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Permalink
https://escholarship.org/uc/item/7gj533sd

Journal
International Journal for Quality in Health Care, 27(6)

ISSN
1353-4505

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Publication Date
2015-12-01

DOI
10.1093/intqhc/mzv079

Peer reviewed

OXFORD

Article

Quality management and perceptions of teamwork and safety climate in European hospitals

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Abstract

Objective: This study aimed to investigate the associations of quality management systems with teamwork and safety climate, and to describe and compare differences in perceptions of teamwork climate and safety climate among clinical leaders and frontline clinicians.
Method: We used a multi-method, cross-sectional approach to collect survey data of quality management systems and perceived teamwork and safety climate. Our data analyses included descriptive and multilevel regression methods.
Setting and Participants: Data on implementation of quality management system from seven European countries were evaluated including patient safety culture surveys from 3622 clinical leaders and 4903 frontline clinicians.
Main Outcome Measures: Perceived teamwork and safety climate.
Results: Teamwork climate was reported as positive by 67% of clinical leaders and 43% of frontline clinicians. Safety climate was perceived as positive by 54% of clinical leaders and 32% of frontline clinicians. We found positive associations between implementation of quality management systems and teamwork and safety climate.
Conclusions: Our findings, which should be placed in a broader clinical quality improvement context, point to the importance of quality management systems as a supportive structural feature for

promoting teamwork and safety climate. To gain a deeper understanding of this association, further qualitative and quantitative studies using longitudinally collected data are recommended. The study also confirms that more clinical leaders than frontline clinicians have a positive perception of teamwork and safety climate. Such differences should be accounted for in daily clinical practice and when tailoring initiatives to improve teamwork and safety climate.

Key words: quality management systems, human factors, patient safety, teamwork climate, safety climate, clinical quality activities

Introduction and objective

In 1989, Berwick highlighted the importance for organizations to invest leadership, time, capital and technical expertise into continuous quality improvement [1]. Today, healthcare organizations are increasingly concerned with efficient delivery of high-quality, safe health care. Prioritizing safety has led to recognition of the importance of implementing quality management systems and developing a culture of safety.

Quality management systems can be seen 'as a set of interacting activities, methods and procedures used to monitor, control and improve the quality of care' [2, 3]. Components of a hospital-level quality management system include for example the quality monitoring by the board, implementation of quality policy documents, formal protocols, and analyses and improvement of processes and outcome measures [4–6]. The developmental stage (maturity) of a hospital quality management system can be measured by the use of indexes that assess and/or monitor whether a quality management system exists, and if so, if it is partly or fully implemented [7].

Safety culture was first defined in 1986 as: 'that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, . . . safety issues receive the attention warranted by their significance' [8].

Often the terms safety culture and climate are used interchangeable in the literature. Patient safety culture is the deeper rooted aspect of climate, representing professional's shared assumptions, values, attitudes and behaviours that characterize the safety of patients in a healthcare setting. The climate represents the shared perceptions on the way patient safety is conceived, structured and implemented in a work place [5, 9]. The climate is readily measureable by surveys [10–13].

The climate is multi-dimensional, and over time, quality improvement efforts and tools aiming for better safety have put special emphasis on teamwork and safety climate, two composites both conceptualized at the unit level, and for which the strongest associations between improved climate and reduction of specific patient safety problems have been found [14, 15]. Teamwork climate embraces the perceptions of healthcare professionals concerning working collaboratively together in a group of people to provide safe care for the patients. Safety climate refers to professional's dedication to patient safety [14].

To implement a quality management system successfully, strong leadership support—from the top management, via the department management to the unit-level clinical leaders—is a key factor [16]. Introducing a quality management system alters previously established mechanisms and practices, induces structural changes and promotes efficient organizational processes that support communication, coordination and continuity of patient pathways [17]. Thus, a hospital-level quality management system mostly initiated by high-level management is expected to form a supportive context for lower level leaders to address, motivate and prioritize quality, and

create a flouring climate in which safe care can be delivered reliably. Viewed this way, the safety climate is enabled by the line management in a stepwise process that traces through the organization.

The aforementioned causal chain draws on the generic assumption of latent and active errors emerging in a healthcare system [18]. Building upon Donabedian's conceptual model for evaluating healthcare structure, process and outcome, a quality management system can be considered a structural feature that supports and directs the provision of care through organizational and clinical processes [19]. When adapting the framework for evaluating patient safety initiatives set forth by Brown *et al.*, the safety climate among unit-level clinical leaders can be regarded as an outcome of higher level management processes and output. Likewise the climate among frontline clinicians can be regarded as an outcome of unit-level clinical leader's processes and output and a group-level characteristic with the potential to impact clinical processes and health care [20].

Large-scale studies from the USA report that more leaders than frontline clinicians have a positive perception of the safety culture; also more physicians than nurse are positive, indicating mismatching preconditions for evaluating or awareness of safety practices [21–24].

The existence of a management system is identified as a promising factor in enhancing patient safety culture [25, 26], and it is a common strategy in healthcare organizations to implement a hospital quality management system and seek improvements in patient safety culture and the quality of care. Never the less, we have not found evidence documenting that the existence of a quality management system promotes a positive teamwork and safety climate. For that reason, we aimed to investigate the association of hospital-level implementation of a quality management system with teamwork and safety climate, as perceived by clinical leaders and frontline clinicians. Further, we aimed to describe and compare differences between clinical leaders' and frontline clinicians' perceptions of the teamwork and safety climate.

Methods

Setting and participants

This study was conducted as part of the 'Deepening our understanding of quality improvement in Europe (DUQuE)' project [27]. We employed a cross-sectional, multilevel study design and collected data in the Czech Republic, France, Germany, Poland, Portugal, Spain and Turkey. Details on the study design, conceptual framework, organization and recruitment have been described elsewhere [27].

Data collection took place between May 2011 and February 2012.

From each country, 30 acute care hospitals were randomly selected and invited for participation. Twelve of the 30 hospitals per country (in-depth hospitals) were invited for additional data collection. Hospital selection criteria included having over 130 beds, and treating patients for the following clinical conditions: acute myocardial infarction, hip fracture, stroke and handling child delivery.

From each of the 30 hospitals, we gathered information on implementation of the hospital quality management system and unit-level leaders' perceptions of teamwork and safety climate. From the 12 in-depth hospitals, we additionally gathered information on frontline clinician's perception of teamwork and safety climate.

Information on the implementation of the hospital quality management system was retrieved through surveys to the hospital quality manager from all 30 hospitals. A quality manager was seen as the person who was responsible for the coordination of quality improvement activities and thus had an overview of the activities across the hospital.

To capture the perceptions of the teamwork and safety climate of clinical leaders, we applied a purposeful sampling where 10 leading physicians and 10 leading nurses from each of the 30 hospital were invited. A clinical leader was defined as a physician or nurse considered having a leading role within the hospital, e.g. having a formal management role, leading any number of employees. They were selected to represent as much diversity as possible across the hospital.

From the 12 in-depth hospitals, we captured teamwork and safety climate as perceived by frontline clinicians from the four different clinical pathways mentioned above. A frontline clinician was defined as a qualified medical or nurse/midwife practitioner, practicing in a clinical area at least 50% of his/her time and being a member of the hospital staff. From each in-depth hospital, we invited 80 frontline clinicians. They were selected from a list of employees to be 10 physicians and 10 nurses from each of the four clinical pathways. Five nurses and five midwives were invited to participate from the delivery pathway. In hospitals that did not have enough physicians to be invited, more nurses were invited.

Data on implementation of the hospital quality management system as well as teamwork and safety climate were collected through internet-based surveys. The data collection was supported through a centralized training process by the DUQuE research team, country coordinators and a hospital coordinator in each of the participating hospitals. The surveys were completed anonymously, and respondents received a reminder at 7 and 14 days after the first invitation was received [27].

Ethical approval of the study was given by the Bioethics Committee of the Health Department of the Government of Catalonia in Spain. When required by individual countries, the study obtained further approval from national ethical committees.

Measures used

To measure the extend of living out the quality practices outlined by the hospital quality management system, we calculated the Quality Management System Index (QMSI). Details about construction and rationale for the QMSI, and index validity and reliability are published elsewhere [3, 28]. Briefly, QMSI expresses the extent of implementation of hospital-level quality management activities, such as the existence of quality policies and formal protocols for infection control, medication and patient handling, quality monitoring by the board, training of professionals, analysing performance of care processes, professionals and patient experience feedback, and evaluation of results. QMSI gives a composite score averaged over the nine subscales based on 46 items. Answers are given on a 4-point Likert scale, and the scale ranges from 0 to 27 points [3, 28].

To measure teamwork and safety climate, we used the 'Teamwork and Safety Climate Survey' composed of two scales for teamwork (14 items) and safety climate (13 items). However, we only used the abbreviated 6-item teamwork and the 7-item safety climate scales

from the familiar 'Safety Attitude Questionnaire' (SAQ) [15]. Answers are given on a 5-point Likert scale (1 = Strongly disagree, 2 = Somewhat disagree, 3 = Neutral, 4 = Somewhat agree, 5 = Strongly agree). Individual teamwork and safety climate scale scores were rescaled to a 100-point scale where $1 = 0$, $2 = 25$, $3 = 50$, $4 = 75$ and $5 = 100$, and we adopted the recommended convention of considering individual scale scores of 75 or higher as an indication of a positive climate perception [29].

Covariates used were country, hospital teaching status (teaching versus non-teaching), hospital size (<200, 200–500, 501–1000, or >1000 beds) and hospital ownership (public versus not public), as well as gender, age and profession (physicians versus nurses) of survey respondents.

Statistical analyses

The sample data were described by frequencies, percentages, mean scores, standard deviation, 95% confidence intervals (95% CI) and missing values according to data type.

Reliability of the teamwork and safety climate scales was investigated by Cronbach's alpha (α) and interscale correlations by Pearson's correlations. Individual teamwork and safety climate scale scores were computed reporting mean statistic, and per cent of respondents with a positive perception (% positive), defined by an individual scale score ≥ 75. In the analysis, we have used both climate scales as continuous variables with a scale range from 0 to 100 [29]. Teamwork and safety climate scores were only calculated for respondents, who did not have missing values for any of the items in the scales used to calculate the scores.

We used directed acyclic graphs (DAGs) [30–32] to depict our knowledge and assumptions about the (plausible) interrelationships between QMSI and teamwork and safety climate. Variables were included in the statistical models based on the structure of this DAG, and the rules that the DAG imparts on choice of covariates for confounding control, which have been described in detail elsewhere [30–32]. Briefly, in a DAG, a confounding variable is represented by an open, backdoor path between the exposure and effect of interest and should be controlled for in multivariate analyses. Intermediate variables, which lie on the direct pathway between exposure and effect, and colliders, which are the direct result of both exposure and effect, should not be controlled in a model to estimate total effects. Assuming the DAG in Fig. 1 to be representative of the data generating mechanism, and that our independent and dependent variables are synonymous with 'exposure' and 'effect', respectively, to estimate the total effect of the QMSI on teamwork and safety climate, we adjusted for country as well as hospital level (number of beds, teaching status, ownership) and clinician level (profession, gender, age) confounders.

Multivariate linear mixed models with random intercept by hospital, adjusted for fixed effects at the country level (country), at the hospital level (number of beds, teaching status, ownership) and individual level (profession, age, gender) were used for assessment of the association of QMSI on teamwork and safety climate. We used multiple imputation techniques to handle missing quality measure data for hospitals with incomplete data on no greater than four QMSI subscales [33]. Hospitals that did not have enough data to produce an imputed QMSI index were dropped. Only data from respondents with complete records on individual-level variables used (confounders and teamwork and safety climate scores) were included in the multivariate analysis.

We conducted all analyses using SAS version 9.2 (SAS Institute Inc., Cary, NC, USA).
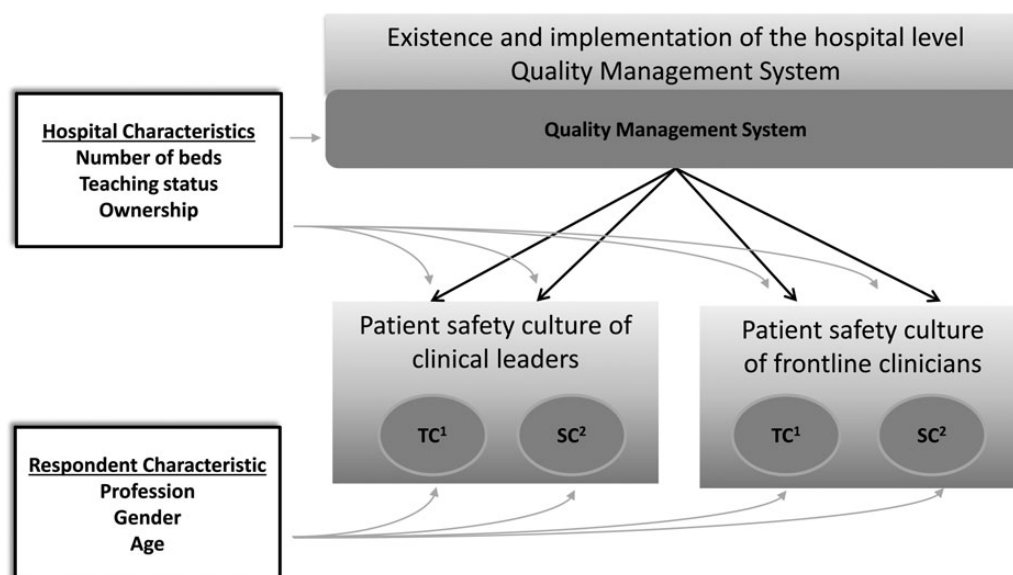
Figure 1 Directed acyclic graph of the conceptual framework for leaders and frontline clinicians. [1]Teamwork climate, [2]Safety climate.

Results

Participation

In total, 188 of 210 invited hospitals participated in the study; of those, 181 had complete imputed data. Among the 74 hospitals participating in the in depth study, 71 had complete data. In both samples, about half of the hospitals were teaching hospitals, with the majority under public ownership.

In total 8525 invitees participated; 3622 of 3760 (96%) invited clinical leaders, and 4903 of 5920 (83%) frontline clinicians provided answers to both the teamwork and safety climate scales.

Characteristics of the hospitals and respondents participating in the study are displayed in Table 1.

Scores on the teamwork and safety climate scales

At the item level, the number of missing answers was <1.5% for all items in both scales.

In psychometric analysis, Cronbach's alpha values for the teamwork and safety climate scales were found to be good ($\alpha = 0.80$ for each scale when combined across respondent types) and interscale correlation was found to be 65%.

Teamwork and safety climate mean scale scores are displayed in Table 2. The mean score for teamwork climate was 71.8 (standard deviation, SD of 17.5); the mean score of safety climate was 68.6 (standard deviation, SD of 16.8). The mean scale score for leaders was higher than for frontline clinicians for both climate scales ($P < 0.0001$). Physicians had a higher teamwork climate mean score than nurses among both leaders and frontline clinicians ($P < 0.0001$).

Numbers and proportions of respondent who evaluated the climate positively (Score ≥ 75) are displayed in Table 3. More clinical leaders (67%) than frontline clinicians (43%) reported teamwork climate positive ($P < 0.0001$). The same was the case for safety climate, where 54% of clinical leaders versus 32% of frontline clinicians perceived the safety climate positive ($P < 0.0001$). More physicians than nurses had a positive perception of the teamwork climate; this applied for both leaders and frontline clinicians ($P < 0.0001$). Generally, respondents perceived the teamwork climate more positively than the safety climate.

Scores on the QMSI

The mean QMSI score was 19.1 (standard deviation, SD of 4.6) for the 181 hospitals, and 19.4 (SD 4.1) for the 71 in-depth hospitals (Table 1). The maximum possible QMSI score was 27, indicating the highest level of implementation (maturity) of the quality management system.

Association between implementation of a quality management system and perceived teamwork and safety climate

Concerning the assumed effect of implementation of hospital-level quality management systems on teamwork and safety climate, we found that a 1-unit higher score in QMSI was associated with a 0.25-unit higher score in teamwork climate (Table 4). Likewise, 1-unit higher score in QMSI was associated with a 0.38-unit higher score in safety climate as perceived by clinical leaders. For frontline clinicians, 1-unit higher score in QMSI was associated with a 0.42-unit higher score in teamwork climate and a 0.38-unit higher score in safety climate. The associations were stronger among clinical leaders than among frontline clinicians. The associations of the QMSI with teamwork and safety climate are displayed in Table 4.

For the teamwork climate among clinical leaders, the added predictors explained 3% of the participant-level variance and 61% of the hospital-level variance, whereas for the safety climate the added predictors explained 0.4% of the participant-level variance and 68% of the hospital-level variance. The interpretations for teamwork and safety climate among frontline clinicians are similar to the ones for the clinical leaders.

For safety climate, there was a statistical significant effect of implementation of the quality management system on the perception of both leading physician's and nurses' perception of safety climate ($P < 0.05$), the same was the case for frontline clinician's perception of teamwork climate.

Discussion

We assumed and found a positive association between the level/maturity of implementation of hospital-level quality management systems

Table 1 Descriptive statistics regarding hospitals and respondents participating in the study

Hospital characteristics	All hospitals		In-depth hospitals	
	N	%	N	%
All hospitals	181	100	71	39
Czech Republic	29	16	12	17
France	25	14	11	15
Germany	13	7	4	6
Poland	28	15	11	15
Portugal	29	16	10	14
Spain	29	16	11	15
Turkey	28	15	12	17
Teaching hospitals	77	43	31	44
Public hospitals	149	82	56	79
Approximate number of beds in hospitals				
<200	18	10	7	10
200–500	76	42	21	30
501–1000	60	33	30	42
>1000	27	15	13	18
Hospital-level exposure variable (range)	Mean	SD	Mean	SD
Quality Management System Index (0–27)	19.1	4.6	19.4	4.1

Characteristics of responders	All hospitals		In-depth hospitals	
Quality managers	N	%	N	%
Male	60	32.7		
Female	123	67.2		
Age (Mean, SD)	44.6	8.6		
Years affiliated with the hospital (Mean, SD)	13.2	9.6		
Years in quality management, (Mean, SD)	4.6	3.2		
Clinical leaders	N	%	N	%
All	3622	100	1444	100
Physicians	1745	48	698	48
Nurses	1877	52	746	52
Male	1449	40	593	41
Female	2152	59	842	58
Frontline clinicians	N	%	N	%
All			4903	100
Physicians			2079	42
Nurses			2824	58
Male			1533	31
Female			3329	68
Age (Mean, SD)			39.3	9.7

and teamwork and safety climate scores. Further, the study is the first large-scale European-based study to confirm that more clinical leaders than frontline clinicians have a positive perception of teamwork and safety climate.

Earlier studies have suggested that the existence of a management system is a promising factor in enhancing patient safety culture [25, 26], and our findings confirm this. However, our findings cannot stand alone, nor be directly utilized in isolation in the clinical improvement work; implementation of a hospital-level quality management system can be regarded as a significant structural feature for improving teamwork and safety climate, but to achieve clinically meaningful changes in teamwork and safety climate, systemic interventions directed towards interrelated processes of safety culture are recommended [5].

Hospital leaders in our European-based study reported higher means and % positive than frontline clinicians, this finding compare well with earlier international studies [22, 34–37]. It has been demonstrated that the larger the gap between the perceptions of leaders and frontline clinicians in regard to safety culture, the more errors are

being made at the frontline—jeopardizing patient safety [21]. Although the proportion of leaders and frontline clinicians reporting positive perceptions of the teamwork and safety climate compares well to other studies [38], the scores of both subgroups for both scales indicate space for further improvement according to the 60% threshold suggested in the literature [39]. Leadership engagement and interdisciplinary team involvement have been shown to be effective in the improvement of teamwork and safety climate [40]. The average of % positive found by us is likely to mask variations across countries and hospitals included, as has also been found previously [14, 34, 41]. The DAG guided our analysis aimed to adjust for such effect to estimate the associations between our dependent and independent variables.

Results presented in this paper are based on a cross-national study that used a multi-method approach to data collection and measurements. Due to the cross-sectional study design, our findings do not support causal conclusions; we would need a longitudinal study design to investigate the associations further. Nonetheless, this study

Table 2 Teamwork and safety climate mean scores

	N[a]	Mean	SD	95% CI	Missing	*P*-value	
Population	**Teamwork climate scores**						
All (whole sample)	8273	71.8	17.5	71.5–72.2	252		
Clinical leaders	3503	77.3	15.5	76.8–77.9	119		<0.0001[b]
Physicians	1688	79.4	15.2	78.7–80.1	57	<0.0001	
Nurses	1815	75.4	15.6	74.7–76.2	62		
Frontline clinicians	4770	67.8	17.8	67.3–68.3	133		
Physicians	2029	71.6	15.6	70.9–72.2	50	<0.0001	
Nurses	2741	65.0	18.8	64.3–65.7	83		
Population	**Safety climate scores**						
All (whole sample)	8203	68.6	16.8	68.3–69.0	322		
Clinical leaders	3479	73.1	16.4	72.6–73.7	143		<0.0001[b]
Physicians	1677	72.5	17.2	71.7–73.4	68	0.0416	
Nurses	1802	73.7	15.6	72.9–74.4	75		
Frontline clinicians	4724	65.3	16.3	64.9–65.8	179		
Physicians	2011	64.8	16.4	64.1–65.5	68	0.0540	
Nurses	2713	65.7	16.2	65.1–66.3	111		

[a]Mean scale scores are only calculated for respondents who did not have missing values for any of the items in the scales used to calculate the scores.
[b]*P*-value corresponds to difference of means between clinical leaders and frontline clinicians.

Table 3 Numbers and proportions of respondent who scored positively (individual scale score ≥75)

	N[a]	Missing[b]	% positive[c]	95% CI	*P*-value	
Population	**Teamwork climate**					
All respondents	4388	252	53.0	52.0–54.1		
Clinical leaders	2339	119	66.8	65.2–68.3		<0.0001[d]
Physicians	1216		72.0	69.9–74.2	<0.0001[e]	
Nurses	1123		61.9	59.6–64.1		
Frontline clinicians	2049	133	43.0	41.6–44.4		
Physicians	1049		51.7	49.5–53.9	<0.0001[f]	
Nurses	1000		36.5	34.7–38.3		
Population	**Safety climate**					
All respondents	3400	322	41.4	40.4–42.5		
Clinical leaders	1877	143	54.0	52.3–55.6		<0.0001[d]
Physicians	897		53.5	51.1–55.9	0.596[e]	
Nurses	980		54.4	52.1–56.7		
Frontline clinicians	1523	179	32.2	30.9–33.6		
Physicians	634		31.5	29.5–33.6	0.367[f]	
Nurses	889		32.8	31.0–34.5		

[a]Number of respondents with a positive perception of the climate; individual scale score ≥75.
[b]Number of respondents with partially blank responses for teamwork and safety climate surveys.
[c]Per cent of respondents with non-blank responses and a positive perception of the climate.
[d]*P*-value corresponds to comparing clinical leaders to frontline clinicians.
[e]*P*-value corresponds to comparing leading physicians to leading nurses.
[f]*P*-value corresponds to comparing frontline physicians to frontline nurses.

provides new information about implications of implementing hospital-level quality management systems, and it adds to the previous knowledge about differences in leaders' and frontline clinicians' perceptions of teamwork and safety climate.

Acceptability of the study methods was high according to the participation; hospital-level data from 181 hospitals across 7 European countries and 8525 surveys from leaders' and frontline clinicians were analysed. However, compared with the volume of hospital staff in the included hospitals, we surveyed only a smaller number of leaders and frontline clinicians within each hospital, limited resources restrained us from surveying the perceptions of all staff. Nonetheless, our sample is exceptional as it included a large number of clinical leaders and frontline clinicians from seven different countries in the same study. Hospitals from Nordic Countries or Central Eastern Europe are

missing or not sufficiently represented in our sample; therefore, it should be stressed that our findings cannot be regarded representative of European hospitals as such; hospitals in these countries are organized differently and may have conceptualized quality management systems differently and implemented these systems to a different degree, also perceptions of teamwork and safety climate may differ from other parts of Europe due to different management styles etc. [23].

Because our study is based on survey research, non-response bias is possible and may affect the representativeness of our sample. Quality improvement and teamwork and safety climate are expected to vary hospital-to-hospital, to account for this, we used hierarchical models with random intercept by hospital; additionally controlled for a number of important fixed effects at the country-, hospital- and respondent level. However, because the study is cross-sectional and observational

Table 4 Effect of the hospital-level exposure variable QMSI on teamwork and safety climate of leaders and frontline clinicians

Effect	Teamwork climate (Score 0–100)			Safety climate (Score 0–100)		
	b	SE	P-value	b	SE	P-value
Clinical leaders QMSI (Index 0–27)[a]	All					
	0.25	0.09	0.003	0.38	0.09	<0.001
	N = 3345			N = 3318		
	Leading physicians					
	0.18	0.10	0.080	0.42	0.12	<0.001
	N = 1610			N = 1598		
	Leading nurses					
	0.33	0.12	0.005	0.35	0.11	0.001
	N = 1735			N = 1720		
Frontline clinicians QMSI (Index 0–27)[a]	All					
	0.42	0.14	0.003	0.38	0.14	0.023
	N = 4469			N = 4430		
	Frontline physicians					
	0.41	0.14	0.004	0.23	0.17	0.175
	N = 1902			N = 1887		
	Frontline nurses					
	0.38	0.20	0.053	0.37	0.18	0.035
	N = 2567			N = 2543		

[a]Multivariate mixed linear regression with random intercept by hospital, adjusted for fixed effects: country, hospital-level characteristics (ownership, teaching status, number of bed) and respondent-level characteristics (gender, age, job type).

in nature, uncontrolled confounding and reverse causation are still possible sources of bias in interpretation of our results.

To decrease the risk of common method variance bias, we used validated methods and different data sources for the independent variables and dependent variable [42]. We used the quality manager of the hospitals as a key informant to gain insight into the status of implementation of the quality management system, assuming that this professional would have comprehensive knowledge about the topic of interest, as is common practice [43]. Thus, the information regarding implementation of the quality management system must be interpreted considering that the data represent exclusively the quality manager's perceptions. Therefore, generalization of these results must be made with caution.

Conclusion

Based upon information from seven European countries, our findings point to the importance of quality management systems as supportive structural features for promoting teamwork and safety climate. To gain a deeper understanding of the impact of implementation of quality management systems on teamwork and patient safety climate, further qualitative and quantitative studies using longitudinally collected data are required, and also more comprehensive samples of staff surveyed are recommended.

The study is also the first large-scale European study to confirm that clinical leaders more often than frontline clinicians have a positive perception of teamwork and safety climate, and that more doctors than nurses have a positive perception of teamwork. Such differences should be accounted for in daily clinical practice and when tailoring initiatives to improve teamwork and safety climate. Further studies should investigate the consequences of this gab in terms of the safety of patients.

Acknowledgements

Funding

References

1. Berwick DM. Continuous improvement as an ideal in health care. *N Engl J Med* 1989;**320**:53–6.
2. Wagner C, Smits M, Sorra J *et al*. Assessing patient safety culture in hospitals across countries. *Int J Qual Health Care* 2013;**25**:213–21.

3. Wagner C, Groene O, Thompson CA *et al*. Development and validation of an index to assess hospital quality management systems. *Int J Qual Health Care* 2014;**26**(Suppl. 1):16–26.

4. Vogus TJ, Sutcliffe KM, Weick KE. Doing no harm: enabling, enacting, and elaborating a culture of safety in health care. *Acad Manag Perspect* 2010;**24**:60–77.

5. Singer SJ, Vogus TJ. Reducing hospital errors: interventions that build safety culture. *Annu Rev Public Health* 2013;**34**:373–96.

6. Wagner C, Groene O, Thompson CA *et al*. DUQuE quality management measures: associations between quality management at hospital and pathway levels. *Int J Qual Health Care* 2014;**26**(Suppl. 1):66–73.

7. Groene O, Botje D, Sunol R *et al*. A systematic review of instruments that assess the implementation of hospital quality management systems. *Int J Qual Health Care* 2013;**25**:525–41.

8. International Safety Advisory Group. *Summary report on the post-accident review meeting on the chernobyl accident*. Vienna, Austria: International Atomic Energy Agency (IAEA) 1986.

9. Zohar D. Safety climate in industrial organizations: theoretical and applied implications. *J Appl Psychol* 1980;**65**:96–102.

10. Robb G, Seddon M. Measuring the safety culture in a hospital setting: a concept whose time has come? *N Z Med J* 2010;**123**:68–78.

11. Goodman GR. A fragmented patient safety concept: the structure and culture of safety management in healthcare. *Hosp Top* 2003;**81**:22–9.

12. Zaheer S, Ginsburg L, Chuang YT *et al*. Patient safety climate (PSC) perceptions of frontline staff in acute care hospitals: examining the role of ease of reporting, unit norms of openness, and participative leadership. *Health Care Manage Rev* 2015;**40**:13–23.

13. Zohar D, Hofmann DA. Organizational culture and climate. In: Kozlowski WJ (ed). *The Oxford Handbook of Organizational Psychology*, **Volume 1**. New York, NY: Oxford University Press, 2012,643–66.

14. Schwendimann R, Zimmermann N, Kung K *et al*. Variation in safety culture dimensions within and between US and Swiss Hospital Units: an exploratory study. *BMJ Qual Saf* 2013;**22**:32–41.

15. Sexton JB, Helmreich RL, Neilands TB *et al*. The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. *BMC Health Serv Res* 2006;**6**:44.

16. Abdallah A. Implementing quality initiatives in healthcare organizations: drivers and challenges. *Int J Health Care Qual Assur* 2014;**27**:166–81.

17. van Harten WH, Casparie TF, Fisscher OA. The evaluation of the introduction of a quality management system: a process-oriented case study in a large rehabilitation hospital. *Health Policy* 2002;**60**:17–37.

18. Reason J. Human error: models and management. *BMJ* 2000;**320**:768–70.

19. Donabedian A. The definition of quality and approaches to its assessment. In: Griffith JR (ed). *Explorations in Quality Assessment and Monitoring*. Ann Arbor, MI: Health Administration Press, 1980,4–163.

20. Brown C, Hofer T, Johal A *et al*. An epistemology of patient safety research: a framework for study design and interpretation. Part 3. End points and measurement. *Qual Saf Health Care* 2008;**17**:170–7.

21. Firth-Cozens J, Mowbray D. Leadership and the quality of care. *Qual Health Care* 2001;**10**(Suppl. 2):ii3–7.

22. Hartmann CW, Rosen AK, Meterko M *et al*. An overview of patient safety climate in the VA. *Health Serv Res* 2008;**43**:1263–84.

23. McFadden KL, Henagan SC, Gowen CR. The patient safety chain: transformational leadership's effect on patient safety culture, initiatives, and outcomes. *J Operations Manag* 2009;**27**:390–403.

24. Pronovost PJ, Weast B, Holzmueller CG *et al*. Evaluation of the culture of safety: survey of clinicians and managers in an academic medical center. *Qual Saf Health Care* 2003;**12**:405–10.

25. Tutuncu O, Kucukusta D, Akman A. The role of patient safety climate on quality management system: perceptions of nurses. In: 51st European Organization for Quality Annual Congress, Prague, Czech Republic, 2007.

26. Guldenmund FW. (Mis)understanding safety culture and its relationship to safety management. *Risk Anal* 2010;**30**:1466–80.

27. Secanell M, Groene O, Arah OA *et al*. Deepening our understanding of quality improvement in Europe (DUQuE): overview of a study of hospital quality management in seven countries. *Int J Qual Health Care* 2014;**26**(Suppl. 1):5–15.

28. Wagner C, Groene O, DerSarkissian M *et al*. The use of on-site visits to assess compliance and implementation of quality management at hospital level. *Int J Qual Health Care* 2014;**26**(Suppl. 1):27–35.

29. Sexton JB, Thomas EJ, Helmreich RL. *Scale Computation Instructions*. https://med uth edu/chqs/files/2012/05/Scale-Computation-Instructions pdf. 2013 (23 September 2015, date last accessed).

30. Pearl J. *Causality: Models, Reasoning and Inference*. Cambridge: Cambridge University Press, 2009.

31. Greenland S, Pearl J, Robins JM. Causal diagrams for epidemiologic research. *Epidemiology* 1999;**10**:37–48.

32. Arah OA. The role of causal reasoning in understanding Simpson's paradox, Lord's paradox, and the suppression effect: covariate selection in the analysis of observational studies. *Emerg Themes Epidemiol* 2008;**5**:5.

33. Little RJA, Rubin DB. *Statistical Analysis with Missing Data*. New York: John Wiley & Sons, 1987.

34. Singer SJ, Falwell A, Gaba DM *et al*. Patient safety climate in US hospitals: variation by management level. *Med Care* 2008;**46**:1149–56.

35. Gallego B, Westbrook MT, Dunn AG *et al*. Investigating patient safety culture across a health system: multilevel modelling of differences associated with service types and staff demographics. *Int J Qual Health Care* 2012;**24**:311–20.

36. Singer SJ, Gaba DM, Geppert JJ *et al*. The culture of safety: results of an organization-wide survey in 15 California hospitals. *Qual Saf Health Care* 2003;**12**:112–8.

37. Wilson D, Redman RW, Talsma A *et al*. Differences in perceptions of patient safety culture between charge and noncharge nurses: implications for effectiveness outcomes research. *Nurs Res Pract* 2012;**2012**:847626.

38. Chaboyer W, Chamberlain D, Hewson-Conroy K *et al*. CNE article: safety culture in Australian intensive care units: establishing a baseline for quality improvement. *Am J Crit Care* 2013;**22**:93–102.

39. Norden-Hagg A, Sexton JB, Kalvemark-Sporrong S *et al*. Assessing safety culture in pharmacies: the psychometric validation of the Safety Attitudes Questionnaire (SAQ) in a national sample of community pharmacies in Sweden. *BMC Clin Pharmacol* 2010;**10**:8.

40. Pronovost PJ, Berenholtz SM, Goeschel CA *et al*. Creating high reliability in health care organizations. *Health Serv Res* 2006;**41**(4 Pt 2):1599–617.

41. Deilkas E, Hofoss D. Patient safety culture lives in departments and wards: multilevel partitioning of variance in patient safety culture. *BMC Health Serv Res* 2010;**10**:85.

42. Podsakoff PM, MacKenzie SB, Lee JY *et al*. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol* 2003;**88**:879–903.

43. Rousseau DM. Assessing organizational culture: the case of multiple methods. In: Schneider B (ed). *Organizational Climate and Culture*. San Fransisco: Jossey-Bass Inc., 1990,153–92.