T h e U n i v e r s i t y o f S o u t h a m p t o n

Academic Year 2011/2012

Faculty of Business & Law

Southampton Management School

MSc Dissertation

Attrition from Nursing and Midwifery Workforce: Analysis of 'Young' Leavers

By

Margarita Dimitrova Dimitrova

Student Registration Number: 25095382

Presented for MSc Management Sciences and Finance

This project is entirely the original work of student registration number 25095382. Where material is obtained from published or unpublished works, this has been fully acknowledged by citation in the main text and inclusion in the list of references.

Word Count: 14,885 words

Abstract

The current work examines some of the main factors which possibly influence the number of 'young' leavers from the nursing and midwifery workforce. Two main reasons justify the significance of this research. Firstly, the education and training of health care staff requires a significant financial and time investment. Secondly, there is a relationship between the size of the available workforce and patient outcomes.

The research was conducted in two stages. The first is a qualitative research based on literature review, which covered English and international publications. The findings are summarised in a cognitive map, designed as a part of this study, which categorises the premature attrition factors in three main groups: job satisfaction – related factors, which are central for this work, external factors, and personal characteristics. As a second stage of the research, a quantitative analysis on midwives was conducted. The ground for this decision is the recognised gap in the academic research in this field (Gerova et al. 2010). The quantitative analysis is divided in two parts, preliminary and statistical. Both provide evidence for the existence of strong connections between the attrition rates and the salary band (AfC band) as well as between the attrition rates and the working hours (FTE).

The current work has a number of benefits and implications. The results from the analysis that was conducted could be applied to different research methods, for example, system dynamics modeling. Additionally, the work suggests fields for further research – studying the international aspect of the issue, investigating temporary leavers, as well as examining attrition factors specific to males since the higher attrition rates for this gender could become problematic in future. The current paper proves the importance of analysing nursing and midwifery workforces and has the potential to establish the foundations for a more detailed research in this field.

Executive Summary

Objective and Rationale of the Project

The attrition from nursing and midwifery workforce is a problem which is widely recognised in academic literature. Two main reasons necessitate the study of attrition factors. First of all, the connection between patient outcomes and nursing daily staffing levels is proven by academic and professional literature (Royall College of Nursing 2010, Griffiths 2009, Refferty et al. 2007, Numata et al. 2006). Different authors establish the same conclusions with respect to midwives as well (Page 2003, Gerova et al. 2010). Since the shortage of nurses and midwives is directly related to local daily staffing levels, examining the factors that affect the attrition rates from the workforce is crucial. The findings obtained by such research may lead to significant reduction of the aforementioned negative consequences of insufficient staffing levels. Secondly, funding the education and professional development of nurses and midwives is related to significant financial investment (Audit Commission 2010). The completion of the professional qualifications requires considerable amount of time as well. This should be considered along with the fact that the NHS is 'facing a period of sustained and significant financial constraint' (Dunkley and Haider 2011). Therefore, studying possible factors related to the attrition from the nursing and midwifery professions should be prioritised.

The following study aims to find relationships between attrition rates in nursing and midwifery and some main factors that influence the number of leavers. The work attempts to provide a detailed description of some of the key reasons for leaving the workforce that are researched in academic literature. Different approaches for achieving these goals are applied.

Approach to the Issue

A literature review on the factors influencing attrition from the nursing and midwifery professions was conducted. The findings from numerous academic publications were summarised in a cognitive map. Statistical approaches were applied for examining the attrition rates and some of the main factors that possibly influence its level. Midwives only were analysed. The rationale for this decision is determined by the existence of a gap in academic literature with respect to studying attrition in midwifery (Gerova et al. 2010). The analysis considers only 'young' leavers

(midwives at 54 years of age or younger), as they are not supposed to leave the workforce at such an early stage of their professional life.

The Health and Social Care Information Centre (HSC IC) provided the dataset that was used in the study. It covers the period from March 2008 to March 2012 and contains the following information: personal NHS identifier, gender, age, location, occupation code, FTE (full-time equivalent), and AfC (Agenda for Change) bands for each employee. These are the factors that are considered as possible influences on the attrition rates.

Key Findings

The qualitative analysis suggested a number of factors that presumably affect the attrition from nursing and midwifery workforces. Some of the key ones are related to job satisfaction and intended turnover, namely, inadequate salary level, low staffing levels, poor management (Aiken et al. 2001), increasing workload, pressure at the workplace (Gantz et al. 2012), as well as job stress and difficulties meeting deadlines (Bradley and Cartwright 2012). A detailed qualitative analysis is presented and a cognitive map is designed as a part of this study.

The quantitative analysis is conducted in two stages: preliminary analysis and statistical analysis. General information regarding the workforce size and attrition rates is presented in the table below.

Period	'Young' Workforce (HC)	'Young' Leavers vs. 'Young' Workforce (%)	'Young' leavers vs. Total Number of Leavers (%)
03/2008-03/2009	20,684	6.87	79.37
03/2009- 03/2010	21,012	6.51	78.58
03/2010- 03/2011	21,787	6.16	74.05
03/2011- 03/2012	22,298	6.44	73.58

Table 1 'Young' Leavers vs. 'Young' Workforce and vs. Total Number of Leavers

The attrition rate varies between 6.16% and 6.87%. The proportion of the 'young' leavers out of the number of leavers of all ages is more than 73% for each of the years. The preliminary analysis was conducted with respect to key information about

the workforce – gender, strategic health authority (SHA), age, Agenda for Change (AfC) Bands, and full-time equivalent (FTE).

The key results from the analysis by gender are presented below:

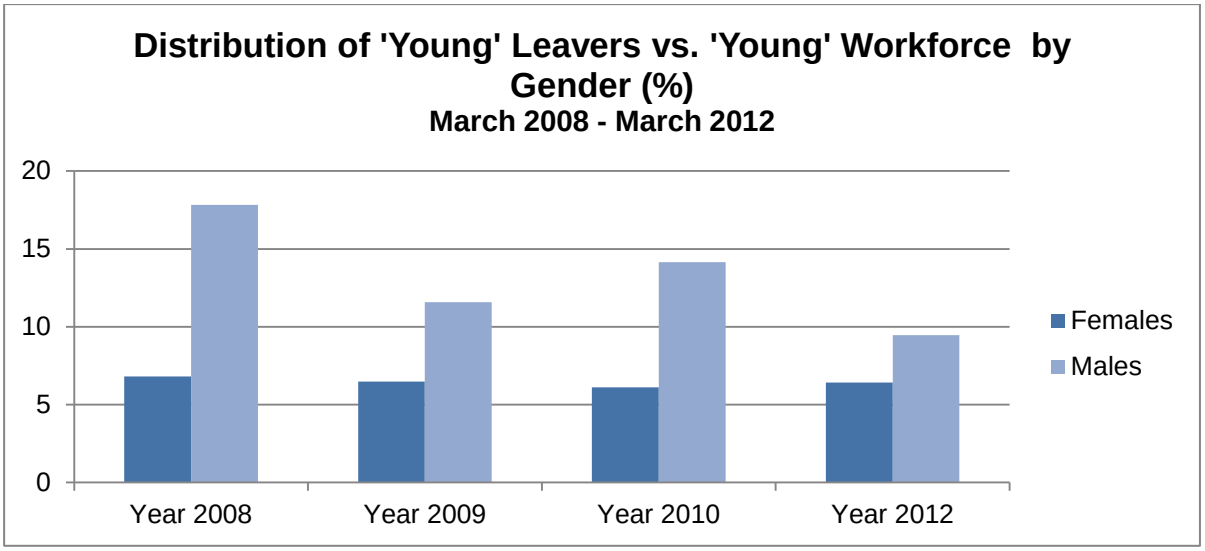


Figure 1 Distribution of 'Young' Leavers vs. 'Young' Workforce by Gender (%)

It was revealed that the average attrition rate for males recorded during the four-year period is slightly over 13%, which is approximately two times higher in comparison to the percentages for females, between 6% and 7%.

According to the analysis by SHA, the highest attrition rates are recorded in the London and the South Central SHAs. The average rate in these two regions is higher than the mean attrition rate for the researched period.

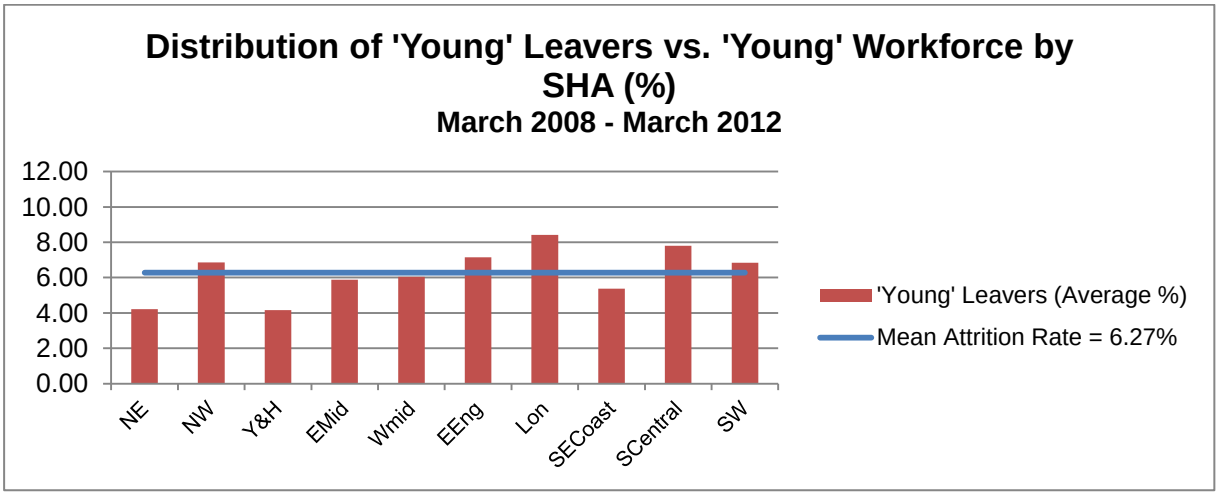


Figure 2 Distribution of 'Young' Leavers vs. 'Young' Workforce by SHA (%)

The reasons for these results may only be guessed. It is possible the higher rates to be caused by the fact that these are densely populated regions, which presumably leads to an increase in the workload for the midwives employed there. Also, personal reasons for moving to other regions or the culture of changing employers may have caused the increased number of leavers in these SHAs.

The preliminary analysis also revealed that the rate of attrition is relatively flat with respect to different age groups, as shown in the bar chart below:

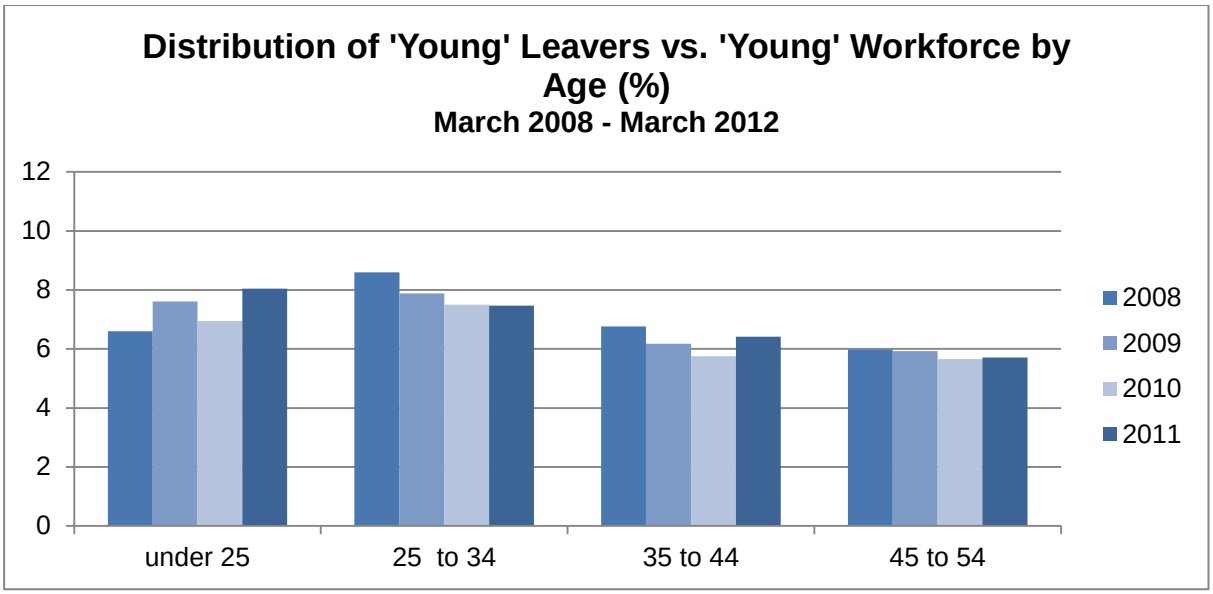


Figure 3 Distribution of 'Young' Leavers vs. 'Young' Workforce by Age (%)

It can be suggested that the percentages are slightly higher with respect to the youngest midwives, those at or under 34 years of age.

AfC bands and FTE have strong relationship with the attrition rate, as shown in Figures 4 and 5.

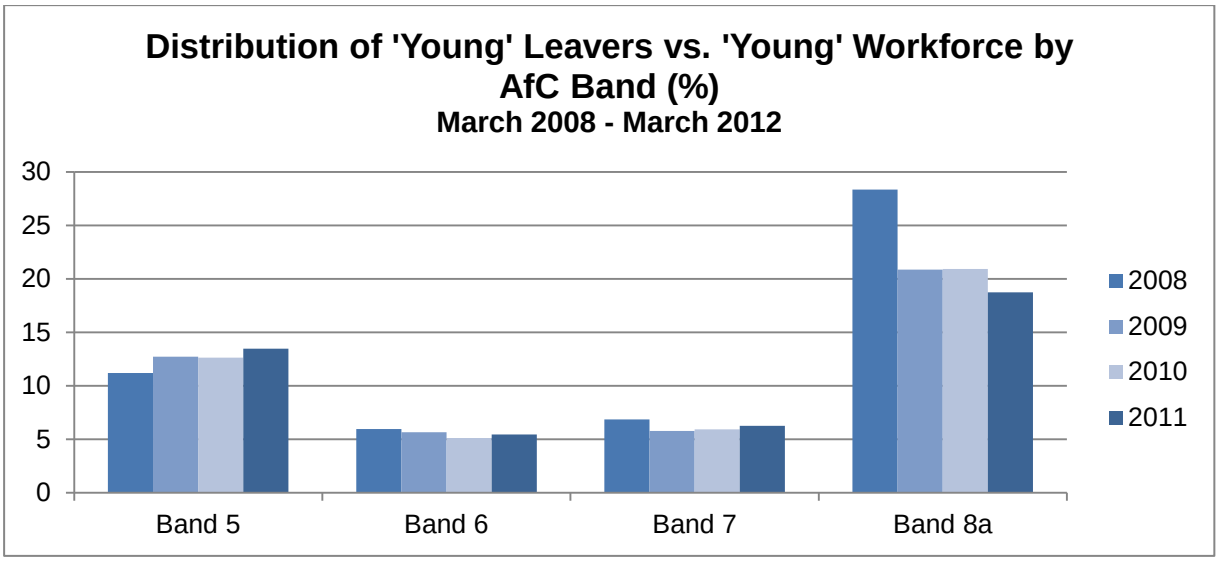


Figure 4 Distribution of 'Young' Leavers vs 'Young' Workforce by AfC Band (%)

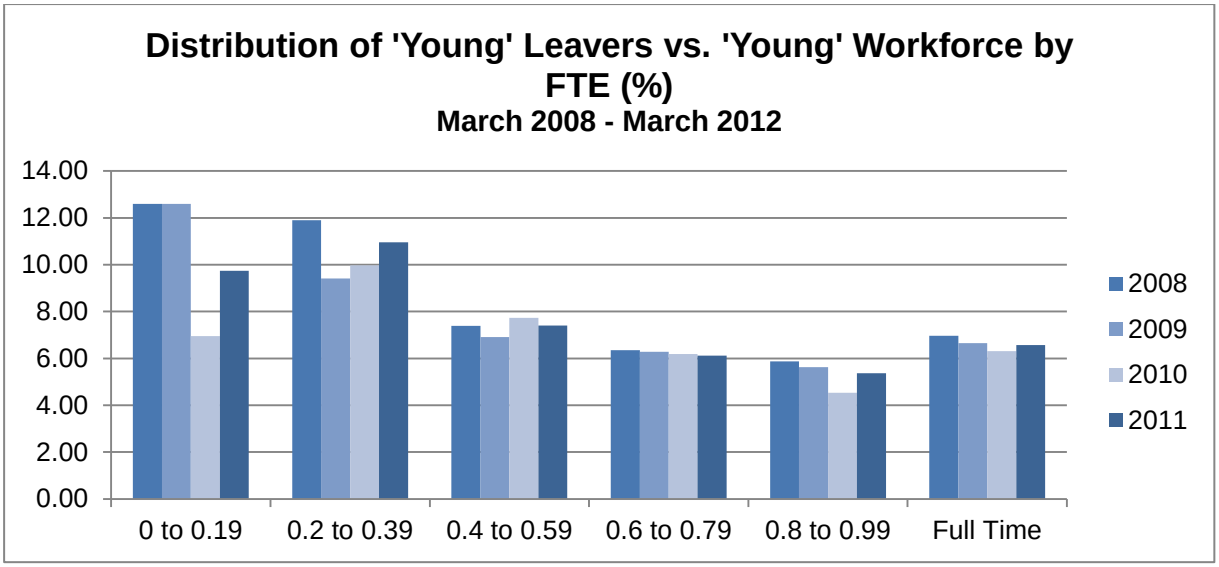


Figure 5 Distribution of 'Young' Leavers vs. 'Young' Workforce by FTE (%)

The approximate strength and the possible type of the connections were examined by the applied statistical methods. With respect to the salary band, it can be suggested that an optimum level exists, Band 6 (most of the midwives are salaried at Band 6), at which the attrition rate is the lowest. Band 5 as well as the higher levels, Band 7 and Band 8a, suggest higher attrition rates. Possible reasons for the increased attrition rate at high salary levels may be the presumably increased workload and stress, related to holding higher positions. It can be also suggested that the effect of the increased payment level stops influencing the job satisfaction and negative factors prevail, leading to a decision to leave. As for the FTE, it is negatively

related to the rate of attrition. In other words, the more time is spent at the work place, the lower the possibility to leave. This may be explained by the existence of a possible connection between longer working hours and increased involvement in the working process as well as higher commitment to the profession, which decrease the probability for leaving the workforce, as suggested in academic literature (Gormley 2011, Lynn and Redman 2005, Nedd 2006, Ellenbecker et al. 2007)

Conclusions and Recommendations

Based on the conducted analysis, the AfC band is suggested to have a strong connection with attrition rates. The increase in the salary band leads to a decrease in the attrition rates until an 'optimum' point is reached, after which higher AfC band is associated with an increase of the influence of negative factors, such as, stress at the workplace, which could lead to higher attrition rates. Also, the increase in the working hours (FTE), which is related to higher professional commitment and involvement in the working process, is suggested to lead to a decrease in the probability to leave.

It is recommended that the influence of gender is further researched. Attrition of males from midwifery could become a subject of a separate study. The ground for this suggestion is based on the assumption that if the number of males entering the midwifery workforce increases with the same factors influencing attrition maintained, the higher attrition rates recorded for men would have a considerable negative impact on the size of the available workforce.

Obtaining more significant results regarding particular reasons for why midwives leave the workforce necessitates a different data collection approach to be applied. It is recommended for more detailed information about personal factors, for example, marital status, having children, educational background, etc., and about professional characteristics, for example, level of empowerment, relations with colleagues and managers, etc., to be gathered. The purpose is to correctly evaluate the job satisfaction level which would allow the usage of more suitable forecasting techniques than those applied in this work. The issue may also be considered from the returners' perspective. For any time patterns to be observed, the dataset should cover a longer period. Recording seasonal changes in the number of leavers would necessitate the information to be organised on a monthly or on a three-month basis.

Acknowledgements

First of all, I would like to thank my father, Dimitar, who made it possible for me to study at the University of Southampton, an opportunity which entirely changed my life. I would also like to thank my father and my mother, Snezhana, for supporting and encouraging me during the whole course of my study. I would like to thank my partner in life, Dobroslav, for giving me strengths to reveal my potentials and supporting me unconditionally.

I would like to thank my lead supervisor, Marion Penn, for the excellent supervision, the invaluable advice and the dedicated guidance she provided me with for the whole duration of the project. I would also like to thank my second supervisor, Prof. Sally Brailsford, for dedicating time to share her rich experience with me.

I would like to thank the people at the Centre for Workforce Intelligence, the sponsor company of the project, who supervised me and guided me throughout the whole duration of the project – Jack Turner, Lead Analyst, who acted as my line manager, Andrew Woodward, Lead Modeller, also a manager of the project, and Graham Willis, Head of Research and Development, who supervised me as well. I would also like to thank Ian Bullard from the Health and Social Care Information Centre for providing quickly the data that was used for the research.

I would like to express my gratitude to the Centre for Workforce Intelligence and the University of Southampton for providing me with the opportunity to work on this challenging project.

Glossary

AfC – Agenda for Change

CfWI - Centre for Workforce Intelligence

CQC - Care Quality Commission

FTE – Full time equivalent

GLMs - Generalised Linear Models

HC – Head Count

HSC IC - Health and Social Care Information Centre

LMX - Leader-Member Exchange

MAC - Migration Advisory Committee

NHS – National Health Service

NMC - Nursing and Midwifery Council

NPSA - The National Patient Safety Agency

OC – Occupation Code

RCM - Royal College of Midwives

RCN - Royal College of Nursing

SD – System Dynamics

WTE – Whole time equivalent

Table of Contents

List of Tables

List of Figures

List of Equations

Chapter 1 Introduction

The following study aims to illustrate the current situation with respect to premature attrition of nurses and midwives in England for the period from March 2008 to March 2012. According to academic literature, the highest attrition rates are recorded with newly graduated nurses, and according to research published within the last 7 years, the attrition rates for this group vary between approximately 30 and 50 percent (Hillman and Foster 2011). Curtis et al. (2009) acknowledge two groups of factors that influence attrition – 'pull' factors that concern the attractiveness of other occupations, and 'push' factors that provoke people to leave the workforce. The focus of the literature review in the current work will be the so called 'push' factors. The qualitative analysis is based on research in the nursing field, recognizing the similarities of the issues existing in both nursing and midwifery professions.

After understanding the problem and defining the main issues that exist with respect to both professions, some of the factors influencing attrition will be examined. Preliminary study followed by a statistical analysis will be conducted. Conclusions and recommendations will be made based on the findings and the discussion of the obtained results. There is a recognised lack of literature addressing issues that exist in the midwifery profession (Gerova et al. 2010). Conducting the quantitative analysis using midwifery dataset aims to fill this gap.

1.1. Company Background

The current dissertation is based on collaborative work with the Centre for Workforce Intelligence (CfWI), which was launched on 1st July 2010 (Royall College of Nursing 2010) as the national authority providing advice on health and social care workforce planning and development. The mission of the organisation is to become the primary source of workforce intelligence in England. One of the key areas of research in the organisation is nursing and midwifery with two different current projects on each of the professions. The results of the analysis should lead to recommendations on the future workforce within these two major sectors in health care (http://www.cfwi.org.uk).

The CfWI approach to forecasting health care workforce is based on stock and flow modeling, which is schematically represented in Figure 1 (Centre for Workforce Intelligence 2012).

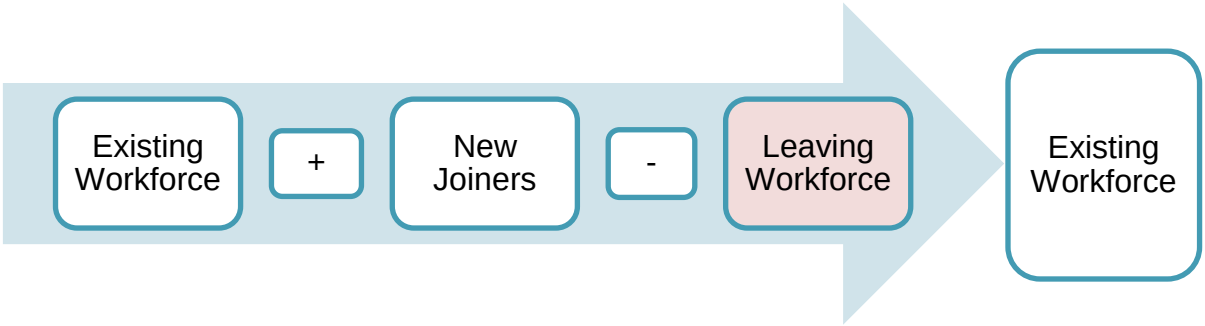


Figure 1 Sample Stock and Flow Model

Source: Centre for Workforce Intelligence (2012)

The results of the current analysis could contribute to the better understanding of the 'Leaving Workforce' segment of the model.

1.2. Nursing and Midwifery Professions Background

1.2.1. The Nursing and Midwifery Council register

In order for one to practice the profession of a nurse or a midwife in the United Kingdom, they need to be registered with the Nursing and Midwifery Council (NMC) professional register. The registration procedure and entry requirements are clarified on the NMC website. The registration can be made within approximately one month's time after completing an application process and paying a fee. Staying on the register requires paying an annual retention fee and the obligation to keep all the information provided to the register up-to-date. In case a professional wants to change their career, retire from practice or move abroad, they may decide to leave the register and cancel their registration. In case one wants to return to the register, they need to meet certain requirements regarding professional practice and educational activities. The so called return-to-practice courses are designed for those who do not meet the aforementioned criteria and are compulsory for them in order to be allowed to join the register again. In case a midwife has taken a break and wishes to come back to practice, they need their employer's assistance (http://www.nmc-uk.org).

1.2.2. Entry Requirements. Government Funding

There are no minimum requirements regarding entering the midwifery or nursing professions. A nursing educational programme at a higher education institution, approved by the Nursing and Midwifery Council (NMC), must be successfully completed before the registration application can be accepted. The length of such a course is usually three years. The training courses for midwives last also three years unless the person is already registered with the NMC as a level one adult nurse. In this case, the training lasts 18 months (http://www.nmc-uk.org).

The NHS Business Services Authority provides financial support, for students who are UK residents, in the form of tuition fees funding, bursaries covering living costs, and a discount from the council tax (http://www.nhsbsa.nhs.uk). The financial support is not available for post-registration courses (http://www.nhsbsa.nhs.uk). According to the Department of Health's Annual Report and Accounts 2010-11, the amount of £4,8 billion was spent to support educating health care workforce, including more than 91,000 nurses, midwives and allied professionals (Department of Health 2011)

1.3. Objectives and Rationale of the Project

The aim of the current work is to find and analyse reasons which possibly affect the attrition rates from the nursing and midwifery professions. The research is focused only on 'young' leavers (under 54 years of age), which are important component of the leaving workforce. The reasons for attrition from the workforce need to be studied for two main reasons. First of all, attrition reduces the number of nurses available to perform high quality health care services, which affects patient outcomes. Second, attrition from the workforce before retirement age is related to loss of substantial financial resources. In addition, the accomplishment of the courses of qualification requires considerable amount of time. While the attrition from the workforce at retirement age is normal, the reduction of the number of employees who have not reached retirement age needs to be limited.

1.3.1. Patient Outcomes

The overall number of people involved in the health care sector is directly related to the daily staffing levels, the maintaining of which requires adequate and accurate workforce planning. Providing sufficient staffing levels is essential for all health care providers in England, as it is one of the main standards required to be met in

compliance with the Care Quality Commission (CQC) (Royal College of Nursing 2010). In the same document it is claimed that shortage of nurses may have many negative consequences threatening the quality and efficiency of the health care service as well as the patient safety and experience. There is plenty of research on the relation between nurse staffing from one side, and patient outcomes and adverse events in hospitals, from another (see Chapter 2). The National Patient Safety Agency (NPSA) made a record of more than 30,000 patient safety incidents related to staffing insufficiency within the period of just one year (Royal College of Nursing 2010). In addition, low staffing levels in midwifery profession is the reason for not following the recommendation for prevailing number of normal births (Page 2003). Although the research is limited, it can be claimed that there is a connection between the midwifery staffing levels and patient outcomes (Gerova et al. 2010).

Staffing levels affect not only the number of adverse events but also mortality levels (Royal College of Nursing 2010). In addition, there are considerable costs related to dealing with the so called 'avoidable complications', the reduction of which necessitates a sufficient staffing level with the needed skills to be secured. Griffiths (2009), Rafferty et al. (2007) and Numata et al. (2006) also suggest that there is a proven connection between the number of registered nurses and the level of mortality among patients. Aiken et al. (2008), Lankshear et al. (2005) and Kane et al. (2007) also talk about the positive relation between the nurse staffing levels and the patient outcomes. The relation could be presented by the diagram below.

Figure 2 Relationship Between Nurse Staffing Level and Patient Outcomes

1.3.2. Financial Aspects

A considerable increase in the number of nurses nationally was observed over the last 20 years. NHS wards have 24 beds on average, 97% of which are occupied and staffed with 3.3 registered nurses and 2.2 support workers, as a survey of the Royal College of Nursing from 2009 suggests (Royal College of Nursing 2010). According to the Audit Commission (2010), the costs related to nursing represent more than a quarter of the overall NHS trust and foundation trust expenditure. It is suggested that

a possible reason may be the sharp increase in the number of patients. It is also stated that the number of hospital-based nurses in England, working in NHS trusts and foundation trusts, has inclined from 163,000 in 1999 to 207,000 in 2009 (full-time equivalent). The costs of nursing vary approximately from £90 to £160 per day (excluding critical care and children's wards), and the overall costs related to nursing staff are approximately £6 billion a year with an average annual salary of £30,000 per employee (Audit Commission 2010). Since 'the NHS is facing a period of sustained and significant financial constraint' (Dunkley and Haider 2011), the research on attrition rates should be carefully considered as a priority in health care workforce planning.

It can be concluded that due to the importance for the public and due to the high costs with respect to nursing and midwives, the overall staff planning on a national basis must be conducted so that the daily staffing levels are sufficient for a high quality and cost-effective health care service to the patients. In order for this to be achieved, the level of people leaving the workforce must be examined. This work aims to illustrate the current situation as well as attempts to find some of the reasons why midwives leave the workforce before retirement age.

1.4. Dissertation Structure

The dissertation begins with an abstract and an executive summary. They aim to provide concise information regarding the whole content of the work. The summary is followed by acknowledgements and a glossary, which contains the abbreviations which are used in the work. Lists of contents, tables, figures, and equations are presented as well.

The dissertation consists of six chapters. The first chapter is introductory and provides background information regarding the sponsor company, the midwifery and the nursing professions. It ends with a short summary of the objectives and the rationale of the project.

The second chapter includes literature review. It is divided in two parts – qualitative research on relevant English and international academic publications and an overview of the technical approaches towards studying the problem and conducting analysis. The qualitative part is summarised by a cognitive map, designed as a part

of this study, which aims to illustrate all findings from the literature review in an easily perceivable for the reader way.

The third chapter aims to explain the methodology that is followed in the current work. The dataset that is used is described in details. Short theoretical descriptions of the methods and techniques that are used are presented. Also, general difficulties as well as specific limitations of the current research are outlined. Lastly, the assumptions that the research is based on are explained.

The fourth chapter contains a preliminary analysis on the data. Firstly, descriptive statistics summaries of the whole midwifery dataset are presented. Also a general description of the ‘young’ leavers is provided. Next, analysis of the ‘young’ leavers with respect to gender, location, age, salary band, and working hours is presented. The chapter ends with an analysis on returners (temporary leavers) to the workforce.

The fifth chapter includes the statistical analysis of the data and justification of the applied statistical methods. Systematic regression analysis is performed. The obtained result are presented and discussed.

The last chapter of the current work includes conclusions and recommendations based on the results of the statistical analysis. Suggestions for further research are also provided. It is followed by appendices, which present some useful background information regarding different aspects of the analysis.

Chapter 2 Literature Review

The following chapter presents the qualitative part of the current research. The first sub-section presents factors suggested by academic literature to have a strong influence on making the decision to leave the nursing and midwifery workforces. The methods applied for the analysis of attrition in different academic publications are presented in the second part of this chapter.

2.1. Nursing and Midwifery Professions – Factors Influencing Attrition

The issues regarding the nursing profession have been of public interest ever since the 19th century. The first nursing journal issues date as far back in time as 1888 (http://www.rcn.org.uk). The current work contains a literature review which covers research results from the last 15 years.

Retention rates of nursing professionals are a global issue which is not typical only to England. According to Douglas (2011), effective workforce planning as well as promotion of the retention of nurses in the workforce is necessary at a global scale. Since most of the issues regarding attrition among nurses are similar irrespective of location, both English and international literature is reviewed. The problems typical to nursing are claimed to be valid for midwives as well (Douglas 2011) and so is assumed for the purposes of this work. Another argument for this assumption is the qualitative research on midwives' opinions on the maternity system in England by Lavender and Chapple (2004), where many of the issues typical to nursing are discussed. There are publications which studied attrition from midwifery as well as problems that exist in the profession. These papers presented findings similar or the same as those in the articles about nursing (Curtis et al. 2006, Gerova et al. 2010, Royal College of Midwives 2011).

Aiken et al. (2001) present results from a survey conducted by International Hospital Outcomes Research Consortium in 1998 and 1999. The survey includes 711 hospitals in five countries among which England. Although the health care systems may differ significantly between countries, the problems reported by the surveyed hospital staff are similar. The sample of nurses employed in England comprised 5,006 health workers. The results of their survey showed that more than 36% of the participants were dissatisfied with their present jobs and nearly 39% were planning to leave their job within 12 months, more than 53% of whom were under 30 years old.

Over 80% of the surveyed nurses in England considered their salary levels as unsatisfactory. Nearly 70% were at the opinion that the registered nurses and the staff are not enough to provide health care services at a high level. More than 58% stated that the support services are inadequate. Between 49% and 59% of the respondents reported poor nursing workforce management in various aspects. As a result of all these factors that are proven to affect the quality of the performance of nurses, more than 70% reported less than excellent quality of the health care service in their unit, and a slightly higher percentage expressed the opinion that the quality level is lower compared to the previous year. The authors concluded that the nurses in Western countries, including England, experience high level of job dissatisfaction, leading to unwillingness to stay in the workforce at the present working conditions. As a result, the average age of the workforce increases. Also, nurses make decision to leave the workforce at an early stage of their career lives. Managerial intervention is suggested by the authors as a measure for retaining nurses within the workforce. According to the research, management policies need to be such that would satisfy needs of the staff, for example, flexible scheduling, opportunities for professional development, enhancement of professional qualification. The authors claim that such management would improve the working environment in terms of increasing the level of loyalty to the profession among staff.

Although the aforementioned problems are reported in 1998 and 1999, and the need for change is realised at least 15 years ago, health care professionals are still witnesses of the same issues nowadays possibly even on a higher scale. Gantz et al. (2012) outline some of the biggest challenges faced by nurse leaders in the UK: low level of job satisfaction, unsatisfactory working conditions and working environment, as well as insufficient quality of the health care services provided by the nursing workforce. According to the same authors, another major problem is the increasing workload and the pressure that health care staff is exposed to on a daily basis. Robinson et al. (2006) found that the amount of administrative work is one of the sources of dissatisfaction among newly graduated nurses. High levels of job stress provoked by increased workload and difficulties meeting deadlines result in low job satisfaction (Bradley and Cartwright 2002). Moreover, according to Gilworth et al. (2007), a large number of nurses are forced to retire early due to profession-related illnesses.

The attrition issue has a considerable financial aspect as well. According to a report issued by the Royall College of Nursing in 2005 (cited in Curtis et al. 2009), unsatisfactory promotion opportunities and pension schemes are common reasons for making a decision to leave. Recent research shows that along with the aforementioned factors, payment level which is inadequate related to professional obligations and responsibilities is among the most common drivers for attrition (Robinson and Bennett 2007, Robinson et al. 2005,). In addition, the culture of changing employment over time and the flatter career structure within the NHS (Curtis et al. 2009) lead to increasing attrition rates.

The analysis of the career length is used in studying the issue of high attrition by Curtis et al. (2009). They examined the life span in the nursing career and found that between the years 2003 and 2006 the working life for women was 18 years and for men – 17 years. The authors outlined factors typical for male attrition, namely the aforementioned reduced hierarchical career structure, the existing less demanding professional opportunities, the deteriorating working conditions, and the low payment level. The article also suggests that men state low salary as a reason for leaving the workplace more often than women.

Stress, as well as social and managerial support were central for a number of studies on job satisfaction and intended attrition. Riahi (2011) conducts a concept analysis on the role of stress at the workplace as a factor influencing attrition rate and being an obstacle for the creation of a healthy working environment. According to the author, an emphasis should be put on this issue on a national level. Bradley and Cartwright (2002) address stress among other factors influencing job satisfaction, for example, social support and health. The results of the study, which uses a sample of 1,162 nurses in 4 health care organisations in England, show that social support received by the organisation influences nurses' job satisfaction in a positive way. Between 11% and 12% of the workforce turnover is explained by this factor. The survey did not manage to prove strong relationship between job satisfaction and social support provided by managers, coworkers, or confidantes. However, other research finds positive relationship between managerial and supervisory support, relationships with coworkers, and job satisfaction, from one side, and intent to stay at one's current employment, from another (Strachota et al. 2003, Nedd 2006, Robinson et al. 2006, Lacey et al. 2007, Gormley 2011).

Another aspect of the working environment is the presence of necessary equipment. According to Robinson et al. (2005), the availability of adequate equipment has an impact on the level of job satisfaction. Robinson et al. (2006), who study newly graduated nurses, also find relation between the availability of the necessary supplies and equipment and the intention to stay in the workforce.

It can be concluded, based on the aforementioned reasons for attrition, that job satisfaction is a key element in research. There is a proven significant positive relationship between job satisfaction and intended turnover in nursing (McCarthy et al. 2007, Spence Laschinger 2012). The leader-member exchange (LMX), which refers to the relationship between a leader and their subordinates, is proven to be also positively related to job satisfaction (Tangirala et al. 2007, Spence Laschinger et al. 2001). Han and Jekel (2011) contribute to this theory by proving that job satisfaction has a mediating role in the relationship between turnover intentions and LMX as shown in the diagram below.

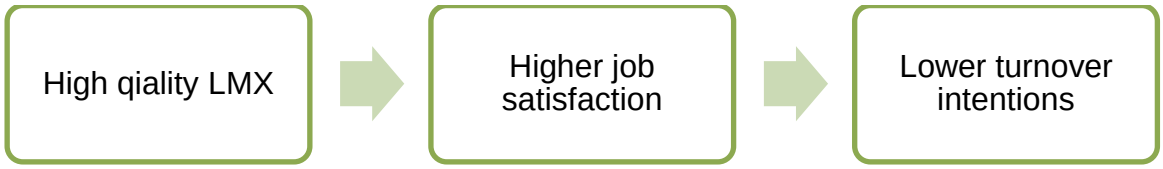


Figure 3 Mediating Role of Job Satisfaction

Their study proves that creating and maintaining positive relationships between staff nurses and nursing management can have a positive impact on retention rates via enhancing job satisfaction levels. The focus of management in nursing should be put on enhancing staff satisfaction by assisting the employees in their career development (Parker and Hyrkas 2011).

In order for the relationships between the managers and staff nurses to improve, both parties' perceptions of the work environment should be similar. However, significant differences exist, and nurse managers perceive the work conditions in a more positive way in comparison to staff nurses (Gormley 2011). According to the author, this may lead to neglecting issues of importance. Gormley (2011) examines the differences that exist with respect to the way those two groups perceive the atmosphere at the workplace. A connection was established between the work environment and the turnover intentions. According to the author, it is of great

importance for the managers and the other members of administrative staff, who are responsible for initiatives related to retaining nurses within the workforce, to fully understand the way nursing staff perceives the work environment in order for the right measures against attrition to be taken. In addition, it is concluded that the participation in unit and hospital governance and the perception of management and quality of care affect staff turnover.

Cowden et al. (2011) also examine the correlation between leadership and management policies and the intent of nurses to keep their current employment position as well as to stay in the nursing workforce. It is claimed that studying this relationships is crucial with respect to developing procedures for retaining nursing staff. According to the authors, the consideration of the leadership style should be balanced. The nurses' roles and powers are also of great importance. Hauck et al. (2011) and Zurmehly et al. (2009) found an inverse relation between the extent to which nurses in critical care units consider themselves as empowered, have access to information, resources, and support, from one side, and the intention to leave their workplace or the profession, from another. Empowerment, control over practice, work group cohesion and participation in making decisions have considerable positive relationship with the intent to stay (Lynn and Redman 2005, Nedd 2006, Ellenbecker et al. 2007). According to Lynn and Redman (2005), the influence of the level of commitment to the organisation on leaving the workplace should be considered for further studies.

Until now, mainly organization-related factors influencing attrition rates were discussed. Personal characteristics, for example, gender, age, ethnicity, having children, educational background, and time at first job, are also proven to have impact on retention (Robinson et al. 2005). Many of the aforementioned authors collect such information as background data and use it for computing descriptive statistics and building forecasting models (Gormley 2011, Han and Jekel 2011, Hauck et al. 2011, etc.).

Suspension is a factor that is worth to be mentioned as well, and which does not fall into any of the aforementioned groups of factors. It is a reason for 'non-voluntary' attrition from the workforce and is important because poor performance of the NHS staff may lead to significant costs. Some of the expenses for the organisation of

employment are those related to time spent in investigation, disciplinary hearings, legal procedures, locum cover, replacement of the dismissed person, possible redeployment and settlement (Stone et al. 2011). The aforementioned expenses increase additionally the financial resources that are spent every year on health care sector in order for it to function effectively.

High quality workforce planning in the NHS is needed in order to provide value for the taxpayers' money (House of Commons - Health Committee 2012). According to the committee, problems in projecting the needed manpower are indicated by the trend of alternating over- and undersupply of qualified staff that has been observed over the years. Since the problems are realised and the need for a change is recognised, certain measures on a national scale have been taken. One of them is the aimed increase in the number of nurse students, registered nurses and midwives (Attree et al. 2011). However, this is just one approach, which is not proven to be the most appropriate. Prevention of high levels of job dissatisfaction among nurses is another approach to the problem. It is important to maintain the so called Y generation (those born between 1980 and 2000) within the nursing and midwifery workforce (Hutchinson et al. 2012). Unrugh and Nooney (2011), Robinson et al. (2006) and other authors studied areas of improvement concerning the newly licensed registered nurses, who reported many of the already aforementioned issues with respect to unsatisfactory work environment.

In the current work, a summary of the discussed literature was made in the form of a cognitive map, which is presented in Figure 4. The map resembles an influence diagram, since it clearly and concisely depicts the factors influencing attrition rates and shows the way they affect the number of leavers. Three main groups of factors influence the rate of attrition before retirement age: job satisfaction-related, personal characteristics and external (with respect to the individual) factors. In addition to the presented factors, the last group may also be influenced by politics, culture, etc. Although important, they influence the attrition indirectly and are not the focus of this work. Therefore they are not included in the diagram. Some of the main factors affecting the other two main groups are presented.

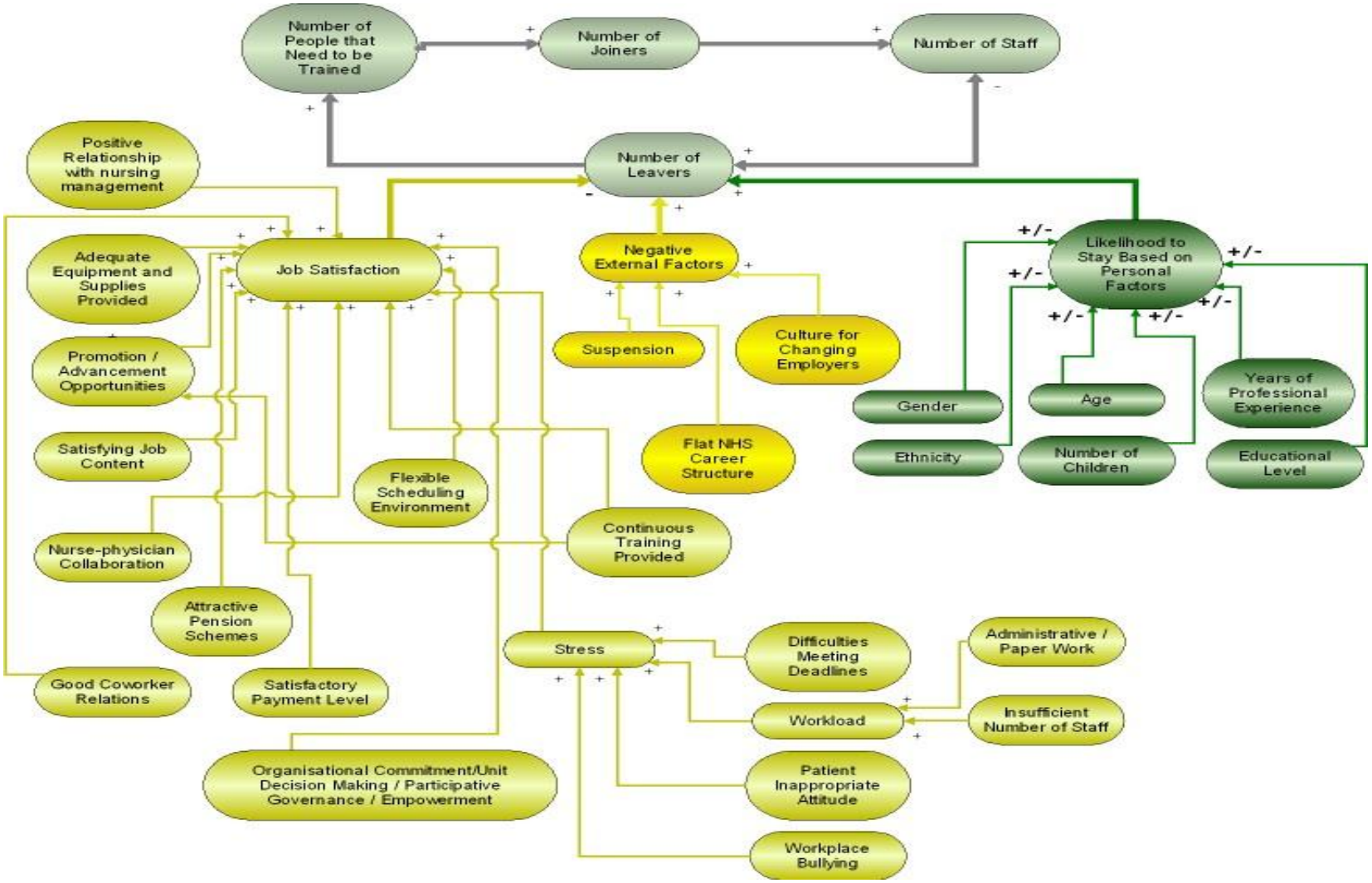


Figure 4 Cognitive Map – Factors Affecting the Number of 'Young' Leavers

The signs at the end of each arrow show the influence that an increase in the factor would have on the related box. With respect to the personal characteristics, a '+/-' sign is put to illustrate that the effect may be in both directions – increase or decrease. In order for this factors' influence to be defined, additional information should be taken into consideration.

2.2. Statistical Methods Used in the Research of the Factors Influencing Attrition

According to the reviewed papers, a widely used data collection method, in which quantitative analysis was applied, is the distribution of surveys in the form of detailed questionnaires or interviews. The questions aimed to gather various information about the participants under different categories - personal, professional, organisational, etc. The questionnaires also required the participants to evaluate subjective aspects of their professional lives, for example, level of job satisfaction, likelihood to stay at their current position, likelihood to leave their workplace or the NHS workforce, etc. The responses were then pre-processed and used for computing descriptive statistics and performing statistical analysis using different techniques.

Robinson et al. (2005) used logistic regression models in order to examine the relation between various factors determining the level of job satisfaction among mental health nurses and the likelihood to stay in the workforce for the next five or ten years. Hierarchal log-linear modeling was used for construction of the model. Similarly, Hogh et al. (2011) applied logistic regression analysis in order to investigate the connections between the intended turnover and the exposure of nurses to regular and occasional bullying at the workplace. The authors also conducted Pearson's correlation coefficient analysis in order to find connections between bullying at the workplace and other variables regarding work environment from one side and health from another. The analysis includes also a time dimension as the data was collected in three different points in time. The authors built four binomial logistic regression models to study the effect of exposure to workplace bullying on turnover. Robinson et al. (2006), Bradley and Cartwright (2002), Bowles and Candela (2005) as well as other authors also collected data in different times

and used descriptive statistics as well as applied logistic regression models in order to study the career paths and retention intentions of newly graduated nurses.

Hauck et al. (2011) performed Pearson's correlation coefficient analysis and descriptive statistics to study the connections between the anticipated turnover and the structural empowerment of nurses working in critical care units. They also investigated the relationships between the background and the specific data regarding work effectiveness and anticipated turnover collected by distribution of questionnaires. The Anticipated Turnover Scale (ATS), researched by Hinshaw et al. (1985) (cited in Hauck et al. 2011), was used to evaluate the responses about the intention of each of the respondents to leave their present job.

Gormley (2011) investigated the connections between the 'staff nurse and manager perceptions of work environment, quality of care and anticipated nurse turnover', where the latter was measured by using the Anticipated Turnover Scale (ATS), studied by Hinshaw et al. (1987). The participants completed the Perceived Nurse Work Environment Scale (Choi et al. 2004). After presenting some descriptive statistics, Pearson's and Spearman's correlation coefficient analyses were performed in order for connections between the dependent variable and the demographic characteristics to be found. An analysis of the variance (ANOVA) and the covariance (ACOVA) were applied as well for identifying potential influences on the main variables.

Han and Jekel (2011) conducted their statistical analysis on determining 'the mediating role of job satisfaction between leader-member exchange and turnover intentions' by computing descriptive statistics in order to describe the participants. Pearson's correlation coefficients were used to determine relationships between the variables. Ordinary multivariate linear regression models were built for examining the relationship between the dependent variables and the predictors.

Spence Laschinger (2012) used descriptive statistics, correlation analysis and hierarchical multiple regression analysis in order to study the relationships between "various situational and personal factors as predictors of job and career satisfaction and turnover intentions" (Spence Laschinger 2012, pp. 479-480) of newly graduated nurses. The same methods were applied ten years earlier by Bradley and Cartwright (2002) in their study on the connection between social support, job stress, health,

and job satisfaction. The authors used stepwise multiple regression analysis to examine the sources of support at the workplace as predictors to job satisfaction. The same regression analysis was used by Lynn and Redman (2005) for studying whether “nurses’ organizational commitment, work satisfaction, and professional satisfaction predict intent to leave the current position or nursing as a career” (Lynn and Redman 2005, p. 267).

A study by Wagner (2010) on forecasting nursing turnover criticised the widely used linear statistical models, claiming that they produce inaccurate and unreliable results. The author advocates the application of non-linear methods as an innovative approach towards predicting turnover. According to the study, catastrophe theory can be successfully applied in the construction of non-linear statistical models, “catastrophe turnover models” (Wagner 2010, p. 2072), and more specifically “cusp catastrophe nonlinear models of nursing turnover” (Wagner 2010, p.2081). These achieve a higher level of accuracy when ”predicting job-related behaviours with highly emotional elements” compared to linear models (Wagner 2010, p. 2072).

Some of the authors used purely qualitative methods, for example, literature reviews and qualitative survey research in order to find relationships between a variety of factors and retention rates among nurses. While examining the image of nursing, Morris-Thompson et al. (2011) found that commitment, taking responsibilities and working autonomously are among the drivers of fulfillment of practicing the profession, which, as previously discussed, is a factor influencing retention in the workforce. Ritter (2011) studied the connection between retention rates of nurses and work environment by conducting a literature review. Cowden et al. (2011) presented in their article the findings, obtained by conducting a systematic literature review, about the relationship between leadership practices and the intention of staff nurses to stay in the workforce. Lavender and Chapple (2004) used an Appreciative Inquiry approach to conduct their survey aiming to illustrate the “midwives’ views on the current system of maternity care in England” (Lavender and Chapple 2004, p.1).

Chapter 3 Methodology

This chapter presents the methodology used in the current work. It presents a description of the data and the data pre-processing step as well as short theoretical background of the main methods and techniques used for approaching the attrition problem. The chapter ends with a summary of the main difficulties in health care workforce planning as well as limitations and assumptions of the current work.

3.1. Data Description and Data Pre-processing

The data that the analysis is based on is obtained by the Health and Social Care Information Centre (HSC IC) and contains information about NHS staff over a four-year period – from March 2008 to March 2012. According to the Occupation Code Manual, the following codes refer to registered midwives: N2C – (Maternity Services), N2L (Neonatal Nursing) and N2J (Education Staff) (Health and Social Care Information Centre 2010). The dataset is structured by personal identification numbers of the members of midwifery staff and contains the following information: unique NHS identifier, SHA (strategic health authority) code and name, reporting organization code and name, occupation code (OC), gender, agenda for change (AfC) band, contracted WTE for assignment (referred to as FTE – full time equivalent - further in this work), and age in years.

Microsoft Excel was used for pre-processing the data, which was conducted in three stages. Firstly, all duplicates that were found in the dataset were deleted. Secondly, all entries, for which information regarding AfC bands was missing, were removed as well. AfC bands are the only variable for which there was missing information. Lastly, for the purposes of the 'young' leavers analysis, all employees at the age of 55 or older were excluded from the dataset.

3.2. Methods and Techniques Used

The quantitative analysis is conducted in two steps. Firstly, a preliminary (also called explanatory) analysis was conducted. The identified trends and patterns as well as descriptive statistics are presented. Secondly, based on the findings from the preliminary analysis, the most appropriate regression models were chosen and fit. The grounds for the choice are provided in Section 5.

3.2.1. Preliminary Analysis and Descriptive Statistics

The preliminary analysis is the third main basic step that is taken when solving a forecasting task, after defining the problem and gathering the data. It includes plotting the data for illustrative inspection and computing descriptive statistics in order to provide an overall picture of the situation during the researched period (Makridakis et al. 1998). The preliminary analysis was conducted based on the following variables: gender, SHA, age, AfC band and FTE. The results are presented in head count and in percentages. Descriptive statistics is provided as well. Relevant conclusions were made based on the findings. The further statistical analysis is based on the identified trends and patterns as well as the relationships between the variables and the attrition rate.

3.2.2. Logistic Regression

Binomial logistic regression is used for examining the relationships between a discrete dependent binary (also called response or outcome) variable and one or more independent (also called predictor or explanatory) variables. One of the main differences between linear and logistic regression models is that the outcome of the latter is binary or dichotomous (Hosmer and Lemeshow 1989). Since the outcome in the dataset is of a dichotomous type, leaver or non-leaver, binomial logistic regression was the first statistical method considered for approaching the problem. Logistic regression is a member of the binomial family of generalised linear models (GLMs). Another family of the GLMs is the normal family, which includes multiple linear regression (Cook and Weisberg 1999), discussed in the next section.

3.2.3. Multivariate Linear Regression

In multivariate linear regression models, the dependent variable is predicted by two or more independent variables, where linear relationship between the forecast and the explanatory variables should exist (Makridakis et al. 1998). A multivariate linear regression model was built. The model was used in attempt to prove a linear relationship between the attrition rates and the explanatory variables.

3.2.4. Polynomial Regression

The next statistical approach that was explored is polynomial regression. The polynomial regression model that was built introduced variables raised to higher

powers. This allows for non-linear relationships between the attrition rates and the predictors to be examined.

3.2.5. Pearson's Correlation Coefficient Analysis

In Chapter 6, Pearson's correlation coefficient analysis was conducted. The analysis aims to find relationships between the rate of returners to the workforce and the data available for them in both the year of leaving and the year of returning. By applying this method, the presence of correlations between the variables could be observed as well.

3.2.6. Operational Research Approach – System Dynamics

An example of a simplified stock and flow diagram is shown in Section 6. The diagram could be fed with some of the results obtained by the conducted analysis. A possible application of system dynamics (SD) simulation is considered as an alternative approach towards the task and is briefly discussed.

3.2.7. Qualitative Approach – Cognitive Mapping

Cognitive mapping was applied based on the literature review that was conducted. A cognitive map was drawn based on the main factors that are proven by the reviewed literature to have impact on attrition rates among nurses. The same factors are assumed to be valid for midwives as well.

3.3. Difficulties in Forecasting and Analysis of the Health Care Workforce. Research Limitations

A number of difficulties exist with respect to health care workforce planning, including nursing and midwifery. First of all, there are many uncertainties related to factors impacting the demand and supply of workers in the health care sector. In addition, the time required for new nurses to be trained is relatively long which makes planning even more difficult and related to high level of inaccuracy as new joiners are difficult to predict. Moreover, significant issues occur with respect to data availability and accuracy, mainly caused by decentralisation of the data warehouses and lack of unification of the health care terminology. Last but not least, various skills are required for workforce planning, for example, knowledge of economics and econometrics, as well as thorough understanding of the health care system. (Curson et al. 2010)

In addition to the common difficulties regarding conducting an analysis on the health care workforce, a number of specific limitations exist with respect to this particular research. Since the data provided by the HSC IC is yearly, it was impossible to analyse seasonality. Also, the data contains only NHS staff so that no employees working outside the NHS are considered. Furthermore, due to the length of the analysed period, no adequate forecast of future attrition rate could be performed, neither any firm trends, with respect to temporary attrition and characteristics of returners, could be identified.

3.4. Assumptions

Certain assumptions were made with respect to the specific features and limitations of the available data. As already mentioned in Chapter 1, people under 54 years of age are referred to as 'young'. This assumption is based on the commonly accepted good practices in this research field (CfWI nomenclature). Since no information regarding the reason for leaving the workforce is available, all employees over 54 years of age that are recorded as leavers are considered as retired. For the rest of the leavers, no evidence-based reasons for attrition could be suggested - they may have left the workforce voluntarily, they have been made redundant or their employment may have been terminated for any other reason.

This work assumes that the attrition rate recorded during the four-year period will maintain its level. This assumption is based on the fact that the percentage of the leavers is relatively flat over time. Moreover, as previously discussed, due to the short period that data is available for, no evidence grounded forecast regarding potential future number of leavers could be performed. Thus, predicting future levels of attrition is not an objective of this work.

The rate of leavers from the workforce is computed separately for each of the years. The case when an employee left in one of the years, returned to the workforce or their workplace and left the workforce or the workplace again was not taken into consideration. Such an employee is considered as a leaver in both years. Otherwise, the preliminary and the statistical analyses would become unnecessarily complicated. Moreover, the percentage of people who left the workforce and returned temporarily was less than 1% of the 'young' leavers and represent an insignificant proportion of the workforce.

Midwives are divided into two main groups, permanent and temporary leavers, according to whether they returned to the profession, rejoined the manpower under another code or left the NHS workforce and were not recorded again in the dataset. Permanent leavers are those who left the workforce and did not return during the analysed period. As permanent leavers are also considered midwives who left the profession and returned temporarily, after which left again and were not present in the 2012 dataset. Temporary leavers are those who returned to midwifery or changed their occupation code before or in 2012. In both cases, the leavers should be present in 2012 in order to fall in this group. Both groups are considered in the quantitative analysis. Permanent leavers are not examined separately due to their absolute numbers, which would lead to obtaining statistically insignificant results. It is assumed that both groups had the same motives to leave the workforce regardless of whether they left permanently or temporarily. In addition, some main aspects of the temporary leavers (returners) are analysed. The assumptions are summarised in Figure 5.

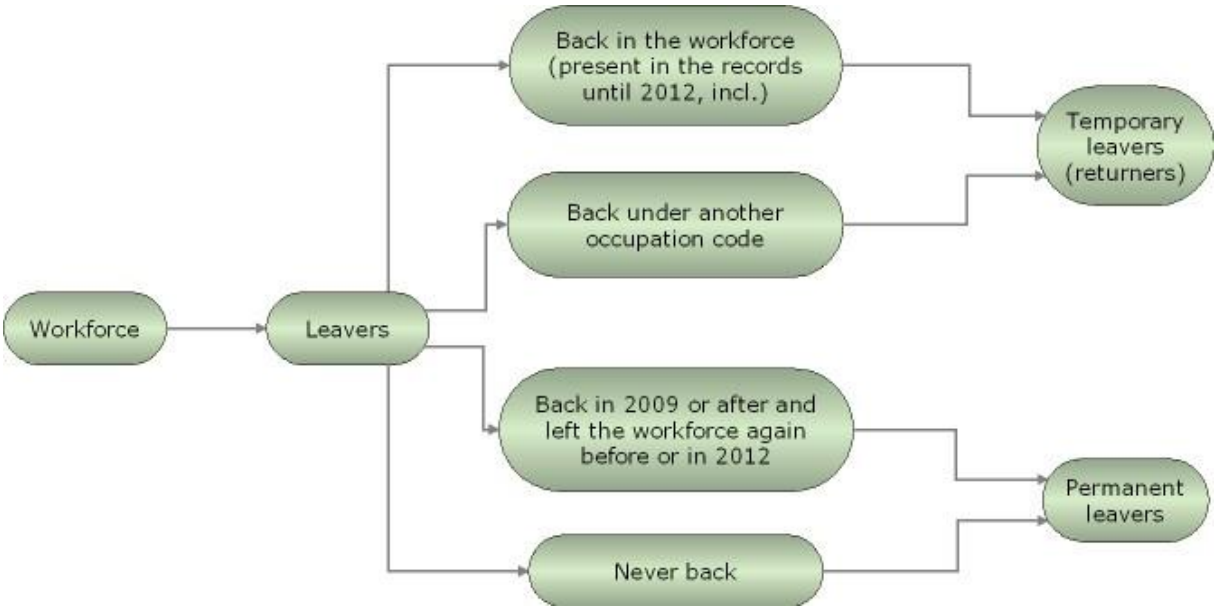


Figure 5 Assumption Diagram

The descriptive analysis of the returners to the workforce, presented in Chapter 4, Section 4.8 in this work, is based on comparisons between the data applicable to the personal NHS identifiers in the year of leaving and the identifiers in 2012. Changes in the factors in intermediate years are not taken into consideration.

Chapter 4 Preliminary Analysis

Descriptive statistics of the midwifery workforce is presented in the first part of this chapter. It is followed by general and detailed analysis of the 'young' leavers by gender, SHA, age, AfC band and FTE. The last part of the chapter presents analysis of the 'young' returners.

4.1. Midwifery Workforce - Descriptive Statistics

Descriptive statistics of the full dataset, which depicts the scale of the problem, are presented in the Table 1.

	All Midwives (HC)	All Leavers (HC)	All Leavers / All Midwives (%)	'Young' Workforce (HC)	'Young' Leavers (HC)	'Young' Leavers / 'Young' Workforce (%)
Average	24,509	1,859	7.68	21,675	1,392	6.49
Min	23,173	1,741	7.36	20,684	1,341	6.16
Max	25,719	1,953	7.92	22,593	1,437	6.87
Range	2,546	212	0.55	1,909	96	0.71

Table 1 Entire Midwifery Workforce vs Leavers – Descriptive Statistics

The general statistics regarding the age in the whole dataset, including midwives at the age of 55 or older, is presented below:

AGE	March 2008	March 2009	March 2010	March 2011	March 2012
Average	43	43	43	43	43
Mode	43	44	45	46	47
Median	43	43	44	44	44
Minimum	21	21	21	20	21
Maximum	70	71	72	73	74
Range	49	50	51	53	53
Standard Deviation	9.64	9.81	9.96	10.15	10.35

Table 2 Entire Midwifery Workforce - Age Statistics

The information regarding age in the available dataset is divided among the following bins: ‘under 25’, ‘25 to 34’, ‘35 to 44’, ‘45 to 54’, ‘55 to 64’, and ‘over 65’. The distribution of the number of midwives by age categories resembles normal distribution as shown in Figure 6 below.

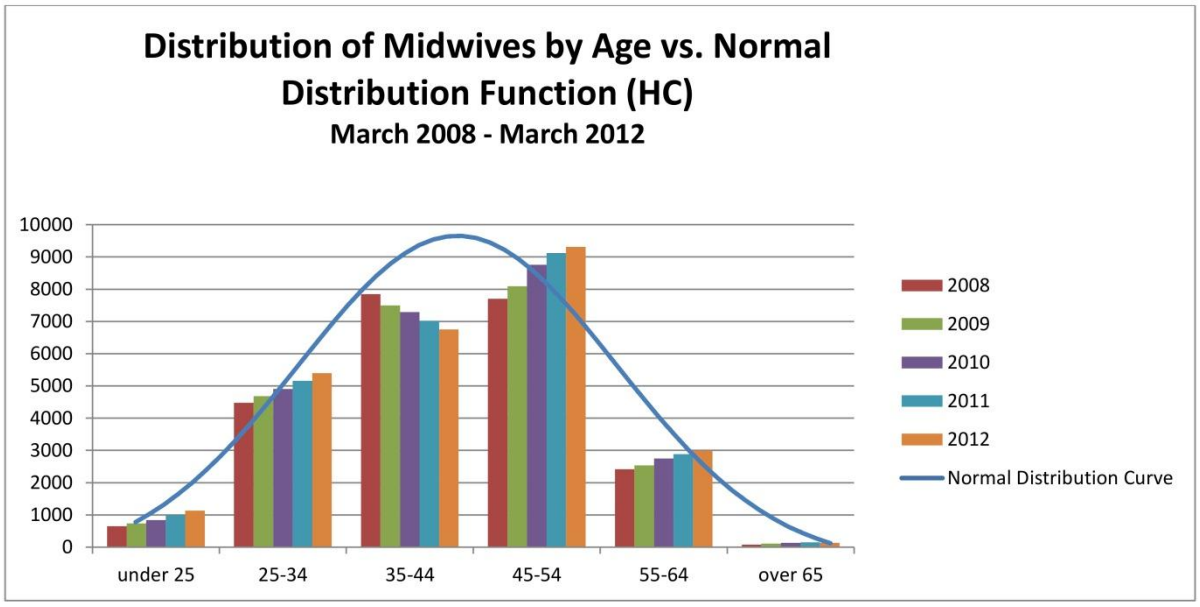


Figure 6 Distribution of Midwives vs. Normal Distribution Function – by Age (HC)

Descriptive statistics regarding the age of the ‘young’ workforce is presented in the table below:

AGE	March 2008	March 2009	March 2010	March 2011	March 2012
Average	41	41	41	41	41
Mode	43	44	45	46	47
Median	42	42	42	42	42
Minimum	21	21	21	20	21
Maximum	54	54	54	54	54
Range	33	33	33	34	33
Standard Deviation	8.30	8.47	8.60	8.80	9.04

Table 3 'Young' Midwifery Workforce – Age Statistics

4.2. 'Young' Leavers – General Information

Summarised information regarding the 'young' leavers from the 'young' midwifery workforce is presented in the figure below.

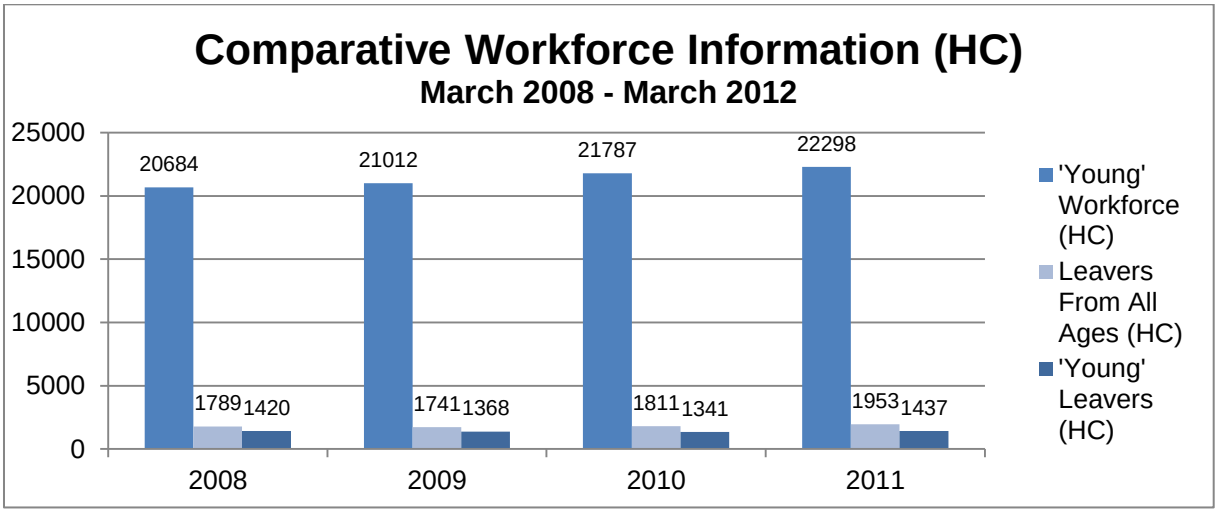


Figure 7 Comparative Workforce Information (HC)

The table below presents the number of 'young' leavers in percentages versus the 'young' workforce and the number of all leavers for the four-year period.

Period	'Young' Leavers vs. 'Young' Workforce (%)	'Young' leavers vs. Total Number of Leavers (%)
03/2008-03/2009	6.87	79.37
03/2009- 03/2010	6.51	78.58
03/2010- 03/2011	6.16	74.05
03/2011- 03/2012	6.44	73.58

Table 4 'Young' Leavers vs. 'Young' Workforce and Total Number of Leavers

The rates of 'young' leavers in the table above are computed by using the following formulas:

$$\text{Rate of Leavers } (\%) = \frac{\text{Number of 'Young' Leavers}}{\text{'Young' Workforce}} \times 100\ \%$$

Equation 1 'Young' Leavers vs. 'Young' Workforce

$$\text{Rate of Leavers (\%)} = \frac{\text{Number of 'Young' Leavers}}{\text{Total Number of Leavers}} \times 100\ \%$$

Equation 2 'Young' Leavers vs. Total Number of Leavers

The percentage of the 'young' leavers out of the workforce varies from 6.16% to 6.87% through the four-year period, which is within a range of less than 1%. Thus, it can be concluded that the percentage of 'young' leavers is relatively constant over the analysed period, which is one of the main assumptions determining the analysis methodology. Since the rate of 'young' leavers is almost constant during the analysed period, it can be concluded that there are firm trends caused by factors influencing the workforce. This work attempts to identify these factors among the available data. Thus, the possible reasons for more than 73% of the midwives to leave the workforce could be explained and possibly avoided in future.

In the rest of this chapter, the 'young' leavers are examined according to gender, SHA, age, AfC band, and FTE. Each of the variables is analysed separately. An analysis of the returners to the workforce is provided as well.

4.3. 'Young' Leavers – Analysis by Gender

The table below represents generic information regarding the analysis of 'young' leavers by gender.

Year	Workforce		Total Workforce	'Young' leavers		Total Number of 'Young' Leavers	Leavers of this gender / % /	
	Males	Females		Males	Females		Males	Females
2008	101	20,583	20,684	18	1,402	1,420	17.82	6.81
2009	95	20,917	21,012	11	1,357	1,368	11.58	6.49
2010	99	21,688	21,787	14	1,327	1,341	14.14	6.12
2011	95	22,203	22,298	9	1,428	1,437	9.47	6.43

Table 5 Gender of 'Young' Leavers – Numbers and Percentages

The number of women who leave the workforce is relatively constant, varying within a one percentage range. It can be also clearly seen that the number of males who

leave the midwifery workforce before retirement age is not considerable compared to the number of women who leave the workforce due to the fact that the profession of a midwife is dominated by women. Nevertheless, the figures presented as percentages of the workforce with respect to the particular gender are more concerning. The percentage of male leavers out of the male workforce is considerably higher compared to the same percentage of women leaving the midwifery.

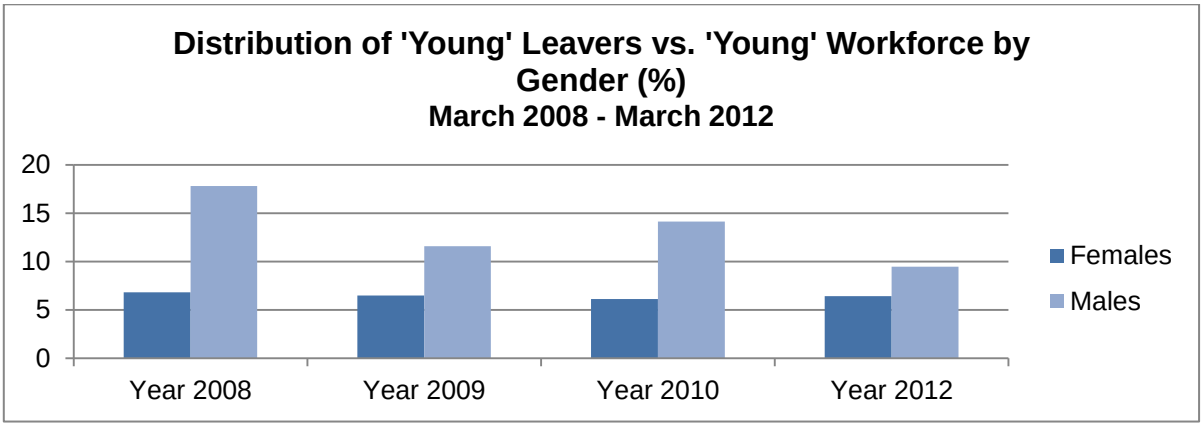


Figure 8 Distribution of 'Young' Leavers vs. 'Young' Workforce by Gender (%)

It can be concluded that if the factors impacting the attrition rate among men do not change, investing financial resources in education and qualification of men in the profession of a midwife would lead to an approximate average 13% loss of the invested amount.

4.4. 'Young' Leavers – Analysis by SHA

The distribution of the number of 'young' leavers by SHAs was analysed.

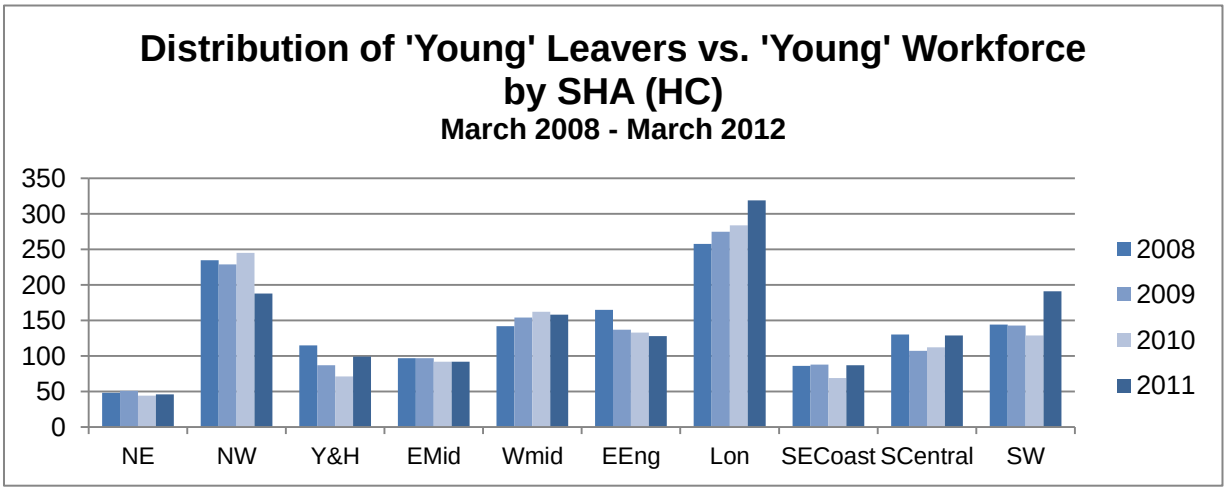


Figure 9 Distribution of 'Young' Leavers vs. 'Young' Workforce by SHA (HC)

The highest numbers of leavers over the whole period are in North West and London SHAs. This can be explained by the fact that those are two of the most populated authorities and the authorities where the highest number of midwives is employed. That is why the figures are recalculated in average percentages, in order to create a more objective picture of the rate of leavers.

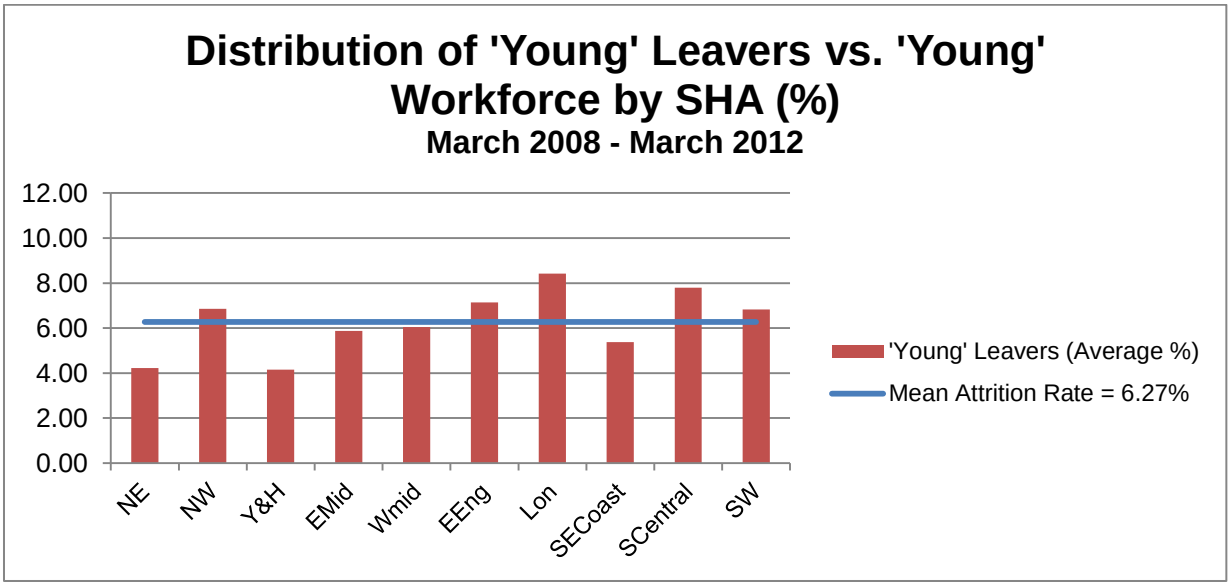


Figure 10 Distribution of 'Young' Leavers vs. 'Young' Workforce by SHA (%)

After excluding the influence of the size of the SHAs, the trend still exists only for the London SHA, where the average percentage of 'young' leavers, 8.43%, is above the average for England, 6.27%. In addition, another noticeable trend emerged with respect to the South Central SHA, where the attrition rate over the four-year period is 7.80%. Those trends could be explained by the intensity of the work in these trusts, which is probably relatively higher compared to organisations situated in other less populated regions. The attrition may also be a result of a personal choice to change the place where young professionals live after finishing their professional training or may be due to the culture of changing employers. The authorities where the attrition rate is at the lowest levels are the North East SHA, which is the one less populated, and the Yorkshire and the Humber SHA, 4.22% and 4.16%, respectively.

4.5. 'Young' Leavers – Analysis by Age

The distribution of 'young' leavers resembles clipped normal distribution due to the absence of the last two age bins – '55 to 65' and 'over 65', as shown in the graph below.

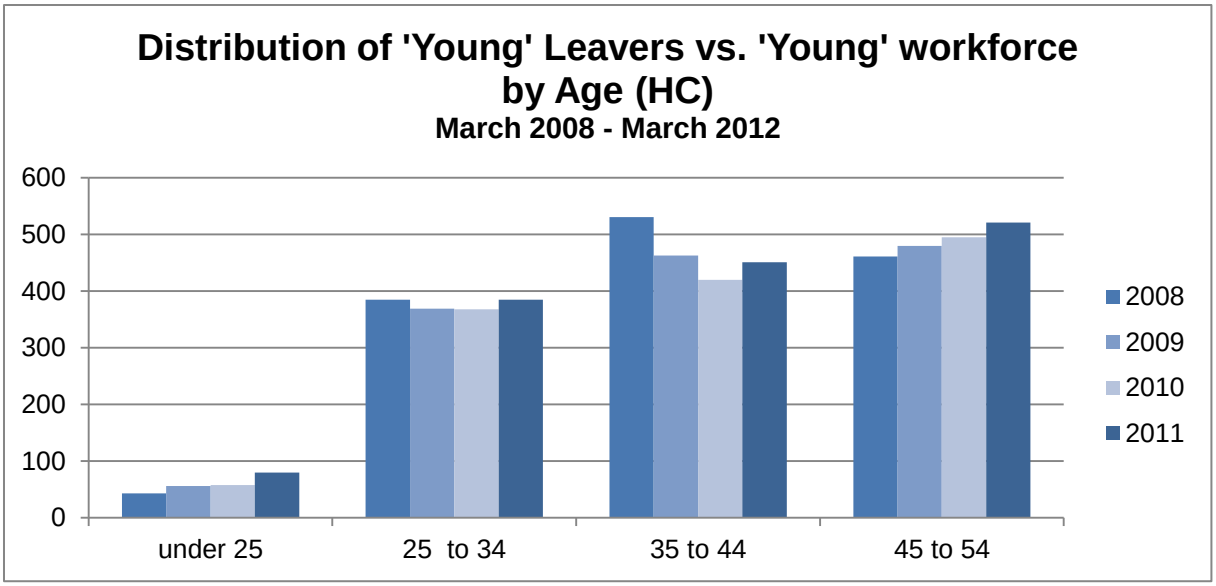


Figure 11 Distribution of 'Young' Leavers vs. 'Young' Workforce by Age (HC)

However, the figures represented in percentages are relatively flat, ranging from 5.65% to 8.59%. The highest values are observed with respect to the youngest, those at or under 34 years of age, as shown in the bar chart below.

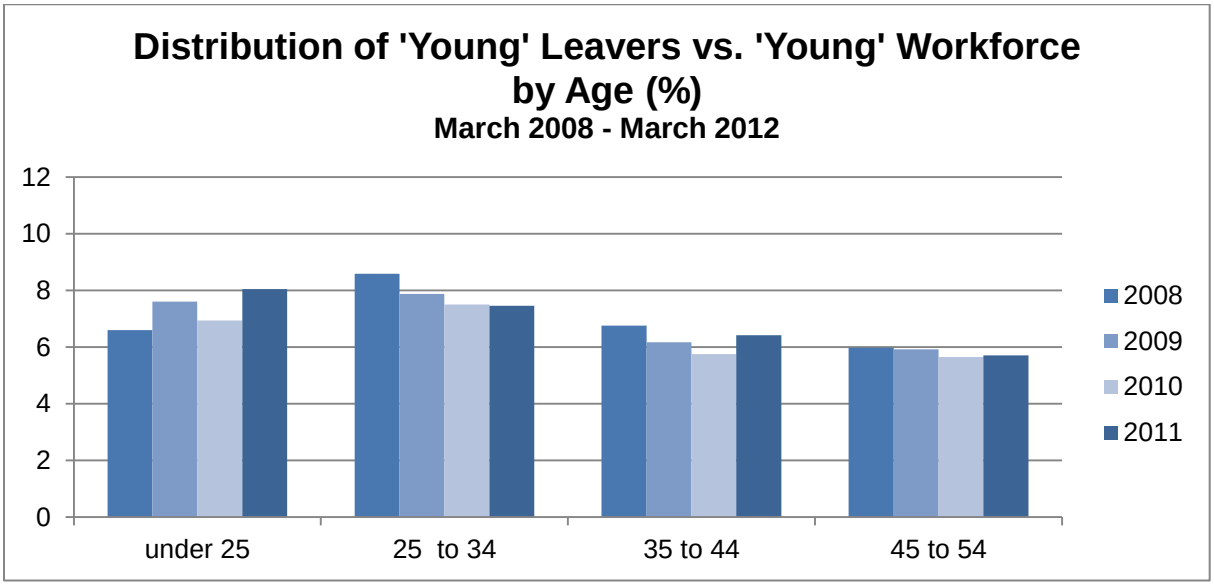


Figure 12 Distribution of 'Young' Leavers vs. 'Young' Workforce by Age (%)

Figure 12 suggests that age will not be strongly related to the attrition rate in the further statistical analysis, since the percentages are relatively flat.

Descriptive statistics regarding the age of the 'young' leavers data set is presented in the table below:

AGE	2008	2009	2010	2011
Average	40	40	41	40
Mode	54	54	54	54
Median	40	40	41	40
Minimum	21	21	21	21
Maximum	54	54	54	54
Range	33	33	33	33
Standard Deviation	8.63	8.99	9.14	9.36

Table 6 'Young' Leavers - Descriptive Statistics - Age

4.6. 'Young' Leavers – Analysis by AfC Band

A general analysis of the salary rates on a national level was conducted in order for the reader to receive a comprehension of the overall average salary bands. The results show that over the analysed period the average level of the salary bands varies between £22,992 and £86,970 Average values were used to recognise trends and patterns. Increases in the payment bands were recorded in 2009 and 2010 compared to the previous years, in the range from 2.25% to 2.93%. In 2011 there was an insignificant increase (less than 0.15%) in the salaries for AfC bands 5 and 6. As for AfC bands from 7 to 9, no change was recorded. No change in the payment level was recorded in 2012 compared to 2011. In addition, the absolute average amount by which the salaries were changed is in the range from approximately £1,296 to £3,908 It can be concluded that the change in salary bands is insignificant and may be a reason for midwives to consider leaving the workforce. More detailed information as well as a graph showing the change in salary levels over the period between April 2008 and April 2012 are presented in Appendix 2.

The largest proportion of the 'young' leavers is salaried at band 6 – between 66% and 72%, as shown in Figure 13.

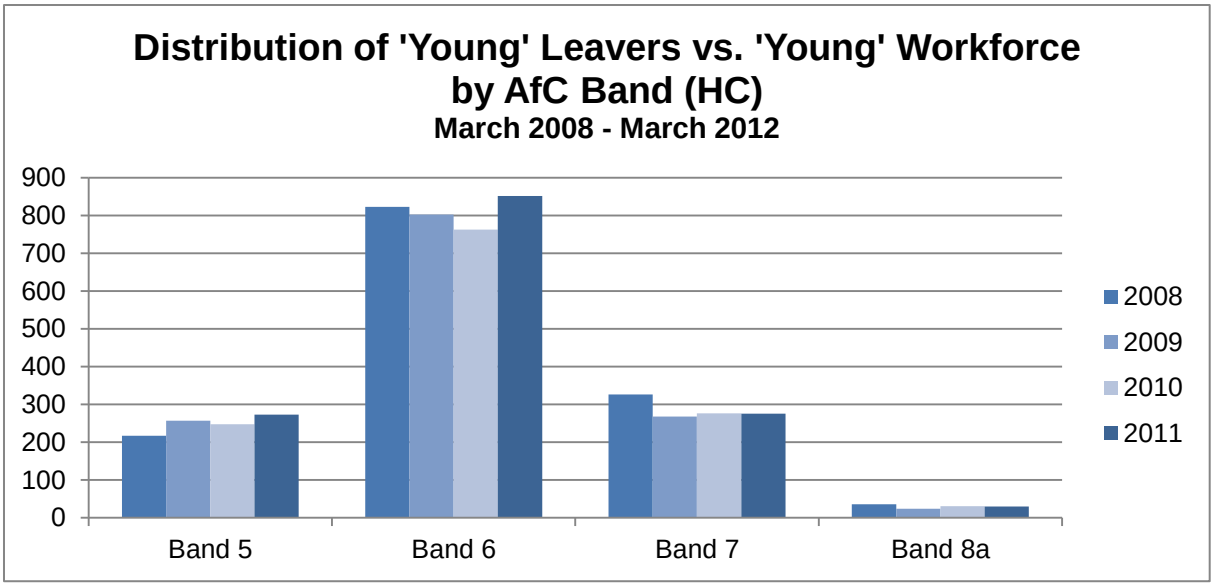


Figure 13 Distribution of 'Young' Leavers vs. 'Young' Workforce by AfC Band (HC)

However, the figures presented in percentages show a different distribution, as shown in Figure 14. Between 18% and 29% of the 'young' workforce who are salaried at Band 8a leave the workforce, followed by those at Band 5 - from 11% to 14%. Only between 5% and 7% of the midwives salaried at Bands 6 and 7 leave the workforce before reaching retirement age.

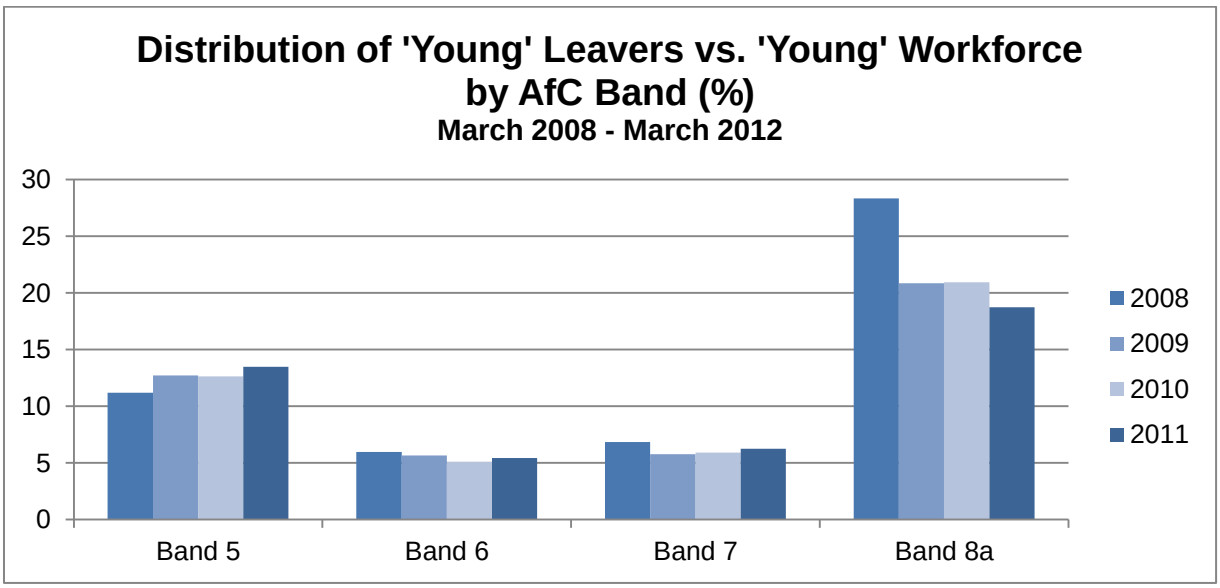


Figure 14 Distribution of 'Young' Leavers vs 'Young' Workforce by AfC Band (%)

From observing Figure 14 it can be suggested that there is a quadratic relationship between the salary band and the rate of leavers. This is consistent with the results obtained by the polynomial regression model later in this work.

4.7. 'Young' Leavers – Analysis by FTE

The figure below presents the distribution of the number of 'young' leavers by FTE during the researched period. The data is categorized in the following bins: '0 to 0.19', '0.2 to 0.39', '0.4 to 0.59', '0.6 to 0.79', '0.8 to 0.99', and 'Full Time'.

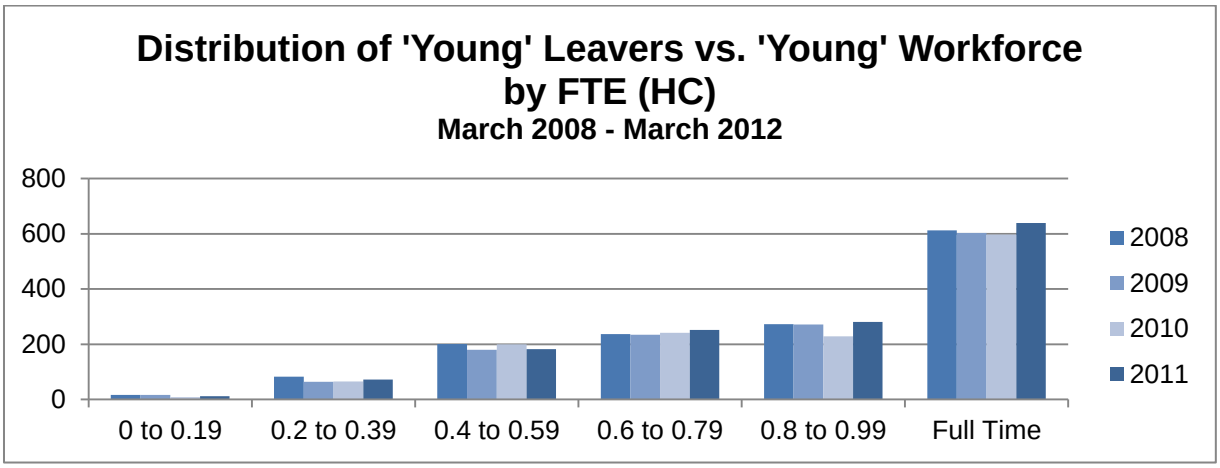


Figure 15 Distribution of 'Young' Leavers vs. 'Young' Workforce by FTE (HC)

The results show that the leavers are inclining as the working hours increase. This may be due to the number of midwives working in each of the bins. That is why, in Figure 16, the distribution is shown with respect to the size of the workforce in the bins.

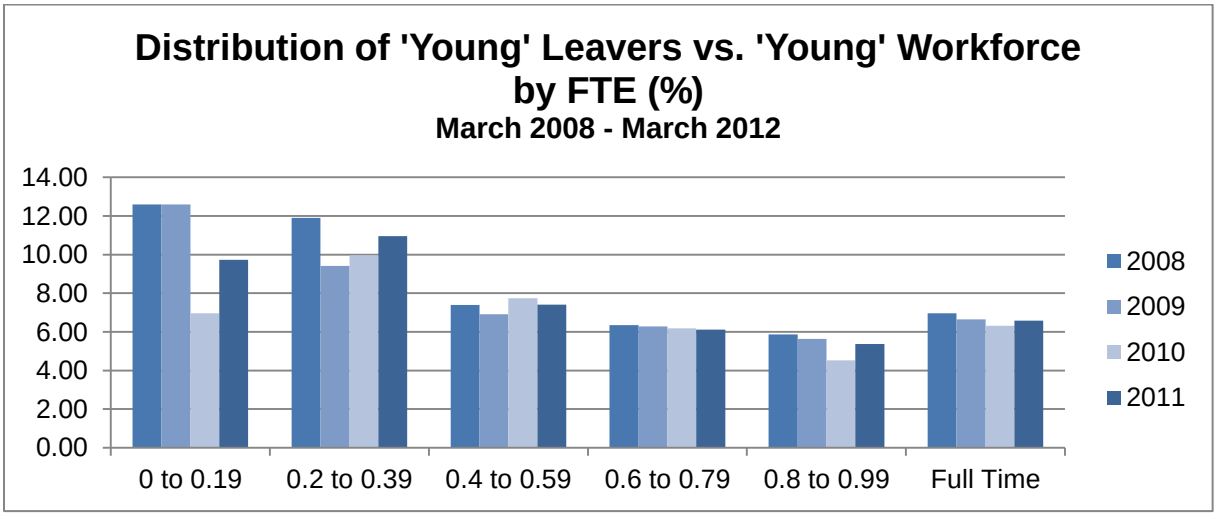


Figure 16 Distribution of 'Young' Leavers vs. 'Young' Workforce by FTE (%)

As expected, there is a considerable difference between the distribution of the head count and the percentage values. From Figure 16 it can be assumed that there is a

non-linear declining trend with respect to the attrition rate. This relationship will be examined in the statistical analysis.

4.8. 'Young' Returners

Further investigation was conducted in order to identify midwives who returned to the midwifery or the nursing workforce. The table below summarises the information regarding midwives who returned to midwifery.

Period	'Young' Leavers (HC)	Leavers in the Years When Recorded Back in the Dataset (HC)								Permanently Back to Midwifery	
		2009	2010	2011	2012	2010 & 2011	2010 & 2012	2010, 2011 & 2012	2011 & 2012	HC	% of 'Young' Leavers
03/2008 – 03/2009	1,420	0	24	12	47	11	2	147	67	263	18.52
03/2009 – 03/2010	1,368	-	0	28	77	0	0	0	193	270	19.74
03/2010 – 03/2011	1,341	-	-	0	184	-	-	-	0	184	13.72
03/2011 – 03/2012	1,437	-	-	-	0	-	-	-	-	0	0

Table 7 Returners to Midwifery by Years – Numbers and Percentages of 'Young' Leavers

Between 14% and 20% of the 'young' leavers returned to the midwifery profession within the four-year period, presumably permanently. From the conducted analysis it can be concluded that none of the 'young' leavers came back to the midwifery in the year following the one they left. From the information in the table above it can be suggested that the number of midwives who return to the profession only for a period of one year increases over time. However, it has to be taken into consideration that the available data covers a period of only four years, which does not provide an opportunity for observing firm patterns in time. For those who returned in 2012, it cannot be claimed whether they will remain in the workforce or they will leave and if

yes, when. Further information regarding changed employment parameters of the returners to midwifery workforce is presented in the figure below.

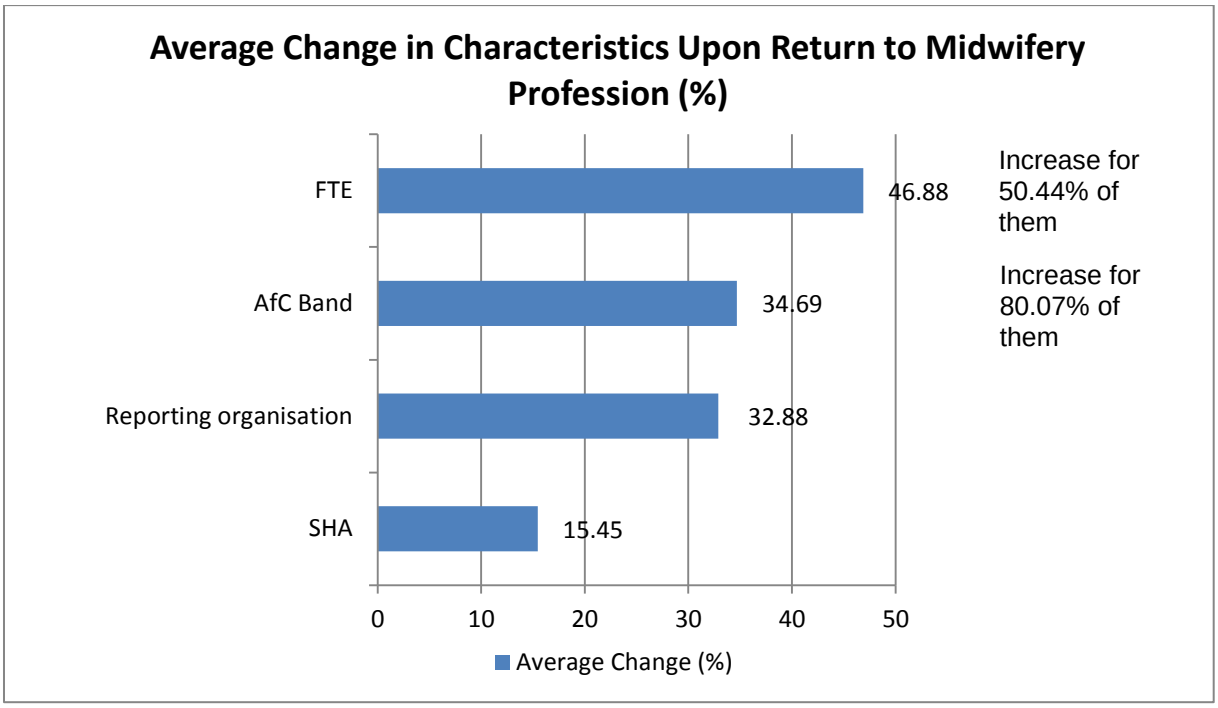


Figure 17 Change in the Characteristics Upon Return to Midwifery Profession

The results are obtained by comparison made between the year in which the midwife left the workforce and the year 2012. If the analysed employment characteristics could be interpreted as reasons for midwives to leave their workplace, the most common one is the working hours which were changed for nearly 47% of the people, on average, followed by the salary band, which was different for approximately 35% of the midwives upon their return. With respect to those whose salary band was changed, for just over 80% of them, the income is increased. Slightly over 50% of the employees worked more hours after they returned to the workforce. Almost 33% of the people started working in a different organisation upon their return. The smallest percentage of employees changed their location (SHA) – approximately 15%.

The table below shows information about the midwives who left the midwifery workforce in one of the analysed years and whether they returned to the NHS workforce under another occupation code or left the manpower.

Year of Leaving	Workforce	Number of 'Young' Leavers	Returned to Midwifery	Left Midwifery and:				Left Midwifery (HC)
				Never Came Back		Returned Under Other OCs		
				HC	% of 'Young' the Workforce	HC	% of the 'Young' Workforce	
2008	20,684	1,420	263	755	3.65	402	1.94	1,157
2009	21,012	1,368	270	720	3.43	378	1.80	1,098
2010	21,787	1,341	184	724	3.32	433	1.99	1,157
2011	22,298	1,437	0	965	4.33	472	2.12	1,437

Table 8 Returners to the NHS Workforce – Numbers and Percentages

The average percentage of people who left not only the midwifery profession but also the workforce over the four-year period that is analysed is nearly 3.7% of the workforce. The average percentage of people who returned to the workforce under different occupation codes is nearly 2% of the workforce, or just over 30% of all 'young' leavers. The percentage of the 'young' leavers who left and never came back to the workforce varies between 52% and 68% of the 'young' leavers, meaning that the probability for someone who left the midwifery workforce never to rejoin the manpower is more than 0.5.

The diagram below presents the percentages of 'young' leavers that returned to the nursing workforce. A table presenting more detailed information is shown in Appendix 3.

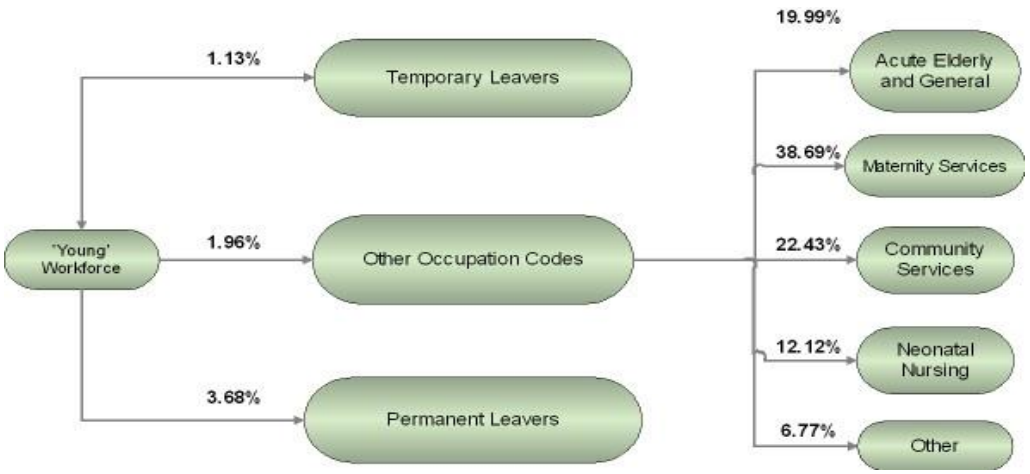


Figure 18 Temporary Leavers and Pernament Leavers (%)

The majority of the returners, nearly 39% on average for the whole period, started working in Maternity Services. Just below 20% of the ‘young’ leavers started working in Acute Elderly and General nursing and almost 23% - in Community Services. Slightly over 12% started working as neonatal nurses.

5. Statistical Analysis. Findings and Discussion

The current chapter will once again try to capture the existing relationships in the data by means of well-established and commonly accepted mathematical regression techniques. The methods that were applied are logistic regression, followed by linear multivariate regression and polynomial multivariate regression. A P-value of less than 0.05 is considered as statistically significant for each of the models. The analysis was performed in a statistical software package Minitab 16. Interpretation of the main results is presented in this section.

5.1. Logistic Regression

The data was pre-processed in order for a binary logistic regression analysis to be conducted. The information for the period between March 2008 and March 2011 was combined in one data set which was used as a training set. The information for the last available year was used as a validation dataset. Next, the 'full' model containing all variables, namely, SHA, gender, AfC band, FTE, and age, was run. The actual values of the categorical variables, SHA, AfC band, and gender, were replaced with integers starting from 1 and increasing up to the number of categories for each variable. The values were assigned based on the percentages of leavers in each category, with 1 for the lowest percentage and increasing towards the highest percentage. The values for the continuous variables, FTE and age, were divided in bins, for which values were assigned based on the same criteria as those used for the categorical variables (see Appendix 4). The binary dependent variable (denoted by Y) is the historical data regarding whether an employee left the workforce or not. 'Young' leavers are denoted by 1 (the event) and the non-leavers are denoted by 0. The detailed report provided by the statistical software package is presented in Appendix 5.

The odds ratios are easily interpreted for gender which is the only indicator variable in the model. The value of 2.01 provides evidence for the results obtained by the preliminary analysis, that the average probability of a male to leave the workforce is twice as high as the probability of a female to be a leaver. Gender has also the highest coefficient of just below 0.7, meaning that it influences the outcome the most. The low P-values of the coefficients indicate that there is a statistical relationship between the predictors and the outcome, which is also confirmed by the computed

low P-value of the model, indicating the influence of at least one predictor on the dependent variable. However, the low values of Somer's D, Goodman-Kruskal Gamma and Kendall's Tau-a measures, due to the relatively low percentage of concordant pairs, show that the predictive power of the model is low. Minitab 16 provides results from three goodness-of-fit tests – Pearson's, Deviance, and Hosmer-Lemeshow. The low P-values of the goodness-of-fit tests indicate that the model does not fit the data well.

Outlier detection was conducted by plotting Delta-beta (standardized) versus probabilities. The scatterplot is presented in Appendix 5. Almost no outliers were detected, which indicates that the low predictive ability of the model is not due to the presence of outliers. In order for the performance of the model to be improved, variables which are not strongly correlated to the outcome may be excluded. Due to the fact that all P-values reported for the predictors were 0, the criterion for exclusion of variables that was used was the coefficients and the odds ratios value. The variable with the lowest coefficient is the SHA code (0.07) and it is removed from the further analysis. The odds ratio of 1.07 is very close to 1, which is another reason for its removal. After excluding location from the predictors, the P-values of the goodness-of-fit tests are all equal to 0, and the Somers' D, Goodman-Kruskal Gamma and Kendall's Tau-a values are lower compared to the 'full' model. The model continues to deteriorate its performance if other variables with low coefficients, namely, age and FTE, are excluded. The full reports are presented in Appendices 6, 7 and 8. It can be concluded that reducing the number of the predictors does not lead to a higher performance model.

The results obtained by the 'full' model are validated. The procedure includes the calculation of z-values using the coefficients obtained by the model and the data from 2011. The values were substituted in the following equation:

$$z = -4.89 + 0.07SHA + 0.7Gender + 0.36AfC\ Band + 0.13FTE + 0.01Age$$

Equation 3 Logistic Regression

All z-values were negative. The figures were then used in order for probabilities of an event (Y=1) occurring to be estimated with the help of the logistic function. The logistic function is presented below:

$$P(Y = 1) = \frac{\exp(z)}{1 + \exp(z)}$$

Equation 4 Logistic Function

All probabilities that were computed were below 0.5. The model predicted all midwives would be non-leavers. This means that the model captures the trend that the majority of employees (above 93%) are non-leavers. However, it cannot distinguish between leavers and non-leavers based on the available predictors. Thus, the conclusion that the model does not have predictive power can be confirmed.

5.2. Multivariate Linear Regression

The next method that was applied is multivariate linear regression. The variables that were included in the model are FTE, age, and AfC band. The dataset is pre-processed in order for multivariate regression models to be built. The independent variables were divided in bins – FTE from 1 to 6, Age from 1 to 4, and AfC bands – from 1 to 4. For a detailed list of the categories please see Appendix 9. All possible combinations of those factors have been listed and the midwives were categorized according to the bins which are relevant to them. As a result, 96 categories were created. All leavers were categorised into these groups irrespective of whether they returned to the workforce, the profession, or left the datasets permanently. The same categorisation was conducted with respect to the 'young' workforce dataset for the whole period analysed. The information for all years was combined, and attrition rates were calculated for each of the categories. The aim of building a regression model with such a stricture is for significant relationships between the independent variables and the attrition rate to be identified. The exclusion of gender from the list of predictors is based on the fact that the number of males in the 'young' workforce as well as the number of men who left the workforce was low and was not a representative sample. SHA was excluded as well since the available data was insufficient for another variable to be included. If both variables were not excluded, the number of categories that were created would be 1,920. Considering the number of leavers in each of the years, not all categories would contain a realisation, some

may contain just a few, and the majority, if not all, would not be representative samples.

Due to the insufficient amount of data, additional pre-processing was conducted. All categories with missing data or in which less than 20 people were recorded in the workforce dataset (at least 20 people working in this category), were removed. Also, only AfC bands from 5 to 8a were included in the regression analysis. In this way, extreme observations will be reduced and the accuracy of the results is expected to be improved. As a result of accepting these assumptions, between 1.2% and 2.7% of the 'young' leavers and between 11.7% and 12.5% of the overall workforce dataset were excluded. The remaining categories used for the regression model are 72. The linear equation obtained as a result from building the regression model is as follows:

$$\text{Percentage of Leavers} = 18.5 - 1.73\text{FTE} + 0.61\text{Age} - 0.40\text{AfC Band}$$

Equation 5 Multivariate Linear Regression - Equation

The complete statistical report is presented in Appendix 10. The R^2 value of 13.2% shows that the regression model has low predictive capability, which is also indicated by the low F-value of 3.44. The P-values for the age and AfC Band coefficients are greater than 0.05, meaning that these variables are not predictive. Although all categories with small number of people were deleted during the data pre-processing step, the statistical software detects unusual observations with large standardised residuals.

The standardised residuals vs. fits graph is presented in Appendix 10. The cluster under the zero line shows that the relationship between the predictors and the attrition rates is not linear. Therefore, a non-linear relationship should be examined.

5.3. Polynomial Multivariate Regression

Due to the aforementioned results, a multivariate polynomial regression model is built as it is believed that it could provide more statistically significant results in comparison to the two previously applied methods. The variables included in the regression model are the same as in the multivariate linear regression discussed above but second degrees of the variables are introduced as well. A second degree polynomial equation obtained during the regression is as follows:

$$\text{Attrition Rate}=62.1-8.69FTE+0.88FTE^2-1.75Age+0.25Age^2-$$
$$-29.5AfC\ Band+6.17AfC\ Band^2$$

Equation 6 Multivariate Second Degree Polynomial Regression - Equation

The detailed report obtained by the statistical software package is presented below:

```
Leavers = 62,1 - 8,69 FTE - 1,75 AGE - 29,5 AfC + 0,875 FTE^2 + 0,250 AGE^2
          + 6,17 AfC^2


Predictor      Coef  SE Coef      T      P
Constant     62,082    6,321   9,82  0,000
FTE          -8,687    1,910  -4,55  0,000
AGE          -1,753    3,371  -0,52  0,605
AfC         -29,480    3,083  -9,56  0,000
FTE^2        0,8752   0,2538   3,45  0,001
AGE^2        0,2504   0,6287   0,40  0,692
AfC^2        6,1671   0,6392   9,65  0,000


S = 5,11593   R-Sq = 66,1%   R-Sq(adj) = 62,9%


Analysis of Variance

Source           DF       SS      MS      F      P
Regression        6  3313,88  552,31  21,10  0,000
Residual Error   65  1701,23   26,17
Total            71  5015,11


Source  DF   Seq SS
FTE      1   629,09
AGE      1    19,99
AfC      1    11,12
FTE^2    1   214,02
AGE^2    1     3,24
AfC^2    1  2436,42


Unusual Observations

Obs    FTE  Leavers     Fit  SE Fit  Residual  St Resid
  7  1,00    6,250  18,330   1,907   -12,080     -2,54R
  9  2,00   25,000  12,415   1,818    12,585      2,63R
 16  2,00   33,333  21,891   1,524    11,443      2,34R
 19  2,00   40,000  25,958   1,892    14,042      2,95R
 60  6,00   20,000   7,028   1,977    12,972      2,75R

R denotes an observation with a large standardized residual.
```

Table 9 Polynomial Multivariate Regression – Minitab 16 Report

The R^2 value of 66.1% is evidence of the high predictive power of the polynomial regression model. The F-value for the model is also higher compared to the one of the linear regression model, namely, 21.1. The significance of the individual predictors is investigated and their effect on attrition as suggested by the polynomial model is compared to the statistical description provided in Chapter 4. First of all, it

should be noted that the data for age, represented in the model by the values of ‘Age’ and ‘Age^2’, does not seem to have any statistical significance. The P-values for both 'Age' and 'Age^2' are much higher than 0.05, and the T-values are much smaller than 1.96 in terms of absolute value. This means that they are not significant predictors. This result is consistent with the findings in Section 4.5, presented in Figure 12. Attrition rates are almost constant for all age values and thus they do not change with respect to this variable. Both ‘FTE’ and 'FTE^2' show statistical significance as their P-values are both below 0.05 and T-values are both above 1.96 in terms of absolute value. The coefficient in front of 'FTE^2' is positive but not very high in absolute value (0.8752). This suggests a certain convex curvature of the attrition rates with respect to the working time. The coefficient in front of 'FTE' is significantly stronger as it has a noticeably higher T-value and a noticeably higher absolute value (-8.687). This suggests that the attrition rates should be falling with the increase of this variable. A closer look at Figure 16 in Section 4.7 reveals exactly this trend, which is consistent with the results of the polynomial regression. The third predictor, 'AfC', seems to have the strongest influence on the number of leavers as suggested by the model's T-values and the coefficients' absolute values. The coefficient in front of 'AfC' is -29.480, which is significantly higher than the other ones. However, its negative influence on the attrition rates is compensated by the high coefficient in front of 'AfC'^2, namely 6.1671. The latter is likely to be responsible for the clearly convex shape of the attrition rates in Figure 14 in Section 4.6.

Most of the statistical tests indicate very good performance of the polynomial regression model. However, a carefull examination of the residuals shows that the assumption of heteroscedasticity, required for such models, is violated. Instead of having constant value over all realisations, the variance of the error increases noticeably as the values of the predicted variable increase. This leads to the funel-shaped plot depicted in Figure 19.

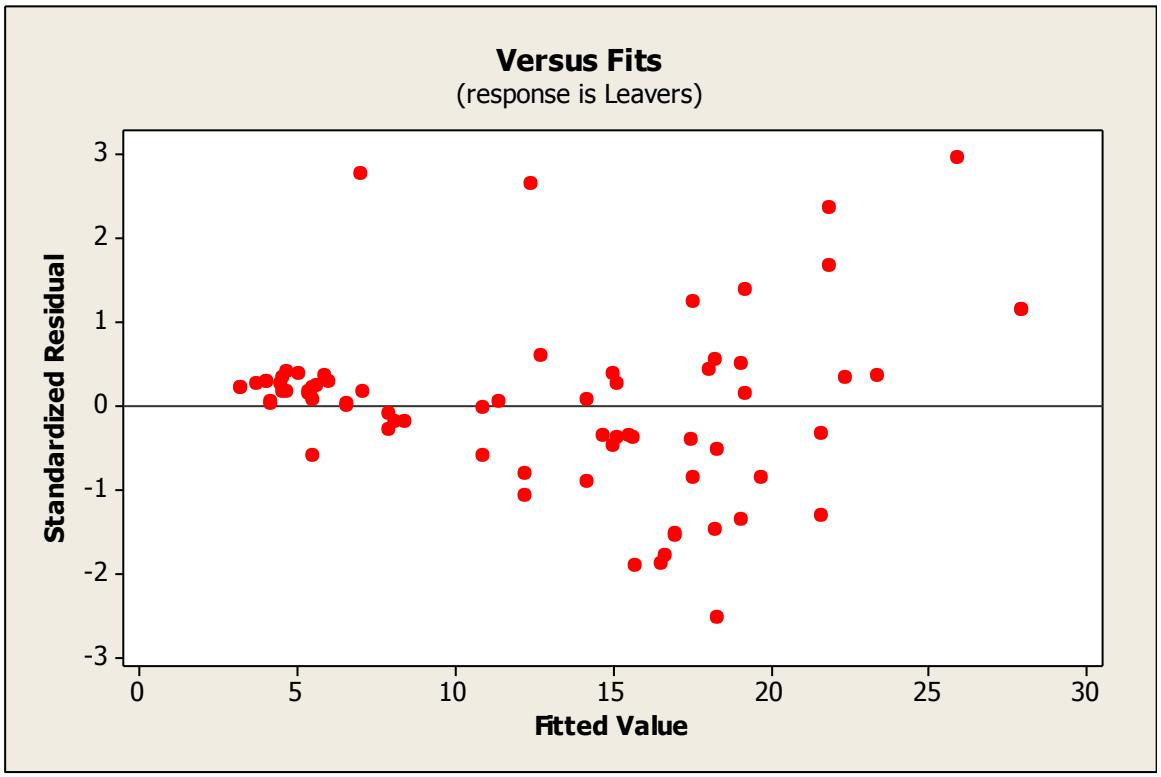


Figure 19 Standardised Residual vs Fits (Response is 'Young' Leavers Rate)

A standard approach towards better heteroscedasticity of the model is to pass the realisations of the predicted variable through a logarithm function such that they lie closer to each other. That often allows model curves to obtain a better fit. This approach was tested in an attempt to improve the heteroscedasticity of the model. The detailed report from Minitab 16 is presented Appendix 11. The relationships between the variables in the new polynomial regression are almost unchanged compared to the previous model. The significance levels of the coefficients stayed almost the same as well. Their absolute values were decreased due to the fact that the logarithm function decreases the absolute values of the realisations. The R^2 value increased by 7.1% to 73.2%, which is considerably higher than the value of 66.1% that was obtained by the previous model. In addition, the heteroscedasticity of the model has improved considerably as illustrated in Figure 20.

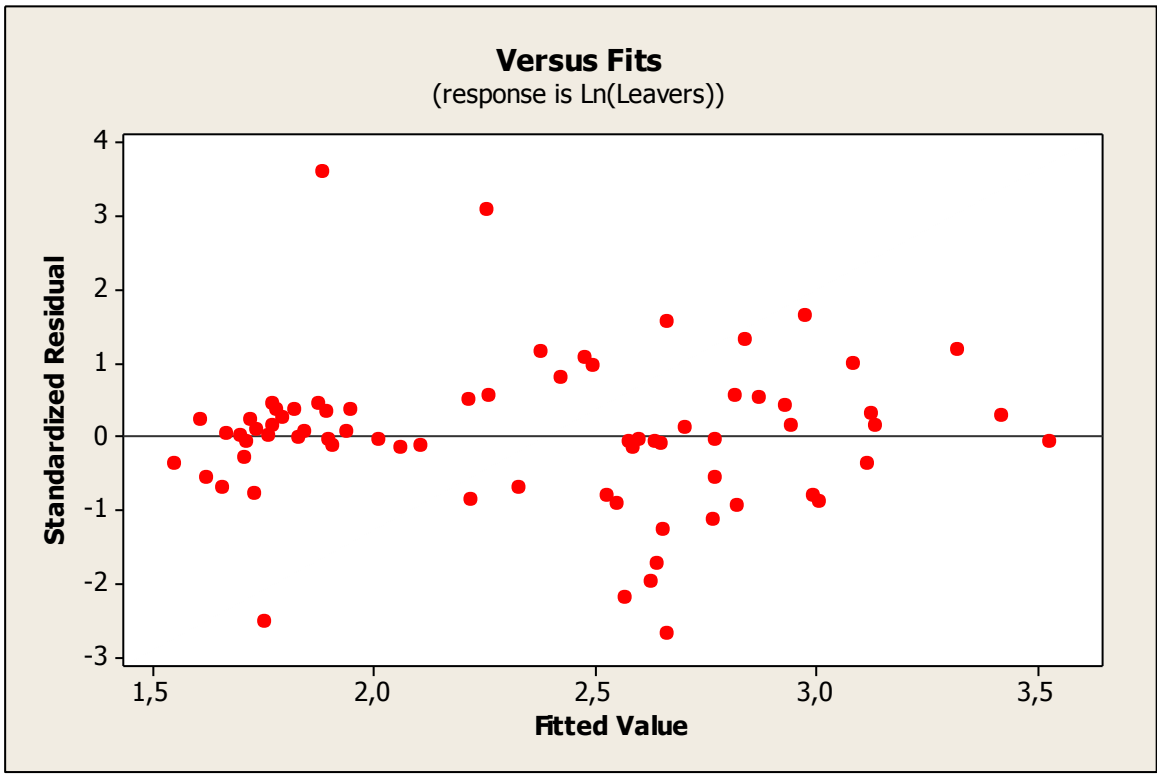


Figure 20 Standardised Residual vs Fits (Response is Ln('Young' Leavers Rate))

Higher order polynomial regression models were also considered, in particular, such of third and fourth degree. After introducing the variables raised to higher powers, the R^2 value did not improve considerably. Therefore, introducing higher order terms does not add much practical value to the model.

Chapter 6 Conclusions and Recommendations

The chapter defines the importance of the current research as well as the possible benefits of it. Final conclusions and recommendations are presented. They are followed by suggestions regarding further research on the nursing and midwifery workforce.

6.1. Conclusions

The conducted qualitative analysis suggested a number of factors that affect premature attrition rates. Some of the most significant of them influence the level of job satisfaction. The preliminary quantitative analysis suggested a non-linear relation between the salary level and the decision to leave. In addition, a negative relationship between the FTE and the attrition rate was observed.

The findings of the statistical analysis were consistent with the qualitative and the preliminary phases of the research. After comparing the results from all regression models, it can be concluded that the polynomial regression has the strongest predictive power. The relative predictive capability of the second degree polynomial regression is considered to be at a sufficient level, excluding the necessity of introducing higher power terms to the model. It was illustrated that the higher involvement in the working process and the steadier employment lead to lower attrition rates as suggested by different articles presented in the literature review. It was also suggested that there is an optimum salary level which leads to the highest retention rates. It is not clear as to why higher salaries might lead to higher attrition rates after a certain point. This is most probably related to other factors, such as stress, for which the salary could be a proxy variable. It may be suggested that after a certain point (Band 6), the increase in the salary level has a weaker effect than the accompanying negative factors, which leads to a decision to leave. The current study proves the necessity for further research on the attrition from the nursing and the midwifery workforces.

6.2. Recommendations

Based on the obtained results in the preliminary analysis, further work is recommended on gender-specific factors of attrition. The low number of males in the workforce at present should not be a reason for neglecting this aspect of the problem. If in future the number of men in the midwifery workforce increases, and the attrition

factors do not change, the overall number of ‘young’ leavers will increase more than two times. Therefore, the possible consequences of such attrition would become much more serious than at present.

Based on the analysis in this work, an alternative approach to the task could be suggested. With respect to data collection, conducting a survey, using interviews or questionnaires, among nurses and midwives may provide the researcher with valuable detailed information which once analysed may lead to obtaining more meaningful and significant results. A successful statistical approach for conducting an analysis could be binary logistic regression. In this case, the survey needs to cover a sample which includes leavers and non-leavers. Various types of information may be collected, for example, personal information: marital status, educational background, having children, etc., which could be used to determine the level of personal satisfaction. Also, detailed information about the professional life of the employees, for example, working environment aspects, work content, organisation of the work, empowerment, etc., could be used to determine the level of organisational satisfaction. The reason for collecting all this information is for the optimal combination of factors influencing the level of job satisfaction to be compiled. Job satisfaction is one of the most commonly used predictors for attrition or retention in the nursing workforce, when regression models are applied (Robinson et al. 2005, Spence Laschinger 2012, Bradley and Cartwright 2002). The method could be successfully applied to midwifery workforce as well.

In order for existence of seasonality to be proven and examined, the analysed data should be organised on a monthly or on a three-month basis. Also, studying potential long-term patterns and trends might be useful. In order for this to be achieved, the length of the period that is analysed should be longer than four years. A ten-year period is suggested to provide a reliable view on the variation of the attrition rates over time.

Since the problem is proven to be of great significance, a general approach could be undertaken. The conduction of a survey on a national scale would provide valuable information, which once analysed, could lead to a possible long-term permanent solution to the attrition problem in the nursing and midwifery professions. The

financial investment related to such an ambitious project should be carefully considered.

6.3. Further Research

The first part of this sub-section provides a suggestion of SD simulation as an approach to the problem. The second one contains analysis on returners to the workforce as an alternative point of view to the attrition issue. The last part of this sub-section addresses the international aspect of the problem as a possible field for further research.

6.3.1. System Dynamics Simulation

Simulation is a popular Operational Research tool for modeling organisational processes, human behaviour, and a variety of other complex issues in health care (Brailsford and Hilton 2001). According to the authors, it is flexible, deals well with variability, and provides an easily perceivable interface. “Most discrete event simulations are microscopic in their focus and involve considerable detail” (Pidd 2004), whereas “system dynamics is less concerned with detail… and focuses, instead, on the ways in which system structures affect system behavior” (Pidd 2004). Hence, the simulation technique that could be recommended for approaching the attrition issue in nursing and midwifery is System Dynamics. The results that were obtained by the current analysis may be applied in a SD model. The sample stock and flow diagram presented below could be a starting point for developing a simulation model.

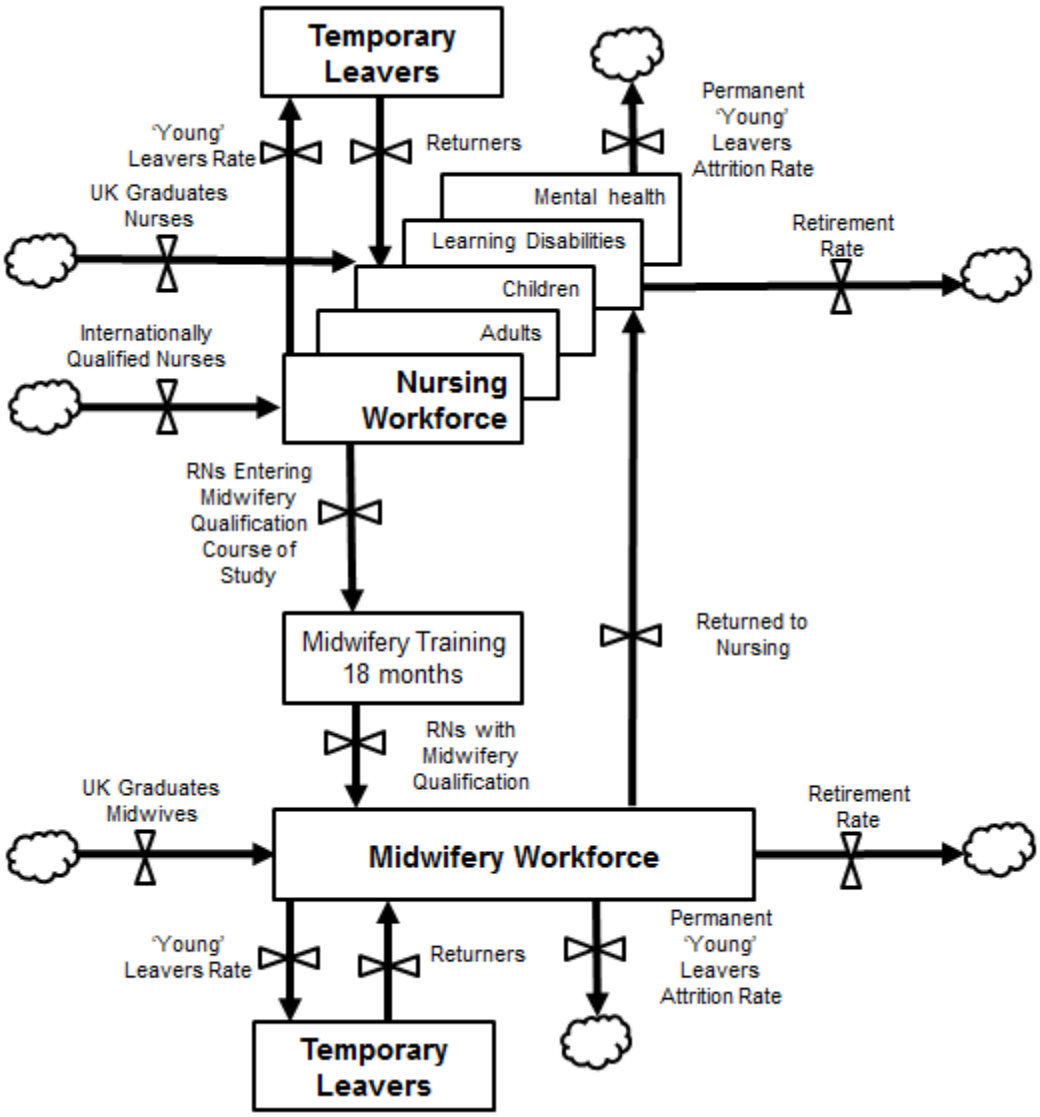


Figure 21 Nursing and Midwifery Workforce - Sample Stock and Flow Diagram

The model represents only the main flows in the system. It can be successfully combined with the cognitive map presented in Section 2.1 of this paper, which contains information regarding the influences of different factors on attrition rates. Different combinations of influences from the map could be applied to the flows which lead to the permanent 'young' leaver exits from the system.

Such a model could examine the impact of the change in the rate of 'young' leavers on the number of joiners in the system, namely, newly graduated nurses and midwives. It could also explore the transition of staff in the system, accounting for its effect on the size of the available workforce. The model is not further developed since it only aims to address an alternative approach to the attrition issue.

6.3.2. Returners Analysis. Multivariate Regression and Pearson's Correlation Coefficient Analysis

A subject of another study could be the main characteristics of the returners to the workforce. In this way, factors influencing the decision of one to return to their profession may be examined. That would be another point of view to the attrition issue, and it may have good potential for finding an approach to solving the problem with the high attrition rate among nurses and midwives.

In order to find out whether such research has potential using the current dataset, two linear multivariate and two polynomial regression models were built. The dependent variable is the rate of returners and the predictors are FTE and AfC bands. The rate of returners is computed using the following formula:

$$\text{Rate of Returners } (\%) = \frac{\text{Number of Returners}}{\text{Number of Leavers}} \times 100\ \%$$

Equation 7 Rate of Returners

The same values as for the regression analysis of the 'young' leavers were assigned to the predictors' bins and data matrices with all possible combinations of the variables were built. The data included in the analysis was taken from the corresponding year of leaving and the year 2012 since only midwives present in the 2012 dataset were considered as temporary leavers (returners). Age was excluded from the analysis due to the limited amount of available data on returners and the fact that it did not show statistical significance in the previous models.

The first model includes FTE in the year of leaving and FTE in 2012. The R^2 value is 31.3%, showing that the model could explain slightly over a third of the variance of the rate of return. The R^2 value was improved only by 5% when the values for the working hours for both years raised to the power of two were introduced in a polynomial regression model. The statistical significance levels were even lower when AfC bands were used instead of FTE. The R^2 value is 7.4% in the third model and 26.7% in the last model introducing the values of the predictors raised to the power of two. The detailed reports of the analyses are presented in Appendices 12, 13, 14 and 15.

In contrast to the regression analysis, the Pearson's correlation coefficient analysis showed more meaningful results, which are consistent with some of the results obtained in the preliminary analysis phase of this research. The results from the analysis are presented in the table below:

Correlations: FTE Years of Leaving; FTE 2012; AfC Years of Leaving; AfC 2012

	FTE Years of Lea	FTE 2012	AfC Years of Lea
FTE 2012	0,491		
	0,000		
AfC Years of Lea	0,089	0,127	
	0,000	0,000	
AfC 2012	0,145	0,260	0,755
	0,000	0,000	0,000

Cell Contents: Pearson correlation
P-Value

Table 10 Pearson's Correlation Coefficient Analysis – Minitab 16 Report

The results show that working hours in the year of leaving and working hours in 2012 are positively and significantly correlated, with correlation coefficient of 0.491. The salary bands in the year of leaving and in 2012 are also positively and even more strongly correlated, with a correlation coefficient of 0.755. These results are consistent with the findings obtained from the preliminary analysis of returners, according to which almost 35% of the returners to midwifery work at a different salary band, slightly over 80% of whom are salaried at a higher AfC band. The working hours are different for just below 47% of those who return, nearly 50% of whom work longer.

6.3.3. International Aspect of the Attrition from Nursing and Midwifery Workforces

A global demand for nurses exists. Shortage of employees led to employment of internationally qualified specialists in many countries, including UK. Shortage occupation lists, which are developed according to recommendations from the UK Migration Advisory Committee (MAC), in collaboration with the Centre for Workforce Intelligence, are announced on a yearly basis by the UK Border Agency. According to a report, published by the UK MAC in September 2011, nurses are present in the recommended shortage occupation list (Migration Advisory Committee 2011). The migration of employees leads to a shortage of nurses in the source countries such

that the local health care needs cannot be satisfied due to the decreased number of staff (Nichols et al. 2011). At the same time, the retention rates in England and other developed Western European countries is low (Aiken et al. 2001). This process is illustrated in the diagram bellow.

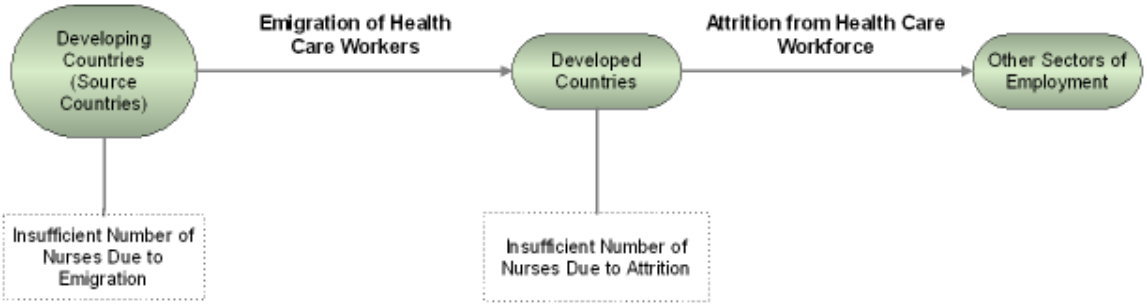


Figure 22 Rate of 'Young' Leavers - International Aspect

The same logic could be applied to midwifery workforce as well. Based on the aforementioned literature and the analysis on midwifery workforce that was conducted, it can be concluded that if the reasons for the high attrition from the workforce in the developed countries, including England, could be found, the number of midwives there would be stabilised at a sufficient level. Thus, less financial losses and negative effects on patients would be experienced. At the same time, if the need for midwifery staff in those countries decreases, the number of professionals emigrating from developing countries will naturally decrease as well. This would be a step towards eliminating the negative consequences of the currently existing shortage in the nursing and midwifery professions, which would be beneficial for both developed and developing countries.

Appendix 1 List of References

Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J. A., Busse, R., Clarke, H., Giovannetti, P., Hunt, J., Rafferty, A. M., and Shamian J., (2001) 'Nurses' reports on hospital care in five countries', *Health Affairs (Millwood)*, Vol. 20, No. 3, pp. 43–53.

Aiken, L. H., Clarke, S. P., Sloane, D. M., Lake E.T. and Cheney T., (2008) 'Effects of hospital care environment on patient mortality and nurse outcomes ', *Journal of Nursing Administration*, Vol. 38, No.5, pp. 223–229.

Attree M., Flinkman M. , Howley B. , Lakanmaa R-L. , Lima-Basto M. and Uhrenfeldt L., (2011), 'A review of nursing workforce policies in five european countries: Denmark, Finland, Ireland, Portugal and United Kingdom/England', *Journal of Nursing Management,* Vol. 19,No. 6, pp. 786–802.

Audit Commission, (2010), *Making the Most of NHS Frontline Staff,* [Online], Available: http://www.wales.nhs.uk/sitesplus/documents/829/Making%20the%20most%20of%20NHS%20frontline%20staff.pdf [Accessed: 29th June 2012]

Bradley, J. R. and Cartwright, S., (2002), 'Social support, job stress, health, and job satisfaction among nurses in the United Kingdom', *International Journal of Stress Management*, Vol. 9, No. 3, pp. 163-181.

Bowles C. and Candela L., (2005), 'First job experiences of recent RN graduates: improving the work environment', *Journal of Nursing Administration,* Vol. 35, No. 3, pp. 130-137.

Brailsford, S.C. and Hilton, N.A. (2001), A comparison of discrete event simulation and system dynamics for modelling health care systems. In, Riley, J. (ed.) *Planning for the Future: Health Service Quality and Emergency Accessibility. Operational Research Applied to Health Services (ORAHS)* , Glasgow Caledonian University, [Online], Available: eprints.soton.ac.uk/35689/1/glasgow_paper.pdf [Accessed: 12th September 2012]

Centre for Workforce Intelligence, (2012), *Workforce Risks and Opportunities - Technical Report - Education Commissioning Risks Summary from 2012*, [Online], Available: http://www.cfwi.org.uk/publications/technical-report-workforce-risks-and-opportunities-education-commissioning-risks-summary-from-2012 [Accessed: 20th June 2012]

Choi J., Bakken S., Larson E., Du Y. and Stone P.W. (2004), 'Perceived nursing work environment of critical care nurses', *Nursing Research*, Vol. 53, No. 6, pp. 370-378.

Cowden T. , Cummings G. and Profetto-Mcgrath J. (2011), 'Leadership practices and staff nurses intent to stay: a systematic review', *Journal of Nursing Management*, Vol. 19, No. 4, pp. 461–477.

Cook R.D. and Weisberg S. (1999), 'Applied Regression Including Computing and Graphics', New York: John Wiley & Sons, Inc.

Current Projects, [Online], [n.d.], Available: http://www.cfwi.org.uk/current-projects [Accessed: 26th July 2012]

Curson J.A., Dell M.E., Wilson R.A., Bosworth D.L. and Baldauf B. (2010), 'Who does workforce planning well? Workforce review team rapid review summary', *International Journal of Health Care Quality Assurance,* Vol. 23, No. 1, pp. 110-119.

Curtis P., Ball L and Kirkham M. (2006), 'Why do midwives leave? (Not) being the kind of midwife you want to be', *British Journal of Midwifery*, Vol. 14, No. 1, pp. 27-31.

Curtis, L., Robinson, S and Netten, A., (2009), 'Changing patterns of male and female nurses' participation in the workforce', *Journal of Nursing Management*, Vol. 17, No. 7, pp. 843–852.

Department of Health, (2011), *Annual Report and Accounts 2010-11*, [Online], Available: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/AnnualReports/DH_129873 [Accessed: 12th July]

Douglas M. R., (2011), 'Opportunities and challenges facing the future global nursing and midwifery workforce', *Journal of Nursing Management*, Vol. 19, No. 6, pp. 695–699.

Dunkley L. and Haider S. (2011), *Workforce Risks and Opportunities: Nursing and Midwifery*, [Online], Available: http://www.cfwi.org.uk/publications/workforce-risks-and-opportunities-nursing-and-midwifery [Accessed: 20th August 2012]

Ellenbecker C. H., Samia L., Cushman M. J., Porell F. W. (2007), 'Employer retention strategies and their effect on nurses' job satisfaction and intent to stay', *Home Health Care Services Quarterly*, Vol. 26, No. 1, pp. 43-58.

Gantz N.R. , Sherman R. , Jasper M., Choo C. Gek, Herrin-Griffith D. and Harris K., (2012), 'Global nurse leader perspectives on health systems and workforce challenges', *Journal of Nursing Management,* Vol. 20, No. 4, pp. 433–443.

Gerova V., Griffiths P., Jones S. and Bick D. (2010), *The Association Between Midwifery Staffing and Outcomes in Maternity Services in England: Observational Study Using Routinely Collected Data. Preliminary Report and Feasibility Assessment*, [Online],
Available:
http://www.kcl.ac.uk/nursing/research/nnru/publications/Reports/NNRUMidwiferyReportDec10.pdf [Accessed: 23rd August 2012]

Getting onto a Course, [Online], [n.d.], Available: http://www.nmc-uk.org/Students/Getting-onto-a-course/ [Accessed: 9th July 2012]

Gilworth G, Bhakta B., Eyres S., Carey A., Chamberlain M. A. and Tennant A., (2007) 'Keeping nurses working: development and psychometric testing of the Nurse-Work Instability Scale (Nurse-WIS)', *Journal of Advanced Nursing*, Vol. 57, No. 5, pp. 543-551.

Griffiths, P., (2009), 'RN + RN = better care? What do we know about the association between the number of nurses and patient outcomes?', *International Journal of Nursing Studies* Vol. 46, No. 10, pp. 1289–1290.

Gormley, D.K., (2011) 'Are we on the same page? Staff nurse and manager perceptions of work environment, quality of care and anticipated nurse turnover' , *Journal of Nursing Management*, Vol. 19, No. 1, pp. 33–40.

Hauck A.,Griffin M. T., Fitzpatrick J. J., (2011), 'Structural empowerment and anticipated turnover among critical care nurses', *Journal of Nursing Management*, Vol. 19, No. 2, pp. 269–276.

Han G. (H) and Jekel M., (2011), 'The mediating role of job satisfaction between leader-member exchange and turnover intentions', *Journal of Nursing Management*, Vol. 19, No. 1, pp. 41–49.

Hillman L. and Foster R. R., (2011), 'The impact of a nursing transitions programme on retention and cost savings', *Journal of Nursing Management*, Vol. 19, No. 1, pp.50–56.

Hinshaw A.S, Smeltzer S.H. and Atwood J.R. (1987), 'Innovative retention Strategies for nursing staff', *Journal of Nursing Administration*, Vol. 17, No. 6, pp. 8-16.

Historical Nursing Journals, [Online], [n.d.], Available: http://www.rcn.org.uk/development/rcn_archives/historical_nursing_journals [Accessed: 31st August 2012]

Hogh A. , Hoel H. and Carneiro I .G., (2011), Bullying and employee turnover among healthcare workers: a three-wave prospective study' , *Journal of Nursing Management*, Vol. 19, No. 6, pp. 742–751.

House of Commons - Health Committee, (2012), *Education, training and workforce planning - First Report of Session 2012–13*, [Online], Available: http://www.publications.parliament.uk/pa/cm201213/cmselect/cmhealth/6/6i.pdf [Accessed: 21th June 2012]

Hosmer D.W. and Lemeshow S. (1989), 'Applied Logistic Regression', New York: John Wiley & Sons, Inc.

Hutchinson D. , Brown J. and Longworth K., (2012), 'Attracting and maintaining the Y Generation in nursing: a literature review' , *Journal of Nursing Management*, Vol. 20, No. 4, pp. 444–450.

Joining the Register, [Online], [n.d.], Available: http://www.nmc-uk.org/Registration/Joining-the-register/ [Accessed: 9th July 2012]

Kane R., Shamiliyan T., Mueller C., Duval S. and Wilt T., (2007), 'The association of registered nurse staffing levels and patient outcomes: systematic review and meta-analysis', *Medical Care*, Vol. 45, No. 12, pp. 1195-1204.

Lacey S.R., Cox K. S., Lorfing K.C., Teasley S. L., Carroll C. A., Sexton K., (2007), 'Nursing support, workload, and intent to stay in Magnet, Magnet-aspiring, and non-Magnet hospitals', *Journal of Nursing Administration*, Vol. 37, No. 4, pp. 199-205.

Lankshear, A.J., Sheldon, T.A. and Maynard A., (2005), 'Nurse staffing and healthcare outcomes: a systematic review of the international research evidence', *Advances in Nursing Sciences*, Vol. 28, No. 2, pp. 163-174.

Lavender T. and Chapple J. (2004), 'An exploration of midwives' views of the current system of maternity care in England', *Midwifery,* Vol. 20, No. 4, pp. 324–334.

Lynn M. R. and Redman R. W., (2005), 'Faces of the nursing shortage: influences on staff nurses' intentions to leavetheir positions or nursing', *Journal of Nursing Administration*, Vol. 35, No. 5, pp. 264-270.

Makridakis S., Wheelwright S. C. and Hyndman R.J. (1998), 'Forecasting: Methods and Applications', 3rd ed., New York: John Wiley & Sons, Inc.

McCarthy G., Tyrrell M. P. and Lehane E. (2007), 'Intention to 'leave' or 'stay' in nursing', *Journal of Nursing Management*, Vol. 15, No. 3, pp. 248-255.

Migration Advisory Committee, (2011), *Skilled Shortage Sensible. Full review of the recommended shortage occupation lists for the UK and Scotland,* [Online], Available: http://www.ukba.homeoffice.gov.uk/sitecontent/documents/aboutus/workingwithus/mac/skilled-shortage-sensible/skilled-report.pdf?view=Binary [Accessed: 23 August 2012]

Morris-Thompson T. , Shepherd J . , Plata R. and Marks-Maran D. (2011), 'Diversity, fulfilment and privilege: the image of nursing', *Journal of Nursing Management,* Vol. 19, No. 5, pp. 683–692.

Nedd N. (2006), 'Perception of empowerment and intent to stay', *Nursing Economics*, Vol. 24, No. 1, pp. 13-18.

Health and Social Care Information Centre, (2010), *National Health Service Occupational Code Manual Version 10*, [Online], Available: http://www.ic.nhs.uk/webfiles/data%20collections/NHS_Occupation_Code_Manual_Ver_10.pdf [Accessed: 20th June 2012]

Nichols, B.I., Davies C.R. and Richardson D.R., (2011), 'An integrative review of global nursing workforce issues', *Annual Review of Nursing Research*, Vol. 28, No. 1, pp. 113-132.

Numata Y. , Schulzer M. , Van Der Wal R. , Globerman J . , Semenuik P. , Balka E. and Fitzgerald J.M., (2006), 'Nurse staffing levels and hospital mortality in critical care settings: literature review and meta-analysis', *Journal of Advanced Nursing*, Vol. 55, No. 4, pp. 435–448.

Page, L. (2003), 'When normal birth is in the minority', *British Journal of Midwifery,* Vol. 11, No. 6, pp. 356-56.

Parker S. and Hyrkas K., (2011), 'Priorities in nursing management', *Journal of Nursing Management*, Vol. 19, No. 5, pp. 567–571.

Pay Circular (AforC) 2/2010, (2010), [Online], Available: http://www.nhsemployers.org/Aboutus/Publications/Documents/Pay-Circular-AforC-2-2011.pdf [Accessed: 8th August 2012]

Pay Circular (AforC) 2/2011, (2011), [Online], Available: http://www.nhsemployers.org/Aboutus/Publications/Documents/Pay-Circular-AforC-2-2011.pdf [Accessed: 8th August 2012]

Pay Circular (AforC) 2/2012, (2012), [Online], Available: http://www.nhsemployers.org/Aboutus/Publications/PayCirculars/Documents/Pay_Circular_AfC_2-2012.pdf [Accessed: 8th August 2012]

Pidd, M. (2004), 'Computer Simulation in Management Science', 5th ed., Chichester: John Wiley & Sons Ltd.

Rafferty, A.M., Clarke, S.P., Coles, J., Ball, J., James, P., McKee, M., Aiken, L.H., (2007), 'Outcomes of variation in hospital nurse staffing in English hospitals: Cross-sectional analysis of survey data and discharge records', *International Journal of Nursing Studies*, Vol. 44, No. 2, pp. 175–182.

Returning to the Register, [Online], [n.d.], Available: http://www.nmc-uk.org/Registration/Returning-to-the-register/ [Accessed: 9th July 2012]

Riahi S., (2011), 'Role stress amongst nurses at the workplace: concept analysis', *Journal of Nursing Management,* Vol. 19, No. 6, pp. 721–731.

Ritter D., (2011), 'The relationship between healthy work environments and retention of nurses in a hospital setting', *Journal of Nursing Management*, Vol. 19, No. 1, pp. 27–32.

Robinson S. and Bennett J., (2007), *Career Choices and Constraints: Influences on Direction and Retention*, Nursing Research Unit, King's College, London, [Online],
Available: http://137.73.2.2/content/1/c6/01/69/80/CareerChoicesExec.pdf [Accessed: 20th June 2012]

Robinson S., Murrells T. and Clinton M., (2006), 'Highly qualified and highly ambitious: implications for workforce retention of realising the career expectations of graduate nurses in England', *Human Resource Management Journal,* Vol. 16, No. 3, pp. 287–312.

Robinson, S., Murrells, T. and Smith, E. M., (2005), 'Retaining the mental health nursing workforce: Early indicators of retention and attrition', *International Journal of Mental Health Nursing*, Vol. 14, No. 4, pp. 230-242.

Royal College of Midwives (2011), *State of Maternity Services Report 2011*, [Online], Available: http://www.rcm.org.uk/college/policy-practice/government-policy/state-of-maternity-services/ [Accessed: 29th August 2012]

Royal College of Nursing, (2010), *Guidance on Safe Nurse Staffing Levels in the UK*, Policy Unit, RCN, London, [Online], Available: http://www.rcn.org.uk/__data/assets/pdf_file/0005/353237/003860.pdf [Accessed: 24th May 2012]

Spence Laschinger H.K. (2012), 'Job and career satisfaction and turnover intentions of newly graduated nurses', *Journal of Nursing Management,* Vol. 20, No. 4, pp. 472–484

Spence Laschinger H.K., Finegan J. and Shamian J. (2001), 'Impact of workplace empowerment, organizational trust on staff nurses' work satisfaction and organizational commitment', *Health Care Management Review*, Vol. 26, No. 3, pp. 7-23.

Stone K. , Traynor M. , Gould D. and Maben J., (2011), 'The management of poor performance in nursing and midwifery: a case for concern', *Journal of Nursing Management*, Vol. 19, No. 6, pp. 803–809.

Strachota E., Normandin P., O'Brien N., Clary M., Krukow B., (2003), 'Reasons registered nurses leave or change employment status, *Journal of Nursing Administration*, Vol. 33, No. 2, pp. 111-115.

Student Bursaries, [Online], [n.d.], Available: http://www.nhsbsa.nhs.uk/Students/816.aspx [Accessed: 9th July 2012]

Tangirala S., Green S. G and Ramanujam R. (2007), 'In the shadow of the boss's boss: effects of supervisors' upward exchange relationships on employees', *Journal of Applied Psychology*, Vol. 92, No. 2, 309–320.

Unruh L.Y. and Nooney J., (2011), ‘Newly licensed registered nurses perceptions of job difficulties, demands and control: individual and organizational predictors’, *Journal of Nursing Management*, Vol. 19, No. 5, pp. 572–584.

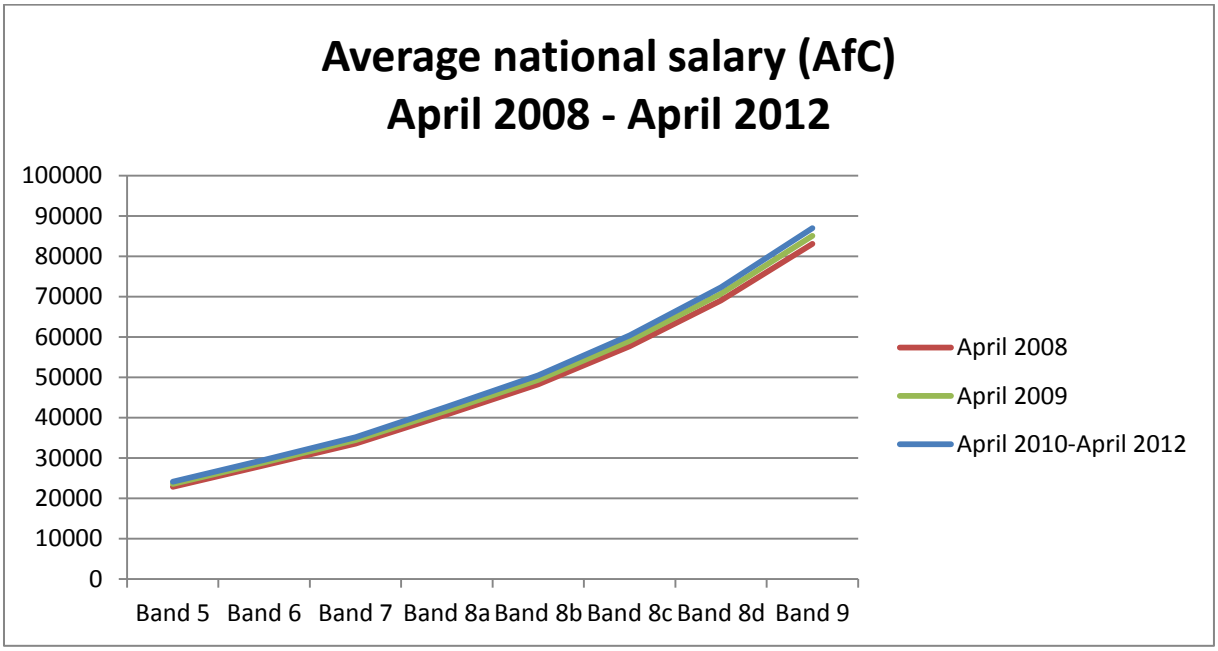
Wagner C.M. (2010), ‘ Predicting nursing turnover with catastrophe theory’, *Journal of Advanced Nursing* , Vol. 66, No. 9, pp. 2071–2084.

Zurmehly J, Martin P. A., Fitzpatrick J. J., (2009) ‘Registered nurse empowerment and intent to leave current position and/or profession’, *Journal of Nursing Management*, Vol. 17, No. 3, pp. 383-391.

Appendix 2 AfC Bands – An Overview of the Period from April 2008 to April 2012

	April 2008 /£/	April 2009 /£/	Change /%/	April 2010 /£/	Change /%/	April 2011 /£/	Change /%/	April 2012 /£/	Change /%/	Total Change /£/
Band 5	22,892	23,562	2,93	24,155	2,52	24,188	0,13	24,188	0,00	1,296
Band 6	28,167	28,889	2,56	29,567	2,34	29,591	0,08	29,591	0,00	1,423
Band 7	33,610	34,416	2,40	35,191	2,25	35,191	0,00	35,191	0,00	1,581
Band 8a	40,757	41,735	2,40	42,674	2,25	42,674	0,00	42,674	0,00	1,917
Band 8b	48,227	49,384	2,40	50,496	2,25	50,496	0,00	50,496	0,00	2,269
Band 8c	57,687	59,071	2,40	60,400	2,25	60,400	0,00	60,400	0,00	2,714
Band 8d	69,016	70,672	2,40	72,263	2,25	72,263	0,00	72,263	0,00	3,247
Band 9	83,063	85,056	2,40	86,970	2,25	86,970	0,00	86,970	0,00	3,908

Data Sources: Pay Circular (AforC) 2/2010 (2010), Pay Circular (AforC) 2/2011 (2011), Pay Circular (AforC) 2/2012 (2012)



Data Sources: Pay Circular (AforC) 2/2010 (2010), Pay Circular (AforC) 2/2011 (2011), Pay Circular (AforC) 2/2012 (2012)

Appendix 3 Returners to Other Occupation Codes

OC Group in 2012	Leavers in 2008		Leavers in 2009		Leavers in 2010		Leavers in 2011	
	HC	%	HC	%	HC	%	HC	%
A - Acute Elderly & General	77	19.15	93	24.60	87	20.09	76	16.10
B - Paediatric Nursing	23	5.72	18	4.76	16	3.70	15	3.18
C - Maternity Services	120	29.85	131	34.66	211	48.73	196	41.53
D - Community Psychiatry	0	0.00	0	0.00	1	0.23	0	0.00
E - Other Psychiatry	1	0.25	2	0.53	0	0.00	1	0.21
F - Community Learning Disabilities	0	0.00	0	0.00	0	0.00	0	0.00
G - Other Learning Disabilities	0	0.00	0	0.00	0	0.00	0	0.00
H - Community Services	109	27.11	110	29.10	69	15.94	83	17.58
J - Education Staff	4	1.00	5	1.32	5	1.15	6	1.27
K - School Nursing	5	1.24	6	1.59	3	0.69	1	0.21
L - Neonatal Nursing	63	15.67	13	3.44	41	9.47	94	19.92
Total	402		378		433		472	

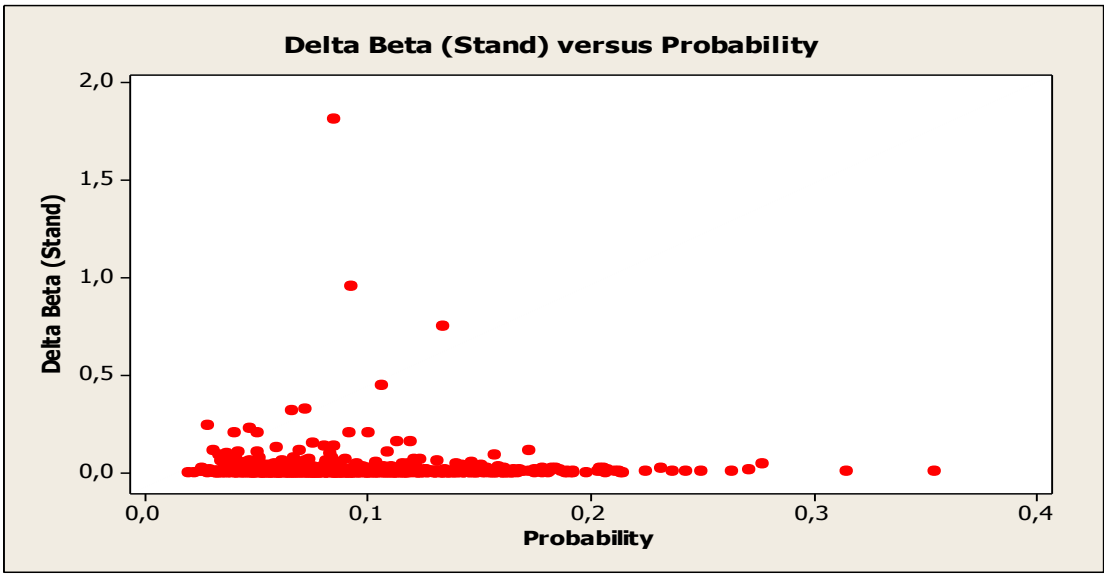
Appendix 4 Categories Used in the Logistic Regression Models

Variable	Code	Variable	Code	Variable	Code	Variable	Code	Variable	Code
FTE		Age		Afc Bands		SHA		Gender	
0-0.2	6	Under 25	3	Band 1	0	Q30	2	Males	2
0.2-0.4	5	25 to 34	4	Band 2	0	Q31	7	Females	1
0.4-0.6	4	35 to 44	2	Band 3	0	Q32	1		
0.6-0.8	2	45 to 54	1	Band 4	0	Q33	4		
0.8-1	1			Band 5	3	Q34	5		
1	3			Band 6	1	Q35	8		
				Band 7	2	Q36	10		
				Band 8a	4	Q37	3		
				Band 8b	0	Q38	9		
				Band 8c	0	Q39	6		
				Band 8d	0				
				Band 9	0				

Appendix 5 'Full' Binary Logistic Regression Model

Binary Logistic Regression: Leaver versus SHA; Gender; ...

```
Link Function: Logit


Response Information

Variable  Value  Count
Leaver    1       4129  (Event)
          0      59354
          Total  63483


Logistic Regression Table
                                                    Odds      95% CI
Predictor       Coef    SE Coef       Z      P  Ratio  Lower  Upper
Constant    -4,88604   0,180447  -27,08  0,000
SHA        0,0700719  0,0058545   11,97  0,000   1,07   1,06   1,08
Gender      0,699329   0,167748    4,17  0,000   2,01   1,45   2,80
AfC Band    0,359629  0,0205901   17,47  0,000   1,43   1,38   1,49
FTE         0,131048  0,0151298    8,66  0,000   1,14   1,11   1,17
Age        0,0889592  0,0137989    6,45  0,000   1,09   1,06   1,12


Goodness-of-Fit Tests

Method           Chi-Square   DF      P
Pearson             1895,02  741  0,000
Deviance            1269,54  741  0,000
Hosmer-Lemeshow       26,81    8  0,001


Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs          Number  Percent  Summary Measures
Concordant  146627023     59,8  Somers' D              0,21
Discordant   95099909     38,8  Goodman-Kruskal Gamma  0,21
Ties          3345734      1,4  Kendall's Tau-a        0,03
Total       245072666    100,0
```



Appendix 6 Binary Logistic Regression Without SHA

Binary Logistic Regression: Leaver versus Gender; AfC Band; FTE; Age

Link Function: Logit

Response Information

Variable	Value	Count	
Leaver	1	4129	(Event)
	0	59354	
	Total	63483	

Logistic Regression Table

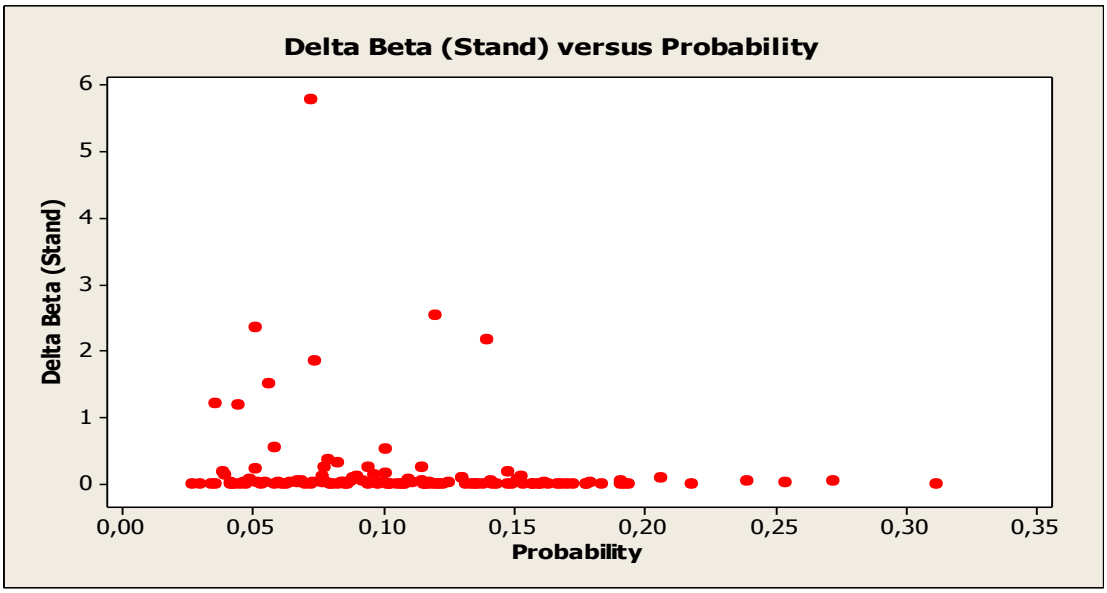
Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	Upper
Constant	-4,55109	0,177660	-25,62	0,000			
Gender	0,742528	0,167470	4,43	0,000	2,10	1,51	2,92
AfC Band	0,365128	0,0204896	17,82	0,000	1,44	1,38	1,50
FTE	0,144408	0,0149710	9,65	0,000	1,16	1,12	1,19
Age	0,0955568	0,0137777	6,94	0,000	1,10	1,07	1,13

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	839,893	117	0,000
Deviance	425,873	117	0,000
Hosmer-Lemeshow	52,661	7	0,000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	138280009	56,4	Somers' D	0,18
Discordant	95052721	38,8	Goodman-Kruskal Gamma	0,19
Ties	11739936	4,8	Kendall's Tau-a	0,02
Total	245072666	100,0		



Appendix 7 Binary Logistic Regression Without SHA and Age

Binary Logistic Regression: Leaver versus Gender; AfC Band; FTE

Link Function: Logit

Response Information

Variable	Value	Count	
Leaver	1	4129	(Event)
	0	59354	
	Total	63483	

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	-4,38880	0,175916	-24,95	0,000			
Gender	0,762958	0,167446	4,56	0,000	2,14	1,54	2,98
AfC Band	0,375865	0,0205861	18,26	0,000	1,46	1,40	1,52
FTE	0,146969	0,0148835	9,87	0,000	1,16	1,13	1,19

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	625,577	41	0,000
Deviance	320,495	41	0,000
Hosmer-Lemeshow	53,354	5	0,000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	127829949	52,2	Somers' D	0,16
Discordant	88396634	36,1	Goodman-Kruskal Gamma	0,18
Ties	28846083	11,8	Kendall's Tau-a	0,02
Total	245072666	100,0		

Appendix 8 Binary Logistic Regression Without SHA, Age and FTE

Binary Logistic Regression: Leaver versus Gender; AfC Band

Link Function: Logit

Response Information

Variable	Value	Count	
Leaver	1	4129	(Event)
	0	59354	
	Total	63483	

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	-4,03705	0,171689	-23,51	0,000			
Gender	0,811827	0,167274	4,85	0,000	2,25	1,62	3,13
AfC Band	0,367677	0,0205423	17,90	0,000	1,44	1,39	1,50

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	574,513	7	0,000
Deviance	263,799	7	0,000
Hosmer-Lemeshow	69,282	2	0,000

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	80905767	33,0	Somers' D	0,11
Discordant	53313297	21,8	Goodman-Kruskal Gamma	0,21
Ties	110853602	45,2	Kendall's Tau-a	0,01
Total	245072666	100,0		

Appendix 9 Categories Used in the Multivariate Linear Regression and Multivariate Polynomial Regression Models

Variable	Code		Variable	Code		Variable	Code
FTE			Age			Afc Bands	
0-0.2	1		Under 25	1		Band 5	1
0.2-0.4	2		25 to 34	2		Band 6	2
0.4-0.6	3		35 to 44	3		Band 7	3
0.6-0.8	4		45 to 54	4		Band 8a	4
0.8-1	5						
1	6						

Appendix 10 Multivariate Linear Regression

Regression Analysis: Leavers versus FTE; AGE; AfC

The regression equation is
Leavers = 18,5 - 1,73 FTE + 0,610 AGE - 0,399 AfC

Predictor	Coef	SE Coef	T	P
Constant	18,457	3,923	4,71	0,000
FTE	-1,7259	0,5867	-2,94	0,004
AGE	0,6102	0,9479	0,64	0,522
AfC	-0,3993	0,9582	-0,42	0,678

S = 8,00267 R-Sq = 13,2% R-Sq(adj) = 9,3%

Analysis of Variance

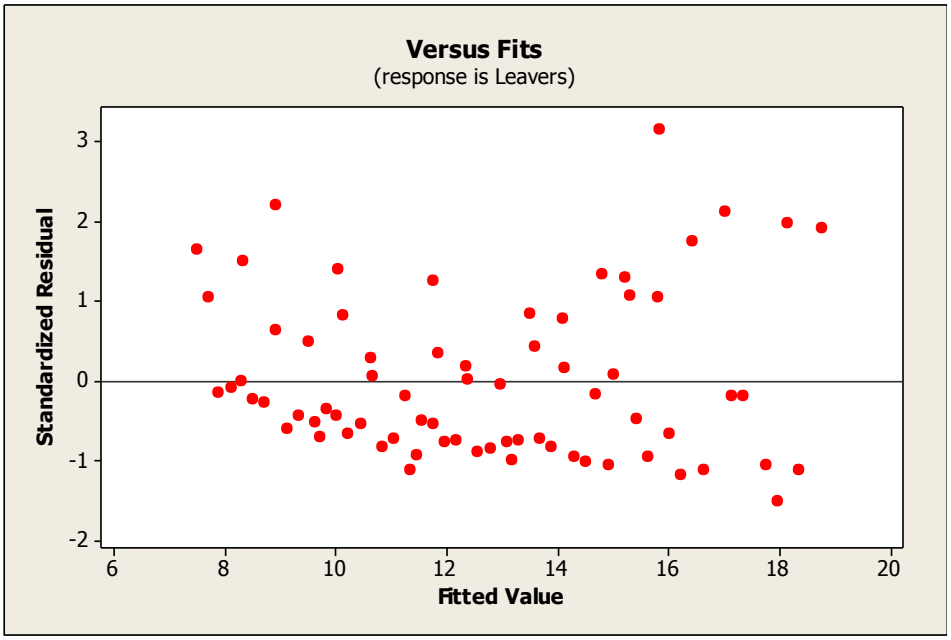
Source	DF	SS	MS	F	P
Regression	3	660,20	220,07	3,44	0,022
Residual Error	68	4354,91	64,04		
Total	71	5015,11			

Source	DF	Seq SS
FTE	1	629,09
AGE	1	19,99
AfC	1	11,12

Unusual Observations

Obs	FTE	Leavers	Fit	SE Fit	Residual	St Resid
16	2,00	33,333	17,047	2,147	16,286	2,11R
19	2,00	40,000	15,849	2,305	24,151	3,15R
72	6,00	25,769	8,945	2,372	16,824	2,20R

R denotes an observation with a large standardized residual.



Appendix 11 Multivariate Polynomial Regression (Outcome Ln(Leavers))

Regression Analysis: Ln(Leavers) versus FTE; AGE; ...

```
The regression equation is
Ln(Leavers) = 5,93 - 0,635 FTE + 0,093 AGE - 2,35 AfC + 0,0643 FTE^2
              - 0,0285 AGE^2 + 0,492 AfC^2


Predictor       Coef  SE Coef       T      P
Constant     5,9283   0,4123   14,38  0,000
FTE         -0,6350   0,1246   -5,10  0,000
AGE          0,0934   0,2199    0,42  0,672
AfC         -2,3456   0,2011  -11,66  0,000
FTE^2       0,06428  0,01656    3,88  0,000
AGE^2      -0,02854  0,04101   -0,70  0,489
AfC^2       0,49202  0,04170   11,80  0,000


S = 0,333716   R-Sq = 73,2%   R-Sq(adj) = 70,8%

PRESS = 9,41301   R-Sq(pred) = 65,19%


Analysis of Variance

Source          DF       SS      MS      F      P
Regression       6  19,7995  3,2999  29,63  0,000
Residual Error  65   7,2388  0,1114
Total           71  27,0384


Source  DF   Seq SS
FTE      1   3,0481
AGE      1   0,0325
AfC      1   0,0304
FTE^2    1   1,1176
AGE^2    1   0,0631
AfC^2    1  15,5078


Unusual Observations

Obs    FTE  Ln(Leavers)     Fit  SE Fit  Residual  St Resid
  7  1,00       1,8326  2,6659  0,1244   -0,8334     -2,69R
  9  2,00       3,2189  2,2572  0,1186    0,9617      3,08R
 33  4,00       0,9676  1,7586  0,1133   -0,7910     -2,52R
 45  5,00       1,8795  2,5717  0,1148   -0,6922     -2,21R
 60  6,00       2,9957  1,8887  0,1289    1,1070      3,60R

R denotes an observation with a large standardized residual.
```

Appendix 12 Linear Regression – Returners vs FTE_year of leaving and FTE_2012

Regression Analysis: Returners versus FTE year of leaving; FTE 2012

```
The regression equation is
Returners = - 5,77 + 0,862 FTE year of leaving + 1,01 FTE 2012


Predictor              Coef  SE Coef      T      P
Constant             -5,771    2,437  -2,37  0,027
FTE year of leaving  0,8617   0,4179   2,06  0,051
FTE 2012             1,0061   0,4179   2,41  0,025


S = 2,95535   R-Sq = 31,3%   R-Sq(adj) = 25,1%

PRESS = 287,991   R-Sq(pred) = 0,00%


Analysis of Variance

Source          DF       SS      MS     F      P
Regression       2   87,736  43,868  5,02  0,016
Residual Error  22  192,149   8,734
Total           24  279,885


Source               DF  Seq SS
FTE year of leaving   1  37,123
FTE 2012              1  50,613


Unusual Observations

       FTE year
Obs  of leaving  Returners     Fit  SE Fit  Residual  St Resid
 25        6,00     17,284  5,435   1,322    11,848      4,48R

R denotes an observation with a large standardized residual.
```

Appendix 13 Polynomial Regression – Returners vs FTE_year of leaving and FTE_2012

Regression Analysis: Returners versus FTE year of leaving; FTE 2012; ...

The regression equation is
Returners = 2,92 - 1,22 FTE year of leaving - 1,88 FTE 2012
+ 0,260 FTE year of leaving ^ 2 + 0,361 FTE 2012 ^ 2

Predictor	Coef	SE Coef	T	P
Constant	2,917	7,483	0,39	0,701
FTE year of leaving	-1,216	2,886	-0,42	0,678
FTE 2012	-1,881	2,886	-0,65	0,522
FTE year of leaving ^ 2	0,2597	0,3569	0,73	0,475
FTE 2012 ^ 2	0,3609	0,3569	1,01	0,324

S = 2,98589 R-Sq = 36,3% R-Sq(adj) = 23,5%

PRESS = 348,747 R-Sq(pred) = 0,00%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	4	101,574	25,393	2,85	0,051
Residual Error	20	178,311	8,916		
Total	24	279,885			

Source	DF	Seq SS
FTE year of leaving	1	37,123
FTE 2012	1	50,613
FTE year of leaving ^ 2	1	4,723
FTE 2012 ^ 2	1	9,116

Unusual Observations

Obs	FTE year of leaving	Returners	Fit	SE Fit	Residual	St Resid
25	6,00	17,284	6,676	1,674	10,607	4,29R

R denotes an observation with a large standardized residual.

Appendix 14 Linear Regression – Returners vs AfC Band_year of leaving and AfC Band_2012

Regression Analysis: Returners_1 versus AfC Band year of; AfC Band 2012

The regression equation is
Returners_1 = 6,08 - 0,80 AfC Band year of leaving - 0,36 AfC Band 2012

Predictor	Coef	SE Coef	T	P
Constant	6,077	3,432	1,77	0,107
AfC Band year of leaving	-0,802	1,224	-0,65	0,527
AfC Band 2012	-0,358	1,134	-0,32	0,759

S = 4,10042 R-Sq = 7,4% R-Sq(adj) = 0,0%

PRESS = 243,140 R-Sq(pred) = 0,00%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	13,39	6,70	0,40	0,682
Residual Error	10	168,13	16,81		
Total	12	181,53			

Source	DF	Seq SS
AfC Band year of leaving	1	11,72
AfC Band 2012	1	1,67

Unusual Observations

Obs	AfC Band year of leaving	Returners_1	Fit	SE Fit	Residual	St Resid
5	2,00	14,17	3,76	1,29	10,41	2,67R

R denotes an observation with a large standardized residual.

Appendix 15 Polynomial Regression – Returners vs AfC Band_year of leaving and AfC Band_2012

Regression Analysis: Returners_1 versus AfC Band yea; AfC Band 201; ...

```
The regression equation is
Returners_1 = - 6,63 + 5,04 AfC Band year of leaving + 6,16 AfC Band 2012
              - 1,18 AfC Band year of leaving  ^ 2 - 1,30 AfC Band 2012 ^ 2


Predictor                        Coef  SE Coef      T      P
Constant                       -6,634    9,420  -0,70  0,501
AfC Band year of leaving        5,037    5,852   0,86  0,414
AfC Band 2012                   6,163    5,772   1,07  0,317
AfC Band year of leaving  ^ 2  -1,175    1,185  -0,99  0,351
AfC Band 2012 ^ 2              -1,300    1,148  -1,13  0,290


S = 4,07856   R-Sq = 26,7%   R-Sq(adj) = 0,0%

PRESS = 320,422   R-Sq(pred) = 0,00%


Analysis of Variance

Source          DF      SS     MS     F      P
Regression       4   48,45  12,11  0,73  0,597
Residual Error   8  133,08  16,63
Total           12  181,53


Source                          DF  Seq SS
AfC Band year of leaving         1   11,72
AfC Band 2012                    1    1,67
AfC Band year of leaving  ^ 2    1   13,73
AfC Band 2012 ^ 2                1   21,33


Unusual Observations

     AfC Band
      year of
Obs   leaving  Returners_1   Fit  SE Fit  Residual  St Resid
  5      2,00        14,17  5,87    1,94      8,30      2,31R

R denotes an observation with a large standardized residual.
```

Appendix 16 Ethics Approval

Your Ethics Submission (Ethics ID:2293) has been reviewed and approved

ERGO [DoNotReply@ERGO.soton.ac.uk]

Sent:15 July 2012 17:30

To: dimitrova m.d. (mdd1g11)

Submission Number: 2293
Submission Name: Attrition from the Health and Social Care Workforce, an Investigation of Young Leavers
This is email is to let you know your submission was approved by the Ethics Committee.

Comments
1.Thanks for clarifying the nature of the data that you will be analysing. As it involves NHS related data, it was necessary that the clarifications be made.

Click here to view your submission

ERGO : Ethics and Research Governance Online
http://www.ergo.soton.ac.uk

DO NOT REPLY TO THIS EMAIL