Northumbria Research Link

Do nurse-staffing levels affect patient mortality in acute secondary care?

ABSTRACT

This systematic literature review explores and considers whether registered nurse staffing levels affect patient mortality in acute secondary care settings. A discussion makes particular reference to the philosophical foundations of contrasting research approaches used within the literature. At the time of writing, the author was a modern matron for surgery, managing the ear, nose and throat; head and neck; airway; and reconstructive plastic surgery services in a large acute teaching hospital in central London. Effective management and leadership of acute clinical areas requires appropriate nurse:patient ratios. In practice settings, patient to staff ratios are based on care being provided by highly skilled and competent nurses providing best quality, evidence-based practice.

Key words: Nurse: patient ratios ■ Safe staffing ■ Patient safety ■ Surgery ■ Mortality ■ Burnout

Despite ongoing recruitment and advertising, nurse shortages in London continue (Royal College of Nursing (RCN), 2015). RCN London produced a safe staffing report in 2015, which suggested there are more than 10 000 nursing posts to fill in the capital, giving a vacancy rate of around 17%. This has risen from 14% in 2012 and 11% in 2011. Some London trusts have nurse shortages of up to 30% (RCN, 2015). Pay freezes imposed by the government have had a direct impact on nurse recruitment in London, as nurses cannot afford to live and work in the capital (RCN, 2016). The RCN (2015) notes that nurse pay has been approximately 10% below inflation since 2010.

The RCN (2016) has warned that London's health recruitment crisis could get worse, with thousands of nurses working in London potentially affected by changes to immigration rules after Britain leaves the EU (known as Brexit). Nurses from every part of Europe now work in London, with Spain (1486), Portugal (1060) and Ireland (2411) being the most common nations of origin. It is well recognised that European staff are an essential part of the nursing workforce in every part of London, with 2133 working in west London, 2620 working in south London and 3126 working in north and east London. With many London trusts struggling to recruit at home after a long pay freeze in the NHS, the RCN estimates that recruitment from the EU is now at its highest level for 20 years (RCN, 2016). With this in mind, it would be short-sighted to neglect the fact that the NHS is countrywide, and so the picture will be similar throughout the UK.

In addition, increasing pressures from the government—such as 18-week referral targets, which increase theatre lists, improved diagnostics requiring earlier surgical interventions and

peripheral demands, such as Brexit developments—are creating real concerns, while patients must continue to be cared for.

A consequence of these concerns is that capacity for emergency ward admissions is minimal. Temporary interventions, such as opening escalation wards in winter or during increased activity, now require nurses to be reshuffled to provide cover for these areas, with unfilled shifts covered by agency nurses. The question this raises is: 'What impact does the shortage of nurses have on the mortality of patients in secondary care?'

There are many discussions to be had and multiple perspectives on this topic to be considered, potentially leading to a large debate. This report will explore the links between nurse staffing and patient mortality, and examine any themes found in the literature.

Background

Inappropriate staffing levels and unfavourable patient outcomes are major concerns for health-care organisations in England (RCN, 2013; 2015; 2016). Alarms over care quality and adverse patient outcomes were raised by the publication of failings at Mid Staffordshire Foundation NHS Trust, reported by Robert Francis QC, known as the Francis Report (Healthcare Commission, 2009; Francis, 2013). Consequently, the National Quality Board, sponsored by chief nursing officer (CNO) for England Jane Cummings, issued guidance to support providers and commissioners to make the right decisions about nursing, midwifery and care staffing capacity and capability in the publication *How to Ensure the Right People, with the Right Skills, are in the Right Place at the Right Time* (NHS England, 2013).

In England, there is a drive to consider implementing minimum nurse:patient ratios in hospitals. Cummings believes that, by establishing a minimum nurse:patient ratio, the government will be 'missing the point' of what is required to 'fix' the NHS. It is believed that 'the right staff, with the right skills, in the right place at the right time' will change patient outcomes for the better (NHS England, 2014). There are currently 329 000 nurses working in the UK (National Audit Office (NAO), 2016). Of those joining in 2014, 13 400 (4.2%) were newly qualified, 7200 (2.3%) were recruited from outside the NHS, 5800 (1.8%) were recruited from overseas, 800 (0.3%) were in return-to-practice schemes and 4600 (1.5%) were temporary. Of those leaving the NHS in the same year, 7500 (2.4%) retired and 17 800 (5.7%) left before reaching retirement age (NAO, 2016).

Only two states—Victoria in Australia and California in the US—have implemented minimum staffing ratios. Victoria was the first to implement fixed nurse:patient ratios, and California the second (Unison, 2014). In California, National Nurses United uses a model that sets mandatory nurse staffing levels, which depend on the type of environment and patient acuity. For example, in medical and surgical wards, the minimum nurse:patient ratio is one nurse to four patients (1:4); however, if patients or ward areas have acute needs, there may be one-to-one (1:1) or one-to-two (1:2) ratios.

In summary, there is a conflict between the opinion of the CNO for England and the standardisation of minimum staff ratios in California and Victoria in how to move forward with best practice and provide high-quality patient care.

The fundamental interest of this article, however, is to seek evidence that indicates what effects, if any, staffing levels have on patient mortality, and why. Themes identified during the background literature review will be examined in the discussion section.

It imperative that readers understand the significance of the nurse role. The connection between nurses and the health and wellbeing of patients is complex, and recent failures to invest in the nursing workforce are now being recognised as having a profound impact on the care patients receive and, even more disturbingly, having a negative impact on patient survival (Australian Nursing and Midwifery Federation, 2009; McHugh et al, 2016). The study by McHugh et al (2016) examined patient survival rates after cardiac arrest in the context of the work environment and nurse:patient ratios. They found that each additional patient per nurse on a medical-surgical unit was associated with 5% lower odds of survival and 16% lower odds of survival for patients in hospitals with poor work environments; both findings were statistically significant. The conclusion of this study is that better hospital work environments and adequate hospital nurse staffing levels are important strategies in improving patient survival rates.

NHS hospitals are using 'harm-free care' reports, which audit staff vacancies and turnover, and benchmark these against pressure ulcer incidence, failure to rescue and slips, trips and falls; these factors are linked to mortality rates. As the most prevalent health professional group, nurses offer a great deal of advanced knowledge and specialise in many areas of practice. Nurses are at the frontline and forefront of health-care delivery and have the capacity to save lives, prevent complications, avert suffering, encourage health and, inevitably, save money (Shuldham et al, 2009).

The majority of the literature on the links between nurse staffing and patient outcomes originates from the US. While there have been some contradictory findings, research has generally shown a direct relationship between nurse levels and patient outcomes for specific nurse-sensitive indicators, with having fewer patients per nurse associated with better outcomes (Shuldham et al, 2009). In the UK, both the RCN and Unison recognise the NHS needs to have appropriate staffing levels to improve patient safety and have published reports such as *Safe Staffing Levels: a National Imperative* (RCN, 2013) and *Running on Empty: NHS Staff Stretched to the Limit* (Unison, 2014).

Methodology

It is suggested that research is a systematic enquiry that adopts methodical approaches to answer questions or explain problems, and concludes with developing, expanding and refining knowledge (Polit et al, 2001). Different research methods can be applied (Cronin et al, 2008). The quantitative approach is most closely associated with positivism, and qualitative with constructivist enquiry, although positivists sometimes undertake qualitative studies, and constructivists sometimes collect quantitative information (Polit et al, 2001).

Unlike established or narrative reviews, systematic reviews use a rigorous, structured approach to reviewing literature (Aveyard, 2010). Systematic reviews are applied to answer well-focused questions about clinical practice (Polit et al, 2001). Traditional reviews attempt to summarise the results of a number of studies; conversely, systematic reviews use explicit, rigorous criteria to identify and critically evaluate and synthesise all available literature on a particular topic (Cronin et al, 2008).

It is important to recognise the difference between systematic review and a meta-analysis. The Cochrane Collaboration (Higgins and Green, 2011) suggests that a systematic review is a formal, systematic and structured approach to review all the relevant literature on a topic. Meta-analysis is a statistical method used to combine the numerical results from such studies, if this is possible. Often studies produce results that are too different to combine using statistical techniques. Systematic reviews often include a meta-analysis, but not always. It is usually good to carry out a meta-analysis, if the data from the studies that you have systematically reviewed allows this. Hoffman et al (2013) suggest that most experts recognise that the higher up the hierarchy the study design is positioned, the more rigorous the methodology and hence the more likely it is that the study design has minimised the effect of bias on the results. In most evidence hierarchies, current, well-designed systematic reviews and meta-analyses are at the top of the pyramid, and expert opinion and anecdotal experience are at the bottom. Davidson and IIes (2013) advised that well-done systematic reviews, with or without an included meta-analysis, are generally considered to provide the best evidence for all question types; this is because they are based on the findings of multiple studies that have been identified in comprehensive, systematic literature searches. However, the position of systematic reviews at the top of the evidence hierarchy is not an absolute.

Before starting a literature search, it was essential that researchers understand the hierarchy of evidence so they can provide an appropriate report (Haynes, 2006) (*Figure 1*).

Blaikie (2007) believed that deciding upon the 'research question' is the most critical and perhaps the most difficult part of the research design. However, Bettany-Saltikov (2012) recognises that the review question is a commonly neglected aspect of the design and conduct of research. The formulation of the research question is crucial because the review question

underpins all aspects of the review methodology. In consideration of these factors, the PICO (population, intervention, comparison and outcome) tool was used (*Box 1*). This assisted in the formation of the research question, supporting the creation of the search strategy (*Box 2*). This process has resulted in an evidence-based approach to literature searching in bibliographic databases (Aveyard, 2010).

A literature review was conducted with the aim of reviewing critical points of current knowledge, including substantive findings, as well as theoretical and methodological contributions (Aveyard, 2010). Databases were searched for published and unpublished studies. Limits were applied to the search to maintain consistency and rigidity within the results. Inclusion and exclusion criteria are shown in *Table 1* and search terms in *Table 2.*

For the initial stages of the review, books were selected from the Royal College of Nursing and the university library to provide background knowledge and increase understanding of the subject area. The next stage was an exploration via Google Scholar (www.googlescholar.com) to gain wider knowledge regarding staffing levels and patient outcomes in the NHS. This search resulted in >15 000 papers. PubMed was then searched, which gave 36 results, none of which were full text, only abstracts. However, this did lead to other potential primary research articles. The Cochrane Collaboration was then searched to access a variety of systematic reviews on the effects of healthcare, resulting in 16 articles. Medline was then selected, as it offers access to medical, social care and nursing literature (Aveyard, 2010), resulting in 22 articles. To obtain evidence that would be transferable and applicable to a UK population, the British Nursing Index was also selected (Lanoe, 2002), resulting in 13 articles. The Cumulative Index to Nursing and Allied Health Literature (CINAHL), one of the most comprehensive resources for nursing and allied health literature, resulted in 13 articles. Ovid was also

searched, and two articles were found. Ovid serves as a major resource in providing information for clinicians, and it allows access to a great number of databases, including Medline and the Cochrane Library (Guyatt et al, 2008). Finally, EBSCOhost was used at the university library, and 14 articles were found.

All searches were conducted between May and June 2014, and searches were saved to provide evidence of a systematic approach, and captured in a table. As the initial search was relatively broad, limits on the search criteria were applied to obtain results that were relevant to the research topic through the development of inclusion-exclusion criteria (*Table 1*) (Polit et al, 2001), which helped to further refine the search area.

After multiple searches, the methodological process was complete as data saturation was accomplished. Boolean logic 'AND', and 'OR' were applied in the search (Galvin and Galvin, 2017). After the evidence had been considered, critical appraisal and analysis were applied to the chosen articles to ascertain the rigour, reliability and validity of the research. The final five articles chosen were saved as pdf files. During the critical appraisal process, the articles were critiqued. Key words (including synonyms) that were identified in the critiqued articles are tabulated below (*Table 2*).

Articles Gathered:

Cochrane Library search (*n*=16)

BNI search (*n*=13)

CINAHL search (*n*=13)

EBSCO (*n*=14)

OVID (*n*=2)

Articles excluded: duplicates or not in English (*n*=44)

PubMed abstracts (*n*=36)

Abstracts excluded for being review articles, not primary research or irrelevant (*n*=36)

Articles selected for full text and citation review (*n*=15)

Articles excluded for irrelevance (*n*=11)

Articles included in literature review (*n*=5)

The Population Intervention, Comparison and outcome (PICO) approach taken when forming the review question
Population
Adult patients in acute hospitals

Intervention

Staffing levels

Comparison

Not applicable

Outcome

Mortality

Box 2. Review question

Do staffing levels have an impact on patient

mortality in acute hospital settings?

Table 1. Inclusion and exclusion criteria

Inclusion	Exclusion
Author aged 18+ years	Author aged below 18 years
Written in English language	Published before 1994
Published from 1994 to present date	Primary care or community setting
Peer-reviewed articles in academic journals	
Global	

> Intervention-based
>
> studies
>
> Secondary care and
>
> hospital settings

Findings and discussion
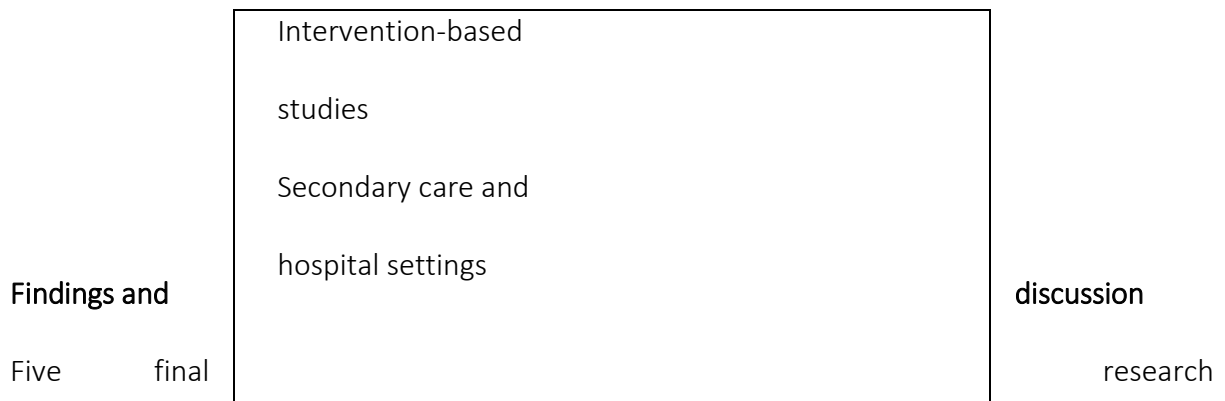
Five final research articles were chosen (*Table 3*).

Although key research studies may be described in some detail, it is not necessary to provide full details of all the research for every reference, especially when there are word constraints (Aveyard, 2010). Studies with comparable findings should be summarised together in a discussion section of a research report (Polit et al, 2001). Ary et al (2014: 104) stated that a research hypothesis cannot be proved or disproved, only supported or non-supported. Even if it cannot be supported, a hypothesis may still serve a useful purpose because it can lead the researcher to revaluate rationale and procedures and consider approaches to the problem. Of significance to this particular literature review, hypotheses cannot be proved or disproved by empirical testing, and no systematic review can be made from examining a single research study, hence there is a need to discuss and summarise the chosen articles (Aveyard, 2010).

The studies found appear to support the hypothesis that there is a direct relationship between reduced nurse hours and complications in outcomes experienced by patients (Needleman et al, 2002; Halm et al, 2005; Rafferty et al, 2007; Shuldham et al, 2009; McHugh et al, 2016). Some of the studies showed mortality was increased directly as a result of unfavourable nursing hours, while others showed this could be inferred in their research papers, suggesting that poor-quality care—such as failure to rescue—could contribute to patient mortality (Rafferty et al, 2007). All studies identified elements of risk associated with available nursing

hours or unfavourable nurse:patient ratios, showing that there is a relationship between nursing time and unfavourable patient outcomes, but did not link this specifically linked this directly to patient mortality.

Rafferty et al (2007) conducted a vast research study that covered 3984 nurses and 118 752 patients. This showed that patients who were cared for by nurses where there is a low nurse:patient ratio were 26% more likely to die overall, and that 29% of patients were more likely to die following complications during hospital stays, possibly because of limited nursing time. Shuldham et al (2009) supported this finding, stating that lower nurse:patient ratios in surgical patients lead to higher 'failure to rescue' rates and overall mortality. Furthermore, Needleman et al (2002) suggested that multiple nursing factors could contribute to an avoidable increase in patient mortality, especially through failure to rescue. Failure to rescue was a common factor in all four research papers. Failure to rescue is defined as death of a patient with one of five life-threatening complications: pneumonia; shock or cardiac arrest; upper gastrointestinal bleed; sepsis; and deep vein thrombosis. Early identification of these by nurses and nursing intervention can influence the risk of death (Needleman et al, 2002).

Halm et al (2005) tested several variables for significant mortality: age, sex, complications, organ support, admission type and nurse:patient ratio. Analysis revealed that men were 2.8 times more likely to die within 30 days of admission than women. For every 1-year increase in age, mortality increased by of 4.5% (P=0.001). The conditions that were most likely to lead to death in hospital were cardiac related; patients with a cardiac condition were five times more likely to die than others (P=0.04). Patients admitted through accident and emergency were three times more likely to die in hospital (P=0.005) than others and, finally, a patient's risk of hospital mortality increased by 80% for every additional comorbidity (P=0.0001) (Halm et al,

2005). These variables have significant value, particularly relating to this literature review, as it is important to know the type of factors that would normally lead to death, as opposed to early death from inadequate nursing time.

Conversely, inconsistencies exist within and between studies regarding direct increases in patient mortality. Many of the research studies reported both significant and insignificant relationships between nurse staffing levels and different patient outcomes within the same study, or significant relationships that were the opposite of those hypothesised. For example, among the studies with significant findings, Needleman et al (2002) did not report a significant relationship between nurse hours per patient-day and in-hospital death. However, Halm et al (2005) reported that higher mortality was linked to nursing hours. Both suggested that patient acuity was the determining factor in overall mortality. It is evident, though, that patients with lower nurse:patient ratios on acute wards, such as critical care, have a higher chance of survival. However, only one study (Rafferty et al, 2005) discussed the quality of nurse input, for example the experience and education of the nurse providing care. This information could have given more context to the results, as whether a nurse could have recognised deterioration at an early stage or give input through a good knowledge base might explain differences in failure-to-rescue levels.

Another pertinent theme found in this literature review that might explain the quality of care patients receive is staff dissatisfaction and burnout. Halm et al (2005) and Rafferty et al (2007) were the only two studies to categorically address this factor. Rafferty et al (2005) conducted surveys, which were provided to all inpatient nurses working in secondary care. The survey questions collected data on demographics, including age, as well as on education, qualifications and experience. It also asked about workload, quality of care and fulfilment.

Nurse staffing levels were derived from questions relating to the number of nurses on shift and the numbers of patients on the ward. A total of 3984 responses were returned—a rate of 49.4%. Nurses then undertook a 'burnout inventory' test (Maslach and Jackson, 1986), and answered a job satisfaction question on a scale of 1–4, from poor to excellent. The qualitative data showed that 36% of nurses felt dissatisfied with their jobs, 16% of nurses suggested that care quality was poor on their ward areas and 27% of nurses believed care quality was deteriorating on their wards. Inaddition, 71–92% of nurses with the heaviest workloads were at risk of burnout and feeling dissatisfied with their jobs.

Similarly, Halm et al (2005) found that the longer hours a nurse worked in their hospital, the greater was their risk of emotional exhaustion. Because their study used a cross-sectional analysis, the investigators could not determine whether staffing predicted emotional exhaustion or job dissatisfaction. Instead, this analysis investigated whether clinical specialty predicted nurse outcomes. Because staffing ratios vary, depending on acuity and patient care environment (for example, critical care have more nurses per patient than orthopaedic or surgical wards), it may be inferred that, since practice area was not predictive of nurse outcomes, staffing would not be either.A limitation of this study was the low survey return rate of 42%. It is not known if the characteristics of the nurses who responded to the survey were different from those of non-respondents. The use of a convenience sample and the low return rate may have introduced sample selection bias into the results. In addition, nurse outcomes were based on how nurses perceived their emotional exhaustion and job dissatisfaction in 2002. These perceptions may have changed. This measurement approach was used to compare emotional exhaustion and nursing job dissatisfaction with patient outcomes over the same study period.

Implications for practice

All of the research papers reviewed showed a relationship between the quality of care patients received from nurses and outcomes. However, only half of them showed a direct relationship between nursing time and patient mortality, so there is a notable requirement to review more literature.

However, from the author's point of view as a matron for surgery, a proposition for practice would be to consider not only improving nurse:patient ratios and nursing time to provide high-quality patient care, but also to analyse nurses' skill sets and knowledge base. Failure to rescue is a main contributor to mortality, causing longer hospital stays and increasing infections. In addition, poor recognition of avoidable harm, such as falls, pressure ulcers and infections, needs to be addressed.

Recognising and escalating patients who require critical care to appropriate ward areas would reduce mortality, as the dependency was recognised and addressed appropriately.

On the second theme, staff burnout appears to exist alongside the continual struggle to cover inappropriate numbers of patients, while continuing to provide the best-quality care. Nurses in some acute areas are nursing 14 patients at one time (Griffiths et al, 2014). Patients who are acutely unwell require constant attention by nurses. It appears that putting nurses under this amount of stress causes burnout and dissatisfaction, leading to nurses leaving acute care settings or specialising in other clinical areas.

This has implications for practice, and addressing it could involve recognising the signs of burnout early and intervening with solutions. For example, an acuity audit recognising patient

dependency and formatted into a business proposal might assist in identifying the increased need and therefore be used as a tool to gain more nurses or at least recognise the need to review the skill mix on a ward area. It would be beneficial to look at the grade of nurse in relation to burnout; it may be that the senior nurses are burning out because of continual pressures from the junior nurses; this could be addressed by improving education on the ward, possibly through the use of clinical education nurses or teaching sessions from the nurse managers. Retaining nurses means there will be more nurses available to look after patients and decrease the human factors identified behind failure to rescue.

Conclusion

Two research articles support the hypothesis that reduced nursing time directly affects patient mortality; two do not, although they report that patient outcomes are affected negatively, contributing to poor patient experience, and one says that patient survival rates after cardiac arrest in acute care settings are directly related to nurse ratios. All studies suggest patient outcomes are likely to be under-reported, and the degree of under-reporting may be higher where staffing levels are low. This limits the ability to observe associations between outcomes and staffing levels.

Further research is needed to refine the measurement of the nursing case mix on the basis of discharge data and to elucidate the factors influencing nurse levels and the mix of nurses in secondary care settings. Given the evidence that low staffing levels are associated with adverse outcomes and that there are current and projected shortages of hospital-based nurses, action is required to ensure there are adequate nurse numbers to protect patients and to improve the quality of care.

If nurses are exhausted and continue to burn out, patient outcomes are directly affected. Although evidence to link direct increases in patient mortality to nursing time is weak, the literature has identified that nurses are overworked and burned out because they are looking after high numbers of acute patients in acute ward settings, which has led to poor patient outcomes.

Wounds, infections, falls, medication errors and other recognised failures have a huge impact on costs in hospitals, not only through litigation but also because of the cost of dressings, medications and rehabilitation. These costs could be reduced by appropriately upskilling and employing competent, educated nurses, who will be supported in clinical practice.

Providing an appropriate, supportive environment for patients and staff will improve morale, patient experience and cost-effectiveness.

KEY POINTS

Nurse:patient ratios must allow for some flexibility if a clinical area accepts patients with acute care needs and risk of deterioration to avoid failure to rescue (FtR) and improve patient safety

Nurse:patient ratios are set with the belief that the nurses caring for patients have a level of competence befitting the acute environment's requirements. Supernumery, inductive and non-competent staff are yet to gain the required competence. This must be considered during nurse allocation processes

Nurses who are dissatisfied and burnt out will unintentionally give poor quality care. Therefore, investment in nurse wellbeing should improve the quality of care patients receive

Nurses working in acute areas must have the skills and competencies required to identify

patient deterioration and escalate their concerns promptly

Nurse retention is improved when they are provided with education and training and

invested in

Utilising appropriate nurse:patient ratios will allow for better harm-free care

CPD reflective questions

How does your organisation ensure that 'the right people are in the right place at the right

time'? Reflect on the roles and responsibilities of yourself and members of your team

Reflect on the nurse:patient ratios in your department. Do these ratios change depending on

the acuity ofthe patient?

After reflecting on this article and considering the above questions, identify any areas of

concern and try to utilise the literature search process to explore evidence-based answers

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