ABSTRACT

Aim: To test the effect on patient mortality of implementing a Nursing Systems Framework across a national health system.

Background: There have been five previous observational studies that have tested the effect of a Nursing Systems Framework on clinical outcomes for patients. Implementation of a Nursing Systems Framework in the health system of a developing country has not been evaluated.

Design: Quasi-experimental (before and after) study

Method: A nursing systems framework consisting of six themes: i. Professionalisation; ii. Education; iii. Structure; iv. Quality of nursing care; v. An academic health system; vi. Communication (Professional), was implemented across the national health system of Qatar in March 2015. Routine administrative data were extracted (March 2014 - February 2016) for elective admissions. Our primary and secondary outcomes were, respectively, all cause mortality at discharge and readmission to hospital (within 28 days of discharge). We split the data into two time periods; before (March 2014 - February 2015) and after (March 2015 - February 2016) the implementation of the nursing systems framework. Multivariable regression modelling was used to examine the effect of the framework on patient mortality, after adjusting for key confounding variables (patient age, episode acuity, intensive care admission, and length of stay).

Findings: Data were extracted for 318,548 patients (year 1=130,829; year 2=187,725). After adjusting for confounding there was a significant association between the implementation of the nursing systems framework, mortality and readmission.

Conclusion and implications for nursing policy and practice: Our observations suggest that the implementation of a nursing systems framework may be important in improving outcomes for patients in emerging health systems.

Keywords: Observational, Mortality, Nurse, Qatar, Magnet, Governance, Framework

Introduction

Authors have reported that the quality of nursing care provided has a direct impact on patient outcomes (Estabrooks et al 2005, McHugh et al 2013, Kelly et al 2014). A high performing nursing service and good nursing governance requires a series of elements or components that include: education, a highly skilled workforce, a practice evidence base and an effective leadership infra-structure (Gkantaras et al 2016, Aiken et al 2008a). These elements combine to form a Nursing Systems Framework (NSF) that is intended to support nurses in providing high quality care for their patients. There is comparatively little evidence that a NSF can positively impact on patient outcomes. Much of the research to date comes from America and has focused on evaluating the American Nurses Credentialing Center (ANCC) Magnet Recognition Program® (MRP®); arguably the pre-eminent framework for organising nursing care globally. The ANCC lists five key characteristics of a Magnet® facility: transformational leadership, structural empowerment, exemplary professional practice, new knowledge, innovations and improvements, and empirical outcomes (ANCC, 2014, page 5). To date there are over 440 Magnet® recognised hospitals in America (ANCC, 2016), representing about 8% of registered facilities nationally (AHA, 2016). Outside of the USA only a handful of hospitals have achieved Magnet® accreditation. In part, this may be explained by the lengthy and complex transition for hospitals to achieve this goal, as well as different policy and strategic approaches for addressing system wide change in dissimilar health economies. There is a need for NSFs to support the development of nursing, particularly in countries with developing health systems, where Magnet® may be considered a distant (often unaffordable) aspiration or is not fully aligned with local or national conditions.

Background

We conducted a review of the literature to identify studies that have evaluated the impact of the introduction of a NSF. Authors have described the process of implementing Magnet® (Aiken et al 2008a, Kuhar et al 2004, Mondino 2005), and the impact on workplace empowerment (Laschinger et al 2003, Luzinski 2012), the effect on recruitment and retention (Upenieks 2003, Taylor 2004) and the effect on the quality of the nursing environment (Bolton 2003, Choi and Boyle 2013). We were particularly interested in studies that have tested the effect of Magnet® designation on clinical outcomes (mortality and readmission) for patients. This is examined in five studies (Aiken et al 1994; Aiken et al 1999; Evans et al 2014; Lake et al 2012; McHugh et al 2013a;). Two studies compared surgical patients' outcomes in Magnet® and non-Magnet® hospitals (Aiken et al 1994; McHugh et al 2013a), three focused on specific patient populations: AIDs, trauma patients and low weight babies (Aiken et al 1999; Evans et al 2014; Lake et al 2012). McHugh et al (2013a) reported 30-day in-patient mortality for 641,187 (109,090 Magnet, 532,097 non-Magnet) surgical patients aged 21-85 years of age. The observed odds of death are reduced by 14% (OR=.86) in patients treated in Magnet® hospitals.

Readmission is a potentially important outcome in this type of research, partly for obvious economic reasons but also as an outcome that matters to patients; readmission to hospital is disruptive, unpleasant and anxiety provoking. As far as we can determine, readmission rates have only been evaluated in one Magnet study (Aiken et al 1999), although McHugh (2013b) combined three elements of a nursing framework (environment, education and nursing numbers) and reported a positive effect on readmission.

We also identified a number of studies that have examined particular elements of a NSF. For example, there are a number of studies that show staffing levels (Aiken et al 2002, Aiken et al 2008b, Estabrook et al 2005, Hickey et al 2010, Needleman et al 2002,), levels of educational attainment (Aiken et al 2014, Blegen et al 2013, Estabrook et al 2005, Gkantaras et al 2016) and nursing environment (Kazanjian et al 2005), can affect patient mortality. The MRP® does not consistently articulate targets for its empirical outcomes component, but instead allows hospitals to choose benchmark cohorts for several sources of evidence, as well as to establish targets for several other sources of evidence (ANCC, 2014). The MRP® requires hospitals to evidence reform of the nursing environment, as a whole.

We developed a NSF based on consultation with experienced clinical and academic nurse leaders, utilising the best available evidence (particularly research around Magnet® hospitals) and drawing on key characteristics of high reliability organisations e.g. resilience, making use of expertise, a focus on failure (Sutcliffe, Paine & Pronovost, 2016). Comprising 34 discrete elements, the NSF was organised under six themes: 1. Professionalization; 2. Education; 3. Structure; 4. Quality of nursing care; 5. An academic health system; 6. Communication (professional). The overarching aim of our NSF was to support the development of nursing in a maturing health system, to ensure the provision of high quality care and to enhance outcomes for patients.

The study

Aims

The primary and secondary study objectives were to, respectively, determine the effect of a NSF on all cause patient mortality and readmission (within 28 days).

Design

A quasi-experimental (before and after) study. De-identified patient records were extracted (March 2014 – February 2016) from administrative sources of the eight general and specialized public hospitals in the national health system (NHS) of Qatar. Hospitals included in the study had a total of 2,078 beds and admitted a total of 318,548 patients, over the two-year study period. Hamad Medical Corporation Institutional Review Board (IRB) reviewed the study (reference number 16121).

Setting

Around 2.4 million people live in the state of Qatar, most (approximately 88%) are expatriate workers, who are young or working age adults; around three quarters are male (Supreme Council of Health [SCH] 2014). The study was undertaken across a secondary and tertiary NHS, focused around eight hospitals, five of which are in the capital city, Doha. Joint Commission International (JCI) accredits the health system. The service employed a total of 7,683 nurses in 2014 which increased to 8,231 in 2015. In 2016, 70% were educated to at least a baccalaureate level. Most nurses (93%) undertook their pre-qualifying education outside of the country. Around 1%

(approximately 105) of the nurses working in the health system are Qatari nationals. The vast majority of the workforce is from South East Asia (predominately India and the Philippines). Staff turnover rates for nurses are low at less that half a percent per annum.

Participants

We included all patients, admitted to any ward (e.g. oncology, cardiovascular, medical, paediatric, surgical) in one of the eight participating hospitals, for at least one 24-hour period, from the 1st March 2014 through 29th February 2016 (the second full year of the strategy and a year after the implementation of all of the elements). We excluded accident and emergency admissions because of the higher risk of mortality associated with this patient population.

Data collection

We (IG, second author) extracted data on the following (independent variables): age, diagnosis (ICD-10 codes), diagnosis priority (recorded on a scale from 1 (illnesses that were not serious or life threatening) – 5 (critically ill) as a measure of patients' acuity determined at the point of admission by the treating physician, admission to intensive care whilst inpatient, and readmission (defined as admission for the same diagnostic reason within a period of 28 days after their discharge, excluding patients receiving haemodialysis and chemotherapy as these were planned readmissions). The dependent variable in this study was mortality defined as death prior to discharge.

Exposure: Nursing System Framework

The NSF was implemented in March 2015 and consisted of thirty-four interventions organised around six themes (figure 1): i. Professionalization (nursing career framework, scope of practice, code of conduct); ii. Education (focus on recruiting baccalaureate prepared nurses, access to bachelor of nursing (BSN) transition program, masters education to develop clinical nurse specialists, increasing availability of ANCC® approved continuing professional development); iii. Structure (governance structures, staffing ratios, patient care hours) iv. Quality of nursing care (development of nursing dashboard containing: key nursing indicators, pressure ulcers, falls, nurse satisfaction), v. Part of an academic health system (nurse led research, journal clubs) vi. Professional communication (monthly newsletter, nursing website, feedback sessions with frontline staff).

Data analysis

We followed standard data cleaning procedures (Benchimol et al. 2015, p. 13). Incomplete or inaccurate patient records were excluded. It was assumed that there were no systematic reasons for records being incomplete.

Sample size

We estimated that with an alpha of .05, 80% power and a ratio of exposed to unexposed of approximately 1 and an estimated odds ratio of .781, a sample size of 12, 130 would be required for this study (http://www.openepi.com/SampleSize/SSCohort.htm (accessed: 29 February 2015).

Statistical methods

We used multivariable logistic regression to test the effect of the NSF on patient mortality and readmissions. We adjusted for potential confounders that have been used in previous studies. We also sought to develop two trend analysis models, using polynomial regressions, to obtain the optimum trend line that describes the cause of mortality and number of readmissions, over the study period.

All analyses were completed using SPSS (V21). We considered a p-value of ≤.05 to be significant.

Findings

We extracted 319,411 patient admission records over the two-year study period. Of these 857 had incomplete information and were excluded from the data set. This gave us a final dataset of 318,554 patients.

Descriptive data (table 1)

On average, patients were in their late twenties, had a diagnosis priority score of 1.8 and were inpatients for around three days. Over the course of the study there were

1,125 (0.35%) patient deaths, 3,367 (1.06%) intensive care admissions and 16,171 (5.08%) readmissions.

Main results (table 2)

In both the adjusted and unadjusted models we observed a decrease in the number and proportion of patients who died and in the proportion of patients readmitted, over the study period; there was an increase in the number of patient deaths and readmissions over the course of the first year that then declined in the second year.

Table two shows unadjusted and adjusted logistic regression models. As might be expected, diagnosis priority, intensive care unit (ICU) admission and patient age, were all significantly and negatively associated with patient mortality. Patient age and the length of stay were associated with readmissions. A significant association between the implementation of the NSF and mortality and readmissions was observed.

Discussion

Key results

The primary aim of this study was to examine the effect of implementing a NSF on patient mortality. After controlling for the age of the patient, their diagnosis priority, length of stay (LoS), and ICU admission, we observed a 22% reduction in the odds of death, which compares favourably with previous research (Aiken et al 1994, 1999; Lake et al 2012; McHugh et al 2013; Evans et al 2014). For example, McHugh et al.

(2013) using a similar methodology reported a 14% reduction in the odds of death following the implementation of the MRP®. As far as we are aware, this is the first study that has reported on the effect of implementing a NSF in a developing healthcare system. Our observation suggests the adoption and implementation of a comprehensive NSF may be important in providing the appropriate architecture for nursing and the delivery of nursing care.

The NSF tested in this study was a collection of thirty-four individual elements (see figure 1) which we clustered into six themes. Elements were derived from the literature, or from expert opinion. We are unclear how much each element contributed to the association that we observed.

We worked hard to consult with junior nurses. The Chief Nurse (AMC), for example, routinely held open feedback/discussion meetings with clinical staff. However, on reflection we were slow in engaging more junior clinical nurses fully in the process. One of our key mechanisms for involving front line nurses was through the introduction of shared governance; implementation of this approach was not unproblematic. Shared governance emerged from countries with a tradition of partnership working, equity and accountability in the health care environment. In a developing country, with an immature health system, nurses would attend shared governance meetings and be comparatively passive rather than active participants in the process.

There was resistance from some clinical nurses, in particular, to the introduction of the career framework. Concern was focused on how the system might impact on individual career progression. For example, some nurses felt that it was unfair that they were not able to apply for more senior posts without having completed a masters degree, particularly when educational opportunities are limited in country and access restricted due to eligibility requirements for support for non national staff . Our aim in implementing the career framework was to ensure that the rules were clear and that there was an open and transparent process for career progression for nurses, working across the health system. Ultimately, our aim was to ensure that the right nurses were in the right post, if they demonstrated the knowledge, experience and confidence required, to provide safe and effective patient care.

Working within an academic health system was important in promoting evidence based nursing practice. For example, clinical nurses highlighted, through the shared governance model, that there was inconsistent practice across the organisation in how pain was assessed in unconscious patients. Colleagues in the evidence collaborative undertook a rapid appraisal of the available evidence (systematic reviews and primary evidence) so to assist in supporting clinical practice. The review authors recommended that the Critical-care Pain Observation Tool (CPOT) was a measure that was valid and could easily be implemented into practice. The shared governance model was then utilized as the mechanism for ensuring implementation across the health system, as a standard of care, reflected in policy, the electronic health record and related education.

As we have reported previously (Gkantaras et al 2016), turnover rates among junior nursing staff in Qatar tends to be exceptionally low. Among the senior team involved in implementing the NSF, turnover rates were an important risk to successful implementation and maintenance of change. We would reflect that when there is new leadership it is tempting, even inevitable, that a change to the architecture of the NSF would occur. And indeed this is what we have observed (for example gradual breakdown of the career framework particularly the essential requirements on job descriptions which are seen as dissonant to competing national agendas). In our view, maturing health systems require stable leadership to ensure the nursing service follows an incremental improvement pathway.

Limitations

Previous authors have reported that their evaluations provide compelling evidence of the impact of a specific NSF (MRP®) (e.g. McHugh et al 2013a, Aiken et al 1994). None of the previous studies were randomised and this is an important limitation. There is the possibility that an unknown confounder could explain part, or all of the associations that we observed. As in previous studies, we adjusted, in our model, for a number of obvious confounders that might have affected the number of deaths or readmissions.

The study was undertaken across a NHS and our sample size is comparable with similar studies. The quality of the data was good, with few patient records discarded due to being incomplete or inaccurate, minimising the potential for bias. There is no other obvious source of bias, e.g. performance or selection bias, as all data were collected independently and extracted retrospectively.

During year 1 (before) the corporate nursing team were engaged in developing the elements of the NSF with a view to 'launching' in March 2015. It is important to acknowledge the process of developing the NSF necessarily involved consultation, discussions, and planning with nursing colleagues throughout the health system. It is possible that awareness that significant change was being planned may have affected (contaminated) nursing practice. However, we have no evidence that this was the case.

The NSF was not uniformly implemented across the health system. Some facilities (hospitals) were early adopters of elements of the NSF, for example activelyencouraging diploma educated RNs to apply for the locally delivered BSN transition program. Other hospitals were slower or resistant to change; this was not unexpected. It is also important to note that all parts of the NSF were not implemented at the same time; elements were introduced as part of a rolling change program. Elements that were implemented first included: the career framework, recruitment of graduate nurses, access to diploma to BSN program, scopes of practice. Journal clubs and the evidence collaborative were implemented later in the process.

Several existing papers discuss the effect of nurse education and staffing on patient mortality (Aiken et al 2008b; Aiken et al 2014; Estabrook et al 2005; Gkantaras et al

2016; McHugh 2013b). Over the course of this study there was an increase (53%-70%) in the proportion of baccalaureate nurses working in the health system, as well as an increasing number of nurses. In a separate study, we have examined the effect of the educational preparation of nurses on mortality and observed a modest but significant association (Gkantaras et al 2016). It is possible, but probably unlikely, that the improvements in patient outcomes, that we observed, can be entirely explained by changes in the educational preparation of participating nurses. However, given the strength of evidence about the impact of nurse education it is perhaps self-evident that the increase in the proportion of baccalaureate prepared nurses played an important contributory role.

It is important to be aware and transparent that this study is a discreet part of a program of research that has the overarching aim of enhancing the quality and effectiveness of nursing care in the maturing health system of a developing country. Other projects focus on the educational background of nurses, staffing ratios, and patient care hours.

Implications for Nursing and Health Policy

The most important observation from this study is the possible effect of the introduction of a NSF on patient outcomes, in a developing health system. This study highlights the important components that should be considered when creating a NSF that is intentionally designed to provide the architecture to enable nurses to provide high quality care for their patients. Our observations suggest that policy makers in mature and developing healthcare systems should recognize that, if nurses are to function at their most optimum, they need to be enabled by a robust infrastructure that allows them to maximize their contribution in the delivery of healthcare. Then, and only then, will they be able to provide high quality; evidence based compassionate care, on par with world-class health care systems.

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