Chapter 11

Psychometric Properties of the Hospital Survey on Patient Safety Culture (HSOPSC): Findings from Greece

Vasiliki Kapaki and Kyriakos Souliotis

Additional information is available at the end of the chapter

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Abstract

Background: Safety culture has been considered to be as one of the most crucial premises for the further development of patient safety in healthcare.

Objective: To study the psychometric properties of a translated Greek version of Hospital Survey on Patient Safety Culture (G-HSOPSC) of the Agency for Healthcare Research and Quality (AHRQ) in the Greek healthcare settings.

Methods: Factor analysis (FA) was performed to examine the applicability of the factor structure of the original questionnaire to the Greek data. In addition to the previously mentioned, internal consistency with Cronbach's coefficient alpha and construct validity was evaluated.

Results: Ten factors with 37 items were extracted by FA, with acceptable Cronbach's coefficients alpha and good construct validity. The factors jointly explained 62% of the variance in the responses. Five items were removed from the original version of the questionnaire. The composition of the factors was similar to that of the original questionnaire and five items moved to other factors. All the composites consisted of two to eight items.

Conclusions: The G-HSOPSC depicted sound psychometric properties for the evaluation of patient safety culture and therefore it is a reliable tool for use in research.

Keywords: hospital survey on patient safety culture, construct validity, reliability, internal consistency

1. Introduction

Safety culture has been deemed as one of the most significant premises for following improvement of patient safety in healthcare [1]. The term 'culture' is often substituted with 'climate' when questionnaire surveys are utilized to assess an organization's culture. The definition of 'safety culture' derives from the nuclear power industry and has been transferred to the field of the healthcare: 'the safety culture of an organization 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 organization's safety management' [2]. Safety climate can be faced as the superficial features of the underlying safety culture [3]. It assesses workforce perceptions of procedures and behaviours in their work environment that point out the priority given to safety relative to other organizational goals [4, 5].

Therefore, individual and self-administered questionnaires allow measuring an organization's safety climate [6–9] while for assessing safety culture, other types of assessment (i.e. 'interviews, on-site observations, focus groups') are more suitable [10–12]. These questionnaires are distributed to a group of professionals that operate in the healthcare field having an aim to provide information on aspects of the organizational culture underlying active failures and latent conditions that have to be addressed by patient safety initiatives [13].

Most of the available tools were developed in the United States (US) but some researchers suggest that various US tools cannot be adapted to European context. For this exact reason, after translating a questionnaire into another language and applying it in a different setting, it is of crucial importance to validate it before extending its use to populations differentiating from the specific geographical and healthcare contexts for which it was initially developed. The psychometric techniques are commonly used in order to ensure potential users that tools will be a good predictor of safety events and provide actionable information [9].

2. Clinical vignette

M.G., a 75-year-old woman with stage four chronic kidney disease (CKD), hypertension and gout was admitted for a total knee replacement under the orthopedic team. According to the routine renal biochemistry results and following advice from nephrology group, she was on a low dose of an activated vitamin D analogue. She was also taking a diuretic, an angiotensin receptor blocker, aspirin, sodium bicarbonate and a statin drug. Serum calcium was not verified again during her admission. Even though discharge communication included the recently started medication with the advised dose, no advice was given to the general practitioner about the required rate of monitoring serum calcium and renal function post discharge and the patient was not duly informed of the necessity for this monitoring. At her home, the patient made a slow recovery from her operation and had limited ability to move around. Her son phoned for the surgery and requested a general practitioner to make a visit to his mother 3 weeks after discharge, as she looked very sick, was more and more confused and was not consuming food or water. The general practitioner arranges for the patient to be re-admitted

into the hospital. The last diagnosis was stage 2, acute kidney injury (AKI), second in importance, iatrogenic hypercalcaemia and dehydration.

2.1. Key learning points

i. Knowledgeable safety culture is when bidirectional communication is open and honest, trust exists for the total levels of the health care structure, and messengers are trained and prized for making better systems. The system is precisely in the handling of employees, reporting of errors is valued, and learning from errors is recognized and valued.

ii. Communication has an effect on health care transactions among health care staff. To be more precise, it is necessary that the list of a patient's medications that is accumulated at admission be communicated successfully to following providers as the patient is transferred between settings and practitioners extending all the way to discharge.

iii. Keeping patients properly informed is essential to good medical practice and may bring in a level of protection to the test results management system. Patients and where right their families and caretakers, need to be informed at the point of discharge that follow-up tests are needed, what the system for follow-up tests is, and how to navigate it.

3. Methods

3.1. HSOPSC measurement tool

The self-administered HSOPSC tool was developed by the US Agency for Healthcare Research and Quality (AHRQ). The HSOPSC tool assesses safety climate from the staff perspective and covers 7 unit-level composites (24 items) of safety climate, 3 hospital-level composites (11 items) and 4 outcome variables. **Table 1** depicts the characteristics of the specific measurement tool [14].

HSOPSC was selected as the tool for testing for several reasons: (a) Organizations can use the tool to assess their patient safety culture, track changes over time and evaluate the impact of patient safety interventions [15]. (b) It had been designed for surveying all hospital personnel (clinical/non-clinical) [14]. (c) It was considered one of the few healthcare safety climate instruments for which initial psychometric results had been reported [6, 7]. (d) Benchmark statistics of HSOPSC can be retrieved from the internet [16]. (e) The questionnaire has been translated into 27 different languages and it is currently used in 59 countries [17]. To use the specific tool will allow for future international comparisons.

3.2. Translation process: pre-test

Firstly, permission was obtained from the authors to use HSOPSC. It was translated into Greek language and then translated back into English by two independent researchers to ensure validity of the translation. In the translation process, it was stressed that the same meaning and 'strength' should be reproduced in the translation into the Greek language. In order to test if respondents understood the meaning of all items, HSOPSC was pilot tested in a group of 35 healthcare professionals which was not incorporated to the final sample. The overall Cronbach's alpha of the pre-test was 0.87.

Characteristics	HSOPSC measurement tool
Writers and date of development	Sorra and Nieva, 2004
Country	USA
Objective	To empower hospitals to evaluate their patient safety culture
Number of items	44
Scale	On a 5-point Likert scale
Setting	Hospital
Staff	Health care staff
Dimensions/elements	**1.** Communication openness **2.** Supervisor/manager expectations and actions promoting patient safety **3.** No punitive response to error **4.** Staffing **5.** Hospital management support for patient safety **6.** Teamwork within units **7.** Teamwork across hospital units **8.** Organizational learning—continuous improvement **9.** Feedback and communication about error **10.** Hospital handoffs and transitions **11.** Overall perception of patient safety **12.** Frequency of event reporting **13.** Overall patient safety grade **14.** Number of events reported in the past 12 months
Psychometric evaluation	**1.** Sufficient psychometric properties **2.** Cronbach's alpha range from 0.63 to 0.84 **3.** Tested on large specimen
Statistical analysis such as item analysis, exploratory factor analysis, confirmatory factor analysis and correlated composites scores across elements were performed to evaluate psychometric properties. It has a solid content validity and has been validated in all levels. FA resulted in 12 factors.	

Table 1. Characteristics of the HSOPSC measurement tool.

3.3. Sample

The study was carried out in 12 Greek hospitals over the period from May 2014 to November 2014. The participating hospitals included nine general hospitals, one of them is a teaching hospital, and three specialty hospitals (1 anticancer-oncology hospital, 1 psychiatric hospital and 1 cardiac surgery centre). The HSOPSC was originally designed for application to all hospital professionals [14]. However, the pre-test showed that items dealing with direct patient care could often not be answered by staff not involved directly in patient care (i.e. hospital managers, administrators). Consequently, the survey was returned by 820 participants (response rate = 59.6%), 10 questionnaires in which fewer than half the items were answered were also excluded. Finally, 810 questionnaires were retained for further analysis.

3.4. Statistical analysis

Factor analysis (FA) clarifies the items which are in depth connected and allude in collaboration to a below composite (or factor). Therefore, the items are able to be lessened to the smallest potential number of understandings that as before make the largest potential part of the variance

clear [18]. A FA was carried out (principal component analysis with varimax rotation) for the purpose of proving that the current scales/dimensions may be fairly employed within the Greek context. When proving the number of elements, the Eigen value (Eigen value > 1: Kaiser's criterion) was taken into consideration, in comparison with the range of explained variance, the shape of the screen plot and the future outcome of interpreting the elements. Kaiser's criterion is trustworthy in a specimen of more than 250 respondents and when the average communality adds up to or is larger than, 0.6. The figure of the screen plot supplies dependable knowledge when the sample is larger than 200 respondents [18]. The data fulfil the requirements.

The Kaiser-Meyer-Olkin (KMO) calculation of sampling appropriateness was ascertained. This value is able to fluctuate from 0 to 1. A value near 1 points out that there is just any diffusion in the correlation pattern, empowered trustworthy and unique elements by FA [18]. The KMO score was 0.9, not close to Kaiser's standard of 0.5.

Additionally, the writers confirmed whether the inter-item correlations were adequate, by a test of the correlation matrix. Queries are a member of the common underlying composite, which will be related as they calculate the identical feature of patient safety culture. Objectives that are not related, or correlate with only a few other variables, are not compatible with FA [18]. Bartlett's test of sphericity illustrated that the inter-item correlations were adequate: (x^2 = 12,190, df = 861, p < 0.001).

Last but not least, the writers confirmed whether the contrary existed: too much connection between the items. According to an ideal, each feature of patient safety culture exclusively is responsible for the patient safety culture. An important connection between two items signifies that patient safety culture aspects cross each other to a comprehensive range. The amount overlapped in the answer patterns is about 50% when a connection is 0.7 [18]. No connections surpassed the specific boundary score. The pre-analyses depict that the data could be employed for FA.

The construct validity was accomplished by determining scale scores for each factor (after any essential opposite coding) and next measuring Pearson correlation coefficients (r) between the scale scores. The construct validity of each factor is revealed in scale scores that are reasonably connected. Despite this, strong correlations (r > 0.7) would point out that factors calculate the identical concept and the above factors may be joined and/or a few objectives could be taken out. Also, connections of the scale scores were measured with the outcome variable 'Patient safety grade'. No connections were measured with the other outcome variable, 'Number of events reported', due to the shortage of variability and distorted type of the specific item (40.1% of the respondents pointed out not to have reported any events during the past 12 months and 35% had reported only one or two events).

Cronbach's alpha was determined to examine the internal consistency of composites. It is expressed as a number between 0 and 1. In case that separate items are considered to calculate the identical concept, the internal consistency (reliability) should be greater than or equivalent to 0.6 [18]. To the reason that the form with questions composed of in a positive and negative way phrased items, the negative ones were made an entry in first reason, due to ensure that a higher score every time signifies a more affirmative reply. Statistical analysis was carried out using the IBM SPSS 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.).

4. Results

4.1. Sample

Most respondents were nursing staff (45.7%), followed by physicians (25.4%), nurse/unit assistants (17.9%) and physical/occupational/speech therapists (3.8%). These percentages give a reasonable reflection of the real distribution of disciplines at the units (**Table 2**).

Characteristics	Category	N (%)
Hospital type	General hospital	501 (61.9)
	Anticancer-oncology hospital	110 (13.6)
	Psychiatric hospital	132 (16.3)
	Cardiac surgery centre	67 (8.3)
Hospital size (beds)	100–250	642 (79.3)
	400 or more	168 (20.7)
Location of hospital	Central hospitals	9 (75)
	Peripheral hospitals	3 (25)
Work area/unit	Many different hospital units/no specific unit	166 (20.5)
	Medicine (non-surgical)	166 (20.5)
	Surgery	204 (25.2)
	Emergency department	12 (1.5)
	Intensive care unit (any type)	49 (6)
	Laboratory	38 (4.7)
	Psychiatry/mental health	117 (14.4)
	Rehabilitation	11 (1.4)
	Pharmacy	1 (0.1)
	Social services department	19 (2.3)
	Other	27 (3.4)
Staff position	Resident physicians	110 (13.6)
	Specialist physicians	95 (11.8)
	Nurses (university training)	49 (6.1)
	Nurses (technological education institute training)	320 (39.6)
	Nurse assistants	136 (16.8)
	Unit assistants	9 (1.1)
	Physical/occupational/speech therapists	31 (3.8)
	Psychologists	5 (0.6)
	Welfare workers	26 (3.2)
	Pharmacy staff	1 (0.1)
	Other	26 (3.2)

Characteristics	Category	N (%)
Gender	Male	247 (30.5)
	Female	563 (69.5)
Age (years)	Mean	41.35
	Std. deviation	7.9
	Median	41
	Min	18
	Max	65
Education level	University	268 (33.1)
	Technological education institute	386 (47.7)
	Secondary education	156 (19.3)
	Master degree	130 (17)
	PhD	12 (1.6)
Professional experience (years)	Mean	14.97
	Std. deviation	8.71
	Median	15
	Min	0.02
	Max	36
Professional experience in the specific hospital (years)	Mean	12.12
	Std. deviation	8.8
	Median	10
	Min	0.02
	Max	35
Professional experience in the specific unit (years)	Mean	7.74
	Std. deviation	6.84
	Median	6
	Min	0.02
	Max	35
Working hours per week	Mean	44
	Std. deviation	12.88
	Median	40
	Min	4
	Max	120
Interaction with patients	Direct	724 (89.6)
	Indirect	84 (10.4)

Table 2. Respondents—hospital characteristics.

4.2. FA: internal consistency

Ten factors were drawn by FA with 37 items. All the items of 'Hospital handoffs and transitions' (F3r, F5r, F7r, F11r) blended into the factor 'Teamwork across hospital units'. Two of the items of 'Feedback and communication about errors' (C3, C5) from the US version blended into the factor 'Communication openness'. A new factor originated, which comprised four items from the original questionnaire (B3r, B4r, A7r, A10r). The factors of 'Non-punitive response to error', 'Hospital management support for patient safety' and 'Frequency of event reporting' from the American study remained stable to the G-HSOPSC. The overall Cronbach's coefficient alpha for the G-HSOPSC was 0.91. Seven out of 10 factors in the G-HSOPSC had Cronbach's coefficients alpha > 0.70 and three factors had values between 0.60 and 0.70, which indicate fairly good internal consistency of the Greek version of the questionnaire (**Table 3**).

HSOPSC factor analysis				**G-HSOPSC factor analysis**		
Composite	**Items[a]**	**Cronbach's α American data**	**Cronbach's α Greek data**	**Composite**	**Items[a]**	**Cronbach's α**
Unit-level						
1. Supervisor/ manager expectations and actions promoting safety	B1, B2, B3r, B4r	0.75	0.70	1. Competent supervisor/manager expectations and actions promoting safety	B1, B2	0.84
2. Organizational learning—continuous improvement	A6, A9, A13	0.76	0.49	2. Organizational learning	A9, A13	0.60
3. Teamwork within units	A1, A3, A4, A11	0.83	0.61	3. Teamwork within units—continuous improvement	A1, A3, A4, A6	0.80
4. Communication openness	C2, C4, C6r	0.72	0.62	4. Feedback and communication openness about errors	C2, C4 C6r, C3 C5	0.77
5. Feedback and communication about errors	C1, C3, C5	0.78	0.74	*	*	*
6. Non-punitive response to error	A8r, A12r, A16r	0.79	0.71	5. Non-punitive response to error	A8r, A12r A16r	0.71
7. Staffing	A2, A5r, A7r, A14r	0.63	0.51	6. Sufficient staffing	A2, A5r A14r	0.60
Hospital-level						
8. Hospital management support for patient safety	F1, F8, F9r	0.83	0.79	7. Hospital management support for patient safety	F1, F8 F9r	0.79

HSOPSC factor analysis				G-HSOPSC factor analysis		
Composite	**Items[a]**	**Cronbach's α American data**	**Cronbach's α Greek data**	**Composite**	**Items[a]**	**Cronbach's α**
9. Teamwork across hospital units	F4, F10, F2r, F6r	0.80	0.82	8. Teamwork across hospital units and handoffs and transitions	F4, F10 F2r, F6r F3r, F5r F7r, F11r	0.88
10. Hospital handoffs and transitions	F3r, F5r, F7r, F11r	0.80	0.78	*	*	*
Outcome variables						
11. Overall perceptions for safety	A15, A18, A10r, A17r	0.74	0.68	*	*	*
12. Frequency of event reporting	D1, D2, D3	0.84	0.82	9. Frequency of event reporting	D1, D2 D3	0.82
				10. Adequate procedures and systems for safety	B3r, B4r A7r, A10r	0.62

[a]The codes in items' column refer to the sections in the questionnaire and the numbers of the questions.
*Some of the items of the American factors 'Feedback and communication about errors', 'Hospital handoffs and transitions' and 'Overall perceptions for safety' assimilated to other factors and other items removed from the questionnaire.

Table 3. Cronbach's alpha and characteristics of the factors after factor analysis.

Five items (A11, A15, A17r, A18, C1) did not have a sufficient factor loading on any of the factors (all loadings < 0.50) and were eliminated. **Table 4** gives the mean scores with standard deviations and factor loadings per item. The factors jointly explained 62% of the variance in the responses (**Table 4**).

4.3. Construct validity: inter-correlations

For each of the 10 factors, scale scores were calculated by obtaining the mean of the item scores within one factor for every respondent. Immediately after, the mono-item outcome variable 'Patient safety grade' has been determined with the connections of the scales. The factors were anticipated to be related in a positive way with the specific outcome measure. Every one of connections with 'Patient safety grade' was important. With the 'Teamwork across hospital units and handoffs & transitions', the most significant correlation of this outcome was measured ($r = 0.49$). Moreover, correlations between the scale scores were calculated. The highest correlation was between 'Hospital management support for patient safety' and 'Teamwork across hospital units and handoffs & transitions' ($r = 0.52$) but no correlation was exceptionally high (**Table 5**).

Item	Factors											
	Mean	**SD**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
B1. My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	3.62	0.95	0.823									
B2. My supervisor/manager seriously considers staff suggestions for improving patient safety	3.67	0.91	0.805									
A9. Mistakes have led to positive changes here	3.12	0.94		0.772								
A13. After we make changes to improve patient safety, we evaluate their effectiveness	3.29	0.91		0.597								
A1. People support one another in this unit	3.52	0.91			0.802							
A3. When a lot of work needs to be done quickly, we work together as a team to get the work done	3.71	0.89			0.711							
A4. In this unit, people treat each other with respect	3.50	0.89			0.778							
A6. We are actively doing things to improve patient safety	3.98	0.75			0.618							
C2. Staff will freely speak up if they see something that may negatively affect patient care	3.78	0.92				0.695						
C3. We are informed about errors that happen in this unit	3.75	0.95				0.645						
C4. Staff feel free to question the decisions or actions of those with more authority	2.77	0.96				0.687						
C5. In this unit, we discuss ways to prevent errors from happening again	3.66	0.89				0.626						
C6r. Staff are afraid to ask questions when something does not seem right (reverse worded)	3.62	0.99				0.604						
A8r. Staff feel as if their mistakes are held against them (reverse worded)	2.35	0.94					0.753					
A12r. When an event is reported, it feels like the person is being written up, not the problem (reverse worded)	2.68	1.00					0.699					

Item	Factors											
	Mean	SD	1	2	3	4	5	6	7	8	9	10
A16r. Staff worry that mistakes they make are kept in their personnel file (reverse worded)	2.66	0.97					0.781					
A2. We have enough staff to handle the workload	2.16	1.03						0.663				
A5r. Staff in this unit work longer hours than is best for patient care (reverse worded)	2.29	1.05						0.732				
A14r. We work in 'crisis mode,' trying to do too much, too quickly (reverse worded)	2.27	0.97						0.578				
F1. Hospital management provides a work climate that promotes patient safety	2.82	0.98							0.745			
F8. The actions of hospital management show that the patient safety is a top priority	3.10	1.09							0.753			
F9r. Hospital management seems interested in patient safety only after an adverse event happens (reverse worded)	2.76	1.04							0.752			
F2r. Hospital units do not coordinate well with each other (reverse worded)	2.73	0.93								0.638		
F3r. Things 'fall between the cracks' when transferring patients from one unit to another (reverse worded)	2.94	0.97								0.736		
F4. There is good cooperation among hospital units that need to work together	3.33	0.85								0.674		
F5r. Important patient care information is often lost during shift changes (reverse worded)	3.44	1.01								0.598		
F6r. It is often unpleasant to work with staff from other hospital units (reverse worded)	3.13	0.89								0.795		
F7r. Problems often occur in the exchange of information across hospital units (reverse worded)	2.96	0.91								0.804		
F10. Hospital units work well together to provide the best care for patients	3.20	0.88								0.718		
F11r. Shift changes are problematic for patients in this hospital. (reverse worded)	3.48	0.97								0.569		

Item	Factors											
	Mean	SD	1	2	3	4	5	6	7	8	9	10
D1. When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	3.41	1.11									0.788	
D2. When a mistake is made, but has no potential to harm the patient, how often is this reported?	3.05	1.13									0.881	
D3. When a mistake is made that could harm the patient, but does not, how often is this reported?	3.17	1.19									0.808	
A7r. We use more agency/ temporary staff than is best for patient care.	3.44	1.02										0.571
A10r. It is just by chance that more serious mistakes do not happen around here.	3.24	1.12										0.505
B3r. Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts. (reverse worded)	3.41	1.01										0.596
B4r. My supervisor/manager overlooks patient safety problems that happen over and over. (reverse worded)	3.91	0.94										0.656
A11. When one area in this unit gets really busy, others help out.	2.30	1.11								0.29		
A15. Patient safety is never sacrificed to get more work done.	4.12	0.81								0.41		
A17r. We have patient safety problems in this unit. (reverse worded)	3.24	1.07				0.49						
A18. Our procedures and systems are good at preventing errors from happening.	3.07	0.97								0.46		
C1. We are given feedback about changes put into place based on event reports.	3.06	0.98								0.44		

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]
[a]Rotation converged in seven iterations.

Table 4. Mean scores and factor loadings of the items regarding patient safety culture.

Correlations

Factor			Patient safety grade	1	2	3	4	5	6	7	8	9	10
1. Competent supervisor/manager expectations & actions promoting safety	Mean (SD)	3.62 (0.86)											
	Pearson r		0.36	1	0.36**	0.34**	0.45**	0.11**	0.11**	0.29**	0.27**	0.16**	0.31**
	Sig. (two-tailed)		<0.001		<0.001	<0.001	<0.001	0.002	0.003	<0.001	<0.001	<0.001	<0.001
	N		810	806	796	802	794	792	793	806	784	806	767
2. Organizational learning	Mean (SD)	3.20 (0.76)											
	Pearson r		0.40	0.36**	1	0.30**	0.38**	0.15**	0.18**	0.37**	0.37**	0.17**	0.26**
	Sig. (two-tailed)		<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N		810	796	800	796	789	785	788	800	780	800	759
3. Teamwork within units—continuous improvement	Mean (SD)	3.66 (0.67)											
	Pearson r		0.34	0.34**	0.30**	1	0.38**	0.16**	0.09**	0.29**	0.39**	0.14**	0.39**
	Sig. (two-tailed)		<0.001	<0.001	<0.001		<0.001	<0.001	0.009	<0.001	<0.001	<0.001	<0.001
	N		810	802	796	806	794	791	794	806	783	806	763
4. Feedback and communication openness about errors	Mean (SD)	3.51 (0.68)											
	Pearson r		0.41	0.45**	0.38**	0.38**	1	0.25**	0.15**	0.25**	0.39**	0.36**	0.33**
	Sig. (two-tailed)		<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N		810	794	789	794	798	784	786	798	777	798	757
5. Non-punitive response to error	Mean (SD)	2.54 (0.77)											
	Pearson r		0.22	0.11**	0.15**	0.16**	0.25**	1	0.38**	0.22**	0.29**	0.13**	0.29**
	Sig. (two-tailed)		<0.001	0.002	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001
	N		810	792	785	791	784	795	784	795	772	795	755
6. Sufficient staffing	Mean (SD)	2.23 (0.74)											
	Pearson r		0.29	0.11**	0.18**	0.09**	0.15**	0.38**	1	0.30**	0.30**	0.08*	0.21**

Correlations													
Factor			**Patient safety grade**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	Sig. (two-tailed)		<0.001	0.003	<0.001	0.009	<0.001	<0.001		<0.001	<0.001	0.019	<0.001
	N		810	793	788	794	786	784	797	797	775	797	756
7. Hospital management support for patient safety	Mean (SD)	2.86 (0.87)											
	Pearson r		0.44	0.29**	0.37**	0.29**	0.25**	0.22**	0.30**	1	0.52**	0.11**	0.31**
	Sig. (two-tailed)		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	0.002	<0.001
	N		810	806	800	806	798	795	797	810	787	810	767
8. Teamwork across hospital units and handoffs & transitions	Mean (SD)	3.13 (0.69)											
	Pearson r		0.49	0.27**	0.37**	0.39**	0.39**	0.29**	0.30**	0.52**	1	0.15**	0.42**
	Sig. (two-tailed)		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001
	N		810	784	780	783	777	772	775	787	787	787	748
9. Frequency of event reporting	Mean (SD)	3.20 (0.97)											
	Pearson r		0.30	0.16**	0.17**	0.14**	0.36**	0.13**	0.08*	0.11**	0.15**	1	0.26**
	Sig. (two-tailed)		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.019	0.002	<0.001		<0.001
	N		810	806	800	806	798	795	797	810	787	810	767
10. Adequate procedures and systems for safety	Mean (SD)	3.49 (0.70)											
	Pearson r		0.38	0.31**	0.26**	0.39**	0.33**	0.29**	0.21**	0.31**	0.42**	0.26**	1
	Sig. (two-tailed)		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	N		810	767	759	763	757	755	756	767	748	767	767

NA: non applicable.
*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).

Table 5. Mean factor scores, correlations with patient safety grade and inter-correlations of the 10 composites.

5. Discussion

Cultural and healthcare differences in terms of context between US and Greece set obvious that reproduction of HSOPSC would be meaningful in Greek hospital settings. The available evidence from studies which were conducted in European and non-European countries—such as Norway [19]; Sweden [20]; Slovenia [21]; the West Bank [22]; Iran [23]; Scotland [24]; the United Kingdom [25]; the Netherlands [26]; Norway [15]; Switzerland [26] and Belgium [27]—suggests that the HSOPSC developed based on the original US version should be cautiously adjusted to other healthcare contexts. In Switzerland, for instance [26], the use of agency staff in nursing is currently relatively uncommon. Moreover, the role of hospital management and the way it is organized presents differences between hospital types and national or regional regulations. Consequently, taking into account the relative published studies, the number of composites varied between 8 and 15 and included 27 to 50 items.

This is the first study which was conducted in Greece which reports the structure as well as the psychometric properties of G-HSOPSC in accordance with the guidelines of the AHRQ. Despite the fact that our results are aligned with the original version, some adaptations were demanded so that the Greek context is fitted correctly. A 10-factor model with 37 items performed better than the original one in the sample of the 12 Greek hospitals. The main difference was that the composite 'Teamwork across hospital units' merged with 'Hospital handoffs and transitions' and 'Communication openness' merged with 'Feedback and communication about error' except an item (C1). The studies [21, 28, 29] showed the same conflations. The items B3r and B4r, A7, A10r loaded slightly more on a new composite which was named 'Adequate procedures and systems for safety' instead of 'Supervisor/Manager expectations & actions promoting safety', 'Staffing', 'Overall perceptions for safety', respectively. Last but not least, the item A6 loaded slightly more on 'Teamwork within units' instead of 'Organizational learning—continuous improvement' which renamed the first one as 'Teamwork within units—continuous improvement'.

Finally five items (A11, A15, A17r, A18, C1) of the original questionnaire were removed. Three of them (A11, A15, C1) have been eliminated from the Arabic, Dutch and French version, respectively too [22, 26, 28]. Ten underlying factors offered 62% of the variance of the items. The originally proposed 12 safety culture composites had explained 64.5% of the variance in the US version [14] and 57.1% and 59.8% in the Dutch adaptation and German version, respectively [26, 29].

If the factor structures of the various applications of the HSOPSC in Europe are compared to the original pilot tested US version, most of the composites presented similar patterns in the Cronbach's alpha. The internal consistency of G-HSOPSC ranged between 0.60 and 0.88 with lowest Cronbach´s alpha values for 'Organizational learning' and 'Sufficient staffing' (both $\alpha = 0.60$). These findings have also been presented in other studies [25, 26, 29, 30]. As far as the present study is concerned, our belief is that these composites and items should be kept since they signify important aspects of patient safety and as such shape a useful foundation for improvement work.

Correlations among the 10 safety culture composites varied from 0.08 to 0.52 ($p < 0.01$). These correlations are deemed satisfactory and do not indicate problematic associations among dimensions. 'Patient Safety Grade' showed its highest correlations with 'Teamwork across hospital units and handoffs & transitions' ($r = 0.49$). 'Frequency of events reported' has actually only a small interrelationship with the other safety culture sub-dimensions (the highest with 'Feedback and communication openness about error', $r = 0.36$). The above results underline the crucial role of the hospital procedures in developing a cooperative and communication openness environment that cultivates free process of evaluation about the adverse events, sharing data about the errors that take place, discussing the way to prevent adverse events and reporting the identified errors. As data indicate an aftermath of that environment will lead to a frequency of event report and improved patient safety grade [31]. Finally, the highest intercorrelation was between 'Hospital management support for patient safety' and 'Teamwork across hospital units and handoffs & transitions' ($r = 0.52$). Considering that both composites share some attention towards transference of important patient care information, this outcome was not considered as surprising; although these composites share a common meaning, they were not integrated into one concept.

5.1. Strengths and limitations of the study

The main strength of the study is the heterogeneity of the selected healthcare facilities. The sample was opted from different types of hospitals in order to capture a more comprehensive view of perceptions towards patient safety culture because the studies which have been published show that the patient safety culture composites may vary among different types of healthcare settings [32].On the other hand, the study has some limitations. Firstly, selection bias might have occurred as hospitals were selected on a voluntary basis and as head nurses were responsible for distributing the questionnaires. It is possible that head nurses chose not to include some healthcare professionals. Secondly, the relatively lower internal consistency of some scales (i.e. organizational learning, sufficient staffing) than that of the original AHRQ data consist another cause. Further studies are needed to investigate the possible association between certain composites and their items. Thirdly, the difficulty of achieving high response rates among hospital professionals, which was thought to be the most practical challenge after conducting this study.

6. Conclusion

The G-HSOPSC is suitable for clinical and research purposes and allows clinicians and researchers to make cross-national comparisons. Healthcare managers could benefit from using the G-HSOPSC for benchmarking when improving hospital patient safety culture in general and at the same time to obtain knowledge about specific areas of improvement (i.e. shift-working, staffing and over-occupancy). Examination of patient safety culture differences between staff groups and factors affecting patient safety culture is also a term of need in order to obtain knowledge of areas in order to take action to improve safety.

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Ethical approval

The research complied with every one of the dilemmas concerned with ethics. The privacy and secrecy or anonymity of employees were made certain.

Abbreviations

AHRQ	Agency for Healthcare Research and Quality
FA	Factor Analysis
HSOPSC	Hospital Survey on Patient Safety Culture
G-HSOPSC	Hospital Survey on Patient Safety Culture in Greek version
KMO	Kaiser-Meyer-Olkin
US	United States

Author details

Vasiliki Kapaki[1]* and Kyriakos Souliotis[2]

*Address all correspondence to: vkapaki2005@gmail.com

1 Health Policy Institute, Athens, Greece

2 Faculty of Social & Political Sciences, University of Peloponnese, Corinth, Greece

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