter can be addressed by HCPs alone and needs to be met with top-down policy-making that considers the wider determinants of health such as an enabling food and built environment, health system strengthening. While healthcare during pregnancy is free in the UK and South Africa, the use of private maternity care facilities is increasingly seen in India even in rural and deprived communities[294] calling for better investment in the public sector and supporting the universal healthcare agenda.

4.4.5 Strengths and limitations

Qualitative methods were employed in this study as they are effective in capturing in-depth information on participants' perception and views on issues. The stakeholders selected were ideally placed to disseminate information related to DOHaD and NCD prevention in early life, though the secondary aim of integrating PCC could not completely be addressed through these stakeholders. Consideration of both high and LMIC-settings and OBGYNs and midwives enabled comparisons between contexts and how HCPs operate to disseminate the evidence from DOHaD. Social desirability bias was reduced to a great extent as interviews were anonymised and participants spoke freely during the interviews. Additional methods were taken to ensure

transparency and reflexivity. Double-coding was conducted during the analysis to ensure consistency, maintaining a constant reflective process for bias. To reduce the effect of bias, I have described my epistemological position informing the study from the onset. Though I did not have an observer overseeing the interview, as they were conducted via telephone, the transcripts of the initial interviews and pilots were discussed with the supervisors for feedback related to tone, nature of follow up questioning and the discussion guide was also modified. Field notes were maintained during and after the interviews, and I transcribed all the interviews, which helped with immersion in the data. Findings have been reported comprehensively and unambiguously using the COREQ checklist Appendix B.4. [295] The above steps help in reducing the potential for bias that could arise if the study is analysed by a single researcher.

However, findings of the study need to be considered in the context of some limitations. The small sample size and lack of saturation of data collected is an obvious limitation. While care has been taken to include a diverse sample, the findings may not be easily extrapolated to all countries. Because the HCPs in this study volunteered to participate on invitation, they may have had a higher degree of interest in PCC compared with those who refused, thus limiting the generalisability of the findings. Furthermore, the patient-level barriers were expressed through the HCP's gaze. Though the HCP-patient relationship means the patients often express their barriers freely, further research to understand patient-level barriers is needed. The potential language bias in the selection of participants is acknowledged as interviews were conducted in English, though the option for speaking in selected Indian languages in which I am fluent was provided to the Indian participants. Study findings have not been sent back to the participants for input. Overall, the results will help develop programmes that can lead to a shift in thinking and action among HCPs for improving the health of future parents and children globally.

4.5   Conclusions

This chapter, comprising qualitative data from interviews of HCPs based in three countries has identified how clinicians try to communicate messages from the DOHaD field to their patients (expectant mothers). Insights on the barriers (provider and patient-level) affecting the uptake and implementation of PCC are also described. Messages from DOHaD have far-reaching public health implications that can be supported by HCPs to an extent. However, given the range of risk factors that affect preconception health and models of maternity care in each country, developing a single best model for HCPs in all countries is difficult, and tailoring the implementation to the local healthcare system will be necessary. OBGYNs and midwives rarely meet women in the

preconception period, particularly if they are not actively planning a pregnancy. However, the antenatal, in particular early pregnancy period, is still very much an important period to intervene and prevent issues such as neural tube defects, and excessive gestational weight gain. Considering that women often present to HCPs towards the end of the first trimester, or late in pregnancy in LMICS, maternity care HCPs still need to be part of the conversation on DOHaD translation through clinical practice. However, better support of HCPs through training and provision of checklists are needed along with an attitude shift in current clinical care to establish that all HCPs meeting reproductive-aged women and adolescents play a role in the PCC agenda. Efforts to strengthen health systems and provide a continuum of care from preconception, through pregnancy and interconception care are recommended and must be complemented by wider public health initiatives to shift societal attitudes towards pregnancy preparation and prevention of NCDs. None of these can be successful without supportive policies for NCD prevention, particularly addressing the inequalities discussed in this chapter and involving wider stakeholders such as ministries of health, international organisations and schools.

Implications of the findings from this study for subsequent chapters

As DOHaD research addresses several sensitive issues related to gender and weight, the implementation of the concepts should take into account the social and cultural contexts that influence decisions related to health and the acceptability of such recommendations among the general public. The information gathered in this chapter provided a foundation for the acceptability study of a nutrition screening tool for reproductive-aged women which was conducted in parallel in the UK (Chapter 5). Since the context of the setting and healthcare systems can significantly influence practice, Chapter 5 focused on the UK to develop actionable recommendations for screening for nutritional status and pregnancy intention routinely. To address some of the shortcomings related to data collection during this study, Chapter 5 included open-ended questions to collect detailed responses on preconception risk factors and nutrition. The conclusions of this chapter also included a multistakeholder approach which is explored further in chapters 5 and 7 and the medical framings used for communicating messages are explored further in Chapter 7. Finally, findings also influenced the development of an eLearning module on PCC for HCPs (described further in Chapter 8).

Chapter 5 Testing the acceptability of a nutrition checklist to improve women's nutritional status and prevent excess gestational weight gain and routine screening for pregnancy intention among women in the reproductive age group, midwives and OBGYNS in the UK

5.1 Introduction

Through interviews with key stakeholders in maternity care (midwives and OBGYNs), Chapter 4 showed the barriers faced by HCPs in engaging with women in the preconception period and in discussing nutrition and NCD-related subjects with those who were planning to conceive or were pregnant. The findings highlight the opportunities in broader primary care services such as general practice, dietetics, and pharmacies for delivering PCC. Similarly, the issues related to communication and lack of resources or training also call for the development of both patient- and practitioner-friendly tools to support discussion of nutrition and preconception health and to assess risk factors for NCDs. Wider stakeholders who are often not engaged in the discussion about NCD prevention in the first 1000 days and PCC were also identified in the policy analysis that was conducted in parallel with the survey work (Chapter 8).

This section begins with an introduction to the FIGO nutrition checklist,[230] (designed for use before conception and during early pregnancy by OBGYNs globally) the modifications made to develop a UK-specific checklist for this study, followed by an overview of universal preconception screening as a method to support healthy pregnancies.

In Chapters 1 and 3, the risks of obesity before pregnancy and excessive gestational weight gain during pregnancy were discussed. International organisations have recommended a varied and healthy diet as the first step to meeting the nutrient needs of adolescent girls and young women in the preconception period. Their diet should provide an adequate intake of key nutrients such as protein, iron, calcium, vitamin D, folic acid and iodine.[230] Preconception checklists, handouts and tools for women that explain PCC, available for example in the clinic waiting room, can improve preconception consultation, and were discussed in Chapter 4.[253] However, this raises the question

of whether such a checklist or tool will be acceptable to women and clinicians. This was studied in the UK context.

5.1.1 The FIGO nutrition checklist

The nutritional risk assessment checklist[296] was developed by the Pregnancy and NCDs Committee in FIGO in 2015.[228,229] The checklist was designed to be a user-friendly tool for HCPs assessing nutrition in women planning pregnancy and in early pregnancy, so that dietary and gestational weight gain recommendations could be discussed at each visit. Moreover, nutritional supplements could then be offered to women who needed them, along with a referral to diet and weight management services if appropriate. Thus, the checklist aims to support the early identification of nutritional issues in pregnancy (or before) and support the prevention of conditions such as gestational diabetes.

Using the UK as the setting, I designed a study to understand if a simple nutritional risk assessment checklist that can be used in the outpatient setting is perceived as useful and acceptable to women of reproductive age as well as to clinical stakeholders who meet pregnant/ preconception women. I also explored if tools similar to the FIGO nutrition checklist are being used in current maternity practice, and so whether the nutrition checklist is a suitable tool to initiate and facilitate conversations about nutrition. This study fits into the broader aim of my PhD studies to integrate PCC in the NCD prevention agenda, by developing tools that can be used by HCPs.

The checklist has been tested in Ireland with evidence suggesting that it helped initiate a discussion on nutrition during consultations and identified women with nutritional issues.[229] The pilot feasibility study in Ireland was conducted in 106 pregnant women and three HCPs (OBGYNs) in the National Maternity Hospital in Dublin. I was involved in the design and analysis of that pilot study. However, it only aimed to assess feasibility and did not include the wider research questions about preconception and barriers to discussing nutrition that are included in this Chapter. Moreover, my PhD explores issues about the use of such a checklist in practice, when clinical consultation times can be short, and the issue of incorporating it in PCC. Hence a wide range of clinical stakeholders and women in the reproductive age group irrespective of pregnancy status will be included here (detailed criteria below). The reliability of the checklist has also been tested in comparison with validated food frequency questionnaires, suggesting that it can be effectively used to identify women with a suboptimal diet before and during early pregnancy.[228] In a recent Italian study, the FIGO checklist was used to develop a 'periconceptional nutritional

score' as a measure of adherence to a healthy diet. A higher score was associated with better pregnancy outcomes such as gestational age at birth and showed a significant association with measures of placental development.[297]

5.1.2   Routine Universal Preconception screening

Though several organisations have included recommendations for routine nutrition screening in pregnancy, and routine discussion of pregnancy intention for women in the reproductive age group in order to address unmet reproductive health needs discussed in Chapter 1,[298-300] it is not clear whether public opinion and patient and public involvement (PPI) were included in the design of such recommendations. Furthermore, some studies have questioned the effectiveness of such screening and counselling to support pregnancy planning, for example on maternal and infant outcomes for women on anti-epilepsy medication.[301] As this chapter also focused on understanding wider public opinion about routine preconception screening, I also assessed through the survey the acceptability of routine discussion of pregnancy intention and preconception health and possible reasons for refusal to discuss them through the survey.

5.2   Research questions

The broad aim of this chapter is to determine if a specifically designed checklist for nutrition before and during pregnancy is considered an acceptable tool by women and HCPs in the UK to facilitate discussions around perinatal nutrition (which includes the period before during and immediately after pregnancy) and intentions to conceive (called pregnancy intentions throughout this chapter).

The following specific questions were addressed:

For women in the reproductive age group:

1. Is the specifically designed checklist for nutrition in pregnancy considered an acceptable and comprehensible tool by women?

2. What were women's experiences of discussing nutrition-related topics during pregnancy with their midwife/ OBGYNs or other HCPs?

3. What were women's opinions on discussing nutrition-related topics routinely, even when not pregnant?

4. Are the specifically designed questions for initiating a discussion on preconception health considered acceptable by women in the UK and what are women's perceptions about being asked about pregnancy intentions routinely?

For HCPs:

1. Is the specifically designed checklist for nutrition in pregnancy considered an acceptable tool by HCPs to facilitate discussions around nutrition with pregnant/ preconception women?

2. What are the practice, habits, and experiences of UK-based HCPs regarding nutrition and gestational weight gain for pregnant women?

3. What are HCPs' views on asking about pregnancy intentions in all women in the reproductive age group during routine visits?

Overall, this study, combined with the two studies in Chapters 4 and 7 will contribute to the broader aim of this PhD to develop recommendations to prevent NCDs across the life course through action in the preconception period. In addition, it will also explore potential barriers to the implementation of preventive interventions.

5.3   Methods

5.3.1   Study design

Two online cross-sectional surveys were conducted, one for women in the reproductive age group (Feb-June 2021) and HCPs (Sept-Dec 2021). Ethics approval was obtained from ERGO University of Southampton for the women's survey (ERGO 61724.A2.R4) and HRA for HCPs (ERGO: 61736; NHS REC reference: 21/HRA/3972).

Though initially planned as a pilot study to evaluate the feasibility and acceptability in the Princess Anne Maternity Hospital in Southampton (similar to the study conducted in Dublin by Killeen *et a*l. 2020),[229] due to COVID-19 restrictions, workload of the HCPs and the subsequent delays caused to the PhD, it was decided that an online survey would be conducted to test the acceptability of the FIGO nutrition checklist in the UK. In addition, representatives from the UK Royal College of Midwives also provided comments on the contents of the checklist, discussed in the results.

5.3.2   Participants and sampling

Inclusion criteria for the women's survey:

- Women living in the UK irrespective of pregnancy status

- Aged 18-45

This age group was selected to include women who may have recently been in contact with perinatal services or are planning a pregnancy, and to include the preconception population who may not be planning a pregnancy.

Inclusion criteria for HCPs:

- HCPs currently practising in the UK who come in contact with women in the reproductive age group (including but not limited to midwives, OBGYNS, registered dietitians, health visitors and GPs)
- Working in a clinical or community setting

Findings from the interviews in Chapter 4 highlighted that clinicians in maternity care may not always meet preconception women during routine practice and the stakeholders they recommended were used for the selection of HCPs in this study. Family physicians and other practitioners (e.g., dietitians, pharmacists, health visitors) meeting prospective parents can also contribute to good quality PCC, which is essentially good quality women's health care, and is an integral part of primary health care. [302] Hence, the definition for HCPs adopted was broad. Dietitians are actively involved in preconception health and could provide valuable information on the contents of the checklist. Health visitors were included as they could potentially support interconception care. The broad definition supported inclusion of other clinical stakeholders with potential to support interventions in the preconception period e.g., pharmacists. To my knowledge, this was the first study to approach such a wide range of HCPs for their views on PCC in the UK and to assess the FIGO nutrition checklist.

The samples of HCPs and women were limited to the UK as I aimed to develop a UK-specific FIGO checklist as an output of this study. In addition, work practice, and differences in health systems and diets can act as barriers to the development of global recommendations as discussed previously. To support participation rates and as a token of appreciation, participants were offered a chance to take part in a prize draw to win an Amazon voucher.

5.3.3   Sample size

As this was a pilot acceptability study to estimate the proportion of women who would find the checklist useful, a sample size calculation was not done. No effect size for acceptability of the checklist has been considered before, so a sample of 500 women was initially targeted. To derive this number, we assumed the prevalence of knowledge and acceptability of the checklist would be 30% among 500 participants - which would provide a 95% CI of 26% to 34%, and this was considered to be sufficiently narrow to be informative. A smaller sample size would result in wider confidence intervals with a larger margin of error. However, after four months of wide dissemination and advertising (details in recruitment section below), the survey was stopped after a sample of 251 valid responses was achieved. For the HCPs, a convenience sample of 100 HCPs was targeted and a snowball strategy was adopted. However, after dissemination 47 responses were received and the survey was closed in Dec 2021. Considering low participation rates during the pandemic period (details in section 5.6.3) this was considered a reasonable and pragmatic sample size for both groups for a descriptive pilot study, though I had to accept that the confidence intervals around all estimates would be wider than intended, and that some statistical tests might not be possible due to small numbers in certain categories.

5.3.4   Development of study materials

5.3.4.1   Modifications for the FIGO Nutrition Checklist

As the original FIGO checklist was developed for a global audience, the checklist was first modified based on UK-dietary guidelines and clinical recommendations for obstetrics and antenatal care suggested by NICE. These included adding a question on exercise on page 1 and modifications to the micronutrient guidelines on page 2. As discussed in Chapter 2, co-creation of tools and resources for HCPs was a key component of this project, and hence I discussed the checklist with the midwifery team at the Princess Anne Hospital in Southampton and with two UK-based registered dietitians, to ensure the new checklist would be appropriate for piloting in the UK-acceptability study. The modified checklist is presented in figure 5.1 and 5.2 below.

NUTRITION CHECKLIST FOR PRE-PREGNANT/ EARLY PREGNANT WOMEN

Good nutrition in the mother, both before and during pregnancy, is important in ensuring healthy outcomes for her and her baby. In a clinical setting, the questions below would be completed by a woman in conjunction with her healthcare professional (e.g. midwife) to assess whether her nutritional intake is sufficient, and provide a basis for the health care professional to advise where changes need to be made (if applicable).

1. DO YOU HAVE ANY SPECIAL DIETARY REQUIREMENTS (E.G. VEGETARIAN, VEGAN, ALLERGIES)? IF YES, PLEASE LIST BELOW:

....

2. WHAT IS YOUR:

a. Weight .... kgs
b. Height .... m
c. BMI .... kg/m2 (Health care professional to complete): Divide weight in kg by height in metres then divide the answer by your height again to get your BMI.

3. QUALITY OF DIET

i) Do you eat meat or chicken 2-3 times per week? Yes / No

ii) Do you regularly eat more than 2 – 3 portions of fruit or vegetables per day? Yes / No

iii) Do you eat fish at least 1-2 times per week? Yes / No

iv) Do you consume dairy products (such as milk, cheese, yogurt) every day? Yes / No

v) Do you eat whole grain carbohydrate foods (brown bread, brown pasta, brown rice or other) at least once a day? Yes / No

vi) Do you consume packaged snacks, chocolates, biscuits, cakes, pastries or sugar-sweetened drinks less than 5 times a week? Yes / No

4. OTHER

i) If you are pregnant, did/do you take folate/folic acid supplements in pre-pregnancy and in early pregnancy (first 12 weeks)? Yes / No

ii) Do you get regular exposure to the sun (face, arms and hands for at least 10-15 mins per day)? Yes / No

iii) Has the doctor/nurse tested your haemoglobin (level of iron in the blood)? Yes / No
(Health care professional to complete) If yes, is it more than 110 g/l? Yes / No Enter the value: ....

5. EXERCISE

Do you exercise less than 3 times per week? Yes/ No
(this could be, for example, 30 minutes of brisk walking)

If you have answered No to any of the questions in section 3 or 4 your nutritional status may need to be assessed in more detail.

Figure 5.1   Page 1 of the FIGO Nutrition checklist

ADDITIONAL DETAILS FOR THE HEALTHCARE PROVIDER

1. A healthy BMI is usually considered to be between 18.5–25 Kg/m2, although this depends on age and geographical region.

2. For women who are not pregnant, counsel on achieving a healthy weight before conceiving.

* For pregnant women provide indications for appropriate gestational weight gain according to pregravidic BMI (see right). This may vary according to local contexts.

Pre-pregnancy BMI category	Total weight gain (kg)	Rate of weight gain 2nd and 3rd trimester (kg/wk)
Underweight <18.5 kg/m²	12.5 - 18	0.51 (0.44 – 0.58
Normal weight 18.5-24.9 kg/m² weight	11.5 - 16	0.42 (0.35 – 0.50
Overweight 25.0 – 29.9kg/m² weight	7-11.5	0.28 (0.23 – 0.33
Obese >30kg/m²	5-9	0.22 (0.17 – 0.27

From 2009 Institute of Medicine guidelines on gestational weight gain: https://www.nationalacaden org/hmd/~/media/Files/Report%20Files/2009/Weight-Gain-During-Pregnancy-Reexamining-the-Guidelines/Report%20Brief%20%20Weight%20Gain%20During%20Pregnancy.pdf

3. Q 3. i. is to assess whether vitamin B12, iron and protein intake is sufficient.
4. Q 3. ii. is to assess whether intake of antioxidants, micronutrients and fibre is sufficient.
5. Q 3. iii. is to assess whether intake of omega 3 / omega 6 polyunsaturated fatty acids, vitamin D and iodine is sufficient.
6. Q 3. iv. if the patient answers No to this question, calcium supplementation should be considered.
7. Q 3. v. and vi. – if No, discuss how the woman could increase intake wholegrains and reduce processed sugar in their diet.
8. Q 4. i. if not taking a folate supplement suggest a folate supplement (dosage below)
9. Q 4. ii. if the patient has little sun exposure or has dark skin, remind them about the recommended Vitamin D supplementation in pregnancy.
10. Q 4. Iii. if Hb < 110 g/l suggest an iron supplement. This cut off may vary according to local contexts.
11. Health care professionals should consider any foods available in their country which are considered unsafe for pregnancy.
12. As well as the questions in the questionnaire, health care professionals should assess whether any other potential unsafe aspects of the woman's lifestyle should be counselled on, such as smoking, alcohol, recreational drug use, or lack of physical exercise

PROFESSIONALS INVOLVED: MIDWIVES, OBSTETRICIANS AND GYNAECOLOGISTS, GENERAL PRACTITIONERS, NUTRITIONISTS/ DIETICIANS, COMMUNITY HEALTH WORKERS, NURSES.

PRE-PREGNANCY – WHEN PLANNING A PREGNANCY

Assessment considerations

-Diet Composition
-Physical activity
-Height, weight, BMI
-Obesity risk (waist circumference and other anthropometric measures)
-Anemia
-Risk of specific nutritional problems:
-Folate, Iron, Calcium, Vitamin B12, Vitamin D

Discussion points

-Importance of a healthy diet and exercise
-Problems of sedentary behaviour
-Risky behaviours and exposures – Tobacco, alcohol, recreational drugs, environmental toxins
-Chronic disease screening and management
-Supplementation folic acid (400mcg for all women preparing for pregnancy, and 5mg daily for omen at higher risk of NTDs (e.g. BMI>30, diabetes and epilepsy)
-Other nutrients (Iron, Iodine, Vitamin B12)

DURING PREGNANCY

Assessment considerations

- Diet Composition
- Physical activity
- Height, weight, BMI
- Obesity risk (waist circumference and other anthropometric measures)
- Gestational Weight Gain
- Blood Pressure
- Risk of specific nutritional problems (low nutrient density or high calorie intake)
- Deficiencies from specific diets or under nutrition
- First Trimester: Folate, Vitamin B12, Iodine, PUFAs
- Second and Third Trimesters: Iron, Iodine, Calcium, folate, B vitamins, Vitamin D
- Energy intake (+200 Kcal/day), PUFAs

Discussion points

Dietary counselling
Safe levels of exercise
Sedentary time
Weight management and gestational weight gain
Risky behaviours and exposures – Tobacco, alcohol, recreational drugs, environmental toxins, sources of food borne infections
Pregnancy complications screening and management (GDM, Blood pressure)
Supplementation:
- Folic acid (400mcg through first 12 weeks)
- vitamin D supplement (10 micrograms per day)
- Other nutrients as required

THIS DOCUMENT HAS BEEN ADAPTED FROM THE FIGO NUTRITION CHECKLIST BASED ON UK NUTRITIONAL GUIDELINES FOR PREGNANCY AND PRECONCEPTION

Figure 5.2   Page 2 of the FIGO nutrition checklist adapted based on UK guidelines

5.3.4.2   Development of survey questionnaire

Building on the questionnaire used in the Dublin feasibility study in 2020,[229] two new questionnaires were developed for this study. Two participant information sheets were also designed which were shown on the front page of the online survey when participants clicked the link. As per Faculty Ethics guidelines for electronic surveys, a consent statement was provided at the end of the information page and agreement to this had to be provided before the participant could progress to the survey. The full questionnaires for each group are provided in Appendix C.

The questionnaires contained open-ended and closed questions (a mixture of 5-point Likert scale questions and other option-based questions) in four sections for each target group. Postcode data was collected (although participants could choose not to provide this) for analysis as they provide more detailed information on deprivation and socioeconomic status than "region". Studies have shown that dietary behaviours, health literacy and obesity are associated with ethnicity, educational status and socioeconomic status.[303,304] Cultural practices also influence dietary habits during pregnancy.

Based on recommendations from review during the ethics applications and to encourage completion of the survey (due to length/ time taken) the questions were not mandatory. For ease of completion, branching and logic on the survey platforms were used as far as possible so that questions irrelevant to certain groups would not be presented to them. For example, the question "I have tried to make changes after my last pregnancy (e.g., lose weight, eat more healthily)" was only presented to the post-pregnancy group. Similarly, questions in on visiting HCPs were relevant only to women who answered that they had met a clinician for reasons related to pregnancy/ pregnancy planning. I collected different demographic questions for women and HCPs as relevant to the study and to avoid collecting data that would not contribute meaningfully to the research questions. The questions presented to the HCPs were also informed by the interviews and document analysis work conducted in parallel, and hence the survey questions for the two groups were not identical.

As the aim of this chapter within the wider framework of my PhD is to develop an acceptable and usable tool and recommendations for further work, it was decided that developing an overall "acceptability score" that would sum the scores provided by each question would not be useful. Instead, the negative and positive attributes of different aspects of the checklist were carefully examined to develop a conceptual model of care that would support HCPs and women to have

better conversations about nutrition and preconception health, as discussed in the final Chapter 8.

5.3.4.3   Pilot testing of survey and questionnaire

The questionnaire was reviewed and piloted by experts from the field of OBGYN (1), midwifery (3), health psychology (2), nutrition (2), and nursing (1) (including the supervisory team) and FIGO team and peer-reviewed twice during the University and NHS ethical approval processes, after which the questionnaire was finalised. Comments received during the piloting and review phase included those about ease of completing the survey, and issues relating to the questions to ensure clarity and appropriateness for capturing the data required.

5.3.5   Setting

Both surveys were uploaded online on Microsoft Forms. After the demographic questions, the checklist was presented, and the participants were instructed to read both pages of this before proceeding with the survey. They were also instructed not to complete the checklist but were presented with the option to download it for personal use/ information if they wished. For the women's survey, after the first month the survey platform had to be changed to the online platform Survey Sparrow. This was done as Microsoft Forms did not support the inclusion of pixels for tracking data required to launch the online adverts effectively via Facebook. An ethics amendment was completed to proceed. To reduce human error and recall bias, even though logic was included in the software to prevent respondents who had not met an HCP from answering certain questions in the survey, an option was included in addition to the Likert scale for "not applicable".

5.3.6   Recruitment and data collection

For both surveys, a mixture of convenience, purposive and snowball sampling was used to reduce the limitations of each method and get a wider representative sample across the UK. The survey was predominantly disseminated via social media, followed by other professional networks (for HCPs), charitable organisation's newsletters (e.g., Diabetes UK), websites etc.

Flyers with a link/ QR code to the survey page were developed separately for each target group. I developed the online page, managed the social media pages, and carried out the dissemination, data collection and advertisements on social media for the survey. An independent marketing expert (*Caribbean Collective*) was recruited to set up the algorithm for the adverts on Facebook

(only for the women's survey) and design the infographics. However, this person did not have access to the data being collected. Detailed social media and dissemination strategy is described in Appendix D.

5.3.7 Analysis

5.3.7.1 Quantitative statistical analysis

For women's survey:

Data cleaning and preparation

The quantitative data gathered from the online platform were entered into an SPSS data file (IBM Statistics V.28). Incomplete responses were included only if they had completed at least one of sections 2/3/4 in full (Appendix C) along with pregnancy status and other key demographic variables. All participants were given an ID number from 1001-1251

New categorical variables were created for analysis as follows:

- Postcode data were converted to Index of Multiple Deprivation (IMD) ranks and deciles[305] and later recoded into quintiles to explore associations between demographic characteristics and nutrition and health behaviours. The IMD is the official measure of relative deprivation for small areas developed by the Ministry for Housing, Communities and Local Government (MHCLG). The national deprivation deciles rank all Lower Super Output Areas (LSOAs) in England from the most deprived (rank 1) to least deprived (rank 32,844) and then divide them into ten categories (deciles) across the whole of England. Deprivation deciles are often used to examine the experience of individuals, families, or communities in terms of the level of deprivation of the area in which they live. For the final variable, IMD quintiles were derived with Quintile 1=most deprived and 5 =least deprived.

- A new variable on pregnancy status (3 categories of preconception, pregnant and up to 2 years postpartum) was developed based on the information provided in Section 1 and the subgroups used in the analysis. This was to get an overview of the different stakeholders (clinical) that the women had met for nutrition and pregnancy-related reasons and to explore any differences in acceptability. New categorical variables for age groups, medical conditions (Yes/ No) and 'Planning a pregnancy' (Yes/ No/ Not thought about it) were also created (the latter for preconception subgroup only).

Though the preconception subgroup could include women who were more than two years postpartum, the data on past pregnancies were not collected. This was done as I aimed to evaluate the most recent practices of the healthcare system.

Statistical analysis

The background sociodemographic information collected was used to describe the overall characteristics of the sample. Throughout the results section 'N' denotes the total valid number of participants included in the analysis and 'n' depicts the frequencies for the variables being described. Valid percentages are presented in the findings for questions with missing data. Cross-tabulations for all independent variables and outcome variables were conducted and key findings are presented in the results in the form of tables or figures as appropriate. The cross-tabulations were also carefully examined for performing Chi-squared tests, but the expected numbers in each cell for different groups were often too small for such tests to be valid. The background characteristics were considered as independent variables and the Likert scale questions (made binary as discussed below) as outcome variables. Data from the overall Likert scale were treated as ordinal. A simple binary logistic regression was conducted to explore the relationship between all independent variables and two outcome variables developed for the following questions on the checklist:

1. The checklist will be easy to complete in a waiting room Y/N
2. Overall, the information on both pages of the checklist will improve discussions of nutrition with a healthcare professional Y/N

These two questions were selected as they summarised the overall acceptability of the checklist. In addition, it was not believed to be useful to explore the demographic characteristics with questions such as style and content. Logistic regression analysis was done for the full sample, as the sample size was too small for subgroup analysis by pregnancy status. Though various combinations of independent and outcome variables were tested for statistical significance by regression analysis and the Chi-square tests, the results were not informative due to the small sample size. Significance levels were checked along with 95% confidence intervals. Analysis due to small numbers in cells was often non-informative or with extremely wide confidence intervals, but all variables were explored. For these reasons, this chapter only presents the descriptive results in detail and key findings of the regression analyses are reported where differences were apparent.

The study was limited by the logic and presentation of the software platform, and hence some questions in included a 'not applicable' response for women (particularly in the preconception

group) who may not have seen an HCP for pregnancy/fertility related reasons. These results are included below in the analysis as a separate category. As only a few women reported having special diets and pre-existing conditions, they are presented in the descriptive statistics but not included in the analysis.

Rationale for selecting the Likert scale and analysis

The Likert scale is a commonly used and validated psychometric tool in health and social sciences to quantify traits such as outlook, perceptions, and attitudes.[306] For this study, I chose to use a symmetric Likert scale which positioned "neutral" in between the two extremes of strongly disagree and strongly agree as I perceived value in collating responses of neutrality and treated the responses as an ordinal scale (choices are arranged in ranking order). In addition, I did not aim to combine the responses to generate a composite score, often done for analysis using Likert as an interval scale. Thus, the items on the scale signify a "greater/lesser than" relationship, but the scale does not capture how much greater/lesser.[307] Additional analysis for ordinal scale items such as regression and Chi-square measures for associations were also attempted.

Research has shown that a neutral response could mean indifference to the topic of research under study. It may also be selected by participants who feel it to be less confrontational than "disagree" (social desirability), or who are hesitant.[308,309] However, studies also report that people may be more honest in surveys when anonymity is ensured.[310] Researchers have also used versions of the scale deleting the neutral response or treating the neutral responses as missing values during analysis.[307] However, the latter would reduce the sample size further and I retained it for this study to get a comprehensive overview of respondents' attitudes towards the topic.

For descriptive analysis and inferential statistics, the data from the Likert scale questions were transformed into binary variables. However, in the results, findings from Likert scale questions are first presented with all categories in the figure, followed by a discussion on agreement or acceptability in binary form. Neutral responses for this study were included in the "disagree and strongly disagree" groups as it was considered inappropriate to assume that respondents who answer "neutral" would accept the checklist or other questions related to nutrition or preconception. The responses were also examined visually and compared with the open text responses, which suggested that the women who answered "neutral" may have not indicated strong support for the checklist in their responses. This dichotomisation was only performed to check for associations between background characteristics and acceptability of the checklist. The findings of the inferential statistics are presented in the context of these limitations and the low

sample size. However, I do acknowledge that the practice of dichotomising quantitative variables after data collection is not widely recommended [311] as it could lead to inaccuracies in results and reduce the value of steps taken to reduce measurement error while designing the questionnaire.

HCP survey

As the survey participant numbers were low, only descriptive statistics are presented for this group, similar to the women's survey. During the survey, the checklist was also sent to the Royal College of Midwives (UK) for comment, and their response (sent via email) was included in the content analysis for this Chapter. The main subgroup divisions were based on job roles.

5.3.7.2 Procedure of content analysis

The rationale for content analysis was discussed in Chapter 2. Though the three open-ended questions in the survey were part of the same study, responses to the data warranted separate analysis and so three coding frameworks were developed. This also helped in assessment of the diversity of categories within each question. The content analysis was conducted using Robson's Six step framework in the three phases of preparation, organisation and reporting as discussed by Elo and Kyngäs (Appendix E).[312] During the preparation phase, I first familiarised myself with the data by reading the responses multiple times, followed by repeated comparisons of the text.[313] The inductive content analysis was broadly done by open coding, and categorisation followed by abstraction.[314] Coding and categorisation were conducted during the organisation phase and initial descriptive codes were developed and later used to code subsequent responses. The codes were later combined according to meaning into sub-categories and finally into categories. To test the clarity of any category/ code definitions, the codes were tested on samples of text by a second reviewer and refined after discussion. Finally, in the reporting phase, the findings were described by each key category identified with a summary and example of the final sub-categories inductively.

Qualitative experts have suggested that information pertinent to the research question should be identified and separated from content that is irrelevant during the initial checking of data. The number of relevant responses is reported for each framework as the "number of valid responses" that were coded. Content areas left uncategorised were either not related to the research questions, had vague responses, or did not contain a meaningful unit of information. [315] Codes that did not appear frequently enough were not excluded but were merged in a meaningful way with a related code or added into a separate category of "other or additional points raised". I have presented the code counts in the Appendix F for transparency, however, I do not claim that

it is representative of the prevalence of acceptability had the survey been conducted in a larger group nor have I assigned weightage to the categories based on these counts.

5.4 Results from survey of women in the reproductive age group in the UK

5.4.1 Participant characteristics

Of 257 responses to the online survey, a total of 251 were included in the final analysis. Six participants were excluded due to a combination of being outside the age range for inclusion (n=5) and/or not providing complete responses for a full section of the questionnaire (n=3). Data for IMD were available for 147 participants who provided their postcode. Results for percentages are rounded up in this section.

The mean age of participants was 32.16 and ranged from 19 to 45 (median 32) years. While more women were in the age group of 31-35 years than in other age groups, the sample had good representation from younger and older women. Overall, the most frequent category for pregnancy status was the preconception group (42%), followed by pregnant (36%) and post-partum women (22%).

The highest proportion of participants was from the Southeast of England (26%), and most were educated to college or university level and above (82%). The majority of participants were of white ethnicity (85%). Almost half the sample (49% for subset with data on postcodes) were from the two least deprived quintiles. Participants' characteristics are shown in Table 5.1.

Table 5.1   Demographic characteristics of survey participants

Descriptor	N	%
Reproductive group		
Preconception	106	42.2
Pregnant	91	36.3
Post-partum	54	21.5
Age		
18-25	35	13.9
26-30	61	24.3
31-35	93	37.1

Descriptor	N	%
36-40	36	14.3
41 and above	26	10.4
Region		
East of England	24	9.6
East Midlands	9	3.6
London	25	10
Northeast	9	3.6
Northwest	19	7.6
Southeast	64	25.5
Southwest	32	12.7
West Midlands	17	6.8
Yorkshire/ Humberside	18	7.2
Northern Ireland	11	4.4
Scotland	17	6.8
Wales	6	2.4
Education		
Primary school or Secondary school up to 16 years	6	2.4
Higher or secondary or further education (A-levels, BTEC, etc.)	26	10.4
College or university	117	46.6
Post-graduate degree	89	35.5
Other	4	1.6
Prefer not to say	9	3.6
Ethnicity		
White	212	84.5
Black/ Black British	6	2.4
Asian/Asian British (South Asian)	18	7.2
Asian/ Asian British (Chinese)	4	1.6
Mixed/Multiple ethnic groups or Other	9	3.6
Prefer not to say	2	0.8
Index of Multiple Deprivation Quintile *	**(N=147)**	**(Valid percent)**
Quintile 1	15	10.2

Descriptor	N	%
Quintile 2	28	19.0
Quintile 3	32	21.8
Quintile 4	30	20.4
Quintile 5	42	28.6

*Total – 251; * Quintile 1 = most deprived and quintile 5 = least deprived.*

Twenty-four women (9.6%) reported having medical conditions/ co-morbidities during pregnancy or high-risk pregnancies. Most common conditions included hyperemesis gravidarum (n=4), gestational diabetes (4), high blood pressure (n=4), type 2 diabetes (2) (full list in Appendix F1). Thirty women (12%) reported having special dietary requirements, for example diabetic diet (n=6), food allergies (4), gluten intolerance (4), vegan/vegetarian (n=2), and eating disorders (2) among others. Vegan and vegetarian diets may however be underreported as the question was about dietary requirements not addressed in the checklist.

Overall, most women in all three reproductive groups were of White ethnicity, followed by South Asian and mixed ethnic groups. The distribution across the three reproductive groups was similar for education and region to that overall as seen in Table 2.
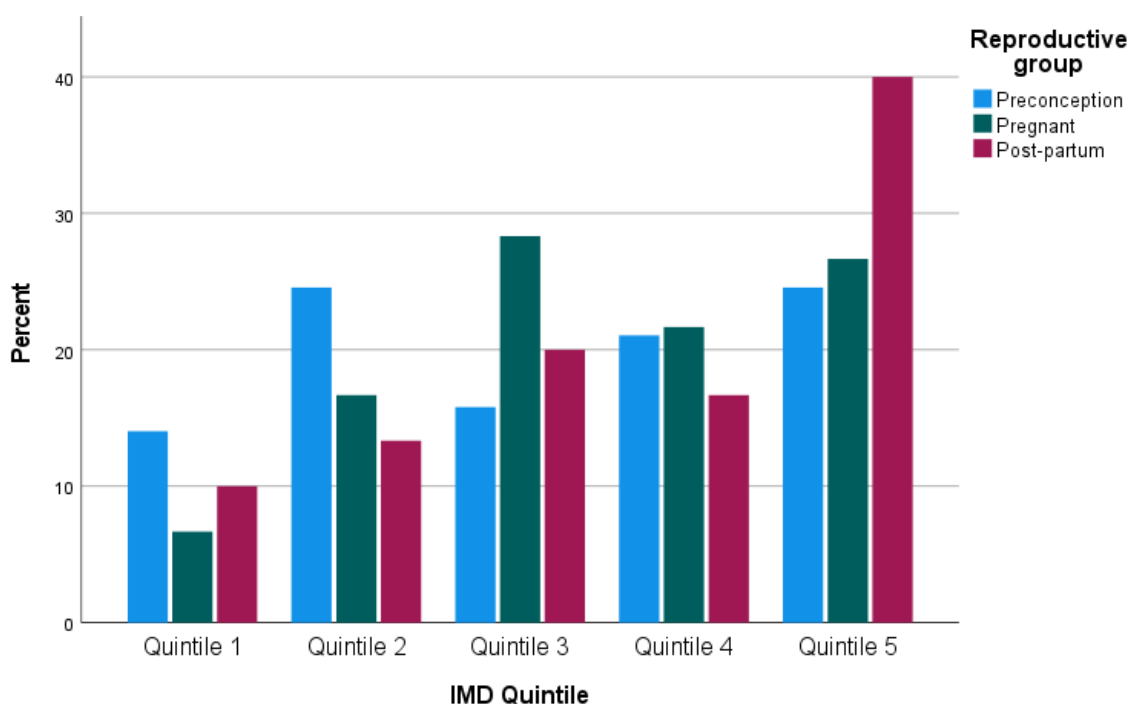
Figure 5.3   Cluster bar chart of IMD quintile by reproductive group

As seen in Figure 5.3, more women were from the least deprived quintiles, particularly in the post-partum group showing more representation from Quintile 5. Figure 5.4 depicts the different age groups by reproductive groups. As anticipated, most preconception women were from the younger age brackets. However, no post-partum respondents were from the 18-25 age group for this survey and more pregnant women were in the 31-35 age group than in any other age group. Post-partum was the largest group for the older two groups.
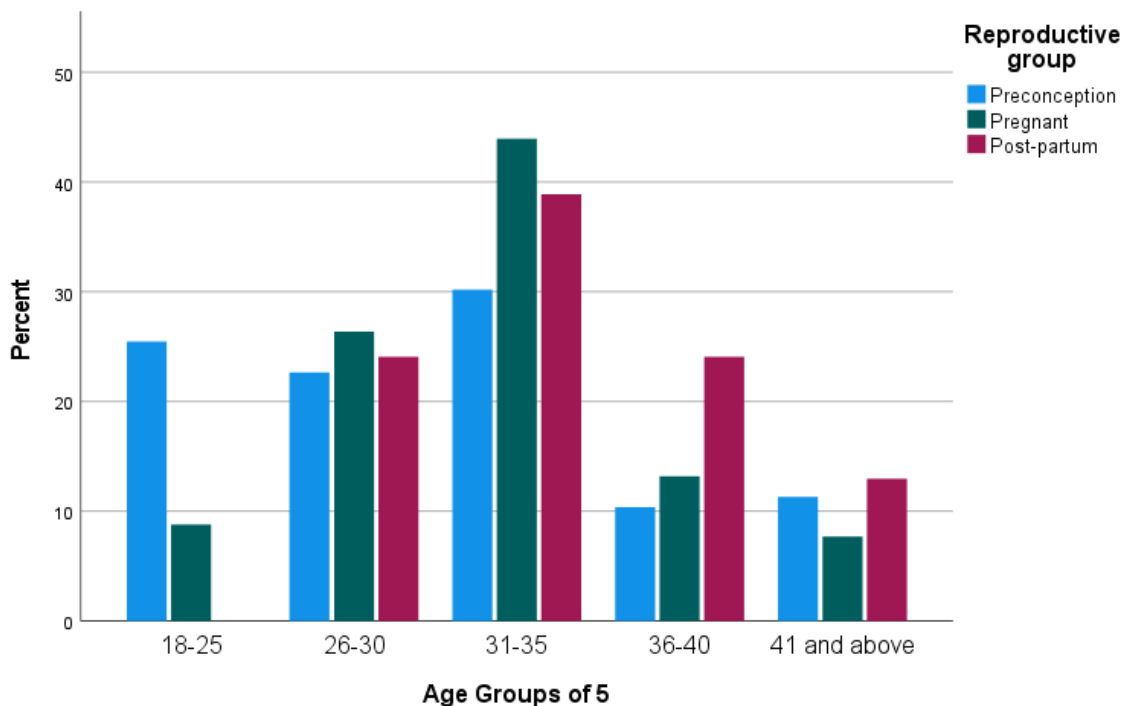
Figure 5.4   Cluster bar chart of age groups by the reproductive group.

Finally, many pregnant women (42%) answering the survey were in the second trimester, and hence would have completed the booking appointment with the midwife or GP. This was followed by women in the third trimester (32%) and women in the first trimester (26%).

5.4.2   Findings from quantitative analysis

5.4.2.1   Acceptability of the FIGO checklist

Overall, the results from the first section of the questionnaire are summarised in Figure 5.5 below, suggesting that most respondents would recommend the checklist for preconception and pregnancy use. A large majority of women also agreed that the format, style and content were easy to understand, and that the checklist would be easy to complete in the waiting room of a GP

or midwife. However, only 32% of women reported that they had not thought about the questions in the checklist before pregnancy, suggesting a high awareness of nutrition-related topics among the respondents. It is likely that a highly motivated group may have participated in the survey.
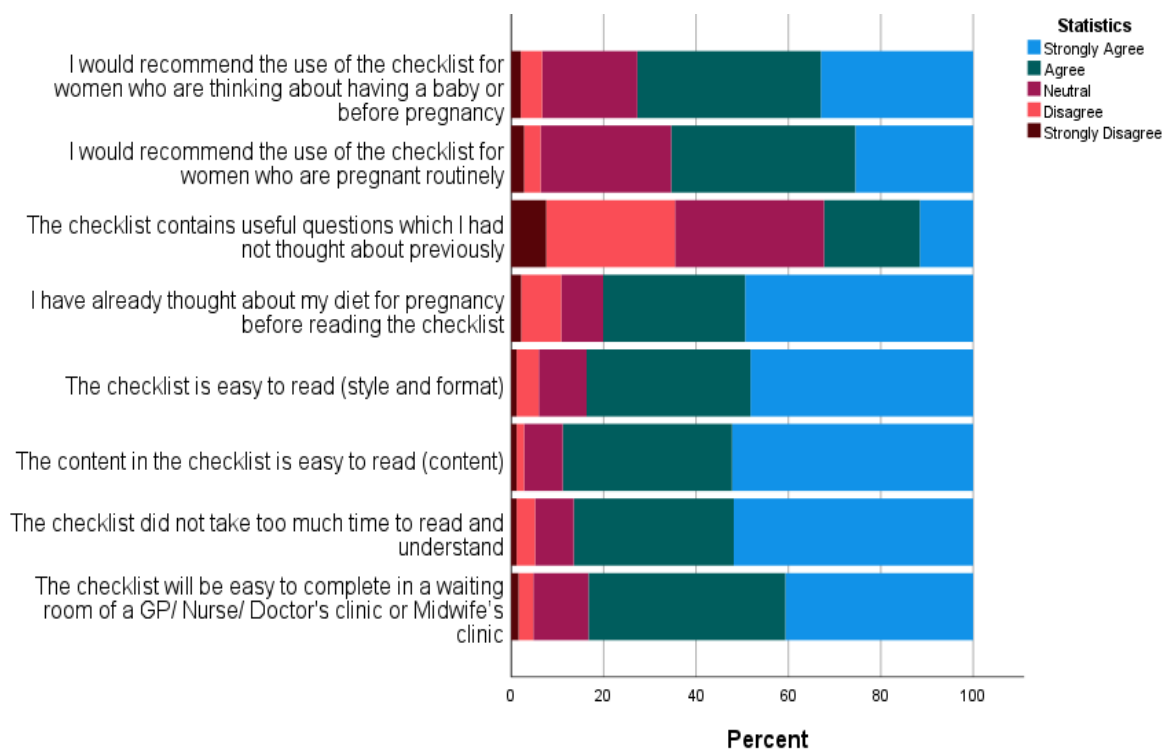
Figure 5.5   Findings for the questions on acceptability of the checklist (Total sample N=251; for the question on "recommends the checklist before pregnancy" N= 194; "thought about diet before pregnancy" N=231)

For analysis by subgroups, binary variables were created for the Likert scale as discussed previously adding the neutral responses to "disagree". When the questions for the acceptability of the checklist were then cross-tabulated by reproductive groups, some minor differences between groups were found which are described here (Full tables not presented in the thesis). Overall, a large majority of women within each group considered the checklist to be easy to complete (78% for preconception; 82% for pregnant; 94% for post-partum groups). Over 75% of respondents in each group thought it did not take too much time and over 80% in each group agreed that the content and style were acceptable. Interestingly, for the question "The checklist contains useful questions I had not thought about previously", 47% of preconception women agreed, followed by post-partum (24%) and pregnant (19%) women, indicating that awareness about nutrition before and during pregnancy was lower in the preconception group. The majority of women (over 60%) from each group agreed that they would recommend the use of the checklist for both pregnancy

and preconception periods. It was interesting to note that the proportion of women who had not thought about the impact of diet before pregnancy before reading the checklist was higher in the preconception (24%) and pregnancy (20%) groups compared with the post-partum group (13%). Women with post-graduate or university degrees and from the 4th and 5th IMD quintiles were more likely to have considered diet for pregnancy, compared with non-college-educated and respondents from more deprived areas - however, the numbers in the subgroups were too small for meaningful conclusions to be drawn. Overall, on cross-tabulations, there were no major differences or disagreements between other categories of background characteristics on questions related to how easy the checklist was to use and understand.

Findings from regression analysis

Compared with the youngest group, women aged 31-35 had twice the odds of agreeing that the checklist was easy to complete (OR 2.87 (95% CI 1.05-7.83; p=0.039). Post-partum women had more than four times the odds (OR 4.7 (95%CI 1.35-16.49, p=0.015) of agreeing that the checklist would be easy to complete in the waiting room compared with preconception women. Finally, compared with women from the most deprived regions, women from quintile 4 (OR 4.7 (95% CI 0.9-24.36)) and 5 (OR 3.8 (95%CI 0.6-17.1)) had higher odds of agreeing that the checklist was beneficial, although the confidence intervals were very wide (N=147).

5.4.2.2   Participants' experiences of discussing nutrition in clinical visits for perinatal health

Approximately two-thirds of women (67%) replied that they had not completed a nutrition checklist or a dietary assessment tool resembling the FIGO checklist during a consultation (67%; n=216), but 12% of respondents had never visited an HCP for fertility/ pregnancy-related reasons (Table 5.2).

Table 5.2   Number of women who completed a similar checklist before and/or during pregnancy during a visit to the clinic/ hospital by reproductive group (*n (% within reproductive group))*

	Yes	No	Cannot Remember	Have not been to a clinic/ healthcare professional for reasons related to pregnancy or fertility
Preconception	4 (6%)	32 (45%)	11 (15%)	25 (35%)
Pregnant	5 (6%)	74 (82%)	9 (10%)	2 (2%)
Post-partum	10 (19%)	39 (72%)	5 (9%)	0
Total = 216				

A key finding was that even among pregnant and post-partum women who would have seen a clinician (e.g., GP/ midwife), most reported not completing a checklist similar to the FIGO nutrition checklist, indicating a missed opportunity for nutritional assessment. Women who had completed a similar checklist recalled using it at midwife consultation (n=13) either at a home visit, phone call or on an online app; with their GP (n=3); a nutritionist (n=1); at fertility assessment clinics (n=2); or on an independent online website (n=1). Among the 54 post-partum women, only 5.6% reported receiving adequate support after a previous pregnancy for diet and weight-related issues. It was interesting to note that 52% of women said they felt better prepared to adopt a healthier lifestyle during or before pregnancy after reading the checklist, with 34% reporting they felt neutral (N=219 responses), and the remainder disagreed. Preconception women were slightly more likely to agree to this question (54.4% of preconception women) than to disagree or be neutral.

When women were in a hospital or clinic, 29% reported that a clinician had discussed their diet and nutritional needs with them (N=235), with the majority (55%) answering "No" and the remainder (12%) reporting they could not remember (3.8% had not been to a clinic). Women discussed this mostly with their midwives (n=42), GPs (n=10), OBGYNs (n=5) or nurses (n=4). Others with whom they discussed this included health visitors or specialists. Similarly, only 26% of women reported that their HCPs discussed weight/ weight gain during pregnancy with them (N=223). This was also mostly with their midwives (n=38) or GP (n=6).

An important finding was that very few women (less than 36% from each reproductive group) recalled discussing diet or nutrition during their visits to the HCPs. Figure 5.6 illustrates that pregnant women were the most likely to have discussed this with their HCP, followed by post-partum women. Even fewer women recalled discussing weight gain during pregnancy within each group (less than 30%, figure not shown). Results for "regular discussion" on nutrition during routine visits are discussed below.
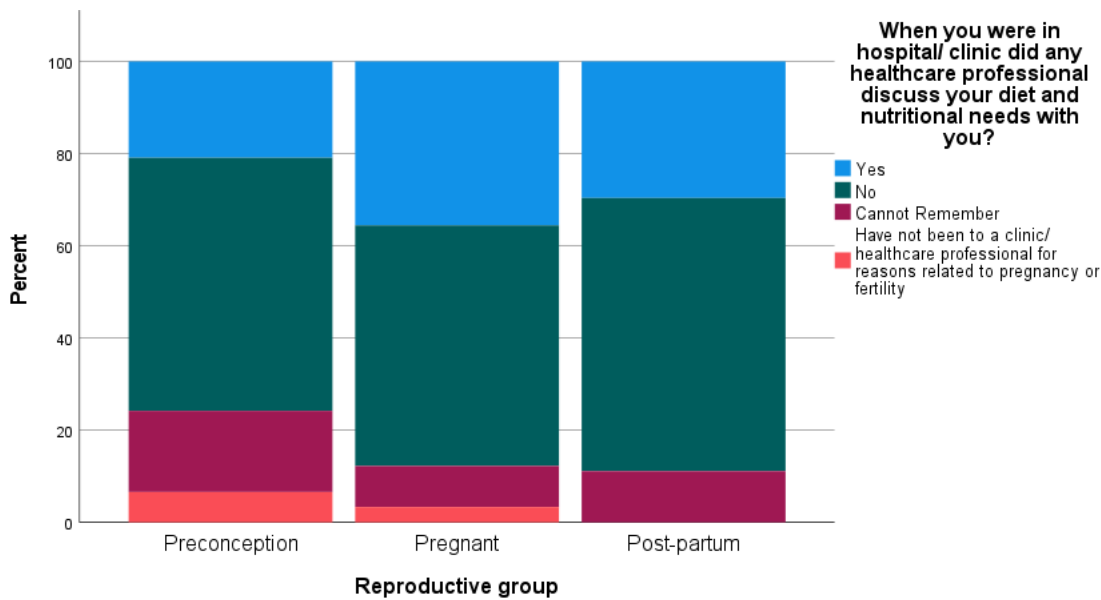
Figure 5.6 Stacked bar chart of reproductive group by responses to discussion on diet and nutrition in the clinic (Percentage of each reproductive group) N=235.

After reading both pages of the checklist, women were asked to reflect on their experiences of visiting clinics in relation to fertility, pregnancy or postpartum health. Figure 5.7 illustrates the agreement on the questions presented in of the survey about their experience during routine visits.

Overall, 70% of women agreed that information on both pages of the checklist would help in visits with the HCPs, indicating high acceptability for use of the checklist among women in the reproductive age group. In addition, based on previous experiences, only 11% of women reported that nutrition was a regular topic of discussion in their visits to the clinic. The majority of the women (67%) felt that HCPs did not have enough time to discuss diet and nutrition during visits. It was interesting to note that for these questions many women used the neutral response that was included in the disagree category, as explained previously.
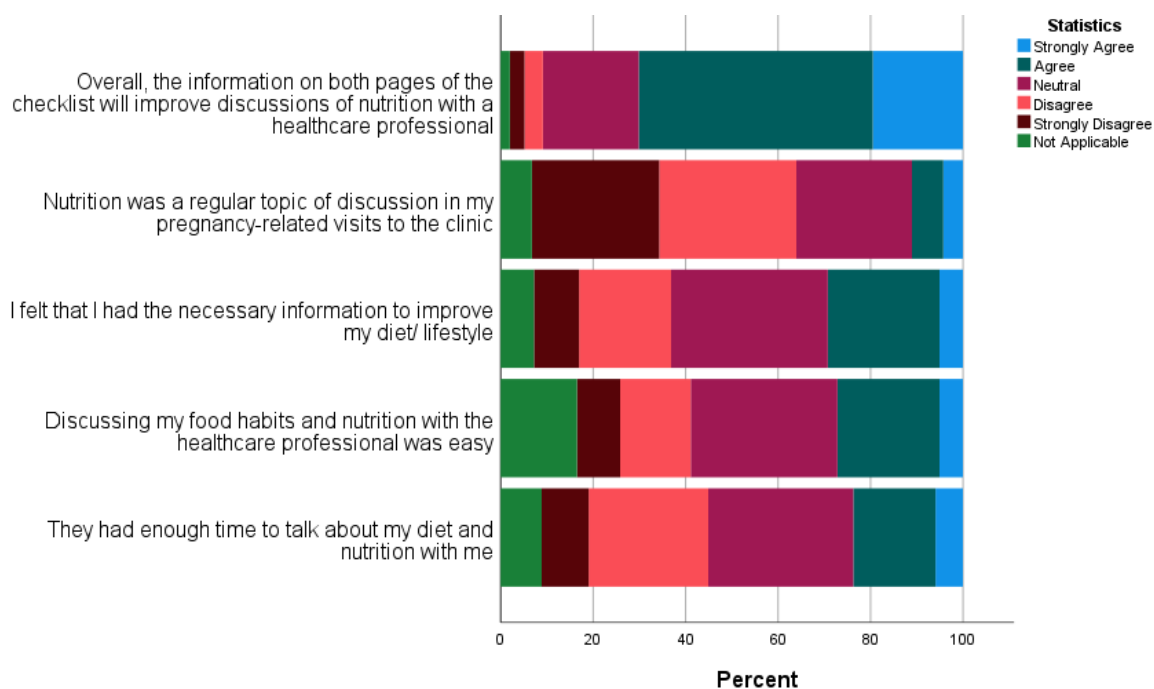
Figure 5.7   Stacked bar chart on experience of discussing nutrition and weight with HCPs (N=251 for question 1 and N=236 for questions 2-5) (Not applicable indicates that women responded that they were not pregnant/ did not have a baby recently/ were not thinking about a pregnancy)

Cross tabulations of the group according to socioeconomic characteristics and reproductive groups did not show any major differences between groups (data not shown). Interestingly, less than 32% of women within each reproductive group perceived that discussing nutrition/ weight with HCPs was easy, suggesting a high level of uneasiness among women about discussing these topics in healthcare settings. As discussed above, very few pregnant (6.7%) and post-partum (7.4%) women agreed that nutrition was regularly discussed during their visits. The agreement was slightly higher within the preconception group (17%), which could be because many preconception women in this survey could have been undergoing treatment for infertility.

5.4.2.3   Findings from questions on preconception health

Results from questions on pregnancy planning and intention, and the acceptability of routine discussion of pregnancy intention are presented here. A majority (78%) of respondents from the preconception group reported that they were planning to get pregnant in the next year, while 13% were not intending to become pregnant, and the remaining women had not thought about it. Among women planning a pregnancy, 40% had visited a healthcare professional in relation to family planning/ fertility. Further, around 20% of women in the post-partum group were also planning their next pregnancy, and six women had visited an HCP to discuss this. Women

reported visiting a range of clinical settings for pregnancy planning or fertility-related consultations, with the GP being the most common contact (n=28). This was followed by OBGYNs (n=7), fertility specialists/ IVF clinics (n=7), nurses/ sexual health clinics (n=5), midwives (n=3), pharmacists (n=2) and others (n=3) such as endocrinologists. Some women had visited multiple clinical professionals.

Most women seemed to have high awareness of the impact of preconception diet and weight on the health of the baby and on a healthy pregnancy; 79% agreed that changes to their diet before pregnancy can make sure their child is born healthy, and 89% also agreed that being closer to a healthy weight before pregnancy is important for having a healthy pregnancy and baby. Finally, a large proportion of post-partum women (76%) reported trying to make changes to their diet and weight after they had their baby.

The number of respondents for the questions on acceptability of routine preconception discussions was lower (194) as the questions were included later on in the study after an ethics amendment.
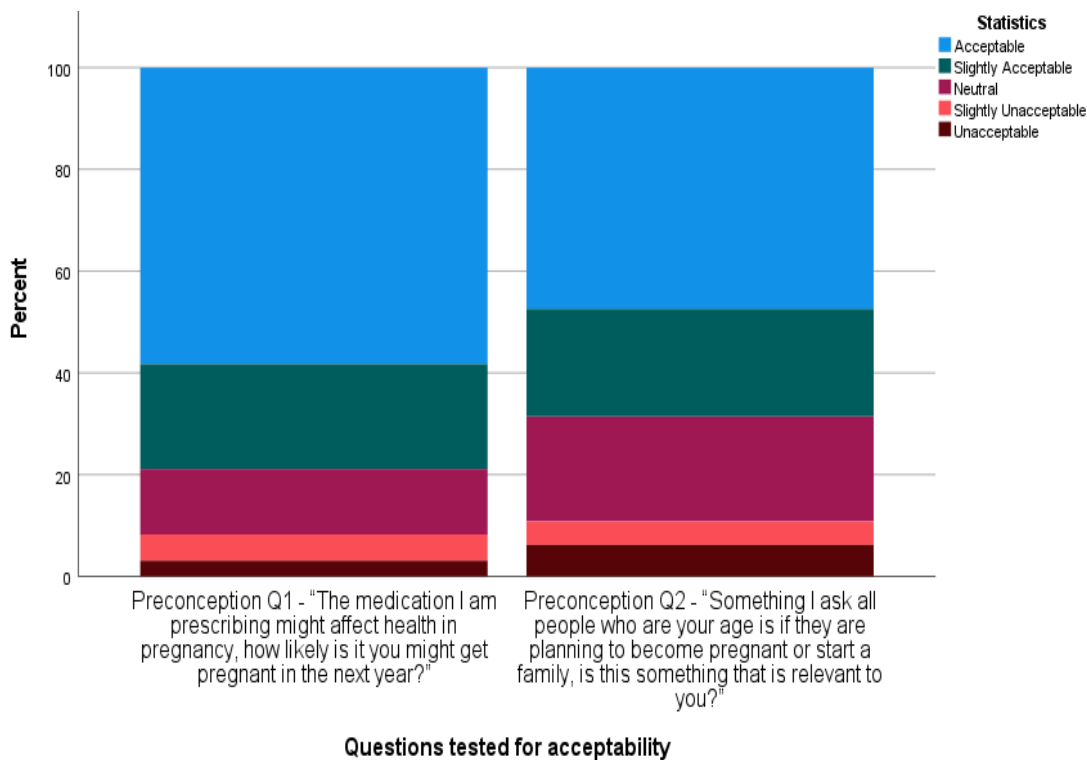
Figure 5.8   Cluster bar chart for two questions about pregnancy intentions assessed for acceptability

Figure 5.8 demonstrates that both questions were considered acceptable by a vast majority (more than 90%) of women with a higher preference for question 1 (79%) compared with question 2

(69%). Detailed exploration of acceptability of these questions, and reasons for preferences was conducted during content analysis.

Compared with other age groups, more women in the 26-30 age group (29%) said it was unacceptable to ask question 1 and 43% of women above the age of 41 found question 2 unacceptable. However, numbers in each group during cross-tabulations were low. No major differences were seen for acceptability in sociodemographic characteristics or by pregnancy groups.

5.4.3   Results from content analysis of open-text responses

Results of content analysis are presented below for the three open-text questions in the survey. For each question, a separate coding framework was developed. The results are not presented in ascending or descending order of frequencies as I have not adopted a positivist approach to analysis (Chapter 2). Some responses were allocated to more than one code. During the framework development process, some codes were pooled to develop meaningful sub-categories, which were deemed to be the final codes within each category. In this section, a narrative summary of the recommendations with sample representative quotations (edited for brevity and clarity in some instances) for each sub-category in order to depict the fully relevant issues, experiences and suggestions are presented. Participant ID numbers are presented with the quotes). Appendix F provides the full list of Tables with key categories and descriptors from content analysis of both women's and HCP's surveys.

5.4.3.1   Suggestions to improve the checklist

This section presents the results to the question on *comments and suggestions to improve the checklist*. A total of 77 participants answered this question, and 15 comments were not coded due to reasons discussed above. From the 62 valid responses, 17 codes were developed grouped into five key categories.

Category A: Gaps Identified

This category is made up of four main domains related to gaps in the current checklist as highlighted by respondents.

Women suggested that the checklist could assess a history of eating disorders which may affect how the questions on the checklist are interpreted and could influence the impact of counselling.

"Disordered eating plays a significant role in nutritional choices, which is often in conflict to that of nutritional guidance for pregnant woman." (ID 1006)

The current checklist was considered to be less focused on plant-based sources of food which could suggest that meat and dairy were requisites for a healthy pregnancy.

"This checklist makes me feel guilty that as a vegetarian I may not have adequately nourished my baby, even though I know that there are other ways to get adequate nutrition…" (ID 1029)

A few women also suggested including discussions of issues related to specific trimesters and preconception, as the first antenatal visit may be too late to discuss folic acid intake.

"Consider how diet/hunger/exercise may change throughout the period of pregnancy." (ID 1030)

Women also added that the checklist heavily focuses on overweight-related issues, but many mothers may need support for good nutrition and weight gain if they are underweight.

"I am underweight and feel people who are obese or overweight get a lot of support. However, morbidity for the patient is also high being underweight … and also potentially damaging to foetus but no support about improving diet or weight provided pre, during or post pregnancy. I've lost a lot more weight breastfeeding which I'm struggling to maintain." (ID 1113)

Category B: Recommendations for additional topics and revisions

This category collated the codes related to specific suggestions to modify existing content in the checklist or include missing information that were important to the respondents.

More clarity on the portion sizes of food items mentioned in the checklist was requested.

"Needs clarification on portion size for questions related to junk food, fruit and veg" (ID 1118)

Women also valued having access to information related to high-risk pregnancies or pregnancies with other conditions and expressed the view that earlier detection would be crucial. These could include questions/ information on hyperemesis, gestational diabetes, multiple pregnancies and history of miscarriage.

"Specifics about the first trimester/sufferers of HG (Hyperemesis Gravidarum) so women are not unduly pressurised when they are already feeling incredibly unwell." (ID 1030)

Questions on non-dietary sources of risk factors pre-pregnancy and early pregnancy were also mentioned as important such as caffeine intake, alcohol and smoking.

"Alcohol and smoking should play a more prominent role in the questionnaire." (ID 1002)

Calculation or measurement of BMI was identified as a barrier to completing the first page of the checklist as women may not be able to do it themselves, particularly in deprived areas.

"Unrealistic to expect people to know their weight and height and to be able to calculate their BMI." (ID 1029)

Women also emphasised the need for good quality and clear information for exercise during pregnancy, which should consider mobility and access to resources for different types of activities.

"During my first pregnancy, the midwife couldn't advise on whether I could continue the exercise regime I was doing because she didn't know. There is also a dearth of information on exercise you can do post birth … you are advised of everything you can't do … but not what you can actually do" (ID 1050)

Category C: Additional support after completion of the checklist

The codes in this category recognise that women needed more support over and above the provision of the checklist during consultation.

Some women suggested that while the checklist could be a stimulus to encourage a two-way conversation, patients should also be provided with adequate information to make healthy choices themselves.

"Focus on making sure women are given information about nutrients they need and guidelines for exercise, rather than routinely scrutinising diet and weight gain throughout pregnancy." (ID 1033)

Several women requested further resources that could be either accessed online or taken home after the consultation, especially on supplementation. These could be in the form of written material (tools/ leaflets/ healthy recipe cards), or counselling related to the gaps identified, group workshops on nutrition etc.

"I believe more supportive tools to take away from the meeting along with the communications provided at the meetings." (ID 1044)

Overall holistic care apart from a focus on nutrition was also recommended.

"It is crucial this is a discussion point at appointments to be able to support good nutritional balance and mental health and well-being." (ID 1006)

Category D: Effective and sensitive communication

Within this major category, it was apparent that how the information in the checklist was discussed was important in having a positive or negative impact on health behaviours and compliance. This included both the written content on the checklist and the post-checklist counselling during the appointment.

Several women appreciated the content in the checklist and suggested it would be beneficial.

"It is just as important as the 'do not smoke or drink' message that women are told about throughout pregnancy, however, is not spoken about as much. It is definitely something that is often overlooked." (ID 1040)

However, women added that the contents on page 2 of the checklist were very technical and could be confusing and suggested including a summary for the patient after the information for doctors.

"It is very high level. It would be useful to provide the patient with the clinician's notes so they can understand why the recommendations are being made on how to improve their diet…." (ID 1194)

From the patient's perspective, conversations around weight, BMI, diet and exercise were very personal and it was important that they felt comfortable and not judged while discussing them with the HCP. However, several women also discussed instances when they felt ashamed of their health/weight statues during clinical visits due to the way the issue was raised or recommendations not taking into account their experiences or lifestyle, leading to unintended harm or weight stigma. Risks need to be communicated without causing undue alarm and should have a balanced focus on underweight or overweight/ obesity based on the risk factors.

"Any advice regarding nutrition and exercise should be offered in a non-pushy way. I feel the majority of women are well aware of the benefits of a healthy diet and exercise for a healthy pregnancy and should not be made to feel guilty if they do not happen to meet the perfect criteria at the time of pregnancy." (ID 1070)

Category E: Additional topics raised.

This category collates two additional points related to the contents in the checklist that could affect the uptake of the recommendations and counselling.

Several women suggested that clinicians should be encouraged to use measures other than BMI and weight for assessment and some women felt strongly against the use of BMI due to their experiences of having a healthy pregnancy with overweight or obesity.

"Isn't BMI a discredited or at least controversial metric, to take so much prominence on the form you're proposing?" (ID 1110)

In the final code, respondents questioned the level of knowledge of HCPs related to nutrition and exercise and indicated that this was a barrier to discussing or requesting nutritional information from them.

"I do not believe that most healthcare professionals are well versed enough in plant-based diets to support the follow-up conversations". (ID 1117)

5.4.3.2   Women's opinions on routine discussion of nutrition

The findings in this section are based on the 241 valid responses to the open-ended survey question - *"How would you feel if nutrition, diet and weight gain during pregnancy were discussed routinely in all pregnancy-related appointments, or when thinking about trying to get pregnant - even if it was not the main reason for your visit?".*

Category A. Positive views on routine discussion

Most responses suggested that a discussion on nutrition and healthy weight gain during each appointment would be beneficial overall.

Women found the topics important and stated that they would feel reassured if this was discussed in a way that made them feel comfortable about it. As some women may hesitate to initiate the discussion themselves, the question raised by the HCP would help them request clarification. Several women also had adverse events in their previous pregnancies and hence supported the discussion.

"When pregnant you have no idea if you're eating the right things / gaining the right amount of weight and I found I received next to no advice or had any conversations around this." (ID 1022)

Some women also recommended that the conversation could be extended to the preconception and post-partum periods as it could support discussions related to fertility and breastfeeding.

"I think it's essential, I'm only just getting support in this area through private help and if I didn't do this, I wouldn't have known the importance of exactly what to eat and how to prepare the body. This should always be included at NHS appointments when TTC (trying to conceive)" (1087)

Women also described how they valued personalised care and how raising the topic during different periods of pregnancy could help with specific issues such as hyperemesis and high-risk conditions e.g., gestational diabetes.

"… Diet was only discussed with me in detail after I was diagnosed with gestational diabetes" (ID 1054)

Category B. Negative implications of routine discussion

Several women also felt that raising the topic routinely could have a negative impact. This category contains the codes where respondents expressed the view that routine discussions would affect them negatively, provided examples from personal experiences or suggested potential negative effects for the patient from routine discussion of nutrition or diet and weight.

Routine discussion was believed to be intrusive or unnecessary for low-risk pregnancies or time-consuming by some women. Contrary to the category above, where some women hesitated to initiate the discussion even if they wanted more information on nutrition, here it was recommended that it should be up to the patient to initiate the conversation if they had any doubts.

"I think it would probably start to feel patronising if it was discussed every appointment - as though I can't be trusted to remember what was said before." (ID 1083)

Reflecting on personal experience, women also felt that this could induce stress, feelings of inadequacy during a period (pregnancy/ trying to get pregnant) when women may often be anxious about the health and development of the baby. It could also trigger anxiety or guilt if women have had adverse experiences in the past such as pregnancy loss.

"It doesn't need to be discussed routinely as it would cause unnecessary stress … Pregnancy sickness and nausea affect dietary habits in the beginning and keeping any food down is a success so regular discussions about nutrition would cause additional pressure." (ID 1072)

Category C. Information

This category collated all codes related to the need for more, better quality and trustworthy information on safe and healthy diets during pregnancy that are easy to access.

Currently, most sources of information on diet during pregnancy focus on food safety and sub-optimal nutrition. Women would also welcome provision of holistic care that includes healthy eating rather than supplementation and considers dietary requirements e.g., vegan.

"I'd find it really helpful. I was vegetarian and chose to eat fish pre-pregnancy to help improve my diet. Any discussion around diet would have been immensely helpful and reassuring." (ID 1113)

It was reported that, while there are many sources such as websites online, very few are reliable and may contain misinformation or not have information on healthy weight gain, sources of nutrients etc.

"I think it would be a great idea, there are so many sources of information which are more or less reliable, and even the NHS website, while very informative, requires you to do quite a bit of research." (ID 1025)

Category D. Communication and Conversation

Similar to the suggestions for communicating the checklist, a major category in this framework was about the importance of *how* the question was initiated, clarifying why nutrition or weight was being discussed and using the short time of the consultation to discuss diet and weight gain in a sensitive manner.

Sensitive, non-stigmatising conversations that make the women feel that their health is also being considered in addition to the child would be welcomed. Patients with overweight or obesity shared feelings of being stigmatised or not being taken seriously after consultations.

"I would be happy with this as long as it was framed positively, not in a way that makes mums feel they are damaging their baby or being shamed. E.g., statements like eating fatty acids are good for baby's brain development" (ID 1027)

Experiences of needless focus on weight and/or BMI during discussion on nutrition were highlighted again and this could be a barrier to communication as BMI was not considered to be a helpful measure.

"(I would feel) Uneasy as I'd feel my health was being judged. Weight and health are not the same thing and I think the language needs to be considerate of this". (ID 1190)

Time during appointment was also a barrier where other issues related to pregnancy or fetal health may be prioritised. The booking appointment (first appointment with the midwife in the UK) was suggested as an appropriate time for a conversation on nutrition, but other appointments are often shorter.

"…given the time limitations of appointments better to have more time to discuss other pregnancy related issues e.g., Modes of delivery". (ID 1076)

Category E. Other

This category includes two codes which were related to refusal of routine discussion for oneself, but acceptance for other women and the baby, when women still considered it to be beneficial.

Women who felt confident in their knowledge on diet and other lifestyle factors may accept the checklist but considered routine discussion of diet and weight gain unnecessary.

"I didn't gain much weight during/after my pregnancy and already back to my pre pregnancy healthy weight. Nutrition was never mentioned to me, but I already live a healthy lifestyle. I think it would be very beneficial to others though." (ID 1026)

Sometimes women reported not considering diet and weight as a key component of pregnancy but are willing to support a discussion if it helps the development of the baby.

"…I will do it for the baby's health" (ID 1136)

5.4.3.3   Women's opinion on routine discussion of preconception and pregnancy intention

Two sample questions to initiate a conversation on pregnancy intentions were tested. The Likert scale questions on which questions they preferred for discussing pregnancy intentions were followed by an open-text question "please explain why". Of the 190 responses received for this question, 174 were included in the analysis.

Category A: Reasons to support discussion of pregnancy intention in routine visits

Of the three categories in the framework, this category had the most coded comments. Advantages of initiating the conversation on pregnancy intention, as identified by women, ranged from prevention of risks during pregnancy to enhancing the benefit of a visit to the HCP.

Women placed a high value on the effects on the health of the fetus and the mother's health during the pregnancy that appropriate advice/ counselling would have. Being asked about pregnancy intentions or the chance of being pregnant during a visit was reported to be acceptable if the medical indication was explained clearly.

"If there is a medical reason for asking, then it can be justified, otherwise there is the possibility of causing offence." (ID 1060)

Women also felt that the questions were framed respectfully and were important considering the impact of knowing the effects of medications and other factors such as nutrition at the earliest time point during reproductive planning. As women may not themselves raise the topic, it would make the conversation easier and could potentially raise awareness among non-planners.

"You may not have yet decided on trying for a baby so the thought of how medication might affect the chances are not always considered, better to have the knowledge before than after taking medication" (ID 1081)

Women also perceived the questions as open and empowering as they could make the final informed decision on taking a prescribed drug or not, or for making changes in their lifestyle.

"Helps the women discuss whether they want to take the medicines or not." (ID 1062)

Routine discussions on fertility were a gap highlighted by respondents. Women supported the discussion in primary care settings, especially for people facing issues about getting pregnant who may only get specialist care later in the process. The questions could normalise the conversation about pregnancy for that age group.

"It can take some a long time to conceive or can go through recurrent miscarriages, often without their GP having this knowledge until they are desperate for help!" (ID 1172)

Several women also perceived HCPs as a trusted source of information (in contrast to the response for routine discussion of nutrition above). Women appreciated receiving person-centred care.

"Information sharing with trusted clinicians should be encouraged" (ID 1092)

Category B. Arguments against routine discussions using the questions provided

This category summarises negative factors expressed by women in relation to routine discussion of pregnancy intention and the sample questions presented.

A few women suggested that if routine care was of good quality, raising the question would not be essential.

"…Also, the risks of any medication should simply be given" (ID 1059)

While Category A for this question considers the option of being presented the question as positive and empowering, *Patient's choice* in this category implies that whether and when women want to consume medications for their own health should be up to them and initiating pregnancy intention is also their choice. As in the code above, it was suggested that routine risk communication and provision of information would be sufficient so that women can make their own choices without raising the issue of fertility.

"It's individual choice, women will start the conversation when they feel it's relevant for them." (ID 1086)

Many women responded negatively to the concept of routine discussion as they also perceived it as an invasion of privacy and may not want to discuss it with all HCPs. Women may not have discussed it with their partners too, and often people do not want children so it could cause discomfort.

"It's a bit patronising. And unless it directly affects my care, none of the health practitioner's business." (ID 1079)

It was reported that patients may also be discouraged by the negative assumptions made by the questions related to gender and age (e.g., all women in the reproductive age group may not be thinking about a pregnancy) and the implication of considering women "reproductive agents". The reference to age could be offensive or exclusionary and imply that only younger women are trying to get pregnant, leading to bias in relation to care provided to older women who may be having fertility problems.

"I found the comment a little abrupt and it assumes all women my age must want children." (ID 1109)

Women responded negatively to poor communication skills of clinicians, which could lead to stress and trigger anxiety in women who have had negative experiences in the past related to fertility or childbirth.

"Asking someone just because they are a certain age feels more like a judgement, if asked in the wrong tone of voice or even just on a bad day I think it could seriously impact mental health, especially if someone desperately wants children …" (ID 1232)

Negative aspects of this domain were also expressed as being irrelevant for routine visits. More context on why the question is being asked is required. The discussion would also be inappropriate as it does not directly affect the health of the woman who may be visiting for other serious issues.

"Unacceptable for patient appointments completely unrelated to fertility/family planning" (ID 1070)

Category C: Additional topics mentioned

Codes that did not imply acceptance or non-acceptance but suggested aspects that could affect the response to fertility discussions were grouped here. In addition, two codes suggesting a preference for one of the two sample questions are also presented in this category.

Women perceived this question to promote gender bias against women in clinical care.

"If it's not asked to both sexes don't ask it" (ID 1175)

The domains of conversations and communications skills were also prominent features of this open text question. While suggesting that more context to the questions should be provided while raising the issue, women also added that the questions on pregnancy intention or chance of being pregnant should be approached with sensitivity, and women's choices after the discussion should be respected.

"If the answer is NO, you can make a generic offer such as "Ok, I just want you to know that whenever you'd like to start planning a pregnancy, you can come back, and we can have a discussion"…" (ID 1180)

A few women specified that the preferred question 1 ("The medication I am prescribing might affect health in pregnancy, how likely is it you might get pregnant in the next year?") over question 2 ("Something I ask all people who are your age is if they are planning to become pregnant or start a family, is this something that is relevant to you?").

"Advising that medication can affect fertility etc. is different as you are advising upon the risks." (ID 1068)

However, some women preferred the more generic format of question 2.

"Second question doesn't assume I am going to get pregnant straight away, just considers my age as a factor which is ok" (ID 1091)

5.5 Results from survey of health care practitioners in the UK

This section presents the results from the survey of HCPs in the UK. As for the women's survey, the quantitative results are presented first, according to the sections of the questionnaire, followed by results of the qualitative analysis.

5.5.1 Participant characteristics

A total of 47 clinicians completed the survey. Table 5.3 summarises the key characteristics of the clinicians involved. Generally, in the UK, community midwives provide antenatal care throughout pregnancy and hospital midwives (called staff/ consultant midwives) care for women during labour and birth. Hence, to explore any differences in practice or findings, the results for these two groups are presented separately.

Table 5.3   Key characteristics of HCPs

Descriptor	N	%
Staff category		
General Practitioner	3	6
OBGYN	8	17
Staff Midwife	11	23
Community Midwife	9	19
Health Visitor	5	11
Dietitian	8	17
Other	3	6
Years of Clinical experience*		
Currently training/ less than 2 years	6	13
2-5 years	8	17
6-10 years	6	13
More than 10 years	27	57
Region*		
London	6	13
North (East and West)	9	19
South (East and West)	23	49
East of England	1	2

Descriptor	N	%
Scotland	3	6
Wales	4	9
Northern Ireland	1	2

(* groups in some categories have been merged due to low numbers)

Respondents predominantly consisted of midwives (43%) followed by OBGYNs (17%) and dietitians (17%). Other clinicians who meet women in the preconception and interconception periods such as GPs and health visitors also participated in small numbers, along with other clinicians such as community health nurses (n=2) and metabolic physicians (n=1). The majority of the respondents had over 10 years of clinical experience. Similar to the results from the women's survey, there was more representation from the Southern regions of England, followed by London. However, there was at least one respondent from each nation in the UK.

5.5.2   Findings from quantitative analysis

5.5.2.1   Acceptability of the FIGO checklist

Figures 5.9 and 5.10 illustrate the acceptability of the checklist to clinicians in the UK with all categories in the Likert scale.
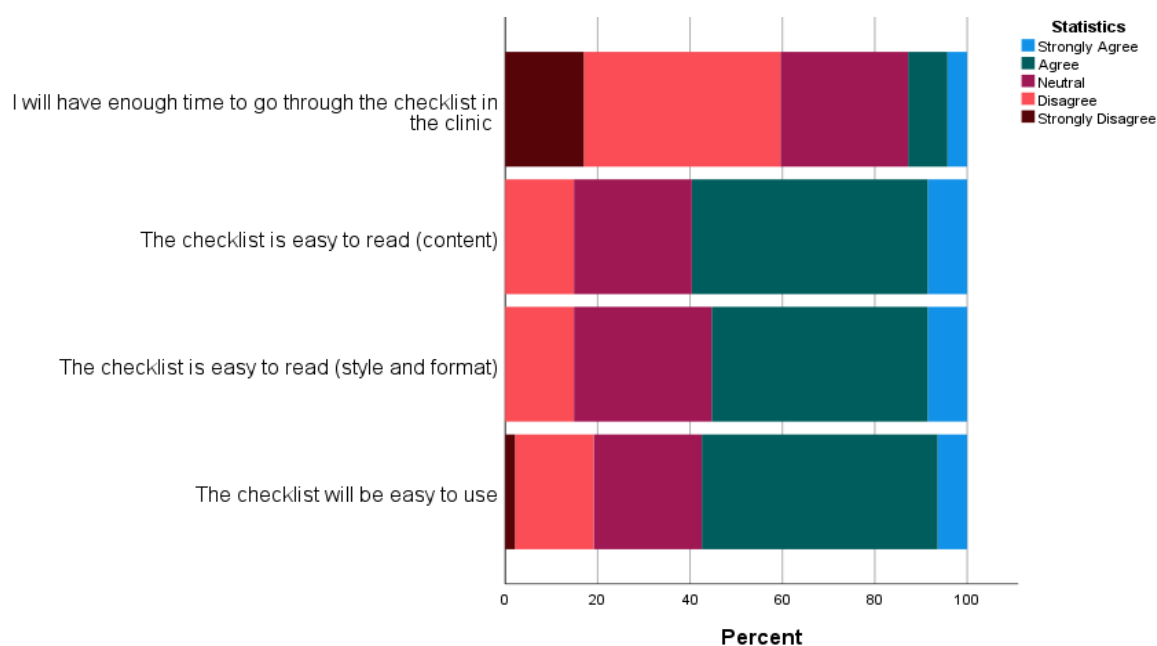
Figure 5.9   Findings for the questions on acceptability of the checklist (HCPs survey)
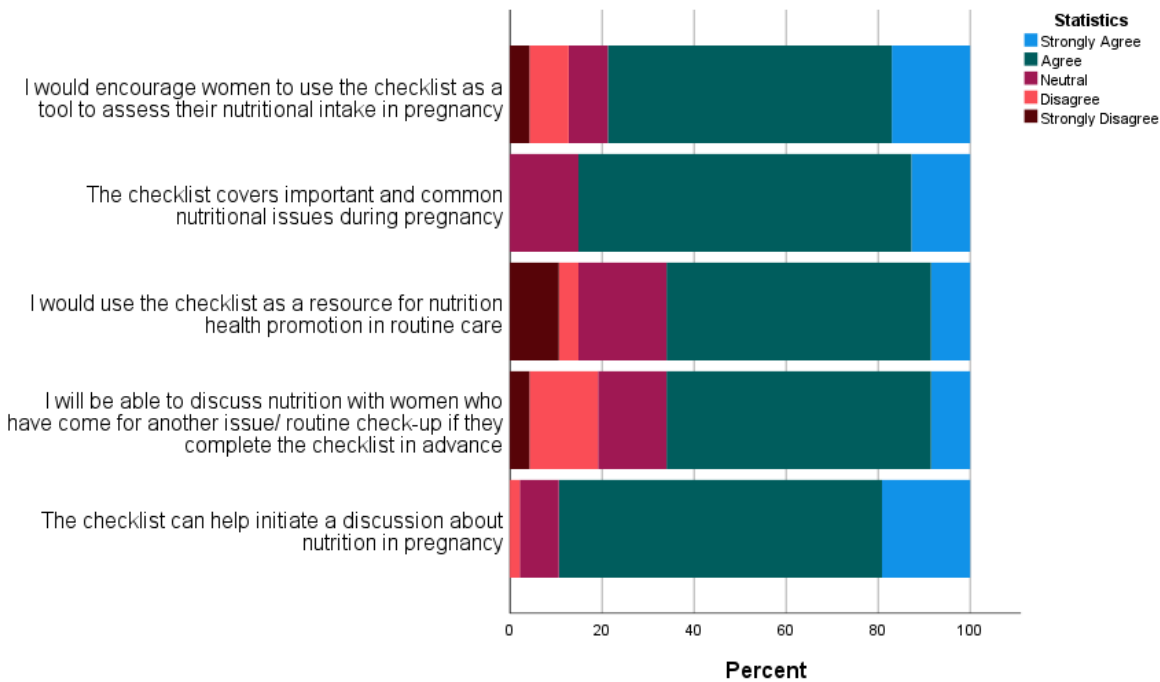
Figure 5.10 Findings for the questions on acceptability of the checklist (HCPs survey)

As seen in figure 5.9, though the majority of HCPs felt that the content and format of the checklist were easy to understand and use, lack of time in routine consultations was a major barrier. Only 13% of respondents agreed (combination of responses as "strongly agree" and "agree") they would be able to cover the contents during routine appointments.

Promising findings in support of the checklist were that most HCPs (89%) agreed that it could help initiate a discussion on nutrition and 85% agreed that it covered all important nutrition-related topics. Figure 5.10 also shows that most HCPs (66%) support the use of the checklist for routine health promotion, even when women visit for other issues, if they complete it in advance (66%).

On cross-tabulation by job titles, few differences were seen for acceptability of the checklist. Most OBGYNs (75%) agreed it would be easy to use, compared with approximately half of the dietitians, community and staff midwives. All midwives and GPs, 75% of OBGYNs and 88% of dietitians reported they would not have enough time to discuss the checklist in their clinics. However, three of the five health visitors felt they would have adequate time. More than 60% of all staff groups (except dietitians) said they would recommend the checklist for routine nutrition health promotion. Almost 75% of dietitians disagreed, potentially because dietitians were more aware of wider nutritional issues not included in the checklist or the need for modification of content in the

checklist. On comparison with the open-ended responses, they were also more likely to critique the weight-/ BMI-related components of the checklist. Dietitians were also less likely to agree that they would encourage women to complete the checklist before their visits (50%) compared with other HCPs (above 72% for each group).

5.5.2.2   Experience discussing nutrition in ANC/ PNC

A key finding from the survey, indicating the gap in similar tools in current practice, was that 92% of HCPs stated they were not using a similar checklist or tool in their routine practice for nutrition in pregnancy. Among the four HCPs who stated they used a similar checklist, the tools used included the ones from their antenatal booklets (in Wales and Southeast England; n=2), verbal communication, and leaflets from the Food Standards Agency. Figures 5.11 and 5.12 illustrate how HCPs feel about discussing nutrition and gestational weight gain during routine practice and how often they discuss nutrition, respectively.

While a vast majority of HCPs (95%) agree that discussing nutrition is important during pregnancy, half the respondents found it difficult to initiate discussions related to weight (50%) and nutrition (43%) in clinical practice. HCPs also felt more confident discussing nutrition (68%) compared with weight management (51%), with only 38% reporting they had the necessary tools/ training needed for discussing both these topics with women routinely.
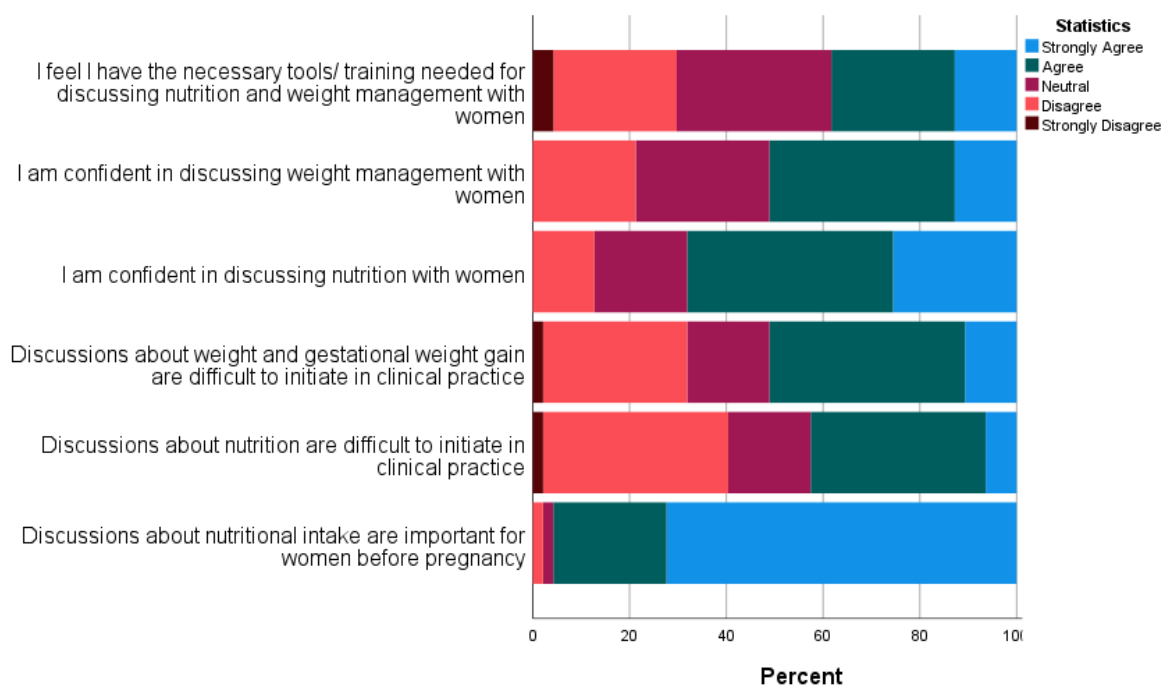
Figure 5.11 HCPs' perceptions on discussion of nutrition in routine periconceptional care
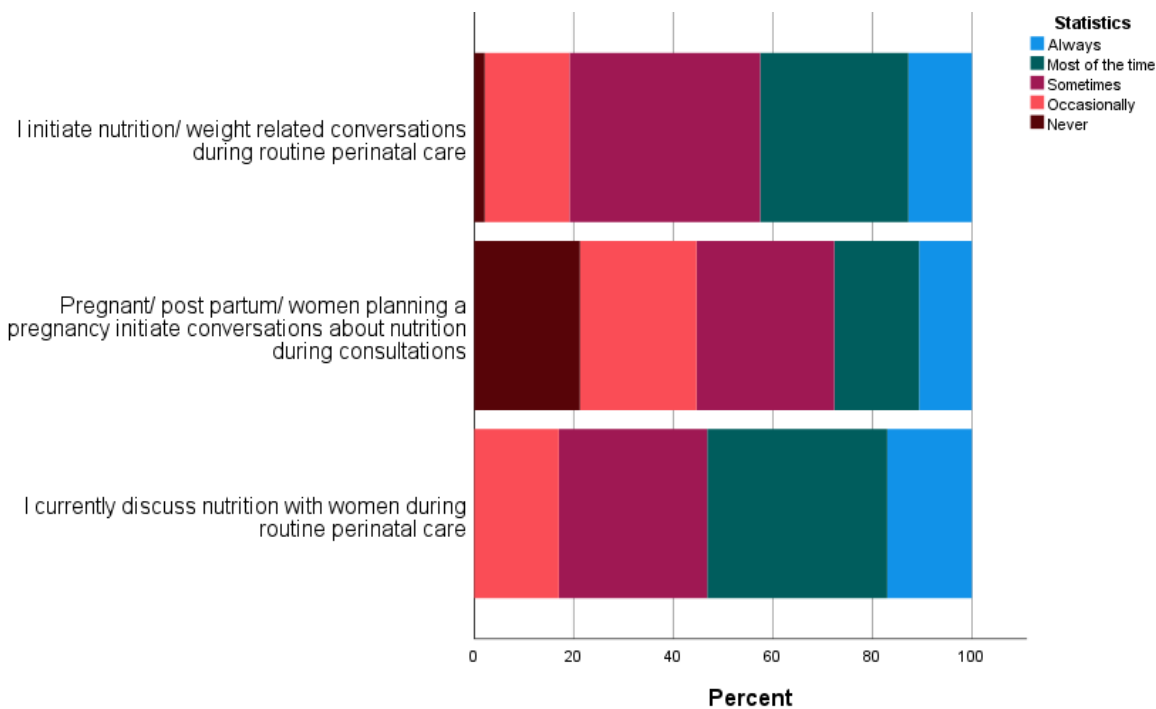
Figure 5.12 Current practice in discussing nutrition according to HCPs

An important, though not surprising, finding was that HCPs reported that women were less likely
to initiate the conversations related to nutrition in consultations (Figure 5.12; 26% answering
always or most of the time). However, less than half (43%) of HCPs reported initiating the
conversations on nutrition/ weight regularly (always or most of the time) indicating that nutrition
may not be discussed at all in most of the consultations in maternity care. Among job categories,
midwives were most likely to report that discussions on nutrition and weight are difficult to
initiate. Dietitians reported the most confidence in nutrition (100%) and weight management
(62%) compared with other groups and were also the only group where the majority reported
that they had resources to support women.

A finding central to the aim of this study was that more than half the HCPs (57%) reported that
they do not meet women in the preconception period in the clinical setting, when asked if women
approach them for pregnancy planning. As anticipated based on the results of Chapter 4, most
midwives (100% community midwives and 64% staff) reported they did not encounter women in
the preconception period, along with most health visitors. Dietitians, OBGYNs and GPs were more
likely to be approached by women planning pregnancies.

5.5.2.3   Acceptability of routine screening for pregnancy intention
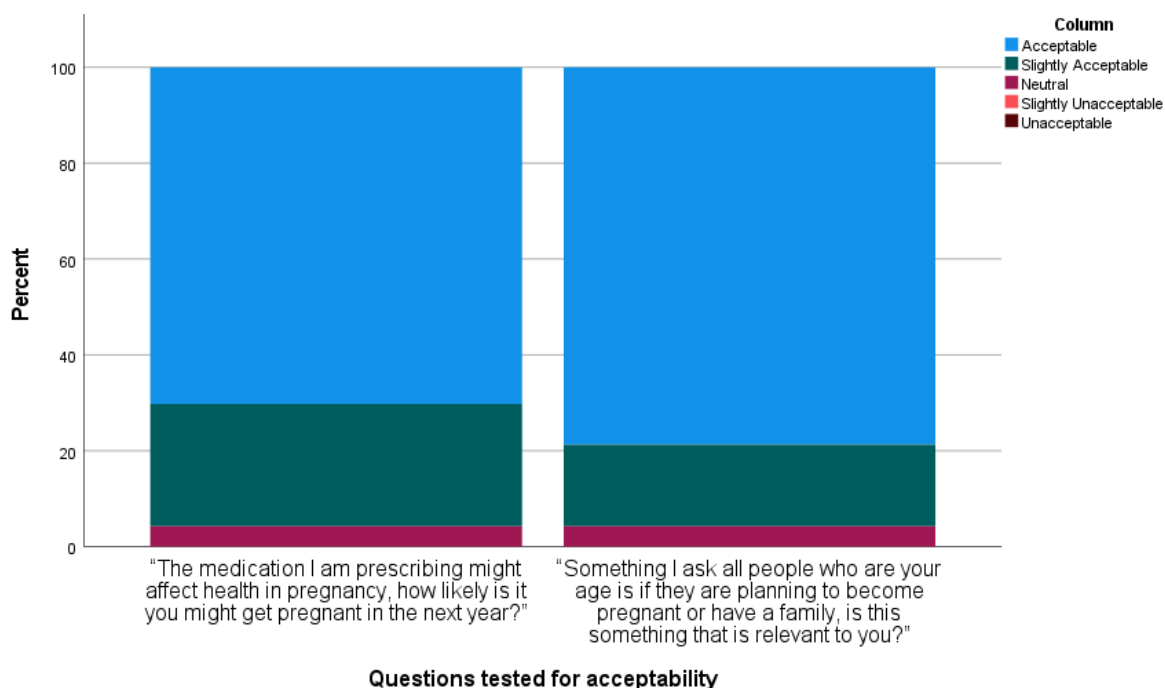
Figure 5.13 Stacked bar chart on HCPs responses to questions on routine discussion of pregnancy intention

When asked how acceptable it would be to them to discuss pregnancy intentions routinely, only 38% of HCPs found it acceptable, with 21% reporting it was unacceptable and 40% being neutral (data not shown in figure). However, as seen in Figure 5.13, a vast majority (>90%) of HCPs found both questions acceptable to use for routine practice indicating acceptance for the questions, but some hesitancy in routinely raising the topic. While 75% of OBGYNs found it acceptable, other staff groups were less likely to find it acceptable (less than 38% of midwives, health visitors, dietitians). All three GPs were neutral.

5.5.3   Results from content analysis of open-text responses for HCPs

As discussed in section 5.3, to organise and present the findings of the open text responses, three different frameworks were developed as for the women's survey and key findings are reported below. Findings are presented as a narrative synthesis of key categories followed by sub-categories and sample quotes (with Job role and ID number). Descriptor tables are presented in Appendix

5.5.3.1   Suggestions to improve the FIGO nutrition checklist by UK-based HCPs

Thirty-four valid responses to the first open-ended question on suggestions to improve the checklist for routine practice were grouped into two main categories described below.

Category A Implementing the checklist in practice

The first category captured a range of discussions related to the operationalisation of the checklist in routine practice in the UK.

Several HCPs felt that the checklist would consume too much time in the current timeframe allocated for appointments, given the need to cover multiple issues around pregnancy/ PCC.

"Certainly, in my clinic there is no time for this kind of discussion, and I would not actively seek to add to my workload with issues that were non-related to the reason for me seeing the patient in the first instance." (OBGYN, 104)

The next subcategory illustrated how the checklist could be used for patient-led care and thus support patient-centred care, as the patients could complete the checklist in advance, then flag up any issues they felt needed further discussion.

"For example, it might be better to concentrate on one aspect of the checklist that is a priority for the patient, would also be more patient centred. E.g., physical activity - could talk about options, exercise in prescription, plan changes." (GP, 101)

The final subcategory summarised instances related to concerns expressed by the HCP about using the checklist.

HCPs expressed concerns related to the impact of the conversation on the patient as they may feel judged, and as the checklist may be too simple to change behaviours.

"From experience, these types of checklists can increase anxiety around weight and nutrition (particularly if someone has missed a window of opportunity e.g., didn't take folic acid in the first 12 weeks)." (Dietitian, 142)

Similarly, concerns were expressed about the contents of the checklist on page two, which HCPs may not feel confident discussing with patients routinely due to a lack of resources or training.

"I have not heard of some minerals like PUFAs and do not have detailed knowledge about other vitamins so would be nervous about giving advice." (Midwife, 136)

Category B Recommended revisions

The second category collated revisions required to make the checklist more user-friendly for patients and HCPs as well as modifications needed to align the checklist with UK NICE guidelines and to add further relevant information.

Improvements were suggested for both language and information. Language changes included basic issues such as the provision of translations, simplification of contents to imperial units, as well as detailed revisions to make it more gender-neutral, appropriate for people with low literacy levels and revising the content related to weight gain to be less confrontational or judgemental.

"I don't like the title of 'diet quality' as you could answer 'no' to most of those questions and still have a good quality diet…. Consider calling it something neutral like 'about your diet'" (Dietitian, 141)

Requests for further information could also be added to the checklist so patients know why they may have scored low or high on certain parameters, and a thorough review by experts such as dietitians to align with the UK guidelines was recommended. Finally, content should reflect cultural variations in diet, vegan/ vegetarian diet, caffeine intake, portion sizes and more information on exercise.

"Given current push to reduce meat and increase vegetables/ pulses, 3i is slightly out with this as may have adequate dietary intake of B12, iron and protein despite not eating meat 3x week." (OBGYN 103)

5.5.3.2 Barriers reported by HCPs when discussing nutrition, weight, and obesity-related topics in clinical care

This section describes the key categories that arose from 34 valid responses from HCPs outlining common barriers faced while discussing nutrition/ weight/ obesity-related topics with women in maternity care and their perceptions on routine discussion of the same.

Category A Practical Issues relating to discussion of nutrition

This category summarises the points related to practical issues while delivering routine care that are also influenced by the healthcare systems and protocols of different hospitals/ primary care centres.

HCPs felt that they are often required to focus on acute emergencies or high-risk pregnancies that present to the clinic. Nutrition may not be a high-priority topic to be raised in routine appointments in the perinatal period, and, when conducted, discussion on food safety during pregnancy was more common for women with a healthy BMI.

"Often other priority areas e.g., communicating info about gestational diabetes and HTN. As always obesity gets underprioritized (GP 101)"

Several HCPs raised lack of time as a factor that affects how often they discuss nutrition and suggested that short consultation time affects which topics they discuss, as for the subcategory above.

"Not enough time in a clinic, every month we are asked to cover more and more information (Midwife 125)"

Other systemic barriers were also raised such as NHS protocols which may refer women to other organisations (e.g., Slimming World) that HCPs felt were not adequately evidence-based or supportive. Some also expressed a lack of referral services that the women would be eligible to attend routinely. Similarly, categorising women in certain weight/ BMI groups could affect the further care-pathways received (e.g., consultations by senior midwives may be needed). Community-based clinicians may have better opportunities to discuss nutrition-related issues compared with hospital-based clinicians.

"We introduced some info on usual weight gain from US data to help support public health conversations, but it then had unintended consequence that women who had gained more than recommended amount were unable to access birthplace of their choice without having conversation with a senior midwife" (Midwife 106)

Finally, while some HCPs acknowledged the importance of routine discussion, they perceived the lack of access to women in the preconception/ postpartum groups as a barrier to their professional role.

"The optimum time to initiate change is pre-pregnancy or post-partum but as hospital obstetricians we do not see women routinely at these times." (OBGYN 132)

Category B Concerns around communication relating to nutrition and the checklist

This category presents concerns raised by HCPs related to making the checklist more patient-centred. Apprehensions that HCPs may have due to any negative effect of discussing nutrition and obesity with patients are also covered here.

It was suggested that the information on the checklist should consider cultural sensitivities, and there may be difficulties in having a conversation about nutrition with patients who may not be fluent in English. Similarly, weight and BMI were key components of the checklist that needed to be communicated appropriately on a case-by-case basis, considering the patient's lifestyle and other risks in order to avoid negative implications.

"… By changing the focus of the dietary changes from being all about weight, to being about making sure mother is having the right nutrition for her and baby, then we can still achieve the same healthy dietary changes (and therefore outcomes) but without the negative connotations and stigma of discussing weight all the time." (Dietitian, 144)

HCPs also expressed reservations about discussing nutrition and obesity as the topics may have negative implications on how they are perceived by the patients, thus affecting the HCP-patient relationship. Patients may often be aware of their overweight/ obesity and may have visited several HCPs for issues related to it, and hence it could distress them or make them anxious to discuss it routinely during pregnancy or while trying to conceive.

"Majority are BMI 30 or above… and you feel like a break down in your relationship once you start talking about their weight. They shut you down and that trust has gone then" (Midwife, 129)

Some HCPs also did not feel confident about delivering the support required for weight loss, or management of special diets, and communicating this sensitively with patients. Requests for resources and training were also raised.

"I feel nutrition is so important and we should all be focusing on it more…Also as GPs we are not always well informed as not taught much about nutrition" (GP, 120)

Category C Support for routine discussion and recommendations

This category collates two sub-categories supporting the discussion of nutrition and providing examples.

The responses included here provide a clear preference by HCPs for further digital resources or an online version of the checklist with information that women could access.

It would be useful if the questionnaire was available electronically as part of their new digital record. (Midwife, 108)

HCPs also supported the use of tools to support behaviour change and some mentioned that they were already discussing nutrition routinely.

Questionnaires promote self-questioning behaviour rather than "being told" by a midwife. (Midwife, 108)

5.5.3.3 Acceptability of preconception screening and discussing pregnancy intention routinely

The sample questions presented to HCPs were followed by an open-text box to discuss why HCPs felt they accepted/ did not accept routine screening for pregnancy intention. Responses to this question were low and this section presents a summary of the 21 valid responses.

Category A Perceptions of topics covered by the questions

This category included HCP's views on routine screening for pregnancy intention and/ or planning.

Several HCPs considered the topic of PCC and pregnancy planning to be an important issue for their patients.

"It's more of a problem when women aren't informed, I regularly hear I wasn't informed or told this risks etc…" (Midwife, 138)

Some HCPs also added that clinical care alone (through routine preconception screening) would not be a remedy as wider factors and social determinants of health should be considered.

"Nutrition to support pregnancy is just good nutrition for everyone (bar additional supplementation) - education should be continuous and for everyone from school age, recognizing the challenges of the obesogenic environment, not targeted at just women of certain ages" (Midwife, 127)

Category B Design and delivery of sample questions

This category covers the suggestions on the sample questions presented.

The questions to initiate a discussion on pregnancy status or intention were deemed to be appropriate by some respondents.

"These phrases are nicely worded and a good way in to discussing preparing for pregnancy if appropriate" (Physician, 105)

However, the question was considered confusing sometimes.

"This question may be confusing for some people as it is very indirect." (Midwife, 112)

Several HCPs also reiterated comments raised by the women's survey on unintended consequences on mental health of patients, especially women with a history of miscarriage or fertility issues. Additionally, the question also makes assumptions about people's preferences due to age.

"Very careful in the way the question is asked as somebody may be trying/ have a miscarriage/ not be able to get pregnant." (GP, 121)

Category C Not a central part of HCPs routine care delivery

This category includes comments on how HCPs are currently discussing preconception health and their perceptions on whether it is part of their role.

Some responses indicate that screening women for pregnancy intention may be done, though not routinely, in their current practice. Sometimes this may be only while discussing complex medical issues or for women with previous high-risk pregnancies.

"I don't ask every time I see them as that's not needed but I will ask if they're thinking about children in the future. I have a clinical responsibility to do so really." (Dietitian, 144)

HCPs also mentioned that they only see pregnant/ post-partum women, or that women who approach them may be of an age group not considering pregnancy.

"As an obstetrician I don't prescribe to non-pregnant women" (OBGYN, 132)

5.6   Discussion

5.6.1   Research questions addressed

This chapter used a study in the UK to partially address the aim of the thesis in developing recommendations for practice on improving preconception health, and thus preventing the long-term risk of NCDs. The current study conducted two online surveys of women in the reproductive

age group and HCPs, to explore the acceptability of the FIGO nutrition checklist in routine maternity and PCC (content as well as the concept of using such a tool), and routine discussion on nutrition and preconception screening. Quantitative and qualitative techniques of analysis were used to identify which factors influenced the acceptability of these parameters. Detailed descriptive statistics were used to explore the findings from the survey and simple binary logistic regression analyses were used for the women's survey to test associations between sociodemographic characteristics and pregnancy status and acceptability.

Findings suggest that, in general, the concept of the checklist was acceptable to women, but HCPs expressed more reservations related to its implementation. Suggestions to improve the content and mode of delivery were provided by both groups. While the content analysis of responses from HCPs revealed some of the potential factors that could affect compliance with using the checklist in practice, particularly those related to time and the health system, it would require further research to investigate the effectiveness of the checklist and follow-up conversations on behaviour change and routine preconception screening on pregnancy planning behaviours.

Among women answering the survey, most would have met an HCP for pregnancy-related reasons – this includes all pregnant and post-partum women and women who approached HCPs for pregnancy planning. It would be reasonable to assume that although women not planning a pregnancy were probably not in contact with a clinician for pregnancy-related reasons, they were capable of providing valuable information on the acceptability of the checklist. This information is also useful for planning the definitive checklist as these groups are harder to reach.

5.6.1.1   Acceptability of the FIGO nutrition checklist

Both women in the reproductive age group and HCPs agreed that the checklist was easy to use, with women recommending it for preconception and pregnant women. Additionally, HCPs added that the tool would be helpful for initiating nutrition discussions and they recommended it for routine health promotion. This was an important finding in light of the qualitative analysis, which suggested some hesitancy among HCPs to discuss nutrition routinely.

A previous study in Dublin evaluating the feasibility of the checklist found similar results for its overall acceptance, however that study only focussed on pregnant women.[229] The pilot evaluation showed that HCPs agreed that the tool would be useful in discussing nutrition in early pregnancy but argued that time would be a huge barrier, as observed in the current study. Though the study in Dublin was based on three obstetricians working in the same hospital, the barrier of time during appointments could affect the prioritisation of nutrition and regular discussion of diet and

exercise. This is discussed further below. The study in Dublin also aimed to assess women's nutritional gaps using the checklist, and showed that four in five women did not meet at least one of the six dietary recommendations on the FIGO nutrition checklist,[229] demonstrating usefulness of the tool.

To address the barrier of time, HCPs in my study recommended using online resources, and the provision of the checklist in advance of the women attending clinics. While this suggestion places the onus on the patient to start a conversation on nutrition and weight management, the results from content analysis also showed that women and HCPs were keen on patient-led care, and some women preferred to raise these issues themselves. Digital versions of the checklist and mobile applications were suggested by the HCPs and some women, and these have shown promise in the preconception and pregnancy period for issues such as smoking cessation and lifestyle modification.[316,317] While such resources would help to reduce the issues related to time constraints, they could also arguably increase health inequalities if they are not easily accessible for women from disadvantaged backgrounds or with low digital literacy skills[316,318] and would need to be available in multiple languages. In addition, women also expressed the need for reliable, trustworthy resources online, which could suggest that they would prefer to have information from HCPs as there is too much information on the internet. A US-based mixed methods study of online health-seeking behaviours during pregnancy showed that engagement with digital health media is influenced by factors such as trust in the online information, individual motivation (internal health orientation) and health literacy.[318]

Variations in the practical use of the checklist could also occur depending on the HCPs involved. While many women criticised the weight- and BMI-related components of the checklist, among HCPs this was mainly raised as an issue by dietitians. Fewer dietitians recommended the tool for routine health promotion. Overall, these important points show that HCPs who routinely meet women during pregnancy and preconception (midwives and GPs) need to be engaged further, as most women in the UK would not visit specialists such as dietitians and OBGYNs for low-risk pregnancies.

A high prevalence of awareness on the topics covered by the checklist was seen among women, particularly among the pregnant and post-partum groups, compared with preconception women. The latter were also more likely to agree that they felt better prepared for pregnancy after reading the checklist. Post-partum women were also more likely to respond that the checklist would be easy to complete, presumably as they had recently experienced the gaps in the healthcare system for nutrition-related issues, compared with preconception women. Though the

reasons for these observations are not clear from the data, it highlights the need to disseminate preconception messages to the right target group as many of the women in the survey reported planning a pregnancy in the next year. General public health messaging and health promotion also have a role to play for the nutrition and wellbeing of women who may not approach HCPs.

This survey strengthens the evidence for inequalities in health literacy and knowledge among women in the reproductive age groups shown in previous research,[319], as women of higher educational status (college and above) and from less deprived areas were more likely to think about their diet before pregnancy. Thus, the implementation of such tools needs to be considered in the context of the wider social determinants of health, and factors beyond clinical health systems.

5.6.1.2 Factors influencing conversations on diet and nutrition and recommendations for effective discussions

Multiple factors emerged from the findings, stated by both stakeholder groups, which could either deter or encourage discussions on nutrition or diet and how it would impact the patient. Interestingly, few women recalled discussing diet/nutrition and gestational weight gain during their visits to HCPs, and some reported that HCPs were not able to provide adequate information, especially for exercise-related guidelines. This could possibly be influenced by the problems raised by HCPs about initiating discussions on weight management and diet, concerns about inducing anxiety in patients, and the call for more resources and training. Such reservations about nutrition/ weight discussion have been expressed in wider research by UK HCPs (midwives) who also reported difficulty in initiating and discussing obesity in current practice.[320] The qualitative study found that while developing a strong midwife-woman relationship was a high priority, most midwives stated that patients had a negative response when discussing obesity. Overall, participants desired better training to initiate discussions, in using sensitive language and communicating risk suitably to empower women. This calls for better support through continued professional development (CPD) and other activities for a broad range of stakeholders who meet women in the reproductive age group, along with curriculum development for student midwives.[321]

A recognisable attribute for non-acceptance of routinely discussing nutrition was poor communication skills of the HCPs. This presents a missed opportunity to cover important topics such as folic acid intake. A possible way to address this issue is through patient-centred care that the HCPs also endorsed, which would involve a focus on what women can do over what they

should not do.[322] Experts have recommended that this concept in pregnancy should move to person-centred care [323] based on the model suggested by Elkman *et al.* (2011).[324] The three key components of person-centred care are: 1. Initiating the partnership (considering the individual's wants, goals and motivation and impact on their life); 2. Developing and working the partnership to achieve the agreed goal; 3. Safeguarding the partnership through documentation (detailing the individual's care preferences in medical records). This further supports the continuum of care concept and considers the person's values and beliefs. An evidence-based technique to support dietary and lifestyle behaviour change in pregnancy is the Healthy Conversations Skills technique for clinicians, which uses an empowerment-based approach to support goal-setting, behaviour change and to improve interpersonal communication, discussed in Chapter 4.[114] Evaluation of the programme, which stresses listening over the provision of information, has shown high acceptability among women and HCPs in the UK. [114]

My findings are broadly similar to studies where women with obesity before and during pregnancy have reported facing weight bias or stigma during appointments with GPs, midwives and other HCPs.[321] Women reported feeling ashamed of their health and weight status during clinical visits due to the way that the issue was raised, or the implication that they were not doing enough or the right thing, which was often framed in the context of weight/ BMI. This has severe implications for the woman's health and wellbeing.[321] Research has shown that weight stigma can have differential effects based on gender, with women more likely to experience it, and to report lower levels of motivation and physical activity as a result,[325] along with increased discomfort and potential reinforcement of self-loathing and body image issues.[321] Women with obesity may also have high-risk pregnancies and higher rates of medicalisation/ intervention, which could affect their treatment pathways, mode of delivery, increased referrals for ultrasounds and pre-anaesthetic evaluation. Women have reported feeling ignored when labelled as "high-risk", with the focus more on fetal wellbeing. [326]

Women's perceptions of confidence in their own knowledge and health behaviours discovered in this study seemed to be a factor leading to non-acceptance of the checklist and regular discussion of nutrition. This is similar to earlier work with pregnant women by Morris et al (2020)[289] who defined "health identity" as the extent to which women perceived themselves as healthy. This could range from 'Health focused' where women feel confident in their knowledge and health status to 'Health disengaged' where they did not consider their health to be high priority. Both these groups are recognised to be hard-to-engage, as women who self-identified as within either of them were less likely to be interested in lifestyle support, while women in the spectrum

between these extremes were more likely to be interested in behaviour change. Using the communication techniques described above and starting the conversations with open questions to assess interest in discussion could potentially help in engaging with these groups. However, HCPs would need to be considerate of the desire for privacy on refusal. While my study did not look at the effectiveness of the checklist in initiating behaviour change, other studies have shown that self-efficacy and health identity are related and these could influence the uptake of health messages.[327]

5.6.1.3 Considerations for universal preconception screening of all women in the reproductive age group

Though the importance of discussing preconception health and pregnancy planning was widely acknowledged, women and HCPs had mixed opinions overall on routinely screening for pregnancy intention. This was despite the sample including a highly motivated group with a majority of respondents who were pregnant/ post-partum or planning a pregnancy in the preconception group. A subset of the preconception and post-partum groups had also visited HCPs to discuss fertility planning further. A large proportion of post-partum women mentioned that they were trying to make changes in their diet and weight after they had their baby, highlighting the opportunity of interconception care.

Reflecting on their personal experience, women also felt that routine discussion could induce stress, triggering negative emotions, especially if they had been trying to conceive or had a previous history of miscarriages. As HCPs who meet the women may differ at different stages, those in primary care may not necessarily be aware how often these issues have been discussed with each woman previously, when posing the sample questions. However, the sample questions presented were considered acceptable and appropriate by both HCPs and women, with some expressing preferences for certain questions, especially those related to the discussion about medication. Being asked about pregnancy intentions or the chance of being pregnant during a visit was reported to be acceptable if the medical indication was explained clearly. A study on routine screening of pregnancy intention conducted in Colorado, USA, showed that though screening rates increased during the trial, barriers during the project suggest that one must question the assumptions underlying universal screening.[299] While some factors such as those patients struggling with infertility feeling offended were also raised, other issues not discussed in my study were also raised in the study by Kvach *et al*. about groups who could be missed or screened unnecessarily through routine systems – e.g., patients who have same-sex partners, transgender people (who may have changed their gender legally and hence do not need

screening, or may not have had reassignment surgery and possibly still need contraception) and adolescents who would need differently-worded questions.[299] Other barriers at the provider-end for universal screening have also been studied in the context of HIV and childbearing, showing similar issues such as unplanned pregnancies, and calling for non-judgemental conversations.[328]

While the benefits of routine screening, such as normalising fertility discussion and preventing high-risk pregnancies, have been expressed in my study and recent guidelines,[300] arguments against routine discussion of pregnancy intentions highlighted the importance of considering patients' values, respecting their choices and privacy, and preventing unintentional triggers. Some women just felt it would be irrelevant for routine visits for them to be judged solely on age and gender. A 2020 Australian survey of men and women [329] found that though acceptability of being asked about preconception intentions by their general practitioner was high (74%), women were more likely than men to be state that they would adopt healthier behaviours if they were planning a pregnancy. This highlights the need to develop interventions to include male partners in the conversation and screening and raising awareness for high-risk factors in men.

Though the predictive value of screening techniques for pregnancy intention such as "one key question" and the "desire to avoid pregnancy scale" have shown corelations with women's reproductive health behaviours,[330] the authors caution that clinicians will need to guide subsequent conversations appropriately, considering the range of responses that could be elicited. Overall, these findings suggest that HCPs should first determine if patients want to engage in a conversation before simply posing the question as a routine activity.

Both the interviews in Chapter 4 and the survey of HCPs in this chapter have highlighted that HCPs such as midwives may not consider PCC as part of their role as clinicians. Thus, HCPs may not always discuss preconception health or pregnancy planning routinely, even though they found the questions acceptable. HCPs such as dietitians, OBGYNs and GPs reported that they frequently meet women planning a pregnancy. A survey of primary care physicians in the USA[331] found comparable results to this study, where most respondents agreed that routine pregnancy intention screening should be performed, however only 48% reported performing such activities in practice. Doctors also reported training needs for contraceptive counselling and fertility assessment. Overall, this calls for further CPD to understand opportunities, such as during post-partum care, for discussing interconception health, particularly for primary care staff e.g., women approached GPs most frequently for pregnancy planning in my study.

Finally, it is important to question some of the assumptions related to age, gender and desire for pregnancies and the message that unintended pregnancies are a "bad outcome", which underpin preconception health messaging and interventions and can have implications for patient wellbeing. Studies have shown that people who were not active planners may welcome unintended pregnancies.[332] A qualitative study in the USA of young people (aged 18-24 years)[333] found that unintended pregnancies may be acceptable to participants. This study however did not report that participants considered the health impact (e.g., not taking folic acid) as a key factor for pregnancy planning and how they could benefit from conversations on planning. The strains in provider-patient relationships have been explored in the social sciences, suggesting that the normative view of "readiness" means that HCPs are not always congruent with patients' values and desires, with women from minority and marginalised groups historically being penalised for "unplanned" parenthood.[334] Callegari *et al*. 2017 recommend that for women not planning a pregnancy, the counselling should focus on the woman's health and wellbeing as an individual, rather than a "potential mother".[332] The impact of such framings are discussed further in Chapter 7.

5.6.2   Triangulation of findings

In the current study on the acceptability of the checklist, I found complementarity for the results from the closed and open-ended questions. Though the Likert scale responses showed wide levels of acceptance, women highlighted a range of methods that have been used or can be incorporated to improve the checklist further, along with suggestions on how to improve consultations. Similarly, though both qualitative and quantitative analysis suggested general acceptance of discussion of preconception and pregnancy intentions, respondents' views on communication and the effects of such discussions helped present a broader picture, highlighting the barriers for future parents when having sensitive conversations and for HCPs in improving current practice. Findings have also been compared to existing literature above and this is discussed further in Chapter 8.

Using the key findings discussed above as the organising principle, figure 5.14 presents the relationships between factors raised by women and HCPs. While several commonalities exist in why discussing PCC and nutrition routinely would be acceptable or not, some factors were only raised by women or by HCPs and, sometimes, differences were seen within the same group. Other unresolved/conflicting issues raised by respondents that could influence acceptability among women in the reproductive age group are shown in the pink circle.
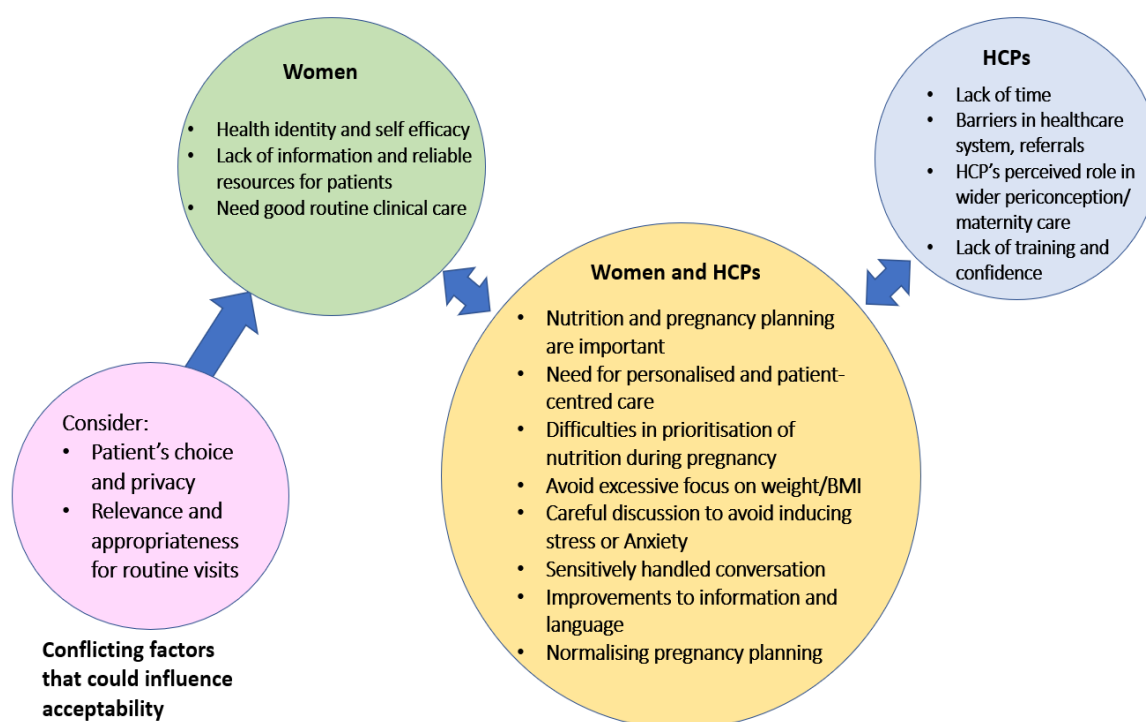
Figure 5.14 Conceptual figure depicts the key findings from the research questions on HCP's and women's perceptions on discussing nutrition and PCC routinely

While discussing how issues are prioritised in routine care, several HCPs felt that the checklist would require more time than available. Short-term high-risk outcomes such as pre-eclampsia or fetal issues have to be prioritised. This issue was also raised in Chapter 5 where interviews with HCPs identified that, though important to use a life course approach, NCD-related outcomes such as future Type 2 diabetes for the mother or the child's risk of diabetes were considered too long-term to merit discussion. It is not clear why a sizeable proportion of HCPs responded "neutral" to questions in the survey. This could possibly be due to factors influencing responses to the Likert scale such as preventing confrontational responses. An assumption could be that they support the checklist but were unsure of how they would use it in practice, due to lack of confidence and other barriers discussed in the open text responses. Future research and implementation studies for the checklist might be able to explain this further, however, for this study the researcher considered the neutral responses as "no agreement".

5.6.3   Strength and limitations

Design and dissemination

Strategies to reduce error during design and dissemination were undertaken based on recommendations from previous research.[335] This is summarised in Table 5.4 below.

Table 5.4   Potential sources of error in the survey and steps for mitigation

Coverage error	Multi-mode design with targeted and snowball strategy adopted to include the target population
Sampling error and Selection bias	Diverse modes of participant recruitment including wide dissemination of Facebook advertisements across the UK regions. There could be potential bias related to recall for questions related to post-partum or preconception visits.
Measurement error	The instruments used (survey questions) were piloted, reviewed by experts in multiple disciplines and the average time of completion was 10 mins (HCPs) 15 mins (women's survey). A user-friendly design was adopted to improve completion rates and data was checked and cleaned to only include incomplete survey responses which provided adequate meaningful data
Non-response error	Wide dissemination strategy used, follow up advertisements and retweets every two weeks.

The detailed social media strategy (Appendix D) shows steps taken to mitigate bias during recruitment. While provision of vouchers could mean potential bias in the results, the level of incentive selected was deemed appropriate after discussion with supervisors who have experience in recruiting and working with women in this age group. Finally, the survey advertisements and flyers used the terms "women" throughout without clarification that this was not necessarily referring to biological sex at birth. Unfortunately, this ambiguity in terminology could have excluded some people who intended to give birth in the future or identified as gender-neutral from participating but were prospective parents. For future studies, I aim to use more inclusive language to hear the experiences and perspectives of a wider range of birthing persons.

Sample size and representativeness

The main limitation of this study has been the small sample size for the quantitative analysis. Studies have shown a lower response rate to surveys both online and in-person during the period of the pandemic.[336] Considering the context of the pandemic and lockdown during the period of the survey, non-response could have potentially occurred due to restrictions in data collection in-person and a rise in research studies using online survey-based methods leading to survey fatigue.[337] In addition, recent studies (Italy, USA) of non-response error suggest that people of higher-educational status were more likely to respond during the pandemic,[336,338] similar to the

findings of this survey. In addition, this study also focussed on HCPs who were directly affected by the pandemic in 2020-21 with increased workloads, possibly affecting response rates in the second survey too. Studies during the non-pandemic period have suggested factors such as survey length, topic and types of questions as reasons for non-response.[339,340] The rate of completion for my survey was high (96%) for women who started it (measured automatically by Survey sparrow). Overall, this suggested that the survey content and questions were well-designed and of an appropriate length but that the response rates in both groups were more likely affected by survey fatigue during the pandemic.

Another limitation related to the study is the distribution of factors that could influence generalisability – educational status, ethnicity, and degree of deprivation. Most women completing the survey were university educated, of predominantly white ethnicity and from regions of low deprivation (when data were available). This may suggest that women of higher-education and socioeconomic status were more likely to access social media websites. Despite targeted advertising of the survey to reach diverse ethnic groups through Facebook groups, and Sure Start pages, their numbers were low overall. Additionally, as purposive and snowball strategies were also used, most responses were from the Southern regions of the UK, followed by London. This could also be due to the population density in the latter regions. The breadth of stakeholders answering the HCPs' survey (pharmacists, dietitians, GPs) was limited which could indicate that these stakeholders may not see PCC as their role/ responsibility (a result similar to interviews in Chapter 4).

As the results of the survey due to low sample size are not treated as representative, I have interpreted and presented the findings cautiously, drawing on similar survey-based studies [341] to develop the recommendations for future large-scale testing of a modified checklist.

Analysis and interpretation

An added advantage of using conventional content analysis was that it helped me to interpret the data in context, thus addressing a common critique of summative analysis or counting the frequencies of codes.[342] Details on rigour in qualitative research have been discussed in the Chapter 2. The trustworthiness devices included for this study such as triangulation and transparency can help in establishing the credibility and transferability of this research.

Overall, this analysis and study would have benefitted from an additional face-to-face element so that the HCPs and women answering the survey could experience the use of the checklist in practice. Chapter 4 and 7 aim to address some of these gaps, along with the final discussion

chapter which provides a rich understanding of harnessing policies and clinical visits to support PCC.

5.6.4 Recommendations

Based on the specific recommendations on content, style and alignment with UK guidelines, a UK-specific checklist needs to be developed that can be used for future pilot studies and trials for implementation, discussed further in the final chapter of this thesis

Figure 5.15 presents a model of integrating the checklist and discussion into routine care, considering the factors discussed in this Chapter and Chapter 4. Overall, as the checklist was considered acceptable and important as a tool to initiate discussions, and studies have evaluated its validity and feasibility and show promising results, it is recommended that the modified UK-specific checklist can be completed by women either online or as a paper version in a clinic/ hospital. The responses could then be discussed during consultation. However, to make the consultations effective and suitable, Figure 5.15 summarises key points for HCPs and promotes patient (person) - centred care. Training of HCPs in Healthy Conversation Skills and CPD for diet and nutrition guidelines would complement the delivery of information through the checklist, along with conversations post-consultation. Incorporating PCC training in the educational curriculum for medical and allied health professions is also imperative. Finally, future research should also consider evaluating the cost-effectiveness and effectiveness of the checklist on lifestyle modification. Including male partners in research related to pregnancy planning could also have significant implications for parental health[343] and needs to be explored further.
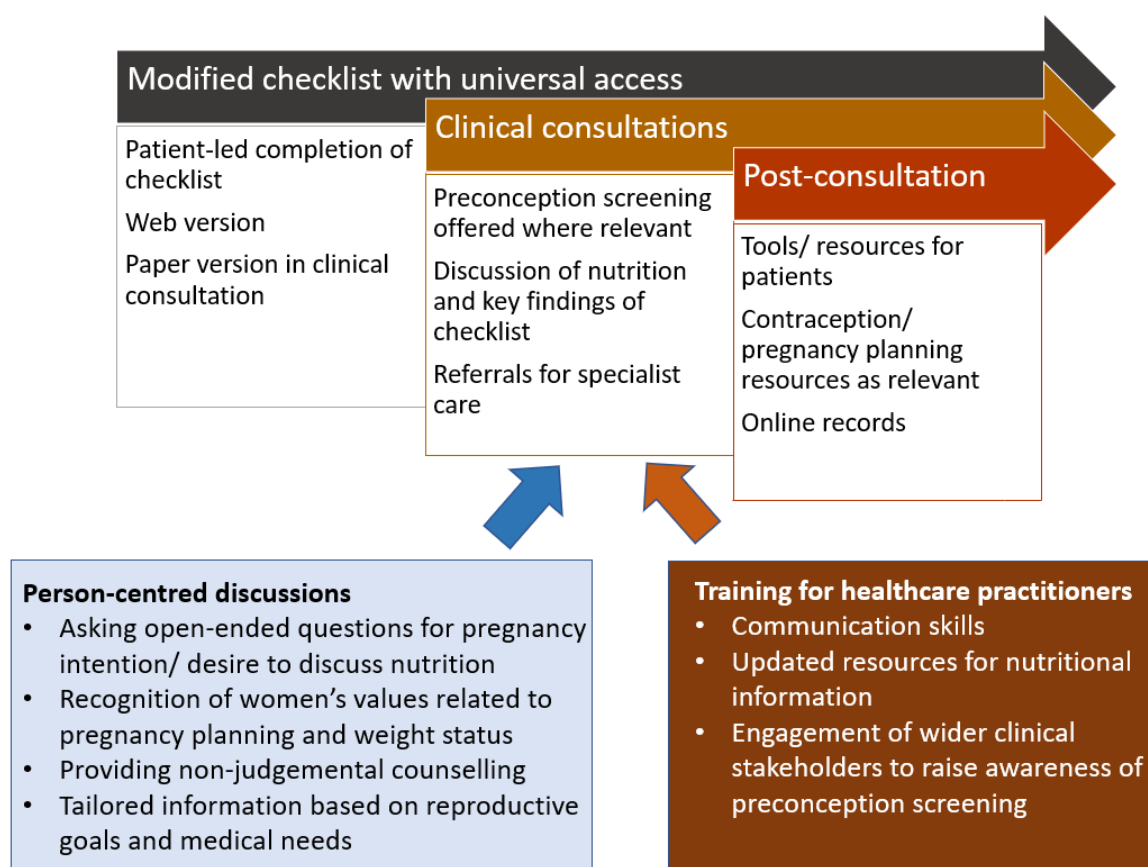
Figure 5.15 Recommendations for implementing the modified checklist and preconception screening during clinical visits

5.7   Conclusions

In this chapter, I aimed to explore the acceptability of a nutritional risk assessment tool (the FIGO Nutrition Checklist) used for women in the preconception and early pregnancy groups. In addition, factors influencing the acceptance of routine discussion on nutrition during pregnancy or pregnancy planning and routine screening for pregnancy intention for all women in the reproductive age group were assessed. Overall, results suggest that though HCPs and women found the checklist to be acceptable in practice, modifications in content and mode of delivery would be required. In addition, the practice habits of HCPs and women's experiences while discussing nutrition-related topics before and during pregnancy were explored using mixed methods, showing differences in practice depending on the type of HCP the women engaged with. While the acceptance of routine discussion of nutrition and preconception were mixed, participants raised useful suggestions for improving the conversations related to such sensitive topics.

Considering the myriad of barriers, and potentially specialist services required, it is not fair to assume that the burden of preventive public health for NCDs should be addressed by clinicians or by individuals alone. For example, issues related to health inequalities and low health literacy levels will have to be tackled with support from public health agencies, educational settings and the government. Development of messaging for public health interventions would also require further consideration as it would be different from conversations happening in clinical settings. This chapter concludes the studies on the clinical stream. The next chapter will explore the state of how the implementation of the life course approach has been measured for the policy stream of this thesis. Policy-related opportunities to improve preconception health using the life course model will be further discussed in Chapter 8.

Chapter 6   How has the implementation of a life course approach been measured?

Chapter 1 discussed how a life course approach views health as a dynamic continuum and not as a set of isolated health states. Scientific evidence in support of the life course approach has grown substantially over the past few decades. In addition, there is increasing political support and commitment from the member states of the WHO for adopting the life course approach.[93] This however presents a challenge in developing a framework to report on its implementation. Programmes based on the life course approach can potentially cover a range of domains (e.g., NCDs prevention, inequalities, social determinants of health) and cover interventions across multiple life stages. In addition, any intervention providing an intergenerational benefit (e.g., nutritional supplementation in pregnancy) or benefit across life stages such as prevention of childhood obesity, use a life course approach – though all studies may not cite the life course framework while doing so. This makes reviewing some of the wider questions such as "How has the life course approach been implemented?" difficult. The question is also too broad to be meaningful for the purpose of developing policies for NCDs prevention with a focus on preconception health, as it also depends on settings, cultural and societal factors, and thus unlikely to produce any definitive answers. An overview of how the implementation has been measured on the other hand is more achievable and will help policy-makers develop a strategy to monitor policies based on the life course approach.

This work on which this chapter is based was commissioned by the World Health Organisation Regional Office in Europe, to be undertaken by myself under the supervision of Prof Mark Hanson. A longer version has been published as a Health Evidence Network (HEN) Report in 2019. [344]

As health promotion interventions at a population level often use a (unstated) life course approach it is challenging to identify the studies and guidelines that were developed specifically for the implementation of the life course model. Studies that have reported on measurement and evaluation would provide more robust and validated evidence for implementation. Hence, the search strategy in this study targeted policies and papers which reported the evaluation of the life course approach as a concept. For the purpose of this chapter, based on literature discussed in Chapter One, the assumption of "what gets measured gets managed" was used. The decision to examine policies that have explicitly mentioned using the life course approach, and measured its

impact was made along with our collaborators at WHO, Copenhagen as these studies would have considered the implementation of the life course approach from the onset.

6.1 Review question

How is the implementation of the life course approach being measured and reported through policies?

The chapter focuses on identifying policy options that to measure the degree to which a life course approach has been implemented, for use at a national level.

6.2 Methods

Using the recommended methodology for a rapid review described in *A resource for developing an evidence synthesis report for policy-making*[345] a rapid review of published and unpublished literature was conducted. Along with academic databases, general website searches and specific searches for strategy documents by public health and government agencies were conducted between February and April 2018.

A search for peer-reviewed papers in English and Russian was conducted. The languages were selected to ensure maximum coverage of the WHO European area and were limited pragmatically due to lack of translation facilities for other European languages apart from Russian. Inclusion and exclusion criteria were defined, and documents were selected after a title and abstract screening based on the criteria (for the academic search and grey literature search).

Inclusion criteria-

1. Studies published in the last 10 years 2007-2018. Documents published prior to 2007 were excluded since they focused mainly on the description on theoretical models and cohort studies and not on the measurement and implementation of the concept.
2. Publications in English and Russian
3. Publications from countries in the WHO European regions were screened first, however as there were few papers addressing this directly, it was decided that all countries globally will be included.
4. Articles describing the measurement of a policy or programme or those proposing a framework for measurement

Experts in the field were contacted and websites of relevant organisations were screened to identify documents that focused on, or included in their objectives, the measurement of the implementation of the life course approach, and provided a plan for monitoring and evaluating it. The detailed search strategy and list of websites searched for international organisations are included in Appendix G. For this project, I worked with stakeholders (knowledge brokers) from the WHO European Office who supported the refinement of the search strategy to target the selection of documents to those that have relevance for policy-making, and hence purely academic opinion pieces with overarching recommendations on the importance of the life course approach or DOHaD were excluded.

The results were organised broadly using the ladder of measurement framework (Appendix G1.) described by Rippon and South[346] which was originally developed for a review of measurement in asset-based approaches, to aid the mapping of documents found.

6.3   Results
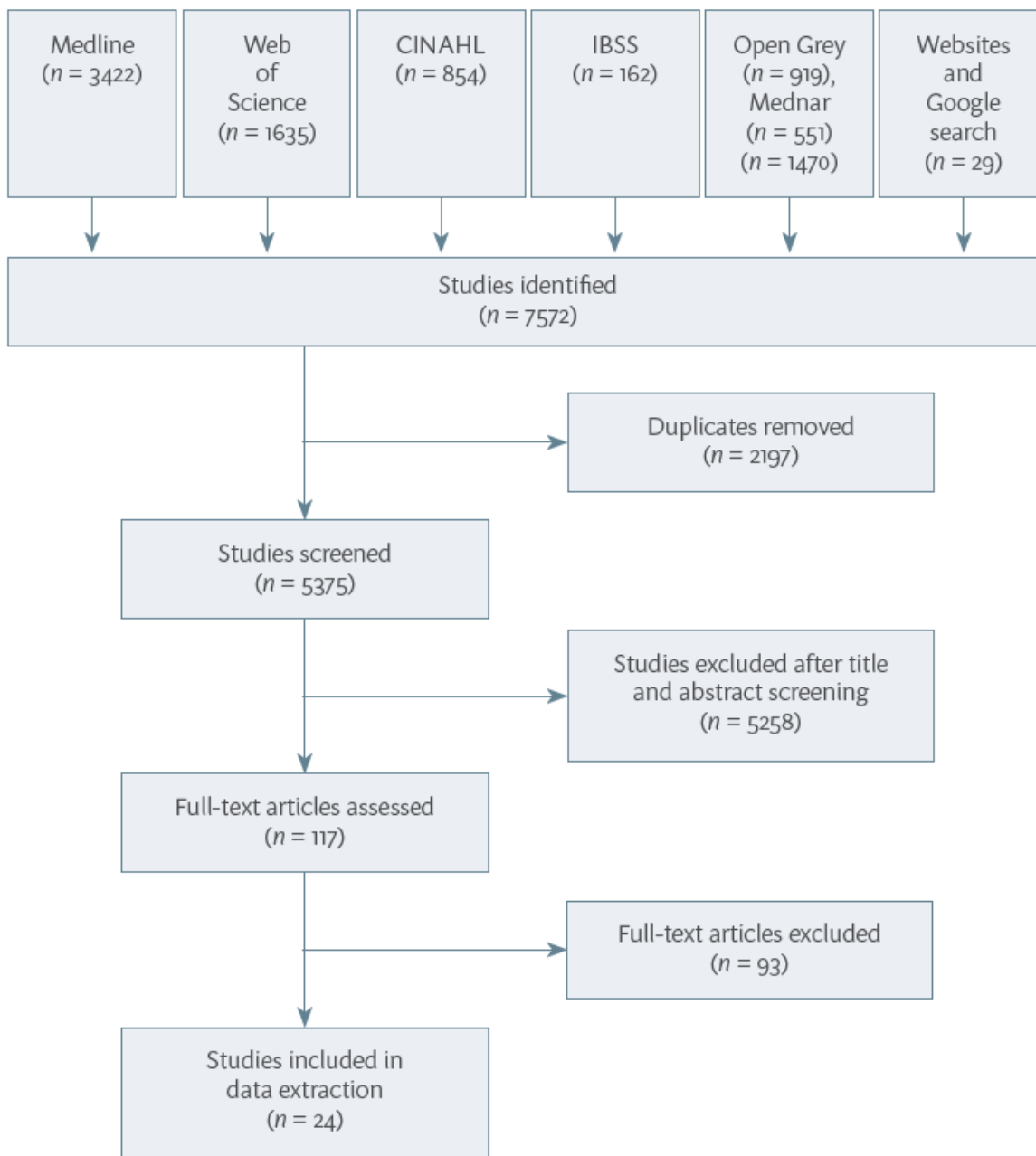
Figure 6.1   Search strategy flow diagram

Twenty-four documents (based on 22 studies and policies) were selected for the final review and narrative synthesis (Figure 6.1 presents the selection process). Detailed description tables developed during data extraction are presented in Appendix H discussing measurement. Notwithstanding an abundance of literature describing the models of a life course approach and its value in health promotion, policies focusing on its implementation are lacking. Though very few papers directly answer the research question, the selected studies suggest indicators for

evaluating programmes, based on the approach, that are validated measures. Selected documents were grouped by the types of methods for measuring the implementation of the life course approach. These included quantitative measurement frameworks, qualitative and mixed methods and conceptual frameworks.

While the focus of the thesis is on early life factors in the life course, the results of the review included measurement frameworks for the second half of the life course including ageing. These are presented as the review aimed to present the state of evidence on how the approach was being used and measured and to learn from best practice examples. I have presented a summary of the findings below which includes ageing, however the full version of the review for the WHO is not included here. This chapter mainly focuses on the findings related to early life (maternal and child health).

6.3.1 Quantitative measurement frameworks

Documents guiding what needs to be measured for initiatives using a life course approach to health, and how to evaluate such programmes using quantitative methods are included in this category.

6.3.1.1 Assessment of life course implementation

Research in medical and social sciences overwhelmingly supports investment in early childhood interventions and informs evidence-informed policy in this area. This includes programmes for early childhood development (ECD). Realising that provision of prenatal care only was insufficient to improve birth outcomes in low-income communities, Pies *et al.* (2012)[347] adopted the life course approach as an organisational framework for interventions and activities. Initiatives entitled Building Economic Security Today (BEST) and the 15-year programme Life Course Initiative (LCI) to reduce inequalities in birth outcomes were developed to improve health using a longitudinal, integrated and ecological approach through Maternal and Child Health (MCH) programmes. The primary aim of the project was to improve birth outcomes such as birth weight and reduce preterm births in the community. The authors aimed to examine independent associations between MCH indicators and programme efforts; to achieve this they tracked changes in staff knowledge as examples of programme implementation and assessed how staff are using the language of the life course approach (called life course perspective in the original study) in routine work. A key challenge highlighted by the authors while evaluating the initiative was the difficulty in selecting measurable objectives. The 12-point plan to improve birth outcomes

using a life course approach included objectives such as improving preconception and interconception care, and enhancing systems coordination and integration of family support services.

To monitor life course initiatives in pregnancy, to prevent NCD development, and to prevent the passage of risk of NCDs, FIGO recommends monitoring of hyperglycaemia in pregnancy and birthweight of the baby as a key component while measuring the outcomes of life course MCH programmes. [348] Results of a systematic review on life course cardiovascular research suggest that longitudinal studies can be used effectively to develop *post hoc* measures for childhood adversity from existing data.[349] The study aimed to summarise measures of childhood adversity in the context of cardiovascular diseases, based on the life course model. Most studies included in this review were based on the accumulation of risk model. Studies examined different cardiovascular outcomes using cardio metabolic biomarkers, inflammatory biomarkers, anthropometric outcomes (e.g., BMI), and blood pressure. Retrospective accounts of adversity using standardised questionnaires also allow for comparability across studies and facilitate the exploration of mechanisms in a population-based setting. However, the authors suggest that this approach lacks a time-based component and may introduce biases related to recall and social desirability.[349] Authors also emphasised the need to study positive factors that might enhance resilience and promote cardiovascular health.

6.3.1.2 Indicator sets and scales

Multiple indicators and lists were identified in the search, [350-354] but the summary in this chapter is not a complete list of all indicator sets that provide the opportunity to measure the life course approach. Several indicators sets exist that target age groups or diseases and that could be utilised to monitor life course parameters.

Four of the documents included described indicator frameworks or groups of measures that specify components that can be measured quantitatively, usually at a population level.[350,351,353,355] Each of these reports focused on a particular life stage as their target group, however, all of them aim to achieve health benefits in subsequent stages of life by adopting a life course approach.

The first indicator set included was from the US Association of MCH Programmes, which began in 2012, to develop indicators to assess, monitor and evaluate the application of the life course approach in public health at the state (states in the USA) or community level.[350,352] The life course stages considered were perinatal/infancy, early childhood, school-age, adolescent, young adult and adult. Following several consultation meetings, a team of experts generated a list of 59 MNCH

life course indicators. The resulting indicator set had measures overlapping with routine maternal and child health measures in the selected regions, illustrating that existing platforms could be effectively utilised for implementing and measuring the life course model. The list of indicators provided is of use to MNCH services and policy-makers but using the same set of indicators in multiple countries could be challenging. For example, the indicator of low birthweight was further divided into preterm birth and SGA. Most existing surveys and reports for MNCH report on low birthweight, but not necessarily on SGA.

With the aim of identifying indicators of early-life socioeconomic position that can be used in population health surveillance systems, Chittleborough *et al.* (2006) provide a list of indicators. These include the categories of education level, income, occupation, living conditions, family structure and residential mobility. The authors suggest including indicators of socioeconomic position while measuring the effectiveness of the life course approach – but the validity, reliability, and relevance of these indicators will need to be considered.

Evidence on long term outcomes suggests that programmes to improve cognitive development and health in children in the first two years of life have long-lasting effects on human capital, educational attainment, adult earnings and reducing the risk for chronic diseases in adults.[356] Two ECD toolkits[351,357] included in this review provide indicators for population-level assessments of ECD and for evaluating ECD programmes. Economic and health-related proxies such as poverty, mortality, stunting, and low birthweight have been used in global health to estimate the well-being of children.[358] Although poverty and stunting are commonly used indicators, such population-based proxy indicators do not capture developmental outcomes, are minimally responsive to programmatic interventions and are context-specific.[359]

The Early Development Instrument [360] was designed specifically for population-level monitoring of children's developmental health at school entry (age can vary in different countries). The 103-item checklist is completed by teachers (a parent version is also available). This approach enables a near-whole population coverage, minimises training requirements and captures information about children's behaviours and skills in a social setting. The social and emotional domains of the Early Development Instrument strongly predicted children's emotional well-being and peer relationships at age 10.[361] Its predictive validity and internal consistency have been tested in Canada and Australia.[362] Results suggest that decreased scores in the five domains predicted greater probability of failure to achieve basic academic competencies by age 8-10 and even later. The instrument has now been adapted for use in more than 20 countries including Estonia, Ireland, Kosovo, Scotland, Spain, and Sweden. A unique feature of using the data is its utility in

long-term evaluation of programmes or reforms in preschool/kindergarten provision, through repeated implementation for populations (children) providing an opportunity for monitoring at the policy and community levels. It has also been suggested that for population-level measurement of ECD, measures should focus on multiple domains of ECD (e.g., fine and gross motor skills, receptive and expressive language skills, social and emotional skills), outcomes must be aligned with other global initiatives, and tools should be evidence-based, reliable and validated with emphasis on test-retest reliability, criterion validity, sensitivity to maturation, biological and environmental inputs, and predictive validity.[359] Usability is another essential component that would allow easy and rapid use and analysis. Other ECD toolkits developed by the World Bank[357] for assessing early child development can be used for population monitoring, programme evaluation, or exploratory research.

The WHO's NCD monitoring framework is rooted in the life course approach.[355,363,364] A total of 25 indicators (and 9 targets) are provided in the framework, which has been used by member states for reporting health status and risk.[354] The framework targets issues such as cardiovascular disease, diabetes, cancer and chronic respiratory disease. Risk factors such as obesity, alcohol intake, dietary factors (high sodium intake) influence blood pressure levels and risk of NCDs such as cardiovascular disease and cancer in adulthood.[365] Intervening to reduce the burden of NCDs in adulthood and earlier in the life course can help reduce the loss of physical capability and improve quality of life during ageing. [365]

The WHO report of the Commission on Ending Childhood Obesity (Implementation plan)[366] highlights the importance of using a life course approach to prevent childhood obesity and NCD risk by monitoring preconception and antenatal parameters such as gestational hyperglycaemia and weight gain during pregnancy. In addition, monitoring the implementation of legislation or regulation on the marketing of complementary foods for infants and young children and the marketing of unhealthy foods is recommended. Measuring parameters such as BMI/ BMI-Z-score of children can help track progress towards achieving national targets. Similarly, the strategy document to reduce obesity by the Department of Health, UK [8,367] commits to using a life course approach through whole-population initiatives. The report suggests that focusing on children alone will not adequately address the issue of obesity in that age group, and interventions based on behaviour change are recommended for preventing obesity in adults to generate a positive intergenerational effect. For monitoring effectiveness, harnessing existing routine surveys such as the National Child Measurement Programme in the UK is recommended.

6.3.1.3   Composite scores based on indicator sets

Three documents [368-371] developed indicator groups with multiple variables to form composite scores. In the first indicator group, Vable *et al.* [370] developed validated measures of childhood social capital, financial capital, and human capital which can be used independently or combined into a single cSES (childhood socioeconomic scale) index for operationalisation and measurement across studies. The cSES scales comprised: Childhood social capital (two factors – maternal investment, family structure), Childhood financial capital (two factors – average financial resources and financial stability) and Childhood human capital (mother's and father's years of education). The authors used the Health and Retirement Study based on the life course approach to develop and validate a theoretically motivated index of cSES, which demonstrated internal consistency reliability, construct validity, and predictive validity ranging from 'acceptable' to 'good' (as defined by assessment criteria in the original study). The study stresses the need for well-defined exposure variables for policy interventions to decrease the impacts of childhood socioeconomic disadvantage on later health outcomes.

The second indicator set using composite scores was the Active Ageing Index (AAI)[369] - a toolkit that makes a comprehensive examination of the activity and independence of older people. It considers the age group of 55 years and older. The Active Ageing Index and the WHO's *Healthy Ageing* models (described in 6.3.3) both take into account individual and environmental factors influencing decline in function, and the extent to which older people's potential is used and they are enabled to be independent and encouraged to participate in the economy.

In the third score, Kramer *et al.*[368] proposed a method that uses commonly-used MNCH databases to inform life course MNCH research by developing socio-environmental trajectories. The authors calculated a neighbourhood deprivation index at the time of each of the women's births (based on a cohort study in Georgia, USA) and from these further calculated a cumulative Index. They recommend that education, income and occupational indicators of early-life socioeconomic status directly reflect the resource and status-based constructs of socioeconomic status and should be prioritised within monitoring and surveillance systems. Proxy indicators of SES related to living conditions, family structure and residential mobility can be included if resources permit. For measuring MNCH research impact, the authors also suggest the creation of trajectories from geocoded longitudinally-linked maternal vital records.[368] Linkage can be undertaken at the level of the state public health department and can provide a descriptive and analytical understanding of cumulative experiences and pregnancy outcomes in a population. However, it must be noted that

this method did not include childhood and adulthood exposures, and hence do not include other experiences during the life course.

6.3.2 Qualitative and mixed-method measurement strategies

Quantitative measurements via surveys and other tools can potentially overlook or poorly interpret the context-specific, individual, cultural, socio-political, economic and environmental factors that influence health and well-being throughout life. Qualitative methods have been recommended to help overcome these issues, however, their potential has not been adequately harnessed.[372] Three of the documents included in this review reported using qualitative methods as part of measurement strategies to evaluate the implementation of a life course approach. The Healthy Start programme (USA) [373] aimed to reduce disparities in Maternal and Infant Health status in high-risk communities using a life course approach by improving prenatal care to achieve optimum health over the life course. The outcome evaluation included measures such as birthweight (comparisons were made between ethnic groups and socioeconomic status), elimination of smoking, insurance coverage, medical homes and check-ups, unmet needs for health care and breastfeeding rates. For the qualitative component and process evaluation, the study sampled successful implementation sites, not effective outcomes sites. The study suggests that implementation and programmatic component assessments should be considered for more recent and short-term interventions, and outcome-oriented evaluations are suitable for long-term studies.

Locke *et al*. (2011)[372] explored the application of qualitative life course research in development studies. Exploratory and diagnostic qualitative investigation methods were compared using two case studies and results suggested that exploratory methods were more interpretive, but the analysis may be less representative. The diagnostic methods on the other hand were more structured. Methods used were narratives elicited using a 'free flowing' format (exploratory) or semi-structured interviews with field researchers (diagnostic). Exploring the context of life course interventions helped reveal the wider social and institutional factors and their roles in human lives.

Overall, evaluation of the implementation of the life course approach could be supported by adopting mixed methods. Mixed methods have also been used by countries in the European region to report on the implementation of a life course approach. In a 2017 report entitled *How small countries are improving health using the life course approach*, eight countries from the WHO European region[374] shared their experiences of implementing life course interventions, focusing

on issues such as nutrition throughout the life course, physical activity, overweight and obesity prevention, early childhood development, vaccines, supporting parenthood, increasing adolescent health knowledge, adverse childhood experiences, and long-term integrated health care. Key features that supported the delivery of programmes and assessment of effects included diversity of participating sectors, political commitment, existence of legislation, using existing working groups, availability of evidence-based literature, data from national surveys, multidisciplinary consultations and campaigns (further details are given in Table 6.1 below).

Table 6.1   Summary of activities and indicators used to report on life course approach by the eight small countries in the WHO European Region.

(Findings extracted from original report)

COUNTRY	LIFE COURSE ACTION/ IMPLEMENTATION OF THE LIFE COURSE APPROACH	MEASURES
ANDORRA	National strategy for Health, Nutrition and Sport Health promotion policy development aimed at disseminating information and promoting healthy eating habits and regular physical activity	A new nutrition survey (to be conducted) to inform decisions about the best way to continue promoting healthy eating habits and physical activity across all population groups
CYPRUS	Strategy to tackle overweight and obesity by promoting nutrition through the life course including future parents, pregnant women, children adults and ageing populations (nursing homes). Cyprus developed a community-based programme as an overall umbrella initiative, with multiple programmes targeting different life stages. Ranged from dietary advice for pregnant women, home visits for screening newborn health, legislation for school lunches, nutrition promotion for males in the army, awareness campaigns for adults, preconception advice on parenting and nutrition for future parents.	This was evaluated by epidemiological studies and collecting somatometric measures as relevant for each programme Pregnant women: weight monitoring Neonatal: weight, home visits
ICELAND	Welfare watch programme – to support at-risk groups such as families with young children, unemployed people, youth (15-25 years), during financial crisis.	Measured using – survey among members of working groups, assessment of the welfare watch programme. Data about the position of children in Icelandic society and the effect of the economic situation on them was gathered to formulate policy for protecting children.

COUNTRY	LIFE COURSE ACTION/ IMPLEMENTATION OF THE LIFE COURSE APPROACH	MEASURES
LUXEMBOURG	Screening children 0-4 years old for early detection of risk factors that may have a long-term effect on cognitive development and socialisation. Follow up till 18 years of age is planned	(Evaluation in progress) Multiple screening programmes have been implemented over the years for detection of hearing and language difficulties, vision, vaccine administration, psychosocial support for children and families and detection of rare genetic diseases.
MALTA	Healthy weight for life strategy	Separate evaluations are planned for each initiative, using questionnaires pre- and post-programmes, along with process and outcome indicators. Monitoring of childhood weight status is also being undertaken, and for adults' results from the European Health Interview Survey (EHIS) are reported.
MONACO	Initiative for care of the elderly population. Goals included: - Provide home-based support to the elderly for as long as possible - Facilitate the life of the supporting relatives - Take care of the elderly in case of loss of autonomy - Maintain a high level of care for the elderly	An evaluation is carried out every year, based on data collected from both the medical and non-medical structures and admission rates are monitored.
MONTENEGRO	Addressing adverse childhood experiences A survey was undertaken to explore the depth of the issue (with the WHO), and a strategic response will be undertaken based on the results.	Evaluation to be conducted
SAN MARINO	Tackling childhood obesity through inter-sectoral action: Prenatal courses and breastfeeding promotion Post-partum support Nutrition in schools	Measures used for monitoring – rates of exclusive breastfeeding, school based systematic surveys (to monitor prevalence of overweight and obesity and food consumption), and WHO surveillance systems for overweight, obesity and eating disorders. The HBSC survey and Global Youth Tobacco survey are also used to monitor outcomes.

The intersectoral approach adopted by small countries such as Malta and Iceland illustrate the efficacy of linking multiple health strategies across different life stages to address the alarming new trends in chronic diseases such as obesity and cardiovascular disease. Box 1 below summarises how the life course approach was used in Malta for the prevention of obesity, and their plans to measure the impact. Ensuring continuity of health and social care, including monitoring of interventions or new initiatives, from birth through the lifespan should also be given priority. Social, educational and health policies targeted at children and young people have

health effects that are expressed in the future and using a life course approach in surveillance methods helps to capture these trajectories. Finally, monitoring is essential to ensure accountability and should be conducted simultaneously with implementation plans. Involving key stakeholders from inception, including members from civil society and health care practitioners, helps in incorporating contextual factors that influence the uptake and delivery of initiatives.

Box 1: Healthy Weight for Life strategy Malta [375]
Context:
In Malta, the life course policy framework guided the development and implementation of a multi-strategy initiative to tackle overweight and obesity across the life course (2012-2020). The programme was structured around the continuum of the life course, with initiatives designed to address barriers to and enablers of healthy weight at each life stage or in each transition period and delivered in multiple settings such as preschools, schools, workplaces, communities and care homes.
Programmes targeted parents and children together to address the intergenerational perspective of the life course approach. Initiatives focusing on nutrition and physical activity were delivered in the prenatal period and childhood to promote the best possible start in life, and also in transition periods such as adolescence and pregnancy. Actions were taken under 3 domains – healthy eating, physical activity and health services.
Key elements measured - process indicators for activities and outputs in implementation, short-term and intermediate outcomes include changes in the environment or knowledge or behaviour and changes in health or health equity will be considered as long-term outcomes.
Methods (The final evaluation to be conducted) Process evaluation of the project was carried out, using measurements of school uptake and attendance and questionnaires. Programme implementation was conducted using focus groups, toolkits, and questionnaires (using a before-after design in participating schools)
Facilitators: - Sustained involvement of diverse stakeholders in planning and implementation   - Political commitment, supportive legislation and policies   - Use of mixed methodologies, including qualitative approaches (focus groups for the Schools on the Move programme*)* and quantitative data (e.g., epidemiological data on obesity for the evaluation of the overall framework).   - Indicators and targets based on existing surveys improved feasibility and efficacy   - Intersectoral approach involving ministries, nongovernmental actors, local councils and community groups, the private sector (e.g., restaurants)   - public consultation and engagement   Barriers: - Influence of external factors on outcomes measured on a complex issue such as obesity   - Difficulty in conducting process evaluations for a large multicomponent strategy

6.3.3 Conceptual frameworks

Three [376-378] of the selected papers provide overarching frameworks relevant for planning monitoring programmes, policies or interventions based on the life course approach. The first of these frameworks is based on the growing evidence supporting the life course model of ageing,

and for early life as a period of opportunity to prevent accelerated ageing.[379,380] To operationalise the concept of intrinsic capacity (defined as the measure of all the physical and mental capacities that an individual can draw on at any point in time)[6], Cesari *et al. (*2017)[376] developed and defined a set of domains, based on data from longitudinal surveys on ageing. Functional ability was an additional concept considered, which is determined by the intrinsic capacity of the individual, the environments they inhabit and the interaction between them. Both intrinsic capacity and functional ability were concepts introduced in the World ageing report, with the aim of using a life course approach to *healthy ageing* – defined as building and maintaining the functional ability that enables well-being in older age). [6,381] To assist in translating theoretical models into practice they first defined the constructs that constitute the Healthy Ageing model, with a focus on the ageing population. Cesari *et al*.'s framework to operationalise intrinsic capacity describes five domains: locomotion, vitality, cognition, psychological, and sensory. The group currently plans to use this framework to measure trajectories of capacity through the life course (further details on this group are presented in Chapter 7 of the thesis).

The second framework - The Life Course Health Development model (LCHD)[377] - discussed the need for vertical and horizontal integration of services. Vertical integration would include linking primary, secondary and tertiary care within different health disciplines, and horizontal integration would merge health services with other sectors such as social and civic sectors. The model also calls for a longitudinal integration of services across different life stages (e.g.- to post-natal care, childhood through adolescence), and intergenerational integration (mother-child) recognising the transgenerational links for passage of disease risk. The LCHD model has informed programmes and studies related to the measurement of children's health, maternal health and addressing health inequalities.[377,382,383] The LCHD model also provides recommendations for monitoring population health such as predicting the need for respiratory care, by measuring the onset and severity of asthma in children, tracking children and adults longitudinally and use of time series data for individuals and populations to guide policies and interventions.

In the last conceptual framework included in the report, Kuruvilla *et al*. (2018)[378] describe a conceptual life course framework that incorporates crucial concepts such as well-being, resilience, risk, life stages, and the realisation of rights and determinants of health. They state that it is essential to have an unambiguous and universal definition of these components to operationalise the framework. Aspects of the life course model defined by the authors align effectively with the Sustainable Development Goals (SDGs) - for example, health and wellbeing envelop SDGs 2, 3, 4, and 5, and realisation of rights includes SDGs, 5, 10 16 and 17. [3] The authors identify key issues in

measurement, monitoring and research related to the life course approach such as the need for international standards incorporating a core set of indicators applicable to all life stages to measure life course variables, information on age ranges for specific life stages and critical periods to effectively target interventions. They also suggest shifting focus towards modifiable determinants of health that influence health throughout life, and to identify interventions that can produce the greatest gains at different life stages.

6.4   Discussion

Overall, studies have reported measuring the life course approach using a range of techniques, as relevant to the study or policy under consideration. Implementing life course theory within actual programmes and policies is perhaps the most difficult of the challenges of using the life course approach. Issues affecting the use in practice of the life course approach include factors affecting the determinants of health across the life course such as socio-economic inequalities and intergenerational genetic/epigenetic determinants, fragmented healthcare systems and the need for resources for long-term follow up.[384] Due to the complexity of addressing the wider socio-economic inequalities, this particular aspect is often overlooked.[385] Translation of the concept into policies was lacking and thus calls for an approach that will build political will and engagement from key stakeholders. Lessons from the life course metrics project show that developing outcome measures for assessing life course interventions requires supportive leadership and interest among key actors. [352]

A whole of society and life course perspective on the social determinants of health is recommended by Marmot *et al.* (2012) to reduce inequalities in health, alleviate intergenerational transmission of risks and disadvantages, and improve the overall quality of life.[386] Thus policy initiatives such as those based on the universal health care principle, together with other forms of social services and social security, have been recommended as a support system to operationalise the life course approach, and enable an upward shift in health trajectories at the population level.[387] This shift towards a values-based approach, initiated by Health 2020, calls for a measurement strategy that considers contextual factors and lived experiences of communities and individuals. A move away from the disease-based models to a capacity or potential based approach as discussed in chapter 1.2.5 was seen in some of the included documents such as the intrinsic capacity model and the life course framework.[6,32]

Studies included in this report recommended the use of existing data collection programmes and including retrospective data collection to measure the implementation of life course

programmes.[349,352,376,378,383,388] Surveys such as the Health Behaviour in School-aged Children (HBSC) survey is a research collaboration with the WHO Regional Office for Europe, carried out every four years in 48 countries across Europe and North America.[389] The Global Youth Tobacco Survey (GYTS) monitors tobacco consumption in youth and is also carried out every four years providing valuable resources. Overall, at the time of this review none of the programmes above included preconception health as a key component except Pies 2012. [347] In 2019 a "report card" for measuring the preconception health status was proposed by Stephenson *et al.* in the Lancet using routinely collected data in the UK (discussed further in chapter 7). [303] Finally, record linkages from routine data discussed above could face issues related to selection bias, migration and data quality (e.g., misclassifications, low specificity of matching during record linkages).

6.4.1   Strengths and limitations of the review

A rapid review was conducted based on methods suggested in *Health Evidence Network synthesis report 50: A resource for developing an evidence synthesis report for policy-making* [390]. This was the appropriate methodology for the synthesis question as the aim was to scope out the methods in current practice used to evaluate the implementation of the life course approach. The search used in this report has targeted studies that refer to using a life course approach/ theory as a framework. There is a possible bias towards studies published in English as the search was mainly conducted in English, and no studies were found through the search in Russian. Finally, the measurement of implementation of a life course approach was not always explicit in the literature. Such studies would be excluded from the literature search if they did not use the terminology that indicates a life course approach. To include them in future research, a broader scoping review will be required using search terms related to life course epidemiology, e.g., health promotion for particular critical periods. Though a second reviewer did not screen the included papers, the knowledge brokers from the WHO office were involved in all steps of the project to examine the quality and rigour in the methods used.

Similarly, I did not undertake a targeted search for related terms such as 'life cycle'. Even so, semantic issues arose in the search from life course terminologies being used loosely in the literature, leading to several irrelevant studies being retrieved by the title and abstract search. The indicator lists described here are not an exhaustive summary of available sets of indicators. However, the ones included have alluded to or referenced the life course approach. Apart from few articles by global health organisations, all other articles included in this review were predominantly from high-income countries, or providing recommendations for them. The life

course model has great significance in improving maternal and child health in LMIC settings and translating these concepts into policies relevant to these settings are recommended. Chapter 7 helps overcome some of the limitations presented by review methodology used in this chapter to understand the process of policy decision-making.

However, this policy review provides a useful overview of how countries are measuring the implementation of the life course approach. In addition, it also discussed how implementation has been conducted in multiple settings, and which life-stages need further attention. A set of policy considerations based on findings from studies included are provided for consideration by stakeholders (policy-makers, researchers and health care practitioners), and the key findings of this chapter were used to develop a checklist for implementing the life course approach (targeting researchers and practitioners) presented in Chapter 7.

6.4.2 Conclusions and Policy options

This chapter has not necessarily identified every existing framework for indicators but provides evidence-informed best practice examples. Targeting key stages of the life course such as preconception, pregnancy and early childhood has been shown to provide long-term benefits. However, most policies did not address the preconception stage of the life course, or adolescence.

While strategies for monitoring specific conditions and life stages (e.g., ageing and childhood) exist, further research is needed to develop a valid, versatile reliable and responsive framework to measure the implementation of a life course approach for use at a policy level and that can be translated to community-based and clinical programmes. Results from the rapid review show that countries frequently invoke using a life course approach for multiple health conditions. Though attempts have been made to include wider determinants (such as deprivation and childhood socioeconomic status),[368,370] a robust strategy for using the concept in practice and measuring its implementation is lacking.

The following recommendations were developed for policy-makers in the WHO-European region in particular, to aid the development of measurement strategies and implementing the life course approach:

- Documenting how life course principles are being implemented in public health strategies and gaining an understanding of the barriers and enablers of such initiatives

- Developing an indicator set based on five core features related to the life course approach – equity, resource realignment, impact, intergenerational wellness and current, scientific understanding of life course health

- Selecting indicators for data collection based on criteria such as: quality, availability (across the selected region) and simplicity (simple to calculate and easy to explain the meaning and use of indicators to professionals and the public)

- Using indicators and measures that have been recommended for the life course approach that are already being measured as part of programmes, and referring to them specifically as life course targets

- Improving the efficacy of data collection by aligning monitoring frameworks (e.g., The SDGs) and using existing data to evaluate the current status of how the life course approach has been implemented

- Integrating services across different stages of the life course (providing a continuum of care)

- Developing the horizontal, vertical, longitudinal and intergenerational linkages which are essential to the life course approach (described by the life course health development (LCHD) model). Vertical integration would include linking primary, secondary and tertiary care, with different health disciplines, and horizontal integration would merge health services with other sectors such as social and civic sectors; a longitudinal integration of services across different life stages (e.g., pre-to post-natal care), and intergenerational integration (mother to child) recognising the transgenerational links for passage of disease risk.

- Exploring opportunities to use data on populations across research fields, to avoid policy compartmentalisation which limits interpretation and usefulness.

- Adopting a multi-sectoral approach that links public health services to other departments such as urban planning and housing, social policy development, education, etc.

- Providing services in other domains that are using a life course model such as mental health

- Developing a national oversight mechanism with responsibility for life course interventions and measurement and creating intersectoral linkages

6.4.3   How has this review influenced the next phase of my doctoral research?

Findings from this chapter have shown that despite widespread acknowledgement of the need for a life course approach to prevent NCDs, and consideration of concepts from DOHaD such as the intergenerational transmission of NCDs, very few policies have implemented these at a national level. The following chapter will investigate what more can be done to use the evidence from

DOHaD in real-world scenarios. The gap in programmes identified in the preconception period highlighted the need to develop recommendations in that period that policy-makers, public health stakeholder and healthcare workers can implement. This will be the main focus in chapter 7 which will follow the outcomes of meetings related to policies in preconception health, MNCH and the life course approach.

Chapter 7   How can the life course and DOHaD concepts be used to inform policies for improving preconception health and prevention of non-communicable diseases?

7.1   Introduction

In the previous chapter, I explored how the life course concept has been operationalised through existing policies and recommendations for measurement of the life course approach. As discussed in Chapter 1 the DOHaD concept has gained international attention in recent years, although clear strategies to use it in practice are still lacking, leading to little translation into policies and practice. Appropriate dissemination of evidence and possible solutions to the challenge of NCDs are needed to build awareness among stakeholders including the general public and policy-makers.

In Chapter 1, the key factors influencing the translation of scientific evidence to policies were discussed In research, DOHaD has now moved beyond animal and biomedical studies focusing on the "programming" of pathological processes to consider how patterns of early development across the normal range influences later responses to challenges from wider environmental and socioeconomic factors. [13] This change in emphasis is insufficiently recognised by DOHaD researchers, with corresponding problems for communicating an appropriate message to policy-makers. Furthermore, the implementation of such concepts needs to be monitored and measured to increase accountability for stakeholders. However, a lack of consensus on target indicators for measurement as seen in Chapter 6 can act as a barrier. The COVID-19 pandemic further exposed inequalities in health and wellbeing and a lack of focus on maternal newborn and child health.[391] For example, evidence on vaccine safety during pregnancy and for children was delayed, and pregnant women and breastfeeding mothers were considered low priority during the trials. [392]

7.1.1   Considerations for framing messages from DOHaD and life course research

The concept of framing and the importance of appropriate framing of messages from DOHaD and life course research were introduced in section 2.4.2. With novel multi-sector interventions

emerging as important for addressing DOHaD issues, DOHaD researchers have been critiqued for focusing mainly on individual responsibility for action, especially among women. [393-395] The narrative framed and presented to the general public about preventing NCDs, for instance through the media, largely emphasizes individual behaviour change (particularly mothers' lifestyles) and diminishes the role of other agencies (e.g., food industries, marketing) [394,395], assuming that individuals have a "choice" to eliminate risk factors. For example, a survey from the charitable organisation *Tommy's – Together For every Baby* explored women's behaviours and perceptions of pregnancy planning. However, the media report presented the headline - '*Women spend more time planning holiday than pregnancy*' which not only assigns the blame to women but also missed the wider picture of the socioeconomic inequalities related to knowledge on preconception risk factors and health behaviours that are discussed in Chapters 1 and 3. [303,396,397]

Taking the perspective of social responsibility in the field of DOHaD is not limited to the research community, but also concerns clinicians and policy-makers. For example, the need to present evidence related to obesity as an NCD risk factor in a non-stigmatising manner has been recommended by organisations such as the World Obesity Federation and recently by the UK government. [398] The damaging effects on public perceptions of attributing blame for obesity to individuals, through media and in clinical settings [399,400], highlight the need to raise awareness about the complexity of risk factors.[401,402] Chapters 4 and 5 of this thesis highlighted that clinicians felt less equipped to handle such conversations, and women reported experiences of facing such stigmatising and upsetting narratives. It has been recommended that both women and their partners need to be considered when developing the research agenda for risk factors and interventions.[403] Similarly, policy advocacy must be congruent with 'maternal and fetal rights' [77,404].

Socioeconomic status and inequalities can determine the availability and access to high-quality foods and healthcare making these dimensions important from a DOHaD perspective.[394,405] However, from the literature review in Chapter 3 and 6 it appears that researchers from the DOHaD and life course fields largely use a biomedical model, aiming to intervene through clinical and health systems, predominantly targeting mothers/ reproductive-aged women, in contrast to the plethora of evidence on wider societal, economic and environmental factors. As policy and public engagement are not adequately captured in the published literature, novel methods are needed to understand how research is being communicated, the process and barriers to engagement and whether the DOHaD communities are making progress in translating the

compelling scientific evidence on pathways to improving population health. Hence, this Chapter examines how experts from the DOHaD, preconception and life course fields developed and positioned their messages for communication with an external audience – namely policy-makers, knowledge brokers and the general public (further details in Section 7.2).

7.1.2 The development of multidisciplinary coalitions advocating for preconception health, life course and DOHaD

It has been recommended that effective DOHaD communication can be achieved through collaborations between academics and other interested stakeholders including community leaders, NGOs, clinical organisations and social workers, industry, consumer advocates, education, and employment sectors. [77] Several such multi-sectoral alliances have been formed in the last decade to advocate for implementation of life course and DOHaD-related outcomes in practice. While scientific societies such as the International DOHaD society and its regional chapters predominantly focus on sharing research, training and capacity-building within academic and scientific circles, other organisations such as the World Health Organisation have developed working groups to explore how value-based concepts such as the life course approach can be used through policies, and how it can be incorporated into their wider agenda for issues such as healthy ageing.[406] While some networks explicitly state implementation of the life course/ DOHaD agenda as an objective (WHO), other networks such as the UK Preconception Partnership (UK PP)[407] broadly aim to generate and translate knowledge from evidence rooted in DOHaD concepts (such as PCC for life course health and obesity prevention). Cairney and Oliver[158] have categorised such advocacy coalitions and research practices into two groups – collaborative (where skills and expertise are shared, often between researchers) and co-productive (where engagement involves equal control over decision-making and researchers transfer much of the control to other stakeholders such as knowledge brokers or policy-makers).

However, it is unclear how these groups have tried to navigate the complexities of the policy arena. In light of this challenge, this chapter asks: How have these expert groups in DOHaD tried to influence policy and what have they recommended? For this study, purposive sampling of five such expert groups was conducted to answer the research questions. The purposive strategy also provided the opportunity for attending and observing meetings in-person to gather the data. The groups and their objectives are further described in sections 7.2 and 7.3.

7.1.3   Aims and objectives

A key objective of this thesis was to explore the factors that influence policies related to DOHaD and the life course approach, and how the preconception agenda can be embedded within these models for NCD prevention and improving intergenerational health. The overall purpose of this study was to explore and to critically analyse how advocacy networks and coalitions frame, perceive and develop recommendations for implementation of the DOHaD and life course concepts. The current study aims to provide insight into mechanisms from the top-down approach (Chapter 2). A stakeholder mapping was also conducted, (described in Chapter 2) to understand the actors involved and their roles in implementation.

Research questions:

1. How do high-level stakeholders (policy-makers and academic/ clinical experts contributing to policy) conceptualise the use of the life course approach to improve preconception health through policies?
2. What factors influence the translation of research from DOHaD and life course approach to policies?
3. What are the perceived barriers and opportunities for PCC to be included in the life course approach and for implementing DOHAD and the life course approach in policy?
4. How are messages within the life-course and DOHAD field framed and what considerations go into their development?

This chapter will critically examine the disconnect between research and policy-makers and other key players, e.g., funders and knowledge brokers, and extract recommendations for implementation. It will also complete the stakeholder mapping discussed in Chapter 2 to identify the key players who are involved in setting the agenda for implementation. Finally, it will identify the missing stakeholders.

7.2   Methods

In order to supplement the findings from the previous empirical chapters, a qualitative prospective methodological approach was used by conducting a document analysis, with observations of meetings followed by qualitative content analysis. The document analysis was supported by the observations to gain a richer understanding of the factors that influence the

process of engagement with policy. A critical evaluation of the meeting reports using document analysis to provide more insightful findings, along with my reflections on having attended these sessions, is presented, along with examples of how these networks evolve in the life course and preconception arena.

Document analysis as a qualitative research method

Document analysis is a commonly used method in policy research. Bowen (2009)[408] has defined document analysis as

"a systematic procedure for reviewing or evaluating documents, which can be used to provide context, generate questions, supplement other types of research data, track change over time and corroborate other sources".

Apart from understanding the content of discussions, document analysis also helps examine the process, discourse and framing of narratives presented at meetings. Additionally, it provides an excellent opportunity to supplement other methods such as observations.[408,409] While several techniques have been used and described in the social sciences and in health policy research to offer direction on policy analysis through document analysis,[410] some have also used the methods to explore the process of agenda-setting, and how research has been used and translated into policies. [411] Many items have been considered as "documents" in these disciplines, with a broad definition.[408,409] They span a broad range of physical or virtual artefacts, which could prove useful at different stages of the research. Document analysis is particularly valuable for qualitative case studies which focus on describing events and organisations. For this study, the documents included were working documents presented and produced by the expert groups selected. This included meeting minutes and summary reports, concept briefs or documents circulated before meetings and draft documents, if available. Presentations and scholarly work were captured while preparing observation notes, but not included in the content analysis. While some authors have defined documents as texts or images without the researcher's intervention, Dalglish *et al.* argue that documents are not necessarily stand-alone objects but are framed by the social web in which they are produced.[409] For the research question in this chapter, it was hence imperative to enrich the document analysis with attendance and observations of the meetings by the researcher. This helped understand how they were produced, disseminated and the roles of different actors in shaping them.

The READ approach for data collection and analysis

As discussed in Chapter 2, qualitative analysis methodology has been used in political science and health policy[412] research because of its ability to capture decision-making and recommendations in the real-life context, which are not possible through structured surveys, systematic reviews or statistical analysis. Most methods for document analysis have been developed in the sociology and political science fields, however the READ approach described by Dalglish *et al*. (2020)[409] was specifically designed for health policy analysis. The technique, which consists of four steps - (1) readying materials, (2) extract information, (3) analyse data and (4) distil findings, was used for this study to systematically select and analyse the documents. The authors present practical advice for each step of the study. The use of the approach was adapted for the current study as illustrated in Figure 1 below. For this study, document analysis was conducted through multiple stages of skimming or examination, followed by thorough examination and interpretation using an iterative approach.

Readying materials
- Expert groups selected and approached
- Meeting observations - feild notes
- Meeting reports/ minutes gathered (2017-2022)

Extract information
- Summary of findings table, stakeholder information extracted
- Deductive frameworks developed for coding based on existing theoretical models - predefined key categories developed

Analyse data
- Qualitative Content analysis of selected documents
- Double coding using an iterative approach to develop framework

Distil findings
- Refining codes into categories
- Results grouped by theoretical categories and presented as a narrative synthesis
- Stakeholder mapping completed

Figure 7.1   Summary of methods used and steps to conducting the study based on the READ approach

7.2.1   Step 1 - Readying materials

A purposive sampling of organisations was conducted. In the READ approach, guided by the research question, studies focusing on specific policy issues may look at a limited number of documents including informal or working documents.

Rationale for Selection of expert groups

The following broad inclusion criteria were used for selection of groups:

- focus on translating DOHaD-related outcomes or the life course approach (e.g., childhood obesity, birthweight, preconception health, MNCH with a long-term focus on reduction of mortality)

- use of evidence from the life course and DOHaD fields for translation to policy and operationalising the life course approach

- explicitly stated engagement with policy or translation to policies as a priority/ objective in agenda or terms of reference

- formed by multidisciplinary stakeholders, usually high-level experts seeking to advocate for a cause related to life course, DOHaD or preconception health

Practical decisions were also made during selection as the study required an in-person element of observation/ engagement in the meetings. Hence, most groups selected were based in the UK or Europe, though they had a global remit. Based on these factors, for this study five such groups were selected to explore the research questions – the Venice Forum, UK PP, LifeCycle consortium, a WHO working group hosted by the WHO Department of Life course and Ageing and the expert group convened by the National Institute of Health Research Biomedical Research Centre (NIHR-BRC) in Southampton, UK. The focus or remit of these groups spanned a range of topics with membership ranging from over 100 members for the LifeCycle consortium, to six for the Venice Forum. Objectives of each meeting are presented as a narrative summary in the results (Section 7.3). Figure 7.2 below summarises the key objectives of the group and its relevance to this study.

The Venice Forum (2019-current)
- •Aim: To make the case for increased investment in maternal, neonatal and child health for long-term benefits of the population and inter-generational impact
- •Relevance: Focus on DOHaD-related outcomes, transgenerational health and engagement with policy-makers for advocacy
- •Meetings observed - Two Global forums (2019, 2021)

UK Preconception Partnership (2018-current)
- •Aim: to normalise the concept of pregnancy preparation
- •Relevance: Focus on DOHaD-related outcomes, translation of evidence to policy, co-production with public health authorities in the UK
- •Meetings observed - Seven Roundtable meetings (2018-2021)

LifeCycle consortium (2017-2022)
- •Aim: Consortium of European population based cohort studies identification of novel markers of early-life stressors affecting health, wellbeing,
- •Relevance: Work packages dedicated to explore use of DOHaD research in policy and developing recommendations for prevention of NCDs across the life course
- •Meetings observed - One expert workshop organised to support researchers increase policy impact (2019)

Working group developed by WHO department of Life course and Ageing (2017-current)
- •Aim: To develop measures for healthy ageing in advance of the Decade of Healthy Ageing 2020-2030
- •Relevance: focus on connecting the first and second halves of life to support healthy ageing, developing policies for health across the life course
- •Meetings observed - Two workshops (2017)

NIHR-BRC (2017-2022)
- •Aim: to explore how the concept of improving nutrition across generations can be translated into a roadmap to inform policy, action and research
- •Relevance: focus on early life and preconception, policies for prevention of NCDs
- •Meetings observed - One multidisciplinary workshop (2020)

Figure 7.2 **Outline of the inception, number of meetings attended to observe and keep notes for the study, the aim of the groups and reason for selection of the networks for this study**

The intended audience for the documents selected (e.g., meeting minutes/ reports) were the attendees and members of the networks, though the networks also produced other documents for wider dissemination such as peer-reviewed articles, commentaries and editorials for journals and policy briefs. However, the latter were not included in the document analysis. The peer-reviewed publications and policy briefs (if developed) by the groups were excluded from this

study as they only presented scientific evidence and would not provide information on the context, process of engaging with policy or evidence for stakeholders involved. However, any policy engagement as an outcome was extracted and is presented in the results (Section 7.3).

Observations were conducted while attending the meetings between 2017-2022. The meetings were conducted in person until 2020, after which they were hosted virtually due to the COVID-19 pandemic. The field notes captured written information related to timelines and planned outputs and were later compared with the approved meeting minutes. The duration of meetings ranged from half-day workshops (LifeCycle, UK PP) to 2–3-day events with breakout sessions. The minutes were recorded by rapporteurs selected by the networks. For the meetings by the UK PP, I was the official rapporteur due to my role as the coordinator of the network. Similarly, I was the minute-keeper for parts of the meetings of the Venice Forum, LifeCycle and the second WHO meeting. The meetings were not audio recorded. My position and reflections on how this could impact the research were discussed in Chapter 2 and are revisited in Section 7.4.

Ethics statement

This study only analysed written documents (available for public viewing on request) and did not involve data from human participants in the form of interviews or focus groups, and therefore falls outside the remit of NHS Research Ethics and institutional research ethics in Southampton. The approval for the wider programme of research for the thesis is described in Chapter 2. Only anonymised versions of the documents were used for analysis and no individual has been quoted in the text. My role as an observer was explained to the attendees, and the chairs of the meetings reviewed the meeting reports and approved my attendance in advance. The names of the networks are however not anonymised in this report as they have publicly available websites, and the chairs agreed on behalf of participants to be observed.

7.2.2   Step 2 - Extract data

A data extraction spreadsheet was developed for each network and the meetings attended to capture key information and this was updated continuously throughout the study period. In addition, the checklist presented in the READ approach (Appendix I.1) was reviewed as appropriate for extracting information and helping develop notes/ memos for the results and to compare groups. As the documents were produced over a while, any shifts regarding attitudes and beliefs of the organisation were also recorded in the notes.

7.2.3   Step 3 – Analysis

7.2.3.1   Content analysis

The method of analysis in document analysis is dictated by the research question and data.[408,409] Both thematic analysis and its variations (interpretive thematic analysis, applied thematic analysis) and content analysis (with or without quantification) can be used for this purpose. Qualitative content analysis (described in detail in Chapters 2 and 5) was selected as it helps organise the data, interpret and critically evaluate the documents. [127,413] Organising the data into categories was particularly important for this study as the documents and discussions during the meetings spanned several topics and produced large amounts of textual data. In the literature, however, the terminologies have been used varyingly, for example, qualitative content analysis is also called "thematic content analysis". However, as thematic analysis has been used in Chapter 4, to maintain consistency the methods used in this chapter will be called content analysis, and the data after coding were organised into key categories and sub-categories. Quantification of data is an intermediary and sometimes optional step – however this was not pertinent for the research question in this chapter is it would not provide meaningful input, and also could misrepresent the data. For example, while preparing the minutes, accurate records of how many times a certain recommendation was made was not captured.

7.2.3.2   Coding process

A mixture of inductive and deductive approaches was used to develop the coding framework during analysis. A theory-based analytical framework was developed to give the categorisation process a clear and comprehensive structure. As no similar research papers have been produced on the topic of implementing life course or DOHaD concepts in policy, theoretical frameworks from health policy research were used as an orientation to determine the key categories a priori. The two models used to develop the framework – Walt and Gilson's health policy triangle and Shiffman's framing theory and their relevance to this study were described in Chapter 2. The sub-categories were developed inductively during the analysis. This mixed technique was helpful for hypothesis generation due to a lack of existing work in this field. The coding framework thus had four key categories from the health policy triangle (figure 2.4) considering *actors* to be at the centre of the process, with a focus on the *process* of agenda-setting and translation to policy, what *context* the discussions took place in, and the *content* (evidence – scientific or otherwise forming the recommendations). For the aims of this chapter, the content would include the

measures and strategies recommended to address the policy issues related to DOHaD, life course and PCC.

All text relevant to the research question was coded. Text related to logistics and the organisation of the meetings was not included in the analysis. For quality control, a consensual coding method was developed as conducted for the previous chapters. Data was also double-coded as relevant – for example, coding for framing of an issue often overlapped with the content and context categories. Two coders (the candidate and an early career researcher in public health policy) each coded the text independently for a third of the documents selected. Multiple meetings were held to discuss and review the coding scheme until a common understanding of the coding scheme was developed. Discrepancies were discussed with supervisors. These steps helped enhance the rigour and transparency of the study. The final framework is presented in Appendix I.2 with descriptors for each subcategory and anchor examples. After this framework was developed, the results were integrated with field notes, enabling cross-connections to be made and to identify other meanings in the data such as the evolution and growth of the groups. As the documents were an interpretation of the rapporteurs and chairs, and direct quotes were rarely mentioned in the reports, examples of the codes are not presented in the results as conventional quotations. Examples of policy engagement or interventions are illustrated in the results within the appropriate categories.

Document analysis is often used in combination with other findings, and results from this study have been triangulated with existing literature. The codebook and coding framework contained detailed descriptions and examples, enhancing the study's transparency and, to an extent, replicability. Thus, efforts were made to address the three main concerns in document analysis related to (1) triangulation, (2) intense exposure and thick description (by observation in person) and (3) audit trails and discrepant evidence.[410,414]

7.2.3.3   Stakeholder mapping

As described in Section 2.3.6, the data extracted for stakeholder mapping was organised using the ODI toolkit for stakeholder mapping to assign a score for influence and interest (Appendix I3, I4). A detailed chart of stakeholder categories is presented later (Section 7.3). The positions and roles

of key players were identified through the documents and the observations and noted to gain a clearer understanding and inform the stakeholder mapping based on influence and interests.[142]

7.2.4   Step 4 - Distil findings

Policy relevant conclusions were drawn based on the aims of this study and are presented in the results. These are grouped in a narrative synthesis by the key categories of the content analysis using Walt and Gilson (1994), and Schiffman's (2017) frameworks.[145,148] A narrative overview of meeting conclusions is also presented with recommendations for policy and research in sections 7.3 and 7.4. While completion or saturation could not be achieved (as the networks are still functional and work is ongoing), the study presents an overview of the current status of how high-level stakeholders conceptualise the implementation.

7.3   Results

Overall, 18 documents were selected for analysis based on the meetings organised by the five selected groups. Table 7.1 provides an overview of the documents selected, agendas of the groups and meetings and outputs produced for policy translation. The content of the documents covered a variety of categories and were organised using the frameworks described above, with sub-categories developed inductively. In this section, the key findings from the content analysis and observations are described as a narrative synthesis. To illustrate the point more clearly, examples from the documents are cited, or a narrative story of incidents or a process is provided, instead of quotes from the minutes. When examples are presented, the document is cited as *"name of network (Year)".* While most documents provided some information on the conceptualisation of the life course approach or preconception, only a few of them articulated it in terms of implementation – namely the WHO working group and the LifeCycle consortium. For these two groups, implementation of the concept was the main focus of attention, though the WHO group had healthy ageing as its main agenda. The other groups referred to DOHaD/ life course in a broad context of other issues – e.g., NCD prevention, preconception health or increasing investment for maternal, newborn and child health for NIHR BRC, the UK PP and the Venice Forum respectively. Overall, all groups considered the life course framework as an effective vehicle to translate the arguments for their respective agenda into policies. All documents used multiple approaches to framing the issues both for problem definition and positioning.

With the exception of the WHO working group, all networks were led by high-income countries, chaired or led by academic experts in the field. While the UK PP and the NIHR BRC were based in the UK and focused predominantly on national issues, experts from other countries were invited as appropriate for collaborations, usually related to research. The Lifecycle consortium on the other hand had a European focus, formed mainly by birth cohorts in Europe, and one from Australia. However, for implementation and policy engagement, only the European context was discussed. Representation from LMICs was absent in all but two groups – the Venice Forum and the WHO working group. Both these groups adopted a global focus, developing global recommendations including LMICs as part of their remit. However, the organisation board of the Venice Forum, formed by members based in European and North American organisations (universities and NGOs), adopted a model where experts were invited to the fora from a range of countries to provide evidence or case studies and co-produce the recommendations. Finally, the WHO group was led by the WHO department of Ageing and Life Course which, at the time of inception of this PhD, came under the remit of a wider group looking at health across the life course including maternal, newborn and child health.

All documents included were complete and cross-checked by the chairs of the networks. The purpose of the documents was mostly for keeping records, and though circulated within the network, and available on request, the documents were not disseminated as they were to a wider audience. While all documents used multiple framings, internal contradictions in framing were seen in several documents (Venice Forum, UKPP, NIHR BRC). The UK PP was the only group that conducted PPI and public engagement activities to inform their agenda and collaborative research, and the NIHR BRC meeting was the only forum that included PPI representatives as attendees and contributors.

Table 7.1   Summary of organisations and meetings included in the study

Name of network and number of documents	Stakeholders represented	Agenda/ Objective of Network	Achievements and outputs *(Planned and completed)*	Notes on structure
The UK Preconception Partnership (UKPP) n=8 Terms of Reference, meeting minutes from roundtables 1 to 7 (2018-21)	- Public health bodies - Academia (reproductive and sexual health, obstetrics and gynaecology, population health and epidemiology, nutritional sciences, behavioural sciences, education in schools, ethics) - Education (schools and universities) - Charitable sector and NGOs (Nutrition, women's reproductive rights) - Medical bodies representing GPs, OBGYNS, Sexual and reproductive healthcare, Health visitors - Journal editors - Local Authorities (UK) - Knowledge brokers (working with public policy units in universities)	- Coalition of groups representing different aspects of preconception health in women and their partners - Key Target groups: Parents (future), policy makers, practitioners - Streams: Policy, public engagement, and data groups (with chairs for each)	- Publications (academic) - Evidence to inquiries by department of Health, members of Parliament, public health agencies - Report card on state of preconception Health in the UK - Presentation of key findings to the Department of Health and Social Care (Ministry) UK - PPI project and research (survey) to understand the public's perceptions on pregnancy preparation, preconception health and the language to be used for preconception messaging	- Initially formed as a group that contributed to the Lancet series on Preconception Health, later evolved to an advocacy group linking researchers, advocates, charities and policy-makers predominantly in the UK. - Involved groups and subgroups work largely in tandem and with well-defined subgroups and roles - Diversity in membership and academic faculties expanded over time.

Venice Forum	Led by academics representing - FIGO (International Federation of Obstetrics and Gynaecology) - DOHaD (International Developmental Origins of Health and Disease Society) - WHO (World Health Organisation) - Additional representation from academic and scientific societies (OBGYN, neonatology & paediatrics, public health, health economics, social science, and education) clinical organisations and clinicians, Patients' rights groups, NGOs (e.g., March of Dimes)	- Informal network of health-oriented professionals bringing together multiple organisations (from healthcare and non-health related sectors) - To make the case that investing in Maternal, Newborn and Child Health is critical for sustainable recovery after COVID-19 and other crises - Key target group: Policy-makers, NGOs and international organisations (e.g., World Bank, United Nations, WHO, Global Financing facility).	- Publications - Close engagement with high-level stakeholders to develop investment case (e.g., PMNCH, FIGO)	- Inception in 2018 as a forum to understand the impact of economic crises on DOHAD outcomes (data from Greek economic crises used as a starting point). - Group evolved to address issues beyond economic crisis over time post COVID-19. - Membership is narrow for the core committee, but broad and global for attendees who provide input during the for a - Leadership comprises researchers and members of NGOs from high-income countries (European).
n=6 Meeting reports (2), pre-meeting concept note (2), programme agenda (2) from 2 meetings (2019, 2021)				

Name of network and number of documents	Stakeholders represented	Agenda/ Objective of Network	Achievements and outputs *(Planned and completed)*	Notes on structure
World Health Organisation (Department of aging and life course) n=2 (Meeting reports 2017-2018)	- Over 50 experts spanning 6 WHO regions comprising academics (epidemiologists, sociologists, demographers, statisticians, economists), clinicians (geriatricians, physicians), agencies for evidence synthesis (e.g., Cochrane Collaboration) - Other actors from diverse roles e.g., community organizers, journalists, heads of national institutes, knowledge brokers and policy makers	1. To summarize current knowledge on intrinsic capacity and trajectories of intrinsic capacity across all critical life stages. 2. To summarize current knowledge on determinants of ageing trajectories leading to maintenance, increment or decline in intrinsic capacity	- Agreement on endorsing the approach and overall terms of reference - Decade of Healthy ageing launched in 2020	- Collaboration with working group developed in 2017, (later formed Consortium) to identify a concise set of quantifiable indicators of Healthy Ageing and outline modes for dissemination, testing and innovation to prepare for the Decade of Health ageing. - Broad structure, primarily led by WHO (Geneva), in collaboration with universities, NGOs and local actors in member nations driving case studies -Strong leadership and mechanisms for data-driven and evidence-based approach has supported progress on the Decade of Health Ageing 2020-30

| LifeCycle Consortium n=1 (Workshop minutes) Meeting conducted to explore how researchers can support evidence-based policy-making along with co-creation to implement the life course approach | - Academics and scientists (epidemiology, medicine, environmental health, epigenetics, health economics, nutrition, public health)
- Collaboration of specific work packages with knowledge brokers, policy-makers (global and local) | - The *LifeCycle* programme (funded by the European Commission's Horizon 2020 scheme) brings together population-based prospective cohort studies from pregnancy or childhood onwards to use data from European birth cohorts for the identification of novel markers of early-life stressors affecting health, wellbeing, and resilience, and to translate findings into policy recommendations for stratified and targeted prevention strategies | - Multiple publications
- Engagement with policy-makers, local authorities | - Tight core of health/epidemiology-oriented professionals
- Key focus is on evidence generation through harmonisation of data.
- Expansion beyond scientific network and dissemination of findings mainly led by two work packages nested within the group. |

Name of network and number of documents	Stakeholders represented	Agenda/ Objective of Network	Achievements and outputs *(Planned and completed)*	Notes on structure
National Institute for Health Research – Biomedical Research Centre Southampton n=1 (Minutes from Interdisciplinary Workshop: Improving Nutrition Across Generations)	- Academics and scientists (public health, nutrition, epigenetics, social sciences, and behaviour sciences) - Representatives from youth and adolescent programmes (Young Health Champions programme and LifeLab initiative) - Preconception Partnership members - clinical organisations: FIGO, ICM and the Royal Colleges (UK) - WHO, NGOs and the International Network of Government Science Advice.	- The group convened an expert meeting to explore how the concept of improving nutrition across generations can be translated into a roadmap to inform policy, action and research. - Three areas of focus were engaging the next generation of parents, achieving continuity of healthcare, informing policy-making to improve nutrition across generations.	- Development of a plan of action for next phase of the Biomedical Research Centre's strategy	- Broadening as main governance group within the research centre collaborates externally with knowledge brokers and external experts (predominantly UK and European context). - Discussions culminated in overall agreement to focus on the interconception nutrition period, however, the governance is fragmented as the life course agenda is part of wider agenda of the network which also focus on respiratory health and infectious diseases.

The main focus and membership of some groups changed significantly over the time of the study. While the UK PP also widened the remit of its aims beyond NCDs to mental health, inequalities, reaching high-risk groups among others, certain groups (Venice Forum) scaled-down the main network to follow a focused argument. The Venice Forum was formed from a larger medical conglomeration of mainly clinicians from OBGYN, neonatology along with basic scientists. Similarly, the NIHR BRC representatives developed a subgroup to focus on interconception health. Factors affecting the timeline and evolution of the groups and change in aims/ objectives are discussed further below. There was also cross-referencing of work done by different groups among the networks, which was expected as most groups had a European focus with a common agenda related to life course or PCC and had several participants in common.

The results are presented in two sections, one to describe the recommendations for operationalising the life course and DOHaD concepts, and the second for framing.

7.3.1   Results for implementation of the life course and DOHaD Models

Figure 7.3 summarises the key themes and subcategories found in the documents related to implementing the life course and DOHaD models through policies. As discussed earlier, Walt and Gilson's health policy triangle[145,152] was used as an overarching framework to organise the data related to implementing the life course approach. The descriptors and anchor examples of each category are provided in Appendix I.2. In the figure, key categories and subcategories for the conceptualisation of how the life course approach can be utilised in policy are outlined (blue circles). Examples of interactions existing between each category that emerged are indicated by the arrows. Though the information from documents was broadly categorised into different groups, several linkages between the categories could potentially influence each other and policy development. For example, contextual factors such as the WHO mandate on healthy ageing[381] could influence the agenda and priorities of actors such as the development of the WHO working group, which later became a consortium with focus on the life course approach and developing measures for healthy ageing. The use of the health policy triangle thus helped to explore the fluctuations of power among actors, and the impact of context on the content of the recommendations.
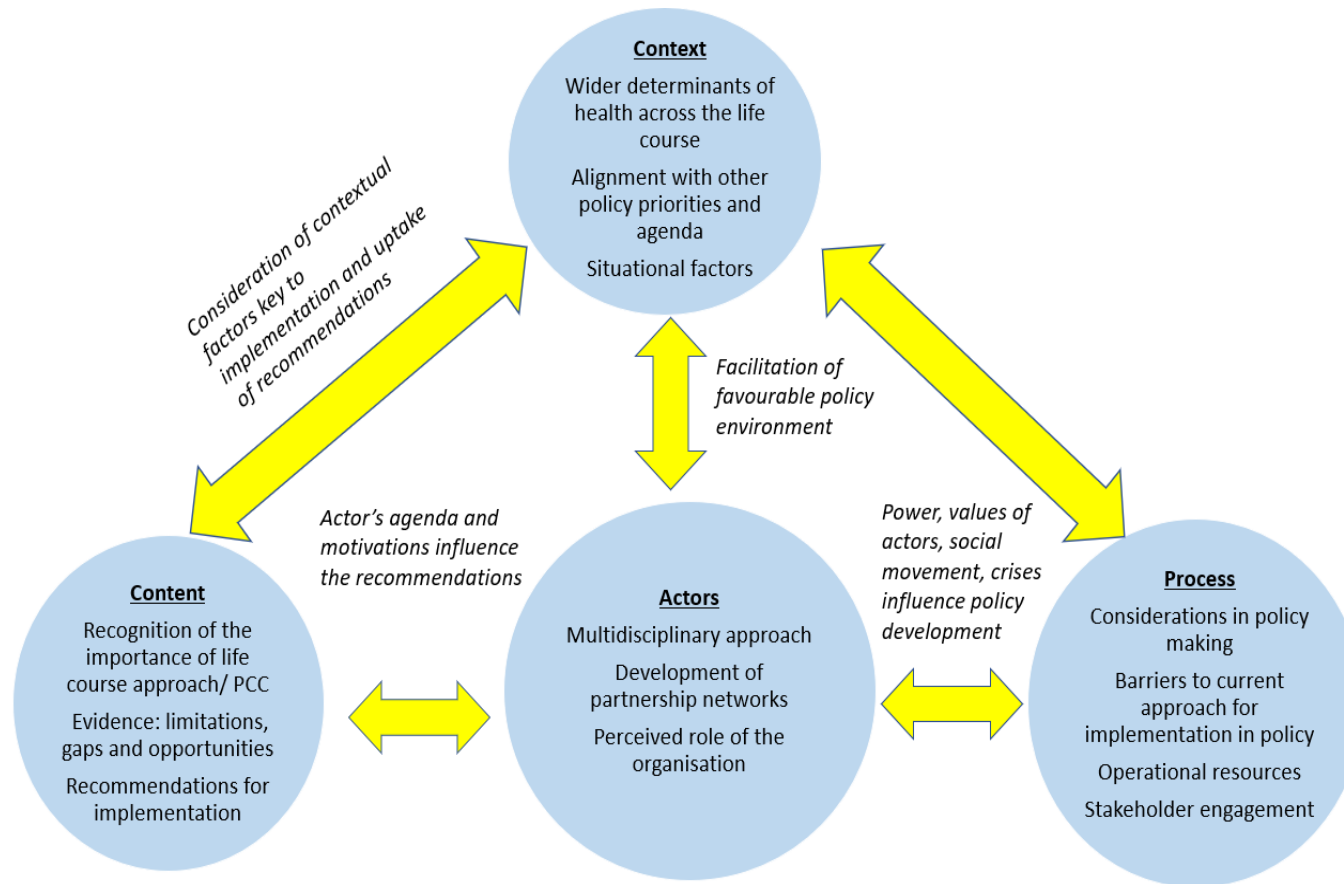
Figure 7.3   Illustration of key themes and subcategories found in the documents related to implementing the life course and DOHaD models through policies.

7.3.1.1   Actors shaping the life course, DOHaD and preconception agenda

Actors refer to individuals, organisations or the state, that affect health policy and contribute to the agenda setting activities and are central to the policy triangle. Stakeholders who contributed to the meetings of each network are listed in the table 7.1 above, but there was marked difference in levels of engagement, involvement, and interest among these groups. However, apart from the WHO consortium, all other groups were led by high-level academics/ researchers.

The adoption of multi- and inter-disciplinary approaches to implementation was a key factor that emerged during the analysis of attendees. This also included the call for representation from wider sectors within and outside academia, to include non-health scientists from fields such as economics, ethics and Science and technology studies (STS). The list of all actors and academic faculties represented is presented in Annex I.3. The range of stakeholders was categorised broadly, based on existing stakeholder groups defined in studies related to health policies to develop the chart in figure 7.4. [140] As shown in the figure, certain actors could fall into different categories and had multiple roles. The figure also shows the linkages between the actors, illustrating the gap in communication channels between the research community and the general public – often filled by the private sector, influencing the content of the messages.

Overall, meetings were attended by individuals representing their universities, international and national NGOs, pressure/interest groups, international clinical organisations, bilateral agencies, funding organisations, and the media, among others. While DOHaD is itself an interdisciplinary field and the number of studies emerging from non-medical or biomedical disciplines is on the rise, the representation in all five groups was predominantly from those with clinical backgrounds, followed by public health, epidemiology, and other biomedical disciplines such as nutrition. Actors standing in as knowledge brokers connected different groups providing policy advice, highlighting the needs of policy-makers, and flagging up high-priority areas in the life course with gaps for interventions/ risks and support for policy engagement with impact (e.g., policy units within universities). In the LifeCycle meeting, it was discussed how in the science-policy interface, the role of such stakeholders could vary from knowledge generators (academics and scientists), knowledge synthesizers (professional bodies, think tanks, government science councils), knowledge brokers (think tanks, advisors to government, regulatory agencies, to policy evaluation (think tanks, government agencies).

In stark contrast to the recommendations provided by the networks (discussed below), two key actors missing from the networks were the private sector (including the food and pharmaceutical industry) and the general public. Researchers who collaborated with these two actors often acted as an intermediary to inform the networks and connect the groups. Other obvious missing actors were researchers and policy-makers from the fields of economics and financing, HCPs such as midwives and representation from LMICs was low.

Stakeholder charting for implementation

Policymakers, governments, administration
- Health Authorities
- Public health bodies
- Departments/ Ministries of – health, finance, social care, children and family, transportation/ infrastructure, education
- Policymakers (national and local) – MPs, politicians
- APPGs

Research
- Universities/ Academia
- Scientific societies e.g., DOHaD society
- Funding bodies (NIHR, MRC)
- Data Sources (NHS digital)
- Pharmaceutical research

Dual roles – clinical and research

Healthcare Practitioners
- Endocrinologists
- Diabetologists
- Dietitians/ Nutritionists
- GPs
- Health Visitors
- Midwives
- OBGYNs
- Pharmacists
- Paediatricians/ Neonatologists

Public
- General public (reproductive aged women, adolescents, couples/ prospective parents)
- PPI groups
- Patients rights advocates
- Youth and adolescent programmes
- Community-based organisations, faith based programmes

Service providers (Health and social care)
- Sure Start Centres
- Family Hubs
- Schools

Civil Society Organisations
- Advocacy groups and Think Tank
- NGOs (NCD Alliance, March of Dimes)
- Charitable Sector (Tommy's)

Private Sectors
- Food industry
- Supermarkets
- Digital technology for health
- Pharmaceuticals
- Media, advertising

- **Knowledge brokers: Evidence synthesis (Cochrane)**
- **INGSA, WHO, ISC**

Direct links and communication channels

International organisations providing policy input, overseeing national authorities for accountability – e.g., IMF, GFF, WHO, UN, UNICEF

Clinical guideline development, advocacy and setting standards for practice: e.g., FIGO, ICM, Royal Colleges

Figure 7.4   Stakeholder chart presenting seven key groups (IMF – International Monetary Fund; GFF – Global Financing Facility: APPGs- All party parliamentary groups; INGSA – International network for Government Science Advice, ISC – International Science Council; In red- missing actors)

The need to develop wider networks and collaborations outside the group was also widely discussed by the selected networks. For example, the UK PP acknowledged the development of a similar network (the Health in Preconception Pregnancy and Postpartum - HiPPP) in Australia, but, no tangible collaborations were formed. Efforts to widen the membership to include other sectors also faced barriers, which were usually addressed through existing research collaborations. For example, the UKPP involved schools to implement the agenda of adolescent health, through programmes such as LifeLab,[415] a complex intervention targeting schools to improve health literacy. The UKPP also engaged with the Department for Education indirectly through links with the Faculty of Sexual and Reproductive Health, UK, which supports the development of the PSHE curriculum. While the WHO uses a targeted approach to commission and assign specific tasks, their agenda-setting, and network development are also influenced by the need to represent all WHO regions and member states. The LifeCycle group invited external birth cohorts (including non-European cohorts) to share experiences, largely focusing on research and methodology. The Venice Forum was presented with challenges related to finding interdisciplinary and policy stakeholders from LMICs, with internal disagreements occurring about how the core committee would liaise with such groups, or whether they should be included in the main board. The Venice Forum most often acted through links with groups such as the WHO, PMNCH and UNICEF to represent LMICs, or connect them with appropriate case studies. Finally, the NIHR BRC meeting used a targeted approach to include Royal Colleges from the UK along with representatives from a PPI group with the aim of co-producing the agenda and identifying priorities for research and policy engagement.

The groups visualised their roles in policy-making in different ways. Only three groups (WHO consortium, LifeCycle and UK PP) had documented their aims and terms of reference formally to define their role and remit. Organisations such as the WHO had multiple roles in the policy-making arena - from leading the consortium for healthy ageing to acting as a link between the Venice Forum and policy-makers. Usually, knowledge brokerage at this level occurs through a consensus development on an issue with academic experts, followed by engagement with policy stakeholders from WHO member nations to suggest potential avenues. However, in practice the uncertainties in the scientific community about DOHaD (target period, target intervention, framing and settings) hindered this process. Other actors with multiple roles included organisations such as FIGO that had a role in setting the research agenda, quality standards and guidelines for clinical care, as well as advocacy for women's sexual and reproductive health.

Links between the types of actors were mainly related to: – individuals with multiple roles and with two or more organisations; members of advisory panels who had a role in policy design and access to high-impact meetings (e.g., World Health Assembly, G-20 summit); and actors from public health organisations recruiting researchers to conduct a policy evaluation or evidence synthesis for a particular policy issue (e.g., developing models for community delivery of PCC with the UK PP). Some of these links are presented in Figure 7.4 above as examples. Except for the WHO consortium, none of the networks mandated a declaration of conflicts of interest and hence this information was not evident. However, it was clear that some of the research and actors had been sponsored by the pharmaceutical or food industry. This was an important point, particularly affecting engagement with agencies such as WHO and UNICEF who actively distance themselves from such networks due to historical issues such as the marketing of breastmilk substitutes by the private sector.

The difference in power of stakeholders was also evident. For example, researchers have a higher influence compared with clinicians in the science-policy interface. Healthcare organisations such as FIGO have greater influence on policy-making and advocacy, while individual HCPs have low power, but higher interest, as the change in policies could affect their workload, roles and responsibilities. However, as none of the networks included politicians/ ministry representatives, actors with the power or influence to block or change a policy were missing. The information from this section was used to develop the stakeholder mapping in the final discussion section of Chapter 8.

7.3.1.2   Contextual factors relevant to policy development using a life course framework

Context relates to systematic factors - political, economic, social or cultural, both national and international, which could influence health policy. Social, cultural factors and gender norms influencing DOHaD/ life course outcomes or preconception health - both implicit and explicitly stated by actors or the evidence presented during meetings - were included here.

Need to consider contextual factors and wider determinants of health

When presenting evidence and discussing strategies for implementation, all networks acknowledged the importance of the wider contexts outside healthcare which influence policy-making. The Venice Forum aimed to highlight how issues such as climate change, gender inequality and food insecurity have created an environment for poor nutritional status for women

and young girls. Similarly, exploring opportunities to improve the built environment and factors such as air quality and safety were raised, and included as part of the work plan by the LifeCycle and WHO consortia. The work of the UK PP and NIHR BRC has shown links between adverse NCD outcomes and deprivation as higher levels of parental risk factors such as obesity and low intake of folic acid preconception was seen among economically deprived groups and higher rates of childhood obesity in disadvantaged areas in the UK.[303,304]

To build on the argument for protecting maternal and child health services, the Venice Forum members presented evidence showing that policy decisions for financial reasons, such as budget cuts for social services, public health and education and reduced aid to low-income families could have effects on child poverty, increased unemployment, and birth outcomes such as low birth weight. The financial contexts in countries also influences healthcare decision-making, with evidence for increased consumption of junk food and processed food, increased parental age and increased medicalisation of pregnancy (e.g., higher rates of Caesarean section in Greece) seen during times of austerity.[416] Factors such as unemployment and labour market uncertainties also affect young people more, leading to knock-on effects such as adolescent girls dropping out of school and a rise in teenage pregnancies during an economic crisis, especially in LMICs.[417] On the whole, these existing contextual factors were identified as important to include in programme development for implementation.

Alignment with national and international policy priorities

Contextual factors such as strategies/ policies at a national or international level, and political priorities during the timescale of the study were not always clear from the documents, but emerged from the discussions, literature and knowledge of the field. Groups often used the strategy of "piggybacking" on other agendas with momentum. For example, for more than a decade the number of organisations articulating the use of the life course approach for a range of health issues was increasing, as seen in Chapter 6. After the Minsk Declaration in 2015, followed by the publication of the World Report on Ageing and Health, a key objective of the WHO was to implement the Global Strategy and Action Plan on Ageing and Health endorsed in May 2016, including setting up a proposal for a Decade on Healthy Ageing 2020-2030. This adopted a life course lens to view healthy ageing and *"connect initiatives in the first and second halves of life"*. Efforts were intensified to address the knowledge gaps and build collaborative networks, leading to the formation of the WHO consortium. Thus, the life course agenda was framed as crucial to the healthy ageing strategy and helped connect other departments focusing on specific life stages

to work collaboratively. Around the same period (2015-2018), key publications such as *The Lancet* series on Preconception Health, and the WHO Ending Childhood Obesity report emphasised the preconception period as a key life stage for long-term NCD prevention and the transgenerational passage of NCD risk.[80,165] This, in addition to evidence from trials based in pregnancy showing moderate to poor results for NCD prevention, put the spotlight on the preconception agenda shaping the priorities of the LifeCycle consortium (initially focused on childhood obesity) and the formation of the UK PP. The NIHR BRC group also widened its plans to include preconception health policies and policies for nutrition, NCDs and obesity through links with the UK PP. However, it could be argued that the increased focus on demonstrating policy engagement by research groups such as the NIHR BRC and LifeCycle was influenced by the requirements of funding organisations.

Other factors such as a change in governance also affected some of the groups. In 2021, Public Health England was dissolved and re-established as part of the Department of Health and Social care (DHSC) as the Office for Health Inequalities and Disparities (OHID). Though this restructuring influenced their links with the UK PP, actors also viewed this as a window of opportunity to support the development of the agenda of the newly formed organisation. Change in leadership and restructuring of the governance between 2017-2019 at the WHO headquarters and change in priorities during the COVID-19 period also influenced the timescale of the life course project within the WHO consortium. Though the decade of healthy ageing was launched in 2020, the work on identifying indicators for early life received lesser attention and is still ongoing.

Impact of situational factors and the COVID-19 pandemic

Even before the pandemic, evidence of low levels of investment in maternal and child health was clear, posing a major chronic threat to population health and the resilience of healthcare systems[418] – an argument presented by the Venice Forum during its inception. The impact of war, socioeconomic crises and natural disasters on MNCH was discussed by the forum (2019) along with its impact on children's neurocognitive and emotional development, stunting and increased risk of obesity, impaired educational attainment and economic prospects in the future. [89,419] These are mediated by contextual factors such as food insecurity, infection, lack of access to healthcare and loss of income, with particularly detrimental and disproportionate effects on women and children.[420] During the pandemic, mortality and morbidity were higher in males and the older population, and thus women and children were excluded from key conversations e.g., related to vaccine development (Venice Forum 2021).

A central agenda of the Venice Forum was to advocate for sustained investment in MNCH in the post-pandemic recovery phase. The group called for a renewed focus on the other targets in alignment with the sustainable development goals (SDGs) e.g., SDG 3 which concerns maternal, newborn and child health, especially 3.1 (reduce global maternal mortality), 3.2 (end preventable deaths of children under 5 years of age), 3.4 (reduce premature mortality from NCDs) and 3.7 (ensure universal access to sexual and reproductive health-care). Key reports published during the pandemic, such as the Build Back Fairer: COVID-19 Marmot review [421] highlighted the need to address the existing inequalities, which led to higher mortality and morbidity among groups such as minority ethnic populations and people with obesity and NCDs. However, they do not refer to the impact on maternal health and long-term risks in the next generation. Both the Venice Forum and the UK PP acted on the "window of opportunity" to include the preconception and life course agenda as part of the "building back" agenda of the post-pandemic recovery phase.

7.3.1.3 Factors in the policy process shaping implementation

Discussions on the development of policies (specific to the research question and generally) and the considerations that go into the formulation and use of evidence in policy were included in this category. The analysis revealed that the policy development process was influenced throughout by four distinct factors which formed the sub-categories – general considerations in the development of policy-making (global and local); barriers and limitations within the current approach for implementation in policy; operational resources required and governance within networks; and, finally, modes of stakeholder engagement.

Policy-makers seek and use evidence for a range of reasons such as changing an existing policy or developing a strategy for a new policy issue. Depending on the need, the method of engagement would also be influenced. For instance, emergencies such as the pandemic would call for "best available" options, at the earliest, while modifications in the school PSHE curriculum could be influenced by evaluations and take years to implement a change. This was discussed by a knowledge broker (LifeCycle 2019) who stressed techniques such as stakeholder mapping and identifying the level of governance (local/ national/ global) of the network as a first step. The research community can also be opportunistic in finding the right time to communicate their message, by monitoring relevant discussions in a new political cycle, which could affect policy-makers' perceptions of the importance of an issue. Having a clear purpose or intention (e.g., warning the policy-maker about immediate consequences such as childhood obesity or predicting

trends in long-term disease burden in the population) was a key factor, which most networks struggled to articulate. Interventions that can have multiple benefits are also preferred over singular interventions by policy-makers, however issues from DOHaD and life course have not often been framed in that context. Groups such as the UK PP have slowly moved away from a sole focus on the NCD prevention and nutrition agenda to include the effects of PCC on mental health, intergenerational health and contraception. While institutional mechanisms may support the knowledge translation process e.g., academic rewards system and impact rewards by universities, networks such as the UK PP and Venice Forum functioned without external funding and relied on individual members to conduct the research activities for the network.

A senior policy-maker from a European country attributed the gains made in life expectancy, well-being and health to "*an approach to public health that has been data-driven and evidence-based, with multiple routine data collection systems, supplemented by stakeholder involvement",* along with health sector reforms over the past decades towards the provision of universal health care (LifeCycle 2019). While the importance of good quality data was articulated by all networks, policy stakeholders and knowledge brokers also cited the power of alternative forms of evidence, including case studies, anecdotes, and public opinion, on issues as key factors, and several studies in political science have corroborated this point.[104] The assumption that governments are more likely to make better choices when they use well-developed evidence wisely has been shown to be incorrect by recent events such as the pandemic and the *anti-vax* movements which showed that the easy availability of misinformation online could contradict expert opinions both at the level of public and policy-makers (LifeCycle 2019, Venice Forum 2021).

Networks recognised and articulated some of the hurdles while communicating evidence, such as lack of a unified, clear message and evidence gaps or uncertainties in the field. While evidence gaps and uncertainties exist, knowledge brokers recommended that reliance on data from cohort studies may not be an efficient strategy, and public engagement and research on lifestyle factors and interventions also provide insight to develop key recommendations and tools for implementation. The influence of industry and the private sector on research and policy-makers is an important barrier to implementing the life course model. Excessive focus on nutritional supplementation programmes for maternal and child health and unethical marketing practices have affected research priorities and health behaviours in the general public respectively. Though industry has no direct role in policy-making, corporations use a wide range of strategies targeting policy-makers, media and the general public as well as scientific research to lobby for their

products. Thus, scientists have to compete with lobby and pressure groups formed by the private sector to present the evidence from the field of DOHaD to policy-makers. Building trust with politicians is thus key to communication, providing clear information on the evidence and existing gaps. Resources to support policy translation such as training researchers in policy methods, funding for networks to employ researchers for specific agendas were also discussed.

Barriers from the policy side include assumptions policy-makers may have that science cannot help in complex issues where knowledge is contested, along with their experiences of working with academics acting in "silos". Additionally, policy-makers have to compare the evidence provided by different groups, including the private sector. Finally, change in governance structures within networks advocating for the life course approach and a lack of political will are also process-related barriers to implementation. For example, the WHO faces several obstacles in getting consensus from all countries while developing guidelines (sometimes linked to industry pressure as discussed above) and, hence they have to be flexible in contextualising their guidelines during implementation.

Overall, outputs by all groups for policy engagement were often in the form of position papers in journals[300,391] which is not an avenue policy-makers usually access. Policy briefs on the other hand are recommended by knowledge brokers. They can be disseminated directly, were developed by certain groups e.g., the NIHR BRC (for interconception) and disseminated to key players. Other policy briefs developed by the Venice Forum and LifeCycle group for example were not completed at the time of the study, as consensus on the contents and messages was not achieved. Finally, groups directly engaged with key policy-makers by providing evidence to strategies and enquiries for the government and public health bodies and writing letters to members of parliament to advocate for preconception interventions (e.g., fortification of flour with folic acid by UK PP), providing a seminar for Department of Health and Social Care staff (UK PP) and engagement with local authorities to address local issues such as the childhood obesity strategy in Southampton (NIHR BRC).

Public engagement and co-production with wider disciplines outside healthcare also help develop a cohesive argument from the bottom up which could appeal to local policy-makers in particular (LifeCycle 2019, NIHR BRC 2020). The LifeCycle and UK PP networks attempted to conduct stakeholder mapping and analysis within their networks, but due to low engagement with policy-makers by the individual groups, coupled with low interest or motivation or lack of resources to conduct the translation activities, the process is still ongoing. However, some examples were

presented as case studies at several meetings so that members could contextualise and implement the models of engagement in their settings. The Born in Bradford project (UK) is a large-scale interventional birth cohort which has adopted a wider focus by looking at community engagement and environmental health and had links with local authorities from its inception. The group developed a "city collaboratory model" (LifeCycle 2019) using a complex systems approach and including healthcare, communities, schools and local authorities, which led to several outputs such as the adoption of universal screening for gestational diabetes (the population has a high south Asian minority group at a higher risk for GDM), the establishment of a regional congenital anomalies register, and early life community-based interventions for obesity prevention and physical activity.[422] Working through strategies such as co-production with policy-makers and practitioners, contextualising research evidence and development of policy briefs to translate the evidence from their research into policies has supported the work of the project. Similar strategies have also been used in LMICs such as groups in South Africa that organised quarterly meetings with local policy-makers, including key players from the society to include voices from the community which helped policy-makers (NIHR BRC 2020).

7.3.1.4   Content and recommendations from actors for policy development

This was a major category, representing the recommendations, gaps, and priority areas identified for DOHaD, life course and preconception. As a range of heterogeneous factors were discussed during meetings, only recommendations related to policy impact, and propositions to support the research and clinical agenda for implementation are included here. This section first discusses how networks and stakeholders showed support for, and recognition of, the life course approach and the preconception agenda as imperative to health and wellbeing. This is followed by the gaps and opportunities in existing evidence for implementation (based on the perspectives of the experts forming the networks). As many interventions across a range of life stages were covered by the documents, all examples are not presented here. The key themes they came under are presented as a narrative synthesis below.

Recognition of the life course approach and PCC

Experts from all groups acknowledged the importance of implementing the life course approach and agreed that, barring a few gaps in knowledge, it was timely and urgent to focus now on implementation strategies for policy, clinical practice and public engagement. There was consensus that the wider societal effects of the pandemics and impact of school closures and

lockdown could influence DOHaD outcomes in the longer term. However, as seen in Chapter 6, there was no clarity on implementation and how policy-makers' attention can be focused on MNCH. The terms DOHaD and life course were often used interchangeably by the stakeholders, with the latter preferred by the non-scientific groups as it includes wider factors not limited to health and disease-based models. However, many groups still struggled with the broad definition of preconception health, which limited the ability to deliver targeted recommendations and programmes, made more difficult by unplanned pregnancies.

Evidence: limitations, gaps and opportunities

Though several actors recognised the need to consider the differences between evidence-based medicine and policy-making and move towards developing a unified communication strategy to disseminate the evidence from DOHaD, much of the deliberations in all groups focused on the need for data collection, research and health monitoring systems for maternal, neonatal and child health.

Scientific actors strongly felt the need for robust, well-designed causal evidence and added that there are areas within the life course agenda that show conflicting evidence. For example, nutritional intervention studies in the preconception period only showed moderate effects on short-term outcomes.[196,423] Hence, academic actors were hesitant about communicating the uncertainties of preconception interventions to policy-makers. However, other actors from fields such as behavioural sciences stressed the importance of using case studies, and community-based participatory approaches for interventions that would have wider benefits on outcomes such as education and long-term productivity over short term proxy outcomes such as low birthweight and macrosomia. These internal conflicts were present in all five networks. Gaps existed not only in the research on risk factors but also in the evaluation of interventions and models of care, particularly for the use of wider settings such as contraceptive clinics for addressing PCC. To address these gaps, the UK PP collaborated with the Institute for Health Visitors in the UK to train health visitors to counsel post-partum women on contraception (currently being evaluated). The project found a lack of confidence before the intervention among health visitors in having conversations related to preconception health, which informed the development of an e-learning module for the health visitors.

Overall, my analysis shows that the networks suggest (implicitly) an approach to harnessing the opportunities presented using evidence and, in parallel, establish a research agenda to address

the limitations in evidence. These are summarised in Table 7.2 below, divided into the three
stakeholder groups most targeted by the networks (policy-makers, HCPs and the general public –
with a focus on young people and adolescents).

Table 7.2   Evidence-based priority areas and gaps for three key stakeholder groups for developing the research agenda and implementing DOHaD policy to prevent NCDs and improve preconception health

(References are included as appropriate when cited during the meetings)

Key findings	Policies and national-level programmes	Healthcare practice	General population
Priority areas for action with increasing evidence	• Planning obesity and NCD prevention interventions together with structural interventions e.g., targeted food taxes, subsidies, food labelling [424] and linked with SDGs and climate change agenda • Maternal mental health (before, during and after pregnancy) [425] • Investing in disadvantaged children [401] • Better workplace policies • Breastfeeding friendly environments • Good quality evidence for: Early childhood development and school readiness [89,90], stress in pregnancy affecting executive function in the next generation[426] • Implementation of nurturing care framework[427]	• Considering the whole family and early childhood development [419] • Focus on missed opportunities in the healthcare system for a continuum of care. These include women seeking fertility, approaching endocrinologists, GPs, cardiologists etc. [34] nurses, pharmacists, community midwives and post-natal health visiting teams [57] • Better detection and management of NCDs through clinical pathways: this can be facilitated by adherence to guidelines by the International Federation of Obstetricians and Gynaecologists (FIGO) (e.g., Hyperglycaemia in pregnancy, Adolescent, Preconception and Maternal Nutrition guidelines)[428,429], RCOG 'Better for Women' report, to adopt a life course approach [430]. • Particular attention to maternal mental health and stress • Developing tools to enable the discussion of nutrition by HCPs • Focus of consultation on fitness and nutrition and not weight loss • Workforce development, training to engage women effectively	• In developing interventions, consider social determinants of Health [431] • Embedding prevention in policies beyond maternal and child health e.g., environment, education, economic stress climate change, pollution, environmental toxicants • Consider wider outcomes to measure effectiveness of interventions - educational achievement, earnings, employment, human capital [432] • Engaging wider public in population-level programmes and generating demand for action on NCDs [57] through campaigns using carefully framed messages • In LMICs effective measures before conception will have added benefits due to lower rates of attendance for antenatal care

Key findings	Policies and national-level programmes	Healthcare practice	General population
Gaps in evidence and areas requiring more engagement	• Increase leadership and commitment from political agencies • Develop monitoring and reporting mechanisms for these initiatives to increase accountability [73] • Develop mechanisms to collect good quality data from routine systems (as used to develop the Lancet report card on preconception health [303]) • Develop novel measures for 'value' e.g., health capital and capacity across the life-course, measures of community resilience	• Increase the focus on collective (e.g., family, communities) and not only individual-level advice for balanced diets in pregnancy, avoidance of alcohol, smoking, unsafe foods, violence and drugs in pregnancy, managing GDM, supporting breastfeeding and care of the newborn [78,419] • Involvement of missing actors – midwives, community health workers in LMICs	• For research, improve follow-up for sustained effects [76] • Household surveys using systems such as the Demographic Health Survey to explore trends related to socioeconomic status and nutrition • Making women's health more visible: Data disaggregated by age and sex to monitor the after-effects of the pandemic and identify different impacts among men and women, and by life-stages. • Clarify language to be used in the preconception period to engage with prospective parents

Recommendations for implementation

The recommendations discussed for consideration in implementing the life course approach spanned several codes, which overall recommended a two-pronged approach– 1. Building a robust case for maternal and child health through measurement, monitoring and better-quality data; 2. Implementing through a multi-system approach. Figure 7.5 below, summarises the recommendations for the approach for implementation, highlighting the key points emerging from the document analysis and discussions. In this section, the content for implementation (explicit and implicit recommendations) is discussed. Measurement and data were a strong theme with several recommendations on how this could be harnessed to increase accountability. Other recommendations included general recommendations for improved nutrition, prevention of NCDs and normalising the preconception agenda. Discussions on framing of messages are covered in section 7.4.4.

Measurement and monitoring systems to support implementation

- Use and **linkage of routine data** surveillance including sociodemographic characteristics, disaggregated by age, sex
- Assess impact of austerity measures after crises on women and children
- **Minimal frameworks** for measures across the life course (biological, psychosocial and environmental)
- Cannot use a "one size fits all" approach for measurement frameworks across the **life course**
- Harnessing **global** best practice examples/ case studies
- **Wider measures beyond health:** resilience, alternatives for GDP, health capital, wellbeing, intrinsic capacity and functional ability
- Use of digital technology and innovations

Better data and monitoring for accountability

Recommendations for implementation

When? (critical periods)

- **Normalising pregnancy preparation**: *Preconception – reproductive aged women, partners, couples*
- Connecting pregnancy and postpartum / **interconception** *(Continuum of care)*
- Early childhood development *(families, **community** based programmes)*
- Adolescent health
- Healthy Ageing

Who is responsible?*

- **Healthcare:** (**Primary care,** OBGYNs, midwives, community health workers)
- **Policymakers** (health and finance sectors, housing, environment)
- Charitable sectors, NGOs, think tanks and advocacy groups

What can be done?

- Risk algorithms for screening high-risk populations
- Advocacy for women's empowerment and health inequalities
- Develop policy safety-nets for MNCH services during a crisis
- Identify and evaluate policies for long term impact, cost-effectiveness
- **Research: Multicomponent interventions** considering **wider determinants of health**
- Individual **behaviour change** to be supported by **enabling environments**, policies to make healthier choices

How can research be communicated effectively?

- Effective **framing** for policy, public engagement, advocacy campaigns – with customised **key messages**
- **Training** of researchers for policy engagement
- Training and provision of tools to HCPs for communication and improved medical **curriculum**
- Developing a unified message from the DOHaD community
- Engage schools, health literacy programmes

Figure 7.5   Key recommendations for implementation.

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The first approach focused mainly on strengthening the evidence base to make a compelling argument. Good quality data can be used to hold policy-makers and other stakeholders accountable and support the evaluation of existing measures to which they have committed. Indicators from existing literature were discussed in the documents with a range of biomedical, anthropometric, psychosocial, behavioural and socioeconomic measures available – though they were often acting as proxy measures for long-term outcomes. It was also acknowledged that the capacities of countries and settings would vary significantly, especially for routine measurement of markers such as adiposity and epigenetics. However, groups such as the WHO have adopted a pragmatic approach, using the best available indicators in the local settings, especially in LMICs, for use by community health workers. Though the focus of the WHO consortium was to develop a parsimonious set of indicators (which they did successfully for healthy ageing)[381] this has proved challenging for connecting the earlier life stages, as the domains to be measured for ageing may not be the same as those for MNCH, which would need to include measures of gender equity, growth, pubertal status etc.

Some groups questioned the value of focusing only on narrow frameworks and used a wider approach to define concepts such as societal value and well-being and questioned the value of existing economic indicators such as Gross Domestic Product (GDP) (Venice Forum 2021). The rationale for this approach was to challenge the dominant view that economic growth measured by GDP is a measure of success, when it does not include factors such as unremunerated contributions to society such as childbearing, domestic work and care – which are largely conducted by women in most societies.[433]

Overall, it was recommended that networks could expand an existing monitoring and surveillance programme. This was implemented by the UK PP who had initially prepared the plan for an annual report card in 2019. The group established a working group on data, who worked with Public Health England (now OHID) to identify priority areas needed for measurement, using routine maternity data. The Governmental Public Health Agency took the agenda on board in 2022 to host the annual report card, thus demonstrating an example of engagement, with a clear message viz. to report on the state of women's health in England. The group is currently conducting a Delphi study to identify the top 10 indicators from the main set of over 66 indicators.[434] The indicators, spanned 12 domains, namely: wider (social/economic) determinants of health; health care; reproductive health and family planning; health behaviours; environmental exposures; cervical screening; immunisation and infections; mental health, physical health; medication and

genetic risk. However, a caveat to be noted here is that the validity and generalisability of all indicators would not be uniform.

Other discussions on implementation covered topics related to which critical periods should be highlighted, who were the key stakeholders to operationalise the research findings, what the key interventions were and improving communication channels both for policy translation and public engagement. The recommendations for interventions (gaps and opportunities) have been covered in table 7.2 and figure 7.5 above and are discussed briefly below.

As the networks were formed for specific agendas, they also focused on different life stages. Within groups targeting a life stage, there were tensions related to concerns about reduced investment or attention for another group (e.g., mothers), at the expense of investing in another (e.g., childhood/ adolescence). Though the life course approach was acknowledged as integral to healthy ageing, the WHO consortium largely focused only on early life factors that had evidence of affecting the functional ability of older persons. While supporting the need to focus on preconception and pregnancy, experts also added that by limiting their scope to pregnancy as a critical window DOHaD researchers miss an opportunity to focus on the first 2000 days (conception to age 5 years) which could be taken up in policy because the evidence for the impact of early childhood interventions (e.g., neurodevelopmental, and nutritional outcomes) is strong (Venice Forum 2019).

The UK PP in particular found it challenging to persuade policy-makers about the importance of preconception health as it was often considered to be a "woman's health issue" within the clinical domain, and due to the wide population, it covers. For developing interventions, the group suggested a three-pronged approach – generalised interventions (e.g., all those women planning a pregnancy need to take a folic acid supplement); women who need specialist care for medical conditions (e.g., referral for diabetes management/ epilepsy medication); and a larger group who need support for behaviour change (e.g., smoking and obesity management). While HCPs were comfortable delivering the first two interventions, they found the final groups challenging, as also seen in the Chapters 4 and 5 of this thesis, making it a key area for improving PCC.

As discussed above, and in Chapter 5, engagement with the public while developing guidelines is also key. It was unclear if the universal screening for weight and nutritional status recommended by members of some of the networks were tested with PPI or other groups before inclusion in the recommendations. While the UK PP and NIHR BRC included public engagement at later stages, their findings, such as the non-acceptance of the term "preconception" by the general public or

even "before pregnancy" by men (as they felt excluded from the conversations) were surprising to the academics in the networks.

The networks often debated if the key messages were about being healthy at the reproductive age (which would be dismissed at a policy level) or about healthier children and/ or longer-term NCD prevention. Overall, there was agreement that, depending on the actors, a customised message which would resonate with the interests and values of the target group would be needed. Similarly, policies that drive gender equity and reduce the penalties of motherhood, such as the provision of parental leave for either parent, were recommended as they could also lead to a societal shift in women's empowerment (Venice forum 2021). During crises such as COVID-19, pre-emptive interventions such as sustaining access to contraception and reproductive health services, preconceptional, antenatal and postnatal care and child health and development programmes at individual and population levels, could all help prevent adverse effects across the life course. The scientific and ethical arguments presented in the 2021 Venice Forum supported strengthening primary care and community services such as home visits during and after pregnancy and in the early years to promote hygiene, nutrition, breastfeeding support, contraception services and immunisation programmes.

7.3.2 How have networks framed the issues and findings related to a life course approach, DOHaD and preconception health?

This section discusses how actors framed the policy problem, and how the solutions to that problem were perceived. Though subcategories were developed during coding, results are presented here as a narrative synthesis and summarised by the network in Table 7.3.

Table 7.3   Framing by networks included in the study

NAME OF ORGANISATION/ NETWORK	FRAMING
1. **UK PRECONCEPTION PARTNERSHIP**	• Relatively cohesive • Normalising pregnancy preparation for the general public. • General agreement within the network on problem definition (making healthier choices easier for the public, harnessing opportunities through routine care) • Recognises positioning would have to be different depending on the target group – e.g., presenting opportunities for prevention and using data to hold policy-makers accountable, non-stigmatising messages for future parents. • Framing considers wider determinants but competes with individual behavioural and medical framings.
2. **WHO CONSORTIUM**	• Cohesive but not yet adequate • Predominant focus on adopting the life course approach to improve healthy ageing • Other frames of NCD-prevention, medical/ biological indicators adopted with acknowledgement of socioeconomic factors and wider inequalities • Still searching for positioning and target group that will garner political will
3. **VENICE FORUM**	• Contested but growing cohesion • General agreement among the members and experts on problem definition which however spans several framings – ethical imperative, intergenerational risk/benefit, return on investment, long-term effects of crisis, disproportionate impact on women and children, maternal and child mortality. • Positioning in novel ways to advocate for investment e.g., a caring economy and focus on feminist economics and social justice
4. **LIFECYCLE CONSORTIUM**	• Cohesive but not yet adequate • Agreement on problem definition mainly focused on childhood obesity and prevention of NCDs. • No widespread agreement on interventions to address issues or on the positioning of the issue. Recommendations for interventions are predominantly behavioural but environmental and spatial risk factors and interventions also widely explored.
5. **NIHR BRC**	• Contested but growing cohesion (towards interconception) for problem definition. • Largely medicalised view with a key focus on healthcare systems and clinicians. • Though evidence for wider determinants and inequalities are cited, positioning for solutions is largely in the field of nutrition and prevention of NCDs through healthcare systems.

Overall, there was overlap in frames used to address, how problems were defined internally, and when plans for positioning were made. Disagreements existed within groups as well about what was considered to have a higher impact in persuading policy-makers or the public, and what could cause inadvertent harm. A highly medicalised perception of DOHaD and preconception health was clear from the discussions, particularly influenced by the actors from healthcare organisations such as FIGO and the Royal Colleges. Arguments about changing lifestyles with support from HCPs as a solution for addressing risk factors such as obesity, contrasted with views on obesity as a systemic problem influenced by the environment and deprivation, which concern governments as key actors.

Some members of the networks highlighted that the medical model of obesity, smoking, alcohol intake and other issues in the prenatal period could lead to a stigmatised framing of behaviour, particularly among low-income populations, as it assigns a set of values and moral implications, falling disproportionately on the mother. This was also relevant for framing related to *unintended pregnancies* and *normalising pregnancy preparation* (UK PP), which the UK PP acknowledged was a way to improve uptake of contraceptive services and folic acid supplementation. Viewing *"women as a reproductive agent/ vessel"* was implicit in most groups, particularly the UK PP. However, over time the group explored how to approach discussions on reproductive intentions through PPI activities. The UK PP also stressed the need to represent their findings without causing alarm: for example, though maternal age is a risk factor for some adverse outcomes, nonetheless women above the age of 35 without co-morbidities would usually have healthy pregnancies.

In the effort to develop specific recommendations and actions for policy-makers, and to set the agenda for future research, the focus repeatedly fell on maternal responsibility and risk factors (e.g., smoking during pregnancy, folic acid intake preconception) in all networks except the WHO consortium. This included networks that acknowledged the need for using empowering frameworks such as the social justice argument as well as women's rights. The WHO consortium had framed the benefits of the life course approach predominantly in the context of supporting healthy ageing, using justifications related to human rights, and the capabilities approach for older people to live the healthiest and most fulfilling lives based on what they valued (WHO 2018). Framing while developing the research agenda was also considered, for example there was consensus that the term 'indicator' could be used instead of 'biomarkers' to develop measurement frameworks (WHO consortium).

Framings also linked the first 1000 days to other life stages such as adolescent health (UK PP, NIHR BRC). Some actors across the groups, however, expressed the view that though a systems approach should be recommended to policy-makers, it could dilute the messages for the general public related to specific interventions for NCDs prevention such as weight loss before pregnancy and early childhood development. While health literacy interventions in schools are essential, framing obesity prevention as part of the preconception agenda for adolescents might compete with other efforts to prevent teenage pregnancy, especially in LMICs with a high prevalence of adolescent undernutrition and early marriage.

The Venice Forum initially positioned its agenda as "making the scientific and economic case for investment in MNCH". The group cited several reasons for concern that women and children may receive insufficient attention in the context of the COVID-19 pandemic as they were reported to be less susceptible than men and older adults to hospitalisation or mortality. Longer-term effects on children of isolation during lockdown and loss of education are also unknown. In this context, the Venice Forum adopted framings related to social justice, societal value and women's reproductive rights, to move the focus away from health systems and diseases. Framings related to gender equality were also adopted by the Venice Forum to address the issues in the informal work sectors (forming 61% of the global workforce)[433] such as minimum wage protection, job security or maternity leave, which in turn affect women's ability to breastfeed and provide childcare.

Within the individual framings, messaging was largely restrictive (e.g., list of actions to avoid before pregnancy) and included assumptions related to the choice women have to breastfeed or provide formula, or how empowered/ informed women and couples feel to make the decisions on vaginal birth or caesarean section. Actors also discussed the ethical implications of stressing the advantage of vaginal births for long-term NCD/ obesity prevention and considering that the procedure could be life-saving for both mother and baby, preventing several complications that could lead to lifelong maternal and fetal morbidity such as urinary incontinence and neurological disorders (Venice forum 2019). These issues need to be carefully framed and considered in the light of patient's rights and choices and how they influence communication with them. Individual behaviour change framing is also focused on the rational aspect of decision-making (e.g., providing information on food-based dietary guidelines, Eatwell plates), and actors often recommended appealing to the emotional side of issues related to the benefits on growth and development (UK PP).[435]

As all networks except the WHO consortium had an interest in NCD prevention, particularly obesity, much of the deliberations focus on obesity prevention across the life course. The links between deprivation and childhood obesity in high income countries were widely accepted. Hence, most frames were focused on wider policies, empowering communities and family-based programmes early on in the life course (e.g., post-partum period) and targeting schools and the built environment. It was suggested that the narratives related to childhood obesity should look beyond weight to include wider benefits of exercise and good nutrition on sleep, fitness and better school performance, to prevent inadvertent effects on body image, particularly in adolescents (NIHR BRC 2020). However, for adults, the frames used for obesity prevention related to both personal choice and wider determinants. An increase in framing related to the obesity agenda as linked with the pandemic was also seen, as mortality and morbidity due to COVID-19 was higher in patients with obesity and NCDs such as diabetes.[436] Obesity was also framed as a medical condition by members within networks (UK PP, NIHR BRC). This appeared to be influenced by the World Obesity Federations campaigns on declaring obesity a "chronic relapsing medical condition".[437] However, several members within networks (UKPP, NIHR BRC) also stated that it could "normalise obesity" or over-medicalise the issue, leading to policy-makers passing the responsibility to the healthcare system or, at a local level, address it by commissioning groups such as Slimming World (a weight-loss private organisation in the UK) instead of investing in preventive strategies.

Networks also discussed developing positive and empowering messages in advocacy campaigns related to being healthy/ fit in people of all sizes, with a focus on exercise and good nutrition and focusing on the intergenerational benefits. Messages such as "*obesity to be considered as the new smoking*" or making planning a pregnancy as easy as *"planning a holiday" (UK PP)* could have a negative effect. In contrast, framing by the private sector (though absent from the networks) could influence how policy-makers and the public make choices. A senior member of an international health organisation referring to infant formula stated that *"Industries sell comfort and happiness, while DOHaD sells fear, shame and stigma"* (NIHR BRC 2020). Other members also highlighted that the budget of such corporations for marketing far exceeds most research investments and competes with how science is translated to policy and society (Venice Forum 2019).

The impact of the framings and critiques in the literature are discussed further in Section 7.4

7.4 Discussion

7.4.1 Summary of findings

This qualitative study of interdisciplinary networks in DOHaD, life course and PCC aimed to identify how policy-makers and scientific experts conceptualise the implementation of the life course approach to improve preconception health. Several challenges and opportunities for implementation through policy and clinical practice were discussed, however it was clear that networks were still working towards developing a unified message about what implementation in DOHaD and the life course would really entail. Each group had a different, specific agenda and motives and used a range of methods for policy and public engagement. Using the Walt and Gilson framework,[145] the factors influencing the development of key messages, agenda-setting, engagement and framing were explored along with key priority areas where policy action can and should be initiated, along with areas that are limited by evidence gaps. Overall, the study provided insight into the policy-making process, showing that socio-political factors and framing affect the uptake of research recommendations. While acknowledgement of the value of early life for growth and development was seen, where efforts should be applied and targeted was debated within and between the networks. The life course approach was predominantly viewed as a tool/ framework for advocating for intergenerational health and wellbeing, and improving the quality of the second half of an individual's life. Networks also called for changing the existing notion in health policy that women's health is a service and reframing it as an essential human right.

The narratives in the documents included ranged from the presentation of epidemiological and experimental evidence to strategic advocacy documents. While this heterogeneity presented a methodological challenge, discussions covered important and relevant recommendations related to improving engagement at the science-society and policy interfaces. The following section provides a summary of the findings and key recommendations and attempts to contextualise them in existing literature. However, as discussed previously in Chapters 1 and 6, few studies have tested and explored the implementation of DOHaD through policies, and most existing recommendations were presented in opinion pieces by leaders in the DOHAD academic arena.[12,76,78]

7.4.2 How do advocacy and multidisciplinary groups for DOHaD and life course operate in decision-making?

Several challenges were faced by the networks to engaging in policy, such as assumptions related to what the policy-makers/ politicians wanted, lack of a clear message or action plan, working in "siloes" and a sole focus on scientific data. However, barriers within the operation of the networks could also influence how messages were translated.

Apart from internal and external framing (discussed above), Shiffman (2017) also described how coalition building and governance can influence whether the recommendations presented by global health networks could have an impact in gaining political priority.[148] While the networks described in this study have conducted the coalition building with a set agenda, Shiffman suggests that this should go beyond the recruitment of "allies", namely the obvious candidates from the same field and who agree with the agenda. The stakeholder charting (Figure 7.4) above highlights the key missing actors that networks could need to engage with. Studies have shown that networks who engage with external actors – particularly from outside the health sectors – have more success in achieving their objectives.[438] For example, members of the UK PP have liaised with schools and supermarkets as part of research projects, and the Venice Forum has worked with economists (usually in the role of "invited expert advisor"). If such actors are involved, diverse perspectives could be included from the outset, also reducing delays in implementation. However, networks would need to be cautious when engaging with the private sector to avoid conflicts of interest, discussed further in Chapter 8. Conflicts about problem definitions and content existed within the groups and, in some instances, it was unclear how decisions were made for dissemination. Though some groups such as the UK PP conducted surveys within their networks to reach consensus, formal methods were rarely used by the networks, and most governance was led by leading institutions, as discussed above.

Balanced representation (geographic and disciplinary) was achieved by few. Though multidisciplinary research in DOHaD is increasing, this could be difficult as scientists usually operate within specific faculties, and invitations to such groups are often based on reputation and work in specific projects considered best practice examples. Factors that supported success in production of outputs included personal motivation of the actors to champion the issue and development of mandates on deliverables assigned to subgroups.

While the literature does not identify a single ideal format for governance, in health policy-making, particularly with smaller networks, the domination of a single individual or organisation

could derail agenda setting. On the other hand, larger networks could face issues related to trust, and disagreement over goals, leading to a lack of structure to their activities.[148] Some networks have over time tried to overcome such issues, for example through establishment of and an executive board (UK PP), while other groups, particularly research projects such as LifeCycle, had periodic reporting and external reviews by external funders and authorities. During the meetings, to develop collective agreement the act of "putting on paper" through minutes and meeting reports on the group discussions acted as a way to achieve temporary consensus or a plan of action – which however did not mean explicit agreement.

Thus, in the context of networks operating in DOHaD, all four barriers outlined by Shiffman – problem definition, positioning, coalition building and governance – were identified to varying extents. The networks need to consider in the future how their decisions can be made formally to achieve consensus, who participates and whether the existing representation is sufficient. The stakeholder mapping presented in Chapter 8 may assist in answering some of these questions.

7.4.3 Gaining policy traction for the life course approach and DOHaD concepts

While all groups conceptualised translation in a range of ways, section 7.3.1.4 provides an overview of the key messages and the role of actors in improving the impact of such messages. These findings were used to develop the pathway for implementation, discussed in Chapter 8. The current section summarises key evidence to address some of the barriers related to translation and highlights existing opportunities.

7.4.3.1 Improved translation of research to policy and practice

When presenting evidence to policy-makers, researchers need to be prepared to address questions, that the fields of DOHaD and life course have not explored adequately, due to a narrow focus on the medical and epidemiological evidence. This includes queries related to why there is a need to change the status quo/ or do something new, considering that overall indicators related to maternal and infant mortality are improving in most settings. Other issues include the political and economic risks of action or inaction, why long-term prevention of NCDs is a priority, and that the costs of prevention, are either inadequately explored in research or have not been articulated using the appropriate framings to policy-makers.[78,158]

The term 'policy' in the DOHaD context can range from national-level actions (e.g., a ban on marketing of unhealthy food to children), guidelines for HCPs and health systems (e.g., providing a continuum of care, nutritional supplementation in pregnancy) to policies that affect people's

behaviours and choices (e.g., sugar taxation, product placement in supermarkets). NCDs are an example of a global health challenge that cannot be resolved by a single strategy.[439] However, in communicating with policy-makers, collaboration between the disciplines has been limited, [78] particularly with social scientists and economists who are increasingly presenting the evidence for DOHaD-related effects on human health and social capital; [77] networks need to be more inclusive to improve disciplinary diversity.

Another important issue related to problem definition is addressing the tensions and achieving complementarity within the groups while presenting evidence to policy-makers. DOHaD has presented a platform to unite actors from OBGYN and maternal health with newborn and children's health. Such alliances significantly increase political prioritisation by adding the child health and development agenda, but this inevitably takes the focus away from maternal/women's health.[440,441] This diffusion is made worse when other agendas, such as adolescent health, are added to the mixture which have their own set of problems. Providing practical and scalable options, and acknowledging the uncertainties is key.

For networks to achieve their goals in policy engagement, several operational resources may be required, such as capacity building and training for researchers to communicate evidence effectively. Training in methodologies related to policy-making to improve translation and communication and widening their understanding of the policy process and what can be considered as evidence by governments is also beneficial.[106,158] Several resources exist, provided by knowledge brokers such as the International Network for Government Science Advice and the International Science Council which provide policy training with a particular focus on framing.

Windows of opportunity to form alliances with other global networks also can be harnessed. For example, the WHO organisation - PMNCH, the Global Financing Facility and the World Bank are developing a Global Investment Framework for women, children and adolescent health and well-being with a strong component on preparedness, response and gender-sensitive recovery.[442] The framework aims to offer clear evidence of the costs and return on investment. Barriers such as lack of engagement from key players in finance and health economics have hindered the development of the argument for the Venice forum. However, by forming alliances with the PMNCH the Venice forum could represent the voices of actors from DOHaD to ensure the preconception agenda is embedded in the framework.

Researchers also need to recognise that policy-makers base their judgements on beliefs and values and familiarity with the issue, and that choices are not limited to the quality and strength

of evidence but are also political.[104] Researchers' motivation and engagement also affect the process, as influencing policy requires long term commitment and action, not always within the remit of an academic's role in an institution – though reward systems, by universities for example, may support this. Though widely believed that policy-making is a slow process and persuasions could only lead to minor changes, this has been challenged by the recent pandemic, with swift, radical decision-making having huge implications for finances, health care and the health of the general public. The networks thus have the opportunity to build on the momentum to rebuild and reframe the case for using the life course approach with PCC at its centre.

7.4.3.2   Strengthening the research agenda

Despite the barriers to policy translation discussed above, a reliable evidence base is needed to improve the response to the issues related to DOHaD and PCC. For monitoring and surveillance through routine data, which was a key finding in the content of the document analysis, good quality routine birth records with data on birth weight and gestational age will be essential. Though obtaining such data will be challenging, especially in LMICs, insights can be obtained from household surveys (e.g., Demographic Health Survey), coupled with more intense efforts to collect rich data in specific geographic areas through observational field sites or ongoing cohort studies. Such good quality household surveys have played a significant role in understanding trends related to socioeconomic status and nutrition in countries. For example recent studies on severe maternal thinness (BMI <16 in adults and BMI for age Z score <-2SD in adolescents) in India using the National Family Health Survey data found that severe maternal thinness was associated with adolescent pregnancies and lower socioeconomic status, while increase in educational level attained reduced the risk.[443] On the other hand, prevalence of maternal obesity was increasing and associated with older maternal age, urban residence, increasing wealth quintile, and secondary education.[444] Thus, sex and age-disaggregated data with markers of socioeconomic status help develop the case for improving the education of girls, reducing teenage pregnancies, and scaling up efforts for women's empowerment in LMICs, using routine data.[445]

Similarly, the recent analysis of a population-based birth cohort using routine antenatal data in the UK suggested that between 2004 and 2016 socioeconomic inequalities in risk of having a SGA baby did not narrow over time, with babies born to unemployed mothers, or mothers with unemployed partners, and educated only to secondary school level being at a higher risk.[431] Such markers of life course and preconception health are often not available or measured by public health systems, nor are they connected to intervention development. Novel measures are also needed to assess factors across the life course such as wellbeing. Developing measures of

community resilience and social cohesion can be challenging but will be crucial in the post-COVID-19 era to inform the delivery of intervention packages and measure their effectiveness.[446]

7.4.3.3 Learning from existing public health and wider evidence in developing policies and population-level interventions for DOHaD

Much of the deliberations in the results focused on the urgency of policy engagement for the DOHaD field and exploring wider determinants of health, both for identifying risk factors and addressing them during interventions. Based on the findings of this thesis, it can be argued that though research gaps exist, in consideration of the principles of EBPM, the DOHaD community can learn from existing interventions and best practice examples to communicate and position the issues more effectively.

Evidence from interventions showing long-term economic benefit can strengthen the argument for policy-makers. In the Perry Preschool and Abecedarian programmes, at-risk children were provided with pre-designed kindergarten and home interventions. Evaluations showed an increase in high school completion rates and college attendance, but lower rates of teenage pregnancy, and dependency on welfare. [31,432,447] A recent review of early childhood educational interventions found that they led to a positive social return irrespective of the type of programme,[448] including earning, maternal employment and income, and also reductions in crime and childcare and health care costs. The finding that the capabilities of a child can have different weighting, with a deficit in one dimension potentially compensated by increased strength in another, [419] has great significance for long term health of the next generation as well as DOHaD-based policies.

There is an increasing focus in DOHaD research on intervention studies coupled with sophisticated analytical techniques for causal analysis from big-data projects such as the LifeCycle consortium's activities.[208] Additionally recent population-based complex interventions, such as the Healthy Lives Trajectories Initiative (HeLTI),[449] which integrates interventions based on education, social support and the food environment in new cohorts starting before conception and in four countries (South Africa, India, China and Canada), are ongoing and show promise in providing policy-relevant evidence. The development of long-term programmes such as HeLTI required political support and commitment, shown by the respective governments of the four countries along with WHO and the Canadian Institutes of Health Research. At a local level, collaborations in DOHaD between schools, hospitals and universities have developed complex interventions and public engagement programmes, targeting young people.[415,450] These activities promote the

awareness of DOHaD concepts and build inquiry skills among young people while also increasing understanding of factors influencing their health literacy and health behaviours. This creates a bottom-up synthesis of knowledge for NCD prevention among the adolescent group, who are becoming increasingly at risk for NCDs globally. [451]

Key recommendations for implementation and measurement based on the literature were discussed in Chapter 6 and a summary of overall recommendations from interventions and target groups have been discussed in section 7.3. With a focus on three key stakeholder groups – researchers, policy-makers and healthcare providers, figure 7.6 below shows how the three groups are interconnected, with the general public at the centre, available to be involved in all stages.
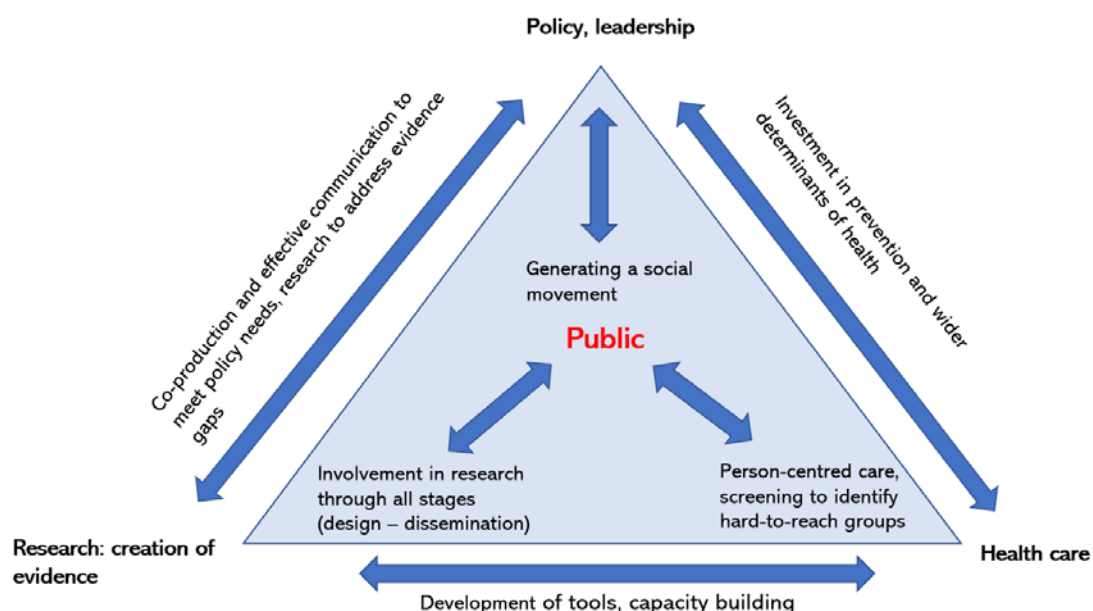
Figure 7.6   Potential for effective transfer of knowledge and opportunities for support between the key actors

Research and science can provide support policy through ways beyond the development of academic outputs. such as: building the evidence base for increased accountability, including short-, medium- and long-term outcomes, so that policy-makers can be presented with interventions with potential for immediate effects; co-production of studies including relevant national/ local policy-makers, multidisciplinary researchers and PPI; responsible and effective framing of messages; and supporting and engaging with the agenda of coalitions formed for DOHaD.

Finally, investment in the MNCH workforce, especially supporting the community-based model, is crucial. Investment of US $5 per person per annum in the 74 countries which together carry 95% of the global maternal and child mortality burden is calculated to yield up to a nine-fold return in social as well as economic terms by 2035.[452] Almost a third of such investments are related to health system strengthening, in particular contraception, preconceptional, antenatal and postnatal care, and child health. This is in accordance with immunisation and monitoring programmes to reduce incidence and transmission of HIV/AIDS, malaria and other infectious diseases. Similarly, strengthening primary care and community health services, incorporating elements of training care workers in early childhood development, capacity building for front-line community health workers, improved hygiene, breastfeeding support and immunisation have all helped in reducing under-five mortality in low-middle income countries, and these need to be encouraged to develop resilient systems that are sustainable during recessions.[453] Midwife-delivered family planning interventions alone could help avert half of maternal deaths as shown by a recent study.[454] Scaling-up of midwifery-led interventions (training midwives in skills and competencies for different stages of the continuum of care such as contraception, PCC, antenatal care, and postpartum care) in LMICs could prevent 2.2 million deaths (maternal, neonatal deaths and stillbirths) by 2035. In high-income settings, this could include operationalising the recommendations for nutrition screening discussed in Chapter 5, while in LMICs, nutritional interventions would need to be supported by interventions to improve mother and child survival.

7.4.4   Framing for science, policy, and society

In this thesis, framing theory was used to describe how stakeholders involved in advocacy networks for DOHaD shaped perceptions related to the policy issue, and the solutions to the problem. How this was communicated to an external audience of policy-makers and the general public was also explored. Figure 7.7 demonstrates the different frames used for problem definition and communication, with certain frames used in both. Though the issues can be framed in multiple ways, they can also have negative effects leading to low uptake in policy. The scale for positive and negative impact is based on discussions in the network meetings and literature, though certain conflicts exist, discussed further.

Internal framing

- Parental/ familial health
- Preventive model and moving away from disease-based focus
- Environmental health, toxins
- Economic case for return on investment, capabilities approach
- Prevent unplanned pregnancy
- Maternal risks and singular lifestyle interventions
- Obesity prevention, burden and individual responsibility

Overlap:
- Framing within other agenda: Climate change, Gender equality
- Inequalities (socioeconomic, racial)
- Holistic wellbeing, mental health
- Normalise pregnancy preparation
- Focus on "next generation"/ child health
- DOHaD outcomes are "medical/ clinical problems
- Maternal responsibility and lifestyle choices
- Preconception/ pregnancy as relevant to all women

External framing

- Social Justice and human rights
- DOHaD agenda complementary to SDGs, Universal Health Care
- Tackling child poverty
- Feminist, ethical perspectives
- Future productivity
- Gender neutral, inclusive people-first language
- Focus on risk factors: maternal age, caesarean sections
- Obesity as a disease

Arrow (top): Empowering messages for the public, messages with higher political traction

Arrow (bottom): Negative impact of framing - e.g., maternal blame, stigma

Figure 7.7   The framings used within groups and for communicating to an external audience. The blue and yellow circles show internal and external framings respectively with certain commonalities. Certain framings may have negative consequences while others have more positive effects as shown by the arrow to the right.

The analysis showed that though wider socio-ecological determinants of health were acknowledged, most networks still used a medical model of viewing DOHaD outcomes and its implementation. While this model presents some advantages, such as the development of targeted interventions through the healthcare system, and actors who are easy to identify in the continuum of care, this framing can be counterproductive in positioning for policy-makers. While the evidence for implementing a life course approach starting in the first 1000 days mostly involves maternity services,[344] Such interventions have the potential to have wider effects on NCD prevention, mediated by food security, dietary habits and lifestyle/behaviours. In addition, as weight loss is hard to achieve and sustain, [455] influential organisations such as FIGO could support the agenda that clinicians in contact with future parents (e.g., GPs, midwives, OBGYNS) need to shift the focus from weight management to optimum health and fitness, supporting individuals in setting realistic expectations of lifestyle modification. As expressed by HCPs in Chapters 4 and 5 lack of time to address most lifestyle issues, and over-stretched health systems will not be able to accommodate the NCD prevention and PCC agenda into routine care, without the support of wider preventive measures. These preventive measures need to focus on the socioeconomic determinants of health and cultural contexts. In addition, routine discussions by HCPS without training and capacity building to have sensitive conversations with women and their partners could backfire and lead to experiences of stigma during clinical consultations for PCC and pregnancy (Chapter 5).

It is recommended that science to policy translation should not overclaim its findings, and the extrapolation of messages from animal-based epigenetic studies and observational data through the media has been critiqued. Müller *et al.* (2017)[402] describe how studies exploring rodent behaviours, such as maternal licking and grooming of pups and their effects on gene expression, have been compared to how human mothers could influence psychological development of their children, without adequate consideration of differences in species-typical behaviours. Hence, it has been suggested that the DOHaD community should consider adopting a more reflexive approach, bearing in mind the unintended effects on society, on how the risk factors for NCDs are perceived by stakeholders and the effects on the public. For example, the focus on breastfeeding or women's BMI as part of the DOHaD agenda for NCD prevention may clash with other social values such as gender equality and women's decisions about their own bodies or when to return to work after delivery. [394,402,456]

Maternal blame, and more often responsibility, influenced the framings of most networks looking into PCC. Richardson *et al.* (2014) in a critical article wrote that "exaggerations and over-

simplifications are making scapegoats of mothers, and could even increase surveillance and regulation of pregnant women".[457] This warning was not unfounded as previous actions taken for issues in the perinatal period such as fetal alcohol syndrome, drug use (both now linked with social class) have been linked with criminal prosecution of pregnant women – indiscriminately affecting African American women.

The effects of maternal age at delivery in Greece after the financial recession, while illustrating how an economic crisis can cause changes in reproductive behaviour such as timing conception, was also framed as a risk factor for DOHaD outcomes.[416] Framings of advanced maternal age as an issue can harm gains made in women's empowerment. Efforts to address the issue should not be focused on individual counselling alone but need to be supported by policy measures such as parental leave, which provide women wishing for pregnancy to start a family earlier. Additionally, the notion that gender-neutral language should be used for discussing pregnancy (considered by the UK PP) - and PCC-related issues has been contested. Recent debates on "desexing" language related to reproductive health have been critiqued, particularly considering its "dehumanising" terminologies, lack of inclusivity/ difficulties in transferring to other cultural context or languages and potentially undermining the rights of women and children, particularly in settings with high maternal and infant mortality.[458] this area needs further research to explore appropriate acceptable language in the general public in multiple contexts.

The impact of differences in framings can also influence how the networks are perceived by external stakeholders, thus affecting the extent to which the solutions they raise are prioritised in policy-making.[148] Disagreements about target groups and interventions mean that actors are not able to successfully position their solutions for policy-makers. This also impedes the evaluation and measurement of progress for the programmes suggested. While the agendas are complementary, in that maternal health and preconception issues are now linked with those for newborn and child health, as discussed earlier, it also causes a diffusion in the identity of the issues.

Overall, though most groups adopted medicalised framings, over time the value of social justice and wider determinants of health were increasingly recognised. The framings discussed in this qualitative study mirror those found by a recent ethnographic study of DOHaD researchers which showed that the biomedical framings were often married with simplistic articulations of the environmental context. This was mainly due to the limitations presented by the methodologies and tools available in epidemiology for collecting behavioural and socioeconomic determinants of health. [459] Using a line of reasoning related to social justice and gender equality arguments is key

as there is evidence that women are more vulnerable to domestic violence and economic insecurity, are more likely to lose their jobs, and to suffer adverse pregnancy outcomes after a crisis. Similar issues also exist in high income countries where there can be large differences in health outcomes by geography and ethnicity.[460] A substantial fraction of maternal deaths and childbirth-related complications are not only due to a lack of resources, but as a result of pre-existing NCDs associated with obesity such as diabetes, and hypertensive pregnancy disorders – also more common in women from deprived areas in high-income settings. These statistics present a compelling argument to address socioeconomic inequalities. Positioning for policy-making in DOHaD needs to make it perfectly clear, that the field does not rely on individual behaviour change alone.

7.4.5   Strengths and limitations

This study used a novel approach to explore how advocacy networks aiming to influence policy conceptualised and framed the use of the life course approach in policies and improving preconception health. Targeted selection of the networks had the advantage that the context of how recommendations were framed and developed could be extracted, along with a timeline of activities that are not always recorded in published documents. It also provided a recent context, considering evolving developments in the field. To reduce bias related to my interpretation in note-taking, all minutes were cross-checked and edited by the chairs of the meetings. Discussions during meetings on context and policy development were corroborated with official government or public health websites. This helped improve the credibility of the documents. However, certain discussions during plenaries had to be taken in good faith, with trust placed in the high-level experts. But the inclusion of such comments was usually restricted to framings, which by definition can be more subjective. Finally, though a literature search of meeting minutes and grey literature would produce wider documents, due to low retrievability of the documents for the selected networks, a grey literature review was deemed inappropriate for the study.[408]

However, some limitations related to the study are acknowledged here. In addition, Chapter 6 has explored the use of the life course approach in published and grey literature, providing an overview of the evidence available. Selection bias of the networks is an obvious limitation of the study, as these groups were very much immersed in the life course and DOHaD agenda and did not include the voices of academics who may express scepticism about the DOHaD concept. Heterogeneity in the format of the documents used was a challenge. Meeting reports often tend to present a positive view of the group's success and achievements, use advocative language and

may contain insufficient details (or excess unrelated content) to answer a research question. Finally, the reports contained content added in by the boards/ committees of the selected groups too, and hence were not solely developed by the rapporteur. All attempts were made to ensure my presence did not alter discussions during the meetings.

Reflexivity and rigour

As discussed in previous chapters (2,4,5) qualitative studies are not value-free, and efforts were taken to address any known sources of bias. Overall, as described in the methods, a systematic process based on published literature was used for the document analysis and my contribution to all aspects of data collection and interpretation has been described. Some researchers have suggested that a lack of involvement by the researcher could be an advantage of a document analysis.[408] However, my ontological position of critical realism recognises that achieving a bias-free "truth" related to the current study would not be achievable (Chapter 2), and demonstrating neutrality and objectivity is not the aim of reflexivity in qualitative research.[461] My knowledge and views on preconception health and framing related to DOHaD during research for the thesis were also influenced by the discussions during the meetings that I attended. This was also in parallel to developments in the field over the last four years. To address some of these issues, an audit trail was maintained for notes, to improve replicability and traceability for analysis. The iterative process of categorising and coding, and double-coding by a second reviewer, helped to improve the trustworthiness of the study. In addition, using a hybrid approach including deductive and inductive analysis helped systematise the analysis. Finally, the steps taken for transparency and coding helps address the concerns in document analysis discussed in Section 7.2.

7.5   Conclusions

The current study aimed to explore potential barriers and challenges to implementation in policy and understand how experts from the field of DOHaD conceptualised and articulated operationalising the life course and DOHaD models in practice. DOHaD research led to a paradigm shift by moving away from fixed genetic effects, this highlighted that early environmental and socioeconomic factors could affect long-term and intergenerational health. Implementation of this concept in policies has been low, as seen in previous chapters. Though the origins of DOHaD research were rooted in social and political events such as wars and famines, the framing of messages has predominantly focused on clinical care and individual behaviour change. The notion that wider determinants and contexts should be considered is not new. Sigerist's pioneering work, which influenced the WHO definition of "Health",[462] emphasised that

the occurrence of disease was affected by social and economic factors, and hence needs to be addressed by social and economic reorganisation. The understanding that medicine is the application of biology in a milieu consisting of historical, social, political, cultural and economic factors, though introduced decades earlier, still appears to be missing in health policies, and is particularly relevant for DOHaD and the life course models.

From a policy perspective, there is a need to mobilise political will through evidence-informed policy and improved public awareness. For evidence, there is a need to invest in research and data collection to monitor the immediate and longer-term impact of interventions, and conversely the effects of stressors such as the pandemic, on health. This would include strengthening routine data collection systems to hold policy-makers accountable for actions related to MNCH. The COVID-19 pandemic necessitates urgent action to address these challenges, placing MNCH at the centre in terms of healthcare, and in the context of reducing gender, reproductive, ethnic and social inequalities. A resilient public health system, which protects MNCH, is key to adapting to withstand future unpredictable disasters, whether economic, environmental, health or societal, and to driving improved population health. However, for messages to be translated effectively, they need to be positioned and framed responsibly, with a clear message based on existing evidence on what can be targeted immediately – e.g., improving early childhood development and preconception health.

This chapter illustrated that the role and power of a range of stakeholders involved in policy-making can be harnessed through effective engagement. Overall, it is clear that a one-size-fits-all approach cannot be used for operationalising the life course approach. Developing a combined message working with multidisciplinary stakeholders within and outside academia and healthcare systems is recommended. This Chapter also explored the key DOHaD messages, emphasising the need for population-level interventions to be communicated in a socially just and non-stigmatising manner. The findings, together with the results of Chapters 4 and 5 which included the voices of HCPs and the general public, support the research questions of this PhD to understand the perspectives of key stakeholders related to using the life course approach and providing PCC. The next Chapter pools the key themes and findings from the empirical data gathered in this thesis to develop a pathway for implementation of the life course approach for utilisation in policy and healthcare.

Chapter 8   Discussion and Conclusions

8.1   Outputs of this PhD

To offer insights from this study to healthcare practice and policy-makers, and to disseminate key findings with the research community, several outputs were developed from this thesis listed below.

1. **Development of an eLearning tool for clinicians**

Based on findings from the clinical stream of this PhD (Chapters 3,4,5) as part of my work with the LifeCycle project I have led the concept development and content writing for an E-Learning module on an online platform Early Nutrition Elearning Academy (ENEA). The course targets clinicians and aims to provide a summary of risk factors and interventions in the preconception period to prevent NCDs in the next generation. It also includes a section on how the FIGO nutrition checklist can be used in routine practice in the preconception and early pregnancy period.

2. **Online website development for the nutrition checklist in partnership with FIGO for the general population and HCPs**

Based on the findings from this thesis, I have been collaborating with the FIGO-Pregnancy Obesity and Nutrition Initiative to develop a web version of the checklist which can be completed by women remotely before consultations. This was also complementary to the findings of Chapter 5 where women requested online versions of the resource, along with information on diet and nutrition in pregnancy. The acceptability and validity of a translated version of the checklist are also being evaluated in India, and I have been supporting the development of that study to test the use in an LMIC setting. The Indian checklist is designed to consider regional dietary variations in India and will include an element of training HCPs e.g., nurses to discuss the checklist with the women.

3. **Publications**

Based on the studies conducted for the PhD the following papers were published

Table 8.1   Table of publications

Article	Corresponding Chapter in this thesis	Statement of contribution by the candidate for the paper (co-authored by supervisors and other members of wider research group) and how the thesis informed the paper
Jacob CM, Newell ML, Hanson M. Narrative review of reviews of preconception interventions to prevent an increased risk of obesity and non-communicable diseases in children. Obesity Reviews. 2019 Aug;20:5-17.	Chapter 3	Review concept (80%) Search (100%) Review of articles and data extraction (100%) Writing of the paper (80%)
Jacob CM, Killeen SL, McAuliffe FM, Stephenson J, Hod M, Diaz Yamal I, Malhotra J, Mocanu E, McIntyre HD, Kihara AB, Ma RC. Prevention of noncommunicable diseases by interventions in the preconception period: A FIGO position paper for action by HCPs. International Journal of Gynecology & Obstetrics. 2020 Sep;151:6-15.	Chapter 3	Review concept (90%) Search (100%) Review of articles and data extraction (100%) Writing of the paper (80%)
Jacob C, Cooper C, Baird J, Hanson M. What quantitative and qualitative methods have been developed to measure the implementation of a life course approach in public health policies at the national level? Health Evidence Network Report World Health Organization. Regional Office for Europe; 2019.	Chapter 1, 6	Design of the study (80%) Search (100%) Review of articles and data extraction (100%) Writing of the paper (80%)
Jacob CM, Lawrence WT, Inskip HM, McAuliffe FM, Killeen SL, Hanson M. Do the concepts of "life course approach" and "developmental origins of health and disease" underpin current maternity care? Study protocol. International Journal of Gynecology & Obstetrics. 2019 Nov 1;147(2):140-6.	Chapter 4 (protocol of the study was published)	Design of the study (80%) Data collection (100%) Analysis – N/A Writing (90%)
Acceptability of a simple tool to assess nutrition before conception and in early pregnancy: a study of women and HCPs in the UK. Status: In press (Special issue on "Early-Life Nutrition and Microbiome Development" for the journal *Nutrients*)	Chapter 5	Design of the study (80%) Data collection (100%) Statistical analysis (100%) Writing of the paper (ongoing) (90%)

Book Chapter: Book title: The Handbook of DOHaD & Society past, present and future directions of biosocial collaboration Editors: Michelle Pentecost, Jaya Keaney, Tessa Moll, Michael Penkler Title: Jacob *et al.* Framing DOHaD for Policy and Society	Chapter 7,8	Concept (70%) Data collection and analysis (100%) Writing – ongoing (80%)
Jacob CM, Hanson M. Implications of the Developmental Origins of Health and Disease (DOHaD) concept for policy-making. Current Opinion in Endocrine and Metabolic Research. 2020 Aug 13 Jacob CM, Briana DD, Di Renzo GC, Modi N, Bustreo F, Conti G, Malamitsi-Puchner A, Hanson M. Building resilient societies after COVID-19: the case for investing in maternal, neonatal, and child health. The Lancet Public Health. 2020 Nov 1;5(11):e624-7.	Editorial/ opinion pieces based on key findings from multiple chapters	Concept (70%) Data collection and analysis (100%) Writing (80%)

4. **Presentations**

- 2022: I have submitted three abstracts of the completed research study from Chapter 4,5,7 to: International Congress on Developmental Origins of Health and Disease Vancouver 2022.

- 2020: Presented a talk on *"Prevention of noncommunicable diseases by interventions in the preconception period: action by healthcare practitioners"* for two webinars: i. Strengthening Maternal Nutrition Assessment and Services in Antenatal Care, With Focus on India E-Dialogue (November 2020) and ii. The FIGO Pregnancy Obesity and Nutrition Initiative (PONI) – Advocating for Obstetricians and Gynaecologists to Think Nutrition and Weight First, at Every Contact for the prevention of Non-Communicable Diseases in mothers and their children (September 2020)

- 2019: 7th International Forum Fetal Life to Childhood congress on the first 1000 days, Istanbul, turkey (March 2019) Oral presentation on findings from chapters 3 and 6: Preconception and the life course approach to health: implications for informing policy?

5. A policy **brief on the life course approach to preconception health and NCD-prevention is under development** (in collaboration with the LifeCycle consortium) based on a summary of findings of this PhD and I aim to disseminate this widely to key stakeholders discussed in this chapter.

8.2   Summary of main findings

In this chapter, I discuss how the aims of the PhD have been met and present pooled findings from the previous chapters. The novel findings of the empirical research are brought together from multiple chapters offering new tools for future testing and implementation. Implications of the work in multiple domains – policy, clinical practice and research are discussed. The original contributions of this thesis are made explicit. Contextualising the findings of individual studies has been conducted in detail within each empirical chapter and is only summarised here briefly. The main aim of this chapter is to provide actionable recommendations with the key stakeholders in mind – which include HCPs, policy stakeholders, researchers and stakeholders directly linked with the general public.

The overall aim of this thesis was to examine how the life course approach can be used in policies to prevent NCDs and the intergenerational passage of risk. A secondary objective was to understand how action in the preconception period could be incorporated into this approach to improve the health of the mother and the next generation. Both of these aims were developed to advance preventive strategies through policies and clinical practice. A narrative review presented the state of evidence for interventions in the preconception period and highlighted the need for better quality indicators and studies with a long-term focus. The review of clinical guidelines showed increasing recognition of the importance of PCC globally, however, several barriers were raised when studying HCPs and their experiences in delivering PCC. Both HCPs and reproductive-aged women showed support for routine discussion of nutrition and pregnancy intentions, though some cautions related to preventing stigma and the need for sensitive communication were raised. The thesis makes an original contribution to knowledge in healthcare research in early pregnancy and preconception through the acceptability study for the nutrition checklist. Furthermore, the policy review and the study of advocacy networks that aim to impact policies related to life course and DOHaD were the first empirical studies to my knowledge to explore the current state of policy-making in the life course and DOHaD arena, critically examining the existing barriers for translation of evidence to policy and suggesting windows of opportunity. Collating the findings from these chapters this section presents recommendations for operationalising the concepts of life course and DOHaD and highlights the areas requiring further work. Three novel findings from the studies presented below are – a stakeholder map as a prototype for actors (from research, policy and other fields); a checklist for actors aiming to operationalise the life

course approach for NCDs; and pathways to implementation of PCC through routine opportunities in the life course using the socio-ecological framework.

8.2.1 Research aim 1 – Operationalising the life course approach and DOHaD concepts

Most publications in the decade preceding this project used an epidemiological point of view of the life course perspective with a focus on the risk of diseases. While this helped develop the evidence base on the trajectories of physical and socioeconomic risk, few interventions adopted a life course lens as seen in Chapter 3 and 6. Recommendations for health promotion and implementation [36,463] in recent years help shape the outputs of this thesis highlighting the need for long-term investment in maternal and child health. In addition, recommendations for policy-making hitherto were based on the hierarchy of evidence and presented as opinion pieces in reputable journals. The review in Chapter 6 presented examples of strategies that have attempted to implement the model and evaluate its effectiveness.

8.2.1.1 How can the life course and DOHaD concepts be put into practice systematically in policies?

The question of how a life course model should be adopted was difficult to answer. From the work conducted in this thesis, it is clear that a universal framework for implementation will be hard to develop, and actors would need to adopt an approach relevant to the topics under consideration (e.g., NCD-prevention in this thesis) and select the target variables and critical periods accordingly. A key barrier was the lack of definition of terminologies related to the life course approach and clarity on how the approach should be used, when planning a programme based on the approach (Chapter 6,7).

To support the development of programmes Table 8.1 below summarises the factors that are key to the life course model, suggesting a "checklist" to guide implementation. This checklist looks particularly at the context of NCD prevention through early-life interventions. The checklist does not assign a score, however, it is recommended that at least one element of each of the eight categories are answered "yes".

Table 8.2   Policy checklist for implementing the life course approach to prevent NCDs

1. **Life course strategy**	
- Has a critical period(s) been selected with a focus on early action?	Yes/ No
- Is the rationale for selection explained?	Yes/ No
- Are outcomes described (proxy outcomes, short/medium/ long-term?)	Yes/ No

2. **Stakeholder involvement**	
- Was a stakeholder mapping conducted?	Yes/ No
- Is there an element of public involvement or strategy to raise public awareness and demand?	Yes/ No
- Are healthcare professionals engaged?	Yes/ No
- Is there a focus on communities and families?	Yes/ No
3. **Multidisciplinary and cross-sectoral approach**	
- Is there a plan to integrate and link with other policy sectors or departments to address wider determinants? (e.g., housing, finance?)	Yes/ No
- Is the intervention focussed on individual responsibility?	Yes/ No
4. **Robust data plan**	
- Is there a plan for using routine sources of data or collecting data to evaluate outcomes (above)?	Yes/ No
- Age/ sex disaggregation?	Yes/ No
- Is there a plan for monitoring progress?	Yes/ No
5. Is the **temporal** aspect of the life course approach considered (e.g., repeat measures)?	Yes/ No
- Are transitions in life considered? E.g., pregnancy, interconception	Yes/ No
6. Is there a plan for **capacity building and training** of the services delivering the programme?	Yes/ No
7. **Whole of society approach**	
- Are wider socioeconomic measures considered in the evaluation plans?	Yes/ No
- Are measures for assessing inequalities/ disparities included?	Yes/ No
- Is there a process evaluation for the interventions planned?	Yes/ No
8. **Accountability**	Yes/ No
- Is there a dissemination plan for findings?	

The checklist builds on the recommendations from Chapters 6 and 7, and is intended to guide planning in early stages of implementation, with the caveat that the checklist has not been tested before. Future research can test the checklist and its applicability in different contexts. Similar checklists can be developed for other issues such as adolescent health etc.

8.2.1.2 A stakeholder map to guide implementation activities

A key original finding of this thesis included understanding the key players involved in implementation and identifying opportunities in the critical periods for action. Improved understanding of the interactions between the biopsychosocial factors and epigenetic mechanisms brought the inter-disciplinary nature of the field to the forefront of policy-making. Indeed, there is a clear need to involve the right actors for advocacy as well as action for the prevention of NCDs using the life course approach.

While epidemiologists and public health practitioners were at the forefront of tackling the COVID-19 pandemic, these voices largely remain silent during recessions when there is a need to develop

strategies to alleviate their social as well as financial effects. In the aftermath of the pandemic, groups such as the Venice Forum used this window of opportunity to advocate that efforts must be supplemented with NCD-prevention strategies to reduce the proportion of the population vulnerable to future epidemics. However, most networks were open largely to other academic and scientific communities, with few policy stakeholders present, as discussed above. This leads to the development of "echo chambers", hindering the process of learning and revising strategies to increase impact. To improve communication with stakeholders, this thesis used techniques from studies related to project management and business to develop a stakeholder map for DOHaD researchers (Chapter 2). [464,465]

While the chart (Section 7.3.1.1) and stakeholder analysis conducted throughout this thesis identified the different groups, developing recommendations for stakeholder management required a different approach. Hence, these groups were then mapped based on their power and influence (using the scoring system described in Chapter 2, presented in Appendix I.4), to define the actions that can be taken for stakeholder engagement, and to provide recommendations for engagement. Each quadrant of the map has a separate associated communication strategy that can be used as shown in Figure 8.1 below.
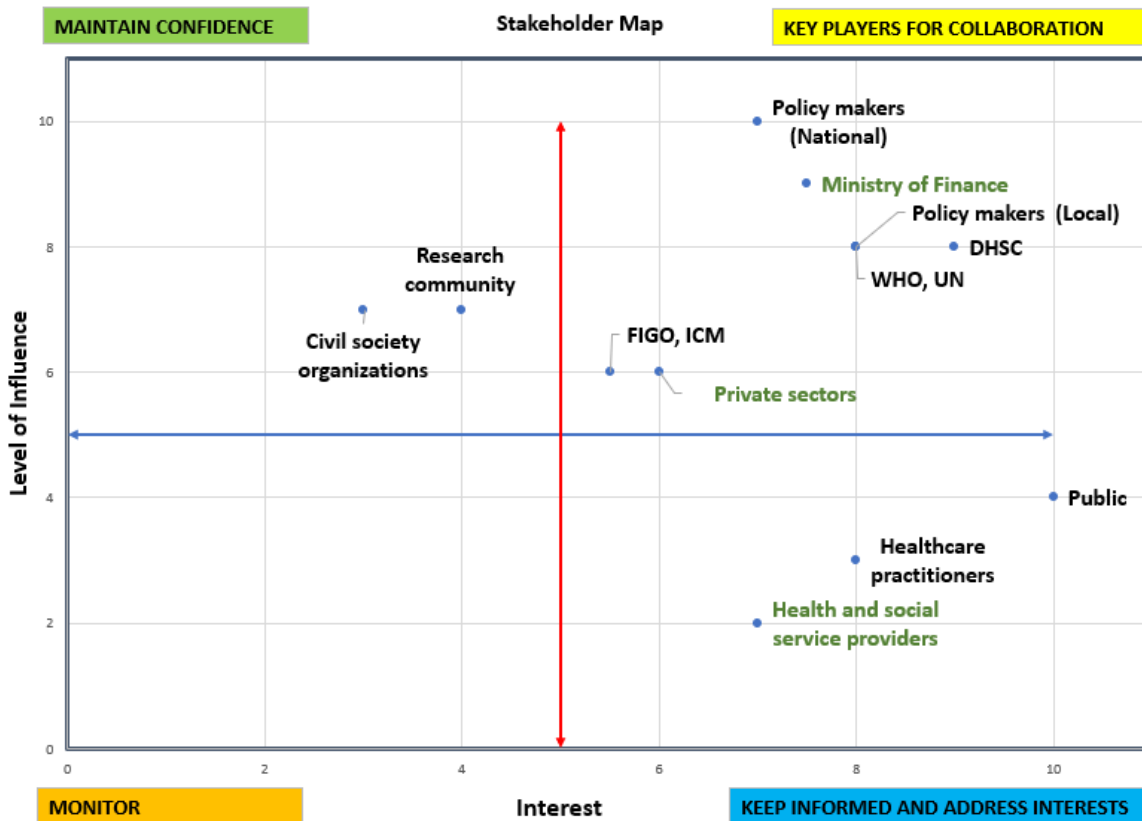
Figure 8.1 **Stakeholder map with four quadrants for management. The Y-axis determines the level of influence from the highest on the top, to the lowest below, and the X-axis measures the level of interest. Stakeholder categories were then plotted on the map based on how they scored for these two elements. Missing actors are depicted in green, and examples of how certain actors within stakeholder groups can vary are also shown. The coloured boxes indicate the recommended actions for the stakeholders within that quadrant.**

Stakeholders with both a high level of influence and interest need to be managed closely and are the key target groups for collaboration.[141,142] These include departments of health, ministries of finance and local policy-makers. Examples of how certain actors within stakeholder groups can vary are also illustrated. For instance, ministries of finance in different countries have more influence on the issue of investment that can also influence the wider determinants of health, and also the funding received by organisations operating in public health activities. Hence, they have a higher influence than the Department of Health and Social Care.

Stakeholders with high influence, but less interest, need to be kept involved, ideally incentivised with new information, and monitored. This would include providing support for training researchers and supporting civil society organisations in developing programmes for implementation. For this thesis, none of the stakeholders fell into the category of low interest and low influence. Finally, the group with high interest but less influence includes the general public and HCPs, who also tend to be most impacted by policies. Regular updates and feedback from these groups can be beneficial, especially through PPI activities, in all stages of research and evaluation. Actions to address their interests need to be taken into perspective. While HCPs fall into this group, overarching organisations for HCPs such as FIGO, and the Royal Colleges have more influence. It must be mentioned here that a map of HCPs, would also appear different when based on professional roles. For example, from the work in this thesis, it is clear that GPs have a higher impact on PCC compared with midwives (in the UK context) while specialist OBGYNs and midwives have access to high-risk women with GDM and pre-eclampsia for disseminating messages related to interconception care.

The stakeholders can also be managed appropriately to "shift" their positions on the map. For example, effective communication through advocacy campaigns has the potential to create a social movement and bottom-up demand for women's and children's health. Similarly, policy-makers' interest in the issue of life course and preconception may fall during events such as the pandemic, when the focus is on infectious disease management, economic uncertainties due to lockdown and on short term goals for mitigation. Selection of stakeholders from the map, based on the issue under consideration (e.g., developing preconception services for obesity management), followed by targeted communication methods are recommended. While the scope for private sector engagement in policy-making has increased with the rise of neoliberal democracies, this has also led to an increase in lobbying and pressure strategies by the food and beverage industry.[412] Studies have shown that voluntary public-private partnerships, such as the Public Health Responsibility Deal in the UK, did not have a positive impact on improving health outcomes such as cardiovascular disease due to the lack of robust evaluation, monitoring and independent target-setting.[466] Thus, future involvement of actors from the private sectors (in research, policy-making or advocacy campaigning) must be done cautiously, with a plan to develop accountability and evaluate the impact of actions taken by the private sector for preventing NCDs.

8.2.2   Research aim 2 – Incorporating the preconception health agenda in the life course framework for preventing NCDs.

Focus on prenatal health historically has chiefly been on prevention of anomalies and treating fertility problems, and the conversations on using the preconception period as a platform for wider NCDs prevention were only recognised in the last decade.[34,57,467]. The landmark 2013 WHO report [468] on a PCC package presented 13 broad areas of intervention to support national policy-makers on how and when to deliver PCC. In recent years, key organisations have linked this agenda with feminist perspectives discussed in previous chapters as preconception health is not just about the health of the woman, intending to create a healthy mother or baby, but also relevant to women who do not want a pregnancy.[469] Finally, the recognition that women enter maternity care pathways too late to prevent or manage obesity and NCD risks was seen from recent trials discussed in Chapter 3, and this has pushed the current movement on normalising pregnancy preparation. This approach, which could target women and couples to enter pregnancy in the best possible health, considering wider factors and adopting biopsychosocial-ecological models, was a common theme found in this thesis. While the call for such integration has been discussed before,[210] based on the findings of this thesis, an approach integrating the socioecological model of health (discussed in chapter 2) for the life course approach to PCC is presented in Figure 8.2. The pathway provides examples of how all levels of the socio-ecological model will need to be engaged, and communicate with each other, for increasing the impact of interventions. Specific recommendations and gaps in research were discussed in previous chapters and the figure outlines the opportunities for intervention, and engagement before conception. Selected opportunities for action are presented in figure 8.2, at all levels of the socio-ecological model for stakeholders. Stakeholders communicate through different channels across the levels to link the top-down and bottom-up approaches. At the international/ national and institutional level, policies to reduce inequalities that complement interventions to build resilience across the life course are recommended. Each socio-ecological level independently influences health, and also bidirectionally influences others including the reciprocal interactions between biology, psychology, and socio-economic factors.
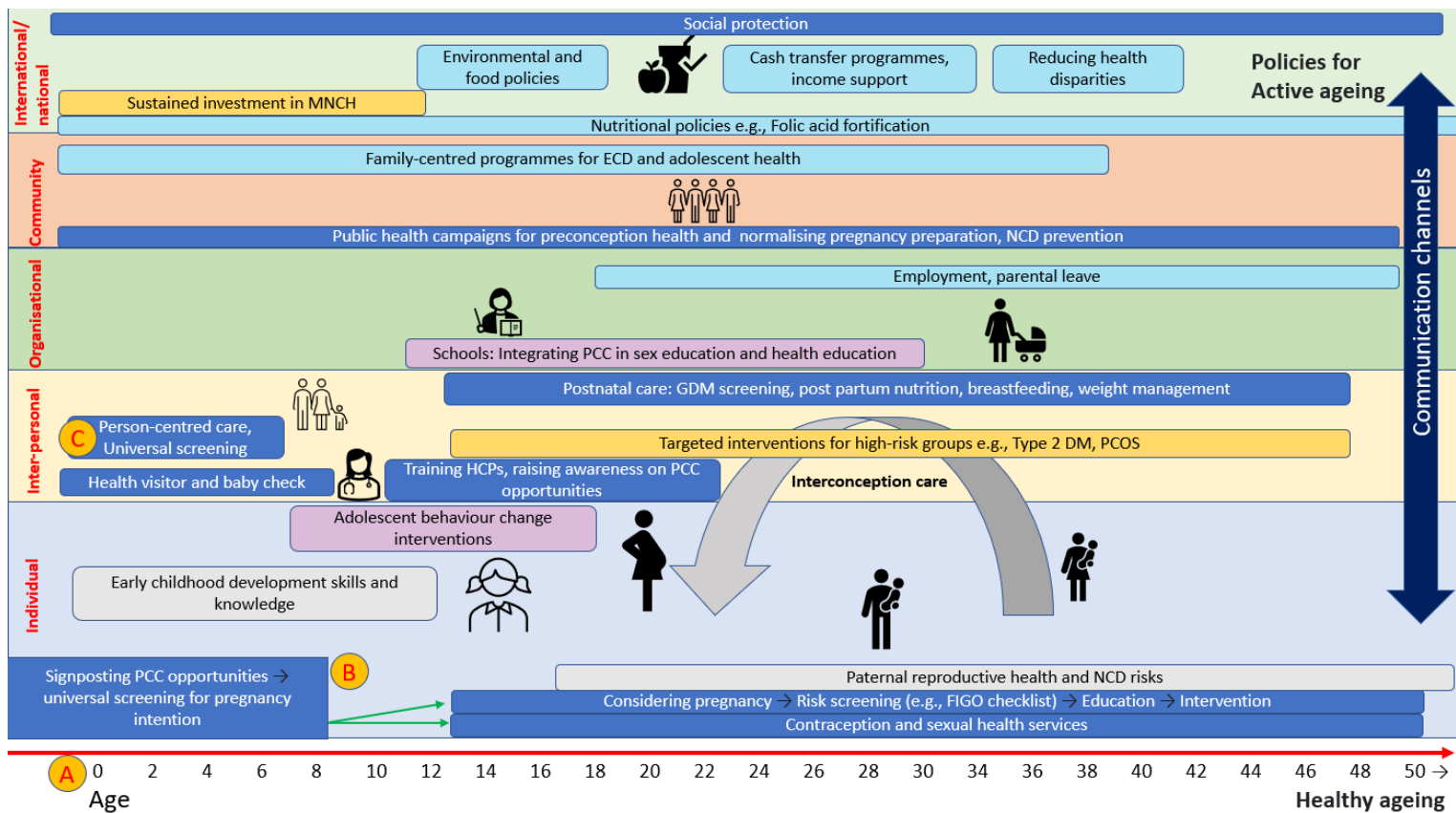
Figure 8.2 A life course approach to implementing an integrated NCD prevention and PCC agenda based on the findings of the thesis. *A – preconception health of the parent; B- opportunities in routine service; C – Applicable across all life stages; UHC – universal health care*

The recommendations from this thesis focus on using an empowering approach for future parents to be informed about risks to their own health, and their future offspring. How these messages should be communicated and framed to avoid paternalism, stigma and disempowerment were discussed previously (Chapters 5.6 and 7.4). Though DOHaD researchers have been critiqued for inflating the risk while communicating with the general public or policy-makers, communication of risk in the preconception period should not harm expectant mothers. The aim of universal screening and counselling for pregnancy preparation is not to create a judgement on who should or should not become pregnant, but to support parents attain the best health possible for themselves and their offspring, having the option to make informed choices for conception, lifestyle modification and interventions. Though dependent on health systems and contextual factors, a continuum of care from preconception through pregnancy, and postpartum (interconception) would help break the siloes in maternity care practice, as discussed in Chapter 4.

Behaviour change and nutritional interventions outside the healthcare system discussed in Chapter 3 also show promise. While an update of trials since 2018 could not be conducted due to time constraints, some preconception health interventions have shown that digital health interventions could provide newer platforms for engagement with prospective parents, and in some studies the app was preferred by pregnant and post-partum women in combination with face-to-face contact.[200,317] Similar digital interventions were trialled in the USA and evaluated the effect of the MyFamilyPlan web-based intervention on women discussing reproductive health with HCPs at well-woman visits.[470] The study led to a significant increase in the proportion of women who reported discussing reproductive health with providers.

Multicomponent nutritional interventions in LMICS have shown mixed results for DOHaD outcomes, for example, the LBWSAT intervention in Nepal[471] recruited preconception women and had three intervention arms – Participatory learning and action (PLA) alone, PLA + food and PLA plus cash. Overall, food supplements in pregnancy with PLA women's groups increased birthweight more than PLA plus cash or PLA alone but differences were not sustained at 18 months. The qualitative evaluation showed that cash transfers were often used for improving pregnant women's food intake. Thus, community-based, empowering interventions show promise particularly in LMIC contexts, but need to be supported by wider societal movements to improve gender equality and top-down policy prioritisation in maternal health.

However, the sustained effects of the interventions above for individual behaviour change are yet to be explored, and hence clinical care still presents a major platform for addressing women's

reproductive goals. The findings of this thesis are complementary to the review by Hall *et al*. 2022 [111] on community care models for PCC. Those authors highlight that opportunities to discuss contraception and other preconception needs also exist for adolescent health through sexual health clinics, HPV vaccination, menstrual health, and young women through appointments for cervical smears. Referral to resources such as Tommy's charity planning for pregnancy toolkit [472](UK) can also be done during post-natal visits such as the baby's one-year developmental review. Discussions using the nutrition checklist, for example, can be done at the risk screening stage when pregnancy intention is expressed.

8.2.3   Other key findings from the thesis

8.2.3.1   What gets measured gets managed

For the policy review in chapter 6, I focused on measurement strategies for the life course approach, as a lack of guidelines for implementation, along with variations in how the life course model was used presented issues while selecting relevant studies. A key principle underpinning the intention of the review was also for accountability of the member states in the European region who had signed the Minsk declaration (see outputs of the thesis below). Monitoring the implementation of such strategies has been a key technique for holding policy-makers accountable used by international agencies such as the WHO and UN. This is done, for example, through the case studies from member countries (on operationalising the intrinsic capacity model discussed in Chapter 6) presented in the World Report on Ageing [6] and the report launching the Decade of Healthy Ageing.[381]

Through the work in this thesis, it was clear that routine measurement of good quality, age and sex-disaggregated data is key and investment in systems for routine measurement through health systems provides the opportunity to develop tools such as the UK preconception report card – discussed in chapter 7. A similar tool was also developed by Frayne *et al.* (2016) in the USA to assess preconception health bearing in mind the context of high infant and maternal mortality in the USA compared with other high-income settings. Indicators were developed to monitor the effectiveness of interventions through health systems, including nine measures that served as a proxy for "preconception wellness", namely - 1) pregnancy intention, 2) access to care, 3) preconception multivitamin with folic acid use, 4) tobacco avoidance, 5) absence of uncontrolled depression, 6) healthy weight, 7) absence of sexually transmitted infections, 8) optimal glycaemic control in women with pregestational diabetes, and 9) teratogenic medication avoidance. [473] Key indicators for target setting, within a timeframe, are also recommended to understand the

success of a policy. Key policy documents from the UK such as Public Health England's *Making the Case for Preconception Care* (2018),[474] and the recent 2021 Women's health strategy for England[475] have the life course approach is at the heart of its strategy and has the ambition to support women with safe, high-quality health services. However, neither have mentioned a monitoring strategy and such target-setting will help monitor the success of such plans.

The practice of weighing women during pregnancy, which is now optional in the UK, for several reasons including the stigma faced by women discussed previously, was highlighted as a missed opportunity by HCPs in this thesis. It must be noted, however, that weighing women during pregnancy supports setting gestational weight gain targets and discussing a plan for managing maternal obesity, and concerns related to stigma could be overcome through appropriate staff training for communication skills (Chapters 3 and 5). From a research perspective, as women often present during pregnancy and getting records for preconception BMI routinely is difficult, studies have shown that weight measured in early pregnancy was a valid surrogate for preconception weight. [476]

Finally, from a high-level policy perspective for measurement, there is a need to create a shift in thinking regarding what constitutes value, which could help in policy prioritisation for MNCH. This would involve rethinking the conventional model of defining economic prosperity solely using GDP – defined as the total monetary value of all final goods and services produced (and sold on the market) within a country during a period of time (typically 1 year).[477] Historically, ministries and financial institutions have solely focussed on GDP and a rise/growth in GDP as a key target. However, the inequalities in health outcomes seen in high income settings, particularly after the pandemic have exposed the shortcomings of this indicator of progress. This shift in policy perspective will require robust data showing the value of measuring other parameters such as "caring economy" which includes measures for wellbeing, child poverty etc.[478]

8.2.3.2   Communication and framing

Methods tested and recommended in this thesis such as questions on pregnancy intention and discussion on weight management and improved nutrition using the FIGO checklist open the door for a guided conversation and signposting women to appropriate services or resources regardless of pregnancy intentions. However, concerns related to autonomy, feeling judged for weight and barriers related to socio-economic factors and familial/ cultural factors call for an increased focus on sensitive communication from the healthcare provider. HCPs also may have biases and different perceptions of their role in the clinician-patient interface which could affect how the

evidence from DOHaD is translated (Chapters 4,5 and[272]). Training for healthy conversation skills and continued professional development to understand the state of evidence on DOHaD risks (encouraging non-reductionist thinking) is key and has been discussed in detail in Chapters 4 and 5. Overall, using a person-centred approach is recommended for providing a life course approach to PCC for preventing NCDs.

In Chapter 7 it was seen that researchers and advocacy groups were better at problem definition than positioning the issue in a manner that would get a policy-maker's attention. Positioning using the language of return on investment could support advocacy with policy-makers. There is much data showing that investing in MNCH offers high rates of return in the medium- to longer-term, in addition to reducing the burden of short-term outcomes such as maternal and child deaths and stillbirths,[452] particularly for children from low-income families. Interventions for early childhood health and development, including by community health workers as recommended by the recent WHO-UNICEF-Lancet Commission,[82] have shown long-term benefits in prevention of NCD risk factors such as obesity.

Studies have shown that intersectoral action required to address climate change are similar to those for health benefits such as supporting active travel, reduced air pollution, and low-environmental impact diets.[479] Thus using the momentum for the climate change agenda, particularly among younger populations, provides an opportunity to disseminate the messages related to healthy lifestyles and policies with wider benefits for health and the environment. Framing the issue for public health messaging as well as in research communication to a range of stakeholders should be done with caution to avoid maternal blame (e.g., smoking during pregnancy, folic acid preconception). Based on the legal systems in a country related to fetal rights, such framing that focuses on maternal responsibility and health of the fetus as a "future person" could even lead to criminalisation of the mother as seen in cases of women who had still births after a history of drug abuse during pregnancy.[480]

Frames relate to viewing *"women as a reproductive agent"* were implicit in publications and discussions in the networks (Chapter 7). The social justice framing puts reproductive justice and women's bodily autonomy at its centre. By considering how social structures and contextual factors influence health inequalities, the social justice framework prioritises social change to create a shift in attitude for policy-makers and society.[446] Finally, in view of the evidence for acceptance of unintended pregnancies by parents (usually when living conditions were favourable),[481] framings related to "planning pregnancies" may not always have an impact, unless the benefits for the mother and baby are communicated appropriately.

8.3 Future directions and implications

Recognising that complex, multilevel interactions affect health and development across the life course, findings from this thesis call for a multi-stakeholder approach implementing the evidence from the field of DOHaD and life course epidemiology, using different platforms such as policy, clinical practice and public engagement and address the research gaps to further understand the influences on the risk of NCDs across the life course. As the empirical chapters have provided specific recommendations, key messages for the following streams are outlined below.

8.3.1 Clinical practice

Globally, health systems are primarily focused on the treatment of chronic conditions such as diabetes, and this thesis contributes to the literature which shows that support of individuals and communities for prevention of risk factors related to NCDs must be done in parallel to clinical intervention. That said, not addressing common preconception risk factors during routine visits presents a missed opportunity for the health of two generations – the parents and the offspring. Recommendations from this thesis for adopting the pathways for implementing PCC in the life course model, use of tools such as the FIGO nutrition checklist and recommendations for person-centred care can be translated into multiple global contexts in a culturally sensitive manner. It would be beneficial to modify the checklist based on regional diets so that it is relevant to the women completing it. Such work is already underway and is discussed further in the outputs below. Future research is needed to look into long-term sustained behavioural effects on diet, gestational weight gain and birth outcomes after using the checklist and being counselled using health conversation skills.

High-level decision-makers for guideline development (e.g., NICE UK, FIGO) need to consider the provision of easy-to-implement guidelines for HCPs to screen for high-risk women for NCDs, with updated evidence from DOHaD fields and sustainable weight-loss interventions. Finally, medical curriculum needs to emphasise preventive care, which when supported by enabling socio-ecological policies could potentially reduce healthcare expenditure due to NCDs and improve intergenerational health.[482] PCC and women's health needs to be viewed as an essential service, that does not always require specialist clinics and this task-shifting will require mobilising resources to support clinicians to discuss pregnancy intentions.

8.3.2   Clinical and public health research and interventions

HCPs in this study broadly showed their use of the biopsychosocial model of health, however, further research is needed to understand the perspectives of a wider range of clinicians not covered in this study such as pharmacists, sexual and reproductive health nurses and community health workers. Studies to evaluate the impact of routine discussion about contraceptive uptake and lifestyle modification are needed.

Overall, a gap in research for risk factors and interventions for PCC in men was clear. There is a need to explore environmental factors affecting transgenerational risk factors in males such as occupational exposure to endocrine disruptors, environmental toxins, obesity and health behaviours such as smoking on long-term offspring health.[483] Further research is also needed to understand which framings of preconception health issues are acceptable to the general public and the language and terminologies that would also enable the inclusion of male partners in the conversation.

While large scale birth cohorts help address the issue of understanding causal mechanisms, they are expensive to set up, and they don't satisfy the demand by policy-makers for short-term outcomes delivered quickly. Interventional cohorts that include elements of local community engagement, with process and economic evaluations are recommended. Economic evaluations of the long-term benefits of PCC and early life interventions are key to making a robust case for policy-makers. Similarly, with digital interventions on the rise (usually for fertility planning) and even health systems using web-based resources for pregnancy and child health records, the cost effectiveness of such interventions needs to be examined.

Academic research in DOHaD is not limited to biomedical fields and researchers from DOHaD could potentially link with the STS, social scientists and economists to present a unified voice informed by multidisciplinary perspectives for policy-making. Researcher-public health agency partnerships seen for the development of the preconception report card[303] have been productively used routine surveillance data for MNCH to develop resources which could help monitor and evaluate existing intervention effects (e.g., folic acid uptake, rise in obesity). Such public health programmes can be supported by researching indicators relevant to the national context. These indicators could also include targets that are sensitive to inequalities and health disparities.

Finally, the effects of the pandemic on pregnancy and preconceptional behaviours are already being explored with studies showing an impact on pregnancy planning (UK) with several women

delaying pregnancies,[484] and increased anxiety and emotional eating during pregnancy (China).[485] However, most studies hitherto have been using online surveys (similar to this thesis, presenting similar limitations) and more rigorous studies are needed to understand the impact of preconception dietary and physical activity changes on outcomes such as gestational weight gain, post-partum weight retention in the mother and offspring outcomes.

8.3.3 Policy

To avoid framing preconception and life course concepts as solely health issues, the thesis discussed several recommendations developed for a range of policy-makers, not limited to the departments of health globally. The stakeholder map (figure 8.1) discussed in this thesis can support engagement activities as well as target groups for evaluation. It is clear from the work presented in this thesis that policy-making is not value-free in the life course, DOHaD and MNCH fields. High-quality independent evaluations of policies are recommended to study the impact of new programmes. While measures to improve accountability have been discussed, government clarity on the effectiveness (on outcomes and cost) of its own policies is required for NCD prevention.[412] Furthermore, research using policy analysis techniques (document analysis, stakeholder interviews) is needed to understand the influence of the food industry and private sector actors and policies related to preconception and MNCH.

Finally, at an international and national level, advocacy for increased investment in MNCH, and recognition that health inequalities are at the core of adverse DOHaD outcomes is needed. To garner attention from policy-makers, along with framings related to social justice and economic benefit, robust analysis of the cost-effectiveness (e.g., by Stenberg *et al.* 2014) [452] is needed, especially in the post-COVID-19 era. Recognition that MNCH is an essential human right and needs to be protected in times of austerity will require strong advocacy targeting a range of stakeholders and involving global leaders. This is an example of how a problem (lack of priority to MCNH and PCC), the policy (solutions to the problem) and the politics (policy-makers have the motive and opportunity to address the issue) fit Kingdon's multiple streams theory.[153] Thus, the need to identify investment priorities for post-COVID-19 recovery provides an opportunity to implement bold, new policies to improve MNCH for sustained, transgenerational benefit. Key questions raised in this thesis also were those related to power imbalances related to stakeholders for MNCH or LMIC v/s high-income contexts. Answering some of these questions was beyond the scope of this thesis but exploring these issues in policy-making provides the opportunity to study contextual factors affecting such policy-making.

8.4   Strengths and limitations

Methodological issues and strengths were addressed in individual chapters in detail. Here, I have summarised key features of the thesis that helped contribute to original research.

An important strength of this thesis is the use of mixed methods to integrate findings from observational studies through the reviews as well as include perspectives from a broad range of stakeholders from several domains (healthcare, public, policy, knowledge brokers, academics). This also included co-production at the design and analysis stages with key stakeholders (discussed in Chapter 2). This will significantly impact the dissemination as the outputs planned from this report also aim to guide policy-makers and other stakeholders looking to implement sustainable life course NCD-prevention policies and programmes. A pragmatic perspective was adopted, in collaboration with experts in policy-making and knowledge brokers from the networks discussed in Chapter 7, in order to develop actionable policy recommendations.

In the survey and interviews, the interpretation of the results using a critical realism lens has allowed me to suggest actions for implementation and potentially improved acceptance of the FIGO checklist, discussion of nutrition and start conversations about pregnancy intention and planning between women and their HCPs. Finally, the sample also included preconception women who may not have visited an HCP for a long period. For such participants, the questions presented a hypothetical scenario, and the responses represent participants' perceptions of the research questions. This was considered acceptable because obtaining the views from women not necessarily planning a pregnancy was an added advantage as they do not have an obvious motivation to discuss conception during routine visits.

The methods used in Chapter 7 were novel in the field of DOHaD and life course approach, and indeed novel to me as a researcher too. However, these are widely acknowledged in the field of political sciences and have been used to study decision-making for a range of topics such as climate change.[486] This thesis used several theories in a complementary manner to link perspectives from social sciences while explaining and critically examining the outcomes of the empirical studies.

Despite the significant strengths discussed above, some of the limitations of this study include the generalisability of the findings. The focus of Chapters 5 and 7 was mainly UK-centric. To overcome this, I have collaborated with global organisations such as FIGO to disseminate the findings more widely. Additionally, stakeholder interviews with policy-makers would have added insights from a

policy perspective on the process and barriers, however, this could not be conducted due to time constraints.

The thesis does not follow the conventional structure of a literature review to inform the gaps in knowledge. The chapters are arranged logically to provide the reader context on how my decisions were made, especially as the work was conducted over a long period of four years. Chapter 3 in particular provides a summary of the state of preconception interventions and guidelines to present the reader with the rationale for how PCC can be incorporated into the life course model. Large variations in outcomes considered in the reviews limited the ability to draw specific conclusions about the effectiveness. However, I reiterate that the aim of the PhD was not to build the evidence for PCC interventions, as the context for the opportunity provided by the preconception platform was established before determining the aims of this thesis.

Though the survey inclusion criteria were widened to include all women in the reproductive age group, the dissemination through social media included terms and imagery related to pregnancy/ preconception. As a result, the survey predominantly included a highly motivated group to seek health information. However, I also attempted to target different regions of the UK to address the issue of representation of all regions and circulated the link to organisations that support high-risk pregnancies so that at-risk women were also allowed to take part. Language constraint was also a limitation for both surveys and interviews as the survey was only conducted in English. Finally, exploring all aspects of NCDs and preconception issues such as mental health issues, social environment and interpersonal violence and their impact on transgenerational health was not feasible in this thesis and would have required different methodologies.

The future research recommendations discussed above can help address some of the limitations.

8.4.1 Researcher's reflections and reflexivity

I have endeavoured to demonstrate reflexivity and trustworthiness throughout the study design, analysis, and interpretation of the results, adhering to the assumptions of the critical realist paradigm. Certain pragmatic decisions made during the course of the projects due to COVID-19 have been described in the respective Chapters.

An issue faced while contextualising the findings, particularly from the policy field was that several disagreements exist in the DOHaD field related to the hierarchy of evidence, reliance on observational data and framings. Navigating through these perspectives were challenging, however, based on my worldview, I accepted that there is no absolute truth or a "valid" method/

solution to implement the life course approach for NCD prevention. Analytical methods used such as content analysis were also applied as relevant, and as an early career researcher with a background in clinical medicine, I had to come to terms with such adopting flexibility - keeping the key research question at the heart of the work. Though Chapter 4 was limited by the lack of response, I do not believe that this thesis suffers academically for the lack of further interviews as subsequent research could be conducted on specific elements found by that study such as interviewing wider stakeholders who meet preconception women.

8.5   Conclusions

NCDs are now the number one cause of avoidable deaths worldwide, even in LMICs. Adoption of the life course approach and the DOHaD paradigm has been accepted as key to preventing NCDs through early intervention. The preconception period and the clinical continuum of care presents a window of opportunity to address the NCD prevention agenda and is recommended. However, this narrow focus on individual responsibility and translation at the clinician–patient interface is bound to fail as wider socioeconomic, cultural, and political factors influence the risk factors for NCDs and the intergenerational passage of risk. Stark health inequalities are seen in the presentation of risks across the life course calling for a multi-sectoral approach to developing policies that target domains both within and outside the health systems.

To implement the life course approach for this NCD prevention agenda, it is recommended that a combination of bottom-up mobilisation through increased public demand should be met by top-down policies. However, to engage all stakeholder groups, researchers play a key role in linking them to develop a sensitive, relevant and timely message that can be communicated to the public and policy-makers effectively and "sell" the concept of normalising pregnancy preparation. Through the course of my studies, further complexities in policy-making with relevance to the life course approach were exposed, questioning assumptions on how policies are made and revealing that there is no "silver bullet" for preventing NCDs using a life course lens, or even a single common message for all stakeholders.

Bringing the high-level concepts into practice will also require resources and investment in healthcare systems for maternal newborn and child health. There is a demand for tools such as checklists for nutritional risk screening before and during pregnancy which are considered acceptable and important for HCPs and reproductive-aged women. Although much attention has focused on pregnancy, findings revealed opportunities in routine care as well as in community settings to deliver PCC. In addition, framing issues in early life as a pregnancy/ women's health

problem has been problematic in attributing blame on women, and alienating other groups such as men or people who do not identify as women. The novel findings in this thesis on framing and using a right-based and social justice approach, focusing on the overall health of an individual, has potential in expediting the science-policy translation.

The work in this thesis highlights that return to "business as usual" after the pandemic would be inadequate to address the increasing NCD and obesity issues and considering MNCH an essential service to be protected during crises is the need of the hour. In one of the meetings included in this thesis, a former Prime Minister of the UK endorsed the approach of using compassion and justice to promote women's health and intergenerational health adding *"The post-COVID world cannot be a return to the old normal... our shared aim is that instead of developing some of the potential of some of our children in some of the countries of the world, we do everything in our power to develop all of the potential of all children, in all countries."* Such a global outlook, that includes justice, and addressing inequalities and a national and international level, can only be attained through a life course model which integrates not only life stages from preconception, but also all wider societal factors that shape human wellbeing.

Appendix A   Details for the review of preconception interventions and guidelines

A.1   Search terms and search strategy

The following four search strings were used on PubMed and on EBSCO host (Medline, CINAHL) limited to 2006-2018 for English language articles.

String 1: systematic [sb] AND ("Preconception Care"[Mesh] OR preconception [tiab])
    Pubmed – 107; EBSCO - 37

String 2: systematic [sb] AND (("Preconception Care"[Mesh] OR preconception [tiab]) AND
    pregnancy outcome* [tiab])
    Pubmed – 17; EBSCO 218

String 3: systematic [sb] AND ("Female"[Mesh] AND ("Health Behavior/epidemiology"[Mesh] OR
    "Life Style/epidemiology"[Mesh] OR "Sedentary Lifestyle/epidemiology"[Mesh] OR "Risk
    Reduction Behavior"[Mesh]) AND "Treatment Outcome"[Mesh])

PubMed 31; EBSCO 70

String 4:

systematic [sb] AND (("Risk Reduction Behavior"[Mesh] OR risk reduction [tiab]) AND
    ("Female"[Mesh] OR female*[tiab] or woman[tiab] or women[tiab]) AND ("Diabetes,
    Gestational"[Mesh] OR gestational diabetes[tiab] OR "Diabetes Mellitus, Type 2"[Mesh] OR
    Type 2 diabetes[tiab] OR "Overweight"[Mesh] OR overweight[tiab] OR "Obesity"[Mesh] OR
    obesity[tiab]) AND offspring[tiab])

PubMed 110; EBSO 55

Cochrane DARE

"Preconception" as key word

15 articles found, five included for full text review

Search terms on google scholar:

Appendix A

Preconception interventions AND "childhood obesity" AND review

Preconception interventions AND "pregnancy outcomes" AND review

Preconception interventions AND "neonatal outcomes" AND review

Limits applied to all four strings were publications between 2006-2018, English language and human studies.

A.2   Inclusion and exclusion criteria for the review of reviews of preconception risk factors and interventions to prevent future NCDs

	Criteria	Justification
Inclusion	**Population** Participants in the reproductive age group	The review focuses on preconception populations. Reviews were included even if the interventions extended into pregnancy.
	Intervention	No limit was placed on the type or setting for interventions
	Interconception and post-partum interventions	Though the search did not specifically target post-partum interventions, if the studies included this period, they were included in the review. Interventions between pregnancies, and those addressing risk factors in the previous pregnancy, help prepare for any subsequent pregnancy
	Comparison	Reviews including studies with and without a control group were included

	Criteria	Justification
	Outcomes Studies reporting outcomes: change in maternal weight and body composition, birth weight, the incidence of LGA and SGA births, childhood obesity (incidence) and maternal health behaviours (diet, physical activity exercise and smoking), prevention of maternal risk factors such as GDM, type 1 and 2 diabetes.	Direct and proxy measures for long-term risk of NCDs in the next generation. From existing literature, I anticipated very few studies would use a long-term or longitudinal analysis to include outcomes such as childhood obesity after the intervention.
	Study design Observational and experimental studies	To provide a thorough review of recent literature. Though the quality of evidence will be lower for observational studies a detailed and transparent quality assessment of included studies was conducted.
	High, middle, and low-income settings	To provide a global overview of preconception interventions. Considering the double-burden of over and under-nutrition in LMICs,[487]it would be helpful to also collate evidence on relevant interventions for different contexts.
	Studies published from 2006-2018	To provide an updated account of interventions since previous reviews
Exclusion	Studies not reporting outcomes related to NCDs	NCD risk factors discussed in this chapter are the focus of this review, and the thesis aims to develop recommendations for preconception interventions to prevent the transgenerational passage of NCDs.
	Papers published in a language other than English	Translation resources not available

Appendix A

	Criteria	Justification
	Specific disease groups targeted or interventions for subfertility, Studies evaluating medical treatment for NCDs such as high blood pressure, focus on specific clinical conditions such as pre-eclampsia, focus on IVF.	Outcomes not within the remit of this review

A.3   ROBIS Risk of Bias Evaluation framework

PHASE 1 Category	Target question	Review being assessed	Relevance assessment	Reasoning
Population			Yes/No	
Intervention			Yes/No	
Comparator			Yes/No	
Outcome			Yes/No	

PHASE 2 Domain 1: study eligibility criteria

1.1 Did the review adhere to pre-defined objectives and eligibility criteria?	**Y/PY/PN/N/NI**
1.2 Were the eligibility criteria appropriate for the review question?	Y/PY/PN/N/NI
1.3 Were eligibility criteria unambiguous?	Y/PY/PN/N/NI
1.4 Were all restrictions in eligibility criteria based on study characteristics appropriate (e.g., date, sample size, study quality, outcomes measured)?	Y/PY/PN/N/NI
1.5 Were any restrictions in eligibility criteria based on sources of information appropriate	Y/PY/PN/N/NI
Domain 2: Identification and Selection of Studies	
2.1 Did the search include an appropriate range of databases/electronic sources for published and unpublished reports?	Y/PY/PN/N/NI

2.2 Were methods additional to database searching used to identify relevant reports?	Y/PY/PN/N/NI
2.3 Were the terms and structure of the search strategy likely to retrieve as many eligible studies as possible?	Y/PY/PN/N/NI
2.4 Were restrictions based on date, publication format, or language appropriate?	Y/PY/PN/N/NI
2.5 Were efforts made to minimise error in selection of studies?	Y/PY/PN/N/NI
Domain 3: Data Collection and Study Appraisal	
3.1 Were efforts made to minimise error in data collection?	Y/PY/PN/N/NI
3.2 Were sufficient study characteristics available for both review authors and readers to be able to interpret the results?	Y/PY/PN/N/NI
3.3 Were all relevant study results collected for use in the synthesis?	Y/PY/PN/N/NI
3.4 Was risk of bias (or methodological quality) formally assessed using appropriate criteria?	Y/PY/PN/N/NI
3.5 Were efforts made to minimise error in risk of bias assessment?	Y/PY/PN/N/NI
Domain 4: Synthesis and Findings	
4.1 Did the synthesis include all studies that it should?	Y/PY/PN/N/NI
4.2 Were all pre-defined analyses reported or departures explained?	Y/PY/PN/N/NI
4.3 Was the synthesis appropriate given the nature and similarity in the research questions, study designs and outcomes across included studies?	Y/PY/PN/N/NI
4.4 Was between-study variation (heterogeneity) minimal or addressed in the synthesis?	Y/PY/PN/N/NI

4.5 Were the findings robust, e.g., as demonstrated through funnel plot or sensitivity analyses?	Y/PY/PN/N/NI
4.6 Were biases in primary studies minimal or addressed in the synthesis?	Y/PY/PN/N/NI
Phase 3: Judging Risk of Bias	
1. Concerns regarding specification of study eligibility criteria:	LOW/HIGH/UNCLEAR
2. Concerns regarding methods used to identify and/or select studies	LOW/HIGH/UNCLEAR
3. Concerns regarding methods used to collect data and appraise studies	LOW/HIGH/UNCLEAR
4. Concerns regarding the synthesis and findings	LOW/HIGH/UNCLEAR
RISK OF BIAS IN THE REVIEW	
A. Did the interpretation of findings address all of the concerns identified in Domains 1 to 4?	Y/PY/PN/N/NI
B. Was the relevance of identified studies to the review's research question appropriately considered?	Y/PY/PN/N/NI
C. Did the reviewers avoid emphasizing results on the basis of their statistical significance?	Y/PY/PN/N/NI
Risk of bias in the review	LOW/HIGH/UNCLEAR

Y=YES, PY=PROBABLY YES, PN=PROBABLY NO, N=NO, NI=NO INFORMATION

A.4   Search strategy for PCC guidelines

Search terms used on PubMed: ((preconception*) OR (preconception care*)) AND (guidelines)

Limits: 2010-2020; English
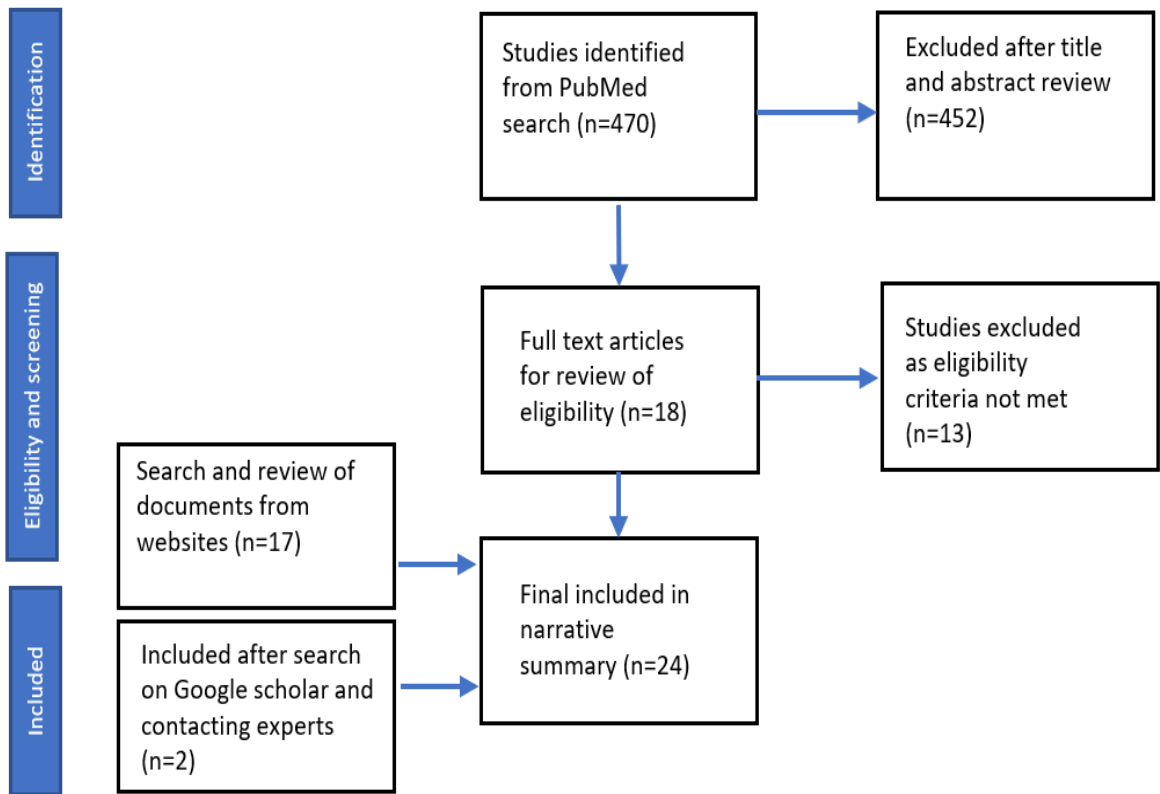
Figure A.4: flow chart presenting the selection of documents for guidelines

A.5 Guidelines relevant to nutrition and prevention of obesity and noncommunicable diseases in the preconception period

Recommendations were extracted from documents published by key maternal and reproductive health organisations and relevant systematic reviews. To ensure the latest guidelines were adopted, only documents published in the last 10 years were considered.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
1. Australia: Royal Australian College of General Practitioners (RACGP) (Reported in Dorney and Black 2018)[488]	General preconception care	Regional organisations such as South Australia's Preconception Advice Clinical Guideline have developed comprehensive online resources to assist the pre-pregnancy counselling process. The preconception care checklist includes: **Diet** Nutritional requirements including folic acid supplementation Advice on a healthy diet **Weight** Measurement of body mass index and appropriate advice **Exercise** Advise 150 minutes of exercise per week or 30 minutes on most days **Pregnancy history** Screen for any modifiable risk factors

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
2. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) (2017) [224]	Target audience: All health professionals providing care to women prior to pregnancy.	The document provides health professionals with advice on the counselling of women prior to pregnancy. All women planning a pregnancy are advised to consult their General Practitioner with a view to: (1) detecting and assessing any specific health problems in the woman or her partner that may be relevant, so that these can be appropriately managed prior to the pregnancy; (2) obtaining general advice about optimizing personal health care and lifestyle with pregnancy in mind. Other healthcare professionals (such as obstetricians, infertility specialists, and midwives), may also be presented with a valuable opportunity to assess and counsel a woman prior to a planned pregnancy. **Lifestyle recommendations**: • Healthy weight - Active steps to correct high BMI (dietary, exercise and where appropriate consideration of bariatric surgery) prior to a pregnancy should be recommended. • A recommendation for moderate intensity exercise and assessment of any nutritional deficiencies is appropriate. • Excessive caffeine consumption (>300 mg/day; equivalent to 3–4 cups of brewed coffee/day) should be avoided • Supplementation - Folic acid should be taken for a minimum of one month before conception and for the first 3 months of pregnancy. The recommended dose is at least 0.4 mg daily. Where there is an increased risk of neural tube defects (anticonvulsant medication, prepregnancy diabetes mellitus, previous child or family history of neural tube defects, BMI >35), a 5 mg daily dose should be used. The National Health and Medical Research Council recommends women should start a dietary supplementation of 150 µg iodine prior to a planned pregnancy or as soon as possible after finding out they are pregnant.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
3. Government of Canada (2018)[489]	Information for HCPs to optimise preconception health	The goals for preconception care are to improve the health status of women and men before conception and to reduce those behaviours and individual and environmental factors that could contribute to poor maternal and child health outcomes. Key recommendations include: • Encourage all women and men of reproductive age to develop a reproductive-life plan, whether they intend to have children or not. • Recommend a daily multivitamin containing 400µg (0.4 mg) of folic acid for all women of reproductive age who could become pregnant and discuss risk factors that may warrant a higher dose. • Encourage progress toward healthier weights in women who are underweight, overweight, or obese. Adverse perinatal and maternal outcomes can be reduced with appropriate preconception weight gain or loss. • Optimize chronic medical conditions prior to conception to improve perinatal and maternal outcomes. • Obese women should be made aware that a weight loss of as little as 5%–10% of their current weight can improve their chances of conceiving • Lifestyle advice: - 150 minutes per week of moderate to vigorous physical activity for adults aged 64 and under. - No more than 2 drinks per day on most days, with no more than 10 drinks per week for nonpregnant women to reduce long-term health risks.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		- All women who could become pregnant should take a daily multivitamin containing 400 µg (0.4 mg) of folic acid - A pre-existing pattern of healthy eating helps to optimize maternal and fetal health. Advice for avoiding fad diets and the need to counsel women about having a healthy balanced diet is included in the report. The preconception period is the ideal time to achieve (or progress toward) an optimal weight
4. China's National Preconception Health Care Project (NPHCP)[243]		The national program mainly targeted communities with a focus on healthy weight and nutrition and improving diet. However, as obesity rates vary across regions more action has been called for preventing weight gain before and during pregnancy, to increase awareness among underweight and overweight women.
5. Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland (2013)[490]	Obesity and pregnancy clinical practice guideline	• It is recommended that obese women should take high dose (5 mg) folic acid for at least one month before conception and continue throughout the first trimester. • Women of childbearing age who are overweight or obese should be encouraged to lose weight whether they plan to conceive or not. Obesity is associated with PCOS and women with obesity and anovulation who are planning a pregnancy are more likely to conceive if they lose weight although there is little evidence that one diet is better than another for enhancing reproduction.
6. Federation of Obstetric and Gynaecological Societies of India (FOGSI)	For healthcare practitioners	Comprehensive set of recommendations for clinical practice for women in the preconception period: **Folic acid:** All women of childbearing age should be recommended to take folic acid 0.4/0.5 mg daily, at least 1 month before conception to up to 3 months after conception to reduce the risk of neural tube defects.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
Good Clinical Practice Recommendations on Preconception Care (2016) [221]		**Anaemia**: All women in the preconception period should be screened for anaemia with haemoglobin as a primary screening test and treated appropriately. In addition, considering a very high incidence of anaemia in India, weekly supplementation of 100 mg elemental iron and 500 μg folic acid with deworming medication (albendazole 400 mg) should be recommended to all women in the preconception period.
		BMI: It is advisable to attain BMI 18–23 prior to conception and healthcare providers should advise women about the measures to attain it.
		BMI cut-off for Asian Indians: Normal BMI: 18.0–22.9; Overweight: 23.0–24.9; Obesity: >25.
		Overweight: Overweight and obese women in the preconception period should be counselled about the increased risk of adverse maternal and perinatal outcomes.
		Focused counselling sessions combined with multipronged interventions consisting of nutritional modification along with aerobic and strength-conditioning exercises should be the first-line approach to achieve the target weight loss.
		• Irrespective of the pre-pregnancy weight, weight loss during pregnancy is not recommended and hence counselling during preconception should be done to achieve a realistic target of 5%–10% over a period of 6 months.
		• Bariatric surgery is suggested in women with BMI above 32.5 with comorbidities, and in women with BMI above 37.5 without comorbidities. Patients should be advised to avoid pregnancy for at least 12–18 months after the surgery.
		Underweight: Healthcare providers should examine the food choices and provide nutritional advice to underweight women.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		• Underweight women should also be screened and treated for eating disorders like anorexia nervosa and bulimia. • Counselling about proper nutrition to maintain optimal BMI well before pregnancy should be provided as weight gain in pregnancy does not reduce the risks associated with the low pre-pregnancy BMI. **Diabetes:** • In the preconception period, all women should be screened for diabetes as per WHO criteria **(**Fasting plasma glucose (FPG) ≥126 mg/dL or 2-hr plasma glucose ≥200 mg/dL) • All women with pregestational diabetes should be counselled on diabetes self-management skills, the importance of maintaining good glycaemic control before and throughout pregnancy, and about the strong benefits of long-term cardiovascular disease risk factor reduction. • Women with pre-existing diabetes mellitus should be advised to achieve a glucose level of 80–110 mg/dL (fasting) and an HbA1c goal of <6.5% before conception.
7. NICE 2015 United Kingdom[237]	Clinicians in contact with women of childbearing age with diabetes and for gestational diabetes risk assessment	• Offer women with diabetes who are planning to become pregnant individualized dietary advice. • Offer women with diabetes who are planning to become pregnant and who have a BMI above 27 advice on how to lose weight, in line with the NICE guideline on obesity: identification, assessment, and management of overweight and obesity in children, young people, and adults. • Advise women with diabetes who are planning to become pregnant to take folic acid (5 mg/day) until 12 weeks of gestation to reduce the risk of having a baby with a neural tube defect. • Contraception and planning for pregnancy.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		• Providing information, advice, and support on outcomes for mother and baby. • Offer women with diabetes who are planning to become pregnant monthly measurement of their HbA1C level. • Offer women with diabetes who are planning to become pregnant a meter for self-monitoring of blood glucose. • Review safety of current medication. • Retinal and renal assessment. Also includes: Removing barriers to the uptake of preconception care and when to offer information. 1.1.26 Explain to women with diabetes about the benefits of preconception blood glucose control at each contact with healthcare professionals, including their diabetes care team, from adolescence. 1.1.27 Document the intentions of women with diabetes regarding pregnancy and contraceptive use at each contact with their diabetes care team from adolescence. 1.1.28 Ensure that preconception care for women with diabetes is given in a supportive environment and encourage the woman's partner or other family member to attend.
8. NICE 2019 United Kingdom [227]	Preconception advice and management	Overall advice on diet: • **Using the Eatwell guide for information on achieving a balance of healthier food** • **Dietary advice to women planning pregnancy to eat a healthy, balanced diet and to help maintain a healthy weight before pregnancy (recommendations include, for example - b**ase meals on starchy food (for example bread, rice, pasta, potatoes), choosing wholegrain if possible, eat fibre-rich foods (for example fruit,

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		vegetables, oats, beans, peas, lentils), eat at least 5 portions of different fruits and vegetables each day, low fat diet, reduced consumption of fried food, drinks and confectionary with added sugar (for example cakes, fizzy drinks) etc. • Advise women that achieving a healthy weight (BMI 18.5–24.9) before becoming pregnant reduces the risk of pregnancy complications. • Advise the woman of the potential health risks of being obese (BMI of 30 or more). • **Advise on achieving a healthy weight before conception and risks of being overweight before conception** • Weight loss - the recommendation to advise women to lose weight if obese, and the target weight loss suggested is based on the NICE public health guidance: *Weight management before, during and after pregnancy.* • **Folic acid:** recommendation to prescribe folic acid 5 mg daily to people at higher risk of neural tube defects and 400 µg to people at normal risk of neural tube defects. • **Counsel about risk of being underweight before conception.** • **Managing suspected eating disorders**
9. RCOG 2018, UK Green-top Guideline No. 72[222] (United Kingdom)	Women with obesity in pregnancy	• Primary care services should ensure that all women of childbearing age have the opportunity to optimize their weight before pregnancy. Advice on weight and lifestyle should be given during preconception counselling or contraceptive consultations. Weight and BMI should be measured to encourage women to optimize their weight before pregnancy.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		• Women of childbearing age with a BMI 30 or greater should receive information and advice about the risks of obesity during pregnancy and childbirth and be supported to lose weight before conception and between pregnancies in line with National Institute for Health and Care Excellence (NICE) Clinical guideline (CG) 189. • Women should be informed that weight loss between pregnancies reduces the risk of stillbirth, hypertensive complications, and fetal macrosomia. Weight loss increases the chances of successful vaginal birth after caesarean section. • **Nutritional supplements**: Women with a BMI 30 or greater wishing to become pregnant should be advised to take 5 mg folic acid supplementation daily, starting at least 1 month before conception and continuing during the first trimester of pregnancy. Women with obesity are at high risk of vitamin D deficiency. However, although vitamin D supplementation may ensure that women are vitamin D replete, the evidence on whether routine vitamin D should be given to improve maternal and offspring outcomes remains uncertain.
10. RCOG – Better for Women report 2019 [430] (United Kingdom)		• Overall, the report highlights the importance of a life course approach. • Health services need to find innovative ways of communicating with girls and women at an early stage in their reproductive lives, to highlight the importance of eating a healthy diet, having a normal BMI, being physically active, stopping smoking, avoiding alcohol and recreational drugs, and taking supplements of folic acid in the preconception period. • Data collection should be supported before, during, and after pregnancy and maternity and SRH data can be integrated by the inclusion of outcomes such as the London Measure of Unplanned Pregnancy in the

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		antenatal booking history, which can be used to monitor the effectiveness of preconception and family planning services and identify areas for action. • Each contact with an HCP is an educational opportunity to engage women in thinking about their health, preparing for pregnancy, and understanding how their current lifestyle choices will influence the outcome of their pregnancy and their baby's future health – these include attending their GP practice or gynaecology clinic for the insertion or removal of a contraceptive implant or intrauterine device, or visiting their GP or local early pregnancy unit after a miscarriage or ectopic pregnancy, baby checks, and vaccination visits for young children. Women should be offered advice on body weight and lifestyle in primary care, such as during preconception counselling and appointments about contraception.
11. American Academy of Family Physicians (AAFP) Preconception Care [491] USA	General practitioners	• All women who have a BMI greater than 30 or less than 18.5 should be counselled about the risks their weight status poses to their own health and to future pregnancies; these patients should be offered specific strategies to improve the balance and quality of their diet and physical activity level. • In addition, The AAFP recommends screening for obesity in all adults and offering or referring patients with a BMI of 30 or higher to intensive, multicomponent behavioural interventions
12. American College of Obstetricians and Gynaecologists (ACOG) 2019	OBGYNs and other healthcare practitioners	• Prepregnancy counselling is recommended whether the reproductive-aged patient is currently using contraception or planning pregnancy. Counselling can begin with the following question: "*Would you like to become pregnant in the next year*?"

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
Prepregnancy counselling [220], USA		• Any patient encounter with nonpregnant women or men with reproductive potential is an opportunity to counsel about wellness and healthy habits, which may improve reproductive and obstetric outcomes should they choose to reproduce. • Patients should be screened regarding their diet and vitamin supplements to confirm they are meeting recommended daily allowances for calcium, iron, vitamin A, vitamin B_{12}, vitamin B, vitamin D, and other nutrients. • Patients should be encouraged to try to attain a BMI in the normal range before attempting pregnancy, because abnormal high or low BMI is associated with infertility and maternal and fetal pregnancy complications. Ideally, weight should be optimized before a woman attempts to becoming pregnant, although the health benefits of postponing pregnancy need to be balanced against reduced fecundity with female ageing. • Prepregnancy, during pregnancy, and postpartum - women should exercise moderately at least 30 minutes a day, 5 days a week, for a minimum of 150 minutes of moderate exercise per week. These levels of exercise are recommended. • Pregestational diabetes: Euglycemic control (HbA1C <6.5%) and optimal weight management. Additionally, screen for thyroid dysfunction
13. American Association of Clinical Endocrinologists 2015 [238], USA	Women with PCOS	• Assessment of a woman with PCOS for infertility involves evaluating for preconception issues that may affect response to therapy or lead to adverse pregnancy outcomes and evaluating the couple for other common infertility issues that may affect the choice of therapy, such as a semen analysis. Women with PCOS have multiple factors that may lead to an elevated risk of pregnancy, including a high prevalence of

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		IGT (a clear risk factor for gestational diabetes) and Metabolic syndrome with hypertension, which increases the risk for pre-eclampsia and placental abruption. Women should be screened and treated for hypertension and diabetes prior to attempting conception. Women should be counselled about weight loss prior to attempting conception, although limited clinical trial data are demonstrating a benefit to this recommendation.
14. World Health Organization 2013 [468]		- Folic acid insufficiency, anaemia, and iron deficiency: Iron and folic acid supplementation (e.g., food fortification, use of micronutrient powders containing iron); screening for anaemia; information; education. - Underweight: Nutrition education (counselling about risks to own health and future pregnancies); nutritional monitoring. - Overweight and obesity: Nutrition education (counselling about risks to own health and future pregnancies); nutritional monitoring; nutrition counselling (lower caloric intake, increase physical activity, structured weight-loss program, continued breastfeeding). - Diabetes mellitus: Information and education; communitywide or national screening among populations at high risk; blood glucose monitoring; management of diabetes (glycaemic control before, during, and after pregnancy); exercise; nutritional counselling (screening for pre-existing type 2 diabetes and every 1–3 years after gestational diabetes). Iodine deficiency: however clinical intervention is not recommended (iodized salt as a public health measure recommended).

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
15. WHO Regional Office for South-East Asia (2014)[492]	WHO Southeast Asia region	• Folic acid deficiency, anaemia and underweight were identified as important nutritional issues for preconception care along with increasing maternal overweight and obesity. Specific clinical recommendations not mentioned.
FIGO (International Federation of Gynecology and Obstetrics) 16. Hanson et al. (2015) "Think Nutrition first"[230] And 17. FIGO Working Group on Good Clinical Practice in Maternal–Fetal Medicine (2019) Good clinical practice advice: Micronutrients in the periconceptional period and pregnancy[233]	Women in the reproduction age group	• Women who plan to become pregnant or who are of childbearing age and not using a contraceptive method, and women who do not have risk factors for neural tube defects, should take 400 µg (0.4 mg) of synthetic folic acid beginning at least 30 days before conception and continue daily supplements throughout the first trimester of pregnancy. • High risk pregnancies for neural tube defects: Those with a personal or family history of pregnancy affected by some neural tube defects, use of anticonvulsants, mutation in enzymes related to folate, insulin dependent diabetes, obesity (body mass index >30), malabsorption syndromes, and pregnant women with a history of surgery for obesity. Such high-risk groups should be advised to take 4000 µg per day (4.0 mg). For both regimens, supplementation must begin at least 30 days before conception and be continued daily throughout the first trimester of pregnancy. • Patients should be asked about their use of iodized salt and be informed of the importance of adequate iodine nutrition to ensure optimal thyroid function both before and during pregnancy. • Attention should be paid to preconception or early pregnancy body weight and BMI, and steps should be taken to provide adequate support for dietary modification and achieving appropriate levels of physical activity.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		• General preconception and adolescent health assessment by healthcare providers can include as appropriate for the setting: diet composition, physical activity, height, weight, BMI, obesity risk – waist circumference and other anthropometric measures, anaemia, risk of specific nutritional problems (low nutrient density) folate, iron, calcium, vitamin B12, vitamin D, iodine, zinc, PUFAs. For women specifically planning a pregnancy, this could include discussions related to: Importance of a healthy diet and exercise, sedentary behaviour, weight loss counselling, risky behaviours and exposures (e.g., tobacco, alcohol, recreational drugs), environmental toxins, chronic disease screening and management, supplementation. Folic acid supplementation 400 µg/day and other nutrients as required (iron, iodine, vitamin B12).
18. Atrash and Jack (2020)[213]**	Clinical Practice guidelines for PCC to improve pregnancy outcomes by developing a tool for clinicians	The review of published and grey literature provides recommendations for clinicians on how to address a range of risk factors and health behaviours. All practitioners encountering women in the reproductive age group are encouraged to ask about pregnancy intentions. Key points to consider in consultation for women who are planning a pregnancy include: • Review patient history • Family history (particularly for Chronic conditions and genetic disorders) • Specific questions on personal medical history (including previous history of GDM, pre-eclampsia, congenital malformations in previous pregnancy) • Questions on Domestic violence, health behaviours (smoking, alcohol, drugs), stress, environmental exposures and exercise are included in the checklist

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		• Counselling on healthy lifestyles would include - Consume a healthy balanced diet including diet rich with iron and folic acid, consume iodized salt instead of non-iodized salt, engaging in moderate physical activity and maintaining a healthy weight and BMI (between 18.5 and 24.5).
19. Kominiarek *et al.* (2016)[214]**	Women in the reproductive age group	• Review of national guidelines on obesity before during and after pregnancy. • Six documents were included (USA, UK, Australia, New Zealand, Ireland, Canada) • Risk factors on maternal and neonatal outcomes due to preconception obesity are discussed • Differences in guidelines were seen for gestational weight gain recommendations. Most organisations followed the IOM guidelines while NICE did not recommend routine weighing during pregnancy. Nutrient supplementation is recommended, however, differences in dosage were observed. E.g., iodine (150 μg daily) is recommended by RANZCOG preconception and during pregnancy, but ACOG and Society of Obstetricians and Gynaecologists of Canada, SOGC did not recommend these.
20. Mahmud *et al.* (2010)[215]**	PCC for women with diabetes	• Review of guidelines found five documents (USA, Australasian region and the UK) • All five guidelines recommended control of blood sugar preconceptionally to prevent congenital anomalies. • The documents also recommended the use of contraception until glycaemic control is achieved. • Differences were seen in targets for optimum metabolic control Metformin was recommended as an adjunct or alternative for diabetic treatment preconceptionally when insulin treatment cannot be used

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
21. Shannon *et al.* (2014) [250]**	Public health models of preconception healthcare delivery	Based on the systematic review, four approaches were adopted in developing a model of healthcare delivery: 1. Universal, primary care, defined as the provision of preconception healthcare opportunistically within the context of primary healthcare services such as general practice, nurse practitioners, local healthcare clinics, and pharmacies. 2. Hospital-based opportunistic care, including education, interconception care. Using a hospital admission as a point of contact with the healthcare system and a platform for general patient medical education. 3. Establishment of specialized preconception healthcare clinics, which provide targeted, specific preconception healthcare. 4. High-risk and outreach preconception care, defined as the identification of women with specific medical and social issues that may be of higher risk during pregnancy than the general population, and targeting this group with appropriate interventions, including community outreach.
22. Shawe *et al.* (2015) [216]**	Review of Guidelines in Six European Countries	• Overall, preconception care recommendations were available for women with chronic disease but guidance for healthy women was fragmented and inconsistent, and there was very little guidance relating to men. In all countries, antenatal care and pregnancy guidelines were found that alluded to the requirement for good health before pregnancy and included advice about folic acid supplementation before conception. • At the time of review, only Italy, the Netherlands, and the UK had definitive preconception national guidelines available via the web to healthcare practitioners for women without pre-existing medical conditions. • UK, Netherlands, Italy, and Sweden had specific dietary and nutritional advice.

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		• In the UK and Belgium, guidelines for women planning pregnancy included counselling about the associated risks and recommend structured weight loss programmes for women with a BMI exceeding 30 and that healthcare practitioners should actively discuss this issue with women of childbearing age.
23. Simon *et al.* (2020)[217]**	Systematic review of clinical practice guidelines for the management of pregnant women with obesity	**Recommendations for preconception care of women in childbearing age with obesity** • Women of childbearing age with obesity should receive information from healthcare providers about both the risks of being affected by obesity and the benefits of weight loss before pregnancy, specifically improving pregnancy outcomes for both mother and baby by reducing the risks of miscarriage, pre-eclampsia, and gestational diabetes mellitus (GDM). • Women should be reminded that weight loss also reduces long-term health risks, including hypertension, sleep apnoea, pulmonary disease, and cardiac disease especially in women with diabetes. • Women with a BMI ≥30 wishing to become pregnant should be advised to take 5 mg of folic acid supplementation daily, starting at least 1 month before conception and continuing during the first trimester of pregnancy. • In addition, prior to attempting to conceive, women of childbearing age should stop taking medication for weight loss. • One clinical practice guideline (CPG) recommended that "bariatric surgery could be considered to improve fertility outcomes in women with PCOS who are anovulatory, have a BMI ≥35 kg/m2, and who remain infertile despite undertaking an intensive structured lifestyle management programme involving reducing dietary energy intake, exercise, and behavioural interventions preferably for a minimum of 6 months." However, other CPGs have suggested that bariatric surgery should not be considered as a

Citation/organisation, Year	Target population and remit	Key clinical recommendations for the preconception period *
		treatment for infertility. One CPG recommended that if a woman has had bariatric surgery prepregnancy, ongoing follow-up by a dietician is necessary.
24. Zühlke *et al*. (2016) [218]**	Recommendations for preconception counselling in the African context	• Based on WHO recommendations for preconception counselling (2013) around 13 areas and provide an evidence-based package of interventions addressing the following areas: nutritional conditions; vaccine-preventable diseases; genetic conditions; environmental health; infertility/subfertility; female genital mutilation; too early, unwanted, and rapid successive pregnancies; sexually transmitted infections; HIV; interpersonal violence; mental health; psychoactive substance abuse; and tobacco use. • Evidence-based interventions to be considered for: screening for anaemia, nutritional supplementation (iron and folate), information, education and counselling, food supplementation, promoting exercise and a healthy diet, and family planning and child spacing. • Components of preconception care should include nutritional assessment. • When possible, prepregnancy blood pressure should be normalized with lifestyle changes before pregnancy such as dietary changes (low salt intake, increased intake of fresh fruits and vegetables), healthy weight modification to avoid obesity, and adherence to antihypertensive medications.

*Information with a focus on nutrition and non-communicable disease prevention (e.g., weight loss, diet, and physical activity) is listed here.

**Other key publications on preconception weight management and NCD prevention

Appendix B   Documents for interviews with healthcare practitioners

B.1   Consent form

The form was sent via email, which the HCPs then signed and returned to the researcher before the interviews.

Study title: Exploring the knowledge of DOHaD concepts among healthcare practitioners and understanding the barriers and facilitators to the implementation of life course and DOHaD concepts in practice.

Researcher Name: Chandni Maria Jacob

ERGO number: 48281

Participant ID number:

	Please initial box:
1) I have read the information sheet for this interview study and have been able to ask questions.	
2) I understand that it is my choice to take part in the study and that I am free to stop taking part at any time, without giving any reason, and my data will be destroyed.	
3) I agree to take part in the study.	
4) I agree to have the conversation audio-recorded and understand that my name and the names of people and places I mention will not be transcribed or used.	
5) I understand that sections of transcripts (after anonymisation) of data collected during the study may be looked at by individuals from the University of Southampton. I give permission for these individuals to have access to my data (transcripts only).	
6) I understand that I may be quoted directly in reports of the research but that I will not be directly identified (e.g., that my name will not be used).	

Appendix B

Name of participant giving consent	Date	Signature
Name of person taking consent	Date	Signature

Participant Information sheet

Do the concepts of life-course approach and developmental origins of health and disease underpin maternity care in practice?

Researcher: Dr Chandni Maria Jacob

ERGO number: (ERGO 48281)

> *Laying the foundations for a healthy pregnancy and the health of next generation*
>
> *Our health behaviours such as our food habits, physical activity and smoking not only affect our future health but lay the foundations for the health of our offspring. Research has shown that a woman's health before and during pregnancy can influence the health of the baby in many ways. Women who were overweight before pregnancy had a higher risk of children who were overweight or obese.*
>
> *With the rising rates of non-communicable or lifestyle diseases, addressing the passage of risk from one generation to another is vital. Diseases such as diabetes during pregnancy can have severe consequences for the mother and baby. Providing support during the preconception period can help prevent these adverse outcomes to a great extent. I am keen on hearing your views and experiences as a healthcare professional involved in maternity care, on addressing this passage of risk.*

You are being invited to take part in the above research study. Before you decide whether to participate, you need to understand why the research is being done and what it would involve. Please read the information below carefully and ask questions if anything is not clear. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

This study is part of a PhD research project by Dr Chandni Maria Jacob to understand the barriers and facilitators faced by healthcare practitioners while supporting women to plan a healthy pregnancy. This study is a qualitative study that uses the method of interviews. Sometimes, we don't know what the problems faced by healthcare practitioners are, for example issues with communicating with women regarding improving BMI before/during pregnancy. To find out why, and to help develop programmes in the future to support healthcare practitioners we conduct interviews to obtain useful information about your experiences.

Why have I been asked to participate?

As a health care practitioner who is the key point of contact for pregnant women and women/couples planning a pregnancy, I would like to hear about the experiences you have had in supporting and encouraging your patients to eat better and make lifestyle changes to prevent obesity and non-communicable diseases, such as diabetes, and live healthier lives. I am also interested in understanding your views on the issues you face in communicating with women before they are pregnant to support them to prepare for a healthy pregnancy.

What will happen to me if I take part?

I would like to conduct a short telephone interview with you in order to find out:

- Your understanding and knowledge about the role of early life (pre-pregnancy, pregnancy and early childhood) and the risks during the period that could lead to non-communicable diseases such as diabetes in later life.
- The challenges you face while communicating with patients about their lifestyles and in trying to help them to lead healthier lives.
- What would help you to engage more effectively with women before and during pregnancy to support them to change their behaviours related to diet and physical activity.

When? At a time that suits you

How? Email me, Chandni Maria Jacob c.m.jacob@soton.ac.uk with the best time and number to contact you on, and I will contact you with more information and to arrange a telephone interview at a time that suits you.

Are there any benefits in my taking part?

Your views, experiences and a healthcare professional and insights about your field of work are important to help us understand the area. Knowing the issues faced by practitioners like you can help us develop better programmes for training and undertake other actions that will help improve communication related to nutrition and non-communicable diseases with women preparing for pregnancy.

Are there any risks involved?

The study is low risk as only telephone interview will be conducted. Interviews will be conducted at a time suitable for you.

What data will be collected?

The data collected will be our conversation during the interview, which will be audio recorded and then typed and saved on a password-protected and encrypted computer that only I have access to.

Will my participation be confidential?

Your participation and the information we collect about you during the course of the research will be kept strictly confidential. With your permission, the interview will be audio-recorded. What you say will be typed up. Your name and names of other people and places you mention will not be used. I will use aliases instead. Your name will also be replaced with a number, so no one can identify you. Only members of the research team and my supervisors from the University of Southampton will be given access to data, after your name and other names have been changed. We will follow ethical and legal practice and all information about you will be handled in confidence.

Do I have to take part?

No, it is entirely up to you to decide whether or not to take part. If you decide you want to take part, you will need to sign a consent form to show you have agreed to take part.

What happens if I change my mind?

Taking part in this research is completely voluntary. You can choose not to answer questions. You can stop taking part at any time, without giving a reason, and the audio-recording will be deleted immediately.

What will happen to the results of the research?

Your personal details will remain strictly confidential. Research findings made available in any reports or publications will not include information that can directly identify you.

The results of this study will be published in peer-reviewed scientific journals. We are also happy to share the publications with you on request. You will not be identified in any report, publications or presentations. Direct quotes from the interviews may be used in reports and publications; however, the quotes will be anonymised to ensure that you cannot be identified.

Where can I find more information?

If you have any questions, please e-mail me, Chandni Maria Jacob, on c.m.jacob@soton.ac.uk

What happens if there is a problem?

If you have a concern about any aspect of this study, you should speak to us and we will do our best to answer your questions. Supervisor: Prof Mark Hanson M.Hanson@soton.ac.uk

If you remain unhappy or have a complaint about any aspect of this study, please contact the University of Southampton

B.2   Interview topic Guide

Exploring the knowledge of Developmental Origins of Health and Disease (DOHaD) concepts among healthcare practitioners and understanding the barriers and facilitators to the implementation of life course and DOHaD concepts in practice.

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ID number: **Date**:   **Time:**

Exploratory questions and prompts:

Background

- What, to you, would be the characteristics of a healthy pregnancy …. and a healthy baby?
- What do you see as your role in supporting women (and their partners) coming to your clinic/hospital in adopting healthy behaviours before pregnancy?
- How often do women approach you for help in preparing for pregnancy - before they know they are pregnant?
- How have you supported young couples/ women in the past in making the changes related to healthy lifestyles e.g., to improve their nutrition, physical activity level or BMI?

Level of awareness among stakeholders of DOHaD concepts and intergenerational transmission of risk of lifestyle disorders/NCDs for example diabetes, heart disease and obesity.

- What are the non-communicable disease (or lifestyle-related diseases as they are often called) that you come across in practice as a midwife/ OBGYN/Nurse?
- What do you know about the factors before and during pregnancy that are linked with NCDs in the mother?
- What do you know about the influence of these factors on the risk of NCDs in the children throughout their lifetime? How much of an awareness is there in the clinical community about it?
- If the period from before conception to the age 2 years is a time when NCDs can be prevented, then what can be done? (In your capacity as a midwife/ OBGYN/ nurse).

Barriers and facilitators to implementing these concepts in practice

- What are the barriers/ issues/ problems you face while talking to women when you meet them for consultation in the clinic?

- What have you done to overcome these?

- How easy/ difficult is it to discuss topics such as diet, physical activity, smoking, alcohol or drug use with women and their partners planning for pregnancy?
- What would help you communicate better with them regarding prevention of NCDs?

- Other than (in) fertility issues, what do women ask you about in relation to planning a healthy pregnancy?

Increasing engagement of HCPs

- How can midwives/ OBGYNs/nurses be engaged effectively to increase awareness of the long-term influence of these factors before and during pregnancy?
- What can be done to support you to increase your contact/ clinic attendance/ visits with women in the preconception period?
- From your experience, what would women and their partners find helpful/what would support women to engage in preconception services?
- How can midwives/OBGYNs/nurses help in supporting women to change their health behaviours, e.g., diet, physical activity?
- What barriers do you come across in achieving this?
- How well supported or equipped do you think clinicians are to start a conversation about health or nutrition guidelines in the preconception period with women and their partners?

About DOHaD:

- What do you think that means for the DOHaD/ life course agenda?
- How would that feel, to shift the attitude of the workforce?
- How would that agenda sit/ or be received by the maternity care workforce, that they would also have to consider these long-term outcomes?

Other:

- What else would you like to add about the opportunities or issues in addressing preconception health with women?
- What else would you like to add about DOHaD and the prevention of NCD risk across generations?
- What other types of healthcare practitioners should we contact for an interview on this topic?

-

B.3   Pre-interview reading (Vignettes)

Laying the foundations for a healthy pregnancy and the next generation

The participant information sheet provided to you outlines how health behaviours such as our food habits, physical activity and smoking not only affect our future health but lay the foundations for the health of our offspring. I am keen on hearing your views and experiences as a healthcare professional involved in maternity care, on addressing this passage of risk to the next generation. I would now like to tell you about a woman's experience during pregnancy, delivery and post-partum. Please reflect on the story as a basis for our discussion during your interview about how decisions during each stage can lead to issues at this critical time in life. The discussion will not be about the medical management of the case, but the role of OBGYNs in different healthcare settings to support NCD prevention.

Sample vignette:

> *Maria is 28 years old and lives in an urban area in South Africa. During her 24th week of pregnancy, she was diagnosed with gestational diabetes. Maria knows about diabetes as her mother has it and takes tablets. She was told that this can affect the weight of the baby and lead to preterm delivery. The doctor also tells Maria that it is important that she delivers the baby in the health centre as a caesarean section could be needed. She is worried, but thinks it should be okay as long as she takes the medication during pregnancy and it will not affect the baby long term if it is born on time. At 38 weeks Maria has a C-section and gives birth to a baby boy weighing 4.2 kgs. After the surgery, the nurse discusses options for feeding the infant, and advises her to exclusively breastfeed the child for 6 months. But Maria is unsure. She was planning on resuming her work in a few months. Some of her friends had done the same and their families had helped look after feeding the baby using formula.*

> *2. Anna is 32 years old and lives in a city in the UK. She has a 3-year-old daughter and is trying for a second child with her partner. She is now visiting her GP (General Practitioner) to discuss this. Her BMI is 33 and she mentions that she had gained weight during her previous pregnancy and she was never really able to lose that. She consumes alcoholic drinks socially. She has a full-time job which is quite stressful. She mentioned that her health visitor had referred her to a weight loss organisation in the UK, but she never really had the time to attend. She is not taking*

any supplements. Her physician asks further about any issues with her periods, which she says are normal. She asks her to take folic acid tablets and gives her some information leaflets on healthy eating. If necessary, Anna will be referred to a fertility clinic after trying to conceive for a year.

B.4 COREQ Checklist

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups.[295]

No. Item	Guide questions/description	Notes and Reported in section # of thesis
Domain 1: Research team and reflexivity		
Personal Characteristics		Chapter 2 reflection and positionality
1. Interviewer/ facilitator	Which author/s conducted the interview or focus group?	
2. Credentials	What were the researcher's credentials? E.g., PhD, MD	
3. Occupation	What was their occupation at the time of the study?	
4. Gender	Was the researcher male or female?	
5. Experience and training	What experience or training did the researcher have?	Chapter 2, 4 (Methods)
Relationship with participants		
6. Relationship established	Was a relationship established before study commencement?	No
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g., personal goals, reasons for doing the research	The information sheet provided a background to the study. Personal goals were not shared.
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g., Bias, assumptions, reasons and interests in the research topic	Chapter 2, Chapter 4
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Thematic analysis, critical realism (Chapter 2,4)
Participant selection		

10. Sampling	How were participants selected? e.g., purposive, convenience, consecutive, snowball	Chapter 4
11. Method of approach	How were participants approached? e.g., face-to-face, telephone, mail, email	Chapter 4
12. Sample size	How many participants were in the study?	Chapter 4
13. Non-participation	How many people refused to participate or dropped out? Reasons?	Chapter 4 Saturation not reached due to reasons related to COVID-19 pandemic
Setting		
14. Setting of data collection	Where was the data collected? e.g., home, clinic, workplace	Chapter 4 (Telephone interviews)
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	Chapter 4 Telephone interviews
16. Description of sample	What are the important characteristics of the sample? e.g., demographic data, date	Chapter 4 Only data relevant to the study were collected as demographic details (location, job description)
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Chapter 4, Appendix B
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	No
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Yes, details in Chapter 4
20. Field notes	Were field notes made during and/or after the interview or focus group?	
21. Duration	What was the duration of the inter views or focus group?	
22. Data saturation	Was data saturation discussed?	
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	No
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Two

Appendix B

25. Description of the coding tree	Did authors provide a description of the coding tree?	Iterative coding process discussed in 4.2. Yes, thematic map discussed in (Section 4.3)
26. Derivation of themes	Were themes identified in advance or derived from the data?	Inductive approach (Section 4.2)
27. Software	What software, if applicable, was used to manage the data?	NVivo
28. Participant checking	Did participants provide feedback on the findings?	No
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant number	Yes (Section 4.3)
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Yes (Section 4.3)
31. Clarity of major themes	Were major themes clearly presented in the findings?	Yes. (Section 4.3)
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Discussion of themes and sub-themes presented (Section 4.3)

Appendix C   Online survey questionnaires

C.1   Questionnaire for women

Full list of questions listed here, however, on the online platform the survey appeared different as a logic was introduced so women only needed to answer questions relevant to their reproductive group.

FIGO Healthy mother, healthy baby – Nutrition checklist for pre-pregnant / early pregnant/ post-partum women

Consent statement: Thank you for reading this information sheet and considering taking part in this research.

Please tick (check) this box to indicate that you have read and understood the information on this form,

are aged 18 or over and consent to take part in this survey.

Section A: Personal details

None of the questions are compulsory/ mandatory and you can choose to omit answering questions that you may feel are uncomfortable.

i. Age: _____

ii. Post code: _____

(Any personal identifiable information such as postcode you provide will be analysed anonymously in conjunction with your survey responses. We will not pass on these details directly to anyone or use it for identifying a person. Your postcode is needed to classify which region you live in. The survey results will be processed in adherence to GDPR)

iii. In what region do you live? *[choose one only]*: 1. East of England 2. East Midlands 3. London 4. Northeast 5. Northwest 6. Northern Ireland 7. Scotland 8. Southeast 9. Southwest 10. Wales 11. West Midlands 12. Yorkshire / Humberside

iv. What is the highest level of education you have completed? *[choose one only]* 1. Primary school 2. Secondary school up to 16 years 3. Higher or secondary or further education (A-levels, BTEC, etc.) 4. College or university 5. Post-graduate degree 6. Prefer not to say 7. Other

v. Which of the following best describes your race or ethnicity? *[choose one only]* 1. White 2. Black/Black British 3. Asian/Asian British 4. Mixed 5. Other 6. Prefer not to say

vi. Are you pregnant now?   Yes   No

If yes,

Weeks of pregnancy: _____

vii. Are you planning to get pregnant in the coming year and have visited a healthcare professional for advice related to pregnancy planning?   Yes   No

viii. Did you deliver a baby in the last 2 years?   Yes   No

Have you visited a healthcare professional for advice related to pregnancy planning?

If you answered "yes" to the question above, whom did you consult or visit to discuss preparing for pregnancy? (e.g., GP, midwife, pharmacist) (open text response)

Please complete Section B AFTER reading the FIGO Healthy mother, healthy baby – Nutritional questionnaire for pre-pregnant / early pregnant women (answer the questions as appropriate for your own diet and lifestyle)

(note – "We would like you to only read the full checklist. You do not need to complete the answers for the checklist. The aim of the checklist is to help women discuss nutritional issues with their healthcare provider. If you were in a clinic, this would be provided to you in the waiting room before your consultation. If you would like to keep the information on the checklist for your records, a link will be provided at the end of the survey to download it. All information on the checklist is in accordance with UK health guidelines")

Section B: Views on the FIGO Nutritional Checklist

Please tick the response that best characterises how you feel about each statement

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The checklist will be easy to complete in a waiting room of a GP clinic/ Midwife's clinic	5	4	3	2	1
The checklist did not take too much time to read and understand	5	4	3	2	1
The checklist is easy to read	5	4	3	2	1
I have already thought about my diet for pregnancy before reading the checklist	5	4	3	2	1
I completed a similar checklist before and/or during pregnancy If yes – where? (e.g., GP clinic, Midwife consultation) open ended answer	Yes	No	Cannot remember		
The checklist contains useful information	5	4	3	2	1
I would recommend the use of the checklist for other women during pregnancy	5	4	3	2	1
If you are planning another pregnancy, how much do you agree with the following statements: (for women who answered Yes to viii OR ix):					
Changes to my diet before I become pregnant can help make sure my child is born healthy	5	4	3	2	1
If you had a baby in the last 2 years How much do you agree/ disagree with the following statement					
I have tried to make changes after my last pregnancy (e.g., lose weight, eat more healthily	5	4	3	2	1
After my previous pregnancy, I received support with nutrition and weight related issues from healthcare workers	5	4	3	2	1

Section C:

During a consultation, you would be able to discuss the information on page 2 of the checklist and your answers with the healthcare professional (HCP)

When you were in hospital/ clinic did any healthcare professional (Doctor or midwife) discuss diet and nutrition with you?

    ☐ Yes   ☐ No   Don't remember

1. With whom did you discuss this?   GP   ☐ Doctor ☐ Midwife

   Other ……….

For each of the statements below, please circle the response that best characterises how you feel about the statements that apply to your conversation(s) with the healthcare practitioner:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The HCP had enough time to talk about my diet with me	5	4	3	2	1
Discussing my food habits and nutrition with the HCP was easy	5	4	3	2	1
I felt that I had the necessary information to improve my diet/ lifestyle	5	4	3	2	1
I feel better prepared to adopt a healthier lifestyle in pregnancy (after reading this checklist)	5	4	3	2	1
Nutrition has been a regular topic of discussion in my pregnancy	5	4	3	2	1
The FIGO checklist will improve discussions of nutrition with an HCP	5	4	3	2	1

2. How would you feel if nutrition diet and weight gain during pregnancy were discussed routinely in all antenatal appointments (even if it was not the main reason for your visit)?

   _____

   _____

   _____

3. Do you suffer from any conditions requiring a special diet which was not addressed in the checklist? (e.g., coeliac disease)

    Yes   No

If yes, please add details here -

_____

We welcome any further comments and suggestions to improve the checklist

_____

_____

_____

Section D

Sometimes healthcare professionals may ask about women's plans on having a baby during routine visits. How acceptable would it be to you, if you were visiting a healthcare professional (for example your GP) for ANY reason and the following statement was raised in the conversation

"The medication I am prescribing might affect health in pregnancy, how likely is it you might get pregnant in the next year?"

1= Acceptable; 2= Slightly Acceptable; 3= Neutral; 4= Slightly unacceptable; 5= Unacceptable

"Something I ask all people who are your age is if they are planning to become pregnant or have a family, is this something that is relevant to you?"

1= Acceptable; 2= Slightly Acceptable; 3= Neutral; 4= Slightly unacceptable; 5= Unacceptable

Please explain why (open text response)

If you would like to save a copy of the checklist, complete it for your records or discuss with your practitioner you can download it here (link to checklist)

If you would like to be included in the prize draw for a £20 Amazon voucher, please add your email address here: You will only be contacted if you have won the prize draw. Your contacts will be deleted after the study is completed and you will not be contacted in the future

C.2   **Questionnaire for HCPS**

Consent statement: Thank you for reading this information sheet and considering taking part in this research.

Please tick (check) this box to indicate that you have read and understood the information on this form,

are aged 18 or over and consent to take part in this survey.

FIGO Healthy mother, healthy baby – Nutrition checklist for pre-pregnant / early pregnant/ post-partum women: acceptability questionnaire for UK Healthcare Practitioners

Section A: Demographic

1. What is your staff category?

    ☐ Consultant OBGYN   ☐ General Practitioner

    ☐ Community Midwife   ☐ Staff Midwife   ☐ Dietitian

    ☐ Other ….

2. How many years of clinical experience do you have?

    ☐ Less than 2 years   ☐ 2-5 years   ☐ 6-10 years

    ☐ More than 10 years   ☐ Currently training

3. **Region of practice in the UK**

    [choose one only]: 1. East of England 2. East Midlands 3. London 4. Northeast 5. Northwest 6. Northern Ireland 7. Scotland 8. Southeast 9. Southwest 10. Wales 11. West Midlands 12. Yorkshire / Humberside

Section B: FIGO Nutrition Checklist

Please read both pages of the Nutrition checklist before answering the following questions. You do not need to complete the questions on the checklist. You will only need to read the checklist and complete the questions below). In a clinical setting, women will be expected to complete the checklist in the waiting room (page 1) and then discuss the findings with the healthcare practitioner.

4. For each of the statements below, please circle the response that best characterises how you feel about the statement:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The checklist will be easy to use	5	4	3	2	1
The checklist is easy to read (style and format)	5	4	3	2	1
The checklist is useful (content)	5	4	3	2	1
I will have enough time to go through the checklist in the clinic	5	4	3	2	1
The checklist can help initiate a discussion about nutrition in pregnancy	5	4	3	2	1
I will be able to discuss nutrition with women who have come for another issue/ routine check-up if they complete the questionnaire	5	4	3	2	1
I would use the checklist as a resource for nutrition health promotion in routine care	5	4	3	2	1
I would encourage women to use the checklist as a tool to assess their nutritional intake in pregnancy	5	4	3	2	1
The checklist covers important and common nutritional issues during pregnancy	5	4	3	2	1

5. Are there other tools that you are currently using in **<u>routine</u>** practice to discuss nutrition during pregnancy?   ☐ Yes   ☐ No
   If yes, please provide details: _____

   _____

   _____

   _____

6. Do you think the checklist needs to be improved or changed to make it more effective in your practice?   ☐ Yes   ☐ No
   If yes, please provide details on what can be modified:

   _____

_____

_____

Nutrition Discussion

7. For each of the statements below, please select the response that best characterises how you feel about the statement:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Discussions about nutritional intake are important for women **before** pregnancy	5	4	3	2	1
Discussions about nutrition are difficult to initiate in clinical practice	5	4	3	2	1
Discussions about gestational weight gain are difficult to initiate in clinical practice	5	4	3	2	1
I am confident in discussing nutrition with women	5	4	3	2	1
I am confident in discussing weight management with women					
I feel I have the necessary tools/ training needed for discussing nutrition and weight management with women	5	4	3	2	1

8. For each of the statements below, please circle the response that best characterises how you feel about the statement:

	All the time	Most of the time	Sometimes	Occasionally	Never
I currently discuss nutrition with women during routine antenatal/postnatal care	5	4	3	2	1
I initiate nutrition conversations during routine antenatal care	5	4	3	2	1
Women initiate conversations about nutrition during routine perinatal care	5	4	3	2	1

9. **Recent guidelines from organisations such as the International Federation of Gynaecology and Obstetrics have stated that all healthcare professionals (e.g., doctors, nurses, health visitors, dietitians, pharmacists) have a role to play in preconception care and should as key**

questions such as "Are you planning a pregnancy/ how likely is it you might get pregnant in the next year?" to all women in the reproductive age group during visits that may not be related to pregnancy.

How acceptable would it be to you to discuss pregnancy intentions routinely in all appointments - even if pregnancy/fertility was not the main reason for the visit?
1= Acceptable; 2= Slightly Acceptable; 3= Neutral; 4= Slightly unacceptable; 5= Unacceptable

- How often do you discuss diet and nutrition before women are pregnant or if they approach you for pregnancy planning?
- How acceptable would it be to you to discuss pregnancy intentions routinely in all appointments with women in the reproductive age group?
- How acceptable is it to you to raise the following statement in the conversation with non-pregnant women

Please explain why

---

10. *We welcome any further comments or suggestions for the checklist:*

_____

If you would like to save a copy of the checklist you can download it here

If you would like to be included in the Prize draw for a £20 Amazon voucher, please add your email address here: ….

You will only be contacted if you have won the prize draw. Your contacts will be deleted after the study is completed and you will not be contacted in the future

Thank you very much for completing this questionnaire. We appreciate your time

Appendix D   Social media strategy

Dissemination via snowballing and targeted recruitment:

For the women's survey, initially purposive sampling was conducted by contacting UK based women's health groups, community groups were identified from websites such as Mumsnet, Netmums, Facebook, Instagram and Twitter and the link to the survey with an e-flyer were circulated. Permission was sought form the group/webpage administrators where applicable. Other websites with registered members such as Tommy's charity, Fertility Network UK, Your Baby club UK, Kicks count UK, Southampton Parents etc. were also contacted via email. The study was also advertised on the NIHR page for research participants and websites of charities such as Diabetes Research UK, first steps nutrition (done by providing a short protocol of the study which was later approved by the administrators of the discussion boards on the websites. As it was advertised on social media, a snowball strategy was also used where people/ organisations who have received post were able to share and disseminate further (though people were encouraged to share, information on retweets were not measured/ tracked).

For the HCPs, the survey was also circulated in the Southampton General Hospital and Princess Anne Hospital Staff emails. In addition, organisations such as the Royal College of General Practitioners, Royall College of Midwives, Royal College of Obstetricians and Genealogists, British Dietetics Association, Institute for Health Visitors among others were approach via email and social media.

For both surveys, a spreadsheet was created to list the person/ organisation/ group contacted and each entity was only contacted twice (a reminder was sent at after 2 weeks). The spreadsheet also contained a list of over 100 "influencers" on social media (Instagram, twitter, Facebook) with a high number of followers who were contacted to support dissemination. A minority of the people contacted responded and shared the survey. As posts can be shared independently on social media too, the data for the full reach of the surveys are not available.

Paid advertisements and incentives:

After 1 month of running the survey online, only 50 responses were received. Hence after deliberation with the supervisory team, the inclusion criteria were widened and paid

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advertisements for the survey were added through the study Facebook page. Inclusion of women in the preconception group who would not be planning pregnancy had the added advantage of getting the opinion of the general population who were the target of some recommendations being tested (universal nutrition and preconception screening). Thus, we were able to gather stakeholder views from a wider population who are hard to engage and are at risk for unplanned pregnancies.

A lottery system was used to provide a voucher for participation. 5 participants selected at random from each survey received £20 Amazon vouchers. This was only offered to respondents who opted in by adding in their email address at the end of the survey. The data with the email address was downloaded separately, to maintain anonymity and was not linked to the rest of the survey.

Confidentiality and data management

Participants were informed that all responses to the survey will be anonymous, and if they provide contact details at the end of the survey, only CMJ was able to access these. An invitation to join the survey with a link to the MS form was posted on social media platforms with flyers containing key information and inclusion criteria. When the participant clicked the link, the first page presented the information sheet in plain text, with an option to "agree and move forward to give the survey" or opt-out. This statement (Annex PIS) was used as confirmation of consent, as an alternative to a separate consent form. Data from the survey was stored as digital data in a password-protected computer and uploaded into SPSS software for data analysis. Confidentiality and unlinked anonymity were ensured. Participants are only referred to by ID number in the results.

Key figures from the Facebook campaign

The UK FIGO Survey online ad campaign ran for 45 days.

Reach: 101,100

Unique Clicks*: 1,035

Impressions: 175,794

CTR (Unique Clicks*/Impressions): 0.005%

*Note these persons have just clicked on the ad, they may not have taken the survey.

Of the 5 ads used, highest performing ad creatives were 1 (736 clicks) and 2 (201 clicks).
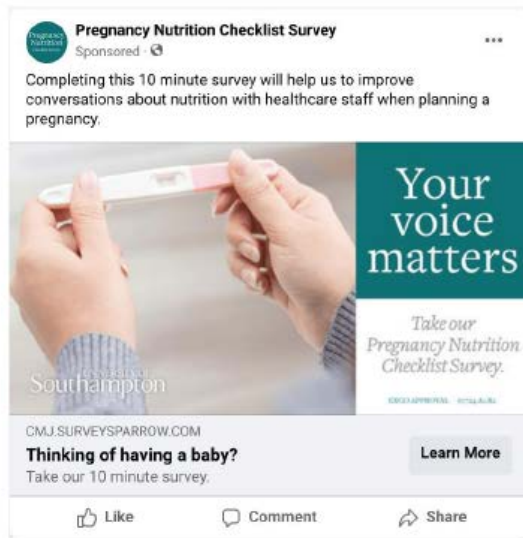
Ad Creative 1
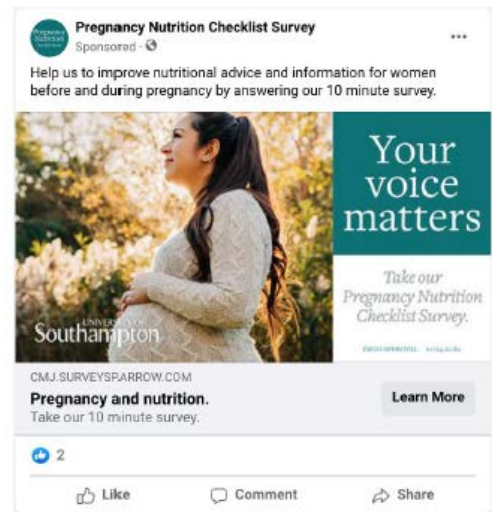
Ad Creative 2

Appendix E   Stages and steps in content analysis carried out for the open-text responses.

Stage of content analysis	Steps during analysis of open-ended responses[312,314]
Preparation phase	1
Research question	• It was determined that a content analysis would be used for analysing the open-text responses while designing the survey
Data collection	• Online survey designed • Data downloaded into an excel spreadsheet and I familiarised myself with the data through multiple readings and note taking. • Participants providing at least one open-text response were included in the analyses, hence the sample size varies for each coding framework
Organising phase	2
Define the recording unit	• Codes were defined as a unit of meaning which could be a phrase, sentence or more than one sentence that corresponded to the research question. Single-word responses were included only if they provided adequate meaning when considered in the context of the research question to avoid coding that is too narrow and fragmented. • While determining the concepts within the responses, the terms could be implicit or explicit. • Explicit terms are easier to identify, however, the judgement of meaning of implicit terms can be subjective. This could posit an issue for reliability/ validity. However, having an additional reviewer helped to reduce this issue.

Stage of content analysis	Steps during analysis of open-ended responses[312,314]
Constructing categories for analysis	• Coding frameworks were developed for the first 50 responses for each research question, and then used for the remaining responses, adding in new codes as appropriate. • Some responses by the same participant were split to two codes if relevant • Descriptors were developed for each code. • Codes were grouped by content and meaning and those considered too similar were combined into one code. • The framework development was an iterative process including discussions with a second reviewer.
Test the coding and assess reliability	• The codes developed were tested back on samples of text in the survey responses to reduce bias/ error in interpretation and any conflicts were resolved through discussion. This helps in ensuring the categories are usable and reliable.
Carry out the analysis	• Lists of sub- categories were grouped under higher order heading with the aim of reducing the categories and providing the means to describe and interpret the data. • Abstraction was also carried out during this step (formulating a general description of the research topic through generating categories) • Descriptors were also developed for each category
Reporting phase	3
	• Results are described by the content of the categories (codes) describing the phenomenon using an inductive approach. • Comparison to earlier studies were carried out in the discussion.

Appendix F   Coding frameworks with key categories and descriptors

F.1   Descriptor Tables from content analysis of women's survey responses

('n' in the tables represent the number of times each category or codes for sub-categories appeared in text)

Descriptor Table 1. Framework for improving the content and use of the FIGO nutrition checklist in clinical practice

Category (n)	Category description	Sub-categories (n)
A. Gaps Identified (15)	This category reflects the suggestions provided by women regarding gaps in the contents of the checklists and areas lacking questions/ information.	• Eating Disorders (2) • Vegan/ Vegetarian diets (9) • Consideration of different trimesters and pre-pregnancy (2) • Consideration of underweight (2)
B. Recommendations for additional topics and revisions (23)	This category summarises the suggestions provided to improve/ modify the checklist and its contents along with inclusion of new questions or topics.	• Including information on High-risk pregnancies and other conditions (12) • Portion size (2) • Alcohol, smoking, caffeine (2) • BMI measurement difficult (4) • Exercise (3)
C. Additional support after completion of checklist (15)	This category addresses requests for additional resources for nutrition/ dietary factors apart from the checklist that would help maintain healthy behaviours e.g., tools/ leaflets	• Empower women to make healthy choices over routine screening (3) • Provide evidence-based resources (11) • Holistic care for women (1)
D. Effective and sensitive Communication (28)	This large category includes aspects of verbal and written communication and counselling during clinical visits (both negative and positive) that respondents suggested must be considered if using the checklist.	• Checklist can support conversations during consultation (6) • Information needs modification/ simplification (10) • Sensitive and non-judgmental conversations needed (weight,

Category (n)	Category description	Sub-categories (n)
		BMI, nutrition and exercise) (12)
E. Additional points raised (9)	This category collates two separate issues that were raised related to consultations which affect women's health behaviours and knowledge related to nutrition and lifestyle in the periconceptional period.	• BMI unreliable marker (5) • HCP's level of knowledge (4)

Descriptor Table 2. Summary of results content analysis on women's view on routine discussion of nutrition

Category (n)	Category description	Sub-categories (n)
A. Positive views on routine discussion (158)	This category measures support for discussing routinely and includes suggestions for extending the discussion on nutrition to the preconception and post-partum periods and contributes to a holistic and personalised approach to care.	• Beneficial (127) • Helpful before and after pregnancy (10) • Personalised care (21)
B. Negative implications of routine discussion (33)	This category emphasises the negative effects of routine discussions on nutrition that could induce stress and seem intrusive or judgemental.	• Inappropriate for routine visits (26) • Induces stress (7)
C. Information (20)	This category is defined as the evidence and materials requested by women for reference during pregnancy that come from a trusted and reliable source which were stated to be currently lacking.	• Lack of Information on good nutrition (16) • Reliable source (4)
D. Communication and Conversation (38)	This category captures the experiences and recommendations provided by respondents on communication with healthcare providers calling for sensitive, non-judgemental discussion of pregnancy outcomes not limited to body weight.	• Sensitively framed conversation (21) • Focus on weight/BMI (7) • Time as a barrier (10)
E. Other (19)	This separate category looks at reasons to refuse routine discussion for oneself but accept it for other women or for the health of the baby.	• Confidence in own knowledge and health behaviours (13) • Nutrition education not seen as the main priority during pregnancy (6)

Descriptor Table 3. Reasons for and against routine discussion of pregnancy intention and acceptability of the sample preconception questions presented in the survey.

Category (n)	Category description	Sub-categories (n)
A. Reasons to support discussion of pregnancy intention in routine visits (145)	This category includes positive effects and how routine discussion could play a critical role in a healthy pregnancy	• Preventing risks with intention to improve health (30) • Questions deemed important (85) • Patient's choice (positive) (4) • Normalize fertility discussion (16) • Support received from the HCP (10) • Need good routine clinical care (2)
B. Arguments against routine discussions using the questions provided (73)	This category reflects women's perspectives on why routine discussion of pregnancy intention would be inappropriate or unnecessary and could have negative effects.	• Patient's choice (negative) (6) • Privacy (19) • Makes negative assumptions (14) • Triggering emotionally (14) • Irrelevant for routine visits (18)
C. Additional topics mentioned (19)	This category captures topics that could influence acceptance of routine discussion (but the respondent has not stated if that would be irrelevant or beneficial) and provides information on how discussions can be framed and preference for certain questions.	• Should consider asking men/ male partners/ fathers (2) • Sensitively handled conversation (8) • Preference for question 1 (3) • Preference for question 2 (4) • Questions need modification (2)

F.2 Descriptor Tables from content analysis of HCPs' responses

Descriptor Table 4. summary of HCP's recommendations to improve the FIGO nutrition checklist

Category (n)	Category description	Sub-categories (n=number of codes)
A. Implementing the checklist in practice (15)	This category reflects the comments made on how the checklist may be used in routine practice and potential barriers to doing so.	• Lengthy/ time consuming (5) • Using the checklist to promote patient-led discussions and support (5) • Concerns with using the checklist (5)
B. Recommended revisions (47)	This category summarises the specific recommendations made by HCPs to improve the contents of the checklist, align it with UK guidelines and improve acceptance by patients.	• Improvements to information and language (32) • Recommendations for additional information (15)

Descriptor Table 5. Barriers reported by HCPs when discussing nutrition, weight, and obesity-related topics in clinical care

Category (n)	Category description	Sub-categories (n=number of codes)
A. Practical Issues relating to discussion of nutrition (31)	This large category includes aspects related to the health system in the UK which may affect discussions, care and management along with practical issues related to discussion of nutrition and weight management that HCPs face in their routine practice.	• Requirement to focus on higher priority health-related topics in perinatal care (3) • Time for appointments (15) • Barriers in the healthcare system (10) • Access to patients (3)
B. Concerns around communication relating to nutrition and the checklist (21)	This category addresses concerns expressed by the clinicians while discussing nutrition and related topics, the impact that may have on patients and barriers HCPs may face while having these conversations with patients.	• Checklist information should be tailored to patient need (5) • Topics discussed may have negative implications (10) • HCPS's not confident to discuss areas of the checklist or delivering support required (6)

Category (n)	Category description	Sub-categories (n=number of codes)
C. Support for routine discussion and recommendations (12)	This category discussed HCP's views on using digital resources in practice and support for routine discussion on nutrition	• Electronic or digital resources recommended (6) • Routine discussions around nutrition are supported (6)

Descriptor Table 6. Summary coding framework for acceptability of routine preconception screening among HCPs

Category (n)	Category description	Sub-categories (n=number of codes)
A. Perceptions of topics covered by the questions (9)	This category addresses HCP's view on screening for preconception health and what it should entail.	• Important to cover preconception care (7) • Wider factors influencing preconception health (2) • Questions framed appropriately (4)
B. Design and delivery of sample questions (10)	This category reflects suggestions by HCPs on how preconception screening should be conducted routinely and their opinions on the sample questions presented.	• The style of the question is confusing (1) • Questions need to be delivered with sensitivity (5)
C. Not a central part of HCPs routine care delivery (6)	This category summarises the HCP's current state of practice which may or may not include routine screening and their perceptions on their role in discussing pregnancy planning or intention routinely.	• Current practice may include discussion around preconception (3) • Discussion on preconception not part of HCP's role/ remit (4)

F.3   Full list of medical conditions reported by respondents of the survey

Medical conditions during pregnancy
Hyperemesis (n=4)
GDM (n=4)
High blood pressure (n=4)

Type 2 DM (n=2)
Other Conditions reported IUGR (n=1) Endometriosis (n=1) Pre-eclampsia (n=1) Velamentous cord insertion (n=1) Obstetric Cholestasis (n=1) Haemorrhoids (n=1) Hypothyroidism (n=1) Cardiovascular issues (n=1) Varicose veins (n=1) Pregnancy related pelvic girdle pain (n=1) Low PAPP-A (n=1) Fibroids (n=1) Incompetent Cervix (n=1) Perinatal depression (n=1)

Appendix G   Search Strategy for review of measurement of the life course approach

Search terms and search strategy

Certain key words such as 'interventions' or 'health promotion' were excluded because their sensitivity and lack of specificity extend beyond the scope of this scoping review and would cause deviation from the primary synthesis question. To ensure that relevant strategies of implementation related to life course concepts were captured, searches with life course and adjacency terms were broad. Results were exported into Endnote software and duplicates were deleted.

The search was conducted in May 2018

CINAHL

("life course" OR lifecourse N3 (theor* OR perspective* OR stud* OR approach*)) AND (measur* OR evaluat* OR indicator* OR implement* OR policy)

2007-2018

English language; peer reviewed, exclude Medline records

Results narrowed by subject majors

IBSS

("life course" OR lifecourse NEAR/3 (theory* OR perspective* OR stud* OR approach*)) AND (measur* OR evaluat* OR indicator* OR implement* OR policy)

Timespan after 1 January 2007

Document type (HM) Sociology, Abstract, Article, Articles, Book, Book Chapter, Case Report, Case Reports, Case Study, Case_Study, Commentary, Conference Paper, Conference Proceeding, Conference Proceedings

Medline

((life course or lifecourse) adj3 (approach* or theor* or perspective* or method* or stud*))
Limit 1 to yr="2007-Current"

Web of Science

Appendix G

("life course" OR lifecourse NEAR/3 (theory* OR perspective* OR Stud* OR approach*)) AND (measure* OR evaluat* OR indicator* OR implement* OR policy)

Timespan 2007–2018

Results refined further based on source types (journal articles, conference proceedings)

Expanded Medline search for related concepts

1. Life course.tw

2. Lifecourse.tw

3. or/1-2

4. measure*.tw

5. evaluat*.tw

6. implement*.tw

7. POLICY/ or PUBLIC POLICY/ or policy.mp. or HEALTH POLICY/ or POLICY-MAKING/

8. indicator*.mp

9. or/4-9

10. 9 and 3

11. Limit 10 to (English language and yr=2007 -Current")

Google and Google Scholar

"life course OR lifecourse" AND (measure OR evaluation OR framework)

"life course OR lifecourse" AND (implementation)

Grey literature

MedNar: (lifecourse OR life course) AND (measur* OR indicator*)

OpenGrey: lifecourse OR life course

Websites of organisations and health agencies

American Public Health Association, Australian Government Department of Health, Centers for Disease Control and Prevention (United States), Centre for Reviews and Dissemination, University of York, Danish Health Authority, European Commission, European Community Psychology Association, European Public Health Association, FIGO, Finnish Ministry of Social and Health Affairs, French Ministry of Social and Health Affairs, Institute of Equity, Marmot Review, National Institute for Health and Care Excellence guidelines, United Kingdom, NCD Alliance, NHS Health Scotland, Nordic co-operation, Organisation for Economic Co-operation and Development, Public

Health Agency for Northern Ireland, Health and Social Well-Being Improvement, Public Health England, Public Health Ontario, Health Protection and Promotion, Royal College of Obstetricians and Gynaecologists, United Kingdom, Royal Society for Public Health, United Kingdom, SDG Knowledge Platform, Swedish Public Health Agency (Folkhälsomyndigheten), United Kingdom Department of Health (policy papers for health-related documents), United Kingdom Department for International Development, United Nations Children's Fund, United Nations Educational, Scientific and Cultural Organization, United States Department of Agriculture (Centre for Nutrition Policy and Promotion), United States Department of Health, Welsh Assembly, Health and Social Care, World Bank, WHO Promoting Health through the Life course, WHO Regional Office for Europe

G.1   Ladder of measurement framework

Rungs	Ladder of measurement	What do they do?
1	Conceptual frameworks	Unpack complex constructs into different concepts/elements Provide definitions and may link to validated tools
2	Evaluation frameworks	Provide guidance on what can be measured and how to go about evaluation Frameworks often provide categories or **domains of measurement**. They can be used to identify measures or to guide data collection and report outcomes. Evaluation frameworks may encompass quantitative, qualitative and mixed method designs.
3	Logic models/logical frameworks/theory of change/ evaluation plans	These articulate the causal pathways and identify the expected outcomes – short, medium and long term of specific interventions or types of intervention
4	Indicator sets or indicator frameworks	Groups of measures that specify components that can be measured quantitatively, usually at a population level. Public health indicator sets typically cover a range of measures: health (including physiological), economic and social.
5	Measures, indicators and scales	Indicators specify attributes or outcomes that can be measured quantitatively. Indicators can be at population level to assess trends in health or health systems or can be used to evaluate an intervention or service. A single indicator can be broken down to a set of measures. Measures/scales may be validated (e.g., social capital, QoL) or non-validated). Proxy indicators show change in a related outcome using an aspect that is easier to measure than the actual thing Often the terms indicator and measure are used synonymously
6	Validated tools or questionnaires	Validated questionnaires or groups of questions that operationalise indicators. These can be used for evaluation, usually administered through surveys.

Appendix H   Summary of studies and reports included in review

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
001 Appleton, A. *et al.,* 2017, USA[349]	To summarise measures of childhood adversity in the context of cardiovascular disease (CVD), based on a life course model.	Systematic review	• Metrics found in selected studies included different sets of adverse events, relational factors, and socioeconomic indicators. • Most studies were based on the accumulation of risk model. • Studies examined different CVD outcomes such as CVD end points, cardiometabolic biomarkers, inflammatory biomarkers, anthropometric outcomes (e.g., BMI), and blood pressure and vascular outcomes. • Majority of studies calculated unweighted summary • Scores to estimate cumulative adversity during childhood, where counts were treated continuously and/or as ordinal variables • All studies showed a positive association between childhood adversity and adult CVD risk.	For research - Need to test the sensitive period hypotheses, considering the effects of adversity at relevant developmental time points. -Need to study positive factors that might enhance resilience and promote cardiovascular health. Longitudinal studies have developed post hoc adversity measures from existing data. However, the authors also recommend creating retrospective accounts of adversity using standardized questionnaires. While this allows for comparability across studies and helps study mechanisms in a population-based setting, it also lacks temporality and may introduce biases related to recall, respondent mental health, and social desirability.	-

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
002 Association of Maternal and Child Health Programs (AMCHP) and life course metrics project, 2013, USA[350]	AMCHP launched a project designed to identify and promote a set of indicators that can be used to measure progress using the life course approach to improve maternal and child health	Expert consultations to develop 413 indicators, later voted down to 59	59 indicators in the following categories were developed- 1. Childhood experiences 2. Community Health Policy 3. Community Wellbeing 4. Discrimination and segregation 5. Early life services 6. Economic experiences 7. Family wellbeing 8. Health care access and quality 9. Mental Health 10. Organisational Measurement Capacity 11. Reproductive life experiences 12. Social Capital These categories fall into the risk/outcome domain or service/ capacity domains and have been informed by over 25 data sources.	The full indicator list is available on the website.	The indicator list is recommended for state and national MCH programmes based on a life course framework to monitor and evaluate the effectiveness of the programmes (currently being tested in multiple states in the USA).

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
003 Bernard van Leer Foundation, Every Childhood Matters (2016)[351]	Series of articles focusing on Early childhood development	Recommendations from two papers in the series providing indicators for ECD are reported here.	For population level measurement of ECD: 1. Should focus on multiple domains of ECD relevant to early and later functioning such as fine and gross motor skills, receptive and expressive language skills, cognition and problem-solving skills, social and emotional skills. 2. Tools should be evidence-based, reliable and validated with emphasis on - (test–retest reliability), criterion validity, sensitivity to maturation, biological and environmental inputs, and predictive validity. 3. Usability – easy and quick to use and analyse, align with other global initiatives, show implications for policy and in the public domain.	The Early Development Instrument (EDI) is a checklist of 103 items and completed by teachers, based on the domains of physical health and wellbeing, social competence, emotional maturity, language and cognitive development, communication skills and general knowledge. . The EDI has now been adapted for use in more than 20 countries	In some Canadian provinces the EDI is completed regularly, with results informing governments' early childhood policies. In Ontario EDI results – collected once every three years – are among the 11 indicators used for the Poverty Reduction Strategy for 2014 to 2019

004 British Medical Association Board of Science, 2013, United Kingdom[493]	To provide recommendations for improving childhood health using a life course approach	-	-	Recommendations for implementing a life course model of improving child health is provided. Data on monitoring extracted and reported below. Help parents plan for a healthy family from preconception through birth and infancy, and provide children with the best start in life. -Annual report on health of children similar to CMO's report on the state of public health should be published. - Comprehensive, reliable, regularly collected data on child health and health care needs to inform health services planning and evaluation - Monitor the impact of and address gaps related to marketing and promotion of breast milk substitutes in the UK. Engage with families in different environments such as retail outlets, children's centres, and monitor and review the uptake of Healthy start scheme.	Accountability at the ministerial level and within cabinet is essential for children's health and wellbeing. To ensure progress, a framework of monitoring, reviewing, and remedying processes must be included. A national oversight mechanism, with responsibility for child health services, should be set up (reporting at ministerial level). Policy on matters affecting socioeconomic determinants of health should be devised and evaluated according to the ECM (every child matters) outcomes, with

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
					reference to the needs of children.

| 005 Callahan, T .*et al.* 2015, USA[352] | To develop indicators for use at a state or community level to assess, monitor, and evaluate the application of life course principles to public health | A four-point, and later a 12-point framework was developed for state teams to develop indicators. This paper reports on the AMHCP strategy described above | • 59 final indicators were selected in 12 categories: Childhood Experiences Community Health Policy Community Wellbeing Discrimination and Segregation Early Life Services Economic Experiences Family Wellbeing Health Care Access and Quality Mental Health Organisational Measurement Capacity Reproductive Life Experiences Social Capital
• Choice of indicators was influenced by factors such as – availability of indicator data in routine surveillance systems, sensitivity and specificity, positive predictive value, reliability, complexity in calculation and for use by public/ professionals.

Indicators criteria:
Core features: 1. Equity - The indicator reflects and has implications for equity-related measures such as social, psychosocial, and environmental conditions, poverty, disparities, and racism
2. Resource alignment - reflective of programs, services, and policies that expand beyond the traditional MCH focus
3. Impact - The public health impact of a positive (increase or decrease depending on the indicator) change in the indicator due to | Provides a wide-ranging set of indicators for MCH programs to implement policy changes based on the life course framework. The indicators cover a range of issues such as contraception, immunisation to adverse childhood experiences. |

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
			program or policy interventions 4. Intergenerational wellness - reflects the time and trajectory components of the life course theory with an emphasis on indicators that address critical and transitional periods throughout life 5. Life course evidence - current, scientific understanding of life course health Core features for Data: 1. Availability - available in each of the public health agencies in the 50 states and the District of Columbia 2. Quality 3. Simplicity - simple to calculate; easy to explain the meaning and use of indicator to professionals and the public		

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
006 Cesari, M. et al., 2017[376]	The paper describes the methods used to develop the constructs of intrinsic capacity, which can be used to operationalise intrinsic capacity.	Based on the World report on Ageing, intrinsic capacity is defined as the composite of all the physical and mental capacities of an individual. A literature review was conducted.	• The Intrinsic capacity model is based on the previous WHO recommended ICF framework, but health conditions and diseases are not included in the IC model. • The bodily functions defining the construct of IC are – cognition, locomotion, psychological, vitality, sensory (hearing and vision).	Efforts are currently being undertaken by the WHO to develop validated measures (objective) for adequately capturing each intrinsic capacity domain, and generate recommendations for the metrics of intrinsic capacity.	Digital devices commonly used in daily life (e.g., smartphones, actimeters) are now capable of capturing a wide range of data about bodily functions and can potentially be harnessed to inform public health measures. This can also be used to observe population-merged data, or even develop personalised interventions by linking it with clinical data.

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
007 Chittleborough, C R. *et al.* 2006 [353] Australia	To identify indicators of early-life SEP that can be used in population health surveillance systems.	Literature review	Early-life SEP indicators used in cross-sectional and longitudinal studies fell into the broad categories of: Education level Income Occupation Living Conditions Family structure Residential mobility Provides a list of indicators used by studies from 1992 – 2005 (all quantitative) It must be noted that not all indicators of early-life SEP listed are relevant for all population groups, at all times and in all places.	• Education, income and occupation indicators of early-life SEP, directly reflect the resource and status-based constructs of SEP and should be included as priority in monitoring and surveillance systems. • Proxy indicators of SEP related to living conditions, family structure and residential mobility can be included if resources permit. • Validity, reliability, relevance and deconstruction of indicators need to be considered to determine the value of indicators. • Indicators that can be measured retrospectively and are relevant to sociocultural context in which the survey operates are recommended.	The effectiveness of economic, social and educational policies can be monitored over the life course if SEP indicators are included in population health surveillance systems.

| 008 Halfon, N. *et al.* 2002 USA[377] | The paper describes the Life Course Health Development (LCHD) framework, that aims to explain how health trajectories develop over an individual's lifetime. It also provides suggestions for using this approach to guide policy and research. | - | Measuring positive developmental health assets supports health policies based on building individual and community health assets. According to the LCHD framework presented, differences in developmental health trajectories are likely to explain much of the variance in the nature and rate of later declines in health. | For monitoring population health, the following methods are suggested. 1. Chart and link community members' cognitive outcomes and trajectories. 2. Predict the need for respiratory care, by measuring the onset and severity of asthma in children, their access to and quality of care, the community's success in eliminating pests and allergens, and long-term respiratory function in its elders. 3. Track children and adults longitudinally and use time series data for individuals and populations to guide policies and interventions. 4. Use various markers in several domains to track and understand related and temporally linked health trajectories. Monitoring individual health - Using the LCHD approach, measurement strategies could become more linked across physiological systems and developmental periods. The framework can also be used to identify future risk factors due to developmental stress in early childhood. | Interventions to address health issues occurring in later stages of the life course can be prevented by addressing the biological, emotional, cognitive and environmental determinants of the outcomes. The paper also suggests organising health management systems and integrating preventive programmes in ways that are conductive the life course model. For example, ensuring access to a continuum of medical services that are integrated longitudinally (integrating organisations that serve individuals at |

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
					different stages in their life course. The authors identify that a challenge for health policy now is to identify the relationships and interactions between an individual and the environment and intervene at those points that are most cost-effective.

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
009 Fabienke R, *et al*, 2018, International Federation of Gynaecologists and Obstetricians (FIGO) [348]	Discussing the implications of using a life course approach to prevent GDM and other NCDs in pregnancy	Commentary article	Low maternal birth weight, and being overweight as a young adult, are both risk factors for developing hyperglycaemia in pregnancy. This in turn transfers the risk of obesity, type 2 DM, hypertension, PCOS and other NCDs to their offspring too.	FIGO's guide for gestational diabetes diagnosis, management and care offers pragmatic advice on how to address hyperglycaemia in pregnancy applicable to diverse contexts. FIGO recommends that all women should be tested for hyperglycaemia during pregnancy	Pregnancy offers a unique opportunity for identifying women at high risk of developing diabetes and other chronic conditions at a young age. Appropriate and sustainable lifestyle interventions should therefore be instituted during pregnancy to help prevent/ delay the onset of diabetes. Achieving an optimal birthweight for the baby is also important.

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
010 Kotelchuck, *et al.* 2010, Rosenbach *et al.* 2010, USA [373,494]	To evaluate the Healthy Start Programme (the programme - The Healthy Start Initiative – began in 1991 and aims to reduce disparities in Maternal and Infant Health status in high-risk communities using a life course approach.	Being a community-based programme, it was challenging to evaluate, but multiple methods were used. Both quantitative and qualitative methods were used.	Nationally representative ECLS-B database, standardised to the survey participants' characteristics, was used for benchmark comparison. Evaluation of single sites, case study evaluations were also conducted. The outcome evaluation included measures such as birthweight (comparisons were made between ethnic groups and SES), elimination of smoking, insurance coverage, medical homes and check-ups, unmet needs for health care, breastfeeding rates, indicators from the Healthy People 2010 objectives such as putting infants to sleep on their backs. A process evaluation was also conducted to monitor participant's satisfaction with the programme, response rates. For evaluation at successfully implemented program sites, perspectives of the local staff was also collected using qualitative methods.	Future evaluations should move away from the current primarily descriptive evaluations to more performance-based evaluations. The study sampled successful implementation sites, not effective outcomes sites. Local variations and context specific factors need to be measured as desirable independent factors to be assessed for their effectiveness. The author recommends implementation and programmatic component assessments for more recent and short-term interventions, and more outcome-oriented evaluations for long-term studies.	Healthy Start would ideally be a part of a broader, more comprehensive set of longitudinal initiatives throughout high-risk communities to enhance birth outcomes and subsequent maternal and infant health. That is, Healthy Start is a necessary, but not a sufficient program, to address the perinatal impacts of racial/ethnic and social class disparities in America

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
011 Kramer, M. *et al.* 2013, USA[368]	To propose a method which uses commonly-used MCH databases to inform life course MCH research	The authors calculated a neighbourhood deprivation index (NDI) at the time of each of the women's births (based on a cohort study in Georgia) and from these further calculated a cumulative NDI.	An approach to the use of existing data to create truncated life course socioenvironmental trajectories for multiparous women is described. They also tested specific life course theory hypotheses relating cumulative NDI to risk for preterm birth	The authors recommend the creation of trajectories from geocoded maternal longitudinally- linked vital records for carrying out some types of life course MCH research. This can be done at the level of state public health department, and can provide a descriptive and analytical understanding of cumulative experiences and pregnancy outcomes in a population.	

| 012 Kuruvilla, S. *et al.*, 2017, World Health Organisation, Geneva[378] | Discusses how a life course approach can be applied to all health topics, age groups and countries, using existing evidence, experiences from different countries and health programmes. | The paper develops a conceptual framework by analysing the findings two evidence synthesis reports in the form of a narrative synthesis and based on the WHO's world report on Ageing and Health. | Four key areas identified for implementation of the life course approach are
- Policy and investment
- Health services and systems
- Local, multisectoral and multistakeholder action
- Measurement, monitoring and research. | An understanding of the life course approach can be obtained from objective and subjective measures.
Gaps identified include:
 - need for international standards incorporating a core set of indicators applicable to all life stages to measure life course variables.
- Information on age ranges for specific life stages and critical periods to effectively target interventions.
- Focus on modifiable determinants of health
- Identify and measure factors that can cause decline in function, reverse decline and identify interventions that can produce the greatest gains at different life stages.
- investment in birth cohorts and longitudinal and intervention studies such as SAGE (WHO's Study on global AGEing and Adult Health).
- Improve capacity to evaluate programmes, support information systems in countries to use data on health and social and environmental determinants for policies and programmes.

The authors also propose a monitoring framework which brings out the alignment between SDGs and a life course approach. | Long term holistic policies and investment strategies are recommended to provide age-appropriate health care and address inequities across the life course. Developing interventions and programmes based on the life course framework must coincide with national planning to achieve universal health care using a people-centred approach. |

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
013 Locke, C *et al.* **2011** **USA**[372]	The article provides recommendations for applying qualitative life course research in development studies using two case studies	-	Implications of the case studies included – The interpretative methodology was less legible to non-qualitative researchers, had a small sample but allowed subjects to tell their stories their own way. However, the structured methodology was more legible to researchers but compromised on extent to which youth tell their own stories.	Qualitative life course analysis has great potential both to examine perceived intentionality of individual action (agency) and to evaluate individual experience (subjective meaning) in the context of linked lives and changing times. These insights have potential to inform developmental trajectories in which chronic poverty or other forms of disadvantage may be escaped, transmitted or acquired. Studies focus on how individual respondents made sense of their lives.	Semi-structured techniques can be used for practitioners not accustomed to qualitative techniques. The role of lived experiences and wider socioeconomic and political circumstances are central to qualitative methods used in life course research. Qualitative methods used could be exploratory (more interpretive) or diagnostic (more structured).

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
014 Pies, C. *et al.* **2012 USA**[347]	The paper described how the life course perspective was used to develop a MCH programme, and recommendations for evaluation of such programmes.		As part of the life course initiative (LCI) the group has: (1) Created life course educational materials (training curriculum and fact sheets about the LCI and the 12-Point Plan), (2) Conducted Life course Perspective (LCP) educational sessions with Family maternal and child health (FMCH) Programs and Public Health Division staff and leadership, and community partners (3) Assessed the effectiveness of the educational sessions with staff (4) Established a Life Course Perspective-based intervention entitled Building Economic Security Today (BEST). The 12-point strategy was based on the three components of – 1. Improving Health Care for African American Women 2. Strengthening African American families and communities 3. Addressing social and economic inequities	Based on the evaluation of the programme the authors suggest the following points to consider while developing life course-based programmes- • It is critical to involve local public health leaders and policy-makers from the initial stages • It is challenging to evaluate programmes but tracking changes in staff knowledge, examples of program implementation, and how staff are using the language of the LCP in their day-to-day work have been used as measures to determine success of programmes. • Measuring intermediate outcomes, such as financial stability is essential.	The educational component of the LCP was offered to key stakeholders such as Public Health Division staff, policy-makers, local health leaders, and community partners. This was done to increase knowledge about the Life Course Initiative among influential Individuals.

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
015 Vable, A. et al. 2017, USA[370]	To develop and apply an explicit conceptual framework to the measurement of childhood Socioeconomic status (cSES) using variables available in the Health and Retirement Study (HRS, a nationally representative study of community-residing United States adults aged 50+ years).	cSES scales were developed and validated, and the validated measures were compared with previous cSES indices created and used in HRS.	Validated measures of childhood social capital, financial capital, and human capital are suggested which can be used independently or combined into a single cSES index for operationalisation and measurement varies across studies. The cSES scales were comprised of: Childhood social capital (two factors – maternal investment, family structure) Childhood financial capital (two factors – average financial resources and financial stability) Childhood human capital (mother's and father's years of education)	• The authors used the HRS study based on the life course approach to develop and validate a theoretically motivated index of cSES, which demonstrated acceptable to good internal consistency reliability, construct validity, and predictive validity. • The measures proposed also outperformed previous multi-item indexes proposed with respect to proportion of variability explained for adult self-rated health and depressive symptoms in these data.	The study stresses on the need for well-defined exposure variables for policy interventions to decrease the impacts of childhood socioeconomic disadvantage on later health outcomes.

016 World Health Organisation, Europe (2017) [374] **Andorra, Cyprus, Iceland, Luxembourg, Malta, Monaco, Montenegro and San Marino,** **017 World Health Organisation, Europe (2017)** [375] **Report by two countries: Iceland, Malta**	Eight countries share their experiences with implementing life course interventions focusing on issues such as nutrition throughout the life course, physical activity, overweight and obesity prevention, early childhood development, vaccines, supporting parenthood, increasing adolescent health knowledge, adverse childhood experiences, and long-term integrated health care.	A case study from each country is presented, with majority of the programmes focusing on acting early in the life course.	1. Andorra's National strategy for Health, Nutrition and Sport - A new nutrition survey (to be conducted) to inform decisions about the best way to continue promoting healthy eating habits and physical activity across all population groups 2. Cyprus – strategy to tackle overweight and obesity by promoting nutrition through the life course including future parents, pregnant women, children adults and ageing populations (nursing homes). This was evaluated by epidemiological studies and collecting somatometric measures. 3. Iceland's welfare watch programme – to support at-risk groups such as families with young children, unemployed people, youth etc. during financial crisis. Measured using – survey among members of working groups, assessment of the welfare watch programme. 4. Luxembourg – screening children 0-4 years old for early detection of risk factors that may have a long-term effect on cognitive development. (evaluation in progress) 5. Malta – Healthy weight for life strategy. Measure - Separate evaluations are planned for each initiative, using questionnaires pre- and post-programmes, along with process and outcome indicators. Monitoring of childhood weight status is also being undertaken, and for adults' results from the European Health Interview Survey (EHIS) are reported. 6. Monaco – care of the elderly population	Iceland's welfare watch initiative - The Government established the Welfare Watch initiative in 2009 to monitor the social and financial consequences of the crisis, provide recommendations to the authorities (the Government, local authorities, institutions) and develop measures to protect people's welfare. The overall aim of the inter-sectoral initiative was to protect the more vulnerable groups, with a focus on children, families with children and youth (adolescents and young adults). The evaluation included – a process evaluation and an evaluation of the programme effects. This used methods such as interviews, focus group meetings and surveys (among members of the working groups, staff of agencies and organisations involved with the programme. This was followed by a content analysis of all documentations including minutes of meetings and reports. The key lessons learnt and considerations for policy from Malta's Healthy Weight for Life strategy is describes in case study 2.	Key features that supported the delivery of interventions included diversity of participating sectors, political commitment, existence of legislation, using existing working groups, availability of evidence-based literature, data from national surveys, multidisciplinary consultations and campaigns. Barriers to monitoring and evaluating included time pressures, lack of suitable indicators, resources required and the complexity of the intervention. Participation of civil society is of great benefit to

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
			An evaluation is carried out every year, based on data collected from both the medical and non-medical structures and admission rates are monitored. 7. Montenegro – Addressing adverse childhood experiences Evaluation to be conducted 8. San Marino – childhood obesity Measures used for monitoring – rates of exclusive breastfeeding, school based systematic surveys, and WHO surveillance systems.		programmes to influence behaviour and use of mixed methods are suggested.

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
018 World Health Organisation, Europe - Review of national Finnish Health Promotion policies (2002) [495]	The review aimed to appraising the performance of the Finnish health promotion System, and provides recommendations for improvement in the future	-	The report lays our priority areas for the national long-term public health programme (Health 2015). The life course approach and health in all policies were key components. It sets both general and life course–related health goals. The document sets outs general as well as life course related goals. Life–course goals aim at: • Children – improved health and welfare. • Adolescents – reduced smoking, and limited use of drugs and alcohol. • Young men – reduced mortality from violence and accidents. • Working adults – increased retirement age through improved functional capacity. and • Older adults – maintaining upward trends in functional abilities of people 75 years and older.	Monitoring and evaluation plan for life course implementation is not reported in original document. Studies have evaluated the implementation of the programme,[496] but does not focus on measuring the life course approach	Central authorities, universities and other agencies produce a vast amount of information on the health status of populations, which have not been used to its full potential for health promotion activities.

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
019 NCD Global Monitoring Framework: Ensuring progress on noncommunicable diseases in countries, WHO (2013) [355]	Following the Political Declaration on Noncommunicable Diseases (NCDs) adopted by the UN General Assembly in 2011, WHO developed a global monitoring framework to enable global tracking of progress in preventing and controlling major NCDs and their key risk factors		Though not directly alluding to the life course approach, the framework provides a comprehensive set of indicators for monitoring and evaluating life course-based programmes to prevent NCDs.	A total of 25 indicators (and 9 targets) are provided in the framework as part of the following elements – Mortality and morbidity Behavioural risk factors Biological risk factors National systems response Additional indicators	

020 Zaidi, A et al. 2018, Economic and Social Commission for Asia and the Pacific (ESCAP), [371,497] **021 Active Ageing Index 2014 Analytical report (UN Economic commission for Europe, European commission)** [498]	To provide recommendations for indicators to be used for monitoring the Madrid International Plan of Action on Ageing (MIPAA) For AAI report - to offer policy-makers comparative evidence on the position of their countries (or regions/municipalities) and encourage them to develop strategies for making progress.	Review of grey literature and published studies. The AAI report analyses key trends observed between the 2010 AAI and the 2014 AAI, in the domain-specific scores, and between men and women in the 28 EU member states.	The Active Ageing Index (AAI) which measures the extent to which older people can realise their full potential in terms of employment, participation in social and cultural life and independent living is recommended as a framework. Indicators from the AAI can be used to identify whether a country is achieving progress. Four domains of the AAI: 1. Contributions through paid activities: Employment 2. Contributions through unpaid productive activities -Participation in society 3. Independent, healthy and secure living 4. Capability to actively age: Capacity and enabling environment for active ageing MIPAA Indicators are provided for the categories within the following three priority areas: 1. Older Persons and development - Active participation - Work and the ageing labour force - Rural development - Access to knowledge education and training - Intergenerational solidarity - eradication of poverty -Income security, social protection/ social security and poverty protection -Emergency situations 2. Advancing Health and Wellbeing into old age - Health promotion and wellbeing throughout life	The document does not directly refer to measuring the life course approach, however, focuses on a core component of the framework – measuring ageing. It compares the MIPAA indicators with other frameworks such as AAI. For the target region of this document – the Asia Pacific region – it was noted that existing data sources aligned with the AAI indicators. Challenges include lack of age disaggregation in surveys, different definitions for age categories – thus calling for more robust data collection methods	The document provides a list of UN (2006) indicators for each of the three priority directions. The dashboard of indicators in the MIPA framework is suggested to be a good starting point for monitoring MIPAA implementation. The effectiveness of the AAI as an instrument to evaluate policies for active ageing using a life course approach depends on its adoption by local and regional policy-makers and stakeholders.

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
			- Universal and equal access to healthcare services - Older persons and HIV/AIDS - Training of care providers and health professionals - Mental health needs of older persons - Older persons and disabilities 3. Ensuring enabling and supportive environments - housing and living - Care and support for caregivers - Neglect, abuse and violence -Images of ageing The AAI, in addition to some of the above categories of the MIPAA, include indicators for social connectedness and physical exercise. However, AAI does not include indicators on HIV, rural development, training, attitude towards ageing and emergency situations.		

Study ID, Author, publication year, Country	Aim	Methods	Results and conclusions	Recommendations for measurement/ monitoring of life course approach	Policy and public health implications
022 Department of Health (2011) Healthy Lives Healthy People: A call to action for obesity in England, United Kingdom. [367]	This document outlines an approach to public health to enable effective action on obesity and encourages a wide range of partners to play their part.		The National Child Measurement Programme will be harnessed for data collection and to monitor outcomes such as prevalence of obesity.	The National Child Measurement Programme will be used to inform local prioritisation and decision-making – working with the Department for Education. As focusing on children alone will not adequately address the issue, 'Shifting the curve' through whole-population approaches will be used. Interventions based on behaviour change is recommended for preventing obesity adults, and this in turn can have a positive intergenerational effect. Local governing bodies will be given more freedom to determine the best context-based approaches. However, the reports on childhood obesity prevention (Childhood obesity: A plan for action) released in 2016 and 2018 do not refer to the life course framework.	The need for a life course approach, and the importance of synergistic efforts at the individual, local and national level is highlighted in the document.

Appendix I   Appendices for document analysis

I.1   Checklist of Questions to ask your overall body of documents - Using the READ approach

When analysing individual documents:

• Is the document complete? Is this a finished document, or a draft?

• What is the purpose of the document? Who is its target audience?

• Under which circumstances was the document produced? Under which circumstances is it consumed?

• Who created the document? Aside from the listed authors, what other contributors were likely involved in its creation?

• What could be the 'agenda' of the document's creators?

• Are there other versions of the document? Why? How might they differ?

• Are there internal contradictions within the document (e.g., differing rationales or framings)?

• Is the document credible? Do you have any questions about its accuracy, good faith, balance, selective reasoning, etc.?

• What sources are cited (or not cited)? What kind of evidence does it use?

When analysing the overall body of documents:

• How complete is the set of documents? What is missing?

• Which documents were easy to find? Which were harder to find? Which proved impossible to find? Why might this be the case?

• Which voices are represented in the overall body of documents? Which are not?

• How do the documents compare in terms of content? How do they compare in terms of style, format, length and 'look'? How about in terms of formality and tone?

• What visual information can you find in the documents (charts and graphs, pictures, etc.)?

• How are the same issues discussed in different ways across documents?

• Do the documents 'speak to each other'? Do they reference each other, or respond to each other's arguments or propositions? Are they responding to other documents not included in the review?

• How are documents similar or different across different topic areas, types of document or governance levels (e.g., global, national, sub-national)?

• How does the information from documents compare to data from other data sources (e.g., interviews, focus groups, observation, quantitative analyses)?

I.2   Appendix table coding framework document analysis

Framework 1 – How can the preconception period and the life course approach be implemented through policies and practice?

Sub-category	Sub-category descriptor	Anchor Examples*
Category 1	**Description** **Actors: Actors refer to individuals, organisations or the state, and their actions that affect health policy and contribute to the agenda-setting activities. Role of academics, knowledge brokers, policy-makers, clinicians etc. are described here. Relationships between the actors, level of involvement. Focus on who are involved and how much do they contribute.**	
1 A. Multi- and inter-disciplinary approach for implementation	- Key the actors included in the activities, background - Relating to individuals or organisations and their background. - Specific calls for key players are included here/ Missing actors - Discussions that specify the value, gaps and current approach related to disciplines/ key players involved in the implementation of the life course approach or preconception care - Role of stakeholders	Examples of actors include the broad groupings - individuals, international and national NGOs, pressure/interest groups, international organisations, bilateral agencies (DFID), funding organisations, private sector companies, and the media. Doctors and midwives stand between the public and policy. If the Forum forms a coalition and drafts recommendations, we need the clinicians to commit to championing it and provide input to develop actionable recommendations (Venice Forum 2019)

Sub-category	Sub-category descriptor	Anchor Examples*
1 B. Development of partnership networks	- Discussions relating to the development of collaborative networks and which actors, or sectors are needed for this process - Institutional changes needed to support/ enable this are included in *Process*	Establish new collaboration of stakeholders: HCPs, policy-makers, agencies and NGOs, each liaising with the public in different ways. (Venice Forum background document, 2019)
1 C. Perceived Role of the Organisation in policy-making and programme development	- Text focused on describing how the actors view their contribution/ role to the field and how they describe their position - influencers/advocates/ practitioners/ knowledge brokers. - Their concerns and motivating factors that support collaboration and network development are coded here. - Prevailing concerns and motivating factors	Advocacy, influence and accountability: Seek to hold relevant agencies to account for improving the state of preconception health in England. (UK PP terms of reference 2018)
Category 2	**Context: Context relates to systematic factors - political, economic, social or cultural, both national and international - which may have an effect on health policy. Role of policy, state, and different levels of authorities. Social, cultural factors, gender norms influencing DOHAD/ life course outcomes - both implicit and explicitly stated by actors or evidence presented during meetings - included here.**	

Sub-category	Sub-category descriptor	Anchor Examples*
2 A. Evidence for impact of wider determinants of Health	- Context and evidence provided for within and outside healthcare systems - Clinical barriers that impact current NCD prevention strategies - Evidence cited for wider determinants outside healthcare that influence health, health policies and influencing uptake of LCA/ DOHaD policies are included here - Other factors to be considered that influence policy-making, unrelated to *process* but related to values and views of target population that influence individual choices and behaviours - Structural factors that are relatively unchanging and beyond individual control (e.g., the political system, type of economy, demographic features, healthcare models – public v/s private), cultural factors and international trade.	Even before the crisis, ongoing issues such as climate change can lead to a baseline level of food insecurity influencing nutritional status of men and women in the reproductive age group (Venice forum 2019)
2 B. Alignment with priorities and agenda of other organisations to influence health policy for DOHAD	- Context of existing priorities with momentum which could be linked to the implementation of life course agenda - Call for alignment with priorities and agenda of other organisations/ policy stakeholders that could influence health policy for DOHaD/ life course/ preconception	e.g., World Health assembly (VF 2021), parliamentary meetings, Decade of Healthy ageing planned for 2020-2030 (Who group on HA), existing push for folic acid fortification (UK PP)
2 C. Situational factors	- Historical evidence on impact of events e.g., war, famine, economic crises and political events on critical periods and long-term and intergenerational impact.	Economic shocks have a disproportionate effect on women and children, especially in low resource settings (e.g., urban poor, ethnic minorities). Early signs are food insecurity, maternal and child mortality, low birthweight. (Venice Forum 2019)

Sub-category	Sub-category descriptor	Anchor Examples*
3 A. Considerations in policy-making/ OR Development of policies and global strategies	- Discussions on how stakeholders approach development and implementation of the LCA - General discussion on the policy-making process (not linked specifically to the LCA). Both implicit and explicit included here. Recommendations for researchers on how and when to engage with policy included here - Texts referring to how global policies and strategies are developed and how their agenda is determined - Strategies to improve accountability	Applying a life course approach can identify an integrative, evidence-based UHC package. Combined with priorities informed by multiple stakeholders, resources, costs and effectiveness analyses within a specific country, policy-makers can propose what can be covered now within UHC benefit packages, and what would be the next services covered, with additional resources. This stepwise approach to identify services for different population sub-groups, should be informed by a life course approach. (WHO 2018)
3 B. Barriers to current approach for implementation in policy	- Barriers to the process (e.g., legal issues affecting MNCH) - Contextual factors affecting the general policy-making process are included here (e.g., diversity in political systems) - Difficulties in political commitment needed for implementation - Practical events and factors influencing policy/ programme development for activities related to LCA	Barriers to process (working in siloes, technical priorities, e.g., policy-makers may choose other agenda over life course/ preconception) (Lifecycle 2019)
3 C. Operational resources/ Resources and governance within networks	- Resources needed, gaps (These include physical tools e.g., for clinicians or easy to use summaries for policy-makers e.g., policy briefs) - Technicalities of maintenance and development of the group	Establish a Technical Review Group to identify a theoretical framework and set of metrics/indicators (UK PP)

Sub-category	Sub-category descriptor	Anchor Examples*
3 D. Stakeholder engagement	- Discussion on engagement e.g., with the general public/ policy-makers for research, PPI, intervention development (approach and impact if detailed) - Best practice examples presented (discussing the engagement process). - Policy engagement examples and plans	Partnership engagement with Public Health England, DHSC etc.
4 A. Recognition of the importance of the Life course approach	- Acknowledgement of the importance and presentation of evidence for focus on early life (codes mentions why and how adopting a life course model will support life-long health) - Consideration of health, wellbeing, and wider determinants (discussion/ recommendation on links with life course approach and wider determinants)	Yet given the interlinkages across the 17 SDG goals, a life course approach supports this new agenda as it connects to multiple goals where inequities or advantages accumulate - such as eliminating poverty, achieving gender equality, access to quality education, or productive employment. (WHO 2018)
4 B. Evidence: limitations, gaps and opportunities	- Evidence presented specifically to support the development of policy agenda - Discussion on areas within the life course epidemiology that show conflicting results or data, thus presenting a challenge. - Arguments for gaps in evidence in PCC and life course - Limitations of existing measures - Limitations and gaps in measurement, Challenges in developing measurement frameworks / Evidence for indicators required included here; recommendations in 4C.	- Research is now showing that there is an intergenerational component in the origins of the executive function. For example, in Singapore there is compelling evidence that stress in pregnancy is one of the biggest contributors to executive function in the next generation. (Venice forum 2021)

Sub-category	Sub-category descriptor	Anchor Examples*
4 C. Recommendations for implementation	Recommendations discussed for consideration when trying to implement the life course approach. This could be related to specific life stages or discussing how to approach selection of intervention. Three main codes formed this sub-category **General recommendations for implementation** (Implicit and explicit) and recommendations specific for preconception care (normalising pregnancy preparation) **Measurement and monitoring systems to support implementation** Relating to the monitoring and/or surveillance of an identified issue, for example, preconception smoking obesity levels. Includes indicator definitions; recommendations for markers in each life stage/ physiological systems.	General recommendations: - Training (HCPs for communication; researchers for knowledge translation) Development of a TOG for OBGYNs in the UK, developing eLearning for Health visitors. Training HCPs to discuss sensitive issues such as weight management Experiences about alternative ways to deliver reproductive health services (e.g., telemedicine, self-help) could help to deliver better care and to expand access to these services in the recovery phase (in particular among disadvantaged communities) (Venice Forum 2021)
a. DOHaD viewed as a medical problem	- Medical model of framing (e.g., disease focus across life course/ preconception) - Medicalisation of obesity, pregnancy and childbirth	The health consequences of obesity should be clear while developing messages for such issues without further stigmatising people with obesity; use of people-first language (UK PP 3rd roundtable)

Sub-category	Sub-category descriptor	Anchor Examples*
b. Return on investment for the health of the next generation	- Health of "next-generation" as key focus. Better start for every child/ intergenerational risk - Economic argument for better investment in women's health for the health of the future generation.	DOHaD research shows that the effects on women of reproductive age will affect life course health, wellbeing and resilience to future challenges of the next generation, with very long-term consequences – even to grandchildren. (Background document Venice forum 2019) Health economic evaluations suggested in the report card and analysis for return on investment for NCDs will be helpful to support out argument that women entering pregnancy in good health would reduce costs for maternity care. (UKPP 3rd roundtable)
c. Call for newer definitions taking a holistic perspective	- Holistic focus on wellbeing and not just disease-prevention - Highlighting wider societal issues (e.g., feminist, ethics perspectives)	Currently the focus is very much on weight management and trying for pregnancy and hence the key focus of the messaging from the UK PP group should be on general health messages as well. (UK PP 5th roundtable)

Sub-category	Sub-category descriptor	Anchor Examples*
d. Focus on women mother as "future mother" and Individual behavioural framing	- Framing largely related to women's health, lifestyle, choices and responsibilities. - Calls for women in all age groups to be included in interventions, making the healthy choice the default.	Maternal age for deliveries also increased during the period, after recession, possibly suggesting that women were delaying pregnancies due to financial constraints and effects of austerity… Supplier-induced demand by doctors during financial crises, coupled with declining fertility, could lead to increased CS (or expensive clinical interventions during deliveries) without adequate medical indications. (Venice forum 2019) Young girls of today are the mothers of tomorrow. (Venice Forum 2021)
e. Framing within other agenda	- Framing within other agenda which may have more traction and can garner political support/ funding/ resources/ political support	(e.g., economic, capabilities approach, NCD prevention, Obesity and childhood obesity, Maternal and child health, women's health, climate change, nutrition, adolescent health and teenage pregnancies, early childhood development/ educational attainment, gender equality, human rights, maternal and child mortality
f. Shift towards "parental Health"	- Discussions on framing messages (considering paternal factors and LGBTQ parents)	Nurturing Care" as a framework for family-centred approaches to promote women's and childrens' health There is an increasing recognition of the embeddedness of individuals in social networks (primarily families) and the importance of this embeddedness for health → importance of family-centred care (Venice Forum 2021)

Sub-category	Sub-category descriptor	Anchor Examples*
a. **Developing empowering messages for the public**	- Careful non-stigmatising framing with an empowering message to normalise pregnancy preparation for all future parents - Make the messaging empowering	While discussing content for public health messaging – "Specific recommendations for **gender-neutral language** included - trying to avoid the words mother/father, women/men and instead use terms such as "people who carry a baby" partner/ parents etc. This may be longer but was more inclusive." UKPP 7th Roundtable
b. **MNCH is a global issue relevant to all individuals with long-term consequences beyond health**	- Links to discussion on looking beyond health care and health for individuals while developing the agenda for programmes/ interventions and policies.	Messaging to policy makers and public will be focused on improving health and well-being rather than preventing disease. (UKPP 2nd Roundtable)
c. **Positioning within other global/ national programmes to garner support for implementation**	- Linkages with existing wider global agenda (SDGs, UHC) to support policy-makers in implementation of life course approach, or contraception and sexual reproductive health for preconception.	Use the human rights instruments that already exist; build on human rights organisations to make social justice arguments: this is a human rights case and not just a question of non-investment (Venice Forum 2021)
d. **Solutions are within healthcare systems**	- Discussions predominantly target healthcare systems and not wider determinants of health	Programmes such as "one key question", universal screening for pregnancy intention (multiple documents of UKPP; NIHR BRC 2020)
e. **Using a social justice framework**	- Discussion on using the human rights, social justice argument to position the case for DOHAD/ life course - This includes gender equality and feminist perspectives.	Enshrining health rights is part of a justice-based approach. MNCH results indicate whether or not health systems prioritize social justice (as a majority of maternal and under age 5 deaths are preventable) (Venice Forum 2021)

Anchor examples are not quotes, but sections of text from the document or a summary of what was included for coding in the relevant sub-category

I.3 Full list of Actors

Actors	Engagement with respective group
Public Health bodies (National) e.g., PHE	Provides fundings or commissions specific research projects; acts as link with departments of health and advisory role on communicating needs of policy-makers
Research	**Faculties/ fields represented:** *(some members are multidisciplinary)* Behavioural sciences, Education in schools, environmental health, Epigenetics, Ethics, Geriatrics, health economics, Medicine, Neonatology and paediatrics, Nutrition, Population Health and Epidemiology, Public Health, Sexual reproductive Health, social science, Statistics, STS, medical anthropology
Universities/ Academia, Academic/ Scientific societies (DOHaD Society)	**Provided driving force for taskforce establishment**
Funding bodies (e.g., NIHR)	Representative attend meetings on invitation; may have wider agenda not restricted to preconception/ DOHaD/ life course
Healthcare Professionals **Health visitors** **GPs** **Endocrinologists** **OBGYNs** **Paediatricians/ Neonatologists**	**Actively engaged, provides input for developing actionable recommendations, discusses barriers and opportunities.**
Schools	Through intermediate groups (e.g., LifeLab)
Charitable sector (e.g., Tommy's, British Pregnancy Advisory Service) **Patients' rights groups Representatives from youth and adolescent programmes**	Represents voices of the general public, advocates for wider framings e.g., women's reproductive rights.
NGOs (e.g., March of Dimes, NCD Alliance)	Multiple roles acting as knowledge brokers as well as representing patients' rights. Could have close links with food industry and also have a voice in agenda setting e.g., at the world Health Assembly

Medical bodies **ICM** **RCOG** **Institute of Health Visiting (IHV)** **Royal college of paediatrics** **FRSH (Faculty of Sexual and Reproductive Health)** **RCGP, FIGO**	Individuals attend meetings on behalf of organisation
Knowledge brokers	Occasionally invited to meetings. Among stakeholders attending, multiple groups have engaged in this role – e.g., WHO, PHE, Policy Units in universities, NGOs
International Network of Government Science Advice	Occasionally invited to meetings
World Health Organisation (not referring to the consortium)	Provides fundings or commissions specific research projects; acts as link with departments of health and advisory role on communicating needs of policy-makers Representative from respective department related to the life stage/ policy issue
Agencies for evidence synthesis (e.g., Cochrane Collaboration)	Occasionally invited to meetings
Representatives from journals, journalists	Occasionally invited to meetings
Policy makers (local authorities, politicians)	May rarely attend meetings to provide input and discuss priority areas from government perspective

Appendix I

Missing actors

Ministers of health

MPs, politicians

All Party Parliamentary groups (UK)

Midwives

Pharmacists

PPI representatives

Department of Health and Social care

Department of Education

Supermarkets

Food industry

Pharmaceutical industry

Data sources - NHS digital, DHS survey

Community based programmes e.g., - Family Hubs, Sure start centres

HIAPPP Australia and other global networks

Pharmacological research

Ministry of Finance

International Monetary Fund, Global Financing Facility

Community groups, faith-based organisations

Media, advertising and marketing

I.4 Scoring sheet for stakeholder mapping

Stakeholder Category	Interest	Level of Influence	Notes
Policy-makers (National)	7	10	High variability – e.g., Ministry of finance higher influence than others
Policy-makers (Local)	8	8	Local governments are impacted by high-level decision-making at the centre
Public	10	4	Public perceptions on issues could have variable impact - e.g., Higher impact closer to election cycles
Research community	4	7	High variability - Several factors affect how research evidence could influence policy
Healthcare practitioners	8	3	Influence on public – GPs have a higher influence compared to midwives for PCC
Health and social service providers	7	2	While policies such as budget cuts/ spending affect these groups, their influence is low
Civil society organisations	3	7	High variability- UN, WHO have higher authority compared to other NGOs
Private sectors	6	6	Changes in policies could impact food industry/ pharma services both positively and negatively

Scoring was conducted for the seven stakeholder groups developed from the chart (Section 7.3.1.1)

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