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Visualizing variations in organizational safety culture across an inter-hospital multifaceted workforce

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Abstract

Rationale, aims and objectives To develop a reliable and valid questionnaire that can distinguish features of organizational culture for patient safety across subgroups such as hospitals, professions, management/non-management positions and units/wards.
Methods We developed a Hospital Organizational Culture Questionnaire based on a conceptual framework incorporating items from a review of existing literature. The questionnaire was administered to hospital staff including doctors, nurses, allied health personnel, and administrative staff at six public hospitals in Japan. Reliability and validity were assessed through exploratory factor analysis, multitrait scaling analysis, Cronbach's alpha coefficient and multiple regression analysis using staff-perceived achievement of safety as the response variable. Discriminative power across subgroups was assessed with radar chart profiling.
Results Of the 3304 hospital staff surveyed, 2924 (88.5%) responded. After exploratory factor analysis and multitrait analysis, the finalized questionnaire was composed of 24 items in the following eight dimensions: improvement orientation, passion for mission, professional growth, resource allocation prioritization, inter-sectional collaboration, responsibility and authority, teamwork, and information sharing. Construct validity and internal consistency of dimensions were confirmed with multitrait analysis and Cronbach's alpha coefficients, respectively. Multiple regression analysis showed that improvement orientation, passion for mission, resource allocation prioritization and information sharing were significantly associated with higher achievement in safety practices. Our questionnaire tool was able to distinguish features of safety culture among different subgroups.
Conclusions Our questionnaire demonstrated excellent validity and reliability, and revealed distinct cultural patterns among different subgroups. Quantitative assessment of organizational safety culture with this tool may further the understanding of associated characteristics of each subgroup and provide insight into organizational readiness for patient safety improvement.

Introduction

Hospital safety culture has drawn increasing attention as it can have a direct influence on ensuring patient safety [1,2]. Instead of blaming individual health care professionals for incidents and accidents, efforts should be made to improve the health care delivery structure to preemptively stop problems from occurring [3,4]. One such approach focuses on organizational safety culture enhancement to complement insufficient quality improvements from structural changes [5].

The often-quoted definition of hospital safety culture is 'the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of an organisation's safety management' [6]. Given a certain level of safety culture maturity, an organization's performance in quality and outcomes can be expected to be high [6,7]. Several empirical studies have demonstrated an association between organizational culture and quality or safety improvements [8–12], whereas others have shown no such relationship [13,14]. These contradictory results are thought to arise

from the use of ill-suited assessment tools [5,15]. However, assessing the precise features of hospital safety culture remains difficult because hospitals are organizations consisting of multifaceted subgroups, with a variety of professions, management/non-management positions, and unit/wards. Therefore, there is a need for a relevant and sensitive assessment tool to evaluate hospital safety culture, and it must also be applicable to all hospital staff to ensure global improvement. Previous studies have demonstrated the validity and reliability of assessment tools, yet have failed to quantitatively show discriminative power [16–21].

There is a lack of consensus on the appropriate dimensions of hospital safety culture that should be evaluated by assessment tools [5,7,15–21]. While most of the previous tools have evaluated individual and group values, attitudes, perceptions, competencies and patterns of behaviour; few have addressed managerial issues such as policies, procedures and practices, which are also important factors of safety culture [5,20]. In addition to systems and structures, it is also important to assess beliefs, attitudes and behaviours [15,20]. Because different types of staff have different perceptions of organizational culture [22–24], it would be reasonable to employ a dimensional approach to provide details for improvement [5,15].

The aim of the present study was to develop a reliable and valid hospital safety culture assessment tool (designated the Hospital Organizational Culture Questionnaire, or HOCQ) that can help to distinguish between the different cultural patterns among hospitals, professions, positions and units/wards in an effort to identify areas that require patient safety improvements in hospitals with complicated organizational features.

Methods

Theoretical framework

A literature review was conducted on the safety culture, safety climate and organizational culture of health care and other settings in order to develop a theoretical framework of the components needed to assess hospital safety culture (Table S1). This theoretical framework was composed of the following eight dimensions: 'collaboration' [13,20,25–28], 'information sharing' [20,27,29–31], 'professional growth' [20,25–27,29], 'morale' [20,27,29,30,32–34], 'common values' [3,4,20,25,26,30,31,33,35], 'resource allocation prioritization' [20,25–27,29,33,34], 'responsibility and authority' [31,33,34], and 'improvement orientation' [20,25,29,32,35]. Several tools incorporate 'job satisfaction' as a dimension of safety culture, and most studies address it as a related factor, albeit distinct from safety culture [21,36]. However, in the context of the definition from the Advisory Committee on the Safety of Nuclear Installations, we considered 'job satisfaction' an unnecessary element of safety culture [6].

Questionnaire development

Questionnaire items concerning various concepts of the different dimensions were reviewed and modified to ensure ease of understanding and relevance to patient safety in hospital settings. The initial version of the assessment tool consisted of 66 items, and the associated concepts are shown in Table S1. We further refined the assessment tool through interviews with doctors, nurses, allied health personnel and administrative staff. Based on these interviews and group meetings, the items forming the core of the pilot questionnaire were consolidated; the original 66 items were aggregated into 25 items spanning the aforementioned eight dimensions (Table S2). In addition, we also included two items of staff-perceived achievement regarding hospital safety practices; these were used to evaluate the safety level as an outcome of hospital safety culture (Table S2).

Our assessment tool employed Likert-type rating scales ranging from 1 (strongly disagree) to 5 (strongly agree), and utilized dimension scores ranging from 0 to 100 for data analysis. Reverse-worded items were reverse scored prior to data analysis, and a higher score therefore indicates better safety culture status. To collect information regarding respondent characteristics, we also examined the following items: respondent profession, position, unit/ward and years of experience in the current hospital. Here, professions were categorized into four groups (doctor, nurse, allied health personnel and administrative staff), position was used to indicate the respondent's managerial level in the organizational hierarchy and unit/ward demonstrated the group level of interest (e.g. work units, patient care areas and nursing units). A preliminary pilot survey was conducted to test the feasibility of the assessment tool, enrolling more than 30 staff (including doctors, nurses, allied health personnel and administrative staff) from hospitals that did not participate in the final survey.

Survey procedure

The survey was conducted at six public hospitals within the Kinki and Shikoku regions of Japan during February 2006. These six hospitals had been invited to take part in the survey, and all had voluntarily participated as a means to seek out opportunities to improve organizational culture. Each hospital primarily comprised acute care beds (bed numbers ranged from 200 to 600), with two hospitals also having long-term care beds and one hospital with psychiatric beds.

The numbers of full-time active hospital-employed staff were first obtained from each of the six participating hospitals. The self-administered questionnaire was then distributed to all these full-time staff, consisting of 3304 individuals from all job categories and levels of hierarchy in the participating hospitals. These included doctors, nurses, allied health personnel, administrative staff and other hospital staff (such as cooks, sanitary workers and counsellors). The hospital workers were informed that there was no obligation to participate in the study, but that submitting a completed questionnaire would imply consent to participation. Completed questionnaires were sealed and collected by survey coordinators. Confidentiality and anonymity were protected during the entire study procedure. All questionnaires were collected within a month of distribution. This study was approved by the Ethics Committee, Kyoto University Graduate School and Faculty of Medicine.

Data analysis

Exploratory factor analysis (EFA) was performed to assess construct validity and to determine items and dimensions for inclusion [37]. The maximum likelihood method with promax rotation was used for EFA. Items with factor loadings of less than 0.25 and

Table 1 Characteristics of the survey respondents

	Total	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Hospital F
Number of respondents	2,924	570	465	491	783	431	184
Response rate, % (for total sample and by hospital)	88.5	89.1	89.3	89.4	95.1	74.1	97.4
Respondents by profession, number (%)							
Doctor	284 (9.7)	50 (8.8)	39 (8.4)	60 (12.2)	76 (9.7)	35 (8.1)	24 (13.0)
Nurse	1,863 (63.7)	394 (69.1)	296 (63.7)	242 (49.3)	512 (65.4)	307 (71.2)	112 (60.9)
Allied health personnel	374 (12.8)	76 (13.3)	59 (12.7)	76 (15.5)	89 (11.4)	50 (11.6)	24 (13.0)
Administrative staff	383 (13.1)	44 (7.7)	69 (14.8)	109 (22.2)	100 (12.8)	39 (9.0)	22 (12.0)
Other staff	20 (0.7)	6 (1.1)	2 (0.4)	4 (0.8)	6 (0.8)	0 (0.0)	2 (1.1)
Positions, number (%)							
Management position (top or middle)	766 (26.2)	273 (47.9)	69 (14.8)	134 (27.3)	165 (21.0)	75 (17.4)	50 (27.1)
Experience at the current hospital, number (%)							
1 year	362 (12.4)	48 (8.4)	61 (13.1)	63 (12.8)	100 (12.8)	67 (15.5)	23 (12.5)

Data in parentheses indicate column percentages of total respondents (e.g. by profession, managerial position and experience at the current hospital). Total percentages for respondents by professions for the total sample and by hospital may not add up to 100% due to rounding.

items with cross-loads on two factors with a loading of more than 0.40 on the second factor were excluded from analysis.

To further assess construct validity, we conducted multitrait scaling analysis by calculating Pearson's correlations among items and dimensions [38]. Internal consistency for each dimension was then assessed using Cronbach's alpha coefficients [37].

Criterion validity was evaluated using multiple regression analysis of hospital safety culture dimensions and staff-perceived achievement of hospital safety practices. Our model used the score of staff-perceived achievement as the response variable. Explanatory variables included the eight dimension scores for safety culture, as well as dummy variables of each hospital, respondent profession, position and experience at the current hospital (<1 year or ≥1 year). Diagnostic tests for multicollinearity were performed using variance inflation factor (VIF). Explanatory power of the models was measured using adjusted R^2.

To conduct a graphical evaluation of discriminative power across subgroups (hospitals, professions, positions and units/wards), we created radar charts bearing the dimension scores. In addition, the average (AVE), standard deviation (SD), interquartile range (IQR), coefficient of variation (CV) and IQR/AVE of the dimension scores and percent positive responses were calculated for each subgroup. Percent positive response refers to the percentage of positive responses (i.e. agree, strongly agree) to positively worded items or negative responses (i.e. disagree, strongly disagree) to negatively worded items. AVE, SD, IQR, CV and IQR/AVE were calculated across subgroups (but not across individuals), which ensured that each subgroup received an equal weight. Larger values of CV and IQR/AVE indicate larger variations, which in turn suggest that the assessment tool has the ability to discriminate between subgroups.

Analyses were performed using IBM SPSS 20 for Windows (SPSS Inc., Chicago, IL, USA). Two-sided tests were used and a $P < 0.05$ was considered to be statistically significant.

Results

Survey population characteristics

Of the 3304 hospital staff surveyed, 2924 from six hospitals responded (overall response rate: 88.5%). Results of the descriptive statistics are shown in Table 1. Respondents included 284 doctors, 1863 nurses, 374 allied health personnel, 383 administrative staff and 20 other hospital staff. Hospital response rates ranged from 74.1% to 97.4%. The highest response rate among the various professions was from nurses (overall rate: 63.7%), and the lowest response rate was from doctors (overall rate: 9.7%). More than a quarter of the respondents (26.2%) selected 'top management' or 'middle management' as their management position.

Validity and reliability

The mean and SD for each survey item, which was examined prior to conducting EFA, showed no ceiling or floor effects on the score. Bartlett's test of sphericity ($\chi^2 = 34178.57$, degrees of freedom = 300, $P < 0.01$) was significant, and the Kaiser-Meyer-Olkin measure of sampling adequacy yielded a value of 0.94. These results provided us with the statistical basis to proceed with EFA.

The EFA results, including the maximum likelihood method with promax rotation, are detailed in Table 2. As the hypothesized theoretical framework differed from that obtained by the EFA, we modified the hypothesized dimensions into empirical dimensions as follows: 'collaboration' was divided into 'teamwork' and 'inter-sectional collaboration'; and the 'morale' and 'common values' dimensions were incorporated into a single dimension designated 'passion for mission'. As a result, our safety culture scale contained eight dimensions: 'improvement orientation', 'passion for mission', 'professional growth', 'resource allocation prioritization', 'inter-sectional collaboration', 'responsibility and authority', 'teamwork' and 'information sharing'. The item 'Q14: non-punitive and system-focused approach' under the hypothesized dimension of "common values" showed loading in another factor, and was regrouped into the 'improvement orientation' dimension (Table 2). In contrast, the item 'Q15: good understanding of organizational policy' under the hypothesized dimension of 'common values' did not have factor loadings greater than 0.25, and was omitted from the later analyses.

Multitrait analysis was performed to confirm construct validity (Table S3). Correlation coefficients calculated for each item within a respective dimension were all above 0.58, showing good convergent validity. Thus, there was a total of 24 items included in the

Table 2 Factor structure of hospital safety culture

Abbreviated name of item	Mean	SD	Factor loading I	II	III	IV	V	VI	VII	VIII
Q25: Promotion of safety improvement actions	61.7	22.1	0.86							
Q24: Thoroughness and follow-up of improvement implementation	57.4	23.4	0.84							
Q23: Collection of information external to the hospital to prevent errors	55.3	22.8	0.81							
Q22: Collection of information within hospital for safety improvement	59.7	23.5	0.78							
Q14: Non-punitive and system-focused approaches	52.5	27.0	0.29							
Q9: Active commitment for safety improvement on an individual level	79.9	18.6		0.82						
Q7: Highly motivated commitment for safety by colleagues	73.2	22.2		0.75						
Q8: Enthusiastic commitment for safety improvement by organization	71.0	22.9		0.66						
Q13: Prioritization for preventing errors or accidents	58.8	21.8		0.39						
Q16: Concrete goals set at workplace	69.3	23.8		0.28						
Q10: Professional skill-building opportunities available	65.2	23.1			0.87					
Q11: Professional inspiration from peers	66.7	23.9			0.83					
Q12: Sufficient opportunity for training and development	62.2	25.2			0.61					
Q19: Sufficient number and quality of staff	28.7	24.1				0.86				
Q18: Sufficient time for delivering quality care and services	28.5	24.6				0.86				
Q17: Sufficient facilities, equipment and devices for safety	51.5	24.0				0.37				
Q3: Freedom to express opinions without hesitation	50.2	26.4					0.87			
Q4: Good coordination with other units, wards or disciplines	56.4	25.2					0.60			
Q21: Clearly defined chain of command	57.1	25.3						0.79		
Q20: Adequate authorization to fulfill responsibilities	50.9	23.0						0.74		
Q15: Good understanding of organizational policy[a]	56.8	23.0								
Q2: Free discussion and reporting of problems at workplace	73.3	24.2							0.69	
Q1: Mutual help to prevent errors	80.9	19.7							0.60	
Q6: Prompt distribution of information to relevant units	63.0	25.6								0.80
Q5: Appropriate sharing of information to prevent errors	74.2	22.9								0.58

[a]Omitted from later analyses due to low loading.
I: improvement orientation; II: passion for mission; III: professional growth; IV: resource allocation prioritization; V: inter-sectional collaboration; VI: responsibility and authority; VII: teamwork; VIII: information sharing.
SD, standard deviation.

Table 3 Correlation matrix of dimensions after determining of dimensions and items

Dimension		Mean	SD	I	II	III	IV	V	VI	VII	VIII
I	Improvement orientation (5)	57.2	18.2	[0.82]							
II	Passion for mission (5)	70.4	16.0	0.61*	[0.78]						
III	Professional growth (3)	64.7	20.6	0.48*	0.57*	[0.82]					
IV	Resource allocation prioritization (3)	36.2	20.3	0.47*	0.37*	0.35*	[0.79]				
V	Inter-sectional collaboration (2)	53.3	23.4	0.48*	0.49*	0.46*	0.37*	[0.78]			
VI	Responsibility and authority (2)	54.9	19.0	0.56*	0.46*	0.47*	0.46*	0.43*	[0.75]		
VII	Teamwork (2)	77.2	20.2	0.48*	0.61*	0.53*	0.26*	0.54*	0.45*	[0.76]	
VIII	Information sharing (2)	68.6	21.9	0.60*	0.67*	0.51*	0.35*	0.55*	0.45*	0.60*	[0.77]

Items with loading <0.25 were omitted from the analysis. Dimension correlation coefficients were calculated using Pearson's correlation. The number of items included in each respective dimension is indicated in parentheses. Cronbach's alpha coefficient is indicated in square brackets.
*Significant at $\alpha = 0.01$ level.
SD, standard deviation.

later analyses. Cronbach's alpha coefficients calculated for each finalized dimension ranged from 0.75 to 0.82 after the item 'Q15' was omitted, thereby demonstrating adequate internal consistency (Table 3).

A multiple regression analysis was performed to examine the relationship of the safety culture dimensions with staff-perceived performance. The eight dimension scores and variables related to respondent characteristics were employed as explanatory variables. The results of the regression analysis are presented in Table 4. Four of the safety culture dimensions ('improvement orientation', 'passion for mission', 'resource allocation prioritization' and 'information sharing') were positively associated with perceived performance. Diagnostic tests for multicollinearity using VIF detected no evidence of effects that may inflate standard errors for the model. The cumulative variance explained by the model was 64%.

Table 4 Associations of safety culture dimensions with staff-perceived achievements in safety practices

	B	SE	β	VIF
Safety culture dimensions				
Improvement orientation	0.54	0.02	0.50***	2.18
Passion for mission	0.27	0.02	0.22***	2.55
Professional growth	0.02	0.02	0.02	1.86
Resource allocation prioritization	0.13	0.01	0.13***	1.53
Inter-sectional collaboration	0.02	0.01	0.03	1.94
Responsibility and authority	0.01	0.01	0.01	1.77
Teamwork	–0.03	0.02	–0.03	2.13
Information sharing	0.04	0.02	0.04*	2.50
Hospitals (ref: Hospital F)				
Hospital A	–2.08	1.08	–0.04	3.34
Hospital B	–4.72	1.15	–0.09***	3.22
Hospital C	–3.43	1.11	–0.06**	3.11
Hospital D	1.12	1.04	0.02	3.91
Hospital E	–2.49	1.13	–0.04*	3.02
Professions (ref: nurse)				
Doctor	1.13	0.91	0.02	1.41
Allied health personnel	0.35	0.66	0.01	1.10
Administrative staff	–0.31	0.89	0.00	1.12
Positions (ref: non-management)				
Management position (top or middle)	–2.14	0.59	–0.05***	1.27
Experience at the current hospital (ref: <1 year)				
≥1 year	2.49	0.72	0.04**	1.09
Explanatory power				
Adjusted *R*-square	0.64			

*Significant at $\alpha = 0.05$ level, **Significant at $\alpha = 0.01$ level, ***Significant at $\alpha = 0.001$ level.
β, standardized coefficient; B, unstandardized coefficient; ref, referent category; SE, standard error; VIF, variance inflation factor.

Discriminative power

Radar charts designed to provide a graphical understanding of the discriminative power of our assessment tool revealed differences across subgroups, stratified by hospital, profession, position and unit/ward (Fig. 1). We found variations in each dimension score across different subgroups. Among the different respondent professions, differences were dependent on dimensions of safety culture. Across positions, managers perceived patient safety culture more positively than non-management staff in all culture dimensions. In addition, we calculated CV and IQR/AVE across subgroups for the score and percent positive response of each dimension (Table S4). The ranges of CV values calculated for scores across hospitals, professions, positions and units/wards were 0.09–0.16, 0.05–0.13, 0.05–0.13 and 0.12–0.25, respectively. The ranges of IQR/AVE values for percent positive response across hospitals, professions, positions and units/wards were 0.15–0.58, 0.11–0.36, 0.10–0.50 and 0.19–0.66, respectively.

Discussion

In the present study, we designed and tested a new assessment tool for hospital safety culture, and demonstrated its ability to identify distinct features of safety culture among different hospitals, professions, management/non-management positions and units/wards using radar charts and calculating CV and IQR/AVE. Our results revealed that the HOCQ has a larger discriminative power when compared with that of previous studies [16–21]. With verification of the underlying assumption of validity and reliability for assessing hospital safety culture, this discriminative power across subgroups is a major strength of the HOCQ. This tool is expected to be useful for inter- and intra-institutional comparisons, and can clarify the need for interventions that aim for general or local improvement.

The values for IQR/AVE across hospitals in this study were larger than those published in previous reports [16–21]. In addition, the differences among respondent professions, positions and units/wards in our study were in general larger than those in previous studies that reported variations in perceptions of safety culture among the different subgroups [22–24]. The discriminative power of our assessment tool was able to effectively identify variations in hospital safety culture across subgroups, which can help guide organizations towards improvement in safety culture.

During the process of assessing face validity and content validity, the results of the dimensions in the preliminary analysis helped to refine our initial hypothetical framework for hospital safety culture. The multiple regression analysis using the modified framework enabled the identification of factors that require special attention, whereas previous studies have rarely specified particular dimensions among multidimensional characteristics of hospital safety culture [5,15]. Our findings emphasized the importance of 'improvement orientation', 'passion for mission', 'resource allocation prioritization' and 'information sharing' among the eight dimensions. These four dimensions are closely related with institutional-level management, rather than individual/unit-level management [13,20,25–27,29]. This suggests that safety culture management at the institutional level is more important for hospital safety than management at the individual/unit level.

The finding that managers' perceptions of organizational culture differ from that of non-managers is consistent with research from the United States [22,23]. Because managers have more influence on the formation of organizational culture, they may be more aware of organizational culture than non-managerial staff. On the other hand, a comparison of doctors and non-doctors showed that the former's perceptions were not consistently more positive than the latter's, which was also consistent with previous studies [22,24]. The inconsistencies among different professions in their perceptions of organizational culture may explain the contradictory results of relationships between culture and performance.

The HOCQ differs from existing safety culture surveys in three content-related aspects: first, it incorporates both institutional-level and individual/unit-level topics with fewer items than other safety climate surveys [16–21], thereby providing a more comprehensive understanding of an organization's safety culture. Instruments with fewer items also have the advantage of a reduced risk of suffering from lower response rates. Second, existing measures have tended to focus on factors that create an environment that prioritizes safety and encourages open communication and teamwork. In contrast, the HOCQ also includes an emphasis on the bottom-up rationale and actions that are subsumed by the 'professional growth' and 'responsibility and authority' dimensions, as well as that of top-down management. Although some of the more

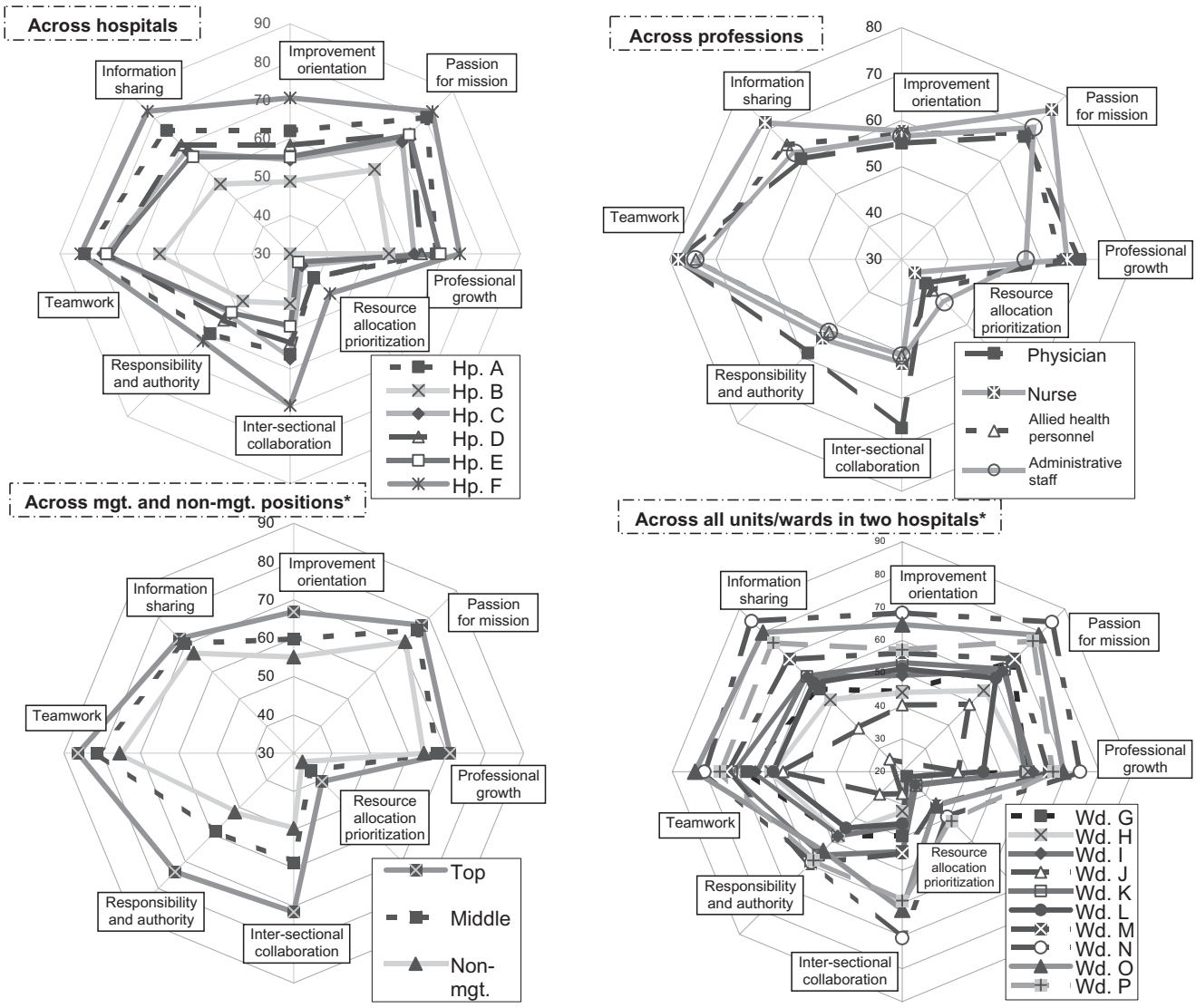

Figure 1 Differences in subgroup dimension scores for hospital safety culture. *Subgroups with fewer than 10 samples were excluded from the analysis. Hp., hospital; Mgt., management; Non-mgt., non-management; Wd., ward.

comprehensive questionnaires possess items similar to the HOCQ, they only capture a fragment of the behaviours documented [16–21]. Third, the HOCQ includes items related to whether data are consistently collected and analysed for continuous improvement; only a few other scales cover such activities [29,32].

Our study has several limitations. First, determination of the achievement of safety practice was conducted using subjective measures based on staff perceptions, because the direct outcomes of patient safety activities are difficult to measure as objective indicators. However, perceptions of safety culture are related to the actual behaviour of staff, which in turn may be related to rates of errors or accidents [39]. Future studies are needed to evaluate the outcome of actual performance affected by hospital safety culture and to verify the appropriateness of the HOCQ's framework. Second, it is difficult to infer causalities due to our cross-sectional design. A longitudinal survey should be conducted to examine if safety culture drives good performance or vice versa [9,10]. Third, our survey analysis did not utilize a large sample, and further studies encompassing a larger number of hospitals will strengthen the findings presented here.

There may be other important opportunities to improve the instrument further. For example, it may be possible to validate our assessment tool against other existing measures. Our analysis demonstrated that the HOCQ has a larger discriminative power than previous scales, but there is still a need for direct comparisons with other existing tools for validation purposes. Furthermore, because the development of this tool was conducted in the Japanese hospital setting, analyses should also be conducted to test the feasibility and applications of the assessment tool in other cultural contexts.

In conclusion, we developed a psychometric tool to discriminate distinct patterns of organizational safety culture among hospitals,

professions, management/non-management positions and units/wards. The dimensions of the HOCQ correlated with staff-perceived achievement in safety practices. The results have implications for improving patient safety by enhancing safety culture, particularly in the dimensions of 'improvement orientation', 'passion for mission', 'resource allocation prioritization' and 'information sharing'. Quantitative assessments obtained with this tool should help further the understanding of safety culture characteristics across different subgroups and help to provide insight into organizational readiness for patient safety improvement.

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Conflict of interest

The authors declare no conflict of interest.

References

1. Nieva, V. & Sorra, J. (2003) Safety culture assessment: a tool for improving patient safety in healthcare organizations. *Quality & Safety in Health Care*, 12 (Suppl. 2), II17–II23.
2. Walshe, K. & Shortell, S. M. (2004) When things go wrong: how health care organizations deal with major failures. *Health Affairs*, 23 (3), 103–111.
3. Kohn, L. T., Corrigan, J. & Donaldson, M. S. (2000) To Err Is Human: Building a Safer Health System. Washington, DC: National Academies Press.
4. Reason, J. (2000) Human error: models and management. *British Medical Journal*, 320 (7237), 768–770.
5. Scott, T., Mannion, R., Davies, H. & Marshall, M. (2003) The quantitative measurement of organizational culture in health care: a review of the available instruments. *Health Services Research*, 38 (3), 923–945.
6. Health and Safety Commission (HSC) (1993) Organizing for Safety: Third Report of the Human Factors Study Group of ACSNI. Sudbury: HSE Books.
7. Niskanen, T. (1994) Safety climate in the road administration. *Safety Science*, 17 (4), 237–255.
8. Clarke, S., Sloane, D. & Aiken, L. (2002) Effects of hospital staffing and organizational climate on needlestick injuries to nurses. *American Journal of Public Health*, 92 (7), 1115–1119.
9. Scott, T., Mannion, R., Marshall, M. & Davies, H. (2003) Does organisational culture influence health care performance? A review of the evidence. *Journal of Health Services Research & Policy*, 8 (2), 105–117.
10. Shortell, S. M., Marsteller, J., Lin, M., Pearson, M., Wu, S., Mendel, P. & Rosen, M. (2004) The role of perceived team effectiveness in improving chronic illness care. *Medical Care*, 42 (11), 1040–1048.
11. Singer, S., Falwell, A., Gaba, D., Meterko, M., Rosen, A., Hartmann, C. W. & Baker, L. (2009) Identifying organizational cultures that promote patient safety. *Health Care Management Review*, 34 (4), 300–311.
12. Singer, S., Lin, S., Falwell, A., Gaba, D. & Baker, L. (2009) Relationship of safety climate and safety performance in hospitals. *Health Services Research*, 44 (2), 399–421.
13. Shortell, S., Jones, R., Rademaker, A., Gillies, R., Dranove, D., Hughes, E. & Huang, C. (2000) Assessing the impact of total quality management and organizational culture on multiple outcomes of care for coronary artery bypass graft surgery patients. *Medical Care*, 38 (2), 207–217.
14. Rosen, A., Singer, S., Zhao, S., Shokeen, P., Meterko, M. & Gaba, D. (2010) Hospital safety climate and safety outcomes: is there a relationship in the VA? *Medical Care Research and Review*, 67 (5), 590–608.
15. Halligan, M. & Zecevic, A. (2011) Safety culture in healthcare: a review of concepts, dimensions, measures and progress. *BMJ Quality & Safety*, 20 (4), 338–343.
16. Singer, S., Meterko, M., Baker, L., Gaba, D., Falwell, A. & Rosen, A. (2007) Workforce perceptions of hospital safety culture: development and validation of the patient safety climate in healthcare organizations survey. *Health Services Research*, 42 (5), 1999–2021.
17. Vogus, T. J. & Sutcliffe, K. M. (2007) The Safety Organizing Scale: development and validation of a behavioral measure of safety culture in hospital nursing units. *Medical Care*, 45 (1), 46–54.
18. Ginsburg, L., Gilin, D., Tregunno, D., Norton, P. G., Flemons, W. & Fleming, M. (2009) Advancing measurement of patient safety culture. *Health Services Research*, 44 (1), 205–224.
19. Sorra, J. & Dyer, N. (2010) Multilevel psychometric properties of the AHRQ hospital survey on patient safety culture. *BMC Health Services Research*, 10 (7), 199–211.
20. Sorra, J. & Nieva, V. (2004) Hospital Survey on Patient Safety Culture. Rockville, MD: Agency for Healthcare Research and Quality. Publication no. 04–0041.
21. Sexton, J., Helmreich, R., Neilands, T., Rowan, K., Vella, K., Boyden, J. & Thomas, E. (2006) The safety attitudes questionnaire: psychometric properties, benchmarking data, and emerging research. *BMC Health Services Research*, 6 (4), 44–53.
22. Hartmann, C. W., Rosen, A., Meterko, M., Shokeen, P., Zhao, S., Singer, S., Falwell, A. & Gaba, D. (2008) An overview of patient safety climate in the VA. *Health Services Research*, 43 (4), 1263–1284.
23. Singer, S., Falwell, A., Gaba, D. & Baker, L. (2008) Patient safety climate in US hospitals: variation by management level. *Medical Care*, 46 (11), 1149–1156.
24. Singer, S., Gaba, D., Falwell, A., Lin, S., Hayes, J. & Baker, L. (2009) Patient safety climate in 92 US hospitals: differences by work area and discipline. *Medical Care*, 47 (1), 23–31.
25. Singer, S., Gaba, D., Geppert, J., Sinaiko, A., Howard, S. & Park, K. (2003) The culture of safety: results of an organization-wide survey in 15 California hospitals. *Quality & Safety in Health Care*, 12 (2), 112–118.
26. Aiken, L. & Patrician, P. (2000) Measuring organizational traits of hospitals: the revised nursing work index. *Nursing Research*, 49 (3), 146–153.
27. Kontoghiorghes, C., Awbre, S. M. & Feurig, P. L. (2005) Examining the relationship between learning organization characteristics and change adaptation, innovation, and organizational performance. *Human Resource Development Quarterly*, 16 (2), 185–212.
28. Shortell, S. M., Zimmerman, J. E., Rousseau, D. M., Gillies, R. R., Wagner, D. P., Draper, E. A. & Duffy, J. (1994) The performance of intensive care units: does good management make a difference? *Medical Care*, 32 (5), 508–525.
29. Institute for Healthcare Improvement. (2004) Safety climate survey. Available at: http://w.primaris.org/sites/default/files/resources/Patient%20Safety/safety%20climate%20survey.pdf (last accessed 20 August 2013).

30. Ingersoll, G., Kirsch, J., Merk, S. & Lightfoot, J. (2000) Relationship of organizational culture and readiness for change to employee commitment to the organization. *Journal of Nursing Administration*, 30 (1), 11–20.
31. Schulman, P. (2004) General attributes of safe organisations. *Quality & Safety in Health Care*, 13 (Suppl. 2), 39–44.
32. Cohen, M. M., Eustis, M. A. & Gribbins, R. E. (2003) Changing the culture of patient safety: leadership's role in health care quality improvement. *Joint Commission Journal on Quality and Patient Safety*, 29 (7), 329–335.
33. Roughton, J. E. & Mercurio, J. J. (2002) Developing an Effective Safety Culture: A Leadership Approach. Oxford: Butterworth-Heinemann.
34. Shojania, K. G., Duncan, B. W., McDonald, K. M., Wachter, R. M. & Markowitz, A. J. (2001) Making health care safer: A critical analysis of patient safety practices. Rockville, MD: Agency for Healthcare Research and Quality. (Publication no. 01-E058).
35. Kho, M., Carbone, J., Lucas, J. & Cook, D. (2005) Safety Climate Survey: reliability of results from a multicenter ICU survey. *Quality & Safety in Health Care*, 14 (4), 273–278.
36. Huang, D., Clermont, G., Sexton, J., Karlo, C., Miller, R., Weissfeld, L. & Angus, D. (2007) Perceptions of safety culture vary across the intensive care units of a single institution. *Critical Care Medicine*, 35 (1), 165–176.
37. Hays, R. D., Anderson, R. & Revicki, D. (1993) Psychometric considerations in evaluating health-related quality of life measures. *Quality of Life Research*, 2 (6), 441–449.
38. Cronbach, L. J. (1951) Coefficient alpha and the internal structure of tests. *Psychometrika*, 16 (3), 297–334.
39. O'Toole, M. (2002) The relationship between employees' perceptions of safety and organizational culture. *Journal of Safety Research*, 33 (2), 231–243.

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