Design and cohort profiles: Health and working life of registered nurses in Thailand - a longitudinal cohort study

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Abstract

Background: Shortages and inequitable distributions of nurses are experiencing nationally and globally. Thailand established a 20-year longitudinal cohort study to investigate these issues.
Objective: To describe design of the study and key findings of the baseline survey of Thai Nurse Cohort Study (TNCS).
Methods: TNCS is an accelerated longitudinal design comprising multiple age cohorts, proposing to follow the cohort every three years for at least 20 years. The cohorts included the initial 9 age groups based on a 5 year intervals, from 20 to 64, and new entry cohorts added every three years. The first wave or baseline survey was conducted in September 2009 using a 13-page mailed-questionnaire. Respondents were invited to be cohort members. The second wave, conducted in June 2012, served as the follow-up of the initial cohort and the baseline survey of the 2012 new entry cohort.
Results: From 142,699 RNs who hold nursing licenses granted by Thailand Nursing and Midwifery Council (TNC) as of 2008, a sample of 50,200, drawn from the 9-age-groups using stratified random sampling, were surveyed. There were 18,198 questionnaires returned undeliverable due to no recipients. Of the remaining 32,002, there were 18,756 (58.6%) RN responded and consented. Their average age was 43.7 years. About 14% of RNs, or an estimated of 20,000 RNs based on the current population, was considering leaving the profession, while the number of new entry RN was much lower.
Conclusions: Thailand shares the same critical shortage of nurses as many other countries, with a high proportion of aging nursing workforce, high rate of intention to leave nursing profession, and low number of new entry nurses. Further studies are needed to investigate root causes of the crisis so that effective measures can be formulated to minimize the problem.

Key words: nurse cohort, workforce shortage, inequitable distribution, women health

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Background

Shortages, high turnover, and inequitable distributions of nurses are experiencing globally.[1-6] Some countries, such as the United States, the shortages have been reported cyclically for more than 50 years[7] and the demand for nursing services was predicted to exceed the supply by nearly 30% in 2020.[8] At global level, the World Health Organization (WHO) reported in 2004 that in Africa and South East Asia there was a very low nurse to population ratios- approximately 10 nurses per 100,000 population. This was far behind that of some western countries which was 1,000 nurses per 100,000 population.[6]

The gap could be much wider in future. It was clear that the high-income countries are facing low fertility and large elderly, hence, low new nurses and high demands of health care. This introduced migration of nurses from poorer countries, which would lead to losing a return on their investment of educations. Likewise, the middle-or-low income countries such as majority of South East Asian countries, demands of health care are increasing due to several reasons. Firstly, a large cohort of young people (baby boomers) in these countries will turn to ageing population. Secondly, many countries are facing high incidence of infectious diseases and the rapid emergence of chronic illness.[6, 9]

The trend of nursing shortages is increasing. Aging of nursing profession has been reported in many countries.[9-11] These comprise a large component of the current nurse population and gradually approaching retirement. In addition, the decline in younger women choosing nursing as a career is also observed. Information about the retirement rate of nurses is also very scarce. International health human resource policy needs to be formulated with sufficiency of this information so that positive care outcomes can be maintained.[1, 6 12]

Focusing in the ten countries integrated of the Association of South East Asian Nations (ASEAN) Economic Community (AEC) into one single market in 2015 had very low nurse to population ratios and varied wildly across countries. The WHO reported the nurse per 1,000 population at a specified year as 4.24 for Singapore (2001), 2.67 for Brunei Darussalam (2000), 2.82 for Thailand (2000), 1.69 for Philippines (2000), 1.35 for Malaysia (2000), 1.03 for Lao PDR (1996), 0.62 for Indonesia (2003), 0.56 for Vietnam (2001), Cambodia 0.55 (2002), Myanmar 0.38 (2004). These are far too low as compared to that of the western, e.g., 9.37 for the United State and 12.12 for the United Kingdom.[9]

An agreement of free flow of skilled labor in this region that planned to start in 2015 could lead to a more severe and complex nursing migration than has been previously experienced. This stimulated an urgent need for a careful surveillance on migration of nurses in this region where capabilities of health system in attracting and retaining their local staff are unknown.[13] A review suggested that a study investigating these issues conducted locally is essential.[14]

Numerous factors influencing both the supply of registered nurses as well as the demand for nursing services had been identified. However, most of these were from the western. For example, a study in the United States identified four major contributors to the nursing shortage: the ageing RN workforce; declining enrollment; the changing work climate; and

the poor image of nursing.[15] Another review in the United State identified that reasons for nurses leaving hospital practice were management issues, job design, job stress, physical demands, and the failure to nurture new nurses.[16] Some studies identified that inadequate staffing, heavy workloads, flat salaries, and increased use of mandatory overtime are primary issues related to job dissatisfaction, hence, job turnover or leaving.[17] In an Asian country, a study in Japan reported that the main factors behind the Japanese nursing labor shortage are a rapid increase in the number of hospital beds, poor working conditions, nurses' low social position in their places of work.[4] This indicated an existing of a unique and incomparability of the findings between the western and the eastern countries.

Although there are many studies investigating nursing crisis, most of them were cross-sectional studies. A cohort study of nursing profession has a greater potential to address the crisis as well as the emerging issues in women's health such as breast cancer, cervical cancer, osteoporotic fractures, postmenopausal illness and its consequence, etc. Parts of the world had established the study of this kind. The oldest and the largest nurse cohort study is the Nurse Health Study, initiated in 1976 in the Unites States which focused in cancer and other illnesses.[18, 19] The Danish Nurse Cohort Study (DNCS) established in 1993 investigated working conditions and health including hormone therapy use and risk factors of various health outcomes.[20] The Japan Nurses' Health Study (JNHS), initiated in 2001, investigated effects of lifestyle and healthcare practices on women's health.[21, 22] The Nurses and midwives e-Cohort Study, established in 2006, aimed to examine factors associated with recruitment and retention of the nursing and midwifery workforce among nurses in Australia and New Zealand.[23] Recently in 2009, the Nurses' Early Exit Study (NEXT), a cross-cultural and longitudinal project conducted in ten European countries involving 56,406 nurses to analyze the relationship between working conditions and nursing workers' health.[5, 24] In the same year, Thailand established a longitudinal cohort study in 2009, proposing to be a 20-year prospective study to address nursing crisis being faced and women health in Thailand.

Ultimate goal of the study was to establish and maintain the Thai nurse cohort to generate evidence on workforce dynamics and health statuses of Thai nurses.

The specific objectives of this study were: 1) to determine rates, patterns, and trends of job transition as well as their determinants; and 2) to assess prevalence, incidence, and long-term changes of key health problems as well as health conditions causing the problems among Thai nurses as well as their determinants.

Methods

Overall study design

Thai Nurse Cohort Study (TNCS) is a short title of the Health and Working Life of Registered Nurses in Thailand - a Longitudinal Cohort Study. It is an accelerated longitudinal design comprising multiple age cohorts.[25] Members of the TNCS comprised only registered nurses (RN) at the initial wave then expand to cover other categories of nursing profession at subsequence waves of the study. The TNCS was planned as the age-group cohort study and proposed to follow-up the cohort members for at least 20 years. The cohorts included the initial 9 age groups based on a 5 year intervals, from 20 to 64, and new entry cohorts added every three years.

The initial cohort included RNs who hold professional licenses granted by Thailand Nursing and Midwifery Council (TNC) as of 2008 selected using age-stratified random sampling technique from 5 year-interval age-groups, from 20 to 64. Thus there were 9 age-group cohorts formed at the initial of the study. The first wave, which was the baseline survey, was conducted in September 2009 using mailed questionnaire.

The new entry cohort was planned to select from RNs who newly registered at the TNC and listed in the TNC database after the previous wave survey. The first cohort of this kind was formed at the second wave which was the first follow-up wave of the initial cohort. Since the TNCS planned to follow-up its members every three years, we then named the new entry cohort according to year of inclusion, hence, the "2012 cohort" for the first one. By this, the TNCS had multiple cohorts comprising the 9 age-group initial cohort, the 2012 cohort, and proposed to have subsequent new entry cohorts namely the 2015, 2018, 2021, 2024 and 2027 cohort. Each cohort member will be followed until 2030 unless they withdraw consent, or being diagnosed having cancer of any kinds, or die, except members of 60-64 age group who will be followed until they were 68 years old.

Questionnaire administration

Baseline survey of the initial cohort was a mailed questionnaire. The baseline survey of the 2012 cohort and the first follow-up survey of the initial cohort, conducted in June 2012, were mixed mode administered, either paper or web-based questionnaire, depending on member's preferences. From then, it was planned to be exclusively web-based administered questionnaire. In other words, the TNCS planned to be an e-cohort study at time of enrolment of the 2015 cohort.

For baseline survey of the initial and the 2012 cohorts, study materials were arranged in an envelope uniquely designed for the TNCS with a clear TNCS's logo. Inside the envelope, there were a letter from the TNCS Director that served as an informed letter, describing aims and other important information about the TNCS required by the Institution Review Board (IRB) of the Ministry of Public Health. Other materials included a 1-page consent form, a 13-page questionnaire, and a blank envelope pre-labeled with the TNCS address to be used when returning the questionnaire. Both cohorts, the members were also offered an alternative mode of responding the survey via web-based by putting in the envelope a secured piece of paper containing user ID and password, with a brief instruction to use the web-based survey.

The RN who responded to the baseline survey, signed and dated the consent forms, and returned them to the TNCS Office, were enrolled as the TNCS cohort. Similar processes were also applied to the web-based mode.

We contacted the non-respondents to inform and invite participations mainly via phone call and e-mail messages that were given by them upon registration at the TNC database at their last re-licensing. This was done two month after posting the questionnaires to them. The second reminding was one month later and that was the last contact. For those who cannot be contacted by these means, we sought assistances from the administrative nurses at the province in which the non-respondent worked.

Measurements

The questionnaire for the baseline survey comprised three main sections (Table 1). The first section contained personal data such as birth date, address, marital status, education, income, debt, and family burden. The second section involved employment characteristics, job transition since graduation, job Strain which was adapted from Job Content Questionnaire short version (JCQ).[26] The third section included questions regarding health status, including EuroQol five-dimension questionnaire (EQ-5D)[27, 28], Short format International Physical Activity Questionnaire (IPAQ)[29], History and current illness, and self-care activities.

Table 1 Summary parameters and their utilities for the baseline survey of Thai Nurse Cohort Study.

Parameters	Utilities
A. Demographic and socio-economics characteristics	
○ Thai citizen identification number to be used for ascertainment of morbidity and mortality status in National Health and Death Registry Databases (password protected access)	○ Estimating rate of morbidity and mortality for overall and specific to causes or other subgroups ○ Simultaneously monitoring long-term changes of morbidity and mortality and their determinants ○ Investigating survival outcome (time to disease, disease progression, dead) ○ Estimating life expectancy of nurses and its 20 year trends ○ Determining long-term effect of various factors on mortality and morbidity ○ Reflecting women health status in Thailand
○ Birth place (province and district)	○ Characterizing geographically distribution of nurses ○ Describing work place preference against birth place ○ Explaining and predicting Job turnover and retention ○ Testing hypotheses about scholarship or other incentives for working in underserved area
○ Birthdate or age, sex, marital status	○ Investigating their effects on job turnover and health statuses
○ Month and year of nursing graduation	○ Estimating median survival of working in nursing profession
○ Month and year of started working and employment status	○ Estimating duration of work ○ Estimating time gap before employment ○ Being a baseline employment for investigation of job turnover ○ Investigating its effect on job turnover and health statuses
○ Institute from which being graduated (public college under the Ministry of Public Health, public university, private educational institute)	○ Investigating its effect on retention and workplace preference (urban versus rural, and total survival in profession) ○ Being a mode for maximizing follow-up rate such as establishing social network among cohort members

Parameters	Utilities
○ Education (highest level of educational, specialized training, scholarship)	○ Determining opportunity of career advancement ○ Describing distribution of skilled and skill-mix nursing, comparing between urban and rural ○ Investigating effect of scholarship on work retention and nursing distribution
○ Economic status (income, debt, perception of income sufficiency, dependency)	○ Investigating its effect on job turnover ○ Investigating its effect on stress or various health problems as well as health conditions causing the problems
B. Work-life characteristics	
B1. Job transition since graduation	
○ Date start working for each roles or employment ○ Type of work: service and non-service (administrative, teaching) ○ Leaving nursing for other careers or for un-employ ○ Study leave ○ Place of work (public versus private, inside versus outside birthplace)	○ Characterizing of job transition pattern over working lifetime ○ Monitoring of long-term nursing turnover ○ Describing distribution of nurses between major sectors ○ Determine pattern of job turnover on intention to stay or leave nursing career ○ Estimating duration between certain point in time or type of employment and the turnover ○ Estimating of work-life expectancy (It was 22 years according to the latest estimate in 2007.)
B2. Employment characteristics and working intensity	
○ Current employment status (government, private, freelance, others) ○ Current position (nursing services, administration, research, academic, others) ○ Current workplace category (hospital, health care center or unit, under study leave, others) ○ Full time part-time employment, ○ Work shift arrangement, ○ Work under night shift, ○ Working hours per week ○ Other job in addition to nursing	○ Determine current and long-term trend distribution of nurses according to various type of employments, sectors, and employment status ○ Describing working load as determinants of job turnover and health ○ Investigating roles of night-evening shift on job turnover and health ○ Describing work-life balance profile and its role on job turnover and health
B3. Perceived work stresses (21 items, score 1-4 each)	○ Estimating proportion of nurses with work stress ○ Investigating its effect on job turnover ○ Investigating its effect on various health problems as well as health conditions causing the problems
B4. Workplace violence and	

Parameters	Utilities
occupational injuries	
○ Physical harassment, psychological harassment, from colleagues, patient and their relatives	○ Estimating proportion of nurses facing workplace violence ○ Investigating its effect on job turnover
○ Occupation injuries: specify: cut wound, needle stick, chemical and radiation injuries, ○ Hospital acquired infections e.g. TB, Hepatitis, HIV/AIDS,	○ Estimating rate and trend of occupational injuries ○ Investigating its effect on job turnover
B5. Intension to leave and to return to nursing career	
○ Intention to leave nursing profession and the reasons for those currently working in nursing profession	○ Estimating probability to leave and predicted duration before quit ○ Investigating its effect on job turnover
○ Intention and enabling conditions to return to nursing profession for those currently not engaged in nursing profession	○ Estimating probability of return to nursing professions, list of potential policy intervention on retention ○ Investigating its effect on job turnover
C. Health status and related information	
C1. Anthropometrics, daily activities, and sleeping	
○ Current anthropometric measurements: body weight, height, waist and hip circumference	○ Investigating its effect on job turnover ○ Investigating its effect on stress or various health problems as well as health conditions causing the problems
○ Intensity of daily physical activities (duration of heavy, moderate, walk, sit activities) ○ Physical activities at leisure	○ Estimating prevalence of regular physical activities, compared to general population ○ Investigating roles of physical, diets and cholesterol on various chronic diseases and metabolic syndromes
○ Average duration of sleeping per day and frequency of sleeping difficulties	○ Investigating its effect on job turnover ○ Investigating its effect on stress or various health problems as well as health conditions causing the problems
C2. History and current illness, and self-care activities	
○ Family members who had history of illness being diagnosed by medical doctor	○ Investigating its effect on job turnover ○ Investigating its effect on stress or various health problems as well as health conditions causing the problems
○ The respondent's history of illness being diagnosed by	○ Estimating incidence / prevalence and type of chronic illnesses

Parameters	Utilities
medical doctor and whether or not currently under treatment	
○ Annual physical checkup being done and their results with regard to breast self examination, cervical cancer screening, chest film, blood examination, lipid measurements, etc.	○ Describing health awareness ○ Estimating proportion of nurses who had certain problems regarding various laboratory findings, health measurements, or diseases
○ Health care services being utilized by the respondent during the last 12 months	○ Investigating health profiles
○ Hospitalization during the last 12 months	○ Investigating health profiles
○ Medication used during the last 30 days	○ Investigating health profiles
○ Self assessment of health in the last 30 days based on EuroQol five-dimension questionnaire (EQ-5D)	○ Estimating level of health status according to self-perceptions
○ Reproductive health for female respondents (pregnancies, delivery, and family planning methods)	○ Estimating total fertility rate among nurse, infertility, prevalence and profile of contraception

***Data management**:*

System for paper-based questionnaire

The paper-base system was used for the baseline survey. The Data Management Office of the TNCS undertook the data management tasks for this study. All returned questionnaires and signed consent forms were scanned. The papers were stored securely at the office of the TNCS which was at the main building of the TNC within Ministry of Public Health. These were in locked file cabinets with a secured room requiring finger scan to access and was maintained and viewed by TNCS staff only. The image files were used further for data management processes. Firstly, images of the signed consent forms and the first page of the questionnaire that contained personal data were kept securely and separately from the main questionnaire. These files were encoded and password protected. Secondly, images of the main questionnaire were entered into a computerized database. There was no names or personally identifying information on any parts of the questionnaire. Access to all questionnaire images was restricted to authorized personnel. The data was entered into the computer using optical recognition technology namely "OMERET: Online Medical Research Tools" developed and maintained by the Medical Research Foundation (www.omeret.org). The questionnaire images were import into OMERET where the optical recognition engine translated the images into the data and placed it into the database as a data file for further uses. The accuracy of such recognition results was enhanced by verifying manually against the images. Logical, range, and consistency check were also performed and corrected using Stata statistical software

(StataCorp, College Station, TX). By this, we can performed data cleaning and declared database lock within 3 months after the receiving the last questionnaire.

System for web-based questionnaire

This system was used for the second wave survey. The questionnaire was made available in both paper and online forms accessible via internet- the web-based questionnaire. We developed the form using PHP language and MySQL database server. The form was placed at the TNCS web site (www.thainursecohort.org). The cohort members were contacted via e-mail or phone number given by the member at the first wave for the initial cohort, or upon relicensing for the 2012 cohort. They were informed about the survey and instructed how to login into the system. User identification number and password was also securely provided to individual member.

Sample size calculation

The sample size of 30,000 was planned based on an aim of detecting any events with a proportion of as low as 1% with a precision of +/-0.1%. i.e., a relative precision of +/-10%, for two-sided 95% confidence level. We then allowed for an expected non-responses due invalid contact addresses, refusal for participation, and lost to follow-up of 40% which was slightly better than what was found in a study involving nurses in Japan.[30] By this, the sample size was 50,000 and then inflated to 50,200 according to managerial reasons.

Sampling techniques

Members of the TNCS were classified into two categories- the initial cohort and the new entry cohort. This section describes sampling techniques for each categories of the cohort.

The initial cohort comprised RNs who were randomly selected from the TNC database, who signed a consent form, and who responded the first wave survey questionnaire. The TNC database being used as the sampling frame included all RNs who hold professional licenses granted by the TNC as of 2008. By this, a total of 142,699 RNs formed the sampling frame. We then applied age-stratified random sampling technique for the sample selection. Firstly, RNs were stratified into 9 age groups based on a 5 year-interval, between 20 and 64, i.e., < 25, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, and 60-64 years. Based on the sample size of 50,200, the average size of each age group would be 5,578. However, members of the last two groups were less than the average stratum size. Thus we selected all members of the 55-59, and 60-64 age groups. The remaining 7 age groups were then randomly selected with a fix size equally to all strata. Regarding the selection methods, firstly a set of random numbers were generated using Stata statistical software (StataCorp, College Station, TX). This assigned a random number to each Citizen Identification Number (CID) of individual nurse. Secondly, the CIDs were sorted according to the assigned random numbers. Thus, nurses in each age group were listed in the sorted order. Thirdly, nurses were selected consecutively, starting from the first order, until achieving the required size.

For the new entry cohort, all RNs who hold professional licenses granted by the TNC after the previous wave and were not part of the sampling frame of the previous cohort formed the sampling frame. The cohort of this kind included the 2012, 2015, 2018, 2021, 2024, and 2027 cohort. It was planned that 25% of the new RNs listed in the TNC database. For the 2012 new entry cohort, there were 6,402 RNs, 25% were planned to be

the final sample size. To allow for 47% non-responses based on the previous wave survey, a total sample size of 3,020 was required.

Analysis and dissemination of the findings

After the database locked, the data was exported from MySQL database to various formats suitable for statistical software being used by investigators. Whatever software used, the TNCS required analysis to be done via batch mode where all analysis processes were documented in a text file containing command lines and notes or remarks, ensuring reproducing of the results. This aimed to allow auditing and quality assurance of the statistical components of the study. Biostatisticians at the Department of Biostatistics and Demography at Khon Kaen University provided statistical consultations to the study.

At the early phase of the Project, the Steering Committee, described in the next section, proposed topics for generating research reports. Then researchers who involved in design the study did those tasks. Researchers from outside the TNCS were also invited. Lastly, before any research findings can be disseminated, the written reports must be reviewed and approved by the Steering Committee.

Organization of the TNCS

A steering committee provided advisory supports to the TNCS Office. Key partners and stakeholders were the members of the Committee. President of Thailand Nursing and Midwifery Council was the Chair, and the Director of the International Health Policy Program was the Vice Chair of the Committee. Other members included President of Thai Nurse Association, President of Consortium of Dean of Nursing Shcools, Director of Ministry of Public Health Bureau of Plan and Strategy, Director of Nursing Systems Research Institute of Thailand Nursing and Midwifery Council, Director of Prabomarajchanok Institute of Health Workforce Development, Director of Health Systems Research Institute, National Health Security Office Representative, National Health Commission representative, Director of Human Resource for Health Research and Development Office, and the Ministry of Public Health Bureau of Nursing.

Sustainability

Maintaining a cohort with at high rate of follow-up and low costs were challenge issues, in particular, in the low-and-middle income countries. We then designed the TNCS to be part of the existing routine data collection system. Firstly, information regarding contact address and some essential follow-up data including job transition and health status was embedded in a form to be filled upon renewal of the professional license. This form was mandatory and placed in the web-based registration system of the. License renewal interval was every 5 years, hence, enabling sustainability of the cohort, maximizing follow-up rate, and ensuring that health status and job transition and leaving nursing career being able to investigated continuously and simultaneously. Secondly, information regarding morbidity and mortality was planned to ascertain from the National Health Registry and Death Registry Databases at the same period as the survey questionnaire administration. Fortunately, information in the TNC database allowed us to be able to do that.

In addition, the TNC offered 20 credits of the Continued Nursing Education (CNE) to all cohort members and will offer 30 credits to the members who remain in the cohort after 10 years. A 50 credit CNE is a requirement for re-licensing as a registered nurse in

Thailand. Finally, the TNCS was officially under the Human Resource for Health Research and Development Office was the technical secretariat of the TNCS.

Ethical conduct of the study

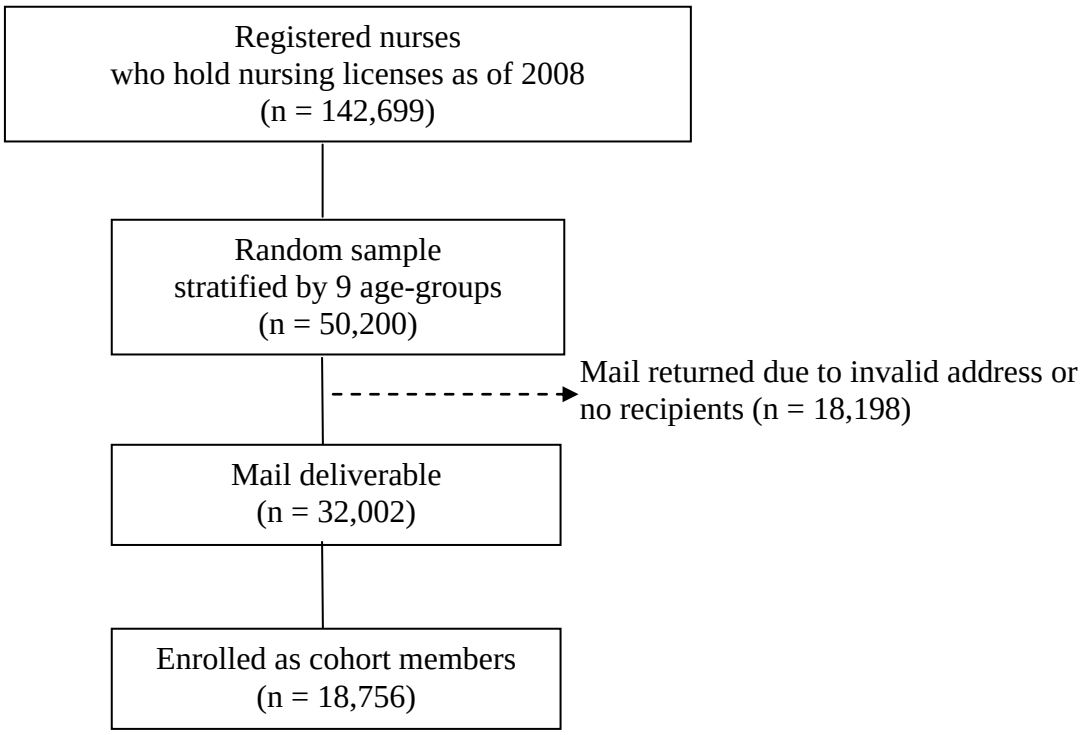
Institutional Review Board of the Ministry of Public Health had approved the proposal. The TNCS obtained signed and dated consent forms before enrolment of participants as the cohort member. All personal study subject data collected and processed for the purposes of this study were managed by the investigators and their staff with adequate precautions to ensure the confidentiality of those data. All computer entries were done by coded number only, and all databases were secured with password-protected access systems. Forms, lists, logbooks, and any other listings that link participant ID numbers to other identifying information were stored in a separate, locked file in an area with limited access. Participants' study information was not disclosed without the written permission of the participant, except as necessary for monitoring by Thai regulatory authorities.

Results

Response to survey questionnaire

A total of 50,200 questionnaires sent via post mail, 18,198 (36.3%) returned due to invalid address and no recipients (Figure 1). There were 18,756 questionnaires returned with signed and dated consents. Thus the response rate was 58.6% of the remaining of 32,002 deliverable mails, assuming the samples received the questionnaires. The first 10,000 respondents were received within two months after sending the questionnaires.

Figure 1 Population, sample, and respondents of the baseline survey of the Thai Nurse Cohort Study



Among the 9 age-group cohort according to the sampling design, the first three age group had the lowest response rate (Table 2). Probability of responses were given in Table 2 and should be used for weighting in statistical analyses in subsequence papers.

Table 2 Recommended weight to be used for data analysis of the initial cohort of the Thai Nurse Cohort Study

Age group	Population	Respondents	Probability	Weight
Lower than 25	9,352	747	0.0799	12.5194
25-29	2,2664	1,308	0.0577	17.3272
30-34	3,2807	1,760	0.0536	18.6403
35-39	2,4400	2,690	0.1102	9.0706
40-44	2,1760	3,155	0.1450	6.8970
45-49	1,7640	3,584	0.2032	4.9219
50-54	7,827	2,971	0.3796	2.6345
55-59	4,572	2,043	0.4469	2.2379
60 or greater	1,677	498	0.2970	3.3675
Total	142,699	18756		

Demographic characteristics

Majority of Thai registered nurses were female (96.7%), married (60.8%), lived in the central region of the country (38.7%), and attained the bachelor degree of education at the highest (57.2%) (Table 3). About half of them, 48.5%, were older than 44 years. The average age was 43.7 (standard deviation = 9.7) years old.

Table 3 Demographic characteristics

Characteristics	Number	Percent
Sex		
Male	625	3.3
Female	18,013	96.7
Age (years)		
Lower than 25	747	4.0
25 – 44	8,913	47.5
45 or greater	9,096	48.5
Mean (Standard deviation)		43.7 (9.7)
Marital status		
Single	5,754	30.9
Married	11,354	60.8
Widowed	533	2.9
Divorced	880	4.7
Separated	152	0.8

Characteristics	Number	Percent
Region of workplace		
North	2,234	12.7
Northeast	4,060	23.0
Central	6,828	38.7
East	1,318	7.5
West	953	5.4
South	2,258	12.8
Current and highest educational attainment		
Certificate equivalent to bachelor degree	4,289	23.4
Bachelor degree	10,474	57.2
Master degree	3,170	17.3
Doctoral degree	154	0.8
Others	210	1.2

Employment history and career advancement

Most of registered nurses,78.0%, graduated from nursing colleges operated under Ministry of Public Health, 79.5% were under contracted scholarship, and 63.1% employed as registered nurses upon start working. Less than one tenth, 7.9%, graduated from public university. Among 5,833 nurses whose education level when started working were undergraduate, 75.6% were upgraded (67.1% bachelor, 8.5% master, and 0.03% doctoral degree).

Table 4 Employment history and career advancement

Characteristics	Number	Percent
Institute from which graduated		
Public university	1,215	7.9
Nursing colleges under Ministry of Public Health	11,964	78.0
Other nursing colleges	1,590	10.3
Private institutes	574	3.7
Having been under contracted scholarship		
Yes	14,408	79.5
No	3,712	20.5
Employment upon started working		
Undergraduate level		
Public health worker	623	3.4
Assistant nurse	1,152	6.2
Technical nurse	4,220	22.7
Graduate level		
Registered nurse	11,739	63.1

Characteristics	Number	Percent
Nurse lecturer	190	1.0
Others	687	3.69
Career advancement among who started working at undergraduate level (n = 5,833)		
Remain unchanged	1,365	23.4
Upgraded to bachelor degree	3,915	67.1
Upgraded to master degree	497	8.5
Upgraded to doctoral level	2	0.03
Others	54	0.9

Current status of employment

Most registered nurses were practice nurses, 61.2%, followed by moderate level administrators, 21.0% (Table 5). Majority of them, 80.8%, were civil servant and 79.0% worked in hospitals. There was 9.0% worked in health center or clinic.

Table 5 Current status of employment

Current employment characteristics	Number	Percent
Employment category		
Direct care nurse	11,320	61.2
Nurse lecturer	554	3.0
Middle level administrator (Head ward, Unit manager, Chair of the department)	3,886	21.0
High level administrator (Director, Dean of the faculty or equivalent)	548	3.0
Research nurse	489	2.6
Unemployed	311	1.7
Others	1,398	7.6
Main career		
Civil servant	15,032	80.8
Government officer	702	3.8
State enterprise staff	93	0.5
Private sector staff	1,415	7.6
Freelance	177	1.0
Others	1,183	6.4
Workplace		
Hospital	14,088	79.0
Health center, clinic	1,600	9.0
Infirmary in school or other organization	98	0.6
Nursing school	592	3.3
Non health care service office	498	2.8
Others	959	5.4

Intention to leave nursing career

Among 16,470 registered nurse who currently in nursing profession, 2,306 (13.8%) intended to leave their career (Table 6). The percentages of intention to leave slightly increased with age, from 9.1% of the youngest age group to 18.7% of the oldest age group. Research nurses had the highest proportion of intention to leave,16.7%, compared to other categories of employment. Nurses who worked in private sectors had the highest proportion of intention to leave, 18.2%, followed by freelance nurses, 15.8%.

Table 6 Intention to leave nursing profession within next 2 years

Subgroups of registered nurse	Number	% Intent to leave
Overall	16,470	13.8
Age group		
Lower than 25	701	9.1
25-29	1,215	12.8
30-34	1,651	12.5
35-39	2,509	14.6
40-44	2,910	14.5
45-49	3,286	14.1
50-54	2,569	13.8
55-59	1,662	14.3
60 or greater	193	18.7
Employment category		
Direct care nurse	11,134	13.8
Nurse lecturer	551	10.3
Middle level administrator	3,767	13.6
High level administrator	534	14.4
Research nurse	484	16.7
Main career		
Civil servant	13,939	13.7
Government officer	641	10.5
State enterprise staff	80	15.0
Private sector staff	1,188	18.2
Freelance	38	15.8
Others	718	12.3

Health status and health care

Overall, quality of life of registered nurses, based on EuroQol five-dimension questionnaire (EQ-5D), was good, with an overall mean score of 0.758 (standard deviation = 0.191) (Table 7). According to each dimension, pain or discomfort had the lowest proportion of nurses, 44.8%, who had no problem. Almost all registered nurses, 90.0%, had annual checkup. Three quarters, 76.4%, undergone breast self-examination while mammography was done only for 23.1% and about half, 50.6%, undergone cervical cancer screening. Two major health conditions that registered nurses reported being diagnosed by medical doctors; 48.3% musculoskeletal disorder and 28.6% hyperlipidemia. During the last 12 months, nurses seek medical care mainly from general practitioners, 63.7%. Hospitalization during the last 12 months was 10.3% where direct care nurse was slightly higher, 10.7%, than any other employment categories.

Table 7 Health status and health care presented as number and percentage unless indicated otherwise

Characteristics	Number	Percent
Quality of life based on EuroQol five-dimension (EQ-5D)		
Mobility		
I have no problems in walking about	14,180	76.0
I have some problems in walking about	4,445	23.8
I am confined to bed	25	0.1
Self-Care		
I have no problems with self-care	18,266	97.9
I have some problems washing or dressing myself	385	2.1
I am unable to wash or dress myself	7	0.0
Usual Activities		
I have no problems with performing my usual activities	15,439	82.8
I have some problems with performing my usual activities	3,130	16.8
I am unable to perform my usual activities	88	0.5
Pain/Discomfort		
I have no pain or discomfort	8,347	44.8
I have moderate pain or discomfort	9,910	53.2
I have extreme pain or discomfort	389	2.1
Anxiety/Depression		
I am not anxious or depressed	11,210	60.2
I am moderately anxious or depressed	7,135	38.3
I am extremely anxious or depressed	283	1.5
Mean (standard deviation) overall score	0.758	(0.191)
Medical checkup		
No	1,797	10.0
Yes, due to occurrence of symptoms	2,326	13.0
Yes, annual checkup	13,840	77.0
Undergone breast self-examination		
No	4,224	23.6

Characteristics	Number	Percent
Yes, due to occurrence of symptoms	1,769	9.9
Yes, annual checkup	11,879	66.5
Undergone mammography examination		
No	13,708	76.9
Yes, due to occurrence of symptoms	837	4.7
Yes, annual checkup	3,276	18.4
Undergone cervical cancer screening		
No	8,849	49.4
Yes, due to occurrence of symptoms	464	2.6
Yes, annual checkup	8,600	48.0
Illnesses diagnosed by medical doctors		
Cardiovascular disease	620	3.5
Diabetes	511	2.9
Hypertension	1,454	8.1
Hyperlipidemia	5,162	28.6
Diseases related to brain	1,014	5.8
Cancer	426	2.4
Musculoskeletal disorder	8,753	48.3
Blood disease	738	4.4
Lung disease	637	3.6
Viral hepatitis	852	4.8
Care seeking behavior during the last 12 months		
Never	1,581	8.4
Self-medication	4,423	23.6
Prescribed by general practitioner	11,939	63.7
Prescribed by specialist	6,735	35.9
Used alternative medicine	4,966	26.5
Hospitalization during the last 12 months		
Yes	1,887	10.3
No	16,479	89.7
Hospitalization according to current employment category		
Direct care nurse	11,099	10.7
Nurse lecturer	543	8.7
Middle level administrator	3,808	9.9
High level administrator	533	9.9
Research nurse	479	8.8
Others	1,368	9.1
Unemployed	301	9.6

Discussions

Thai Nurse Cohort Study was established to address both the crisis of nursing workforce and women health in Thailand. To our best knowledge, this is the first nurse cohort study in South East Asia. It could be served as evidence from low- and middle-income countries where ways of living, environments, and health behaviors were differ from that of the western or high-income countries. Long-term nursing workforce dynamics and changes of women health are essential in policy formation regarding these issues. In particular, the TNCS established just in the right time, in 2009, where changes before and after a new era of the ten countries integrated as the ASEAN Economic Community (AEC) to start in 2015 can be investigated. This reported was published during an administration of the second wave which was the follow-up survey of the initial cohort of 18,756 nurses and the baseline survey of the 2012 new entry cohorts of 1,600 nurses. The third wave which will be in 2015, just at the start of the AEC, then the forth wave will be in 2018. With this design of the TNCS, we could investigate how the agreement on free-flow of nurses workforce affects nursing crisis and women health, both in short- and long-term, and simultaneously before and after such erupted changes in This region.

In addition, the TNCS had 9 age-group initial cohort and would have many subsequent new entry cohorts. These cohorts covered all age groups throughout the period of the study. This design has many advantages over the conventional single age cohort study as pointed out by Miyazaki and Raudenbush (2000).[31] A planned of having new entry cohorts at every 3 years will allow us to plan baseline survey to accommodate some unpredicted issues needed to be addressed under such a rapid global changes circumstances.

To our best knowledge, the TNCS had a small size and later on a moderate size of nurse cohort. The oldest and the largest one is the Nurse Health Study, initiated in 1976 in the Unites States, following up every 3 years via mail questionnaire, and is now involving 238,000.[18, 19] The Danish Nurse Cohort Study, established in 1993 with 19,898 nurses, then the second wave in 1999 an additional new cohort of 24,155 nurses, and the third wave in 2009 that involved 11,114 nurse.[20] The Japan Nurses' Health Study (JNHS), initiated in 2001, had a cohort size of 18,000 nurses.[21, 22] The Nurses and midwives e-Cohort Study, established in 2006 for Australia and New Zealand, there were 8,247 participated in the study.[23] At the same year the TNCS being established, the Nurses' Early Exit Study (NEXT) involved 56,406 nurses from ten European.[5, 24]

The response rate for the baseline survey was 58.6%. This was similar or even greater than being obtained in other large studies conducted among nurses.[32-34] The initial cohort of 18,756 nurses was 13.1% representative of the total 142,699 registered nurse population in Thailand. This proportion of representation is higher than many cohort studies. [5, 23, 24] One of the most recent nurse cohort conducted in 2006, the Nurses and midwives e-Cohort Study, it was reported that, from 290,000 nurses in Australia and 44,400 in New Zealand, 8,247 (2.5%) participated in the study.[23] We observed that, without any extra efforts, our first 10,000 participants were obtained within 2 months after posting the questionnaires. This convinced us to believe that, hopefully, the follow-up rate could be less difficult than foreseeing.

The actual number of cohort members was much less than the sample size that was initially planned. However, the sample size is expected to increase at every wave of the study due to new entry cohort, for instance, the 2012 cohort add another 1,600 to the initial cohort. Thus, an expected sample size of 20,356 as of 2012 would allow for estimating any events with a proportion of as low as 1% with a precision of +/-0.15%. i.e., a relative precision of +/-15%, for two-sided 95% confidence level. This is sufficient for important disease such as incidence of breast and cervical cancer.

This report presented details of study design and administration of the TNCS so that subsequence papers can used for their references and our future collaborators can be used for their plan contributions. We also provided details of the design as well as weights for future statistical methods to be applied for TNCS data. We strongly recommended that any analyses should implement weights we provided in the report, or at least, should explore how weighting affects their conclusions. Nonetheless, cohort profiles as well as some key findings were also presented briefly. Reports in more insight investigation these issues and others that had not mentioned in this report shall be followed. In this report, we found that Thai nurse were aging. About half of them, 48.5%, were older than 44 years. The average age was 43.7 (standard deviation = 9.7) years old. However, this is partly due to that older nurses participated in the TNCS more than the younger. We then sought to get the average age based on the TNC database- it was 37 years. This was slightly younger when compared to what was reported in a study in the United States which estimated that by 2008 the average age of RNs was 45.4 years, with more than 40% of the RN workforce were older than 50 years.[10] A survey in 2005 in Hawai'i found that mean age of RNs was 49.3 years.[11] In the United States, 33% of the RN workforce were older than 50 years[35], and about 20% of RNs aged of greater than 45 years in 2008 and forecasting to be 59 to 71% in the next 25 years in Italy.[36] In Thailand, 48.5% of RNs were 45 years old or greater indicating similar phenomenon compared to other countries regarding aging nurses.

We found that 13.8% of Thai RNs intended to leave nursing career someday during their employments. However, the percentage of intention to leave within the next 2 years was 4.3%. This was much lower than in other countries, for instance, a survey in 2001 in the United States revealed that one in five nurses was seriously considering leaving the profession within the next five.[37] Another survey in 2005 in Hawai'i founded that 69.9% of current RNs planned to retire by 2020.[11] It was 34.4% of the nurses intended to leave the hospital within 1 year in Italy.[38] A study in Hungary and some European countries showed that about 50% of nurses intended to leave.[39]

However, with the proportion of who intended to leave within the next two years being 4.3%, based on the current RN population in Thailand, it is approximately 6,000 nurses. Fortunately, the new entry RN who hold nursing licenses granted by the TNC as of 2009 and 2010, 2-year duration after the survey, was 6,402. The number of intention to leave based on the 13.8% was about 20,000. This could be an alarmingly high turnover rate if they did what they were intended.

In conclusion, health status of the current RNs were generally satisfactory. However, Thailand shares the same nursing crisis as many other countries, with a high proportion of aging nursing workforce, high rate of intention to leave nursing career, and low number

of new entry nurses. Further studies are needed to investigate root causes of the crisis so that specific measures can be formulated to minimize the problem.

Acknowledgement
The TNCS gratefully acknowledged Professor Tada Yipintsoi, who initiated and encouraged the investigators to form the cohort, for his advices and crucial contributions. The TNCS was supported by the Human Resource for Health Research and Development Office, Health System Research Institute, the International Health Planning and Policy, and the Thailand Nursing and Midwifery Council. The authors thank to Kawin Thinkhamrop and Chaiwat Tawarungruang for their assistant in data management, and all cohort members for their valuable participations.

References

1. Oulton JA. The global nursing shortage: an overview of issues and actions. *Policy Polit Nurs Pract* 2006 Aug;**7**(3 Suppl): 34S-9S.

2. Odom J. Nursing shortage: impending doom or challenging opportunity? *J Perianesth Nurs* 2000 Oct;**15**(5): 348-9.

3. Yun H, Jie S, Anli J. Nursing shortage in China: State, causes, and strategy. *Nurs Outlook* 2010 May-Jun;**58**(3): 122-8.

4. Sawada A. The nurse shortage problem in Japan. *Nurs Ethics* 1997 May;**4**(3): 245-52.

5. Camerino D, Mansano Sarquis LM. [Nurses' working conditions, health and well being in Europe (Nurses' Early Exit Study)]. *Prof Inferm* 2010 Jan-Mar;**63**(1): 53-61.

6. International Council of Nurses. The global shortage of registered nurses: an overview of issues and actions. 2005.

7. Spetz J. Hospital nurse wages and staffing, 1977 to 2002: cycles of shortage and surplus. *J Nurs Adm* 2004 Sep;**34**(9): 415-22.

8. Andrews DR, Dziegielewski SF. The nurse manager: job satisfaction, the nursing shortage and retention. *J Nurs Manag* 2005 Jul;**13**(4): 286-95.

9. Organization. WH. The world health report 2006: working together for health.; 2006.

10. Buerhaus PI, Staiger DO, Auerbach DI. Implications of an aging registered nurse workforce. *JAMA* 2000 Jun 14;**283**(22): 2948-54.

11. Winters-Moorhead C, Kooker BM. Four indicators for monitoring progress in addressing the registered nurse workforce shortage in Hawai'i. *Hawaii Med J* 2008 Dec;**67**(12): 322-5.

12. Twigg D, Duffield C, Thompson PL, Rapley P. The impact of nurses on patient morbidity and mortality - the need for a policy change in response to the nursing shortage. *Aust Health Rev* 2010 Aug;**34**(3): 312-6.

13. Kingma M. Nurses on the move: a global overview. *Health Serv Res* 2007 Jun;**42**(3 Pt 2): 1281-98.

14. Nevidjon B, Erickson JI. The nursing shortage: solutions for the short and long term. *Online J Issues Nurs* 2001;**6**(1): 4.

15. Janiszewski Goodin H. The nursing shortage in the United States of America: an integrative review of the literature. *J Adv Nurs* 2003 Aug;**43**(4): 335-43.

16. Duvall JJ, Andrews DR. Using a structured review of the literature to identify key factors associated with the current nursing shortage. *J Prof Nurs* 2010 Sep-Oct;**26**(5): 309-17.

17. Palmer C. The nursing shortage: an update for occupational health nurses. *AAOHN J* 2003 Dec;**51**(12): 510-3.

18. Colditz GA, Manson JE, Hankinson SE. The Nurses' Health Study: 20-year contribution to the understanding of health among women. *J Womens Health* 1997 Feb;**6**(1): 49-62.

19. Colditz GA, Coakley E. Weight, weight gain, activity, and major illnesses: the Nurses' Health Study. *Int J Sports Med* 1997 Jul;**18 Suppl 3**: S162-70.

20. Hundrup YA, Simonsen MK, Jorgensen T, Obel EB. Cohort Profile: The Danish nurse cohort. *Int J Epidemiol* 2011 Mar 18.

21. Hayashi K, Mizunuma H, Fujita T, et al. Design of the Japan Nurses' Health Study: a prospective occupational cohort study of women's health in Japan. *Ind Health* 2007 Oct;**45**(5): 679-86.

22. Fujita T, Hayashi K, Katanoda K, et al. Prevalence of diseases and statistical power of the Japan Nurses' Health Study. *Ind Health* 2007 Oct;**45**(5): 687-94.

23. Turner C, Bain C, Schluter PJ, et al. Cohort Profile: The Nurses and Midwives e-Cohort Study--a novel electronic longitudinal study. *Int J Epidemiol* 2009 Feb;**38**(1): 53-60.

24. Hasselhorn HM, Tackenberg P, Kuemmerling A, et al. Nurses' health, age and the wish to leave the profession--findings from the European NEXT-Study. *Med Lav* 2006 Mar-Apr;**97**(2): 207-14.

25. Tonry MO, L.E. arrington, D.P. *Human development and criminal behavior: New ways of advancing knowledge*. New York: Springer- Verlag; 1991.

26. Landsbergis PA, Schnall PL, Pickering TG, Schwartz JE. Validity and reliability of a work history questionnaire derived from the Job Content Questionnaire. *J Occup Environ Med* 2002 Nov;**44**(11): 1037-47.

27. Brauer CA, Rosen AB, Greenberg D, Neumann PJ. Trends in the measurement of health utilities in published cost-utility analyses. *Value in health : the journal of the*

International Society for Pharmacoeconomics and Outcomes Research 2006 Jul-Aug;**9**(4): 213-8.

28. Brooks R. EuroQol: the current state of play. *Health Policy* 1996 Jul;**37**(1): 53-72.

29. Fogelholm M, Malmberg J, Suni J, et al. International Physical Activity Questionnaire: Validity against fitness. *Medicine and science in sports and exercise* 2006 Apr;**38**(4): 753-60.

30. Ogata Y, Nagano M, Fukuda T, Hashimoto M. [Job retention and nursing practice environment of hospital nurses in Japan applying the Japanese version of the Practice Environment Scale of the Nursing Work Index (PES-NWI)]. *[Nihon koshu eisei zasshi] Japanese journal of public health* 2011 Jun;**58**(6): 409-19.

31. Miyazaki Y, Raudenbush SW. Tests for linkage of multiple cohorts in an accelerated longitudinal design. *Psychological methods* 2000 Mar;**5**(1): 44-63.

32. Friese CR, Himes-Ferris L, Frasier MN, McCullagh MC, Griggs JJ. Structures and processes of care in ambulatory oncology settings and nurse-reported exposure to chemotherapy. *BMJ Qual Saf* 2011 Aug 16.

33. Chipas A, McKenna D. Stress and burnout in nurse anesthesia. *AANA J* 2011 Apr;**79**(2): 122-8.

34. Carver L, Candela L, Gutierrez AP. Survey of generational aspects of nurse faculty organizational commitment. *Nurs Outlook* 2011 May-Jun;**59**(3): 137-48.

35. Hill KS. A business case for phased retirement: will it work for nursing? *J Nurs Adm* 2010 Jul-Aug;**40**(7-8): 302-8.

36. Piccoli M, Cavallo F, Dello Russo C, Di Giulio P, Dimonte V. [Aging of nursing workforce: survey in three hospital of in Piedmont region]. *Assist Inferm Ric* 2008 Jan-Mar;**27**(1): 5-12.

37. Peter D. Hart Research Associates. *The nurse shortage: Perspective from current direct care nurses and former direct care nurses - an opinion research study conducted by Peter D. Hart Research Associates on behalf of the Federation of Nurses and Health Professionals*; 2001.

38. Ambrosi E, Portoghese I, Galletta M, Marchetti P, Battistelli A, Saiani L. [Intention to leave the hospital among nurses with </= 3 years of work experience: an exploratory study]. *Assist Inferm Ric* 2011 Jul-Sep;**30**(3): 126-34.

39. Ujvarine AS, Zrinyi M, Toth H, Zekanyne IR, Szogedi I, Betlehem J. Intent to stay in nursing: internal and external migration in Hungary. *J Clin Nurs* 2011 Mar;**20**(5-6): 882-91.