

ORIGINAL RESEARCH

Quality of nursing doctoral education in Korea: towards policy development

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Abstract

Aims. This article is a report on an international study of the quality of nursing doctoral education; herein, we report findings for Korea. Specific aims were to: examine the validity and reliability of the quality of nursing doctoral education questionnaire; and identify contributing factors and domain(s) for improvement.

Background. The quality of nursing doctoral education has been a worldwide concern with the recent rapid increase in number of nursing doctoral programmes around the world, and comprehensive evaluation is needed for policy recommendations.

Methods. A cross-sectional descriptive study, conducted from October 2006 to January 2007, used an online questionnaire evaluating four domains: programme, faculty, resources and evaluation. Seven deans, 48 faculty, 52 graduates and 87 students from 14 nursing schools participated.

Results. Content and construct validity, and construct reliability of the questionnaire were established. Overall, participants reported that the perceived quality of private universities/schools was significantly higher than that of public/national universities. A higher ratio of doctoral to non-doctoral students was significantly associated with higher quality. The domains of programme, faculty and resources were highly correlated. The programme was the most important domain; availability of sufficient materials and information for students most needed improvement. Overall, faculty perceived the quality of the programme, faculty and resources as more positively than did the graduates and students.

Conclusion. This study provides useful policy guidance for nurse educators worldwide for improving doctoral programmes and faculty's role in educating students. Further study is recommended that examines contributing factors to quality doctoral education.

Keywords: Korea, policy, quality of nursing doctoral education, questionnaire survey

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(UK) and Australia (International Network of Doctoral Education in Nursing 2007).

To date, there is no published comprehensive evaluation of the quality of nursing doctoral education in Korea. This study aims to fill this gap and evaluate the quality of nursing doctoral education through a provider-focused questionnaire.

Introduction

Since the first doctoral programme in nursing was developed in the 1930s in the United States (US), there has been a remarkable increase in the number of nursing doctoral programmes in many countries [American Association of Colleges of Nursing (AACN) 2009]. This rapid increase without a concomitant increase in the number of qualified faculty members and research resources to support doctoral education has raised concerns about the quality of nursing doctoral education across the world (Anderson 2000, Berlin & Sechrist 2002). In the US, researchers (Minnick & Halstead 2002, Minnick *et al.* 2010) found many nursing programmes inconsistencies in the title and purposes of the degree, and lack of programme resources and capacity to provide education, mentorship and research experience to students to become competent researchers. Hence, the need was noted among nursing educators for appropriate standards to enhance the quality of nursing doctoral education (QNDE) (Anderson 2000, Kjellgren *et al.* 2005, Kim *et al.* 2006).

The AACN initiated work on developing indicators of quality in research-focused doctoral education in nursing in 1986 and revised these in 1993 and 1999 (AACN 2001). Pursuant to this, the International Network of Doctoral Education in Nursing (INDEN) Quality Standards and Criteria Indicators (QSCI) committee expanded this work and developed global standards and criteria for doctoral education in nursing (Kim *et al.* 2006). This research used a modified version of the QSCI document (QNDE questionnaire) for purposes specified below, and conducted a survey using e-mails in six countries. This article presents the findings from the study in Korea; reports on other countries will be published elsewhere. Given the global nature of the QNDE questionnaire, the findings of this study in Korea may apply to global nursing doctoral education.

The first nursing doctoral programme in Asia was introduced in Korea in 1978, and the number of programmes increased to 21 by 2006. Of 1058 graduates, 620 (58·6%) graduated from doctoral programmes between 2001 and 2006 (Korean Nurses Association 2007). Korea had the fourth highest number of nursing doctoral programmes of any country in the world, following the US, United Kingdom

Background

Several studies have evaluated the quality of nursing doctoral education. The Graduate Program Self-Assessment (GSPA) instruments developed by the Educational Testing Service (ETS) were used for the evaluation of nursing doctoral programmes (AACN 2001) and for non-traditional option nursing doctoral programmes (Sakalys *et al.* 1995) in the US. However, such general non-nursing-specific questionnaires are limited in reflecting the unique characteristics of a nursing programme.

Evaluation of the quality of nursing doctoral education involves multiple, complex factors. It requires a recognition and appreciation of the various organizational levels involved (e.g. nursing college/department, parent institution and government agencies), and individuals involved in the programmes (e.g. faculty, students) and an understanding of the interactions and interplay among these entities, all of which influence the quality of education. Hence, the perceptions and judgments of faculty, deans, students and graduates can help us come to an understanding of the quality of nursing doctoral education (Pelczar 1985). Consequently, the involvement of education providers (i.e. faculty and deans) and receivers (i.e. students and graduates) was used in previous studies in the US (Holzemer & Chambers 1986). Several significant predictors for the quality of a doctoral programme found by Holzemer (1982) included scholarship of the faculty, such as quality and quantity of publications, the amount of funding, faculty academic rank and participation in professional activities. Holzemer and Chambers (1986) also found perceived academic environments as significant predictors for nursing doctoral programme productivity in the US. In a recent study, the ratios of students to faculty, students to ever-funded faculty and students to currently funded faculty were identified as important variables in evaluating the quality of nursing doctoral programmes (Minnick *et al.* 2010).

Concerns about the quality of nursing doctoral education were also raised in Korea, which experienced a rapid increase in the number of nursing schools in recent years, including undergraduate and graduate programmes and students (Korean Research Institute for Nursing Policy 2006). Evaluations of nursing programmes were conducted by the Korean Council for University Education (KCUE) in 1990,

1997 and 2005 (KCUE 1990, 1997, 2005). However, they focused on only undergraduate programmes rather than graduate programmes and did not use any specific criteria for evaluating nursing doctoral programmes. In addition, the Korean Accreditation Board of Nursing (KABON) was established in 2003 to improve the status of advanced practice nurses (APNs) and lead nursing education (KABON 2003). However, accreditation criteria for nursing doctoral education were not developed, and the evaluation of nursing doctoral education could not be conducted by the KABON. Nursing graduate programmes in Korea still lack clear goals and corresponding curricula (Park *et al.* 2002). Furthermore, the standards and criteria for nursing doctoral programmes in Korea have not been established and not studied comprehensively and systematically.

As a first step to assessing the quality characteristics of nursing doctoral education in Korea, a qualitative study with a focus group approach was conducted (Kim *et al.* 2010). Those authors found differences in the perceptions of programme qualities between providers (i.e. faculty and dean) and receivers (i.e. students and graduates) and the organizational characteristics of nursing doctoral programmes (school ownership and location). In addition, the study showed the need for an appropriate tool for evaluating the quality of nursing doctoral education to suggest recommendations to educational policy makers.

The study

Aims

The goal of this study was to evaluate the QNDE in Korea. Specific aims were to: (1) examine the validity and reliability of the QNDE questionnaire for measuring and evaluating the QNDE; (2) identify contributing factors to the QNDE; and (3) identify domain(s) of doctoral education for improvement.

Design

A descriptive, cross-sectional design was used to evaluate the QNDE from the perspectives of deans, faculty, students and graduates.

Sample and setting

Fourteen of 21 nursing schools with nursing doctoral programmes were selected based on: year of accreditation of doctoral programme; types of school (public/national vs. private); and geographical location (capital city vs. non-

capital area). Public universities in this study were all national universities, which were designated by the Korean government. Individual participants/sample selection criteria were: deans and faculty (currently serving); graduates (graduated within 3 years); and students (completed at least three semesters). These criteria were designed to obtain responses from participants who studied long enough in the PhD programme (students) and recently enough (graduates) to articulate their evaluation.

Fourteen deans or department heads, 152 faculty, 280 graduates and 297 students met these selection criteria, and a total of 194 participants (26.1%) responded: 7 deans or department heads, 48 faculty, 52 graduates and 87 students.

Measures

Quality of nursing doctoral education questionnaire

The QNDE questionnaire was modified by Korean content experts to reflect the Korean situation. Per their recommendation, four of five domains recommended by INDEN (i.e. faculty, student, programmes, resources and evaluation) were selected for this study. The domain of 'student' was not included because the goal of this questionnaire was to examine the quality of nursing doctoral education focused on the provider side.

The QNDE questionnaire included three separate questionnaires, one each for dean, faculty, and for graduates and students. Items for the deans were different from those in the latter two groups, which had the same items. The quality of these four domains was evaluated by faculty, students and graduates. The 12-item questionnaire for deans included five items for consistency of purpose of doctoral education, four items for credits, one item for committees and two items for finance. Each item was rated on a 4-point scale (1 = strongly disagree to 4 = strongly agree).

The 36-item questionnaire for faculty and graduates/students consisted of four domains: the quality of programme/curriculum (17 items), faculty (12 items), resources (9 items) and evaluation (5 items). Each item was rated on a 4-point scale (1 = strongly disagree to 4 = strongly agree), and all scores were summed.

Validity and reliability of the QNDE questionnaire

As this was the first time that the QSCI document (Kim *et al.* 2006) was used as a QNDE questionnaire to evaluate the quality of nursing doctoral education, we needed to establish its validity and reliability. Psychometric tests such as Cronbach's alpha could not be used, because items in this questionnaire were formative constructs, and not reflective constructs. We therefore examined content validity and

construct reliability and validity of the QNDE questionnaire (Diamantopoulos & Winklhofer 2001). For content validity in this study, theoretical rationales and expert opinions of six Korean professors who had experience in Korean nursing doctoral education were gathered during the questionnaire refinement process (Rossiter 2002). After collecting data, construct reliability was established with the absence of multicollinearity using multiple linear regressions, with the summed scores of each domain as dependent variables (i.e. programme, faculty, and resources) and the quality indicators as independent variables (Diamantopoulos & Siguaw 2006). The domain of evaluation could not be analysed because of limited usable data. As a result of three multiple regression analyses, variance inflation factor (VIF) values ranged from 1·2 to 2·5 for programme, 1·53 to 3·96 for faculty and 1·42 to 1·88 for resource domain, showing that all formative domains did not have multicollinearity problems; hence, it statistically met the requirement of indicator reliability ($VIF < 10$) (Diamantopoulos & Siguaw 2006). Therefore, all three domains were considered to be appropriate measures of quality domains.

Formative construct validity was confirmed with all statistically significant indicator weights for the three domains. The indicator weights were estimated with partial least squares (PLS) path modelling for formative construct analysis (Chin 1998). External validity of the three domains was confirmed with the significant associations between the three domain scores and overall rate of quality score ($P < 0·01$) (Diamantopoulos & Winklhofer 2001). It must be noted that we could not employ conventional psychometric assessment procedures for reflective constructs to assess the validity of this survey questionnaire (Bollen 1984, MacKenzie *et al.* 2005, Petter *et al.* 2007).

The number of faculty and students in participating schools
To gain more insights about the profiles of doctoral programme faculty and students, the number of faculty and nursing students enrolled in each school offering doctoral education during the data collection period (2006) was also collected (KNA 2007).

Sociodemographical characteristics

Age, years in programme, region and type of school were included in the questionnaire survey.

Data collection

The data were collected through e-mail for 16 weeks from 16 October 2006 to 26 January 2007. First, the researcher explained the goal and method of research, and the ethical

protection for participants. After obtaining the consent of the dean, a list of e-mail addresses for prospective participants who met the inclusion criteria and an information letter was sent to the deans via e-mail with the questionnaire as an attachment. The content of the e-mail included information about the research goal and method, voluntary participation and confidentiality. A thank you and reminder e-mail was sent to all participants 2 weeks later, followed by reminder e-mails to those who did not complete questionnaires once a month during the data collection period to encourage their participation. Deans simply served as a conduit for disseminating the questionnaires and asked potential participants to consider participating in the study with no further elaboration. For the ethical consideration, this research was reviewed and approved by the Institutional Review Board of universities in the US and in Korea, where the researchers were employed.

Data analyses

STATA 10.0 (StataCorp., College Station, TX, USA) and WarpPLS 1.0 (ScriptWarp Systems, Laredo, TX, USA) were used to analyse the data. Descriptive statistics were used to describe the characteristics of the survey participants. One-way analysis of variance with Fisher's least significant differences (LSD) *post hoc* comparisons was used to assess the differences of perceived quality of nursing doctoral education among faculty, graduates and students. Correlation analyses were applied to explore associations among the three domains (i.e. programme, faculty and resources) and between associated factors. The correlation information was used for selection of a model and variables. Once the significant correlations among the three quality domains were confirmed, seemingly unrelated regressions (SURs) were applied for correlated dependent variables (Zellner 1962). Multiple regression analysis and PLS path modelling were used to examine the reliability and validity of the QNDE questionnaire. Importance-performance analysis (IPA) (Martilla & James 1977) with PLS path modelling was used to measure the significant domain and items in the quality of nursing doctoral education and to identify the strengths and weaknesses. This study adopted PLS path modelling to estimate importance coefficients of domain and items to identify areas for improvement.

Findings

Demographical characteristics

Of 14 nursing schools enrolled in this study, eight (one national/public and seven private schools) were in the capital

Table 1 General characteristics of faculty, graduates and students ($N = 187$).

| Characteristics | Group | | | Total |
|-------------------------------|----------------------|------------------------|-----------------------|--------------|
| | Faculty ($n = 48$) | Graduates ($n = 52$) | Students ($n = 87$) | |
| Age, Mean (sd) | 49.80 (8.22) | 39.81 (6.35) | 37.94 (6.73) | 41.42 (8.54) |
| Years of programme, Mean (sd) | 15.46 (6.61) | 17.51 (7.08) | 19.78 (7.14) | 18.04 (7.18) |
| Region, % | | | | |
| Capital city | 54.2 | 74.0 | 72.9 | 68.3 |
| Non-capital city | 45.8 | 26.0 | 27.1 | 31.7 |
| School type, % | | | | |
| Public/National | 35.4 | 47.1 | 56.3 | 48.4 |
| Private | 64.6 | 52.9 | 43.7 | 51.6 |

city, and six (five national/public and one private) were in non-capital areas. On average, the schools had 11.6 faculty members, 18.6 students in the PhD programme, 35.9 students in the master's programme and 262.6 in the baccalaureate programme.

Demographical characteristics of participants are presented in Table 1. Demographical characteristics of deans were excluded because of the small sample size. On average, faculty participants were 50 years old (range = 33–63); all were women; 70.8% were professors; and 20.8% were associate professors. The average age of the graduates was 40 years (range = 29–54); all were women, and a majority graduated from private schools (52.9%) and those located in the capital city (74%). The average age of students was 38 years (range = 28–54); 97.7% were women; and they were enrolled predominantly in public schools (56.3%) and those located in the capital city (72.9%).

Quality indicators in nursing doctoral programmes

Perceptions of providers and receivers of the quality of the three domains

Overall, faculty, graduates and students had slightly positive perceptions of the quality of the domains of programme (Mean = 2.91 of 4) and resources (Mean = 2.66 of 4) and moderately positive on the quality of faculty (Mean = 3.12 of 4). Faculty perceived the quality of the domains of programme ($F = 8.76$, $P < 0.001$), faculty ($F = 3.37$, $P = 0.037$) and resources ($F = 8.72$, $P < 0.001$) more positively than did the graduates and students (Table 2).

Table 2 Perceptions of the quality of programme, faculty and resources.

| Domain | Total | Faculty | Graduate | Student | Range | F | P |
|-----------|-------|---------|----------|---------|-------|------|--------|
| Programme | 2.91 | 3.14 | 2.79 | 2.85 | 1–4 | 8.76 | <0.001 |
| Faculty | 3.12 | 3.24 | 2.98 | 3.15 | 1–4 | 3.37 | 0.037 |
| Resources | 2.66 | 2.91 | 2.60 | 2.56 | 1–4 | 8.72 | <0.001 |

Correlations among the three domains

The three domains of quality of nursing doctoral education (i.e., programme, faculty and resource) were highly correlated ($0.524 \leq r_i \leq 0.642$, $i = 1, 2, 3$, $P < 0.001$). As major indicators of school characteristics, the total number of faculty ($n = 162$), doctoral students ($n = 260$) and non-doctoral students ($n = 4178$) in each site were included in the analysis of nursing doctoral education quality. Pearson's correlation was calculated among the number of faculty and doctoral and non-doctoral students, to understand the role of the number of nursing faculty in explaining the quality of nursing doctoral education. The correlation between the total number of faculty and of doctoral students was not significant ($r = 0.228$, $P = 0.434$), whereas the correlation between the total number of faculty and number of non-doctoral students was significant ($r = 0.743$, $P = 0.002$).

Multivariate simultaneous regression analyses

The multivariate SUR was employed due to highly correlated dependent variables. According to the estimated results of SUR presented in Table 3, all three equations were statistically significant (programme: $R^2 = 0.158$; faculty: $R^2 = 0.111$; resource: $R^2 = 0.182$).

Faculty showed higher scores for programme ($P < 0.01$) and resource ($P < 0.05$) domains than did student and graduate groups, and age was not a significant factor. The location of school (capital vs. non-capital area) was not a significant factor for quality of nursing doctoral education. Private schools showed statistically higher quality for all three domains (i.e. faculty, programme and resources) than public schools ($P < 0.05$). The ratio of doctoral students to non-doctoral students was significant in explaining the quality of programme, faculty and resource domains ($P < 0.05$). The number of faculty was not significant for quality of all three domains. Therefore, the number of faculty was not included in the model.

Table 3 Multivariate seemingly unrelated regression model results of nursing doctoral education.

| Variable | Programme B (SE) | Faculty B (SE) | Resource B (SE) |
|--------------------------------------|------------------|-----------------|-----------------|
| Individual level | | | |
| Faculty group | 0.316 (0.089)** | 0.166 (0.103) | 0.242 (0.095)* |
| Age | 0.004 (0.004) | 0.006 (0.005) | 0.013 (0.005) |
| School level | | | |
| Non-capital area | -0.026 (0.092) | -0.024 (0.107) | -0.147 (0.098) |
| Private university | 0.255 (0.086)** | 0.256 (0.099)** | 0.239 (0.092)* |
| Doctoral student/total student ratio | 5.789 (1.85)** | 7.482 (2.151)** | 4.869 (1.985)* |
| Number of faculty | -0.009 (0.01) | -0.011 (0.011) | -0.016 (0.010) |
| Constant | 2.1268 (0.266)** | 2.343 (0.31)** | 1.862 (0.286)** |
| Error correlation, <i>r</i> value | | | |
| Programme | 1 | | |
| Faculty | 0.60 | 0.1 | |
| Resource | 0.531 | 0.476 | 1 |
| Overall correlation test | | | |
| Model fit | | | |
| <i>R</i> ² | 0.158 | 0.111 | 0.182 |
| χ^2 value | 33.61** | 22.24** | 39.81** |

P* value < 0.05; *P* value < 0.01.

The Breusch-Pagan test showed statistically significant error correlations among the three domains ($\chi^2 = 154.015$, $P < 0.0001$). The correlation coefficients ($0.47 \leq r \leq 0.60$) were almost the same as the raw correlation coefficients among the three domains.

Combined tests of each factor in explaining the three programme quality scores were performed to better understand the estimated results in three system equations of programme, faculty and resources. Combined tests of region (capital city vs. non-capital area) in explaining the three domains showed no statistical significance [$\chi^2 (3,172) = 2.69$, $P = 0.443$]. School type (private vs. public) [$\chi^2 (3,172) = 10.82$, $P = 0.013$] and ratio of doctoral students to non-doctoral students [$\chi^2 (3,172) = 14.04$, $P = 0.003$] were both significantly associated with the quality of the three domains. The number of nursing faculty was not significantly associated with the quality of the three domains [$\chi^2 (3,172) = 2.45$, $P = 0.484$].

Importance-performance analysis

According to the PLS analysis of perceived quality of nursing doctoral education, the standard path coefficient of the programme domain ($\beta = 0.295$, $t = 3.36$) was larger than that of resource ($\beta = 0.261$, $t = 3.08$) and faculty ($\beta = 0.209$, $t = 2.50$). This indicates that the programme domain is the most important among the three domains in terms of its impact on the overall perceived quality. Therefore, the IPA was calculated for the programme domain items to identify which showed the strengths and weaknesses of the programme domain. Mean performance and importance were used to divide the 17 items into four areas (Martilla & James

1977). Figure 1 illustrates the four areas showing relationships between importance and performance. The 'A: Concentrate Here' area is the most important for strategic planning to improve overall quality of doctoral education among four areas. A group of Q2, Q10, Q11, Q14, Q15 and Q16 were classified as 'Concentrate Here'. Q2 was 'Your institution values, supports, and provides rewards to students for their research and scholarly activities'. Q10 was 'Types of courses include dissertation research seminar and interdisciplinary courses in addition to seminar'. Q11 was 'The environment is supportive of students' learning'. Q14 was 'There are administration systems in place to ensure that faculty carry out regular and appropriate supervision of the students' progress'. Q15 was 'Sufficient materials and information are available for students (e.g., financial support, scholarships, grants, and resources'. Q16 was 'Sufficient information about your career are available'. Q15 was the lowest performance item, but was high in importance, indicating that it is a priority for being improved, whereas Q2 and Q11 items were identified as higher in importance, but also higher in performance than Q15. Both Q15 and Q16 are associated with information availability that can be easily implementable.

Discussion

In this study, we evaluated the quality of nursing doctoral education using the QNDE questionnaire. Quality was evaluated in four domains (programme, faculty, resources and evaluation) by faculty, students and graduates, although too few responses were received for analysis of the evaluation

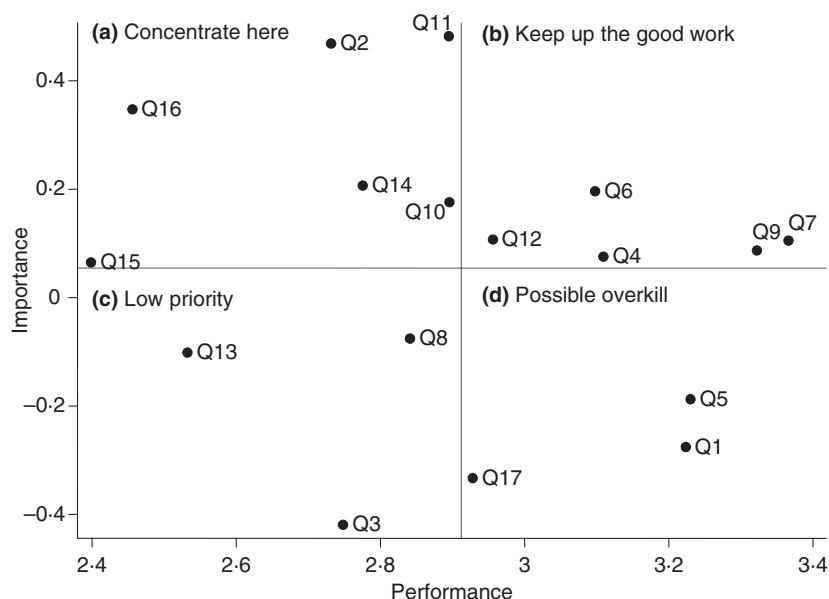


Figure 1 Four areas showing relationships between importance and performance.

domain. The QNDE questionnaire was found to have content and construct validity and reliability.

This study identified important factors that were significantly associated with the quality of nursing doctoral education in Korea. In terms of the school type, schools in private universities showed higher perceived quality in all three domains than those in public/national universities. It is noteworthy to point out that the significance of university characteristics to which the nursing schools belonged explained the quality levels of nursing doctoral education. This finding expands the scope of the previous studies that mainly focused on the factors in the nursing education (Holzemer 1982, Minnick *et al.* 2010). It suggests that academic environmental factors surrounding the nursing doctoral education should be an additional domain to examine programmes' quality.

The location of a nursing school (capital vs. non-capital area) was not significant after controlling for three school characteristics (school type, ratio of the number of doctoral students to non-doctoral students and number of faculty), even though it was identified as a potential indicator in a previous focus group study (Kim *et al.* 2010). However, further research is necessary to explain the difference in perceived quality of nursing doctoral education between private and public schools.

The number of nursing faculty was not significantly associated with the quality of any of the three domains. This was a surprise finding, as the number of nursing faculty generally is considered a major indicator for the quality of nursing education. Our finding suggests that the number of nursing faculty cannot be used as an indicator of nursing

doctoral programme quality; this might be addressed if nursing faculty can be assigned only for the doctoral programme or at least partially divided, so that some are doctoral-specific. The significant association of the ratio of doctoral students to non-doctoral students with the quality of nursing doctoral programme supports this observation. This is further supported by weak and insignificant association after controlling for the number of non-doctoral students. In other words, the total number of nursing faculty did not relate to the quality of doctoral education, and our findings indicate that this may be due to faculty members teaching both undergraduate and graduate students, whereas doctoral students constituted a minor portion of all students. The number of faculty is determined by the equation ($\text{sum of undergraduates}/20 + [1.5 \times \text{the sum of graduate students}]/20$) based on the Rule of Establishment and Operation of National University ordered by the Ministry of Education, Science, and Technology in Korea (Ministry of Education, Science, and Technology 2009). Research-focused nursing doctoral programmes in the US have a mean faculty-to-doctoral-student ratio of 1:2.1 (Minnick *et al.* 2010), but such a ratio cannot be said to exist for nursing doctoral programmes in Korea. Perhaps, not clearly distinguishing whether faculty taught exclusively doctoral students may be the reason for not finding a significant association of the number of nursing faculty to the quality of doctoral education. This is further supported by the finding that the relative ratio of nursing doctoral students to non-doctoral students consistently proved significant in explaining all three quality domains of nursing education. The higher this ratio, the higher nursing doctoral education quality was perceived by

What is already known about this topic

- There are concerns about the quality of nursing doctoral education because of the rapid increase in the number of nursing doctoral programmes worldwide.
- Domains of nursing doctoral education are known.
- The quality of nursing doctoral education in Korea has not been comprehensively and systematically evaluated according to these domains.

What this paper adds

- This is the first comprehensive evaluation of the quality of nursing doctoral education in Korea: the quality was assessed in four domains (faculty, programme, resources and evaluation) by faculty, students and graduates, although too few responses were received for analysis of the evaluation domain.
- Faculty perceived the quality of programme, faculty and resources more positively than did the graduates and students.
- Participants reported that the overall perceived quality of private universities was significantly higher than that of public/national universities. A higher ratio of doctoral students to non-doctoral students was significantly associated with higher quality of nursing doctoral education. The programme domain was the most important area that needed improvement.

Implications for practice and/or policy

- In explaining the perceived quality of nursing doctoral education, the significance of school type (private vs. public/national) and the ratio of nursing doctoral students to non-doctoral students suggest the need for a policy that delineates the faculty role in educating doctoral students.
- Further research on characteristics of private universities that were associated with higher perceived quality than public/national universities should guide specific policy decisions on dimensions for quality nursing doctoral education.
- The programme domain needs priority attention for improvement, particularly in relation to sufficient materials and information for students.

faculty, students and graduates. The significance of residual correlations among the three quality domains after controlling for potential associated factors clearly indicated the close

correlations of these three domains. In other words, any change in one domain might affect the other two.

Hence, more detailed information is needed about how the faculty activities, or resources are divided between doctoral and non-doctoral programmes to accurately assess the needed faculty and resources for quality nursing doctoral education. Findings of this study suggest that the proportion of nursing doctoral students to non-doctoral nursing students could be used as a proxy indicator to characterize the quality of nursing doctoral education. The findings of this study suggest a need for a policy that delineates the teaching load of faculty specifically for doctoral education.

The findings from the importance-performance analysis suggest that more attention needs to be paid to the programme domain of doctoral education. The importance of Q15 in the programme domain speaks to the need for sufficient materials and information, such as financial support, scholarships, grants and resources, for quality nursing doctoral education.

Limitations

Even though we asked all schools ($n = 21$) that offer doctoral programmes in Korea to participate, our purposive selection criteria allowed only 14 schools to be included. This small number of nursing schools did not allow full exploration of the quality of nursing doctoral education. Lack of objective information about the programmes and resources was another limitation. Objective data are needed about each programme (such as types of courses offered by each school and required versus elective courses) and resources (such as equipment and library services) to evaluate the quality of nursing doctoral education at the school level and to compare the perceptions of faculty, graduates and students about the programme and resources. The exclusion of the evaluation domain in analysis because of limited usable data was another limitation. Further study is needed to monitor participants' responses and identify reasons for not answering questions of the evaluation domain. A small sample size was another limitation of this study to assess reliability and validity of a formative measure using PLS. As the required minimal sample size is at least ten times the number of items (Gefen *et al.* 2000), the ideal sample size for 38 items would be at least 380, and if we had included the evaluation domain, it would be 440.

Conclusion and policy suggestions

Findings of this study provide useful guidance for nurse educators for improving the QNDE in Korea and worldwide.

Further study is necessary to examine factors that contribute to better quality of education in universities in Korea and worldwide. For producing ‘well-prepared’ doctorates in a situation where there is a rapid increase of nursing doctoral programmes worldwide, it is necessary to secure a sufficient number of ‘well-prepared’ faculty. A clear understanding of the salient characteristics of the universities, especially about the faculty in doctoral education, could help establish a policy for improving the QNDE worldwide. More clearly stated policy to secure the number of faculty in educating doctoral students is needed for improvement of the QNDE worldwide, as it would make faculty more accountable to the quality dimension of doctoral education.

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Conflict of interest

No conflict of interest has been declared by the authors.

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Author contributions

MJK, HL, YHA, EK, SNY and KJL were responsible for the study conception and design, and performed the data collection. CGP, MK and KJL performed the data analysis. MJK, CGP and MK were responsible for the drafting of the manuscript. MJK, CGP, MK, HL, YHA, Sny, EK and KJL made critical revisions to the paper for important intellectual content. CGP and MK provided statistical expertise. MJK and EK obtained funding. MJK, MK, HL, EK and KJL provided administrative, technical or material support. MJK supervised the study.

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