Nurse-reported patient safety climate in Swiss hospitals

A descriptive-explorative substudy of the Swiss RN4CAST study

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Summary

QUESTIONS UNDER STUDY: Measuring the patient safety climate in the organisation of healthcare can help to identify problematic issues with a view to improving patient safety. We aimed (1) to describe the nurse-reported engagement in safety behaviours, (2) to describe the prevailing nurse-reported patient safety climate of general medical, surgical and mixed medical-surgical units in Swiss acute-care hospitals and (3) to explore differences between hospital type, unit type and language regions.

METHODS: This substudy utilised data from the nurse survey (N = 1,633) of the multicentre-cross sectional RN4CAST study. Patient safety climate was measured with the 9-item Safety Organizing Scale (SOS) which captured registered nurses' engagement in safety behaviours and practices at the unit level.

RESULTS: A total of 35 Swiss hospitals participated in the study. Of the 120 eligible units included in the analysis, only on 33 units (27.5%) did at least 60% of the nurses report a positive patient safety climate. A majority of nurses (51.2–63.4%, n = 1,564) reported that they were "consistently engaged" in only three of the nine measured patient safety behaviours. Our multilevel regression analyses revealed both significant between-unit and between-hospital variability. From our three variables of interest (hospital type, unit type and language regions) only language regions was consistently related to nurse-reported patient safety climate. Nurses in the German-speaking region reported a more positive patient safety climate than nurses in the French- and Italian-speaking language regions.

CONCLUSIONS: The findings of this study suggest a need to improve the patient safety climate on many units in Swiss hospitals. Leaders in hospitals should strengthen the patient safety climate at unit level by implementing methods, such as root cause analysis or patient safety leadership walk rounds, to improve individual and team skills and redesign work processes. The impact of these efforts should be measured by periodically assessing the patient safety climate with the SOS.

Key words: *patient safety behaviours; patient safety climate; Switzerland; acute-care hospitals; general surgical and medical units*

Introduction

Today's hospital-based healthcare is highly complex and despite high quality standards adverse events (AEs) occur every day. Internationally, between 2.9% and 16.6% of hospitalised patients are affected by AEs, such as surgical (peri- and postoperative) complications, medication errors, healthcare-associated infections or patient falls [1–6]. Healthcare is often delivered in a high risk and dynamic environment, involving a vast array of technology and many individual decisions and judgments by healthcare professionals. Most AEs do not result from individual recklessness [7], but from faulty systems/processes that provide conditions that lead people to make mistakes or fail to prevent them [8].

According to international experts, the development of a so-called "culture of safety" within healthcare organisations appears to be a systemic and fruitful approach to better understanding of patient safety mechanisms and protecting patients from harm due to AEs [9, 10]. Patient safety culture is defined as a "subset of organizational culture, which relates specifically to values and beliefs concerning patient safety within healthcare organizations" [11, p. 312]. In high-risk industries such as aviation or nuclear power a common approach to the evaluation and improvement of the safety culture is the use of workforce surveys designed to assess and monitor the safety climate (i.e. the perceived safety culture of a particular place at a particular time) [12].

Measuring the patient safety climate (PSC) in healthcare organisations provides insight into the safety of healthcare environments [10]. Such results, in turn, can help to identi-

fy problematic areas/issues and lead to the development of adequate counter measures [13–16]. Recent studies investigated the PSC within hospitals and its various clinical areas. The results showed that employees' perceptions of the PSC varied between and within hospitals [17]. Personnel in specialised areas where patients may be at higher risk for AE, such as emergency departments, perceived lower PSC than those in other hospital wards. Nurses had an on the whole lower perception of the PSC than other disciplines (e.g. physicians) and frontline workers perceived a lower PSC than management [18–20]. Studies have identified problematic PSC issues in intensive care units [21–23] and operating rooms [24–27], such as poor communication and teamwork [25].

Despite increasing interest in studying the PSC in healthcare organisations in recent years, most research on this topic was carried out in the US and few studies have been conducted in European healthcare systems [15, 28, 29], including Switzerland [30]. In addition, although the perception of PSC has been found to differ between various healthcare professionals, little attention has been given to describing nurses' perceptions of the PSC in depth, which is important considering their key role in delivering patient care and protecting patients from harm [31]. For the first time in Switzerland, we aimed (1) to describe the nurse-reported PSC on general medical, surgical and mixed medical-surgical units in a national hospital sample, (2) to describe nurses' engagement in specific safety behaviours, and (3) to explore the association between the nurse-reported PSC and characteristics of Swiss acute care hospitals. We hypothesised that there would be differences in nurse-reported PSC based on (a) hospital type (university/cantonal hospital versus regional hospitals), (b) unit type (medical versus surgical units) and (c) language regions (German- versus French- / Italian-speaking).

Methods

Design

For this substudy we used nurse survey data from the multicentre-cross sectional Swiss-RN4CAST (Nurse Forecasting: Human Resources Planning in Nursing). The Swiss RN4CAST is part of the 12 European-country RN4CAST study funded by the EU 7th Framework (EU Project number: 223468). Using a cross-sectional design the RN4CAST assessed a number of variables, such as the nurse work environment, nurse staffing and educational level, nurse outcomes (e.g. job satisfaction, burnout) and patient outcomes (e.g., patient satisfaction, risk-adjusted in-hospital mortality) through nurse and patient surveys as well as administrative hospital and patient discharge data. The main aim of the RN4CAST study was to enrich and refine traditional nurse forecasting models with factors that take into account how features of the work environment impact on nurse retention, burnout and patient satisfaction. Thus, it allows simulation of scenarios to illustrate how changes of different nurse-related organisational factors impact on future nursing workforce needs [32].

Sample

The sample of this substudy included registered nurses (RNs) working on medical, surgical and mixed medical-surgical units in Swiss acute care hospitals. The sampling method of the Swiss RN4CAST study was a multi-stage sampling approach. In the 1st step we selected acute-care hospitals using quota sampling. For step 1 we obtained a list of all acute-care hospitals (n = 150) from the Swiss Federal Office of Public Health for the year 2005. Hospitals were eligible to participate if they had at least 60 acute care beds and employed at least 50 RNs. We aimed to include a total of at least 30 hospitals and one hospital for each language region and canton. From a total of 150 acute-care hospitals 88 (62 German-, 19 French- and 7 Italian-speaking hospitals) met our eligibility criteria. Based on the number of hospitals per language region and per canton (ranging from 1 to 14 hospitals), 41 hospitals were selected and invited to take part in the study on the basis of research group consensus. From those 41 hospitals, hospital directors and chief nursing officers from 35 hospitals (85%) agreed to participate and gave their written consent to participation in the study, anonymous benchmarking and dissemination of the study results.

In the 2nd step, a total sample of 132 units from the 35 study hospitals was included: 62 general medical, 59 general surgical units and 11 mixed medical-surgical wards (German-speaking region only). Within the participating university and cantonal hospitals units were randomly selected (n = 76 units) whereas in regional hospitals all medical/surgical wards (n = 56 units) had to be included to achieve the planned RNs sample size per hospital. In the 3rd step, within selected units all registered nurses (except those on sick leave, maternity leave or those who were on vacation) were invited to complete the questionnaires.

Measures

PSC was measured by the Safety Organising Scale (SOS) [33, see items in table 2]. The SOS measures the extent to which RNs and their colleagues engage in patient safety behaviours and practices on their unit. Its theoretical background lies in the high-risk industry and it was adapted for healthcare organisations to reflect crucial safety behavioural processes (e.g. preoccupation with failures) [33]. The SOS is a one-dimensional instrument, consisting of nine items each assessed by a 7-point Likert scale (1 = not at all, 2 = to a very limited extent, 3 = to a limited extent, 4 = to a moderate extent, 5 = to a considerable extent 6 = to a great extent and 7 = to a very great extent). The SOS score, the average of the single nine items, gives information on the prevailing PSC. The original English version of the SOS has excellent psychometric properties, such as high internal reliability (Cronbach's alpha = 0.88), convergent validity (e.g., comparative fit index = 0.964, root mean square error of approximation = 0.055, p <0.001 for all factor loadings) and criterion validity (medication error: B = –0.678, p <0.001 and patient falls: B = –0.629, p <0.001) [33].

The SOS was translated into German, French and Italian following a forward-backward translation procedure according to the adapted Brislin's model [34]. Psychometric evaluation according to the guidelines of the American Educational Research Association (AERA) [35] revealed

evidence based on content (S-CVI >0.89), response patterns (e.g. average of missing values across all items = 0.80%), internal structure (e.g. comparative fit indices >0.90, root mean square error of approximation <0.08) and reliability (Cronbach's alpha >0.79) for all three language versions. Intraclass correlations and within-group agreement demonstrated that the SOS is meaningful at the unit level, which justified aggregation of the individual SOS score at unit level.

The predictor variables, hospital type (university and cantonal = 1, regional = 2), unit type (surgical = 1, medical = 2, medical-surgical = 3) and language region (German-speaking = 1, French- and Italian-speaking = 2) were all categorical variables. As these three variables were inclusion criteria for the national hospital sample, data were retrieved prior and during the sampling strategy from the Swiss Federal Statistics Office (hospital types) and from the hospitals' chief nursing officers (unit types). According to the Swiss Federal Statistics Office, university and cantonal hospitals in Switzerland are characterised by a higher number of medical specialties, with complex structures and processes, and they provide healthcare services for a larger number of patients and a larger proportion of seriously ill patients than regional hospitals [36].

Sociodemographics and professional characteristics on the participating RN included age (in years), education/training in Switzerland (0 = no, 1 = yes), employment level (10–100%), professional experience as an RN (in years) and professional experience in the hospital where they were currently working (in years) and were collected with a subscale of the nurse questionnaire which has been used in previous outcome studies [37, 38].

Data collection and data management

Data collection took place from 12 October 2009 to 30 June 2010. For each participating hospital a predefined contact person (e.g. ward nurses, clinical nurse specialists or chief nursing officers) supported us in planning and data collection. All requisite documents, including the nurse survey questionnaire and additional information on the study, were prepared at the Institute of Nursing Science (University of Basel) and sent to the contact persons in each participating hospital. They distributed the questionnaires to all eligible RNs on the selected units. The questionnaires were distributed with prepaid, addressed envelopes for return of the completed questionnaires by the RNs to the research team. Response rates were calculated for each unit, based on the number of questionnaires that were sent out by the research team and sent back by RNs. Units with response rates <70% after two weeks were reminded by the contact person to complete the questionnaires and if necessary again, to improve the response rate, four weeks after distribution of the questionnaires. Completed questionnaires were scanned and data underwent quality control (e.g. 10% of entered questionnaires were randomly selected and checked for data entry errors).

Statistical methods

To describe the RN and hospital samples and to detect data anomalies (e.g. outliers, extreme values and missing values) descriptive analyses such as frequencies, means, standard deviations, medians, interquartile ranges, cross-tabulations and graphs were performed. As the missing value rate per item was very low (<1.9%), for descriptive and inferential analyses only SOS questionnaires with complete data were included.

First, to describe the nurse-reported PSC on the hospital units, the SOS total score was calculated as the average of the scores on the nine items. Then the proportion of RNs who reported a positive PSC (SOS score ≥6, "to a great extent") for their unit was calculated. In this study, units were considered to have a positive PSC if at least 60% of RNs reported an average SOS score ≥6 (consistent with engaging in the measured behaviours to a great or very great extent). Units were only included in these analyses if at least 50% of their eligible RNs completed the survey.

Second, to describe RNs' perceptions that they and colleagues on their unit are engaged in each of the nine safety behaviours measured by the SOS, we collapsed the 7-point Likert scale to a 3-point Likert scale as follows: not at all (1) and to a very limited (2) and limited (3) extent were recoded as not engaged; to a moderate (4) and considerable (5) extent were recoded as not consistently engaged; and to a great (6) and very great (7) extent were recoded as consistently engaged. We then calculated the number and proportion of RNs who reported that they and colleagues were not engaged, not consistently engaged and consistently engaged in each of the behaviours.

Third, to test our two-sided hypothesis we used regression analyses with the SOS score as dependent variable and language region, hospital size and unit type as independent dichotomous variables (model 1) and adjusted for RN sociodemographics and professional characteristics as possible confounding variables (model 2). We adjusted for the hierarchical data structure (nurses nested within units and units nested within hospital), using multilevel linear modelling with units and hospitals as random effects (model 3). We excluded mixed medical-surgical units from the regression analysis, as they were only present in the German-speaking hospitals and data from RNs working on these units was not comparable to those from RNs working on either medical or surgical units.

The level of significance was set at p <0.05. Descriptive analyses were completed using IBM SPSS Statistics (version 18.0.2; SPSS Inc., Chicago, IL) and Microsoft Office Excel 2011®; for regression analyses we used STATA (version 11.2/SE; StataCorp LP).

Ethical aspects

The study was approved by all 13 responsible ethical committees of the respective cantons. RNs were surveyed voluntarily and they gave their consent to participate in the study by filling out and sending back the questionnaires. Measures were taken to protect the identity of the nurses and to guarantee the confidentiality of collected data (e.g. pre-coded questionnaires, prepared addressed envelopes, and questionnaires stored under lock and key).

Results

Hospitals and nurses

In total, 35 hospitals from the three language regions of Switzerland participated in the RN4CAST study. The hospitals included 4 university, 15 cantonal and 16 regional hospitals varying in size from <200 to >500 acute care beds. Most of the participating hospitals were regional hospitals with fewer than 200 acute-care beds.

A total of 1,633 RNs from 132 medical, surgical and mixed medical-surgical units completed the questionnaires, corresponding to an overall response rate of 72%. Response rates at the unit level ranged between 40% and 100%. The majority (91.7%) of RNs were female, 41.7% were aged 20–30 and almost half of the respondents (48.5%) were employed in full-time positions (working >90%). Their median years of "professional experience as a nurse" and the "professional experience as a nurse in the given hospital" were 8 years and 5 years respectively. Two thirds of the respondents (65.9%) were German-speaking. The proportion of RN working on medical units (48.4%) was slightly higher than the proportion on surgical units (44.8%) (table 1).

Nurse-reported patient safety climate in Swiss hospitals

Most respondents (1,564 of 1,633 RNs; 95.77%) filled out the SOS without omitting items. Overall their perceptions
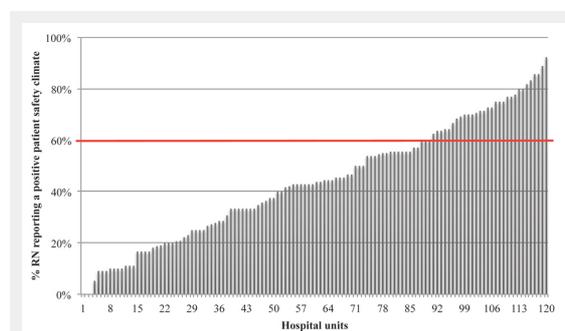

Figure 1

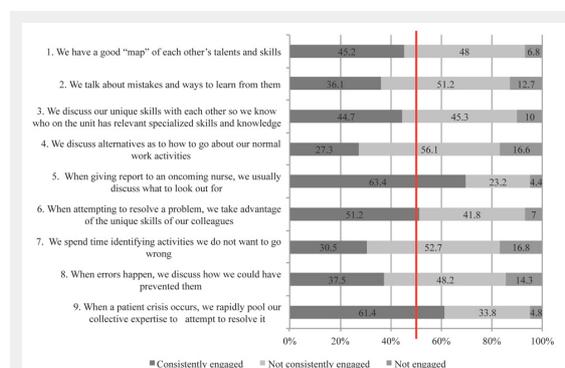Unit's patient safety climate (n = 120).

Figure 2

Frequencies (%) of the single items comparing RN's engagement ("Consistently engaged" = answer categories 6–7, "Not consistently engaged" = answer categories 4–5, "Not engaged" = answer categoreis 1–3) in safety behaviours (n = 1,564).

of the extent to which their unit engagement in the listed patient safety behaviours ranged between a moderate (4) to considerable extent (5) for item 4 "We discuss alternatives as to how to go about our normal work activities" (mean = 4.62 [95% CI: 4.56–4.69]) and to a considerable (5) and great (6) extent for item 5 "When giving report to an oncoming nurse, we usually discuss what to look out for" (5.62 [95% CI: 5.57 to 5.68]). The average SOS score on the nine items was 5.11 (95% CI: 5.07–5.16) suggesting that on average RNs perceived that the behaviours measured were practised to a considerable extent on their unit (table 2).

To compare the PSC on the participant medical, surgical and mixed medical-surgical units we computed the proportion of RNs on each unit reporting a positive PSC (defined as a mean SOS score ≥6). From a total of 132 units, 120 units had a response rate >50% and were eligible for this analysis. The proportion of RNs per unit reporting a positive PSC ranged from 0% to 92.31% (mean = 43.84%, 95% CI: 39.67% to 48.01%). The RN-reported PSC was positive on only 33 out of 120 units (27.5%). For three units (2.5%) no RN reported a positive PSC (fig. 1).

Figure 2 shows the proportion of RNs who reported that they and colleagues were not engaged, not consistently engaged and consistently engaged in each of the PSC behaviours based on the collapsed SOS categories. The behaviours that the highest proportion of the participants (63.4% and 61.4% respectively) reported that they and colleagues engaged in consistently were "When giving report to an oncoming nurse, we usually discuss what to look out for" (Item 5) and "When a patient crisis occurs, we rapidly pool our collective expertise to attempt to resolve it" (Item 9). The behaviour that fewest reported engaging in consistently was "We discuss alternatives as to how to go about our normal work activities" (Item 4; 27.3% of participants).

Differences between nurse-reported PSC

Data from 1,456 RNs were included in regression analysis. In the two naive regression models the unit type and language regions were significantly associated with the nurse-reported PSC with (1) RNs working on medical units expressing higher PSC than RNs working on surgical units and (2) RNs from the French- and Italian-speaking language regions reporting lower PSC than RNs from the German-speaking language region (table 3). For our third variable of interest, hospital type, RNs working in regional hospitals reported higher PSC than those in university and cantonal hospitals, but the results were only borderline statistically significant (see table 3).

Adjusting also for the hierarchical data structure, considering units and hospitals as random effects (regression model 3) we found both significant between-unit variability (variance = 0.100, SE = 0.024, 95% CI: 0.062 to 0.699) and significant between-hospital variability (variance = 0.040, SE = 0.022, 95% CI: 0.014 to 0.118). In this fully adjusted model only language regions remained a significant predictor for nurse-reported PSC. When we included socio-demographic and professional characteristics as potential confounding variables (Model 2 and 3), we observed a significant negative relationship between RNs' total years of experience in the participating hospital and PSC, but we

did not find significant relationships for age, educational level, employment level or professional experience in the hospital where RNs were currently working and PSC (table 3).

Discussion

This is the first study to describe the nurse-reported PSC in a representative national sample of Swiss acute care hospitals. We observed variability in the extent to which

Table 1: Characteristics of hospitals and RN.

Hospital characteristics		RN4CAST hospital sample (n = 35)	Swiss acute-care hospital population* (n = 150)
		n (%)	n (%)
Hospitals per language region			
German-speaking		20 (57.0)	105 (70.0)
French-speaking		11 (31.5)	34 (22.7)
Italian-speaking		4 (11.5)	11 (7.3)
Hospital type			
University hospital		4 (11.0)	5 (3.3)
Cantonal hospital		15 (43.0)	23 (15.4)
Regional hospital		16 (46.0)	122 (81.3)
Hospital size			
Large (>500 acute-care beds)		6 (17.0)	9 (7.6)**
Medium (200–500 acute-care beds)		11 (31.0)	29 (24.4)**
Small (<200 acute-care beds)		18 (52.0)	81 (68.0)**
RN characteristics (n = 1633)	**Median (IQR)**	**n (%)**	
Female		1,466 (91.7)	
Age in years			
20–30		652 (41.7)	
31–40		437 (27.9)	
41–50		321 (20.5)	
>50		155 (9.9)	
Nursing education in Switzerland		1275 (78)	
Employment			
>90%		766 (48.5)	
51–90%		515 (32.6)	
10–50%		299 (18.9)	
Professional experience in years,			
as a nurse	8 (15)		
in this hospital	5 (10)		
RN per language region			
German-speaking		1,074 (65.9)	
French-speaking		401 (24.6)	
Italian-speaking		155 (9.5)	
RN per unit type			
Surgical units		731 (44.8)	
Medical units		789 (48.4)	
Mixed medical/surgical units (only German-speaking region)		110 (6.7)	
Number of RN per unit	12 (5)		

* Characteristics on the Swiss acute-care hospital population (without psychiatric and rehabilitation clinics) were retrieved from the annual hospital statistics 2005 of the Swiss Federal Office of Public Health (www.bag.admin.ch/)
** Data available only on 109 of 150 acute-care hospitals

Table 2: Mean, 95% confidence interval (CI), standard deviation (SD), median and interquartile range (IQR), for the single nine items and the SOS score (n = 1,564).

Items of the SOS [33]	Mean (95% CI) ± SD	Median (IQR)
We have a good "map" of each other's talents and skills	5.23 (5.17 to 5.28) ± 1.073	5 (1)
We talk about mistakes and ways to learn from them	4.92 (4.86 to 4.98) ± 1.251	5 (2)
We discuss our unique skills with each other so we know who on the unit has relevant specialised skills and knowledge	5.13 (5.07 to 5.19) ± 1.237	5 (2)
We discuss alternatives as to how to go about our normal work activities	4.62 (4.56 to 4.69) ± 1.270	5 (2)
When giving report to an oncoming nurse, we usually discuss what to look out for	5.62 (5.57 to 5.68) ± 1.071	6 (1)
When attempting to resolve a problem, we take advantage of the unique skills of our colleagues	5.30 (5.25 to 5.36) ± 1.154	6 (1)
We spend time identifying activities we do not want to go wrong	4.71 (4.64 to 4.77) ± 1.330	5 (2)
When errors happen, we discuss how we could have prevented them	4.91 (4.84 to 4.97) ± 1.305	5 (2)
When a patient crisis occurs, we rapidly pool our collective expertise to attempt to resolve it	5.58 (5.53 to 5.64) ± 1.060	6 (1)
SOS-score	5.11 (5.07 to 5.16) ± 0.913	5 (1)

RNs reported that they and colleagues engage in the individual safety behaviours measured and the PSC climate across units and hospitals. The three items that the RNs reported they and colleagues consistently engaged in reflected safety behaviours such as nurses' shift reports and the use of one another's skills and expertise in critical situations and in resolving problems in patient care. As more than half of the participating RNs reported that personnel of their units consistently engaged in these activities (SOS score ≥6, consistent with "to a great extent"), it may be that these are implicit safety behaviors that are seen as part of their daily business in preventing/protecting patients from harm. Furthermore, results on the use of one another's skills and expertise in critical situations and in resolving problems (items six and nine) suggest good interprofessional relations and communication among RNs and physicians, essential for high levels of patient safety and quality of care [39].

However, in our sample a high proportion of RNs reported that they and colleagues did not or did not consistently engage in six out of the nine behaviours. Those items reflect important patient safety behaviours such as proactive and preemptive analysis and discussion of possible unexpected events, ability to detect and learn from errors and critical thinking about normal, everyday work activities/processes. Learning from errors and near misses is crucial for patient safety and over the last several years many European countries including Switzerland have invested in patient safety measures, methods and instruments. For example, Critical Incident Reporting Systems (CIRS) have been implemented in healthcare systems [40–43]. However, for the benefits of such well-meant systems to be realized, healthcare professionals must be willing to report and share errors [44], which is known to be problematic. In one study, for example, RNs reported only half of the medication errors that occurred [45]. Despite a blame-free and non-punitive environment [45] the functioning and success of CIRS might depend also on healthcare professionals' individual capabilities and skills in detecting, reporting, analysing and learning from errors. To strengthen these individual skills and to increase willingness to report and share errors on systemic levels, creating a "positive" PSC at unit level by

implementation of appropriate activities, such as root cause analysis, is necessary [46].

In addition to processes responding to errors that occur, proactive analyses of unexpected events and critical analysis of existing work activities/processes are important to avoid errors. The results of our study suggest that these behaviours are not yet "implicit behaviours" to the same extent as other safety behaviours measured by the SOS. Activities addressing these proactive behaviors that have been reported in the scientific literature include tools such as patient safety leadership walking rounds [47], safety briefings [48] and Healthcare Failure Mode and Effect Analysis (HFMEA™) [49]. Such prospective methods, aiming to stimulate healthcare professionals' safety awareness and to identify and prevent process problems before they occur, may not yet be extensively implemented in Swiss acute care hospitals.

The fact that the majority of RNs reported that they and colleagues did not consistently engage in six out of the nine SOS safety behaviours was also reflected in a low proportion of units with an overall positive PSC. Given that previous research has shown that units and hospitals with a lower PSC have higher rates of AEs, such as medication errors and patient falls [33, 50, 51], these findings should encourage Swiss hospitals to improve their PSC.

Our hypothesis, that there would be differences in nurse-reported PSC based on (a) hospital type, (b) unit type and (c) language regions, was only partially supported, as in our multilevel model only language region significantly related to variability in the nurse-reported PSC. The higher nurse-reported PSC in the German-speaking region could be related to the implementation of several initiatives on patient safety in recent years, such as the "Critical Incident Reporting and Reacting NETwork (CIRRNET)" in 24 hospitals [52], initiated by the Swiss patient safety foundation first in the German-speaking language region of Switzerland. Recently, CIRRNET and other important initiatives (e.g., "Error & Risk Analysis") are being extended to the Italian- and French-speaking regions or initiated at national level [52] and may contribute to improvement in PSC at the unit level. In our naïve regression models we found that (1) RNs on surgical units reported lower PSC than nurses on medic-

Table 3: Association between the nurse-reported PSC and characteristics of Swiss acute care hospitals (n = 1,456).

Variables	Model 1 (naive, unadjusted)		Model 2 (naive, adjusted)		Model 3 (multilevel, adjusted)	
	Coefficient (p)	95% CI	Coefficient (p)	95% CI	Coefficient (p)	95% CI
Hospital type*	0.093 (0.059)	–0.004 to 0.189	0.091 (0.065)	–0.006 to 0.187	0.125 (0.230)	–0.079 to 0.329
Unit type#	0.104 (0.025)	0.013 to 0.195	0.101 (0.030)	0.009 to 0.193	0.070 (0.346)	–0.076 to 0.217
Language region+	–0.434 (<0.001)	–0.526 to –0.342	–0.436 (<0.001)	–0.529 to –0.343	–0.428 (<0.001)	–0.630 to -0.227
RN age – in years			0.001 (0.552)	–0.001 to 0.003	0.0001 (0.947)	–0.002 to 0.002
RN education°			–0.001 (0.597)	–0.170 to 0.068	–0.002 (0.507)	–0.006 to 0.003
Employment level – %			–0.0003 (0.575)	–0.001 to 0.002	0.0003 (0.676)	–0.001 to 0.002
RN professional experience (total) – in years			–0.003 (0.017)	–0.010 to -0.001	–0.003 (0.029)	–0.005 to –0.0003
RN professional experience (hospital currently working) – in years			0.002 (0.150)	–0.001 to 0.005	0.002 (0.163)	–0.001 to 0.005
Constant	5.441 (<0.001)	5.210 to 5.671	5.409 (<0.001)	5.152 to 5.666	5.433 (<0.001)	4.952 to 5.915

* Hospital type: university and cantonal hospitals versus regional hospitals
# Unit type: surgical units versus medical units
+ Language region: German-speaking region versus French- and Italian-speaking region
° RN education: education in Switzerland versus education outside Switzerland

al units and (2) RN working in regional hospitals expressed higher perceptions of their unit's PSC than RNs working in cantonal and university hospitals. These results might indicate that greater complexity of structures (university and cantonal hospitals) and a large number of interfaces in the care processes (e.g. peri- and post-operative care) might have a negative impact on the PSC, as it is more difficult for health care professionals, such as RNs, to guarantee patient safety in such environments. However, after statistical adjustment for the nested data structure, these relationships were no longer significant. These results indicate that the PSC variability between units and between hospitals is in general higher than the variability between medical or surgical units and between university/cantonal or regional hospitals.

Limitations of the study

Even though this study allowed us to form a picture of nurse-reported PSC in the acute care setting, there are some limitations/precautions to consider. The RN4CAST study used a cross-sectional study design, which does not allow assessment of causal relationships between study variables. Since we have not used randomised sampling techniques in all stages of our sampling process, this increases the risk of bias. External validity is restricted to general medical, surgical and mixed medical-surgical units in Swiss acute care hospitals. Since we only included acute-care hospitals with 60 or more beds to achieve a sample size of at least 50 RNs per hospital, regional hospitals were relatively underrepresented in contrast to the total hospital population.

The SOS gives important information on crucial patient safety behaviours and processes at unit level, but other aspects of PSC such as management support for patient safety engagement or a blame-free environment [11, 30] are not measured with the SOS. Hence the SOS may not present a complete picture of the PSC. As the RN4CAST study included only RNs, the PSC perceptions of other healthcare professionals, e.g. physicians, were not captured.

Conclusions

The results of this study provide initial insights on RNs' perceptions of the extent to which they and colleagues engage in patient safety behaviours and the prevailing PSC on general medical, surgical and mixed medical-surgical units in a national sample of Swiss acute care hospitals. Despite the increasing awareness of patient safety in Switzerland in recent years, our findings show variability in RNs' perceptions of safety behaviours, as well as significant variability in the prevailing PSC between units, hospitals and language regions, and indicate the potential for improvement. Hospital leaders at various levels should strengthen the PSC at the unit level and support/foster healthcare professionals' engagement in safety behaviors by implementing safety methods such as root cause analysis, patient safety leadership walk rounds or safety briefings and de-briefings. This could, in turn, improve individual and team skills and awareness concerning discussions on errors, proactive and critical analyses of possible unexpected events and work processes, improve adherence to CIRS and, most import-

antly, result in better patient safety outcomes. The regular measurement of PSC by the SOS allows evaluation of the impact of implementing such activities and provides a means for ongoing monitoring of the prevailing PSC within hospitals. Linking the PSC with other structural and process indicators (e.g., staffing level, skill mix, leadership abilities, implicit rationing of nursing care) could lead to a better understanding of the complex relationships that impact on the quality of patient care.

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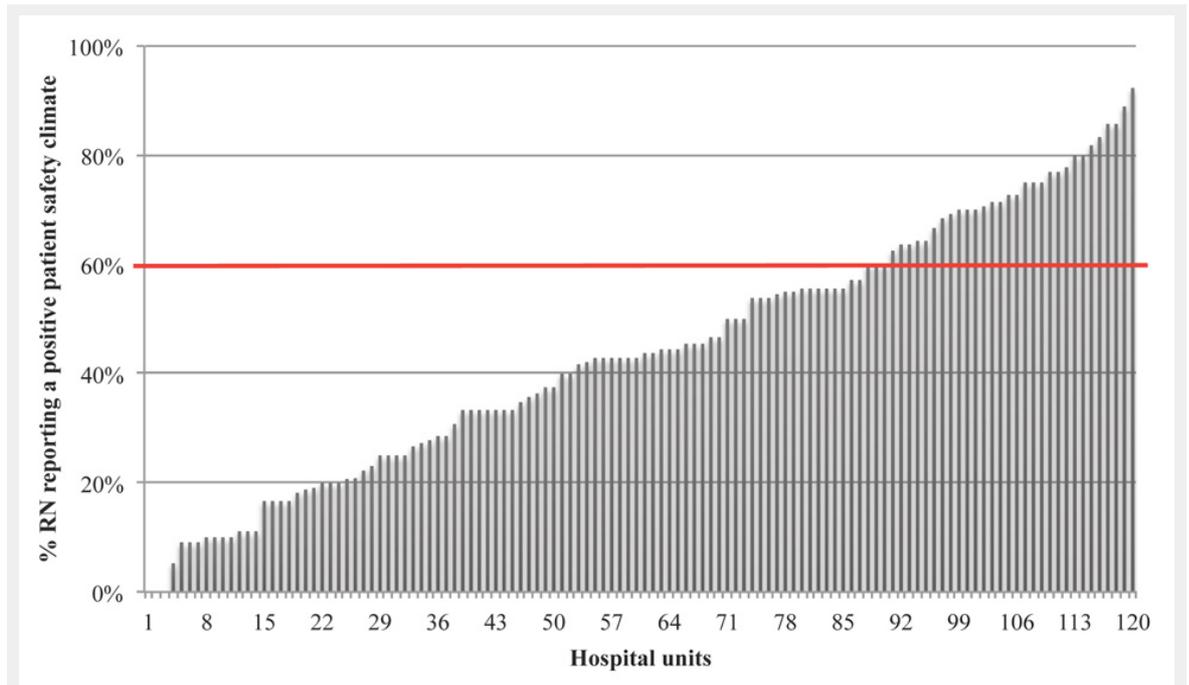
Figures (large format)

Figure 1
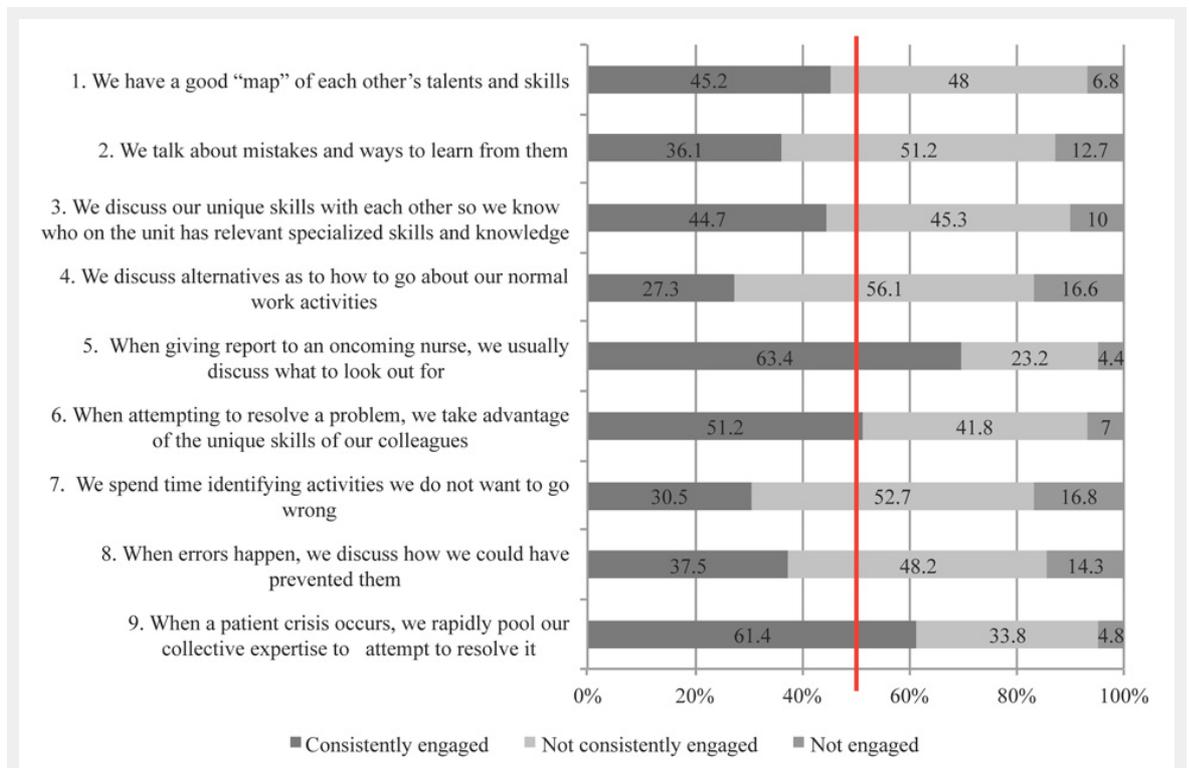
Unit's patient safety climate (n = 120).

Figure 2

Frequencies (%) of the single items comparing RN's engagement ("Consistently engaged" = answer categories 6–7, "Not consistently engaged" = answer categories 4–5, "Not engaged" = answer categoreis 1–3) in safety behaviours (n = 1564).