The educational preparation of nurses in a developing economy and patient mortality

Abstract

Background: Most studies have reported that higher levels (baccalaureate degree) of educational attainment by nurses is associated with lower levels of patient mortality. Researchers working in developed economies (e.g. North America and Europe) have almost exclusively conducted these studies. The value of baccalaureate nurse education has not been tested in countries with a developing economy.

Method: A retrospective observational study conducted in seven hospitals. The primary outcome was all-cause patient mortality. We extracted data on nurses and patients from two different administrative sources and linked them using the staff identification number that exists in both systems. We used bivariate logistic regression models to test the association between mortality and the educational attainment of the admitting nurse (responsible for assessment and care planning).

Results: Data were extracted for 11,918 patients and 7,415 nurses over the first six months of 2015. The majority of nurses were educated in South Asia and just over half were educated to at least bachelor degree level. After adjusting for confounding and clustering, nurse education was not found to be associated with mortality (OR=1·34, 95% confidence interval=·569, 3·156), nurse' nationality and staffing ratios were found to be significantly associated to patient mortality

Implications for nursing and health policy: Our observations suggest that in a developing economy the educational preparation of nurses is not associated with a reduction in patient mortality. Findings should be interpreted with considerable caution but do challenge widely held assumptions about the value of baccalaureate prepared nurses. Further research focused on nursing education in developing economies is required to inform health policy and planning.

Keywords: nurse, education, RN4Cast, observational, mortality, Qatar, developing economy

Introduction

The education of nurses is central to ensuring that health care is provided in a safe and effective manner and that the best possible outcomes are achieved for patients. The Institute of Medicine ("The Future of Nursing," n.d.) suggest that nurses should achieve higher levels of education through an improved education system that promotes seamless academic progression. The report authors recommend setting a goal of increasing the percentage of nurses who hold a bachelor degree to 80% of the American workforce by 2020. It is argued that patients that are cared for by more highly educated nurses will have better clinical outcomes because their thinking is more critical and their practice is more autonomous and evidence based (Yakusheva et al., 2014).

Background

We conducted a review of the literature on the association between educational attainment of nurses and clinical outcomes for patients. We identified 19 observational studies (Aiken et al., 2014, 2011, 2003, Blegen et al., 2001, 2001; Dilles et al., 2010; Estabrooks et al., 2005; Kelly et al., 2014; Kutney-Lee et al., 2013; Kutney-Lee and Aiken, 2008; Lucero et al., 2010; Ma et al., 2015; McHugh et al., 2013; Sales et al., 2008; Sasichay-Akkadechanunt et al., 2003; Sermeus et al., 2011; Van den Heede et al., 2009; Yakusheva et al., 2014). Most report a positive association (15/19). Half (10/19) focused exclusively on outcomes in surgical patients.

We assessed the methodological quality of these studies using a standardized risk of bias measure (Carlson and Morrison, 2009) for observational research. The majority of studies had a relatively low risk of bias. Potential sources of bias related to the use of self-report questionnaires to determine the educational preparation of nurses and a failure to link of nurses included in studies with actual patients they cared for. We also noted that a number of investigators failed to adequately account for the effects of clustering in their analysis (Dilts et al., 1995).

The fieldwork for most studies was conducted in North America and Europe (developed economies, ("IMF World Economic Outlook (WEO), April 2015: Uneven Growth: Short- and Long-Term Factors," n.d.)) with modern health care systems where nurses – arguably – practice with a high degree of autonomy and independence. In the developing economies of Asia, the Middle East and Eastern Europe, there is considerable variability in models of educational

preparation of nurses. There are also marked disparities in the professional standing and autonomy of nursing in the countries where these nurses practice. We argue that research establishing the value of higher levels of nurse education cannot simply be generalized from developed to developing economies. As far as we can determine there have only been two studies that have examined the effect of nurse education on patient outcomes in a developing economy (Gkantaras et al., 2016; Sasichay-Akkadechanunt et al., 2003). Consequently, there is a need to further test the association between nurse education and patient outcomes in these countries. These observations will help inform health policy and strategic planning at both a hospital and country level.

Objective

The objective of this study was to test the association between the educational preparation of the admitting nurse (responsible for initial patient assessment and care planning) and patient mortality in the health system of a developing economy (Qatar).

Methods

Study Design

We carried out a retrospective observational study using data extracted from routine administrative sources. We were able to link patients and nurses records using the nurses' unique staff identification number. This approach confers an important advantage over previously used methodologies in that we are directly linking patients with the nurse who was responsible for assessing and planning their care. We extracted the data for the first six months (January through June) of 2015. Nurse data were extracted at the same time but from a separate database. To this data set, we added – as potential confounders – hospital level nurse satisfaction data and staffing ratios.

We have adhered to STROBE (Strengthening the Reporting of Observational studies in Epidemiology, von Elm et al., 2007) reporting guidelines when drafting this manuscript.

Setting

The data were extracted from the medical records of patients admitted to seven public hospitals in the state of Qatar (3 general and 4 specialist hospitals with a mix of medical, obstetric, oncology, paediatric and surgical wards). We did not include mental health services because of the unique nature of this group of patients. Qatar is a sovereign country located in Western Asia, on the north-eastern coast of the Arabian Peninsula. It has a population of just over 2·7 million people, the vast majority of which are migrant workers involved in construction and the oil and gas industry (Worldometers 2017). The state operates a public system that provides around 95% of the countries healthcare needs. The vast majority of the 8,695 nurses working in the health system are qualified (i.e. there are almost no nursing assistants or aids) and staff turnover is less than half of a per cent per year. Around 1% of the nursing workforce are 'Qatari nationals', the vast majority of the nursing workforce are migrants.

Participants

All admitted patients and the nurses responsible for their admission and subsequent care planning. The conceptual result of the linkage of the two populations is shown as a Venn diagram in figure one while the process of extraction, cleansing and linking the two individual datasets is shown in figure two. The final dataset is composed by 12.830 medical records of 11.918 distinct patients and 7.415 nurses. Some nurse were responsible for the admission of more than one patients and some patients have been admitted more than once. Readmission records of patients admitted with the same DRG over a period of 40 days have been excluded.

Patients

We included all male and female patients admitted to participating hospitals. We excluded patients admitted through the emergency department because of the risk of mortality without having received any nursing care. We have also excluded patient records with missing data.

Nurses

All female and male nurses working on participating inpatient wards who had admitted at least one included patient. Nurses with no recorded educational qualification were excluded.

Variables

Primary outcome (dependent variable)

The primary outcome was all-cause patient mortality at discharge.

Exposure (education of the admitting nurse)

Data about the educational preparation of nurses were extracted from administrative sources. Nurses were initially coded into four groups (licensed, diploma, bachelor or post-graduate degree) based on their highest recorded academic qualification. When nurses are employed, their qualifications go through a rigorous check called credentialing. This process includes contacting the institution that awarded qualifications to check authenticity. We believe this process – that does not rely on the self-report methods used in previous research – gives our measure of educational attainment a high degree of validity.

All registered nurses – as part of their scope of practice – working in the health system were responsible for and expected to admit patients and plan their subsequent care. Although more than one nurse provides patient care during an admission, the admitting nurse is responsible for planning the patient care that will subsequently be delivered by the ward nurses. We argue that the effects of higher educational attainment (critical thinking, evidence-based care) would be expressed during the admission and care planning process.

Data Sources

Patients

We extracted the following additional patient information from the electronic patient records: age (on admission to hospital), gender, length of stay (days). Patients' acuity was scored on a zero to three scale, a higher score indicating the patient's condition was judged more serious (i.e. life threatening).

Nurses

Other variables extracted from the nurses' database were gender, age (in years), country of origin, and the hospital and ward where they usually worked.

Contextual information

The vast majority of the included nurses had also completed the NDNQI (The National Database of Nursing Quality Indicators) satisfaction survey that is a widely used measure of nurse satisfaction (Taunton et al., 2004). The measure contains 32 items covering five main areas: workload, remuneration, autonomy and decision-making, interaction with colleagues, management and administration and professional development. The satisfaction figure we attached to each nurse is the aggregate result computed for each hospital, as the NDNQI results are anonymous. We have also calculated the staffing ratios for each hospital and for each day of the study by dividing the patients treated each day by the number of nurses with an active clinical role on that day and in that facility. This is a standard way of calculating staffing ratios (Kutney-Lee and Aiken, 2008).

Study size

For this study we estimated that with a 95% confidence interval (CI), power of 80%, a ratio of exposed (nurses with a degree) to unexposed (nurses without a degree) of approximately one and an OR of 1·34 we anticipated that a sample size of 6,796 patients would be required.

Data coding and checking

It was necessary to recode some of the original data to enable meaningful analysis. Nurses' educational attainment was coded into two (1. licensed/diploma and 2. bachelor/postgraduate degree) from our initial four groups. The nationality of nurses was divided into five groups: MENA (Middle East and North Africa), Africa (Sub Saharan), East and South East Asia (China, Japan, Mongolia, North Korea, South Korea, Taiwan, Indonesia, Malaysia, Singapore, Philippines, East Timor, Brunei, Christmas Island, Cambodia, Laos, Myanmar (Burma), Thailand and Vietnam), South Asia (India, Pakistan, Bangladesh, Nepal, Bhutan, Sri Lanka) and Western countries (Europe, North America and Australia), based on their geographical coherence and the maturity of their health systems. The same coding was used for patients' nationality. Acuity was recoded into a categorical variable (≤1=low, ≥2=high) for the purposes of our analysis because we expected there would be few patients with the highest rating of two or three.

Ethical considerations

All members of staff working in the national health system of Qatar are identified by a unique corporation number that enabled us to link nurse and patient data. The identification numbers of the patients and nurses were encrypted to avoid any exposure of sensitive data. The date of birth of both patients and nurses was substituted with their age in years, for similar reasons. The study was reviewed by the Medical Research Centre at Hamad Medical Corporation and approved as a quality improvement project (reference number 16107/16).

Statistical Analysis

Descriptive statistics were used to describe patient and nurse demographic, educational and clinical characteristics. Bivariate and multivariate logistic regressions were used to assess the association between the dependent variable (mortality at discharge) and nurse education level after adjusting for confounding. To adjust for the possible correlations between patients cared for by the same nurse, the standard errors of the logistic regression were adjusted for such possible clustering. All analyses were done using STATA version 12 (College Station, Texas, United States of America). A p-value of <·05 was considered significant.

Results

Patients

Over the six-month study period, there were 14,974 admissions to the participating hospitals, of which 946 records were incomplete or inaccurate (e.g. records with negative length of stay). Additionally there were 1,198 Emergency Department records that were discarded. A total of 12,830 (409 surgical, 4,206 elective, 7,168 obstetric and 1,047 oncology) records met the inclusion criteria and were included in the study. This is clearly depicted on Figure2.

Demographic and clinical characteristics

Most of the patients were females in their mid-thirties. The majority were from the MENA region (table one).

Nurses

We identified 7,415 nurses linked with at least one included patient.

Demographic and educational characteristics

Table two shows the demographic characteristics of participating nurses. The majority were female, from South Asia, in their late 30s. Just over half were educated to at least baccalaureate level.

The majority of nurses in the participating wards completed the NDNQI survey that was administered in January 2015. Responses suggest that nurses were generally satisfied, particularly in the areas of task allocation, interaction, autonomy and professional development.

Outcome data

Outcome data are summarised in table one. There were a total of 359 (3·01%) deaths over the six-month study period. Approximately three quarters of those who died had an acuity-rating indicative of them being more severely ill. Patients on average spent three days in hospital. The mean staffing ratio was just over seven patients per nurse.

Main results (table three)

The odds of mortality increased with increasing acuity and duration of stay in hospital. There was also a significant association between nurse' nationality, and staffing ratios and patient mortality. Adjusting only for clustering, the education of the admitting nurse was significantly associated with mortality, (OR=2·658, 95% CI=1·531, 4·615, p=·001). Adjusting for clustering and for nurse and patient age, gender and nationality; patient acuity and length of stay; and nurse satisfaction and staffing ratios, we found no significant association between nurse's education and patient mortality (OR=1·34, 95% CI=·569, 3·156, p=·501).Only when examining the relationship between the nurse education and mortality independently of the rest variables and after adjusting for clustering, we observe significant association, (OR=2·658, 95% CI=1·531, 4·615, p=·001).

Discussion

The primary aim of this study was to test the association between the level of educational attainment of the admitting nurse and patient mortality. In our adjusted model, we found no significant association Our observation is not consistent with much of the published research from the USA and Europe that clearly shows a relationship between the level of nurses educational

attainment and patient mortality (Estabrooks et al., 2005; Kelly et al., 2014). Few studies have tested this association in a developing economy. Authors of a previous study conducted in Thailand also did not show an association between education and mortality (Sasichay-Akkadechanunt et al., 2003). One possible conclusion from our study is that the education of nurses in developing economies is not an important factor in determining patient mortality. An additional reason for that might be the fact the nurses come from a very diverse education background and hence not all of the bachelors are directly comparable. In addition to that, the complementary results of the unadjusted model indicate that nurse' nationality and staffing ratios were found to be significantly associated to patient mortality.

However, there are a number of alternative explanations that require consideration.

A task focused model of care delivery

The model of nursing care delivery in Qatar is generally task focused (tasks often being prescribed by medical colleagues). This may mean that the value of higher levels of education are curtailed by the system within which the nurses find themselves working.

Baccalaureate prepared nurses look after sicker patients

We might expect nurses with higher levels of educational attainment to focus their efforts on patients with more complex care needs who ultimately might represent a greater mortality risk. We extracted patients' acuity as a potential confounder and adjusted for this in our analysis. It is possible, however, that this is a relatively poor measure of patients care needs.

Misplaced focus on the admitting nurse

The focus of this study was on the patients' admitting nurse who provides only a modest proportion of the bedside care patients receive. Whilst we argue that linking nurses with patients they cared for is an intuitive methodological advantage over previous approaches, we acknowledge this as a limitation of our study.

The effect of migration status

The vast majority of nurses in this study were educated in India and the Philippines and moved to Qatar to work. Often nurses are working overseas to support (extended) families at home. At one

level, our observations might reflect differences in the educational systems in different parts of the world. However, it is conceivable that nurses working as 'guests' in a country with a rather dubious human rights record may have found it difficult – or deliberately chose not to – challenging the way in which nursing care was delivered on the ward (Avenue et al., 2017).

The limitations of the study

This was a comparative modest study in terms of sample size, just over 10.000 patients, mainly due to the relatively small population of the country. We did observe though an increase in the odds of mortality in patients who were linked to an admitting nurse who was not a graduate. On the other hand, and in order to generalise and compare the findings, the study needs to be replicated on larger populations.

Methodological issues

In this study, we linked patients with the nurse who planned their care in a methodologically novel way. The linkage of the two datasets was performed in a deterministic and unambiguous manner that contrasts with previous studies (Adams et al., 1997; Ford et al., 2006) Our analysis also takes into account clustering; this is an important methodological issue that some similar authors have not adequately addressed (Dilles et al., 2010; Estabrooks et al., 2005).

Previous studies have relied on surveys of nurses to determine their levels of educational preparation. Response rates of a half to two-thirds of nurses have been defended by authors as being good in health services research (Aiken et al., 2014). Whilst this may be true, there remains a distinct possibility of measurement error. In this study, we measured the education of nurses using a methodology that is almost certainly much more precise.

Implications for nursing and health policy

This is a comparatively modest study conducted in a developing economy. Health systems in developed and developing economies are different in a number of important way that include the status and autonomy of nurses working in the health system. In our view it is not appropriate to generalise observations from one (developed) to the other (developing). Our study challenges convention that the level of educational attainment of nurses is associated with better patient

outcomes (in this case mortality). We are, however, extremely cautious about our findings. There seems to us to be a need to examine in a larger – perhaps multi country – study the association between nurse education and outcomes for patients in developing economies. These observations are important to inform local and national nursing workforce planning.

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Table 1 Patient demographic and clinical characteristics

	Total sample (n = 11 918) n (%)	Dead (n = 359) n (%)	Not dead (n = 11 559) n (%)
Age (mean, SD.)	36.2 (16.1)	27.2 (17.5)	36.5 (16.0)
Female	9263 (77.7%)	281 (78.3%)	8982 (77.7%)
Nationality			
Africa	720 (6.0%)	19 (5.3%)	701 (6.1%)
MENA	7412 (63.0%)	232 (64.6%)	7280 (63.0%)
East Asia	554 (4.6%)	19 (5.3%)	535 (10.7%)
South Asia	2819 (23.7%)	80 (22.3%)	2739 (23.7%)
West	310 (2.6%)	9 (2.5%)	301 (2.6%)
Unknown	3 (0.0%)	0 (0.0%)	3 (0.0%)
Diagnosis priority			
0 (low)	10 973 (92.1%)	90 (25.1%)	10 883 (94.2%)
≥1 (high)	945 (7.9%)	269 (74.9%)	676 (5.8%)
Length of stay (days) (mean, SD)	3.40 (9.5)	4.28 (3.2)	2.2 (3.3)

MENA, Middle East and North Africa.

Table 2 Nurses demographic and educational characteristics

Demographic and education characteristic	Whole sample n = 7415	Baccalaureate or higher n = 4075 (55%)	Licence/diploma n = 3340 (45%)
Age (mean, SD)	37.5 (8.1)	36.61, 9.13	38.52, 7.38
Females (n, %)	7038 (94.9%)	3698, 48.65%	3430, 46.25%
Nationality group			
MENA (n, %)	1286 (17.3%)	648, 8.74%	638, 8.6%
South Asia (n, %)	4252 (57.3%)	2199, 29.65%	2053, 27.68%
Africa (n, %)	162 (2.2%)	76, 1.02%	86, 1.16%
East Asia (n, %)	1690 (22.8%)	863, 11.63%	827, 11.15%
West (n, %)	25 (0.3%)	15,2%	10, 1.3%
Satisfaction (mean, SD)	3.99 (0.22)	-	-
Workload	4.16 (.58)	-	-
Remuneration	2.95 (.78)	-	-
Autonomy and decision-making	3.15 (.65)	-	-
Interaction with nursing colleagues	4.5 (.45)	-	-
Management and administration	3.96 (.76)	-	-
Professional development	3.6 (.55)	-	-
Staffing ratio (mean, SD)	7.27 (1.48)	-	-
Number of bachelor nurses (n, %)	2485(33.5%)	-	-

MENA, Middle East and North Africa.

Table 3 Multiple logistic regression results

Variable	OR (95% CI)	P-value
Education		
Licence	1	
Diploma	2.09 (0.86, 5.04)	0.103
Bachelor/MS	1.34 (0.57, 3.22)	0.489
Acuity		
1	1	
2	28.9 (17.9, 46.7)	0.001*
Patient age (in years)	0.99 (0.96, 1.01)	0.291
Patient gender		
Male	1	
Female	0.90 (0.54, 1.50)	0.693
Length of stay (days)	1.15 (1.13, 1.18)	<0.001*
Nurse age (in years)	1.01 (0.97, 1.06)	0.532
Nurse gender		
Male	1	
Female	0.58 (0.30, 1.13)	0.109
Nurse nationality		
Africa	1	
East Asia	0.70 (0.18, 2.73)	0.610
MENA	0.76 (0.20, 2.89)	0.692
South Asia	0.66 (0.18, 2.42)	0.531
EU/US	0.10 (0.02, 0.70)	0.020*
Staffing	1.93 (1.72, 2.16)	<0.001*
Satisfaction	2.04 (0.63, 6.53)	0.232

MENA, Middle East and North Africa.
*Significant at the 5% level.