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'Care left undone' during nursing shifts: associations with workload and perceived quality of care

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ABSTRACT

Background There is strong evidence to show that lower nurse staffing levels in hospitals are associated with worse patient outcomes. One hypothesised mechanism is the omission of necessary nursing care caused by time pressure—'missed care'.

Aim To examine the nature and prevalence of care left undone by nurses in English National Health Service hospitals and to assess whether the number of missed care episodes is associated with nurse staffing levels and nurse ratings of the quality of nursing care and patient safety environment.

Methods Cross-sectional survey of 2917 registered nurses working in 401 general medical/surgical wards in 46 general acute National Health Service hospitals in England.

Results Most nurses (86%) reported that one or more care activity had been left undone due to lack of time on their last shift. Most frequently left undone were: comforting or talking with patients (66%), educating patients (52%) and developing/updating nursing care plans (47%). The number of patients per registered nurse was significantly associated with the incidence of 'missed care' ($p<0.001$). A mean of 7.8 activities per shift were left undone on wards that are rated as 'failing' on patient safety, compared with 2.4 where patient safety was rated as 'excellent' ($p<0.001$).

Conclusions Nurses working in English hospitals report that care is frequently left undone. Care not being delivered may be the reason low nurse staffing levels adversely affects quality and safety. Hospitals could use a nurse-rated assessment of 'missed care' as an early warning measure to identify wards with inadequate nurse staffing.

INTRODUCTION

The National Health Service (NHS) in England, like many healthcare systems in the world, is facing intense pressure to maintain the quality and safety of care provided in hospitals at the same or less cost than in previous years.[1] The quality of nursing care—and the potential for poor nursing care to do patients great harm—has been the focus of numerous recent reports in England.[2 3] Poor quality care is a source of significant increased cost internationally.[4] The Francis Inquiry[5] examined the reasons why hundreds of patients experienced poor care at The Mid Staffordshire NHS Foundation Trust between January 2005 and March 2009. The Inquiry was instigated when hospital standardised mortality ratios (case mix adjusted mortality rates) indicated that between 400 and 1200 more patients than expected had died over a 2 year period. Numerous patient accounts were heard by the Inquiry, including negative experiences of fundamental aspects of nursing care including care such as communication, maintaining dignity, discharge planning and safety. Failure to ensure adequate nurse staffing was a central factor identified in the report.

There is clearly a need to understand the scale of potential problems in care delivery across the NHS and internationally. There is also a need to understand mechanisms which link nurse staffing to quality and safety outcomes—including our focus here—the nature and extent of care that might be being 'left undone'.[6] The purpose of this study is to describe the nature and prevalence of care left undone (as reported by nurses) and explore its association with nurse staffing levels and nurse ratings of the quality of care and patient safety environment.

BACKGROUND

The body of evidence demonstrating an association between patient outcomes and nurse staffing is substantial. A systematic

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review of 102 studies concluded that increased registered nurse (RN) staffing levels are associated with lower rates of hospital related mortality and adverse patient events.[7] For example, in intensive care units (ICUs) higher RN staffing was associated with lower levels of hospital related mortality; each additional full time equivalent RN per patient day corresponds to a 9% reduction in odds of death in ICUs (ORs, 0.91; 95% CI 0.86 to 0.96), which would save 5 lives per 1000 patients. Although much of the reviewed research was undertaken in hospitals in the USA similar findings have been identified in other countries, for example, Belgium,[8 9] Korea,[10 11] and the UK.[12] Other research shows that in some cases variation in staffing levels and patient outcomes within hospitals is greater than that between hospitals, which can mask the effect of any relationship between nurse staffing and patient outcomes.[13] In the USA, Needleman *et al*[14] used a retrospective observational study to analyse 176 000 shifts. They reported that controlling for hospital and patient differences, mortality rates were significantly greater for patients receiving care on shifts where RN staffing was 8 h or more below the planned level.

Aspects of organisational climate, and in particular nursing practice environment, have also been identified as significant predictors of nursing quality and patient outcomes.[15] A 'positive work environment' has been described as comprising factors including autonomy, positive relationships between staff, teamwork, job satisfaction and low risk of burnout.[16] A series of research studies internationally have used the Practice Environment Scale (PES) [15]—for example, in Belgium,[17] Taiwan,[18] and China[19]—to show that practice environment characteristics have an association with a range of patient outcome measures.[20] Data from the USA have been used to estimate that the increase in mortality associated with a change from good to mixed quality practice environment is greater than the change in mortality associated with a nurse caring for one more patient per shift.[21] A failure to properly observe and respond to patient deterioration is also identified as being part of the causal pathway in the association between low staffing and death from treatable complications (often referred to as 'failure to rescue'), although the staffing outcome relationship here may not be specific to nursing.[22]

Despite the strength of evidence for a link between nurse staffing and clinical outcomes, relatively little is known about the mechanisms through which variations in nurse staffing impact on mortality, or other patient outcomes.[23] There is some evidence that unfinished care by nurses, or 'missed care' could be used as an indicator of overall quality,[24] explaining over 40% of the variation in care quality ratings in one US study.[6]

AIM

The aim of the study was to use data collected from nurses working in English NHS hospitals to address the following questions:

1. What is the nature and prevalence of 'missed care' (ie, care that nurses regard as necessary but was left undone on their last shift due to lack of time)?
2. Is there a relationship between ward nurse staffing levels and the prevalence and type of nursing care that that is left undone due to time constraints?
3. Is 'missed care' associated with perceptions of the overall quality of nursing care or patient safety environment of a ward?

METHODS

A cross-sectional survey design was used. The methodology of the survey in England followed a protocol established by the international RN4Cast consortium of 15 countries.[25] The study focused on general medical and surgical wards in acute hospitals. Ethical approval was sought and gained (from the National Research Ethics Committee) and permissions acquired for the research to be undertaken at each hospital.

SAMPLE

In England a random stratified sample of 64 (out of a possible 341) NHS general acute hospital Trusts (the bodies managing one or more hospital) was identified to ensure mix by size, teaching status and region with a target sample size of 32 Trusts. Within each stratum the chief executive and chief nurse of Trusts were approached in a random order and invited to take part. If a Trust declined to participate then the next Trust in that stratum was approached until the quota defined by the sampling frame was fulfilled. Thirty-one of the 64 Trusts identified in the original sample agreed to take part. Within these Trusts we then took a stratified random sample of up to five general medical and five general surgical wards from each hospital operated by that Trust. Where a Trust had fewer than five wards in a given category we included all wards. Mixed medical/surgical wards were included in the medical sampling frame but analysed separately. In total 401 wards were included. Highly specialist, long-stay rehabilitation, critical care units and ICUs were excluded because of the high intensity of nursing care associated with these types of care settings.[26]

MEASURES

The full content of the questionnaire survey used in this study is described elsewhere and has been used extensively in previous studies of nurse staffing and patient safety.[25] The questionnaire consisted of five sections presented over seven pages covering: Work Environment and Job Satisfaction, Quality and Safety, Your most recent shift, About you, and Where you work. Nurse staffing was calculated from the nurse

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surveys; where nurses were asked to report the numbers of staff giving direct patient care (specifically 'RNs' and 'other nursing care staff') and the numbers of patients on the ward on the last shift they worked. From this we identified:

- patients per RN providing direct care
- patients per non-registered nursing staff (or Healthcare Support Workers (HCSW). The abbreviation HCSW is used as a variable label to refer to 'other nursing care staff' providing direct care who are not registered, such as Healthcare Assistants or nursing auxiliaries)
- the proportion (as a percentage) of the nursing team providing direct care that were RNs (referred to as 'skill-mix')

Nurses were also asked to report the number of patients requiring assistance with daily living and the number requiring frequent monitoring, to measure nursing workload intensity related to patient need.

The nurse work environment was assessed using the PES of the Nursing Work Index (revised), an internationally validated measure that has been adapted and used previously in Europe.[15 27] The PES of the Nursing Work Index measures modifiable organisational factors, including managerial support for nursing, nurse participation in hospital affairs, doctor-nurse relations and promotion of care quality. Four items in the PES that related specifically to staffing and resourcing were excluded to avoid overlap (common variance) with the measures of nurse staffing used in the analysis. The mean PES Score for the remaining 28 items was used to give an overall rating of the practice environment (PES-28).

A single question asked nurses to rate the quality of care on their ward as fair, poor, good or excellent. Using an item from the Agency for Healthcare Research and Quality's hospital survey on patient safety culture, previously validated in the UK,[28] nurses gave their ward an overall grade on patient safety as poor, failing, acceptable, very good or excellent.

Care left undone (termed 'missed care' in the analyses) was assessed by asking nurses to 'On your most recent shift, which of the following activities were necessary but left undone because you lacked the time to complete them?' A list of 13 nursing care activities was presented and nurses asked to tick all that applied. The activities included were based on consistently recognised core components of nursing work and an existing instrument to assess 'rationing' of nursing care.[29] These were:

- adequate patient surveillance
- adequate documentation of nursing care
- administering medication on time
- comfort/talk with patients
- develop or update nursing care plans/care pathways
- educating patients and/or family
- frequent changing of patient's position
- oral hygiene
- pain management
- planning care
- preparing patients and families for discharge
- skin care
- undertaking treatments/procedures

Two measures of 'missed care' were derived. First, reported prevalence of any care being left undone, based on one or more of the activities having been ticked (binary measure). Second, a score indicating the volume of care left undone, by summing the number of activities ticked per person.

DATA COLLECTION

Questionnaires were distributed by local study coordinators to all wards in sufficient quantities for all staff identified as working on the ward to complete. Staff also had the option of completing the questionnaires online. Three reminders were sent (at approximately 2 weekly intervals): a postcard, full reminder pack, and final postcard. As the questionnaires were not distributed to named individuals, reminders were not targeted at non-responders. Data collection was from January2010–September 2010 with the survey typically in the field at each site for 12 weeks.

ANALYSIS

The profile of nurses was described using summary statistics (means, SDs, frequencies and percentages). Descriptive statistics were used to describe the prevalence and nature of care left undone, and address the first research question. The average number of items missed during a shift were compared across groups (directorate, most recent shift worked, patient per RN and patients per healthcare support worker each grouped into quintiles) using analysis of variance. The proportion of shifts where nurses observed at least one item of missed care were compared across groups using the Pearson χ^2 test. Associations between pairs of continuous variables were tested for statistical significance using Spearman's correlation coefficient. Associations between a continuous and an ordinal variable were tested using the polyserial correlation coefficient. These tests were used to explore the relationship between missed care and quality and patient safety (the third research question). All the analyses mentioned so far were performed using SPSS V.20.

The relationships between 'missed care' and other variables (staffing level and practice environment) were explored through multilevel regression models. To analyse the hierarchical cross-sectional design with nurses nested within wards, and wards within hospitals, a three-level multilevel model was fitted to the data using MLwiN, a statistical software package for fitting multilevel models using maximum likelihood estimation and Markov Chain Monte Carlo methods.[30] Practice environment score (PES-28) and directorate (Surgical, Medical, Surgical/Medical) were ward level variables; while shift, patients per RN, patients per HCSW, patients requiring assistance with

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daily living (number of patients) and frequent monitoring (number of patients) were treated as nurse-level variables. These last two variables were included in order to control for variations in the required nursing intensity originating from variation in patient need. These independent variables were regressed onto the number of aspects of care missed (range 0–13), a global nominal dependent variable (no missed care vs one or more aspects of missed care) and 13 individual aspects of missed care.

To aid interpretation we grouped the staffing variables into quintiles. The model fitting included testing two possible interactions. The first was between PES-28 and patients per RN, to test for the potential additional effect on missed care that staffing levels and practice environment may have when taken together, compared with separately. Second, the potential interaction between RN staffing and HCSW staffing was explored to see if HCSW staffing complemented (ie, gave added value to) or substituted (ie, could be used to replace) RN staffing.

RESULTS

A total of 2917 responses were received from RNs in medical and surgical directorates (a subdivision of a hospital according to specialty). A further 73 responses from other directorates (which did not meet the criteria of general medical or surgical) were excluded from this analysis. Precise response rates cannot be calculated as we were unable to track how many questionnaires were actually distributed or how many nurses were actually working on the wards over the period studied. However, using the figures provided by hospitals of the number of RNs employed on the sampled wards, the response rate was estimated at at least 39%; it is likely to be higher due to some nurses being on annual or sick leave or some staff simply not receiving the questionnaire.

The characteristics of the sample are shown in table 1. Comparison with the profile of nurses obtained from an earlier national survey[31] indicates that respondents are broadly typical of nurses working on NHS medical/surgical wards across the UK.

Table 1 Profile of nurse respondents

Characteristics	Value	SD	n=
Mean age	39.6	10.1	2790
Under 25 years (<25)	8%		221
25–34	25%		719
35–44	32%		931
45–54	24%		705
55 and over (55+)	8%		220
Gender			
Female	92%		2673
Male	8%		226
UK trained	83%		2413
Holds a bachelor's degree in nursing	27%		785
Working hours			
Full time	76%		2218
Part time	22%		634
Last shift worked (and reported on)			
Day	56%		1630
Afternoon/evening	13%		390
Night	26%		769
Length of service (mean years)			
Nursing career	13.8	10.6	2702
Current hospital	9.5	8.5	2704
Current specialty	7.7	7.0	2539
Current ward	5.8	5.6	2627
Job title			
Staff nurse	73%		2139
Sister/charge nurse	24%		689
Other	2%		59
Directorate			
Medical	47%		1384
Surgical	50%		1463
Medical/surgical	2%		70

PREVALENCE AND NATURE OF CARE LEFT UNDONE

Across all respondents, 86% reported that on their last shift, at least 1 of the 13 care activities listed had been needed but not done due to lack of time. Nurses missed a mean of 4 items of care. The most common activities identified as missed were: comfort/talking with patients (66%), educating patients (52%) and developing or updating nursed care plans/care (47%). Pain management (7%) and treatment and procedures (11%) were least likely to be reported as missed.

Summary statistics for the number of items of missed care observed during a shift and the proportion of shifts where at least one item of missed care was observed by each independent variable are shown in table 2 based on cases with complete data from wards with two or more responding nurses.

More care was left undone on day and afternoon shifts than night shifts ($p<0.001$). A greater number of patients requiring assistance with daily living or frequent monitoring were associated with the number of care items left undone (Spearman's $r=0.23$ and 0.18, respectively $p<0.001$) and having any missed care (7.66 (SD 5.76) vs 5.75(SD 5.49) $t_{2805}=6.00$ $p<0.001$ and 3.73(SD 3.73) vs 2.87(SD 3.36) $t_{2782}=4.21$, $p<0.001$, respectively). The better the practice environment score the fewer the care items left undone ($r=-0.32$, $p<0.001$) and higher scores were found when nurses said there was no missed care compared with some missed care (2.97 (SD 0.46) vs 2.74(SD 0.45) $t_{2901}=9.78$, $p<0.001$).

CARE LEFT UNDONE AND STAFFING LEVELS

Staffing levels varied considerably among wards and hospitals. The average (mean) number of patients

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Table 2 Summary statistics for prevalence and incidence of missed care

	Number of items of missed care observed during a shift			Shifts where at least one item of missed care was observed	
	No.	Mean	SD	%	(No.)
Directorate					
Medical	1384	4.24	3.05	88%	(1222)
Surgical	1463	3.65	3.06	83%	(1221)
Medical/Surgical	70	4.99	3.54	86%	(60)
	$F_{2,2913}$=17.33, p<0.001			χ^2=14.04, 2df, p<0.001	
Shift					
Day	1631	4.16	3.04	88%	(1440)
Afternoon/evening	390	4.1	3.06	89%	(348)
Night	769	3.57	3.04	82%	(628)
	$F_{2,2786}$=10.12, p<0.001			χ^2=22.77, 2df, p<0.001	
Patients per RN					
up to 6.13	607	3.08	2.99	78%	(473)
6.14–7.33	530	4.12	3.16	87%	(461)
7.40–9.25	535	4.15	2.99	90%	(480)
9.33–11.50	581	4.39	2.99	91%	(527)
11.67 and over	543	4.36	3.01	89%	(484)
	$F_{4,2790}$=18.93, p<0.001			χ^2=54.65, 4df, p<0.001	
Patients per HCSW					
up to 6.80	535	3.84	3.14	87%	(466)
7.00–9.25	510	4.25	3.13	87%	(443)
9.33–13.00	640	4.23	3.15	88%	(563)
13.33–17.00	552	4.14	2.98	89%	(492)
17.33 and over	540	3.49	2.81	83%	(446)
	$F_{4,2771}$=6.25, p<0.001			χ^2=12.15, 4df, p=0.016	

HCSW, healthcare support worker; RN, registered nurse.

cared for per RN during a day, afternoon/evening and night shift were 7.8 (SD 2.8; range 0.50–30), 8.8 (SD 3.3; range 0.33–21) and 10.9 (SD 3.9; range 1–33), respectively. As the number of patients per RN decreases (table 3), so does the amount and occurrence of missed care. Fewer elements of care were missed (p<0.01) and the odds of missing any care were significantly lower (OR 0.343, 95% CI 0.222 to 0.53, p<0.001) when RNs were caring for the fewest patients (6.13 or fewer patients per RN) compared with when nurses caring for the most (11.67 or more patients per RN). Seventy-eight per cent of those in the best staffed environments (the upper quintile, with 6.13 patient or fewer per RN) reported some care was missed on their last shift, compared with 90% of those with lower staffing levels (7.4 patients or more per RN).

The practice environment (PES-28) was also significantly associated with missed care. On wards where nurses rated the practice environment as more positive nurses reported fewer elements of missed care (p<0.01) and were less likely to miss any care (p<0.01). Comparing the 'best' and 'worst' practice environments (by taking the upper and lower deciles) the average number of items of care missed varied from 2.82 in the best practice environments compared with 5.61 for the poorest environments. Similarly the incidence of any care being missed (one item or more) was 79% in the best environments compared with 92% for the lowest decile.

HCSW staffing levels were not found to be associated with either the amount of missed care or the occurrence of any missed care reported by RNs (p<0.05). Neither the interaction between PES and patients per RN (χ^2=2.738, 4 df, p=0.602) nor between patients per RN and patients per HCSW (χ^2=21.811, 16 df, p=0.149) were statistically significant.

RN staffing level was significantly associated with missed care for 8 of the 13 care activities (table 4, and see online supplementary appendix 1). The effect of staffing was strongest for 'adequate patient surveillance', 'adequately documenting nursing care' and 'comforting/talking with patients'. Nurses working on shifts with the worst staffing (11.67 patients per RN) were twice as likely to report inadequate patient surveillance, when compared with those in the best staffed environments (less than 6.14 patients per RN). RN staffing level was not significantly associated with missed care in relation to frequent changing of position, administering medications on time, pain management, and preparing patients and families for discharge.

CARE LEFT UNDONE AND QUALITY AND PATIENT SAFETY

There was a strong relationship between the number of items of missed care and nurses perception of quality of nursing care (polyserial correlation=−0.37, p<0.001) and nurses overall grading of patient safety on their unit/ward (polyserial correlation=−0.40, p<0.001) (table 5).

DISCUSSION

Most nurses working on general medical and surgical wards in this representative sample reported that some care was left undone on their last shift. Care that was frequently left undone included adequate patient surveillance, which has been hypothesised as a key mechanism explaining the association between low nurse staffing and increased mortality.[32] The amount of care left undone was strongly related to nurses overall perceptions of the quality and safety of care.

Our findings clearly show that nurses are more likely to report care being left undone (or 'missed') when they are working on shifts with high numbers of patients per RN. The number of activities left

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Table 3 Multilevel model for missed care

	Number of items of missed care observed during a shift				Shifts where at least one item of missed care was observed			
	B	L95%	U95%	p Value	OR	L95%	U95%	p Value
Ward level variables								
Directorate (χ^2, p value)*	(6.702, 0.035)				(1.846,.40)			
Surgical	−1.028	−1.902	−0.154	0.021	0.981	0.438	2.200	0.963
Medical	−0.817	−1.695	0.061	0.068	1.179	0.520	2.676	0.693
Medical/surgical	0.000				1.000			
Practice Environment Scale (PES-28)	−2.726	−3.312	−2.140	<0.001	0.356	0.195	0.648	<0.001
Nurse level variables								
Shift (χ^2, p value)*	(32.545, <0.001)				(44.054, <0.001)			
Day	0.866	0.564	1.168	<0.001	2.751	2.018	3.750	<0.001
Afternoon/evening	0.721	0.345	1.097	<0.001	2.588	1.698	3.945	<0.001
Night	0.000				1.000			
Assistance with daily living (no. patients)	0.049	0.025	0.073	<0.001	1.041	1.009	1.074	0.012
Frequent monitoring(no. patients)	0.073	0.040	0.106	<0.001	1.057	1.006	1.110	0.028
Nurse staffing variables								
Patients per RN (χ^2, p value)†	(36.296, <0.001)				(37.537, <0.001)			
up to 6.13	−1.087	−1.501	−0.673	<0.001	0.343	0.220	0.534	<0.001
6.14–7.33	−0.427	−0.839	−0.015	0.042	0.574	0.361	0.912	0.019
7.40–9.25	−0.201	−0.595	0.193	0.317	0.847	0.538	1.335	0.474
9.33–11.50	−0.121	−0.488	0.246	0.518	0.971	0.623	1.516	0.898
11.67 and over	0.000				1.000			
Patients per HCSW (χ^2, p value)†	(3.451, 0.48)				(3.021,.55)			
up to 6.80	0.288	−0.098	0.674	0.144	1.154	0.773	1.721	0.483
7.00–9.25	0.284	−0.106	0.674	0.154	0.872	0.581	1.308	0.508
9.33–13.00	0.305	−0.058	0.668	0.099	1.033	0.709	1.504	0.867
13.33–17.00	0.261	−0.102	0.624	0.158	1.201	0.818	1.763	0.350
17.33 and over	0.000				1.000			
Random variance	σ^2	L95%	U95%		σ^2	L95%	U95%	
Hospitals (n=46)	0.128	0.000	0.265	0.067	0.154	0.013	0.295	0.032
Wards (n=392)	0.482	0.231	0.733	<0.001	0.062	−0.134	0.258	0.535
Nurses (n=2566)	7.541	7.096	7.986		n/a‡			

*Two degrees of freedom.
†Four degrees of freedom.
‡In multilevel logistic regression model the residual variance at the nurse level is a function of the estimated model parameters and will therefore vary for each individual nurse unless the data (independent variables) for one or more nurses are the same.
HCSW, healthcare support worker; RN, registered nurses.

undone is also greater. Care is more likely to be left undone in wards where nurses perceive the practice environment to be worse. By contrast, although substitution for nurses by assistant practitioners is proposed as a means of improving the efficiency of care delivery[33] we found no evidence that HCSWs were acting as substitutes or complements for RNs for the nursing tasks we studied.

Our findings raise difficult questions for hospitals in a climate where many are looking to reduce—not increase—their expenditure on nurse staffing. The association between staffing and missed care is only significant within the top 40% of patient to RN ratios (7.33 patients per RN or fewer). If the association observed is causal, for NHS hospitals to significantly reduce the amount of care left undone would require a change to a daytime shift average of just over seven or fewer patients per RN providing care. Sixty per cent of the shifts reported by nurses in this survey were staffed below this threshold. More benefit is associated with higher staffing levels above this threshold.

The tasks selected for our missed care indicator are those which are generally regarded as being within the remit of RNs. Therefore it is perhaps unsurprising that we found no evidence that healthcare assistants are acting as substitutes for RNs (there was no relationship between HCSW staffing and missed care). Nor did we find evidence that the availability of HCSWs increased the ability of RNs to complete these tasks, as would be the case if HCSWs acted as complements.[34 35] If a particular group of workers

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Table 4 Missed care by levels of registered nurse staffing

	Patients per registered nurse											
	up to 6.13		6.14–7.33		7.40–9.25		9.33–11.50		11.67 and over		All	
Overall number of missed care aspects	Mean 3.06 No.	SD 2.98 %	Mean 4.13 No.	SD 3.17 %	Mean 4.16 No.	SD 2.98 %	Mean 4.38 No.	SD 2.99 %	Mean 4.36 No.	SD 3.02 %	Mean 4.00 No.	SD 3.07 %
One or more aspects of missed care	472	78	457	87	474	90	520	91	483	89	2406	87
Comfort/talk with patients	340	56	345	66	365	69	408	71	383	71	1841	66
Educating patients and family	268	44	276	53	280	53	340	59	284	52	1448	52
Develop or update nursing care plans/care pathways	225	37	268	51	253	48	288	50	261	48	1295	47
Adequate patient surveillance	135	22	169	32	195	37	229	40	237	44	965	35
Adequately document nursing care	134	22	190	36	199	38	204	36	193	36	920	33
Oral hygiene	130	22	154	29	166	31	176	31	179	33	805	29
Frequent changing of patient position	136	23	168	32	154	29	169	29	157	29	784	28
Planning care	117	19	154	29	142	27	183	32	170	31	766	28
Administer medications on time	101	17	121	23	116	22	136	24	156	29	630	23
Skin care	78	13	120	23	118	22	135	24	133	25	584	21
Prepare patients and families for discharge	108	18	107	20	103	20	124	22	116	21	558	20
Treatments and procedures	46	8	57	11	65	12	72	13	66	12	306	11
Pain management	36	6	42	8	38	7	50	9	29	5	195	7

(in this case HCSWs) act as a complement for the work of another group (in this case RNs) there is an interaction effect whereby an increase in the complement workforce increases the effect of the other group on outputs (in this case the inverse of missed care). However no such interaction was observed. While we did not study all the potential work of RNs, this finding does not support an increase in the number of HCSWs as a means of increasing the efficiency of RNs.

The desirability of increasing nurse staffing levels as a means to improve quality is contested on grounds other than cost. There is debate internationally about setting standard minimum staffing levels,[36–39] but this policy is often resisted on the basis that it is inflexible and might stifle innovation in workforce planning.[40] Evidence from this study, as elsewhere, suggests that attention should be paid to the quality of the practice environment as a potentially lower cost approach to improving the quality and efficiency of nursing work.[40] Many of the constructs of the nursing practice environment are consistent with West *et al*'s high performance human resource management system[42] including training, performance management, participation, decentralisation, involvement, use of teams and employment security which were related to lower risk adjusted mortality rates in a study in English NHS hospitals. How workforce planners can redress the balance by improving the practice environment in the face of staffing reductions and resultant lack of job security is unclear.

Table 5 Quality of nursing care and patient safety compared with missed care score

	Rating/grade	No.	%	Mean missed care score	95% CI Lower	95% CI Upper	Average (mean) no. patients per RN on day shift
Quality of nursing care delivered to patients on unit/ward*	Poor	66	2	8.08	7.17	8.98	9.1
	Fair	473	16	5.44	5.17	5.71	8.9
	Good	1455	50	4.02	3.88	4.17	8.1
	Excellent	904	31	2.78	2.60	2.96	7.3
Overall grade for patient safety on unit/ward†	Failing	45	2	7.78	6.82	8.74	8.4
	Poor	146	5	6.54	6.03	7.06	9.4
	Acceptable	870	30	4.88	4.69	5.08	8.6
	Very Good	1321	46	3.54	3.39	3.70	7.8
	Excellent	512	18	2.37	2.15	2.59	7.0

*Participants were asked to tick either: Poor, Fair, Good or Excellent in response to 'In general, how would you describe the quality of nursing care delivered to patients on your unit/ward?'
†Participants were asked to tick either Failing, Poor, Acceptable, Very Good or Excellent in response to 'Please give your unit/ward an overall grade on patient safety'.
RN, registered nurse.

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As the enquiry into excess mortality at the Mid Staffordshire NHS Trust in England critically shows the consequences of poorly informed experiments to improve the efficiency of the nursing workforce can be disastrous. Most measures used to detect problems, such as standardised mortality rates, are 'lagging indicators' revealing problems after they have happened.[43] Low staffing levels and poor practice environment have already been identified as potential indicators of poor quality and are endorsed by a number of bodies, for example, the US National Quality Forum and the American Nurses Association. However missed care is a more direct indicator of quality deficiencies with a clear pathway to adverse patient outcomes and experience. Hence, missed care has the potential to be used as a leading indicator, identifying emerging problems before serious consequences occur, enabling employers, regulators or others to identify wards where workload/staffing mismatches are putting patients at risk. Further research is warranted to determine whether routine reporting on missed care can be used in this way.

Limitations

Our use of a cross-sectional survey design allows us to draw inferences about the possible nature and prevalence of missed care but a limitation of the study is that the missed care measure is generated through nurses' accounts. The measure is therefore open to the subjective experiences of individual nurses, who may understand specific items differently (eg, '*adequate* patient surveillance'—which may vary according to ward layout) and hold different expectations and perceptions of what level and type of care is needed and whether or not it was provided. They may also have different interpretations as to the extent to which an activity was not done was due to 'lack of time to complete'. To some extent we were able to limit variation by asking about 13 specific activities (rather than using an open-ended question about the type of activities that were missed). Other research shows that nurses' rating of quality closely aligns to objective measures of patient outcomes.[6] We do not know whether nurses handed over responsibility for care that they themselves might have missed at the end of a shift, or whether this care was done later by another nurse.

The measure gauges differences in nurses' perceptions of the amount of work undone over a standard length shift, but it does not relate this to the total work required, nor does it relate to care done or undone for specific numbers of patients. Future research could usefully seek to examine in more detail whether care 'left undone' was unfinished, rushed or not done to a high standard, or whether it was missed entirely, and place this in a context of the total volume of care being undertaken for patients.

A further limitation is that we have taken nurses' reports of the staffing and patients on their last shift, to produce a measure of average staffing levels. However we do not know how the grade mix of nursing staff varied (for either registered or non-registered), nor the level of temporary staff (bank or agency) that were on duty. Both of which may affect the productivity of the nursing team as a whole, and have an impact on care being left undone. Further research is needed to move beyond establishing an association between overall staffing levels and care being left undone, to explore in more detail the effect of different combinations of staff with different qualifications and experience, on the productivity of the nursing team as a whole.

CONCLUSIONS

RNs working in English NHS hospitals report that care is needed but is often not done because of insufficient time. There is a strong relationship between RN staffing levels and the prevalence of care being left undone—and, the better the practice environment the smaller the volume of care that is left undone. Greater research attention to the impact of 'missed care' is needed. A 'missed care' measure may be a useful correlate of nursing care quality, and inform staffing decisions at ward level. Further research is needed to test the measure against patient outcomes, and to support comparability between care settings and internationally.

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