**Health-related quality of life measured with EuroQol five-dimensional questionnaire (EQ-5D) among registered nurses in Thailand**

Wilaiporn Thinkhamrop, Krisada Sawaengdee, Viroj Tangcharoensathien, Tuangthip Teerawit, Bandit Thinkhamrop

**Abstract**

**Background**: Shortages and inequitable distributions of nursing professions are experiencing nationally and globally. Thailand established a 25-year longitudinal cohort study to investigate these issues.

**Objective**: To describe and compare health-related quality of life based on among the 9 age-group cohorts and to analyze the importance of certain socio-economic and work-related determinants of health among the registered nurses. Does EQ-5D associated with intention to leave nursing career? -> Yes, 69%

**Methods**: A baseline survey of Thai Nurse Cohort Study (TNCS) conducted as a postal 13-page questionnaire where the HRQoL was measured with the EQ-5D. The EQ-5D score was calculated on the basis of responses to five domains by using the Thai value set. Multiple regression analyses using a stepwise method were employed to model the associations between the EQ-5D score and various determinants. Linear regression was applied to data from ..

**Results**: Of 18,756 RN, … HRQoL was worse among RN who reported being experienced workplace violence than in those being not. The affected RN reported more problems in all the EQ-5D dimensions and had considerably lower EQ-5D score than the unaffected. Among the … subgroup, lower income and more severe degree of sleeping difficulties lowered HRQoL. The prevalence of 'moderate or severe problems' is especially high in the dimension 'pain/discomfort', 44.8%. The strongest predictor of intention to leave was having “'moderate or severe problems” in the dimension ‘anxiety/depression’ (OR = 1.5).

**Conclusions**: 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 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**

The EQ-5D is a generic health-related quality of life instrument. It comprises five dimensions. Each of which has three levels health states- No problems, some prblems, and severe problems. EQ-5D health states are assigned values on a scale anchored in perfect health (1) and death (0).[1](#_ENREF_1)

Health-related quality of life (HRQOL) , abbreviated as QOL, can be evaluated by various questionnaires, which are classified as generic and disease-targeted ones. Generic questionnaires are further subdivided into profile-type and preference-based ones. SF-36 and EQ-5D are the best known examples for the former and the latter, respectively. In SF-36 and its shortened one SF-8, the subjects' QOL is expressed by several profiles or subscales. Their advantages include well-conducted validation and availability of national norms. In EQ-5D, a single value representing the subjects' QOL status (utility) is obtained through 5 questions. These generic questionnaires are applicable to patients with various diseases or even to healthy citizens. In contrast, disease-targeted questionnaires lack such features, but can include items that are specifically related to the disease but devoid of general applicability. Thus, generic and disease-targeted questionnaires have their own pros and cons. Selection of the questionnaires depends on the object of the study.[2](#_ENREF_2)

To derive EuroQol five-dimensional (EQ-5D) health states values from the Thai general population. METHODS: Forty-eight trained individuals successfully conducted interviews with a representative sample of 1409 respondents in 2007. A total of 12 sets of health states were used with one set allocated to each respondent. A respondent was requested to assign values for 11 states using the ranking and visual analogue scale methods and 10 states using the time trade-off method. The variables from the three existing models were used in model specifications and the best model was chosen on the basis of the extent of logical inconsistency in the estimated scores, predictive performance, parsimony, and sensitivity to changes in health. RESULTS: Eighty-six health states were valued. The mean age of respondents was 44.6 years old. The highly consistent respondents tend to give higher scores for mild states and lower scores for severe states, compared with those given by the highly inconsistent respondents. The best model used variables from the Dolan 1997 study and estimated from the scores given by the respondents with fewer than 11 inconsistencies. The estimated scores are completely consistent, R(2) is 0.448. The second highest score was 0.766 given to state 11112 and the lowest score was -0.454 for state 33333. CONCLUSION: Values for EQ-5D health states were estimated from the Thai general population. This is the first Thai generic health state value results to be used in evaluating health interventions in Thailand.[3](#_ENREF_3) <Find full article>

Same: OBJECTIVES: Healthy Japan 21 (Japanese National Health Promotion in the 21st Century) was started in 2000 to promote extension of healthy life expectancy and improve health-related quality of life (HRQOL). The present study aims to describe HRQOL of Japanese subjects using the EuroQol questionnaire (EQ-5D) and investigate the influence of social background, health-related behaviors, and chronic conditions on HRQOL using representatives in Takamatsu, Japan. METHODS: Data were obtained from a 2005 Takamatsu City health survey mailed to 2,500 randomly selected Japanese individuals in Takamatsu, a medium-sized city. We examined data from 915 Japanese adults. The questionnaire addressed social background, health-related behaviors, chronic conditions, EQ-5D items, and self-rated health. The impact of social background, health-related behaviors, and chronic conditions on Japanese HRQOL was examined through multivariate regression, adjusting for age and sex. RESULTS: EQ-5D scores decreased with age, particularly for respondents who were unemployed or retired. Adjusting for sex and age, the results showed that age, unemployment/retirement, feeling severe stress, and musculoskeletal and gastrointestinal diseases were significantly associated with decreased HRQOL. Conversely, sufficient sleep (7-8 h/day) and having a hobby were significantly associated with increased HRQOL. CONCLUSIONS: Information is lacking regarding HRQOL in Japanese populations. This study furthers our understanding of some important determinants influencing Japanese HRQOL, using the EQ-5D in Takamatsu, Japan. Our results also resembled some findings from similar studies in other countries. We hope to use the EQ-5D with other health survey questionnaires to gather more data about HRQOL of Japanese people.[4](#_ENREF_4)

\*\*\*Testing the instrument in a population predominantly female\*\*\*

Example use in specific subgroup: PURPOSE: To assess health-related quality of life in patients with Kashin-Beck disease (KBD) in China. METHODS: A total of 684 participants from endemic areas of the Shaanxi province in China were recruited through a multistage stratified random sampling. Amongst those, 368 participants were diagnosed with KBD while the rest of 316 were non-KBD participants. Differences between KBD and non-KBD groups were analysed for the percentage of reporting any problems in each of EQ-5D five dimensions, EQ-5D index scores and visual analogue scale (VAS) scores. RESULTS: KBD patients have a higher percentage of reporting any problems in each of EQ-5D dimension than non-KBD participants and a general population in Beijing. The most affected dimension is pain/discomfort, followed by mobility, anxiety/depression, and usual activities, and self-care being the last. The mean EQ-5D index and VAS scores for KBD patients are significantly lower than those of non-KBD participants. CONCLUSION: This study is the first attempt to measure the health-related quality of life in KBD patients. The results of the study show that KBD has a severe impact on patients' health-related quality of life as measured by EQ-5D. It particularly causes great problems in the dimensions of pain/discomfort, mobility and anxiety/depression. [5](#_ENREF_5)

BACKGROUND: Chronic kidney disease (CKD) is a health-related quality-of-life (HRQOL) deteriorating disease which is not only a public health but also a socioeconomic problem. Interest in developing cost-effective interventions to control CKD has increased. The aim of this study was to measure HRQOL in terms of quality-adjustment weights for cost-effectiveness analysis using EQ-5D in patients with CKD. The relationships between the measured HRQOL and clinical indices/complications were also analyzed. METHODS: EQ-5D, a generic preference-based instrument, was administered to 569 CKD outpatients at Tsukuba University Hospital between November and December 2008. The response rate was 94.4% (537/569). Data on sex, age, creatinine, hemoglobin, serum albumin and eGFR were obtained from the patients' records. Data on the presence of complications such as hypertension, diabetes, and history of cardiovascular disease (CVD) were also retrieved. RESULTS: Measured quality-adjustment weights by the CKD stage were 0.940 (95% CI 0.915-0.965), 0.918 (0.896-0.940), 0.883 (0.857-0.909), 0.839 (0.794-0.884), and 0.798 (0.757-0.839) for stages 1-5, respectively. The decrease in weight was significant by ANOVA (P < 0.0001), and the weight for all stages was 0.885 (0.871-0.898). There was a positive relationship between hemoglobin/serum albumin and the weight. The presence of hypertension lowered the weight from 0.910 (0.885-0.936) to 0.874 (0.858-0.891), diabetes from 0.901 (0.886-0.917) to 0.840 (0.811-0.869), and CVD from 0.892 (0.878-0.906) to 0.783 (0.718-0.848). CONCLUSIONS: HRQOL decreases with progression of CKD stage and/or presence of anemia, undernutrition, hypertension, diabetes, or history of CVD.[6](#_ENREF_6)

OBJECTIVE: To compare health-related quality of life (HRQOL) of patients with rheumatoid arthritis (RA) to that of the general population and to investigate the association with disease activity, focusing on different clinical remission criteria. METHODS: EQ-5D data from 3156 patients with RA from 11 Danish centers were compared with Danish EQ-5D population norms (n = 16,136). The Disease Activity Score (DAS28) and the Clinical Disease Activity Index score (CDAI) were used as definitions of disease activity and clinical remission. The score difference (DeltaEQ-5D) was calculated in each patient as the difference from the age and sex-matched general population and adjusted for age, marital status, education, body mass index, smoking, exercise habits, disease duration, IgM-rheumatoid factor status, joint surgery, extraarticular features, treatment, and comorbidity in multiple linear regression models. RESULTS: 37% vs 22% fulfilled the DAS28 and CDAI remission criteria, respectively. The DeltaEQ-5D values for women/men in clinical remission were DAS28 0.05/0.06 vs CDAI 0.01/0.02; low disease activity: DAS28 0.12/0.13 vs CDAI 0.11/0.14; moderate disease activity: DAS28 0.18/0.20 vs CDAI 0.20/0.23; and high disease activity: DAS28 0.38/0.28 vs CDAI 0.33/0.26. Adjusting for confounders reduced the DeltaEQ-5D values between 0 and 0.04 units. CONCLUSION: Patients with RA had worse EQ-5D scores than the general population, and the difference was strongly associated with disease activity. The EQ-5D score for patients in clinical remission approached that of the general population, suggesting that strict treatment goals are critical in order to achieve near-normal HRQOL in patients with RA.[7](#_ENREF_7)

INTRODUCTION: There are no population norms currently available in Poland for any generic health-related quality of life (HRQoL) questionnaire for adults. OBJECTIVES: The aim of the study was to evaluate the health status of a representative sample of the general Polish population using the EQ-5D questionnaire. MATERIAL AND METHODS: Adult subjects who were visiting patients in 8 medical centers in Warsaw, Skierniewice, and Pulawy, were inter viewed during the Polish EQ-5D valuation study. Stratified quota sampling was used. The respondents completed the EQ-5D questionnaire and provided information on age, sex, marital status, education, employment, income, housing conditions, medical history, and smoking habits. The interviews were conducted between February and May 2008. RESULTS: The final sample (n = 317) was representative of the general Polish population with respect to age and sex. Moderate problems in at least 1 dimension of the HRQoL were reported by 57% of the respondents, while extreme problems by 4.7%. Pain or discomfort was reported by 40% of the respondents, anxiety or depression by 38%. Problems with mobility were reported by 16% of the respondents, with usual activities (work, school) by 13%, and with self-care by 3%. The mean state of health recorded on the visual analogue scale (VAS) was 81.6 +/-14.4 points. The mean VAS value decreased from 87 and 91 points in the youngest age group to 67 and 72 points in the oldest age group, in men and women, respectively. CONCLUSIONS: Pain and anxiety are commonly reported problems in the Polish population, especially by young women. EQ-5D is a valuable tool for studying health outcomes and differences in health status within the Polish population.[8](#_ENREF_8)

Mean EQ=5D score in CAPD The mean PD duration was 7.4 +/- 6.0 months. The mean EQ-5D and visual analogue scale scores were 0.65 +/- 0.23 and 0.65 +/- 0.26, respectively.[9](#_ENREF_9) <Find full article>

EQ-5D index was 0.45 in Korea cancer.[10](#_ENREF_10)

EQ-5D was more sensitive to change with deteriorated condition than the SF-6D: SRM -0.20 (-0.23 to -0.18) versus -0.11 (-0.14 to -0.08).[11](#_ENREF_11)

Overall, the SF-6D was more responsive than the EQ-5D.[12](#_ENREF_12)

This study offers further evidence indicating that income losses do not significantly affect health state valuations.[13](#_ENREF_13)

***Reference number****: The National Institute for Health and Clinical Excellence (NICE) has issued guidance on cost-effectiveness analyses, suggesting that preference-based health-related quality of life (HRQL) weights or utilities be based on UK community preferences, preferably using the EQ-5D; ideally all analyses would use the same system for deriving HRQL weights, to encourage consistency and comparability across analyses. Development of a catalogue of EQ-5D scores for a range of health conditions based on UK preferences would help achieve many of these goals. OBJECTIVE: . To provide a UK-based catalogue of EQ-5D index scores. METHODS: . METHOD: s were consistent with the previously published catalogue of EQ-5D scores for the US. Community-based UK preferences were applied to EQ-5D descriptive questionnaire responses in the US-based Medical Expenditure Panel Survey (MEPS). Ordinary least squares (OLS), Tobit, and censored least absolute deviations (CLAD) regression methods were used to estimate the 'marginal disutility' of each condition controlling for covariates. RESULTS: . Pooled MEPS files (2000-2003) resulted in 79,522 individuals with complete EQ-5D scores. Marginal disutilities for 135 chronic ICD-9 and 100 CCC codes are provided. Unadjusted descriptive statistics including mean, median, 25th and 75th percentiles are also reported. CONCLUSION: . This research provides community-based EQ-5D index scores for a wide variety of chronic conditions that can be used to estimate QALYs in cost-effectiveness analyses in the UK. Although using EQ-5D questionnaire responses from the US-based MEPS is less than ideal, the estimates approximate HRQL guidelines by NICE and provide an easily accessible"off-the-shelf" resource for cost-effectiveness and public-health applications.*[*14*](#_ENREF_14)

***Validation:*** *PURPOSE: The objective of this study was to assess the construct validity of the EQ-5D instrument among the Malaysian population. METHODS: This was a cross-sectional study conducted among Malaysian adults in three northern states of Malaysia. A pre-developed questionnaire consisting of both the EQ-5D and SF-12 items was used for data collection. Concurrent, convergent, and known group validity of EQ-5D were assessed against SF-12 and several known relationships with participants' demographic and illness characteristics. RESULTS: A total of 596 Malaysians participated in the study. The mean EQ-5D score was 0.93 (SD = 0.13), while the mean physical component score (PCS-12) and mental component score (MCS-12) scores were 48.9 (SD = 7.4) and 49.1 (SD = 8.0), respectively. Participants with a current medical problem had lower PCS-12 and MCS-12 scores and reported more problems with all of the EQ-5D dimensions; they also had lower EQ-5D and EQ-VAS scores (P < 0.05). Convergent validity was supported by a moderately positive correlation between EQ-5D and EQ-VAS with MCS-12 and PCS-12 scores; moreover, the stronger effect sizes between PCS-12 and the physical dimensions of EQ-5D as well as between MCS-12 with anxiety/depression scores further supported the convergent validity of EQ-5D. Responses to the EQ-5D dimensions only supported two of the four known group validity hypotheses of higher quality of life among individuals who are better educated and no medical problem. No association was found between income and gender with EQ-5D score. CONCLUSION: This study has demonstrated acceptable construct validity of the EQ-5D among the Malaysian population.*[*15*](#_ENREF_15)

*BACKGROUND AND PURPOSE: The EQ-5D measures quality of life based on self-reported health status in 5 dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. In this study, the EQ-5D was evaluated as an outcome measure for patients with subarachnoid hemorrhage. METHODS: The EQ-5D was completed in 710 patients 9 months after subarachnoid hemorrhage. Relevant demographic and clinical factors were evaluated as predictors of the 5 outcome dimensions in a series of linear regression models. RESULTS: Worse health status in mobility, self-care, and usual activities was predicted by increasing age and by a more severe disease as indicated by the presence of an aneurysm, worse clinical condition at admission, or more blood on the CT scan. Younger age and female gender predicted worse health status regarding anxiety/depression. CONCLUSIONS: The evaluation of the EQ-5D reveals age-related differences in the nature of the challenges faced by these patients.*[*16*](#_ENREF_16)

***Discussion value of EQ-5D*** *: PURPOSE: EQ-5D tariffs are typically based on general population valuations studies, but whether valuations of experienced health (EH) or hypothetical health (HH) are more appropriate is disputed. Previous comparisons of valuations of EH and HH have focused on absolute differences in dimension-specific regression coefficients. We examined differences in the relative importance attributed to the EQ-5D dimensions between EH and HH valuations of EQ-5D states in the United States. METHODS: We used the regression model from the US EQ-5D valuation study on EH ratings from the 2000-2003 Medical Expenditure Panel Survey and on HH ratings from the US EQ-5D valuation study conducted in 2001. We then compared patterns in the relative magnitudes of coefficients that corresponded to the five dimensions. RESULTS: In the HH model, self-care and pain/discomfort were the most important dimensions, while usual activities were the least important. In the EH model, usual activities were the most important dimension, while self-care was one of the least important. DISCUSSION: The findings reveal considerable differences between stated preferences for HH and ratings of EH, particularly for self-care and usual activities. The findings accentuate the importance of the debate about which groups' values should be used in medical priority setting.* [*17*](#_ENREF_17)

*When using the EQ-5D in European cross-national studies, there is no consensus over whether the European value set (EVS), country specific value sets (CVS) or UK value set (UKVS) should be used. Data on health outcomes were collected in 7 countries. EQ-5D index scores were generated for each country using all three value sets. QALYs gained over 4 weeks based on EQ-5D scores were also generated in order to investigate the implications for cost-utility analysis. EQ-5D scores obtained using the EVS were similar to values obtained using the CVS and UKVS in all countries. CVS-based EQ-5D scores were on average associated with a smaller baseline-to-week 4 change/improvement in all countries (except in Wales and Belgium) while UKVS-based EQ-5D scores showed the largest improvement over the same period for every country. With regards to cost-utility analysis, the results suggest that in most countries (with the exception of Belgium and Finland), using different tariffs to value EQ-5D would not have made a difference to the decisions based on the results of cost-utility analysis.*[*18*](#_ENREF_18)

Health state profile data, such as those provided by the EQ-5D, are widely collected in clinical trials, population surveys, and a growing range of other important health sector applications. However, these profile data are difficult to summarize to give an overall view of the health of a given population that can be analyzed for differences between groups or within groups over time. A common way of short cutting this problem is to transform profiles into a single number, or index, using sets of weights, often elicited from the general public in the form of values. Are there any problems with this procedure? In this article, the authors demonstrate the underlying effects of the use of value sets as a means of weighting profile data. They show that any set of weights introduces an exogenous source of variance to health profile data. These can distort findings about the significance of changes in health between groups or over time. No set of weights is neutral in its effect. If a summary of patient-reported outcomes is required, it may be better to use an instrument that yields this directly (such as the EQ VAS) along with the descriptive instrument. If this is not possible, researchers should have a clear rationale for their choice of weights and be aware that those weights may exert a nontrivial effect on their analysis. This article focuses on the EQ-5D, but the arguments and their implications for statistical analysis are relevant to all health state descriptive systems.[19](#_ENREF_19)

**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.[20](#_ENREF_20) 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 25 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 RN who hold nursing 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 RN 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, 2027, 2030, and 2033 cohort. Each cohort member will be followed until they were 68 years old unless they withdraw consent, or diagnose having cancer of any kinds, or die.

***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 turnover since graduation, job Strain which was adapted from Job Content Questionnaire short version (JCQ).[21](#_ENREF_21) The third section included questions regarding health status, including EuroQol five-dimension questionnaire (EQ-5D)[22](#_ENREF_22), [23](#_ENREF_23), Short format International Physical Activity Questionnaire (IPAQ)[24](#_ENREF_24), History and current illness, and self-care activities.

***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.[25](#_ENREF_25) 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 nursing 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 nursing 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, 2027, 2030, and 2033 cohort. It was planned that 25% of the new RN listed in the TNC database. For the 2012 new entry cohort, there were 6,402 RNs. From these, 1,600 (25%) were randomly selected using methods described previously.

***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.

***Ethical conduct of the study***

Institutional Review Board of the Ministry of Public Health had approved the proposal of the TNCS. The TNCS obtained signed and dated consent forms before enrolment of participants as the cohort member.

**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

Registered nurses

who hold nursing licenses as of 2008

(n = 142,699)

Random sample

stratified by 9 age-groups

(n = 50,200)

Mail returned due to invalid address or no recipients (n = 18,198)

Mail deliverable

(n = 32,002)

Enrolled as cohort members

(n = 18,756)

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 |
|  |  |  |
| 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 |
| Academic nurse | 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 |  |  |
| Practice nurse | 11,320 | 61.2 |
| Academic nurse | 554 | 3.0 |
| Moderate level administrator (Head ward, Unit leader, 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 |
| Nursing room at education institute or other organization | 98 | 0.6 |
| Nursing college or faculty | 592 | 3.3 |
| Department, division or equivalent | 498 | 2.8 |
| Others | 959 | 5.4 |

***Intention to leave nursing profession within 2 years***

Among 16,194 registered nurse who currently in nursing profession, 2,506 (15.5%) intended to leave nursing profession within 2 years (Table 6).Among 13,688 nurses who did not intend to leave, 42.1% were uncertain (data not shown). The percentages of intention to leave were similar across age group although the youngest age group was the lowest, 11.8%. Research nurse had the highest proportion of intention to leave, 19.0%, followed by nurses who currently practice nursing services, 16.3%. Nurses who worked in private sectors had the highest proportion of intention to leave nursing profession, 21.7%.

**Table 6** Intention to leave nursing profession within 2 years

| Subgroups of registered nurse | Number | % Intent to leave |
| --- | --- | --- |
| Overall | 16,194 | 15.5 |
|  |  |  |
| Age group |  |  |
| Lower than 25 | 559 | 11.8 |
| 25-29 | 1,012 | 16.6 |
| 30-34 | 1,434 | 14.9 |
| 35-39 | 2,281 | 16.7 |
| 40-44 | 2,754 | 16.3 |
| 45-49 | 3,226 | 15.5 |
| 50-54 | 2,667 | 14.9 |
| 55-59 | 1,853 | 14.8 |
| 60 or greater | 4008 | 13.5 |
|  |  |  |
| Employment category |  |  |
| Practice nurse | 9,653 | 16.0 |
| Academic nurse | 495 | 11.5 |
| Moderate level administrator (Head ward, Unit leader, Chair of the department) | 3,461 | 14.8 |
| High level administrator (Director, Dean of the faculty or equivalent) | 514 | 15.0 |
| Research nurse | 427 | 19.0 |
|  |  |  |
| Main career |  |  |
| Civil servant | 13,104 | 15.4 |
| Government officer | 561 | 12.7 |
| State enterprise staff | 84 | 15.5 |
| Private sector staff | 1,189 | 21.7 |
| Freelance | 155 | 11.6 |

***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 0.76 (standard deviation = 0.19) (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% dyslipidemia. 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 practice 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) |  |  |
| Mean (standard deviation) overall score | 0.76 | (0.19) |
| Lower than 25 | 0.74 | (0.17) |
| 25-29 | 0.74 | (0.18) |
| 30-34 | 0.75 | (0.19) |
| 35-39 | 0.76 | (0.18) |
| 40-44 | 0.76 | (0.19) |
| 45-49 | 0.76 | (0.19) |
| 50-54 | 0.75 | (0.20) |
| 55-59 | 0.78 | (0.20) |
| 60 or greater | 0.81 | (0.19) |
|  |  |  |
| Mobility |  |  |
| No problems | 14,180 | 76.0 |
| Problems | 4,470 | 24.0 |
| Self-Care |  |  |
| No problems | 18,266 | 97.9 |
| Problems | 392 | 2.1 |
| Usual Activities |  |  |
| No problems | 15,439 | 82.8 |
| Problems | 3,218 | 17.2 |
| Pain/Discomfort |  |  |
| No problems | 8,347 | 44.8 |
| Problems | 10,299 | 55.2 |
| Anxiety/Depression |  |  |
| No problems | 11,210 | 60.2 |
| Problems | 7,418 | 39.8 |
|  |  |  |
| 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 |
| 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 |
| Dyslipidemia | 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 |  |  |
| Practice nurse | 11,099 | 10.7 |
| Academic nurse | 543 | 8.7 |
| Moderate level administrator (Head ward, Unit leader, Chair of the department) | 3,808 | 9.9 |
| High level administrator (Director, Dean of the faculty or equivalent) | 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).[26](#_ENREF_26) 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.[27](#_ENREF_27), [28](#_ENREF_28) 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.[29](#_ENREF_29) The Japan Nurses' Health Study (JNHS), initiated in 2001, had a cohort size of 18,000 nurses.[30](#_ENREF_30), [31](#_ENREF_31) The Nurses and midwives e-Cohort Study, established in 2006 for Australia and New Zealand, there were 8,247 participated in the study.[32](#_ENREF_32) At the same year the TNCS being established, the Nurses' Early Exit Study (NEXT) involved 56,406 nurses from ten European.[33](#_ENREF_33), [34](#_ENREF_34)

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.[35-37](#_ENREF_35) 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. [32-34](#_ENREF_32) 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.[32](#_ENREF_32) 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 registered 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.[38](#_ENREF_38) A survey in 2005 in Hawai’i found that mean age of RNs was 49.3 years.[39](#_ENREF_39) In the United States, 33% of the RN workforce were older than 50 years[40](#_ENREF_40), 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.[41](#_ENREF_41) 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 15.5% of Thai RNs intended to leave nursing profession within 2 years. 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.[42](#_ENREF_42) Another survey in 2005 in Hawai’i founded that 69.9% of current RNs planned to retire by 2020.[39](#_ENREF_39) It was 34.4% of the nurses intended to leave the hospital within 1 year in Italy.[43](#_ENREF_43) A study in Hungary and some European countries showed that about 50% of nurses intended to leave.[44](#_ENREF_44) However, with the 15% of Thai RNs, it is approximately greater than 20,000 nurses who intended to leave within the next two years. This number is already greater than total new nurses graduated annually and thus seriously alarmingly high turnover rate if they did what were intended. According to updated data in the TNC database we used as the sampling frame for the 2011 new entry cohort, the situation was expected to be worse. The new entry RN who hold nursing licenses granted by the TNC as of 2009 and 2010 was only 6,402.

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 profession, 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, Panuwat Prathumkham, Chaiwat Tawarungreung, Utis Chaichaya, Wilaiporn Thinkhamrop, and <please add more> for their assistances in data management, and all cohort members for their valuable participations.

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