

Nurse Behaviour in New South Wales

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The retention of nurses has become a key issue for governments in Australia and overseas. Policy makers and health care administrators point to a shortage of nurses, driven in part by nurses exiting the profession at a rapid rate. The causes of this are multi-faceted and include the ageing of the nursing work force, more stringent educational requirements being placed on nursing students and a greater range of career opportunities open to new nursing graduates. This paper examines the employment behaviour of registered nurses in New South Wales between 1986 and 2002. Using a unique dataset we identify the determinants of nurse retention and movement within the health care sector in New South Wales during this period. We estimate a series of duration models to identify the effect of a change in the nature of nurse education, from hospital based training to university based training on labour market behaviour.

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1. Introduction

There is currently a worldwide shortage of registered nurses due, in part, to the profession being unable to retain nursing staff in a variety of specialty areas (AIHW, 1999). In turn, developing strategies to deal with the low retention of this group is currently the main concern of policy makers and health care administrators in many developed countries (Buchan *et al.*, 1994; Commonwealth of Australia 2000; NSW Government 2000). The registered nurse shortage is particularly severe in countries that have large publicly-provided health care systems such as the United Kingdom, Canada and Australia. The problem is also evident in the United States. Moreover, among policy makers and health care administrators there is a concern that as the registered nurse workforce ages, the shortage is likely to become more pronounced (Buerhaus, 1998; Buchan, 1999).

The size of the registered nurse (RN) shortage is substantial across countries. In the United States a registered nurse vacancy level of over 126,000 full-time equivalent positions in 2001 is set to increase to approximately one million by 2010 (American Hospitals Association (AHA) 2001a, 2001b, cited in Shields, 2004). Similarly, in the United Kingdom, the National Health Service (NHS) has identified a RN deficiency of around 20,000 in England alone (Royal College of Nursing (RCN), 2002, cited in Shields, 2004). In Australia, a shortfall of 5,000 RNs was identified in 2002 and this figure has been forecast to increase to around 31,000 by 2006 (O'Hagan, 2002, cited in Shields, 2004). It should be noted that there are more modest estimates of the registered nurse shortage in Australia, for example, Shah and Long (2003) estimate a shortfall of 900 professional nurses per year to 2006. However, Australia is facing two problems in this regard: an ageing nurse workforce and young nurses who are less satisfied with the profession than their older colleagues (Shah and Long, 2003).

It is important to note that the RN shortage is an international issue. In the past, Australia has recruited qualified nurses from overseas in an effort to reduce local nurse shortages. The long-term viability of such an approach is, however, unclear (Duffield and O'Brien-Pallas, 2002). As the shortage of RNs becomes more pronounced in other countries, Australia is likely to face increasing competition for RNs trained in other countries. The 'mobility of nursing qualifications', both locally

and internationally, is an appealing aspect of the nursing career, helping to facilitate travel and movement into and out of the work force (NSW Government, 2000). Since the change in nurse education from hospitals to educational institutions in the mid 1980s in the United Kingdom and Australia, RN skills have become more similar across countries. An implication of this is that RN skills are easily transferred across countries and hence RNs face a worldwide labour market. In these circumstances, it is important to identify factors that are influencing the behaviour of RNs and their willingness to remain working over time.

There are a number of possible explanations for the shortage of RNs reported across countries. Commonly cited factors include an ageing population, both of nurses and the population in general, and changes in nurse education, work place practices and relative salaries which have influenced the demand for and supply of RNs (Duffield and O'Brien-Pallas, 2002). Other factors that have been cited as influencing the current shortage of RNs include increases in patient acuity, limited resources at the workplace, technological advancements, and higher patient expectations. Together, these factors have made the work environment more complex, challenging and stressful for nurses (NSW Health, 1996a). To date, one possible influence on the behaviour of RNs that has received little attention are changes in the nature of nurse training. A key contribution of this paper is to examine how the behaviour of RNs is influenced by the type of training they have undertaken.

An ageing RN population is a key concern for policy makers (Buerhaus *et al.* 2000; Duffield and O'Brien -Pallas, 2002). Around 40 per cent of the nursing work force in the United States will be over 50 years of age by 2010 (USGAO, 2001, cited in Shields, 2004). In the United Kingdom, 25 per cent of nurses are expected to retire by 2007, and only 15 per cent of RNs in the NHS are under the age of 30, representing a 10 per cent decrease in the number of these nurses in the same age category ten years prior (RCN, 2002, cited in Shields, 2004). In Australia, 38 per cent of registered nurses were 45 years or older in 2001 (Shah and Long, 2003), and thus many will be nearing retirement age in the next ten years.

Another important factor influencing the supply of registered nurses, and one of the issues addressed in this paper, is the educational requirements that student nurses must

meet in order to enter the profession. In most countries, these were put in place in the mid 1980s. As the main component of the 'professionalisation' of nursing over this period, the change in nurse education was intended to increase the range of skills held by RNs (Hardill and MacDonald, 2000; Francis and Humphreys, 1999). The change reflected a desire for RNs to be educated in the same manner as allied health care professionals; for student nurses to be able to concentrate wholly on their studies; and, to produce a nursing work force that was knowledgeable in advanced medical procedures and treatment and thus could meet the higher demands of the public (Francis and Humphreys, 1999). More formal or in-the-classroom educational requirements for student nurses have also meant that there is less on-the-job training for this group. Indeed, the lack of student nurses' exposure to work in hospitals and other medical facilities has led some policy makers to cite this as a possible reason for the current registered nurses shortage (ABC News Online, 2005; NSW Nurses' Association website, 2005).

Additionally, since these educational requirements are more academic today, newly qualified registered nurses can transfer many of their learned skills to areas outside the profession. Thus, nursing education courses have been increasingly seen as a 'stepping stone' to other studies and or professions (New South Wales Government 2000). Further, for nurses who have been in the profession since at least the 1980s, the role of the RN has been expanded to include both managerial and administrative duties, in addition to clinical duties. Thus, many older nurses possess skills that can be easily transferred to non-clinical areas in nursing, or even outside the profession.

There is also evidence that nurses are dissatisfied with their work (Shah and Long, 2003). There are various reasons for this, including heavy workloads; shift-work and short-notice about overtime; perceived low relative wages; greater career opportunities outside the profession; and, medical organisations adopting a more business-like attitude. Worldwide evidence of nurses' low job satisfaction using survey data from five countries: the United States, Canada, England, Scotland and Germany, can be found in Aiken *et al.* (2001). These perceptions have also been identified in other countries (Shields and Ward 2001; Buchanan and Considine 2002; Dockery 2004).

One possible response to a shortage of RNs may be to increase wages and salaries. However, empirical evidence suggests that the labour supply of RNs is relatively inelastic (Antonazzo *et al.* 2003; Shields, 2003; Frijters *et al.* 2003; Phillips, 1995; Rice, 2003 in Shields, 2004; Doiron and Jones, 2006). There is limited evidence of how other aspects of the work environment and characteristics of RNs have contributed to their labour market behaviour. This paper contributes to our understanding of the behaviour of nurses by exploiting a longitudinal dataset that contains information on the educational qualifications of nurses. Given the significant change in the nature of RN training that occurred during the period covered by the data, it is useful to consider how, if at all, the behaviour of RNs varies according to the nature of their training. Specifically, the contribution of this paper is estimate a series of duration models that describe the length of employment spells in nursing in New South Wales for recent nursing graduates. Time in nursing is taken to be the time until they leave the nursing work force, although they may remain registered, or they become unregistered and therefore unable to continue working as a nurse. The analysis in the present paper suggests that RNs trained in educational facilities (Universities and Colleges of Advanced Education) exhibit significantly higher exit rates from the RN workforce than those educated in hospitals.

The remainder of the paper is set out as follows. In the next section we discuss some of the institutional considerations associated with nursing in New South Wales. We also provide a brief review of the international and Australian literature on the labour market behaviour of RNs. Following this, in section three we describe the dataset and provides some statistics about the nurse population in NSW. Section four describes the methodology used in the paper. In section five we present the main results of the paper. Section six discusses the policy implications given the results in the empirical analysis section and highlights some additional areas that require additional analysis.

2. Literature review and institutional considerations

There are two types of nurses working in NSW: registered and enrolled (RN and EN respectively). To be eligible to practice nursing or to take-up work which is primarily concerned with the discipline of nursing, such as nursing administration, research or

nurse education, nurses are required to be registered with the Nurses and Midwives Board of NSW. As a general rule, RNs are more qualified and undertake more onerous and complex tasks than ENs (AIHW, 2001, p. 8; ABS, 1997). The focus of this paper is the labour market behaviour of RNs.

In recent years there have been significant changes in the nature of RN training, from an 'apprentice-type training located in hospitals to tertiary training conducted by higher educational institutions' (Francis and Humphreys, 1999, p. 128). The transfer of RN education from the health sector and into the higher education sector was initially announced by the Commonwealth Government in 1984. Registered nurse education was to move into Colleges of Advanced Education (CAEs) (later universities) and the move was to be completed by 1993. Originally, the qualification was set at the Diploma level, however, this was upgraded to a Bachelor degree in 1992. Today, universities also offer postgraduate courses for those who have completed the basic degree and want extra training in nursing specialties such as midwifery. For those who are already experienced in a particular area of nursing there are more advanced courses available covering nurse management and academic research. Enrolled nurse training was transferred from the health sector to TAFE colleges in the mid 1980s. The qualification on completion of enrolled nursing courses is a diploma. Qualified enrolled nurses can undertake bridging courses in preparation for RN studies at university.

There are few empirical studies conducted on the labour market behaviour of RNs, despite the shortage of this group discussed above and the interest of their behaviour to policymakers (Frijters *et al.* 2003, p. 5). The majority of these studies have examined the labour supply of RNs in the United States. Shields (2004) provides an in-depth review of these studies. The analysis has tended to focus on the labour supply of a particular group of registered nurses: female, married and working in nursing. These studies have tended to use cross-sectional data, especially that from the Census of Population 1950, 1960, 1970 and 1980 (Benham, 1971). Some studies have used data from the quadrennial National Sample Survey of Registered Nurses, beginning in 1977 (Link, 1992), or from postal questionnaires that were specifically designed to identify the attitudes and employment behaviour of nursing professionals (e.g. Bognanno *et al.*, 1974; Ault and Rutman, 1994; Ahlburg and Brown Mahoney, 1996).

A principal aim of many of these studies has been to determine how the wages of RN affect behaviour. The majority of these studies found that the wage elasticity of registered nurse labour supply, however measured, is relatively inelastic. Even large increases in registered nurse wages would be unlikely to encourage this group to either enter the work force and or increase their working hours. The average wage elasticity of RN labour supply in studies for the United States is in the vicinity of 0.3 (Frijters *et al.* 2003, p. 5). Only two of these studies found labour supply for RNs to be elastic (Sloan and Richupan 1975; Brewer 1996). The former study found the largest elasticities to date: a wage-participation elasticity of 1.8, and a wage-hours elasticity of 2.8. There is also evidence of a backward bending labour supply function for RNs (Bognanno *et al.*, 1974; Link and Settle, 1981). Some of the more consistent findings across the United States studies are that, for married RNs, increases in husband's wage and non-labour household income, and the presence of young children (usually, under 6 years) have a negative and significant effect on RN labour supply. The relationship between age and labour supply was also found to be inverted U-shaped, possibly reflecting life-cycle consideration such as child-bearing decisions.

Several studies of nurse behaviour in the United States have found that educational achievement, and several education-related variables, such as type of educational qualification, are important determinants of labour market behaviour. For example, Link and Settle (1979) found that after including the level of educational attainment and the presence of a health problem in a model of labour supply, the wage-hours elasticity increased from 0.38 to 0.58. Ahlburg and Brown-Mahoney (1996) found that RNs with additional years of training were between five and ten per cent more likely to leave the nursing work force compared to those with less training. Additional training here refers to a three or four year Bachelor or Diploma degree rather than a two year Associates degree. Thus, there is some evidence that the level of education has a significant effect on RN behaviour.

There are few studies that examine the labour supply of registered nurses outside of the United States. A study by Phillips (1995) of RNs in the United Kingdom estimated a Heckman-type selection model using a small sample of registered nurses (312 individuals) drawn from the Women and Employment Survey 1980. In this study, RN

wages were identified as important determinants of their labour market participation, with an elasticity of approximately 1.40. However, he also found that the wage elasticity with respect to working hours was small and in the order of 0.15. This suggests that wage increases would be successful in increasing the participation of available registered nurses in the United Kingdom, but not in terms of encouraging currently working nurses to increase their hours. The presence of young children (under 6 years) and non-labour household income were found to have a significant and negative impact on participation. Similar results were identified in models that examined hours worked models. Further, having an 'advanced' level qualification, reduced the hours worked by RNs.

Rice (2003) (cited in Shields, 2004) estimated a series of labour supply models (hours worked) for RNs in Britain using data from the first nine waves of the British Household Panel Study 1991-1999. In models that did (did not) include fixed effects, positive and significant wage elasticities in the order of 0.288 (0.377) were found. A number of characteristics were found to be negatively related to working hours among RNs. These include being married, having young children or other caring responsibilities, higher non-labour household income, working night-shifts, and having no managerial or supervisory responsibilities.

Askildsen *et al.* (2003) examined whether, for Norwegian RNs, increasing own-wages would increase labour supply. Using a large panel data set, they found that being married and having children significantly reduced the number of working hours, as did husband's income and non-labour household income. The type of work place, such as hospital, nursing home or medical practice, also had a significant effect on working hours. A wage-elasticity of approximately was 0.201 identified. The authors concluded that wage increases may, to a certain degree, increase the labour supply of RNs, but this policy would be costly to implement.

There are also a number of studies which have examined the reasons RNs quit the profession. Parker and Richman (1995), using pooled data from the US Current Population Survey (CPS) 1980-1990, found that married RNs are more likely to withdraw from the work force than their single counterparts, and that spouse income is not an important determinant of exit. Schumacher (1997), using a sample of RNs

found nurses respond to outside labour market opportunities. A one standard deviation decrease in the difference between the actual and predicted log wage led to an 8 per cent increase in the exit rate of nurses. Ahlburg and Brown-Mahoney (1996) also found that relative wages had a significant effect on nurse turnover. However, the relative wage effect was found to be quite small: a 10 per cent increase in the wage offered to a nurse relative to the expected wage in their best alternative occupation increased the probability of continuing to work as a nurse by only 2 per cent. Thus, workplace-related characteristics were seen as more important determinants of nurse turnover than wages.

Studies from the United Kingdom and Australia have identified similar results. For example, Gray and Phillips (1996) examined the effect of local labour market variables on RN turnover (and for other types of nurses) using local (district) health authority data. In the analysis, they find that the size of the private health care sector and the relative pay with respect to the local average for comparable workers, are important predictors of nurse turnover. At the same time, Gray *et al.* (1996) find that national pay increases for RNs in Britain would not be successful in reducing turnover. The turnover rate for full-time registered nurses are less elastic with respect to pay changes (-1.15), compared to that for enrolled nurses (-6.11). Gray and Phillips (1994) found that nurse turnover rates fall with age, and are highest in the first few years after having completed nurse training.

An Australian study, Doiron and Jones (2006), examines the retention of RNs in New South Wales public hospitals. Using a sample of around 16,000 RNs observed to be working in public hospitals in 1996, a series of models are estimated to identify the determinants of retention in the public hospital sector for this group in the following year. They found that young nurses were most likely to leave the profession; however, promotion at junior levels counteracts this effect. They also found that hours worked were positively related to nurse retention. Finally, they identified hospital characteristics, rather than hospital types, as important predictors of nurse retention. Specifically, hospital size, expenditures, emergency admissions and staffing levels had a positive effect on nurse retention. In comparison, workloads, complexity (measured as ANDRG weights) and Visiting Medical Officer (VMO) expenditures had a negative effect on nurse retention.

More recent empirical analyses of the labour market behaviour of RNs use duration models to consider the time until exit from health care facilities. For example, Holmas (2002) uses a panel dataset containing information on the work and personal characteristics of registered nurses in Norway estimates a number of single-spell duration models. He found that wages and working conditions were important predictors of nurses quitting the public health care system. Specifically, he found that a 1 Norwegian Krona increase in hourly nurse wages decreases the hazard by approximately 3.4 per cent. He also found that nurses working in large hospitals and those in hospitals with high occupancy rates, that is a high workload, exhibited high quit rates. Unlike some U.S. studies, neither the presence of young children nor being married was an important predictor of nurse quitting behaviour.

Frijters *et al.* (2003) use a sample of nurses derived from the United Kingdom Quarterly Labour Force Survey (QLFS) to consider the quitting behaviour of nurses. A series of duration models, incorporating the possibility of both single destination and multiple destinations, are estimated to identify the determinants of an exit (or quit) from the National Health Service (NHS). They find that the hourly wages of NHS nurses were around 20 per cent higher than the wages earned by nurses working outside the public system, and that the hours worked by each group were approximately the same. However, nurses are willing to accept lower wages outside the NHS in order to engage in less shift-work. Those more likely to quit their jobs in the NHS include younger nurses, nurses new to the job and those in senior managerial positions. In terms of the work environment, larger work places (hospitals) were more successful in retaining their nursing staff than small work places such as general practice and community nursing facilities. Importantly, they found that increasing nurse wages would have only a small effect on the retention of nurses in the NHS.

The analysis in this paper is similar to the last two studies discussed in that we examine the employment behaviour of RNs in New South Wales using a series of duration models. We estimate a series of single-spell hazard models using longitudinal data on RNs in NSW. We focus on the effect of work and personal characteristics on the hazard of leaving the nursing work force (either the public or private sector), and the type of education (or training) of nurses. Although some of the

empirical studies of the labour supply of RNs have included measures of 'educational experience' (usually, type of nursing qualification), they have not been able to include both hospital-training and formal, classroom-oriented studies. Given the significant change in the nature of RN training in the 1980s, it is important that we understand how, if at all, this affected nurse behaviour. We are able to shed some light on this issue because the nursing data used here contains detailed information on the type of training and/or education of RNs received. Moreover, during the period covered by the data used in the analysis, important changes were instituted to the nature of RN training in Australia.

3. The data

The data used in the analysis is a series of administrative files collected by the Nurses and Midwives Board of NSW and maintained by the NSW Department of Health. Given its administrative nature, the data contains only limited information on the personal characteristics of individuals such as age and gender. The data does, however, contain information on the personal and work (or job) characteristics of nurses, and the type of education and training they have undergone over the period 1986 to 2002. The source of the data is the NSW Department of Health. Approval for release of the data also came from the Nurses and Midwives Board of NSW (NMRB). The data used in the empirical analysis in this paper is sourced from three separate databases.

The first is information on the registration status of nurses, generated by the NMRB on an annual basis. This data contains some basic information on the individual such as the age group and gender of the nurse. The data follow an accounting-type process, which means that, in any given year, the nurse is either financial or unfinancial, that is, registered or unregistered, with the NMRB. It also indicates whether a nurse is a new registrant in that year; a renewal (ongoing registrant); or has been restored (returned to the Register) or deleted (removed from the Register). This information has been used to identify new registrants in each year, and whether nurses are financial or not. The importance of this data is that it shows who is eligible to work, as

determined by them being financial (or registered), with the NMRB. If an individual is not registered they are not permitted to work in New South Wales as an RN.

The second component consists of the results of the *Nursing Workforce Annual Survey - New South Wales* from 1986 to 2002. The earliest year for an electronic version of the survey data is 1986. The survey data is collected by the NMRB on an annual basis and is analysed by the NSW Department of Health in its annual *Profile of the Nursing Workforce in NSW*. Questionnaires are sent to registered nurses (and enrolled nurses) at the time of their registration with the NMRB. All nurses working in NSW must be registered with the NMRB, and registration occurs on an annual basis. Although completion of the survey is not necessary for registration, the response rate is relatively high at 90.1 per cent in 1996 and 84.1 per cent in 2002 (NSW Health 1996b and 2002). In the study by Doiron and Jones (2005), no evidence was found that the set of RNs who filled in the survey was non-random.

The third component of the data used in the analysis is qualifications data that the NMRB has collected for nurses working in NSW. This data consists of the type of qualification awarded (such as general nursing or midwifery); the awarding authority (such as a medical facility in NSW or a College of Advanced education); and the year in which the qualification is awarded. Information is available on up to six qualifications pre-registration and post-registration. For the purpose of this paper, however, we use only information on the first qualification awarded. Importantly, given that the dataset covers the period soon after the re-structuring of nurse education in Australia, there is significant variation in the nature of RN education, either hospital-trained or attended university.

Doiron and Jones (2006) use similar data to that used in this study when they examine the retention of RNs in public hospitals between 1996 and 1997. Our dataset differs from theirs in a number of respects. Importantly, the data we have available includes the information on nurse qualifications. To our knowledge, this is only dataset of its kind that has been made available for research purposes in NSW which uses 16 years of the data.¹

¹ Missing data in 1998 prevents the identification of new registrants.

In order to facilitate a discussion of what has been happening in the wider nursing work force during the 15 years of the data, we have produced three 'snapshots' of the main characteristics of RNs who renewed their registration and were working in nursing in NSW in the years 1988, 1993 and 2002. Thus the top row shows the number of RNs who, by renewing their registration in that year, were able to work in nursing in NSW: 35,043, 24,188 and 35,956 in the three respective years. Note that these figures refer to the number of RNs who were not missing any information on the work status question of the survey, and variables listed in Table 1.

As can be seen from Table 1, the percentage of males RNs in the nurse population has remained fairly constant, and is just under 10 per cent. Thus, registered nursing remain a female-dominated occupation. There is evidence that the RN work force is ageing, since the percentage of RNs in the younger age groups (18-24, 25-29 and 30-34 years) is dropping over this period, while the percentage in age groups 35-39 years and older increasing. The figures are substantial, for example, in 2002, about 40 percent of the RN work force is aged between 44 and 49 years. This substantial ageing of the nursing workforce over the past decades has been identified in other studies (Shah and Burke 2001). The casualisation of the nursing work force is also evident, with the percentage of RNs who report their main job being casual (rather than permanent full-time or part-time) increasing from 8.5 per cent in 1988 to 15 per cent in 2002.

Table 1: Registered nurses in New South Wales, selected years²

	1988	1993	2002
Number of registered nurses	35,043	24,188	35,956
Male	0.08	0.07	0.08
Age			
18-24	0.06	0.04	0.02
25-29	0.19	0.11	0.07
30-34	0.22	0.21	0.11
35-39	0.17	0.22	0.12
40-44	0.13	0.16	0.20
45-49	0.10	0.12	0.20
50-54	0.07	0.08	0.14
> 55	0.06	0.07	0.14
Nature of employment			
Casual	0.08	0.12	0.15
FT or PT (permanent)	0.92	0.88	0.85
Place of work (main job)	0.00	0.00	0.00
General Public Hosp./Day Proc. Centre	0.55	0.53	0.53
Public Psychiatric/Mental Retardation/Geriatic Hospital	0.09	0.10	0.10
Private Hospital/Day Procedure Centre	0.08	0.10	0.13
Private Nursing Home/Convalescent Hosp.	0.11	0.09	0.06
Public/Private Community Health Services	0.07	0.07	0.10
Private Nursing - all medical	0.02	0.05	0.04
Other	0.08	0.06	0.05
Specialty (main job):			
Medical - Geriatric	0.14	0.16	0.14
Medical - Other	0.07	0.17	0.18
Surgical - All	0.01	0.17	0.18
Mixed medical/Surgical	0.30	0.09	0.05
Diagnostic	0.04	0.02	0.01
Critical Care	0.04	0.10	0.11
Mental Health	0.06	0.07	0.07
Gynaecology/Maternity	0.10	0.10	0.09
Community nursing - general	0.01	0.04	0.04
Developmental Disability	0.03	0.03	0.02
Occupational Health	0.01	0.01	0.01
Other	0.17	0.05	0.11
Awarding authority			
Med. facility or College of Nursing (NSW)	0.59	0.52	0.39
CAE/University in NSW	0.03	0.11	0.27
Med. facility or College of Nursing (not NSW)	0.06	0.06	0.06
CAE/University other states	0.00	0.00	0.02
United Kingdom	0.04	0.05	0.05
Rest of the World	0.29	0.25	0.22
Number of new registrant	4,446	1,812	3,636

² Results from other years are available from the authors upon request

In terms of the place of work for RNs, around 50 percent of qualified RNs are working in the public hospital system. The number of RNs working in public psychiatric centres and nursing homes also remains fairly constant at around 10 percent. In terms of private medical facilities, there has been an increase in the number of RNs working in hospitals, but a decrease in the number working in private psychiatric centre and nursing homes. In terms of nursing specialty, the percentage of the RN population who are report working in Mental Health, Gynaecology/Maternity and Developmental Disabilities in their main job has remained fairly stable over the period. Significant changes can be seen in Critical Care, Diagnostic and Community Nursing.

In early years the vast majority of RNs (over 50 per cent) have been hospital-trained in NSW. However, consistent with the introduction of education based training in the mid to late 1980s, by the later years of the data over one quarter of RNs report having been trained in an education facility in NSW. The majority of RNs educated in other states and territories in Australia have also undergone training hospitals or similar medical settings. The highest figure for university educated RNs (from NSW) is just under 30 percent at the end of the data collection (2002). Interestingly, less than 30 percent of the RN work force has been educated overseas in each of the years. Lastly, the number of new registrants varies substantially across years. From almost 5,000 in 1988 to less than 2,000 in 1993, and then rising again, to around 3,500 in 2002.

4. The Methodology

The registered nurse dataset contains information on the personal, work and educational characteristics of RNs in NSW over the period between 1986 and 2002. No information is available on new registrants in 1998, although information is available for 1998 for those individuals who registered for the first time in earlier years. The RN dataset has relatively detailed information on the work status of RNs and therefore we are able to define the nursing work force in NSW more broadly than one might have expected. When an individual reports their work status in the labour force survey, they identify their current activities. For example, an individual may report various activities such as:

- Working in nursing - only or mainly in NSW
- Working in nursing - (i) only or mainly in other states, or, (ii) overseas.

It is this information on the work status of individuals that allows us to identify employment spells in nursing.

It is worth noting that working as an RN is not confined to hospital based care. The nursing work force consists of RNs who practise nursing in either public or private medical facilities, or whose work is principally concerned with the discipline of nursing, for example, nursing administration, research or nurse education (Nursing Workforce Annual Survey-New South Wales, 1999). Furthermore, RNs can be working in nursing in a number of sectors, such as health, higher education, research, general practice, private industry, or be employed by a range of government departments such as education, defence or corrective services. The aim of the paper is to estimate a series of duration models capturing the first time an RN exits the nursing work force in NSW following his or her initial registration.

For the purpose of this paper, we identify an individual as working in New South Wales as an RN if they fall into one of the following two categories as reported in the annual labour force survey:

- Working in nursing - only or mainly in NSW
- Working in nursing - only or mainly in NSW, but on extended leave

Hence, we consider those individuals who remain registered (or financial) and working as continuing in nursing employment, even if they report being on extended leave. Extended leave may, for example, constitute a period of maternity leave. We estimate a series of duration models that identify the determinants of the length of employment spells in nursing post initial registration.

It is important to stress that in the dataset, survival times have been grouped into discrete intervals of time, where time refers to years of working in nursing in NSW. Consequently, rather than knowing the precise instant when RNs leave the nursing work force, all we know is that it occurred in a particular year. In this case, spell lengths are summarised using the set of positive integers, and the observations on the

transition process are summarised in discrete-time rather than continuous-time. We recognise, however, that the underlying transition process occurs in continuous time because RNs can exit the nursing work force at any time (day, month) in the year. The discreteness of the data arises simply because the actual day or month of exit was not reported.

To allow maximum flexibility in the shape of the hazard function, a proportional hazard model similar to that applied in Meyer (1990) and discussed in Lancaster (1990, pp. 172-208) is estimated to describe the hazard of exiting from nursing.

$$h_n(\tau) = h_0(\tau) \exp\{z_n(\tau)' \beta\} \quad (1)$$

where $h_n(\tau)$ is the hazard rate for person n , $h_0(\tau)$ is the ‘baseline’ hazard common to all individuals, $z_n(\tau)$ is a vector of observable characteristics that may vary with time, and β is a vector of parameters to be estimated.

Following Meyer (1990) the baseline hazard can be estimated non-parametrically as a piece-wise constant function. The time axis is divided into a finite number of intervals and a separate baseline hazard parameter is estimated for each segment. Assuming that $z_n(\tau)$ does not vary within a given interval, the contribution to the log likelihood function for the n^{th} spell is given by:

$$l_n^i(\tau_n / z_n, \gamma, \beta) = \lambda_n \log[1 - \exp(-\exp[\gamma(\tau_n) + z_n(\tau_n)' \beta])] - \sum_{k=1}^{\tau_n-1} \exp[\gamma(k) + z_n(k)' \beta] \quad (2)$$

where τ_n is the observed length of the n^{th} spell, $\gamma(\tau)$ is the baseline parameter corresponding to the τ^{th} period, and λ_n equals one if the spell ends before being censored. The likelihood function for any given set of observed spells in state i in can be characterized as the sum of all terms like (2).

The RN data are generated by a continuous time proportional hazards model. Holford (1976) and Prentice and Gloeckler (1978) have shown that, for the continuous time

proportional hazards model, the corresponding discrete time hazard is the complementary log-log with the coefficient vector β being identically equal to that in the proportional hazards model. Given that β is the same in both the proportional hazards model and equation (2) above, discrete time estimates based on equation (1) are ‘also estimates of the underlying continuous-time model’ (Allison, 1982, p. 73). Note that this hazard model also allows for several time-varying covariates, such as age, home locality and place of work.

5. Empirical Analysis

Characteristics of the sample used in the duration models are set out in table 2. The approach adopted in this study is to use the sample of newly registered RNs each year, thereby avoiding the problem of left censoring of spells. The total number of new registrants each year varies between 5,448 (1987) and 1746 (1992). The data does not allow new registrants in 1998 to be identified. In much of the empirical analysis reported in table 3 below (and the summary statistics reported in table 2), however, a smaller sample that does not contain all new registrants is used by excluding observations with missing information. A specification of the model is, however, run using the full sample and including dummy variables indicating the presence of missing values.

The figures in table 2 indicate that new registrants are, as expected, relatively young as a group. Moreover, it is interesting to note that the proportion of new RNs who are male is approximately constant at 10 to 13 per cent. There are two other patterns of note in the data. The first is the sudden drop off in the proportion of hospital trained nurses after 1987. Recall that the change in RN education was initiated in the early to mid 1980s and involved a transfer of nurse training from hospital and medical facilities to education based institutions such as Colleges of Advanced Education. This change is clearly reflected in the data, with very few RNs identifying their training as hospital based (in New South Wales) in the years after 1987. It is also of note that there is a large number of RNs educated in other countries, over 30 per cent

in some years (1990). This serves to highlight the use made of foreign-trained nurses in New South Wales, as well as the international nature of the RN labour market.

Prior to describing the results of the duration models, it is useful to present some non-parametric descriptors of the data. In figures 1-4 we show the survivor functions for different groups of RNs. Recall that the survivor function at duration t is the proportion of spells that are at least of length t . A number of patterns emerge from these figures. From the survivor functions, it is clear that there are a large number of short spells in nursing. The survivor function for males lies above that of that for females, suggesting that males are more likely to exit from nursing at a quicker rate. As expected, the survivor function for those RNs who receive their basic or initial qualification outside of Australia lies below that of Australian trained nurses. Examination of the data suggests that many overseas trained RNs are registered for only a short period of one to two years. This may reflect the presence of 'backpacker' RNs who are employed in the NSW health sector for short periods only. Finally, for the sample of NSW trained RNs, the survivor function for those trained in education facilities initially lies above that of the hospital trained nurses. By year five, however, this pattern is reversed and the survivor function for hospital trained RNs lies above that of the University trained nurses.

Table 2 – Characteristics of new registrants, 1986-2002

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1999	2000	2001
No. new registrants	2,136	2,640	1,884	1,755	1,840	1,750	752	694	1,139	817	674	780	845	749	713
Age															
19-24	0.38	0.42	0.35	0.41	0.35	0.47	0.53	0.57	0.48	0.37	0.37	0.36	0.32	0.40	?
25-29	0.34	0.29	0.26	0.26	0.24	0.24	0.19	0.23	0.24	0.29	0.30	0.26	0.27	0.18	?
> 29	0.28	0.28	0.38	0.32	0.36	0.29	0.28	0.20	0.28	0.33	0.33	0.38	0.41	0.41	?
Male	0.10	0.12	0.11	0.11	0.11	0.12	0.11	0.12	0.11	0.12	0.13	0.13	0.10	0.10	0.12
Education or training															
Hospital (NSW)	0.57	0.45	0.04	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Edu. inst. (NSW)	0.01	0.17	0.49	0.57	0.53	0.67	0.78	0.86	0.72	0.55	0.51	0.56	0.58	0.62	0.55
Hospital (not NSW)	0.14	0.13	0.15	0.13	0.13	0.08	0.07	0.05	0.09	0.12	0.12	0.09	0.08	0.06	0.07
Edu. inst. (not NSW)	0.01	0.01	0.01	0.01	0.02	0.03	0.01	0.03	0.07	0.12	0.14	0.13	0.12	0.10	0.13
UK trained	0.16	0.12	0.15	0.11	0.12	0.09	0.04	0.02	0.04	0.08	0.09	0.08	0.08	0.09	0.08
Other overseas	0.11	0.12	0.15	0.17	0.20	0.12	0.08	0.04	0.07	0.13	0.14	0.14	0.14	0.13	0.16

Figure 1:

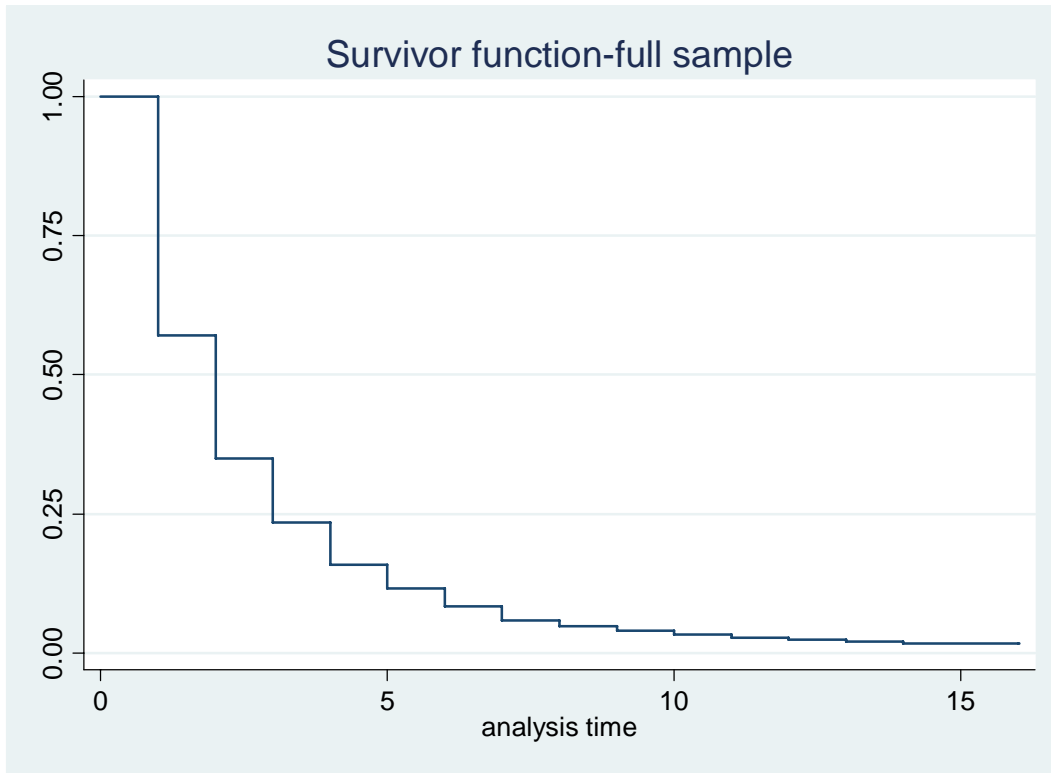


Figure 2:

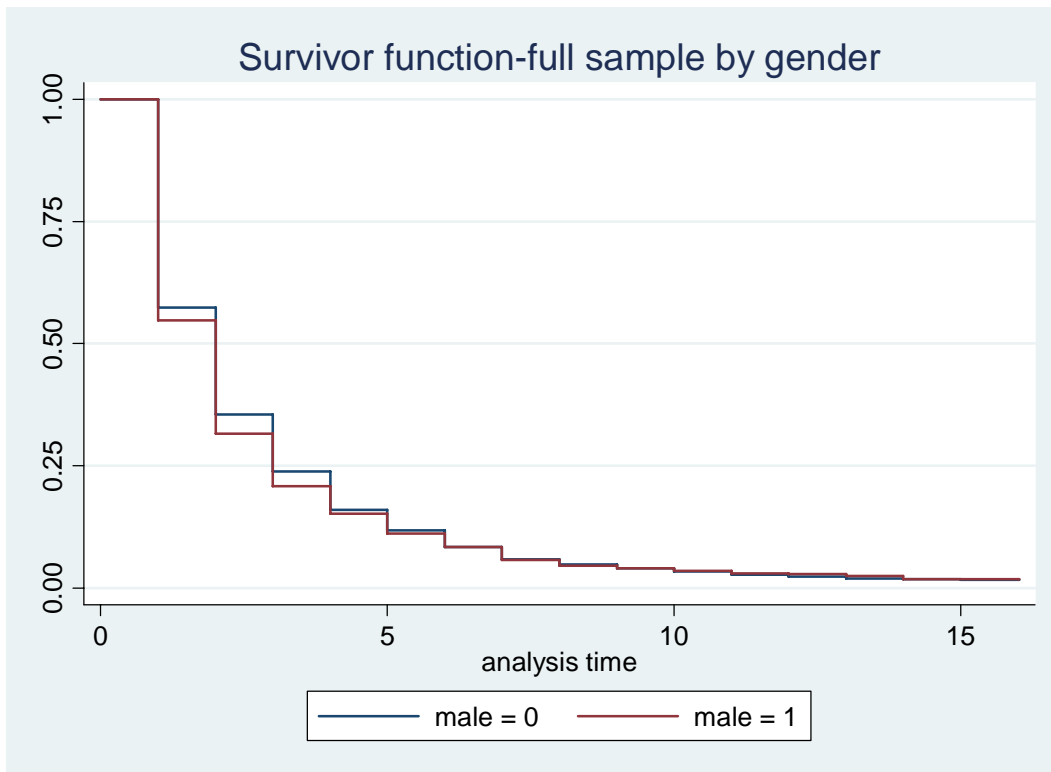


Figure 3:

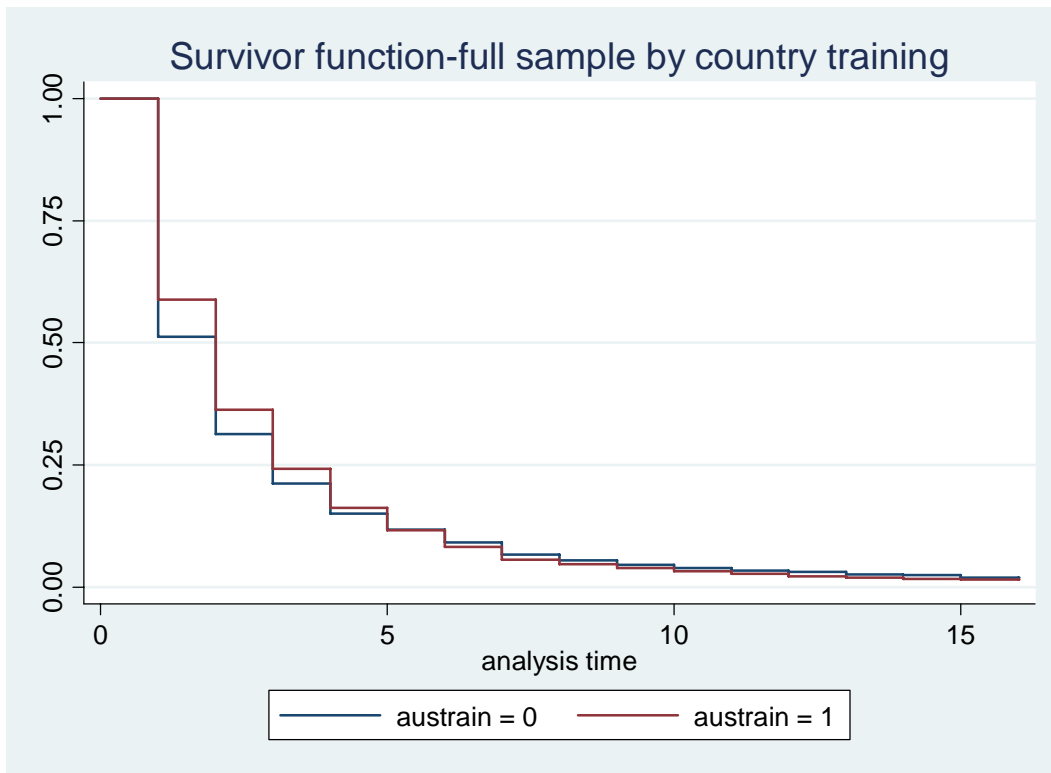
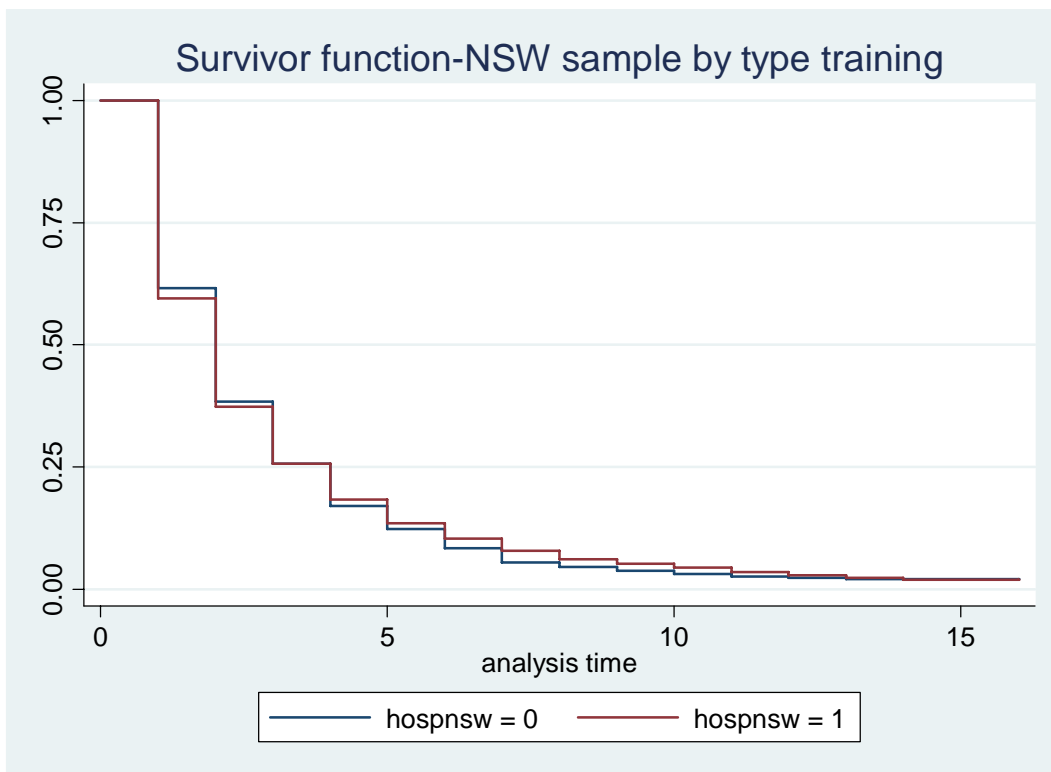


Figure 4:



We can now turn to the results of the duration models presented in table 3. As noted in section 3 above, the data used in the present analysis is administrative data. As with many administrative datasets, only a limited number of covariates are available for the analysis. The models incorporate basic demographic variables such as age and gender. Further, characteristics of the individual's employment, such as type of medical facility and the nature of the work (specialty) are also available. Information is also available on the individual's home location, especially the statistical sub-division to which they belong. Matching of this information with ABS data on unemployment rates facilitated the incorporation of measures of local labour market conditions in some models. Finally, the models incorporate variables to indicate the nature of the RNs training, whether hospital based or undertaken at an educational institution such as a University. Nurses trained in other states and countries can also be identified.

Where possible, the variables are incorporated as time varying covariates. For example, home location, the unemployment rate and a series of dummy variables for age are all modelled as time-varying covariates. Various specifications of the model are estimated with the results reported in table 3. Given the large number of missing values for some of the variables and the consequences on this on the sample size, a number of models are estimated where observations with missing values are included. In such cases, additional variables indicating the presence of a missing variable are included in the model.

There are a number of results of interest. First, males are approximately 8 per more likely to exit from the RN workforce compared to females and hence exhibit shorter spells in nursing than do females. This outcome is consistent with the pattern identified in figure 2 above. The dummy variables on age indicate that younger RNs are more likely to exit the nursing workforce compared to older nurses (recall that the omitted group here are RNs aged 40 and above). This is similar to the result identified in Doiron and Jones (2006) in which the retention of RNs in public hospitals in NSW was examined. The age at which exit from nursing is highest is between 25 and 29 years of age. Such a pattern likely reflects lifecycle considerations such as child bearing. However, without additional demographic information it is not possible to identify this more precisely.

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Table 3 – Duration model estimates

	(1)	(2)	(3)	(4)	(5)
Male	0.085 (0.026)	0.081 (0.026)	0.081 (0.026)	0.083 (0.026)	0.109 (0.021)
Education					
<i>Edu. inst. (NSW)</i>	0.121 (0.024)	0.124 (0.024)	0.111 (0.025)	0.126 (0.024)	0.153 (0.020)
<i>Hosp. (other State)</i>	0.357 (0.033)	0.290 (0.034)	0.307 (0.034)	0.335 (0.034)	0.260 (0.027)
<i>Edu. inst. (other State)</i>	0.366 (0.047)	0.313 (0.047)	0.341 (0.049)	0.345 (0.049)	0.327 (0.038)
<i>UK trained</i>	0.332 (0.034)	0.267 (0.034)	0.265 (0.034)	0.335 (0.034)	0.250 (0.028)
<i>Other OS trained</i>	0.230 (0.032)	0.208 (0.033)	0.202 (0.033)	0.236 (0.032)	0.208 (0.026)
Age					
18-24	0.257 (0.030)	0.234 (0.030)	0.245 (0.030)	0.251 (0.030)	0.359 (0.026)
25-29	0.364 (0.027)	0.325 (0.027)	0.331 (0.028)	0.360 (0.027)	0.419 (0.023)
30-34	0.262 (0.029)	0.234 (0.030)	0.235 (0.030)	0.259 (0.030)	0.266 (0.023)
35-39	0.129 (0.034)	0.125 (0.034)	0.133 (0.034)	0.132 (0.034)	0.119 (0.026)
Age missing					0.078 (0.050)
Employment arrangement					
<i>Permanent FT or PT</i>	-0.195 (0.024)	-0.207 (0.024)	-0.226 (0.025)	-0.202 (0.024)	-0.266 (0.019)
Missing					0.142 (0.047)
Place of main work					
<i>Public Hospital (Psych., Mental Retardation, Geriatric)</i>	-0.038 (0.043)	-0.014 (0.043)	-0.036 (0.044)	-0.041 (0.043)	0.048 (0.034)
<i>Priv. Hospital/Day Proc. Centre</i>	0.040 (0.027)	0.034 (0.027)	0.034 (0.028)	0.033 (0.027)	0.075 (0.022)
<i>Priv. Nursing Home/Con. Hosp.</i>	-0.006 (0.043)	0.017 (0.044)	0.006 (0.044)	-0.009 (0.044)	0.011 (0.035)
<i>Pub./Priv Community Health Services</i>	0.058 (0.045)	0.083 (0.046)	0.079 (0.047)	0.042 (0.046)	0.084 (0.037)
<i>Priv. Nursing - all med.</i>	0.177 (0.056)	0.184 (0.056)	0.176 (0.057)	0.176 (0.057)	0.208 (0.043)
Other	0.280 (0.041)	0.282 (0.042)	0.254 (0.043)	0.262 (0.043)	0.241 (0.033)
Missing					0.298 (0.044)
Specialty					
<i>Surgical</i>	-0.057 (0.028)	-0.054 (0.028)	-0.052 (0.028)	-0.053 (0.028)	-0.030 (0.023)
<i>Mixed medical/Surgical</i>	-0.080 (0.026)	-0.066 (0.026)	-0.070 (0.026)	-0.081 (0.026)	-0.019 (0.022)
<i>Critical Care</i>	-0.025 (0.030)	-0.025 (0.030)	-0.016 (0.030)	-0.021 (0.030)	0.022 (0.024)
<i>Mental Health</i>	0.003 (0.039)	-0.009 (0.040)	-0.006 (0.040)	0.001 (0.040)	0.028 (0.032)
<i>Gynaecology/Maternity</i>	-0.010 (0.036)	0.007 (0.036)	-0.020 (0.037)	-0.031 (0.037)	0.023 (0.029)
<i>Community nursing - general</i>	-0.024 (0.066)	-0.040 (0.066)	-0.052 (0.067)	-0.027 (0.067)	-0.042 (0.055)
<i>Develop. dis./ Occ. health</i>	0.019 (0.058)	0.034 (0.058)	0.047 (0.059)	0.021 (0.059)	0.066 (0.048)
<i>Diagnostic & other</i>	-0.001 (0.030)	-0.011 (0.030)	-0.022 (0.031)	-0.008 (0.031)	0.018 (0.025)
Missing					0.182 (0.034)
Home location					
<i>Sydney metro</i>	0.024 (0.024)				
<i>Newcastle region</i>	-0.006 (0.033)				
<i>Wollongong/ Illawarra</i>	-0.107 (0.045)				
Home local missing					
Full set of SSD DVs		✓	✓		✓
Unemployment rate			0.026 (0.004)	-0.008 (0.002)	
Value of likelihood function					

In terms of place of work, the omitted or reference category are General Public Hospital and Day Procedure Centres. In general, the place of main work is not a significant determinant of the exit from employment as an RN. The type of specialty of the individual's employment (Medical – Geriatric is the omitted category), does have significant effects on exit behaviour. Those RNs in surgical are less likely to leave nursing, as are those in mixed medical surgical. It is also true that individuals in permanent employment (full-time or part-time) have approximately 20 per cent lower hazard rate.

Turning to the main variables of interest, we find that the type of education that an RN has influences the likelihood that they remain working in NSW as a nurse. The omitted category here is hospital-based training, and the results of the duration models indicate that RNs trained at educational institutions in NSW are approximately 12 per cent more likely to leave the RN profession. This result is consistent across the specifications set out in table 3 and may reflect a number of considerations. For example, RNs with a University education may have better outside labour market opportunities than hospital trained nurses. It may also be the case that university students are using the nursing degree as a stepping-stone for undertaking other university studies and/or work opportunities (New South Wales Government, 2000). It also may be the case that University educated RNs have different expectations of nursing work, and are less satisfied with the workplace environment (Shah and Long, 2003).

The availability of information on the home locality of individuals in the dataset also allows some external information to be matched. In particular, information on the statistical subdivision allows information on the outside labour market state, in the form of the unemployment rate, to be incorporated into the model as a time-varying covariate. In general, we would expect that a higher unemployment rate would be associated with a lower exit from the RN state. In specification 3, however, where a full set of SSD dummy variables are also included in the model, the coefficient on the unemployment rate is actually positive. This may, however, reflect some collinearity in the variables. In specification 4, where the set of home location

dummy variables are dropped, the unemployment now has a negative and significant sign, consistent with *a priori* expectations.

6. Conclusion, policy implications and future research

The behaviour of nurses (especially RNs) is of particular concern to policy makers and health care administrators. The analysis in this paper has examined the behaviour of RNs and their tendency to remain working in New South Wales. Of particular concern was the role that the type of education received (hospital based training or University based education) played on the likelihood of remaining working as an RN in New South Wales. We find that nurses educated in Universities are significantly less likely to remain working in NSW. While this finding has important implications for the future of RNs, care should be exercised in drawing policy implications. For example, we do not believe that the results of this paper are that the perceived or actual shortage of nurses is best addressed by a move back to hospital based training. Rather, the results here serve to highlight the role played by training on subsequent labour market behaviour. Formulation of appropriate policy responses should take account of the reasons why RNs leave the profession over time and the role of RNs in the overall health care system. The analysis in this paper offers limited insight into these issues.

How might the analysis in this paper be extended and or improved? The models developed in this paper could be extended in some obvious ways, such as incorporating unobserved heterogeneity into the estimates. Further, later years of the data provide additional information such as hours of work that may help in explaining why RNs are observed to leave the profession. Finally, data is also available on enrolled nurses or ENs. To the extent that is policy should be formulated in the context of the system as a whole, understanding the behaviour of ENs and their behaviour may be useful in formulating policies for the health care sector as a whole.

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