



Associations between nurse education and experience and the risk of mortality and adverse events in acute care hospitals: A systematic review of observational studies



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ABSTRACT

Objectives: To provide knowledge from the summarization of the evidence on the: a) associations between nurse education and experience and the occurrence of mortality and adverse events in acute care hospitals, and; b) benefits to patients and organizations of the recent Institute of Medicine's recommendation that 80% of registered nurses should be educated at the baccalaureate degree by 2020.

Data sources: A systematic search of English and French literature was conducted in six electronic databases: 1) Medline, 2) PubMed, 3) CINAHL, 4) Scopus, 5) Campbell, and 6) Cochrane databases. Additional studies were identified by searching bibliographies, prior reviews, and by contacting authors.

Review method: Studies were included if they: a) were published between January 1996 and August 2017; b) were based on a quantitative research design; c) examined the associations between registered nurse education or experience and at least one independently measured adverse event, and; d) were conducted in an adult acute care setting. Data were independently extracted, analysed, and synthesized by two authors and discrepancies were resolved by consensus. The methodological heterogeneity of the reviewed studies precluded the use of meta-analysis techniques. However, the methodological quality of each study was assessed using the STROBE criteria.

Findings: Among 2109 retrieved articles, 27 studies (24 cross-sectional and three longitudinal studies) met our inclusion criteria. These studies examined 18 distinct adverse events, with mortality and failure to rescue being the most frequently investigated events. Overall, higher levels of education were associated with lower risks of failure to rescue and mortality in 75% and 61.1% of the reviewed studies pertaining to these adverse events, respectively. Nurse education was inconsistently related to the occurrence of the other events, which were the focus of only a small number of studies. Only one study examined the 80% threshold proposed by the Institute of Medicine and found evidence that it is associated with lower odds of hospital readmission and shorter lengths of stay, but unrelated to mortality. Nurse experience was inconsistently related to adverse event occurrence.

Conclusion: While evidence suggests that higher nurse education is associated with lower risks of mortality and failure to rescue, longitudinal studies are needed to better ascertain these associations and determine the specific thresholds that minimize risks. Further studies are needed to better document the association of nurse education and experience with other nursing-sensitive adverse events, as well as the benefits to patients and organizations of the Institute of Medicine's recommendation.

What is already known about the topic?

- Prior studies have provided ecological evidence that better nurse staffing (e.g., low nurse-to-patient ratios, higher nursing hours per patient per day, richer RN skill mixes) and supportive work

environments are associated with lower risks of mortality and adverse events in acute care hospitals;

- There is mounting evidence that the characteristics of registered nurses, namely higher levels of education and more experience, are also associated with lower risks of mortality and adverse events, but

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existing evidence remains scattered;

- In 2011, the Institute of Medicine recommended that by 2020, 80% of registered nurses should be educated at the baccalaureate degree level or higher, but the potential benefits to patients and organizations of such thresholds are not well documented.

What this paper adds

- Higher levels of RN education were associated with lower risks of failure to rescue and mortality in 75% and 61.1% of the reviewed studies pertaining to these adverse events, respectively;
- Few studies have examined the associations between RN education and the risk of other nursing-sensitive adverse events, such as falls, medication errors, or nosocomial infections, and the results of existing studies are inconsistent.
- RN experience appears unrelated to mortality and adverse event occurrence.
- There is emerging evidence that the 80% BSN threshold proposed by the Institute of Medicine is associated with shorter hospital stays and reduced risk of hospital readmissions.

1. Introduction

The association between nurse staffing levels and the occurrence of mortality and adverse events (AEs) in acute care hospitals has been studied extensively over the past decades (Bae and Fabry, 2014; Brennan et al., 2013; McGahan et al., 2012; Shekelle, 2013; Stalpers et al., 2015). As a group, these studies have provided ecological evidence that hospitals with better nurse staffing (e.g., high nurse-to-patients ratios, more nursing hours per patient per day) and higher proportions of registered nurses (RNs) on the nursing staff have lower rates of mortality and AEs. Moreover, these studies have highlighted the fact that hospitals having supportive work environments – which are characterized by strong nurse leadership, collegial relationships between RNs and physicians, nurse participation in hospital affairs, a solid nursing foundation for high quality patient care, and adequate resources to support nursing care (Lake, 2002, 2007) – also report lower mortality and AE rates (Stalpers et al., 2015).

To explain these associations, it has been proposed that nurse staffing and work environment characteristics have the potential to enhance or weaken nurse surveillance, a primary and vital function of RNs (Kutney-Lee et al., 2009). Nurse surveillance refers to the ongoing process through which RNs monitor patient data for emerging signs of complications and problems in care, and subsequently implement interventions to prevent or minimize AEs (Cho et al., 2015; Friese et al., 2008; Kutney-Lee et al., 2009). Adequate nurse staffing is assumed to influence the effectiveness of nurse surveillance by allowing RNs to spend more time with patients, whereas supportive work environments increase the timeliness of interventions by providing RNs with greater decision-making authority and flexibility once a potential or acute AE has been detected (Cho et al., 2015; Friese et al., 2008). Other characteristics of RNs are also hypothesized to influence the effectiveness of nurse surveillance. For instance, a higher proportion of RNs in the hospital with baccalaureate degrees is assumed to be key to efficient AE detection and prevention by providing RNs with more knowledge, better and more efficient communication skills, and patient surveillance ability (Blegen, 2006; Kutney-Lee et al., 2009; Liao et al., 2016). Similarly, greater experience is contended to provide RNs with exposure to different patient conditions and clinical scenarios that contribute to the development of knowledge, technical skills, and critical thinking, which are also assumed to influence the effectiveness of nurse surveillance (Covell, 2008; Kutney-Lee et al., 2009; Stalpers et al., 2015). Of note, while numerous studies have established that better nurse staffing and more supportive work environments are related to lower rates of mortality and AEs, comparatively less attention has been given to the potential benefits associated with a more highly educated and

experienced RN workforce (Kendall-Gallagher et al., 2011; Kutney-Lee et al., 2009).

Research interest in these latter associations has shown a marked increase in recent years since the release of the Institute of Medicine (IOM) report recommending that the proportion of RNs with a baccalaureate degree should increase to 80% by 2020 (Institute of Medicine, 2011). Although the release of this report was followed by a campaign to implement its recommendations, and while chief nursing officers and nursing managers have repeatedly stated their preference for hiring more RNs with a baccalaureate degree (Blegen et al., 2013; Goode et al., 2001; Weinberg et al., 2011), international figures indicate that the IOM's recommendation is still far from being fully implemented. Indeed, between 55 and 65% of RNs in the U.S. currently hold a baccalaureate degree or higher (National Council of State Boards of Nursing, 2017; U.S. Department of Health and Human Services, 2013), and similar figures have recently been observed in 12 European countries where, on average, 54% of RNs were educated at the baccalaureate level (Aiken et al., 2013). According to many experts, barriers to increasing the overall education levels for RNs from current international figures to the IOM's recommendation include the weakness of the evidence supporting the benefits to patient care of nurses with higher education (Blegen et al., 2013). We aim to contribute to this field by systematically reviewing existing evidence on the association between RN education and experience and the occurrence of mortality and AEs in acute care hospitals. In addition, we also intend to synthesize the literature examining the potential benefits to patients and organizations of the IOM's recommendation.

2. Objectives

The objectives of this systematic review of the literature are to summarize existing evidence on the: 1) associations between RN education and experience and the occurrence of mortality and AEs in acute care hospitals, 2) benefits to patients and organizations of the IOM's recommendation. A third objective of this review is to identify implications for research, policy and, practice.

3. Methods

3.1. Design

A systematic review of the literature following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines was conducted (Liberati et al., 2009; Moher et al., 2009). Meta-analytic techniques were not attempted given the methodological heterogeneity of the reviewed studies (see Results for further details).

3.2. Search strategy and inclusion criteria

Two nurse researchers (LAA, CMR) independently searched six electronic databases to identify studies examining the association between RN education or experience and the occurrence of mortality or AEs: 1) Medline, 2) CINAHL, 3) PubMed, 4) Scopus, 5) Campbell and, 6) Cochrane Library. The initial search of the literature was performed between January 2017 and March 2017, and was last updated on August 30, 2017. Our search strategy proceeded in three successive steps.

First, we performed several queries of the selected electronic databases by combining three independent groups of keywords (Table 1): 1) *Independent variable keywords*, 2) *Dependent variable keywords*, which included all nursing-sensitive outcomes endorsed by the Nursing Quality Forum (National Quality Forum, 2004), as well as keywords referring to other AEs frequently investigated by nurse researchers (e.g., 30-day mortality), and 3) *Setting keywords*. Each independent variable keyword was combined with each dependent variable keyword, while restricting the search by setting keywords. Themes and MeSh were

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