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Staffing and resource adequacy strongly related to RNs' assessment of patient safety: a national study of RNs working in acute-care hospitals in Sweden

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ABSTRACT

Introduction Although registered nurses (RNs) are central in patient care, we have not found prior research that specifically addresses how RNs assess the safety of patient care at their workplace and how factors in RNs' work environment are related to their assessments. This study aims to address these issues.

Methods 9236 RNs working with inpatient care in 79 acute-care hospitals in Sweden completed a national population-based survey, including Practice Environment Scale of the Nursing Work Index—Revised and items from Agency for Healthcare Research and Quality's Hospital Survey on Patient Safety Culture. Correlation coefficients (Pearson and Spearman) and proportional odds regression were used for analysis.

Results Nursing work environment factors were strongly related to RNs' assessments of patient safety. RNs' perception of having adequate staffing and resources improved their assessment of patient safety by at least two and a half times (OR 2.74 CI 2.52 to 2.97). RNs with a higher level of involvement in direct patient care gave a better patient safety grade than RNs with a more supervisory role. Most, but not all, patient safety culture items were related to RNs' assessed patient safety grade. We found that work experience seemed to have no influence on RNs' patient safety assessment.

Conclusions While previous research emphasises patient-to-nurse ratios in strengthening patient safety practices, this study complements this by emphasising RNs' own perception of having enough staff and resources to provide quality nursing care, as well as having good collegial nurse–physician relations and the presence of visible and competent nursing leadership—all factors highly related to RNs' assessment of the safety of patient care at their workplace.

INTRODUCTION

Nurse-related factors such as staffing, education, collegial relations with physicians and leadership have all been shown to affect patient safety outcomes, for example, 30-day mortality, in-hospital falls, medication errors, pressure ulcers and hospital-acquired pneumonia.[1–9] Nurses are the largest group of healthcare providers.[10 11] Their central role in patient care makes their perspective unique in assessing patient safety and care quality at their workplace.[10] Reports from the US-based Institute of Medicine (IOM) emphasise a focus on the nursing work environment as a means to improve patient safety and quality care outcomes.[10 12] While patient safety research often focuses on defining patient care errors and the patient safety concept as a whole, the perspective of the bedside nurse working at the frontline or 'sharp end' of patient safety practices also merits investigation.[10 13] Spears[14] argues the importance of obtaining a better understanding of the perspectives of those providing care to generate knowledge of the care environment where errors occur. However, we have not found prior research that specifically addresses how registered nurses (RNs) assess the safety of patient care at their workplace and how different nurse-related factors apply to their assessments.

In this study, we therefore aim to investigate how RNs' assessments of (a) the safety of patient care at their workplace,

(b) the nursing work environment, (c) the patient safety culture, as well as (d) their level of involvement in direct patient care, and (e) length of work experience as an RN relate to, and interact with, RNs' global assessment of patient safety in acute-care hospitals in Sweden.

METHOD

The data analysed here derive from the Swedish subset of the EU 7th Framework Registered Nurse Forecasting (RN4CAST) database. RN4CAST included a multinational survey of RNs (described in depth in ref. [15]) based on 118 items derived from well-known and extensively validated instruments,[16–20] as well as questions developed and tested in prior research that were translated for the study.[3 21] Translations were validated using a content validity index (CVI)[22] giving a Scale–CVI score of 0.91 for the Swedish version of the survey. Ethical approval was received for the RN4CAST project by the regional Ethical Review Board in Stockholm (Dnr 2009/1587-31/5) prior to its initiation.

Data collection

In the RN4CAST survey, the included RNs were clinically active, working directly with inpatient medical or surgical care in acute-care hospitals. In Sweden, survey participants were recruited through the member register of the Swedish Association of Health Care Professionals, with >80% of clinically active RNs in the country as members (Vårdförbundet [Swedish Association of Health Professionals] Per Malmquist, personal correspondence, 1 February 2011). The member register contains information on workplace, both hospital and department, but not on the RN's specific function or involvement in inpatient versus outpatient care. All RNs registered as working in medical or surgical departments were therefore recruited to receive the survey (N=33 083). The survey was distributed between January and March 2010 by Statistics Sweden with the option of answering by web or paper. After three reminders, the return rate was 69.8% (n=23 087), with 12% of responses received via the web version of the survey.

The first survey questions were formulated to control inclusion criteria, that is, if the respondent was clinically active in direct inpatient adult medical or surgical care. At this stage, 12 913 RNs were excluded since they did not meet inclusion criteria, for example, workplaces or functions beyond the scope of inclusion criteria for the study, giving a total study database of 10 174 respondents. Due to internal attrition or invalid responses on the survey items that are analysed here, an additional 938 RN responses were excluded. The responses of all the remaining 9236 RNs constitute the database for this article.

Variables

Explanatory variables

The three subscales—(1) staffing and resource adequacy, (2) collegial nurse–physician relations and (3) nurse manager ability, leadership and support of nurses—from the Practice Environment Scale of the Nursing Work Index—Revised (PES-NWI)[16–18] have been used to investigate different dimensions of the *nursing work environment* on a four-point scale ranging from 1=strongly disagree to 4=strongly agree. The items included in each subscale are shown in table 1. The PES-NWI subscales were analysed by calculating means for the individual RN, ranging from 1 to 4 in each subscale. As noted above, observations with missing values in >50% of the items in each subscale were omitted in the analysis (n=148) to avoid the mean of the subscale for an individual nurse being determined by a single item. The reliability of the three subscales was tested using an internal consistency test, Cronbach's α. All subscales had a Cronbach's α between 0.76 and 0.89, which is consistent with prior research.[17 18 23]

RN work experience was investigated by the single question: "How many years have you worked as a registered nurse in your career?" *RNs' level of involvement in direct patient care* was assessed with the question: "How would you describe your role in caring for most of the patients on your most recent shift?" The three response alternatives were (a) "I provided most care myself", (b) "I supervised the care by others and provided some myself" and (c) "I provided only limited care such as dressing changes or drug administration and most of the direct care was done by others".

Seven items derived from the Agency for Healthcare Research and Quality's (AHRQ) Hospital Survey on Patient Safety Culture (HSOPSC)[24 25] were used to investigate *patient safety culture*. Responses were given on a five-point Likert scale ranging from 1=strongly disagree to 5=strongly agree (items shown in table 1).

Outcome variable

Global patient safety grade is based on the responses to a single-item assessment, "Please give your unit/ward an overall grade on patient safety", on a five-point scale ranging from 1=failing to 5=excellent. The global patient safety grade item comes from the HSOPSC instrument, which has been used and validated in several studies.[24–27]

Table 1 presents correlations between the individual explanatory variables and the global patient safety grade. The highest correlation was found for the item "The actions of hospital management show that patient safety is a top priority" (Spearman 0.44), with only two other items over 0.40. All correlations were significant.

Table 1 Correlation matrix of individual items and the patient safety grade

	Patient safety grade (Spearman correlation coefficient)	Reliability (Cronbach's α)
Staffing and resource adequacy (PES-NWI)		0.78
Adequate support services allow me to spend time with my patients	0.27*	
Enough time and opportunity to discuss patient care problems with other nurses	0.34*	
Enough registered nurses on staff to provide quality patient care	0.43*	
Enough staff to get the work done	0.41*	
Collegial nurse–physician relations (PES-NWI)		0.89
Physicians and nurses have good working relationships	0.27*	
Physicians value nurses' observations and judgements	0.20*	
Physicians recognise nurses' contributions to patient care	0.20*	
A lot of team work between nurses and physicians	0.22*	
Physicians respect nurses as professionals	0.24*	
Collaboration between nurses and physicians	0.26*	
Physicians hold nurses in high esteem	0.23*	
Nurse manager ability, leadership and support of nurses (PES-NWI)		0.76
A supervisory staff that is supportive of nurses	0.39*	
A nurse manager who is a good manager and leader	0.30*	
Praise and recognition for a job well done	0.29*	
A nurse manager who backs up the nursing staff in decision making, even if the conflict is with a physician	0.27*	
RNs' level of involvement in direct patient care		
How would you describe your role in caring for most of the patients on your most recent shift?	−0.04*	
Patient safety culture (HSOPSC)		
Staff feel like their mistakes are held against them	−0.32*	
Important patient care information is often lost during shift changes	−0.39*	
Things 'fall between the cracks' when transferring patients from one unit to another	−0.35*	
Staff feel free to question the decisions or actions of those in authority	0.27*	
In this unit, we discuss ways to prevent errors from happening again	0.36*	
We are given feedback about changes put into place based on event reports	0.32*	
The actions of hospital management show that patient safety is a top priority	0.44*	

Reliability of PES-NWI subscales is included.
*p<0.0001.
HSOPSC, Hospital Survey on Patient Safety Culture; PES-NWI, Practice Environment Scale of the Nursing Work Index; RNs, registered nurses.

Control variables

Individual nurse characteristics, education and sex were controlled for in the multivariate analysis. Since age was highly correlated with work experience (Pearson coefficient 0.8, p<0.0001), it was not controlled for in the multivariate model.

Statistical analysis

Descriptive statistics were used, including cross-tabulations, frequencies and graphs, to discern any data anomalies, such as outliers or extreme values, and to describe the study participants. Correlation coefficient tests (Pearson and Spearman) were used to investigate correlations between items.

For multivariate analysis, a proportional odds model[28] was used to estimate the effects of work environment, work experience as RN, RNs' level of involvement in direct patient care and patient safety culture on the global patient safety grade as the outcome. The proportional

odds model has the advantage of treating the outcome of patient safety as an ordinal variable, not assuming equal distance between response points.[28]

First, bivariate regression models were computed for each of the explanatory variables and the global patient safety grade. Thereafter, a multivariate proportional odds model for the global patient safety grade was performed by including all explanatory variables and controlling for education and sex. Empirical logits, predictor plots and a score test were used to check the proportional odds assumptions of the models. CIs were set at 95%. Data were analysed using SAS V.9.3.

RESULTS

Descriptive statistics

The 9236 RNs included in these analyses had a mean age of 39 years (median 38, SD 11), an average of 11 years' (median 8, SD 10) work experience as an RN

Table 2 Descriptive statistics of the outcome measure and independent variables

	n	%
Outcome measure		
Please give your unit or ward an overall grade on patient safety		
Failing	191	2
Poor	865	9
Acceptable	4 545	49
Very good	3 356	36
Excellent	279	3
Explanatory variables		
How would you describe your role in caring for most of the patients on your most recent shift?		
I provided most care myself	2 490	27
I supervised the care by others and provided some myself	5 098	55
I provided only limited care such as dressing changes or drug administration and most of the direct care was done by others	1 648	18

	Strongly disagree		Disagree		Neither		Agree		Strongly agree	
	n	%	N	%	n	%	n	%	n	%
The following questions ask for your opinion about patient safety issues in your employment setting:										
Staff feel like their mistakes are held against them	1 682	18	2 514	27	3 317	36	1 471	16	252	3
Important patient care information is often lost during shift changes	1 379	15	4 196	45	2 171	24	1 353	15	137	1
Things 'fall between the cracks' when transferring patients from one unit to another	473	5	2 602	28	2 919	32	2 829	31	413	4
Staff feel free to question the decisions or actions of those in authority	1 111	12	2 004	22	2 724	29	3 019	33	378	4
In this unit, we discuss ways to prevent errors from happening again	241	3	913	10	1 238	13	5 268	57	1 576	17
We are given feedback about changes put into place based on event reports	751	8	1 318	14	1 737	19	3 669	40	1 761	19
The actions of hospital management show that patient safety is a top priority	1 413	15	1 563	17	3 028	33	2 638	29	594	6

and worked at 79 acute-care hospitals in Sweden. The majority of these primarily female RNs (93%) had a bachelor's degree in nursing (59%) (data not shown).

The majority of respondents reported their level of involvement in direct patient care as "supervising the care performed by others and providing some care themselves". Approximately one-quarter reported "providing most care themselves", while 18% reported "providing limited care themselves, with most care provided by others" (see table 2).

Low-to-moderate correlations (Spearman −0.04 to 0.44) were found between the explanatory variables and the patient safety grade outcome (see table 1).

Almost half the responding RNs reported the global patient safety grade of their unit as acceptable. Over one-third gave a 'very good' or 'excellent' patient safety grade, while 11% graded patient safety at their unit as 'poor' or 'failing' (see table 2).

In four of the seven items (items a, c, d, g) assessing patient safety culture (see table 2), approximately one-third or more of the respondents were neutral (neither agreeing nor disagreeing with the statement). The proportion of neutral responses to the remaining three questions (items b, e, f) varied from 13% to 24%. Almost half the responding RNs disagreed (disagree or strongly disagree), while 19% agreed (agree or strongly agree) with the statement "that their mistakes are held against them". Most RNs disagreed that

"important patient care information often is lost during shift changes". There is an almost equal balance between RNs who disagreed and those who agreed with the item "things 'fall between the cracks' when transferring patients from one unit to another". While there is relative balance between RNs who disagreed and those who agreed with the statement "staff feel free to question the decisions or actions of those in authority", 12% of the responding RNs strongly disagreed with this statement, that is, reported not feeling free to question those in authority. The majority of RNs agreed with the statement that in their unit or workplace, they are "discussing ways to prevent errors from happening again". Most RNs also agreed they were "given feedback about changes put into place based on event reports". In the item regarding hospital management, there is relative balance between RNs who disagreed and agreed, but 15% strongly disagreed with the statement that "the actions of hospital management show patient safety is a top priority" (see table 2).

Multivariate analysis

The results of the multivariate analysis for nursing work environment, level of involvement in direct patient care, RN work experience and patient safety culture are shown in table 3. Three of the five explanatory variables with the highest odds of giving

Table 3 Relationship between work environment, RN involvement in patient care, patient safety culture, work experience and the patient safety grade outcome

	Unadjusted (bivariate) models		Adjusted (multivariate) models*	
	OR	95% CI	OR	95% CI
Work environment (PES-NWI)				
Staffing and resource adequacy (four items)	5.44	5.06 to 5.85	2.74	2.52 to 2.97
Collegial nurse–physician relations (seven items)	3.40	3.14 to 3.69	1.43	1.30 to 1.57
Nurse manager ability, leadership and support of nurses (four items)	4.50	4.18 to 4.84	1.49	1.36 to 1.63
RNs' level of involvement in direct patient care				
How would you describe your role in caring for most of the patients on your most recent shift?				
I provided most care myself vs I supervised the care by others and provided some myself	1.16	1.06 to 1.27	1.15	1.04 to 1.27
I provided most care myself vs I provided only limited care such as dressing changes or drug administration and most of the direct care was done by others	1.28	1.13 to 1.44	1.19	1.04 to 1.35
I supervised the care by others and provided some myself vs I provided only limited care such as dressing changes or drug administration and most of the direct care was done by others	1.10	0.99 to 1.22	1.03	0.92 to 1.16
Patient safety culture				
Staff feel like their mistakes are held against them	0.53	0.51 to 0.55	0.85	0.82 to 0.89
Important patient care information is often lost during shift changes.	0.41	0.39 to 0.43	0.65	0.61 to 0.68
Things 'fall between the cracks' when transferring patients from one unit to another	0.47	0.45 to 0.49	0.80	0.76 to 0.84
Staff feel free to question the decisions or actions of those in authority.	1.67	1.61 to 1.73	1.01	0.97 to 1.06
In this unit, we discuss ways to prevent errors from happening again.	2.24	2.14 to 2.35	1.27	1.20 to 1.35
We are given feedback about changes put into place based on event reports.	1.75	1.69 to 1.82	1.04	0.99 to 1.09
The actions of hospital management show that patient safety is a top priority	2.33	2.24 to 2.43	1.51	1.44 to 1.58
Work experience				
Work experience as a nurse (by increment of 5)	1.07	1.05 to 1.09	1.01	0.98 to 1.04

*Adjustments were made for gender and education (not shown).
PES-NWI, Practice Environment Scale of the Nursing Work Index; RNs, registered nurse.

a better patient safety grade are related to the nursing work environment, that is, the better the RNs rated their work environment, the better patient safety grade they gave their unit or ward.

Nursing work environment
As noted, the three PES-NWI subscales were each averaged, with means ranging from 1 to 4. This means that for a one-step increase in the subscale, the odds indicate the probability of scoring the patient safety grade one full scale step better using the mean.

The subscale *staffing and resource adequacy* was associated with an increase in RN-reported patient safety by a factor of 2.74 (OR). *Nurse manager ability, leadership and support of nurses* was related to a 51% increase (OR 1.49), while *collegial nurse–physician relations* was associated with a 43% increase (OR 1.43) in RN-reported patient safety.

Patient safety culture
In the patient safety culture items, two of the positively worded items were statistically significant. The item "The actions of hospital management show that patient safety is a top priority" showed the largest increase in RN-reported patient safety (OR 1.51), followed by the item "In this unit we discuss ways to prevent errors from happening again" (OR 1.27).

The statement that "important patient care information often is lost during shift changes" was associated with a decrease in RN-reported patient safety by a factor of 0.65 (OR). Statistically significant odds of giving a lower patient safety grade were also seen for the statements "things 'fall between the cracks' when transferring patients from one unit to another" (OR 0.80) and "Staff feel like their mistakes are held against them" (OR 0.85) (see table 3).

RNs' involvement in direct patient care
In the case of RN involvement in direct patient care, the comparison between the least active role in direct patient care ("I provided only limited care such as dressing changes or drug administration and most of the direct care was done by others") and the most active role in direct patient care ("I provided most care myself") was associated with a 19% increase in RN-assessed patient safety if the RN reported providing most care herself (see table 3).

Length of RN work experience
Length of RN work experience shows no effect on RNs' assessment of patient safety in their workplace in the adjusted multivariate analysis.

DISCUSSION

In this national population-based study of 9236 RNs working in inpatient care in all 79 acute-care hospitals in Sweden, we found that nursing work environment factors are strongly related to RNs' own assessments of patient safety. In these data, the RNs' perception of having adequate staffing and resources increased their assessment of patient safety by at least two and a half times (per scale step). We found that RNs with more involvement in direct patient care gave a better patient safety grade than RNs with a more supervisory role. We also found that the majority, but not all, of the patient safety culture items were related to the RN-assessed patient safety grade and that work experience seems to have no statistical influence on this assessment.

This study is part of a larger multinational study, RN4CAST, conducted within the EU 7th Framework Program. This involves both benefits and potential limitations. In some cases, survey items may lack specificity in the Swedish context, but on the other hand, the RN4CAST project design allows benchmarking with other settings and comparison with previous research. The items used in this analysis were all relevant in the Swedish setting. While another potential limitation of the study is that RNs included in the Swedish RN4CAST project were sampled through the Swedish Association of Health Care Professionals, it should be noted that >80% of RNs are members of this organisation. The return rate of nearly 70% gives good coverage of clinically active RNs working with inpatient care in Sweden. Other sampling strategies, for example, through hospital management, as was the case in most other RN4CAST countries, involve other potential, although different, biases. The RN4CAST project focuses on inpatient care in medical or surgical departments in acute-care hospitals, although when considering the applicability of the results it should be remembered that other areas such as intensive care, labour and delivery, psychiatric wards and paediatric care are excluded. This Swedish study is unique not only because of its scope and in using a national sample of RNs representing all acute-care hospitals in the country but also because of the limited prior research in Sweden in this area.

Our study shows that certain aspects of the nursing work environment highly affect how RNs assess patient safety at their unit or workplace. We find it notable that over a third of the RNs chose a 'neutral' response in several of the individual patient safety culture items, although this survey data do not allow us to better probe the reasons for this. On the other hand, from an organisational perspective, one might consider positive responses as favourable and other responses—negative or neutral—as indicative of a need for improvement. We find that positive RN reports of having enough staffing and resources to discuss nursing issues with other RNs, to get the work done, and to deliver quality care, as well as having good collegial nurse–physician relations, and visible and competent nursing leadership are all highly related to RNs grading overall patient safety as better.

This last aspect is supported by the IOM report,[10] which also emphasises the importance of strong, visible nursing leadership in creating a positive work environment and a 'culture of safety'. Several earlier studies have found adequate staffing to be linked to lower 30-day mortality.[3][6][29] In a recent study, Aiken et al[1] link adequate nurse staffing and better-educated nurses in combination with a good work environment to decreased patient mortality, whereas hospitals with poor work environments were found to have the opposite outcome. In line with our study results, good nurse–physician relations and teamwork have been shown in a number of other studies to be positively related to patient safety outcomes.[7][30]

Our findings, along with the results of prior research in other settings, emphasise the importance of a work environment that enables RNs to feel safe and confident when providing care. The perception of having enough staff and resources may not be consistent with actual patient:staff ratio, but it appears to be an important factor related to how RNs view patient safety at their ward or unit.

Length of RN work experience is a more complex issue. Despite our preconceived assumption that experience might be an important factor in patient safety assessments, in this study we found no effect of the length of RN work experience on RNs' assessment of patient safety at their ward or unit. Other research on the relationship between work experience and safety outcomes shows mixed results. Some studies find a positive relationship between longer work experience and patient safety and safety practices,[31–33] whereas other studies find these relationships are weak or non-existent.[34][35] The studies differ in design, concept instrumentalisation, measurement tools and size; in addition, work experience is generally used as a control variable rather than as an explanatory variable in itself. In our study, work experience might be seen as a mediator since it shows a significant effect in the bivariate analysis but not in the multivariate analysis. It might be that the potential effect of work experience is covariant with some other variable that is absorbed by the 'true' explanatory variable in the multivariate analysis. It seems that work experience might be an important factor and may influence aspects of patient safety, but that this issue warrants further investigation.

Another intriguing finding in our study is that, in the multivariate analysis, three of the seven items assessing patient safety culture were not significantly related to RNs' assessment of global patient safety. This raises the question of whether the single-item global patient safety grade may say more about the assessments of nursing work environment than about patient safety per se. The use of this single patient safety item in RN4CAST is aimed to capture clinically active RNs' views of patient

safety at their workplace. This item reflects not only the care they themselves provide but also allows an overview of their perspective of the safety of the care provided in general at their nursing ward. Single global items are often used in research settings, for example, in assessing quality of life, quality of care and other broad concepts. Single items have the benefit of being easy to administer and to answer, which potentially may give a higher response rate, and can be said to be all-encompassing, as they require respondents to consider their situation, choose what is relevant and not relevant, and then provide a single rating.[36–38] One potential disadvantage of using a global item might be that it is difficult to know exactly what RNs include in their view of the patient safety concept. However, during the translation process of the full RN survey, seven think-aloud interviews were performed, in which RNs who had answered the survey were asked, among other things, what they considered when answering the patient safety item. All these RNs answered that they considered the care provided at their ward, not only the care they provided themselves. This points to the importance of further investigation into not only into the subjective measure of RN-assessed overall patient safety but also into its relation to objective patient safety outcomes.

CONCLUSION

In this study, we investigated how individual RN factors and work environment factors relate to RNs' own assessment of patient safety at their workplace, finding that RNs' assessment of overall patient safety grades was related to their own perceptions of having enough staffing and resources to deliver quality nursing care, as well as having good collegial nurse–physician relations, and the presence of visible and competent nursing leadership. While research emphasises patient-to-nurse ratios in strengthening patient safety practices in hospital care,[1–5] it is important to investigate RNs' experiences of their work setting as they are at the 'sharp end' of patient care and are an instrumental part of patient safety work. RNs work at the patient's bedside, providing 'round-the-clock' care; it is therefore vital to know more about their practice environment to ensure good and safe care. Identifying work environment factors that are linked to patient safety adds to a systems approach to solving patient safety problems rather than using individual error events as the source for solutions.

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