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ABSTRACT

Investigating the Quitting Decision of Nurses: Panel Data Evidence from the British National Health Service*

There is currently a worldwide shortage of registered nurses, driven by large shifts in both the demand for and supply of nurses. Consequently, various policies to increase the recruitment and retention of nurses are under discussion, in particular, the role that wage increases might have in promoting nurse labour supply. In this paper we provide the first detailed empirical investigation into the quitting behaviour of nurses in the British National Health Service (NHS), using a newly constructed longitudinal survey. We fit both single and competing-risks duration models that enable us to establish the characteristics of those nurses who leave the NHS, distinguish the importance of pay in this decision and document the destinations that nurses move to. Contrary to expectations, we find that the hourly wage received by nurses outside of the NHS is around 20% lower than in the NHS, and that hours of work are about the same. However, there is a clear movement away from shift work. Age, seniority, job and employer characteristics are all found to be important predictors of nurses leaving the NHS. However, whilst the effect of wages is found to be statistically significant, the predicted impact of an increase in nurses' pay on retention rates is small. Our main conclusion, therefore, is that the current nurse shortages in the NHS will not be eliminated through substantially increased pay. Rather employers need to identify and address other aspects of the job which are driving nurses' decisions to quit the NHS.

JEL Classification: J45, J63, I18

Keywords: nurses, panel data, wages, hours, quitting, NHS

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* The data are used with the permission of the Office for National Statistics, United Kingdom and the Data Archive at the University of Essex. The usual disclaimer applies.

1. Introduction

There is currently a global shortage of registered nurses (RNs). Consequently, the recruitment and retention of nurses is a major concern for healthcare policy-makers in most Western countries (see, for example, Audit General Victoria, 2002; Buchan *et al*., 1994; USGAO, 2001). The shortage is particular acute in a number of publicly-dominated heath care systems including Australia, Britain, Canada and Norway, as well as in the more privately-orientated US. Moreover, nurse shortages are not a new phenomenon: for example, Britain and the US have experienced nurse shortages from as far back as the end of World War II (see Aiken, 1982; Bognanno et al., 1974; Link, 1992; Roberts et al., 1989; Yett, 1975).

The extent of this shortage is considerable. For example, the US had a RN vacancy level of over 126,000 in 2001, which is projected to increase to around one million by 2010 (AHA News, 2001; Cowan, 2001). In Britain, the National Health Service (NHS) is currently reporting a shortage of RNs of around 20,000 (RCN, 2002) in England alone, while Australia is currently facing a shortfall of 5,000 RNs, which is expected to rise to around 31,000 by 2006 (O'Hagan, 2002).[1] Norway is currently facing a shortage of around 3,300 whole-time posts (Askildsen et al., 2002; Holmas, 2002), and similar shortages are reported in Canada and throughout the Scandinavia countries.

It is widely understood that nurse shortages are the result of continuing shifts in both the demand and supply sides of the nursing labour market (Shields and Ward, 2001). On the demand side, the primary change is due to demographic ageing in most Western countries, which has led to gradual increases in the demand for health services. These changes are predicted to be particularly pronounced as the baby boomers reach their 60s and 70s in the next twenty years. This increased demand for nursing services is and will be evident in each of the hospital, community and residential/nurse home sectors. The demographic ageing effect is being exacerbated by the increased demand for healthcare generally. The more educated the populations become the greater their knowledge about medical issues and the higher are their expectations and demands for treatment. In addition, advances in the RN-intensive medical technology has expanded the treatment possibility frontier. As a result, the demand schedule for RNs continues to shift outwards.

Demographic ageing is also an important explanation for changes on the supply side of the market. It continues to effectively reduce the number of school-leavers available to enter nurse training and to increase the number of nurses retiring each year (see Buerhaus et al., 2000). For example, by 2010 approximately 40% of the US nursing workforce will be over 50 years of age (USGAO, 2001). In the British context, only 15% of NHS RNs are currently under 30 years of age, compared to 25% one decade

[1] The Royal College of Nursing (RNS) website provides a wide ranging selection of news articles concerning the size and consequence of nurse shortages in Britain i.e. rcn.org.uk. Similar information for the US can be found at the American Hospitals Association website i.e. ahanews.com.

ago. Moreover, 23% of NHS nurses are aged 50-55 and will retire in the next 5-10 years (Buchan and Seccombe, 2002). Moreover, the level of educational achievement needed to enter nurse training has been increased in many countries over the past decade. This is an attempt to increase the level of 'professionalism' in nursing and a response to the need for nurses to perform an increasing range of, and more technologically-advanced, medical tasks (Hardill and MacDonald, 2000; Phillips, 1995). The past 30 years have also seen a substantial increase in the range of alternative career opportunities for women. Finally, nurses in most countries report low levels of job satisfaction due, in particular, to heavy workloads, high amounts of overtime and general staffing and auxiliary nurse shortages. Poor relative wages (given alternative career opportunities) and the introduction of competitive forces in the health care sector are also cited as causes of dissatisfaction amongst nurses. International evidence of low morale from survey data on nurses in six countries can be found in Aiken et al. (2000, 2001). Separate evidence for the US can be found in USGAO (2002), for the UK in Beishon et al. (1995), RCN (2002) and Shields and Ward (2001) and for Australia in Buchanan and Considine (2002).

Policymakers have tended to focus on increased pay as the best means to tackle nurse shortages. However, there is a reasonably strong consensus, across studies that have used formal econometric techniques to investigate nurse labour supply, that their labour supply is fairly unresponsive to wage changes. In fact, the average elasticity of supply with respect to wage changes is only about 0.3 (see Antonazzo et al., 2003 and Shields, 2003, for reviews of this literature). However, it is important to note that there has only been two British based studies (Phillips, 1995; Skatun et al., 2001), and there have been no British studies, as far as we are aware, that have used longitudinal survey data to investigate this issue.

The aim of this paper therefore is to shed new light on the issue of nurse retention in the NHS by using newly constructed longitudinal survey and duration models to provide a detailed econometric investigation into the quitting decision of NHS nurses. The results of this analysis will therefore help inform the current policy debate. In particular, for the first time in the British context we (1) identify the characteristics of nurses who quit the public sector, (2) establish the importance of wages and working hours in the quitting decision and (3) document the new labour market destinations of nurses who leave the NHS.

The paper is set out as follows. Section 2 discuss the context of the current British nursing ‘crisis’ whilst Section 3 reviews the international literature on nurse labour supply and turnover. Section 4 introduces the data and provides some salient sample characteristics. Section 5 outlines are econometric methodology, whilst Section 6 discusses the main results. The paper is concluded in Section 7.

2. The UK Nursing 'Crisis'

In the UK context, there are currently just over 320,000 qualified registered nurses and midwives, of whom 90% are employed in the NHS (Buchan and Seccombe, 2002; Department of Health, 2001). The NHS nursing pay-bill stands at 20% of total NHS expenditure per year (Morris and McGuire, 2002). Over the last two decades, nursing in the NHS has persistently been described in the media as in a state of 'crisis'. A recent report prepared for the UK Government suggests that the UK would need to employ over 100,000 more nurses, over the next 20 years, if it is to provide a high quality service by 2022 (Wanless, 2002).

On the recruitment side, the intake into nurse training fell by around 30% between 1987 and 1995 (Seccombe and Smith, 1997), and this trend has continued in recent years. The turnover of existing nurses in the NHS stands at around 14% per annum, but is far higher for nurses who recently completed their training (Gray and Phillips, 1996; Seccombe and Smith, 1997). Between 1990 and 2000, around 170,000 nurses left the nursing register, with over 21,000 going in 1999/2000 alone (Buchan and Seccombe, 2001). Moreover, low satisfaction with many aspects of the nursing job has led to wide spread discontent in the profession, which is reflected in around 40% of nurses indicating that they might leave the NHS in the near future (Beishon et al., 1995; RCN, 2002; Shields and Ward, 2001).

With some NHS hospitals reporting RN vacancy rates of up to 20%, the consequences of such shortages can be severe. In particular there has been increased waiting time for surgery, delays in emergency care and, in the worst cases, complete closures of hospital wards and operating theatres (Audit Commission, 1997). Shortages also cause significant stress among pressurised health workers and force the health service to employ more temporary staff (King's Fund, 2001).[2] In the later respect, many countries are relying on immigrant nurses to meet their nursing requirements. For example, the NHS recruited over 8,000 RNs from abroad in 2000/2001, which accounted for about 40% of all new nurses (Buchan and Seccombe, 2002). This reliance on foreign nurses has raised serious concerns about the quality of patient care in the NHS. In addition, the source countries have complained about the direct recruitment drives used by the NHS, since they desperately need to retain their nurses whose training they have funded. Nevertheless, the trend of using increasing numbers of immigrant nurses is set to continue and the NHS will have to compete in an international nursing labour market, with the USA and other countries who are also experiencing growing nursing shortages (Buchan and Seccombe, 2002).

Given the persistent problem of nurse shortages faced by the NHS, policy attention has focused on ways to (1) increase the recruitment of school-leavers into the profession, (2) encourage nurses no longer working in nursing to re-enter the profession, and to (3) improve the retention of current staff. Central to

[2] In the US, JCAHO (2002) reports that in a recent survey of US hospitals that nurse shortages are caused emergency department overcrowding (38% of hospitals), diversion of emergency patients (23%), discontinuation of programs and services (17%) and cancellation of elective surgeries (10%).

this debate has been the focus on improving working conditions generally in the NHS and the potential effect that increased pay could have on labour supply. Correspondingly, many NHS Trusts have started to introduce more flexible working arrangements, childcare support and even housing subsidies, to improve their staffing position (Elliot et al., 2003). There is also considerable discontentment about the current nurse remuneration system introduced in the NHS in 1983. There is currently a wide ranging discussion between the RCN, trade unions and the Government regarding ways in which to modernise the nurse pay structure and introduce greater regional and grade flexibility. This is highlighted in the recent statement by the RCN General Secretary:

'To attract nurses and especially to keep them for the long term, the (UK) Government needs to invest seriously in the workforce through a modernised pay and career structure...Nurses want better career opportunities, the chance to take on new roles, support to develop their skills and a fairer pay.system.' (Malone, 2003).

3. Empirical studies of the nursing labour supply and quitting behaviour

Despite the fact that RNs represent one of the largest occupations in most Western countries, that nursing skills are a central input into the health (care) production process and that shortages have existed for many years, there are relatively few empirical studies that have examined the labour market behaviour for this important group of workers. The most researched topic by economists in this respect is the labour supply of nurses. However, since the first research papers that used econometric techniques were written in the early 1970s, there have been less than twenty published studies that have modelled the labour supply decision of nurses. Virtually all of these studies have focussed on the US nursing market (see Antonazzo et al., 2002 and Shields, 2003 for full reviews of this literature). Moreover, all of these studies have used cross-sectional data from either the US Census data (i.e. 1960, 1970 and 1980) or, more recently, from the quadrennial National Sample Survey of Registered Nurses, and have estimated either a tobit or a Heckman-selection type labour supply model. The overwhelming conclusion from these studies is that the wage elasticity of nurse labour supply is unresponsive (or inelastic) and that very large increases in RN wages would be needed to adequately meet health care demands. The average wage elasticity, found across all the US studies, is around 0.3. In fact, a number of studies have found evidence of a backward bending labour supply function for RNs, which points to the possibility that, for some markets, wage increases might actually lead to a reduction in the quantity of RNs supplied. Other fairly consistent findings from these studies were that, for married RNs, increases in spouse wages and increases in non-labour household income have a significant negative effect on RNs labour supply. Three

exceptions to the finding of a small wage elasticity are the studies by Sloan and Richupan (1975), Mallikamas (1990) and Brewer (1996) who each found a wage elasticity of greater than unity.

One of the very few non-US studies of nurse labour supply is Phillips (1995) who estimated a standard Heckman-selection type model using a small sample (n= 312) cross-sectional sample of British NHS nurses, collected in 1980. The author found an important role for wages in determining nurse labour market participation with a point-elasticity of 1.40, whilst the wage elasticity with respect to hours was small at around 0.15. The considerable divergence in the determinants of participation and working hours was taken as an indicator of 'discontinuity' of the nursing labour supply function. More recently, Skatun et al. (2001) estimated a standard Heckman selection model of participation, and hours of work, for married nurses in the UK, using cross-sectional data from the Quarterly Labour Force Survey for 1999-2000 (n=1248). They found that the wage elasticity of participation was fairly unresponsive at 0.62, whilst the wage elasticity with respect to hours was 0.48.

In many respects even the most recent literature on nurse labour supply significantly lags behind recent developments in both the theoretical and econometric approaches to modelling labour supply more generally (Blundell and MaCurdy, 1999; Elliot et al., 2003; Shields, 2003). To a large extent these limitations are data determined. For instance the extensive panel data studies needed to understand the role of household bargaining into the empirical framework, control for unobservable individual heterogeneity or identify the wage effect through an exogenous change to wages, are unavailable in most countries including the US. Perhaps the only recent exception in terms of advancements in empirical modelling is the recent study by Askildsen et al. (2002). They use a long and large panel (18,000 individuals over a five-year period, 1993-1997) of female Norwegian nurses, drawn from administrative rather than survey records, to estimate a number of labour supply models. Given the longitudinal nature of their data, the authors estimated a variety of panel data models, which allowed for individual unobservable characteristics (i.e. fixed-effects) to be correlated with the explanatory variables. The issue of wage endogeneity was also considering using Instrumental Variable (IV) techniques. The robustness of the estimates was shown across a number of specifications: OLS, 2SLS, Fixed-effects, Fixed-effects 2SLS and the main panel sample selection model. The authors noted a fair level of stability across each of the models. The wage elasticity from the favoured model, which allowed for individual fixed effects and also controlled for the endogeneity of wages was 0.780. The authors therefore concluded that, for Norwegian public sector nurses, wage increases could have some success in addressing nurse shortages.

In addition to this 'classical' nurse labour supply literature, there have also been a few studies that have investigated the factors influencing an RNs decision to leave nursing. Parker and Rickman (1995) found using pooled data from the US CPS data for 1980-90, that married RNs in the US are more likely to withdraw from the labour force than unmarried RNs, while spouse' income is not an important

determinant of withdrawal. However, this study does not address the issue of outside wage offers. Schumacher (1997) used a sample of RNs drawn from the US Current Populations Survey (CPS) from 1983 to 1994. He found evidence suggesting that US nurses do respond to outside wage offers, with a one standard deviation decrease in the difference between the actual and predicted log wage resulting in an 8% increase in the exit rate of nurses. Ahlburg and Mahoney (1996) found, using survey data for nurses in Minnesota, that relative wages were a significant predictor of nurse turnover. However, the quantitative effect was found to be small: a 10% increase in the wage offered to a nurse, relative to the expected wage she could earn in her next best occupation, increased the probability of continuing to work as a nurse by only 2%. The authors therefore conclude that working conditions are more important determinants of turnover than wages. In the British context, Gray and Phillips (1996) examined the effect of regional labour market variables on nurse turnover using regional health authority level data. They found that the size of the private nursing sector, and the relative pay of other workers in the area ,was a significant predictor of turnover. Gray et al. (1996) found that national pay increases for nurses in Britain were not generally successful in reducing nurse turnover, whilst Gray and Phillips (1994) found that nurse turnover rates fall with age and are highest in the first few years after the completion of nurse training.

In the study most similar to that presented in this paper, Holmas (2002) used the same Norwegian data as Askildsen et al. (2002) and estimated a number of single-spell duration models. He found that both wages and working conditions have an impact on nurses' decision to quit the public health care system. He found that a 1 Norwegian Krona increase in hourly nurse wages decreases the hazard by 3.4%. Moreover, nurses working in hospitals with high occupancy rates (e.g. workload) and in large hospital were more likely to leave nursing. Interestingly, having young children did not have a significant impact on the quitting hazard, and married nurses had a lower quitting rate than unmarried nurses.

Finally, a few recent studies have investigated the determinants (including pay) of job satisfaction for nurses and how this is linked to quitting behaviour. A general review of this literature can be found in Borda and Norman (1997) and Cangelosi et al. (1998). For Britain, Shields and Ward (2001) and Shields and Wheatley Price (2002a) used a large and detailed cross-sectional survey of NHS nurses to investigate these issues. They found that both nurses' own wages and relative wages (i.e. what nurses could earn outside of nursing given their characteristics) to be important determinants of job satisfaction. Those with low job satisfaction were then found to have a 65% higher probability of intending to quit. However, dissatisfaction with promotion and training opportunities were found to have a stronger impact than workload or pay. Moreover, the probability of quitting was found to be highest for young and ethnic minority nurses, whilst no effect of marital status or gender was found. Interestingly, more senior nurses were found to be more likely to quit the NHS than junior nurses, and there was some clear differences by

nursing specialty. The studies concluded that recent policy focus on improving pay for all NHS nurses would only have limited success, unless accompanied by improved promotion and training opportunities. One limitations of these two UK studies, however, is that they are based on intentions to quit rather than observed quitting behaviour (Holmas, 2002).

In this paper we investigate a number of the issues discussed above using, uniquely, longitudinal data on NHS nurses. In particular, we focus on the potential importance of a substantial increase in nurses' wages as a means of addressing the current and projected nursing "crisis" in the NHS.

4. Data and models

4.1 Data

Our sample is derived from the Quarterly Labour Force Survey (QLFS) of the United Kingdom. The Labour Force Survey has been undertaken since 1973. Its primary purpose is to collect internationally comparable employment and unemployment data at a regional and national level for the UK. The questionnaire covers areas such as economic activity, education and training, household structure, qualifications, job search behaviour and working environment. At the beginning of 1992 a quarterly panel element was introduced. The total number of households successfully questioned each quarter is approximately 64,000, amounting to some 167,000 persons. Each household is questioned for five successive surveys, so that if the household is first surveyed in the Spring (interviews conducted between March and May) of one year (wave 1) interviews will be attempted with that household for each successive quarter (waves 2, 3 & 4) up to (and including) the Spring of the following year (wave 5). Hence, each respondent may be observed in the sample up to 5 times (in all 5 waves) and only 20% of the sample (those in wave 1) is new to the survey each quarter.

The panel element of the QLFS has been relatively under-utilised in empirical work and is the only nationally representative data source that provides a large longitudinal sample of NHS nurses. This allows us to track those nurses who leave the NHS and perform reliable econometric analysis using longitudinal information.[3] To obtain this large sample we constructed a series of 16 overlapping panel datasets, the first of which comprises those individuals who are first successfully interviewed in the Spring QLFS of 1997, following them through to the Spring QLFS of 1998. The next panel was first sampled during the Summer QLFS of 1997 (interviews conducted between June and August), and completed its duration in the panel in the Summer QLFS of 1998, whilst the third panel of individuals entered during the Autumn QLFS of 1997 (interviews conducted between September and November), and exited during the following Autumn QLFS, and so on. Our sixteenth and final panel comprises

[3] The British Household Panel Survey, used as a secondary data source in Shields and Ward (2001), yields a sample of less than 200 nurses. This is less than 5% of the sample available by pooling the QLFS. In addition, the Royal College of Nursing

individuals whose first interview took place during the Winter QLFS of 2000 and whose final interview was undertaken in the Winter QLFS of 2001 (between December 2001 and February 2002). This provides a total sample of just under 1.5 million observations (702,398 male, 742,066 female) of working age (16 to 64).

4.2 Sample characteristics

From the total number of observations we have drawn out all those individuals who reported to be a NHS nurse, at least once in any of the waves (quarters) they were interviewed in. This produced a sample of 28,080 observations on 6971 different nurses. Attrition in the QLFS is a significant problem with only 62.7% of nurses observed in all five waves, and an average duration in the panel of 4 waves. Reflecting the female dominated nature of nursing only 9.7% of the sample are male, and the average age is 40.3 years. Just under 73% are married or cohabiting and 6.3% are from a ethnic minority (non-white) group. Within the five quarter time frame, around 78% of observations are currently observed to be in NHS nursing, 15% are in private sector nursing, 3% are in other public sector occupations and 3% are not working. We refer to the latter group as non-participants, though it does include a very small number of unemployed individuals. Our data captures a small number of individuals who entered into nursing during the five waves of the sample survey period and a more substantial group of nurses who we observe leaving NHS employment over this time and are of prime interest in this paper.

Focussing on some salient characteristics of NHS nurses, 16.9% are working in managerial nurse grades (i.e. Grades G, H and I), 40.6% are working in supervisor grades (i.e. Grades E and F) and 42.5% are in junior (i.e. Grade D) and auxiliary nursing positions (i.e. Grades A, B and C).[4] Just over 10% of NHS nurses hold a degree in nursing, a little under 60% are employed full-time and the average nurse works 34 hours per week. The vast majority of nurses (94%) report their position as being permanent. Interestingly, just over 5% of NHS nurses report to be actively searching for a new job, 6.4% hold a second job and 54% report having participated in work-related training in the 13 weeks prior to interview. Three-quarters of NHS nurses report being employed in a workplace with more than 50 employees (a category dominated by the hospital sector). Finally, as expected from a nationally representative survey, our sample of NHS nurses is fairly evenly spread geographically.

4.3 NHS turnover and destinations

(RCN) collects an annual survey of nurses that tracks registered nurses on its list. However, this survey is not suitable for our purposes as it cannot track those former nurses who no longer register with the RCN.

[4] Note that the QLFS does not provide any direct information about actual nursing grades, but rather divides workers (nurses) into managerial, supervisory and non-supervisory positions. However, due to the rigid, nationally-determined, nursing pay scales in the NHS, we have been able to use these scales for each of the survey years, and the wage information contained in the QLFS, to verify the general correspondence of the nursing grades to these three broader seniority measures.

Given the focus of this paper, the most interesting aspect of our data is the characteristics of the 479 nurses that we observe leaving the NHS. This corresponds to a staff turnover or wastage-rate of 10% a year (i.e. 10% of NHS nurses leave the NHS each year). Of these nurses who leave the NHS, 21% move into nursing in the private sector, 7% go into other private sector employment, 35% go into other public sector occupations and 37% move into non-participation. Hence 65% of NHS nurses are completely lost (both from nursing and non-nursing positions) from the public sector and 79% leave the nursing profession altogether.

Since there is widespread dissatisfaction amongst NHS nurses with their working hours and general workload (see Shields and Ward, 2001), it is equally interesting to see what changes in these job characteristics occur for nurses who leave NHS employment. Hence we compare the average number of working hours (self-reported, including overtime, for the week prior to interview) that those nurses that leave the NHS to work elsewhere in their different jobs. We find that those nurses who left the NHS subsequently work more hours - an average work of 29.2 hours per week - in their new job than previously – an average of 27.8 hours per week. Whilst these figures might appear surprising, it is important to note that there is also a general movement towards non-shift work. These findings imply that NHS nurse dissatisfaction with working hours reflects the requirement to undertake shift-work patterns, rather than dissatisfaction with the length of the working week. This has important policy implications, which we will return to in Section 6.4, when our results are discussed.

Apart from hours and workload, there is also general dissatisfaction by NHS nurses with their level of pay (see Shields and Ward, 2001). Moreover, despite the evidence from a number of nursing labour supply studies that nurse labour is fairly unresponsive to wage increases, a policy of increasing nursing pay is the most favoured by nursing unions. Unfortunately, if we wish to look at wage changes for this group, the data poses the problem that wages are only observed in waves 1 and 5 and, therefore, not for all nurses who leave the NHS (i.e. those who left the panel before wave 5, or who did not report their wages). Hence we lack a sufficient sample of directly reported wages, by the same individual in both NHS and non-NHS employment, in order to compare hourly wage differences in the two jobs.

However, we are able use the entire sample to ascertain the determinants of wages for NHS nurses and for employed ex-nurses (those who were an NHS nurse at least once in the sample). Using the results of these estimations we can then predict the hourly wage difference, for each individual, between employment as an NHS nurse and employment elsewhere. The usefulness of this prediction obviously depends on the quality of the information used for predicting wages. We use not only all the usual human capital variables (age, tenure, job-level as an NHS nurse, educational qualification levels), but also the intentions information (whether an individual intends to quit because of dissatisfaction with pay or hours) in order to pick up any unobserved factors which might affect wages. From the calculation of these

predicted wage differences we find that nurses earn on average 19.7% more per hour than that they would in non-NHS nurse employment. We also find this result for those who actually leave, and that the wage bonus of being an NHS nurse is higher for untrained nurses than for qualified nurses. Hence, the information in our sample strongly suggests that both wage rates and hours of work are more favourable in the NHS, compared to outside employment. An obvious explanation is these higher NHS wages and reduced hours of work partially compensate nurses for the heavy workload and unsocial shift patterns in the NHS. However, despite the higher pay and lower hours of work, it is still the case that working conditions appear to be the main driving forces behind the high rate of nurse turnover.

If the percentage of nurse, leaving and entering the NHS remain as they were on average, from 1997 to 2002, then simple accounting techniques lead us to predict the stock of NHS nursing will decline by about 2.5% per year in the coming 5 years. Compared to the rising need for NHS nurses, it is clear that these adverse historical trends are unsustainable: something must give. This makes it all the more important to identify policies which will significantly reduce the rate of NHS nursing turnover.

5. Econometric Framework

5.1 Duration Model

Given that our primary interest is in analysing the determinants of quitting the NHS, we begin by specifying the hazard rate θ of an NHS nurse *i* quitting at time *t* as:

$$\theta_{it} = \lambda_t e^{x_{it}\beta} \tag{1}$$

which means we take the standard Proportional Hazard specification. Here, λ_t is the baseline hazard (which is allowed to be non-parametric, i.e. it is taken to be piece-wise constant); x_{it} is a vector of individual characteristics. With this hazard rate, the probability of observing someone quitting public nursing between T_{k-1} and T_k can then be written as:

$$P\{T_{k-1} < t \le T_k \mid x_{it}, t > T_{k-1}\} = 1 - \exp(-\int_{T_{k-1}}^{T_k} \lambda_t * \exp(x_{it}\beta) dt) \tag{2}$$

which means that the probability of quitting NHS nursing between T_{k-1} and T_k, given that it is larger than T_{k-1}, equals one minus the integrated hazard of that period. The big advantage of this hazard model is that it naturally takes account of right-censoring, which applies to most of our data (the high rate of

attrition in the QLFS was noted earlier). Unusually for this model, we allow for several time-varying characteristics, such as the number of children, marriage, and year effects.

An important question is whether we can include unobserved heterogeneity within this model (see Holmas, 2002). The problem in this respect is that we only have 479 observed transitions from nursing to other states. The standard method of allowing for unobserved heterogeneity is to focus only on those nurses whom we observe entering the profession, and to infer from the interaction between duration and the effect of the explanatory variables on the hazard rate what the unobserved heterogeneity distribution is (see Van den Berg 2001, for a review of modelling options in our context). This way, however, is blocked for us, because the number of nurses that we observe both entering and leaving the NHS within the five quarter window of the data is far too small for meaningful econometric results to be obtained. Another approach would be to make the assumption that the stock of NHS nurses is stable over time, and to use information on the aggregate flows to infer the distribution of unobserved heterogeneity. Given the large changes in the stock of NHS nurses over the last few decades, we reported earlier, such an avenue is also precluded. We hence focus on a model without unobserved heterogeneity, but note that in general any bias would push our estimated coefficients downward. As a practical advantage, however, having no unobserved heterogeneity reduces the importance of functional form for our estimates, because the identification of unobserved heterogeneity in single-spell data is known to be heavily dependent on functional form (e.g. Baker and Melino, 2000).

Of special interest is the construction of the variable denoting the expected proportional hourly wage difference between public sector nursing and alternative employment. As mentioned previously, one practical issue here is that wages are only collected twice in the panel, and, as such, the actual wage difference is not always directly observed. Therefore we compute both the likely wages for nurses in NHS employment, which follows a strict grading schedule, and is hence well-predicted, and the wages in outside employment. In order to account for selection, we include amongst the predictors whether someone was searching for another job whilst a NHS nurse. In order to identify the effect of the expected proportional hourly wage difference on quitting behaviour, we include measures of general qualifications (i.e. pre-nurse training) as a predictor of wages, but exclude it as a direct predictor of quitting. This means we assume that the effect of having non-nursing qualifications on quitting (mainly) works via outside job-opportunities.

As a more elaborate model, we next distinguish between the two main observed exit states, namely outside employment and non-participation. Denote the hazard rate of quitting NHS nursing by individual i at time t for exit state j as θ_{it}^{j} which is specified analogue to (1). The probability of not quitting between T_{k-1} and T_k, given a duration at least as high as T_{k-1}, then equals

(3) $$P\{T_k < t \le T_k \mid x_{it}, t > T_{k-1}\} = \exp(-\int_{T_{k-1}}^{T_k} \sum_j \lambda_t^j * \exp(x_{it}\beta^j)dt)$$

This model is estimated by maximum likelihood, yielding estimates of each of the baseline functions λ_t^j and the parameters β^j.

5.2 Simulations

We use the estimates of the single destination duration model above to address the question of how a policy maker may influence the propensity for a nurse to quit NHS. As the baseline, we use our model to estimate the proportion of NHS nurses that can be expected to quit in any 3 month interval. This estimate is defined as:

(4) $$Quit\ \text{Pr}oportion = \frac{\sum_i \sum_t 1 - \exp(-\int_{T_{it-1}}^{T_{it}} \hat{\lambda}_t * \exp(x_{it}\hat{\beta})dt)}{N}$$

where T_{it-1} denotes the duration in the current public nursing job at the start of the 3-month period of individual *i* in her *t*'th observation, and where N is the total number of 3 month observations.

We can now perform policy simulations by manipulating x_{it}. More specifically, we estimate the effect of reducing the proportional wage difference between NHS nursing and other employment by 10%. This difference can, in practice, be reduced by either increasing the hourly pay (including overtime) of NHS nurses by 10%, or by reducing the hourly pay in other employment by 10%. In this context, it is worth recalling that 35% of the transitions from NHS nursing are to a non-nursing job in the public sector.

6. Results

6.1 Wage differential between NHS nursing and other outside opportunities

The estimates from the log hourly wage regressions for NHS nurse wages and outside wages are presented in Table 1. As mentioned earlier, the two identification restrictions, not included in the turnover model we use to predict outside wages, are whether the nurse has at least 5 'O' levels and at least 1 'A' level. The results from this model appear sensible and the adjusted R-squared measures are both around 0.40. In particular, for both models age takes the expected quadratic profile and hourly wages are higher for males, for whose who are married or cohabiting, for those in more senior positions (i.e. higher nursing grades), those with a nursing degree, those with higher levels of general qualifications (our instruments) and those with a foreign nursing qualification. Wages are lower for those who are widowed,

divorced or separated, for ethnic minorities and for those unsatisfied with their pay. and for those employed in larger workplaces. The finding that ethnic minority nurses obtain lower wages in the NHS is reflective of labour market discrimination found in previous studies (see, for example, Pudney and Shields, 2000a, 2000b; Shields and Wheatley Price, 2002b). Wages differences are also associated with limiting long-term health conditions, having a permanent job, full-time employment and the size of workplace.

We use these estimates to establish the hourly wage differential between NHS employment and the outside job opportunities available to nurses who quit. One very important result is that, on average, hourly wages are found to be 23% higher in the NHS, compared to outside employment. Moreover, as illustrated in Figure 1, the NHS becomes a relatively better paid employment choice with age. The predicted wage differential rises from about 20% at age 21 to around 30% by age 60.

6.2 Quitting NHS nursing: Single Destination Hazard Model

The full results from the duration models are presented in Table 2. We begin our discussion with the results from the single destination hazard model.

The individual determinants of quitting the NHS appear to be quite intuitive, and most of them confirm the findings of Shields and Ward (2001), who investigated intentions to quit rather than actual quitting.[5] NHS nurses are most likely to leave in their first 12 months of employment, and young nurses are found to be more likely to leave the NHS than older nurses. Both of these findings have important implications for the targeting of policies aimed at improving nurse retention. As expected, those nurses reporting a long-term health condition are more likely to exit the NHS. Importantly, nurses employed in the highest nurse grades (i.e. managers) are more likely to leave NHS nursing than junior nurses. Registered and enrolled nurses are also more likely to quit than untrained auxiliary and support nurses. This might reflect the high transferability of managerial skills to the outside labour market, and the poor outside labour market opportunities many auxiliary and support nurses may have.

We find that those employed full-time are less likely to leave the NHS as are those in permanent positions. As expected, those nurses who have recently invested in employer-provided training are less likely to quit the NHS, and we find that the probability of quitting is significantly lower in larger workplaces (i.e. hospitals) than smaller workplaces (i.e. general practice and community nursing). This latter finding, again, has important implications for the targeting of policy. Housing tenure also appears to be a predictor of quitting, with those with a mortgage having the lowest likelihood of leaving the NHS. This might reflect greater financial responsibility for those nurses with a mortgage than those who either

[5] One variable, likely to be important in the nurse quitting decision, as emphasised by Holmas (2002), is the shift pattern that a nurse works. Although we observe this information in our data it is only asked in the Spring quarter of each survey year.

own their home outright or rent. Interestingly, we have found no effect of gender or marital status on the decision to quit the NHS. Neither were season or region significant predictors of quitting behaviour.

We now turn to a discussion of the effect of wages on leaving NHS nursing. The main identifying instruments, in this respect, were the general (pre-nurse training) education variables and an indicator for the permanency of the current job. It is therefore assumed that these factors have an effect on NHS retention only through their impact on the outside wages. These instruments appear intuitively reasonable, but as with any study which does not observe strict exogenous variation in wages, some caution should be exercised in interpreting the results. Given these instruments, we find that the log wage differential is positive and significant at the 1% level. Those with a 1% higher wage outside of nursing were 0.715% more likely to quit NHS nursing. This finding is similar to that of Ahlburg and Mahoney (1996) and Schumacher (1997) for the US, and Holmas (2002) for Norway, and suggests that increasing wages for NHS nurses might have some success in retaining their services. However, it is also clear that a substantial wage increase for NHS nurses would be necessary to make a large enough impact on the nursing shortage problem. We return to this issue, and examine it further, in Section 6.4.

6.3 Competing risks

Whilst the single destination hazard model is informative about the characteristics of nurses who leave the NHS, and the overall importance of wages in this decision, it provides little information about the destinations of nurses. In the competing risks specification, however, we are unable to use the full set of explanatory variables due to the limited number of nurses actually moving into the different competing labour market states. This means we have to be more parsimonious in the number of explanatory variables included in the model. Consequently, we have retained only the most significant variables from the single exit model. Moreover, we model only the two main competing destinations for NHS nurses: namely, other employment (both in the public and private sectors) and non-participation.

These results are also fairly intuitive. The likelihood of leaving the NHS, into both states, declines with age. The exit hazard is also highest for senior nurses in managerial positions, and lowest for untrained auxiliary and support nurses, regardless of the destination. Nurses are also much less likely to quit the NHS at all if they are employed in larger workplace. In fact, together with seniority, workplace size is the biggest predictor of quitting. Clearly larger NHS workplaces have some characteristics which improve the work environment on nurses. Such possibilities include better internal job opportunities and promotion prospects within larger employers such as NHS hospitals, more scope for flexible working or control over shift patterns and hour and increased provision of childcare facilities. Clearly identifying the most important of these, and other factors, is crucial to the design of appropriate national and workplace

Hence we are unable to include it as a explanatory variable in the duration model. However, as mentioned in Section 4, we

policies in order to improve nurse retention in the NHS. Nurses with a limiting long-term health condition are more likely to leave employment altogether, as are those nurses who either own their home or have a mortgage compared to those who rent.

One interesting result in the impact of the wage differentials on NHS movements. The higher is the predicted (or observed) wage offer the more likely nurses are to move to either other employment or non-participation. However, this effect is only statistically significant with respect to non-participation. One interpretation of this result is that nurses who are doing relatively poorly in terms of pay in the NHS are the one most likely to move into non-participation.

6.4 Policy Simulations

As a check on the ability of the single destination model to fit the data, we first predict the proportion of the current nursing stock to leave in a 12-month period using our estimates. The prediction proportion is 10.05%, which corresponds very closely to the raw data estimate of 9.97%. The single risks model hence fits the aggregate raw data very well. Using the predicted proportion as the benchmark, a 10% higher wage for NHS nurses would reduce the percentage of nurses leaving in any 12-month period by 0.660%. This estimate has the same statistical significance as that of the wage difference parameter in the duration model. Importantly, however, this estimate does not include the hiring effect of the higher wages – how many new entrants are induced into NHS nursing due to the better remuneration.

We have also performed a simulation exercise where we used an indicator of whether nurses were dissatisfied with their hours. Hypothetically, we consider the possibility of allowing nurses to adjust their hours of work (which is a big assumption given the 24 hour nature of NHS nursing). We find no significant effect on nurse retention from this hypothetical policy experiment. In particular, if all demands to change hours were met, there would be no more than a 0.1% reduction in the percentage of NHS nurses leaving per year. In other words, our results indicate that those NHS nurses who reported that they were dissatisfied with their hours simply did not turn out to be more likely to actually quit than otherwise similar nurses.

6.5. A Back-of-the-Envelope Estimate of Turnover Costs Savings of a Nurse Wage Increase

Our estimates indicate that there is some beneficial effect, on the retention of NHS nurses, from increasing their wages. We now provide a back-of-the-envelope assessment of the potential savings to the NHS, in terms of reduced training costs for new nurses, from a 10% increase in all nurses wages. Estimates of turnover costs in NHS nursing differ considerably between studies depending on whether or not productivity changes are taken into account (see Gray *et* al., 1996, for an extended discussion). For

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have shown that most of the NHS nurses who move into outside employment are in jobs which involve no shift work.

example, Gray and Normand (1990) calculate an average turnover cost per nurse of £494, which contrasts with the average cost of £4398 found by Buchan and Seccombe (1991).[6] Taking the higher of these figures and inflating it by the CPI index over the last decade, we estimate turnover costs per nurse to be £6,534 in current prices. Taking our point prediction, the reduction in turnover by 0.660% as a result of this hypothetical 10% across-the-board wage increase, would mean an extra 2,119 nurses would be retained in NHS employment (given the 321,000 RNs in the NHS). If we multiply these 2,119 nurses by the turnover cost estimate, we get a total cost saving estimate of just under £14 million per year. Given the current average wage of an NHS nurse of £20,000 per year, a 10% increase in wages for the 321,000 nurses, would cost £642 million per year. Hence we predict the reduction in turnover costs, as a result of increasing all nurses wages by 10%, would save only about 2% of the increase in the NHS wage bill.

7. Conclusions

The question of how to tackle persistent and worsening nurse shortages is an important issue currently facing policy-makers across the world. Despite this, and the fact that nursing represents one of the largest occupational groups, the last few decades have seen very little economic research into the workings of the nursing labour market (Antonazzo et al., 2003; Shields, 2003). In this paper we have provided an original contribution to this literature by undertaking a detailed empirical investigation into the quitting behaviour of nurses, using longitudinal data from the UK. We estimate both single and competing risk duration models. Our main focus is to examine the potential effect of increasing nurses' wages in order to improve nurse retention in the publicly-funded National Health Service. Previous studies from other countries have typically found that nurse labour supply is unresponsive to wage changes.

Using data from the longitudinal aspect of the Quarterly Labour Force Survey (QLFS) of the UK, we clearly find, contrary to the views of the Royal College of Nursing and the main UK nursing unions, that the current hourly wages of NHS nurses are about 19.7% higher than the wages commanded by (otherwise identical) qualified nurses now working outside the NHS. Moreover, these nurses work an average of 1.5 hours more per week than they did in the NHS. However, this appears to be a price worth paying for these individuals who are now less likely to engage in shift work, than they were employed in NHS nursing. For many qualified nurses it is clear that the higher average hourly wages in the NHS are insufficient compensation for the disagreeable non-pecuniary working conditions experienced there. Importantly for the focus of policy, we find that young nurses, nurses new to the job and those in senior managerial nursing grades are significantly more likely to leave NHS nursing, Moreover, we also find

[6] Buchan and Seccombe's (1991) estimate of average turnover costs includes not only administrative costs, but also initial productivity losses which occur as recruits learn on the job. In 1995 prices, their estimate (£5998) consists of the costs of separation (£67), temporary replacement (£1602), recruitment and selection (£489) and training and induction (£3839). It is suggested, however, that this estimate should be reduced by around £1600 to take into account of the payroll savings of a temporarily vacant post (see Gray *et al*., 1996, for an extended discussion of turnover costs in NHS nursing).

that larger NHS workplaces are more successful in retaining their nursing staff than small workplaces such as general practice and community nursing.

Turning to the potential for improving nurse retention by increasing wages in the profession, we found that the higher the expected outside wage relative to the NHS wage, the significantly more likely nurses are to leave the NHS. Our policy simulations suggest that a 10% wage increase for NHS nurses would reduce the percentage of nurses leaving each year from about 10% to 9.4%. We have calculated that such a wage increase would increase the NHS annual nursing wage bill by around £642 million per year. Only 2% of this cost would be saved by lower turnover costs (of £14 million per year). However, these estimates ignore the beneficial impact on the recruitment of nurse that such wage rises may have. There is a clear need for more in-depth research on this important issue. However, only a greater investment in detailed longitudinal data collection will enable researchers to explicitly allow for unobservable heterogeneity in durations analyses and explore the extent to which increases nurses pay will help recruitment into the profession.

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FIGURE 1: Predicted Wage Differential between NHS Nursing and Outside Employment by Age

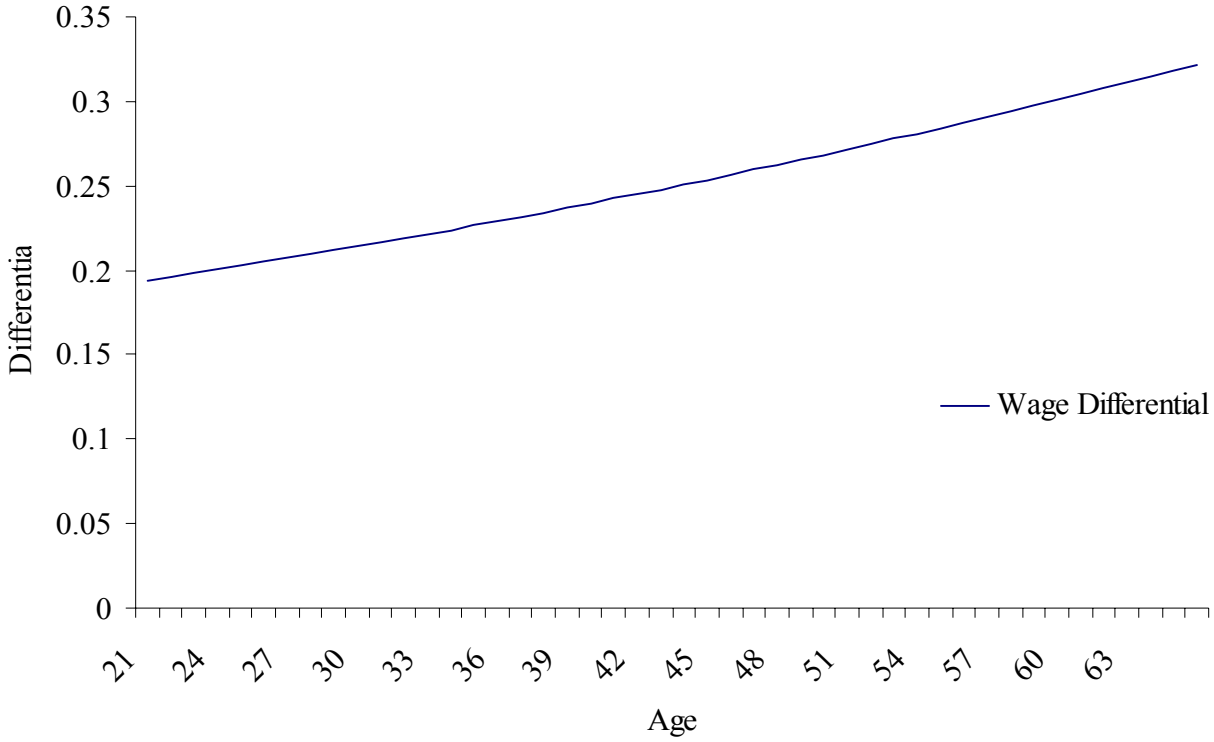

TABLE 1: OLS Models of NHS Nurse Wages and Outside Employment Wages

Explanatory Variables	**NHS Nurse Wage**		**Outside Employment Wage**	
	β	*t*-stat	β	*t*-stat
Age	0.046	16.68	0.045	8.91
Age-squared /100	-0.048	-14.59	-0.050	-8.30
Male	0.052	4.36	0.023	0.72
Married or cohabiting	0.006	0.56	0.036	1.25
Widowed / divorced / separated	-0.023	-1.60	-0.036	-0.96
Immigrant	0.005	0.25	-0.011	-0.22
Ethnic minority	-0.050	-2.60	-0.122	-2.51
Limiting health condition	-0.035	-2.41	-0.001	0.04
Supervisor (Grades E, F)	-0.095	-1.62	-0.165	-1.68
Non-supervisor (Grades C, D)	-0.190	-3.27	-0.235	-2.45
Nursing degree	0.082	7.04	0.119	3.52
5 or more 'O' levels	0.066	7.94	0.152	7.43
1 or more 'A' levels	0.013	1.26	0.011	0.39
Foreign nursing qualification	0.059	2.68	0.118	1.95
Full-time employed	-0.057	-7.40	0.047	2.41
Permanent job	0.067	4.37	-0.037	-1.18
Has a second job	-0.018	-1.22	0.006	0.20
Unsatisfied with pay in nursing	-0.008	-2.36	-0.100	-1.70
Auxiliary nurse (Grades A, B, C)	-0.353	-32.78	-0.334	-12.80
More than 50 employees	-0.037	-4.30	0.090	4.93
Constant	1.309	21.90	1.085	10.79
N	7220			1741
Adjusted R^2	0.392			0.386

Notes: - The omitted categories are female, single, UK-born, white, no limiting long-term health condition, manager, no nursing degree, less than 5 'O' levels, no 'A' levels, no foreign nursing qualification, part-time, non-permanent job, no second job, satisfied with pay, registered or enrolled nurses and less than 50 employees at workplace. The models also include controls for year, season and region (8).

TABLE 2: Proportional Hazard and Competing Risks Proportional Hazard Models for the Decision of Nurses to Quit the NHS

Explanatory Variables	**Single Risks Model**		**Competing Risks Model**			
	Not in the NHS		**Other Employment**		**Non-Participation**	
	β	*t*-stat	β	*t*-stat	β	*t*-stat
Baseline hazard						
Duration < 4 months	1.306	2.98	-1.088	-2.01	1.213	1.45
3 months < Duration < 7 months	1.150	2.68	-1.485	-2.89	1.662	1.97
6 months < Duration < 13 months	1.335	4.24	-1.142	-2.95	1.429	3.11
12 months < Duration	0.494	1.71	-1.870	-5.54	0.170	0.42
Log wage differential	0.715	5.19	0.258	0.49	1.564	8.54
Age	-0.032	-5.49	-0.020	-2.63	-0.040	-4.15
Married or cohabiting	0.250	1.50	-	-	-	-
Widowed / divorced / separated	0.223	0.99	-	-	-	-
Number of children	-0.082	-1.43	-	-	-	-
Dependent child under 3 years	-0.259	-1.66	-0.376	-1.93	-0.023	-0.10
Limiting health condition	0.753	4.78	0.296	1.30	1.335	5.74
Supervisor (Grades E, F)	-2.039	-12.89	-1.261	-6.45	-4.640	-8.27
Non-supervisor (Grades C, D)	-0.976	-8.12	-0.102	-0.62	-3.481	-10.66
Full-time employed	-0.588	-5.27	-0.083	-0.57	-1.368	-7.39
Permanent job	-0.411	1.86	-	-	-	-
Training in last 13 weeks	-0.494	-1.85	-	-	-	-
Auxiliary nurse (Grades A, B, C)	-2.252	-7.06	-2.144	-6.32	-1.959	-1.85
Home owner	-0.143	-0.72	-	-	-	-
Home mortgage	-0.427	-2.86	-	-	-	-
Home owner or home mortgage	-	-	0.103	0.53	0.570	2.39
More than 50 employees	-1.756	-15.29	-1.236	-8.60	-3.381	-9.89
Mean Log Likelihood	-0.092			-0.101		
Number of individuals	5015			5015		
Number of 3-month periods	16174			16174		

Notes: - means that the covariate is not included in the model. The omitted categories are single, no dependent child under 3 years, renter, no limiting long-term health condition, manager, part-time, non-permanent job, has not received employer-funded training in last 13 weeks, registered or enrolled nurses and less than 50 employees at workplace.

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