

## Flexible nurse staffing in hospital wards: the effects on costs and patient outcomes.

With nursing shortages and pressure to increase efficiency, hospital managers still need to ensure safe staffing levels in hospital wards. This means that resorting to flexible staffing resources is often necessary and could be beneficial. These resources can include agency nurses, overtime or the establishment of float teams to meet varying demand. However, there is uncertainty about the impacts for patients and organisational outcomes such as costs. This brief reports on evidence of the effect of flexible staffing.

### What is the problem?

Nurse staffing levels and skill mix are associated with the quality and safety of care in hospital wards. But in common with other healthcare systems, the NHS is facing increasing nursing shortages; a recent report highlighted that demand for nurses still exceeds supply, with an overall 6.5% vacancy rate across England [1]. At the same time, there is rising demand for healthcare with limited resources.

Establishing the most efficient approach to matching limited nursing resources to the often variable demand for care on hospital wards is an important priority. Flexible staffing policies have the potential to ensure that nurses are deployed to wards where the demand is greatest, avoiding the negative consequences for patients when staffing falls below the required level. [2]

However, some flexible staffing approaches, such as use of agency staff, can represent an expensive solution for the NHS and, as a result, trusts are looking at options to reduce their temporary staffing costs [3]. Furthermore, there are some safety concerns related to the use of temporary staff, such as potential for less familiarity with ward practices and disruptions to continuity of care and team communication [4]. But use of external agency staff is not the only approach to flexible staffing and many hospitals 'float' nurses between wards to cover staffing shortfalls. This review aims to give an overview of evidence relating to how patient outcomes and organisational costs are affected by multiple aspects of flexible staffing including:

- Temporary staffing (agency, bank)
- Overtime
- "Floating"

The concept of "temporary staffing" has been used as an umbrella term for deployment of staff who are not permanently employed by the organisation. However, in the UK a hospital's own employees may be hired as temporary staff through an agency and employees of one unit may undertake extra work and be temporarily deployed to their own or another unit via a hospital's own 'bank', or may work exclusively as part of the bank with no permanent unit assignment. Thus, there is potential overlap between 'temporary staffing', 'overtime' and 'floating'. We have organised material by the primary focus.

### Data sources

We searched MEDLINE, CINAHL, PsycINFO, SCOPUS, & the Cochrane Library using terms such as "temporary / agency / bank/ supplemental", "float pod" linked with terms such as "safety", "error", "satisfaction", "costs", "mortality", "performance", "efficiency". We identified a moderate number of studies. Most studies were cross-sectional, and we selected two reviews focussing on float pools and temporary staffing in nursing as core sources [5, 6].

### Temporary staffing

The evidence around temporary staffing is largely from the US, with only two studies from the UK. Three large US studies report that higher use of temporary staff does not affect mortality [5] and higher levels of non-permanent staff are associated with lower levels of adverse events [4], fewer medication errors [7]. A single small UK study found lower occurrence of DVT & pressure ulcers was associated with higher levels of temporary staffing [8]. Other studies found no significant differences in quality outcomes when more temporary staff are deployed [9-11]. These findings suggest that the priority for patient safety is to maintain sufficiently high staffing levels. However, some findings indicate the opposite, so that increased use of temporary staffing is associated with increased patient falls with injury [12] and shortcomings in quality of care [13].

Studies from the UK and US highlighted that wards with more temporary staff are more expensive to run than wards with solely permanent nurses [14, 15], although one US study suggests that a modest use of supplemental nurses (average 0-0.2 Nursing Hours Per Patient day) was associated with slightly reduced total staffing costs [16].

### Overtime

There is evidence that increased use of overtime by nurses, that is time worked beyond the contracted hours for the shift and/or work week is, is associated with adverse outcomes. A large US study found that every additional 10 percent of overtime hours was associated with a 1.3 percent increase in hospital related mortality [17]. A further study found that

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needlestick injuries, work-related injuries, patients falls with injury, nosocomial infections, and medication errors were significantly related to nurses working more than 40 hours in the average week [18]. The negative effect of overtime appears to be independent of the actual length of shift that is worked [19].

### Floating

“Floating” refers to the practice of “assigning nurses to nursing units other than those they are regularly assigned to work”, sometimes drawing from a defined pool of nurses [17]. There are different ways in which float pools are organised and structured within hospitals (e.g. unrestricted unit floating vs clustered unit floating). The evidence about this practice is contrasting, and this may be due to the inability of some studies to disentangle float pool from other aspects of temporary staffing. The limited economic evidence on float pools suggests they are associated with a decrease in agency related costs and in vacancy rates [20] but there is some evidence that patients who are frequently cared for by a float nurse are at higher risk of bloodstream infections [17].

A number of modelling studies have tried to develop solutions to produce schedules that make the most efficient use of the available resources at a hospital-wide level. However, these give contrasting results. For example, one model explored the potential of employing float nurses to dynamically respond to the hospital's fluctuating patient population and concluded it was beneficial [21]. However, another modelling study concluded that effectiveness of care is potentially jeopardised when allowing nurses to float between different wards with clear trade-offs between efficiency and effectiveness [22]. Both unconditional use of floating and a no tolerance policy led to sub optimal outcomes. A small pool of floating staff was recommended.

An extensive but dated review concluded that if floating is mandatory for nurses, they should be competent and skilled enough, and floated to similar clinical areas to the ones where they usually practice [6]. Cross training refers to a specific training to enable nurses to cover other units. Limited evidence indicates positive outcomes from cross training, such as reduction in overtime and use of agency nurses [23, 24].

### Conclusions

Flexible staffing can be implemented in several different ways. The evidence we have identified makes it clear that implementing flexible staffing requires a careful balance of the potential risks and benefits of different practices. Most of the available evidence comes from cross-sectional studies, which make determining cause and effect difficult. Furthermore, little evidence emanates from the UK.

Much of the available evidence relates to the effect of temporary staffing. Because the evidence is mixed, it

would be wrong to make a firm conclusion about any effects of temporary staffing. However, while some studies suggest that there may be risks to patient safety, other studies imply that resource adequacy is the deeper underlying problem and that temporary nurses may compensate for nurse staffing deficiencies, albeit with a risk of reduced effectiveness and higher costs.

Float pools have been credited with decreases in overtime and reduced use of expensive agency staff, but the evidence around this practice's outcomes is mixed. Limited use of float staff who are properly prepared seems more likely to succeed than ad-hoc redeployment of staff. Some approaches to roster planning for flexible staffing have been proposed in modelling studies. However, none of these models has been tested and implemented routinely yet.

More detailed scrutiny of the limited but complex evidence is warranted, but the absence of evidence from the UK suggests more primary research is required.

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## Shift work in hospitals: what are the effects on patient and employee outcomes?

The healthcare sector works around the clock and requires the availability of staff 24 hours a day. This means that shift work is an essential aspect of staffing hospital departments. However, concerns have been raised about the consequences of some shift patterns for both patient and staff. Although there is no “ideal” shift system, this brief reports on evidence of the effect of shift characteristics including the length of the shift, rotation and days off on patient and employee outcomes.

### What is the problem?

Healthcare work is characterised by 24-h operations, so that shift work is a necessity for many hospital services. The efficient and effective deployment of staff to deliver this 24-h service poses many challenges.

In common with other healthcare systems, many UK hospitals are moving to shifts of 12 hours or longer as a strategy to reduce costs while maintaining or even enhancing quality. For staff, adopting these longer shifts offers a compressed week, meaning that the work-week is fitted into fewer days by extending daily hours. This change appears to allow organisations to achieve savings on staffing by moving from three to two shifts per day, reducing handovers, minimising overlap and extending the night shift, which often has lower staffing levels.

The introduction of 12-h shifts has raised concerns: long working hours are correlated with fatigue and decreased levels of alertness, potentially resulting in more adverse events [1, 2]. However, shift length is only one of the several shift characteristics that managers must consider when organising shift work. This review aims to give an overview of evidence relating to how patient and staff outcomes and organisational costs are affected by multiple aspects of shift work including:

- Shift length
- Weekly work hours
- Overtime
- Night work / rotating shifts
- Rest opportunities

### Data sources

We searched MEDLINE, CINAHL, PsycINFO, SCOPUS, & the Cochrane Library using terms such as “shift work / pattern / length”, “work schedule” linked with terms such as “safety”, “error”, “satisfaction”, “burnout”, “quality”, “performance”, “efficiency”, “stress”. We identified extensive literature across many occupational groups. Most studies were cross-sectional, although a small number of intervention studies exist. Because of the range and diversity of literature, we selected three recent reviews focussing on shift work in nursing as core sources [3-5].

### Shift length

Large international studies from Europe, the UK and the USA, report that when nurses work 12-h shifts or longer, they are more likely to report poor quality of nursing care and reduced patient safety [6-8]. There is evidence that 12-h shifts are associated with increased error rates [3] and increased levels of omitted nursing care [6]. This suggests that any direct cost savings from a 2 shift system could be offset by a loss of productivity and adverse outcomes.

Findings have come from a range of diverse inpatient nursing settings and studies correlating long shifts with increased fatigue and decreased alertness derive from a wide range of industries [4]. While performance deficits have been associated with all shifts longer than 8 hours, it is not clear that there is a consistent linear decline [6]. There is evidence that shift length effects may be job specific [4]. We found no economic evaluations of longer vs shorter shifts.

12-h shifts are preferred by some nurses, because they can benefit from more days off work and increased flexibility [9], although studies give a mixed picture. Although some studies have shown increased job satisfaction with longer shifts [9], larger and more recent studies from the UK and Europe indicate lower job satisfaction, increased burnout and intention to leave the job among those working longer shifts [10, 11]. These findings led authors to speculate that some nurses may be prepared to sacrifice job satisfaction for the personal benefits outside work [10]. None of the reviews cited recent quality evidence related to actual turnover or sickness rates. Limited and dated evidence suggests that educational opportunities may be reduced under 12-h shifts for both student nurses [12] and staff [13].

### Other shift work factors

While there is clear evidence of potential risks associated with longer shifts and 12-h shifts in particular, few studies considered multiple shift work factors concurrently. This means that for some studies, results may be confounded or that factors not considered might mitigate adverse effects.

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## *Overtime & weekly work hours*

Studies on overtime report an association between overtime working and impairments of job performance, in terms of increased likelihood of making errors, reduced cognitive function and of reporting poor quality of care, patient safety and higher rates of missed care [6, 14, 15]. One study reported that voluntary paid overtime was also associated with increased odds of making errors [14]. This suggests that, despite staff having control and choice on the hours they work, extending work hours in order to increase income may not be an ideal strategy. Working more than 40 weekly hours is associated with a negative impact on nurses' job satisfaction and performance, including reports of errors and harms to both patients and staff [16]. Long working hours by nurses have been associated with increased mortality [17].

## *Night work*

While night shifts are inevitable for a health service providing 24-h care, night work has been associated with disrupted performance and safety indicators when such shifts are done as part of a rotating shift schedule [18, 19]. However, results from another study suggest that working fixed night shifts, despite offering adaptation to these shifts on a cumulative basis, can be associated with increased job dissatisfaction [20].

## *Rest opportunities and breaks between shifts*

Studies regarding rest opportunities within and between shifts are important determinants of fatigue and alertness although most evidence is from outside healthcare [4]. An increased number of "quick returns" between shifts (<11 hours between two consecutive shifts) appears to be associated with pathologic fatigue in nurses [21]. However, none of these studies were able to capture the quality of the rest breaks, in terms of activities performed when having a break or a day off.

## **Conclusions**

Shift work is multifaceted. Much of the available evidence relates to the effect of 12-h nursing shifts. Because the evidence comes from observational studies, it would be wrong to make a firm conclusion that 12-h shifts cause harm. However, this evidence clearly establishes that there may be risks to both patient and staff wellbeing that increase as both daily and weekly working hours increase. There may also be a reduced efficiency as staff performance declines on longer shifts.

Research on the economic consequences of 12-h shifts is lacking, even though cost saving is a key motivator for their introduction. While some staff express clear preferences for 12-h shifts, the net effect on employee retention is uncertain.

Much like night shifts, long shifts may be necessary for operational reasons. Risks associated with any shift

work need to be carefully managed and attention needs to be given to minimising other factors which may be associated with poor outcomes including:

- **Excess working hours and overtime**
- **Cumulative working hours with no rest days**
- **Missing breaks within shifts**
- **Short breaks between shifts**

Rosters need to be carefully managed and scrutinised, particularly when working long shifts. Staff should be enabled and encouraged to take planned breaks. Introducing fixed shift patterns / rosters with these risk factors minimised may represent an option to improve patient safety.

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## Nurse staffing levels, quality and outcomes of care in NHS hospital wards: what does the evidence say?

There is ample evidence demonstrating associations between nurse staffing levels in hospital wards and important patient and staff outcomes. Reviews have concluded that the evidence is consistent with low registered nurse staffing causing worse outcomes. But much of the evidence is from health systems that are very different to the NHS and gives little indication of the actual staffing levels that should be deployed. This evidence brief considers evidence specifically derived from the NHS, which identifies the levels of staffing on wards that were associated with the outcomes reported.

### What is the problem?

There is an increasingly large amount of research showing that low nurse staffing levels in hospital wards are associated with worse outcomes for patients and staff. Inconsistency in results and limitations in methods have led some to question the validity of this evidence. Nonetheless, substantial overviews of the evidence as a whole concur with the common sense conclusion: low nurse staffing limits the ability of nurses to deliver high quality care, which can lead to low job satisfaction, errors or omissions in care and, in some cases, adverse outcomes for patients [1, 2].

However, the evidence offers little direct guidance for those wishing to set staffing levels on wards. Most studies simply offer an estimate of the average effect of changing staff levels. The estimates are prone to bias and, crucially, give no clear indication of the actual staffing levels to be achieved. In effect, the answer to the question of how many nurses to deploy on a ward is 'more'.

Furthermore, while the relationship between nurse staffing and outcomes has been observed in a diverse range of countries, differences in the configuration of services and composition of the workforce make it unlikely that the same staffing level would apply in all settings.

This review considers evidence specifically derived from the NHS, in order to determine if it indicates safe staffing levels in general wards.

### Data sources

We searched MEDLINE, CINAHL, EMBASE, the Cochrane Library and other databases using the comprehensive search strategy developed for the evidence reviews undertaken to support development of the NICE guidance on safe staffing in acute wards [3]. We selected studies undertaken in the UK that estimated associations between nurse staffing levels on general wards and any quality or outcome measure. We focussed on studies that reported outcomes associated with specific ward staffing levels rather than general associations or whole hospital nurse staffing.

### Results

We found a total of 10 papers reporting associations between nurse staffing levels and outcomes in the NHS [4-13]. Papers were published between 1999 and 2016 using data gathered from 1992 to 2010. There is a degree of overlap between the patient and staff cohorts involved but there are at least seven distinct studies underlying these reports. All studies were observational, with all but one involving large numbers of hospitals or Trusts (range 2 to

183), mainly in England. Samples were typically large, ranging from 2917 to 8887 nurses and from 9877 to over 12 million patients.

All but one study showed some significant associations between higher registered nurse staffing levels and improved quality and/or outcomes [11]. Although the relationship with registered nurse staffing was not always significant in multivariate analyses [e.g.12] most analyses in most studies showed a significant relationship with outcomes including mortality, staff burnout and incomplete nursing care.

### Associations between staffing levels and quality / outcomes

Five papers derived from three distinct studies reported associations between specific ward based staffing levels and some measure of quality or a patient or nurse outcome in the NHS.

One study (reported in a single paper) focussed on staffing in stroke units in 2011-12 [5] while two further studies (each reported in two papers focussing on different outcomes) examined staffing in general medical / surgical wards in the late 1990s [9, 10] and 2010 [7, 8].

#### Mortality

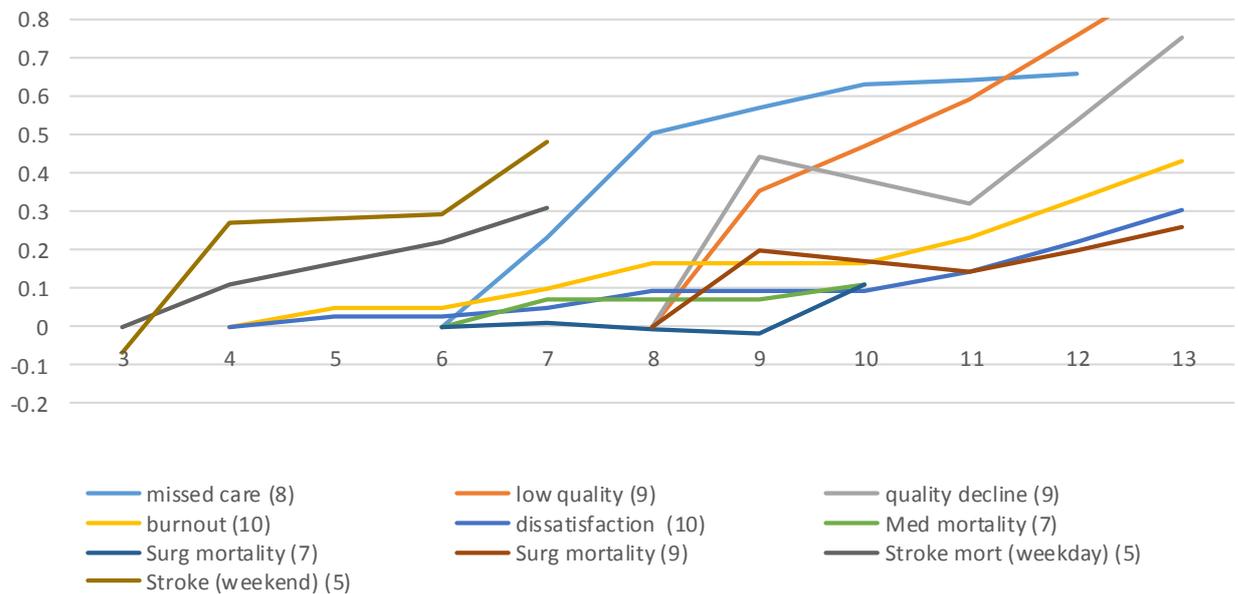
The odds of death for surgical patients were increased by 26% in the hospitals with lowest staffing on general wards (over 12 patients per RN, hospital wide) compared to the best (8.4 patients per RN or fewer) [9]. For medical patients, the odds of death were reduced by 11% in hospitals where average staffing on medical wards was 6 or fewer patients per RN [7]. A similar association was seen for surgical patients in surgical wards but it was not statistically significant. Stroke units with 6.7 or more beds per RN on weekdays had 31% higher mortality compared to units with 3.3 or fewer beds per RN on weekdays [5]. The difference was even greater for weekend staffing levels.

#### Quality of care & staff experience

Nurses' reports of poor or declining quality were significantly more likely in hospitals with the lowest staffing on general wards (12+ patients to nurse) compared to the highest (8 patients or fewer per nurse) [9]. The odds of nurses reporting missing necessary care were reduced by 66% in better staffed wards ( $\leq 6$  patients per RN) compared to the worst (11+ patients per RN)[8].

Odds of reporting dissatisfaction and emotional exhaustion were reduced by 43% and 30% among nurses in the best

## %increase in odds of adverse outcome by average RN staffing



staffed wards ( $\leq 4$  patient per RN) compared to the worst (13+) staffed wards [10].

### Health Care Assistants

Five studies considered the relationship between support worker or health care assistant staffing and outcomes in their analysis in addition to RN staffing [5, 7, 8, 12, 13]. In three of these there was some indication that higher levels of support worker staffing or lower skill mix was associated with worse outcomes, although studies reporting relationships with HCAs deployed on wards found no association (positive or negative) with the outcomes studied [7, 8].

### Thresholds

Mandatory staffing policies in the US and Australia suggest *minimum* staffing levels that are equivalent to between 4 & 7 patients per nurse in general acute wards during day time [14]. A US study showed a significant increase in mortality to be associated with patients experiencing any shifts with 8 or more hours below target staffing identified using a validated staffing tool [15]. In its guidance, NICE identified a threshold of more than 8 patients per registered nurse as associated with increased risk [16].

Figure 1 gives an approximation of the results of the studies mapped against staffing levels. While the odds of adverse outcomes were generally increased when average staffing fell below the 1:8 threshold, better outcomes were often associated with higher staffing levels and ratios of 1:7 and lower. For some services, significant increases in risk occurred well below this threshold. While not giving a clear 'safe' staffing level this evidence reinforces that a 1:8 threshold represents a level at which risk is known to be increased, not an optimal, safe staffing level.

### Conclusions

The evidence from the NHS is consistent with international research showing that lower nurse staffing levels are associated with worse outcomes in a variety of general acute wards or patient groups. It is hard to discern a clear threshold and the staffing levels reported are averages. For several of the studies we reviewed significant differences in outcomes were only observed when comparing the best to the worst staffed wards.

The evidence is specific to registered nurse staffing levels. Where other staff groups were considered, there was no evidence to support substitution of health care assistants for RNs. The required levels of HCA staffing are unclear from this evidence and must be determined in addition to RN staffing levels.

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