

Adaptation and validation of the Hospital Survey on Patient Safety Culture in an electronic Brazilian version

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Abstract

Objective: to adapt the Hospital Survey on Patient Safety Culture (HSOPSC) to the Brazilian context and validate a computer program that facilitates the collection and analysis of data in hospitals with different types of management. **Methods:** methodological study developed in six hospitals in Natal-RN, Brazil; a software which allows data collection via e-mail, cloud storage and automatic data report was developed; validity was verified through confirmatory factor analysis and reliability, through consistency analysis with Cronbach's alpha. **Results:** 863 professionals participated in the study; the adapted version presented total Cronbach's alpha of 0.92 and median of 0.69 in the 12 dimensions (90% confidence interval: 0.53;0.87); the model was fitted and showed good indexes in the confirmatory factor analysis. **Conclusion:** the results confirmed the validity and reliability of the instrument with adequate psychometric properties for the assessment of patient's safety culture in Brazilian hospitals.

Keywords: Validation Studies as Topic; Organizational Culture; Security Management; Quality of Health Care; Patient Safety.

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Introduction

The occurrence of adverse events in health services has caused avoidable damages to patients and there is an urgent need for preventing it in Brazil and worldwide.^{1,2} The awareness towards this issue transformed the patient safety into a priority of health care quality and an important component of systems' management and health services.³

The safety culture in an organization may be defined as the product of individuals and group values, attitudes, perceptions, competences and behavior patterns that determine compromise, style, proficiency, health in an organization and safety management.⁴ Organization with a positive safety culture are characterized by communications based on mutual trust, common perceptions towards the importance of safety and conviction in the efficacy of preventable measures.⁵

The awareness towards this issue transformed the patient safety into a priority of health care quality and an important component of systems' management and health services.

The consensus over the importance of the safety culture is also present in guidelines of health organizations, such as the National Quality Forum (NQF), from the United States of America; this institution is responsible for preparing a document advising about the establishment and maintenance of a patient safety culture based on four recommendations: (i) development of leadership structures and systems for safety; (ii) measurement, feedback and intervention on safety culture; (iii) teamwork training and skill building; and (iv) systematic implementation of risk management.⁶

In the context of Brazilian health care policies, we can highlight the National Patient Safety Program, which aims to promote and support the implementation of actions related to the patient safety.⁷ The current sanitary regulation supports these actions through the mandatory preparation of the Patient Safety Plans and implementation of Centers for Patients Safety in health facilities.⁸

To promote the patient safety culture, the diagnosis and planning of interventions to minimize or reduce the fragilities detected are essential. It is important to highlight that the safety culture must be periodically assessed, as a monitoring activity for the improvements achieved.⁶

Among the instruments used to assess the safety culture, the Hospital Survey on Patient Safety Culture (HSOPSC) is, probably, one of the most used worldwide. The HSOPSC had its psychometric properties assessed in a big sample of North-American hospitals;⁹ this tool is internationally recognized and was translated into several languages.^{10,11}

HSOPSC was translated into Portuguese and validated.^{12,14} However, the final version presented low Cronbach's alpha in some dimensions, probably due to translation flaws.¹⁵

The objective of this study was to adapt the Hospital Survey on Patient Safety Culture (HSOPSC) to the Brazilian context and validate a computer program that facilitates the collection and analysis of data in hospitals with different types of management.

Methods

This is a methodological study that aims to make a cross-cultural adequacy and validation of an electronic tool to assess the patient safety culture: the HSOPSC.⁹

The original tool was translated into Portuguese and, then, passed through a cross-cultural adequacy to the context of Brazilian hospitals. After that, a computer program was developed, in which the electronic survey was provided, to make the data collection easier and to allow automatic analysis of results and reports. Finally, an assessment of the psychometric properties of this instrument was conducted in six hospitals under different types of management.

The assessment tool HSOPSC, object of this research, is self-administered and covers 12 dimensions of the patient safety culture, two of them related to results on patient safety: (i) frequency of events reported and (ii) overall perceptions of patient safety; and ten about safety culture: (i) supervisor/manager expectations and actions promoting patient safety, (ii) organizational learning/ continuous improvement, (iii) team work within units, (iv) communication openness, (v) feedback and communication about error, (vi) nonpunitive response to errors, (vii) staffing, (viii) management support for patient safety, (ix) teamwork across units and (x) Handoffs and transitions. Besides these 12 dimensions, the tool covers two more items: (i) number of events reported and (ii) patient safety grade.

The original survey was developed and validated by the Agency for Health Care Research and Quality

(AHRQ)⁹, located in the United States, where this survey is widely used, as well as in other countries which made their own validation and adaptation.¹⁰⁻¹⁵ This survey allows blank answers, in case they do not apply to that professional or unit.

The HSOPSC was translated into Portuguese by a native English speaker translator, from a translation company. Then, a panel composed of five Brazilian specialists performed the back translation: four health professionals – from pharmacy, medicine and physiotherapy areas – and one specialist from quality management in health services, all of them with experience in patient safety. Afterwards, both translations were compared.

A universalist approach was adopted for the cross-cultural adaptation, which highlights that every measurement instrument, when out of its original context, must consider the fact that the concepts can be different between countries.¹⁶ Initially, the technical group assessed concepts and items, for which each member of the group gave a score from 1 to 5 (1 = totally disagree; 5 = totally agree), for each item of the survey and also for the survey as a whole. In this stage, the criterion adopted was the conceptual coherence of the instrument and the items with what was intended to be measured (content validity): safety culture and culture dimensions, according to the original survey. The criterion for items approval was the presentation of a median equal to 4 or 5 in the scores of the technical group. After this stage, a semantic review was conducted, by comparing the Portuguese translation draft of HSOPSC with other reference translations (Spanish,¹⁷ European Portuguese¹⁸ and initial stage of the Brazilian Portuguese^{12,13}), enabling the adaptation of the assessed version to the local language and terminology.

The computer program was developed using open access technology, with the following programming language: Java, PostgreSQL and Linux, and Play! Framework, a fast tool in the development of Internet applications. The fast development methodology chosen was XP (Extreme Programming), whose objective is to optimize the project development and ensure the client satisfaction. This methodology allows small and medium teams of software creators to develop objective and practical projects, from a focal point. Thus, the HSOPSC was adapted for online and offline collection and analysis, based on the proposals of data analysis of AHRQ, available at: www.ahrq.gov/professionals/quality-patient-safety/patientsafetyculture/hospital/index.html

The program developed is composed by two main modules, electronic survey and administrative system. The first module aims at data collection and enables the instrument to be sent to the e-mail of a previously registered participant, together with a presentation letter of the research and a model of the Free Informed Term of Consent to be signed. In this electronic survey, there is an extra tab with 10 indicator-questions related to good practices on patient safety, recommended by the NQF 2010.⁶ The second module aims to evaluate the management of hospitals and professionals that are taking part in the research, tabulate the data and conduct descriptive analyses of the respondents' characteristics.

Each form is recognized by a unique identifier, automatically and randomly generated by the system, known as access token. This technique enables the confidentiality over the identification of the professional respondent, not hampering the aggregate analysis for the hospital. During the survey filling, the system saves the inserted information, every minute, to ensure the storage of data in case of accidental system closure, blackout or problems on the device used (computer, tablet or smartphone).

After filling and submitting the first survey, the administrative system allows the researchers to view the statistical analysis of the answers in an informative panel with the percentage of answers, average time for filling, frequency of participants per profession, sex, and hospital service, among other professional characteristics. Tables and charts of indicators are built for the Percentage of Positive, Neutral and Negative Answers, in relation to the individual items, the dimensions of safety culture and the general survey. All the results are automatically generated, in real-time, for each hospital and for the total of hospitals assessed.

The computer program enables data to be exported to other softwares, to achieve a more detailed analysis, such as Excel, Statistical Package for the Social Sciences (SPSS) and Google Drive. The file with exported data is created in CSV (Comma Separated Values), a format adopted worldwide to export and integrate data between systems.

The assessment tool developed does not require Internet connection to answer the survey and saves answers in the device used. It needs connection only to send the answers to the administrative system, making the data collection in places with no Internet access easier. The software is of open access, free and is available, in Portuguese, for all hospitals interested, at

Telessaúde/RN website: <http://www.telessaude.ufrn.br/index.php/2013-11-04-22-58-23/seguranca-do-paciente>

This research was developed in six hospitals that present different types of management: three federal public hospitals, two state public hospitals and one private hospital in Rio Grande do Norte State. Among the three federal public hospitals that participated, two are maternity wards and one is a general hospital. Only the maternity wards have emergency rooms (ER) and five hospitals have intensive care units (ICU) – except one of the maternity wards. Of the state hospitals, one is a reference center for infectious diseases and another one for trauma and emergency care, both with ER and ICU. The private facility is a general hospital with ER and ICU and is level 1, according to the National Commission on Accreditation.

The professionals that took part in the survey had high school or higher education degree, worked with health assistance, or hospital management, and had permanent or temporary working contracts. To ensure more reliable information from the hospitals and reduce the probability of including professionals with little knowledge on patient safety, all the substitute professionals were excluded from the study. Convenience sampling was chosen.

The sample size should be large enough to perform factor analysis. For this study there were approximately 20 cases for each item of the survey (42 items x 20 = 840 cases), which is recommended for the adequate statistical confirmatory factor analysis: approximately 140 cases for each one of the six hospitals.¹⁸

Initially, the data collection was conducted via e-mail. The human resources sectors from each hospital provided a list with the electronic addresses of the professionals of health assistance and management, who were active and had available e-mails. In each hospital, posters and memos were distributed into their units, aiming a wide dissemination of the research and gathering a high number of answers, in order to avoid selection bias related to lack of responses. Professionals who did not answer within 7, 10 and 15 days also received automatic reminders in their e-mails.

To increase the number of participants, we also collected data in person, using electronic devices (tablets and smartphones with operational system Android 4.0 or higher) with the self-administered survey available for the professionals. This stage extended the collection to professionals who did not use e-mails or did not answer the survey via e-mail.

Data were collected from January to March 2015, after a pilot-study with 215 participants.

The answers followed Likert scale from 1 to 5, covering the following options: strongly disagree; disagree; neither; agree; strongly agree; or never; rarely; sometimes; most of the time; and always. The scale was recoded and the percentage of specific positive answers – in the dimension or the item – was the main analysis indicator. The database analyses were automatically generated, by the specific software for databases analyses. In the case of reverse questions – formulated with negative clauses –, the answers for Likert scale from 1 to 5 were inverted.

The reliability of the tool was analyzed in an internal consistency study, through the calculation of Cronbach's alpha. This indicator measured the level that the translated items are related within each dimension of the safety culture and in the whole survey. That is, the higher the covariates and correlations are, the higher will be the consistency of measure in the same dimension or the concepts. Regarding the reliability of dimensions and of the full survey, Cronbach's alpha higher than 0.6 is considered as acceptable reliability, higher than 0.7, good reliability, and higher than 0.9, excellent.^{19,20}

The verification of concept validity and the analysis of the multidimensional model were conducted through confirmatory factor analysis. We used the model for structure equations to investigate the adjustment of the data observed to the dimension proposed by the HSOPSC.

The statistical package MPlus v.7 (Muthen & Muthen) was used, with robust estimation method with weighted least squares adjusted for the average and variance (WLSMV). The analysis, thus, was based on the polychoric matrix used for ordinal data. The assessment measures of the fit used to verify the adequacy of the model to the data were (i) chi-square ratio/degree of freedom, (ii) root mean square error of approximation (RMSEA), (iii) comparative fit index (CFI) and (iv) Tucker-Lewis index (TLI). We considered good fit when the chi-square ratio/degree of freedom was <3 .²¹

For the RMSEA, in an ideal situation, the lower value of the 90% confidence interval (90%CI) includes or is close to zero, or is not worse than 0.05; and the higher value is lower than 0.08. In general, values lower than 0.08 are considered good, and values under 0.05, ideal. For CFI and TLI indexes, big adjustments are those over 0.90 and close to 0.95.²¹ Thus, the lower values of the 90%CI provide optimistic estimates for RMSEA value, whilst higher 90%CI values indicate pessimistic values.²¹

This study project was approved by the Ethics Research Committee (CEP Central) of the Federal University of Rio Grande do Norte (UFRN), on April 26th 2013. Report No. 261.289. All the institutions and individuals formally authorized their participation. The professionals' names were not released, to ensure the anonymity of participants and get more reliable answers.

Results

A total of 863 respondents from the six hospitals participated, most of them were females: 77.2%. The majority of respondents worked on health assistance, and 84.7% of the participants had direct contact with patients. Among the participants, most were nursing professionals, especially nurse technicians (44.6%), and nurses (16.2%). These numbers reflect the higher proportions of those professionals in Brazilian hospitals. A small amount of the staff had been working for less than

a year (5.7%). As two of the hospitals were maternity wards and the private hospital also has maternal-infant care, the most prevalent area/unit of work was obstetrics: 12.7% (Table 1).

The reliability of the tool, confirmed by Cronbach's alpha, was excellent, except for dimensions 'Nonpunitive response to errors' and 'Staffing'. The internal consistency in three dimensions – 'Overall perceptions of patient safety', 'Management support for patient safety' and 'Staffing' – increased with the exclusion or change of one of the questions, but the first two already presented good reliability. For example, this latter dimension, 'Staffing', after the exclusion of the item 'We use more temporary/agency staff than is best for patient care.', was the only one that presented good internal consistency (Table 2).

The assessment measures of adjustments used to verify the adequacy to the model of data showed that the instrument is valid and adequate to the 12 dimensions, as proposed by the original HSOPSC, with chi-square ratio

Table 1 – Characteristics of the participants of the survey for cross-cultural adequacy and validation of the tool Hospital Survey on Patient Safety Culture (HSOPSC),^a conducted in the municipality of Natal, Rio Grande do Norte, 2015

Variables	Hospital 1 n=150 (%)	Hospital 2 n=106 (%)	Hospital 3 n=150 (%)	Hospital 4 n=149 (%)	Hospital 5 n=156 (%)	Hospital 6 n=152 (%)	Total n=863 (%)
Sex							
Male	34 (22.7)	35 (33.4)	28 (19.0)	20 (13.5)	27 (17.4)	46 (30.2)	190 (22.7)
Female	116 (77.3)	70 (66.6)	119 (81.0)	128 (86.5)	128 (82.6)	106 (69.8)	667 (77.3)
Contact with the patient							
Yes	128 (85.3)	98 (92.4)	139 (94.6)	118 (79.2)	137 (90.1)	111 (73.5)	731 (85.7)
No	22 (14.7)	8 (7.6)	8 (5.4)	29 (20.8)	15 (9.9)	40 (26.5)	122 (14.3)
Staff position in the hospital							
Nurse	14 (9.0)	25 (23.7)	26 (17.3)	19 (12.8)	31 (19.9)	25 (16.6)	140 (16.3)
Nurse technician	66 (42.9)	33 (31.2)	93 (62.6)	64 (42.9)	63 (40.6)	66 (43.6)	385 (44.7)
Nursing assistant	6 (3.9)	1 (0.9)	3 (2.1)	5 (3.2)	5 (3.6)	4 (2.6)	24 (2.8)
Staff Physician	10 (6.4)	2 (1.8)	3 (2.1)	6 (4.2)	19 (12.2)	10 (6.5)	50 (5.9)
Resident physician	2 (1.3)	2 (1.8)	1 (0.7)	0 (0.0)	6 (3.8)	-	11 (1.2)
Pharmacist	9 (5.9)	9 (8.5)	5 (3.6)	5 (3.2)	4 (2.5)	-	32 (3.9)
Nutritionist	4 (2.6)	2 (1.8)	6 (4.2)	3 (2.1)	3 (1.9)	2 (1.3)	20 (2.4)
Social worker	5 (3.3)	3 (2.9)	0 (0.0)	6 (4.2)	-	-	14 (1.7)
Dentist	4 (2.6)	6 (5.6)	0 (0.0)	4 (2.6)	-	-	10 (1.2)
Psychologist	0 (0.0)	4 (3.8)	3 (2.1)	4 (2.6)	-	1 (0.7)	12 (1.3)
Physical, Occupational, or Speech Therapist	4 (2.6)	5 (4.8)	1 (0.7)	16 (10.7)	2 (1.2)	2 (1.3)	30 (3.5)
Technician (others)	12 (7.8)	8 (7.6)	2 (1.3)	3 (2.1)	3 (1.9)	8 (5.2)	36 (4.1)
Administration/management	1 (0.7)	1 (0.9)	-	-	-	3 (1.9)	5 (0.6)
Unit assistant/Secretary	4 (2.6)	3 (2.9)	1 (0.7)	3 (2.1)	11 (7.2)	19 (12.5)	41 (4.9)
Others	13 (8.4)	2 (1.8)	4 (2.6)	11 (7.3)	8 (5.2)	12 (7.8)	50 (5.9)

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Table 1 – Conclusion

Variables	Hospital 1 n=150 (%)	Hospital 2 n=106 (%)	Hospital 3 n=150 (%)	Hospital 4 n=149 (%)	Hospital 5 n=156 (%)	Hospital 6 n=152 (%)	Total n=863 (%)
How long have you worked in your current specialty/profession? (in years)							
≤1	1 (0.7)	8 (8.4)	18 (12.9)	7 (4.9)	8 (5.6)	7 (4.7)	49 (6.0)
2-5	14 (10.2)	21 (22.1)	33 (23.7)	21 (14.7)	40 (27.7)	37 (25)	167 (20.5)
6-10	31 (21.7)	33 (34.7)	36 (25.8)	30 (21.1)	39 (27.0)	46 (31.0)	215 (26.6)
11-15	17 (11.4)	10 (10.6)	30 (21.6)	14 (9.8)	32 (22.3)	27 (18.3)	128 (15.7)
16-20	17 (11.4)	13 (13.6)	13 (9.4)	12 (8.6)	8 (5.6)	19 (12.9)	82 (10.3)
≥21	64 (44.6)	10 (10.6)	9 (6.6)	58 (40.9)	17 (11.8)	12 (8.1)	170 (20.9)
Your work area/unit							
Many different hospital units	8 (5.3)	9 (8.4)	5 (3.4)	9 (6.5)	9 (5.7)	12 (7.8)	52 (6.2)
General medicine	17 (11.3)	0 (0.0)	31 (20.8)	2 (1.3)	2 (1.4)	16 (10.5)	68 (7.8)
Surgery	2 (1.3)	3 (2.8)	33 (22.2)	3 (2.2)	3 (1.9)	19 (12.5)	63 (7.3)
Obstetrics	2 (1.3)	41 (38.8)	-	-	67 (42.9)	-	110 (12.9)
Pediatrics	20 (13.3)	22 (20.7)	10 (6.7)	6 (4.0)	12 (7.6)	-	70 (8.3)
Emergency	9 (6.0)	-	1 (0.6)	4 (2.5)	10 (6.4)	17 (11.2)	41 (4.7)
Intensive care unit (ICU)	11 (7.3)	-	14 (9.3)	34 (22.8)	21 (13.8)	26 (17.2)	106 (12.2)
Psychiatry/mental health	0 (0.0)	-	1 (0.6)	-	-	-	1 (0.3)
Rehabilitation	1 (0.7)	-	2 (1.3)	3 (2.2)	1 (0.7)	-	7 (0.8)
Pharmacy	13 (8.7)	9 (8.4)	9 (6.0)	12 (8.0)	7 (4.6)	5 (3.3)	55 (6.3)
Laboratory	14 (9.4)	5 (4.8)	3 (2.0)	1 (0.7)	2 (1.4)	1 (0.6)	25 (2.8)
Radiology	-	5 (4.8)	8 (5.6)	3 (2.2)	1 (0.7)	2 (1.3)	19 (2.2)
Anesthesiology	-	-	-	1 (0.7)	-	-	1 (0.3)
Others	53 (35.4)	12 (11.3)	32 (21.5)	70 (46.9)	20 (12.9)	54 (35.6)	241 (27.9)
How long have you worked in your current area/unit (in years)							
≤1	7 (5.4)	11 (26.1)	42 (38.2)	24 (19.1)	25 (21.1)	16 (13.6)	125 (19.4)
2-5	53 (40.8)	16 (38.1)	24 (21.8)	50 (40.3)	59 (50.0)	59 (50.0)	261 (40.6)
6-10	15 (11.5)	5 (11.9)	30 (27.3)	20 (16.1)	13 (11.1)	31 (26.3)	114 (17.7)
11-15	9 (6.9)	3 (7.2)	13 (11.8)	7 (5.7)	7 (5.9)	9 (7.7)	48 (7.5)
16-20	25 (19.2)	4 (9.5)	-	8 (6.5)	8 (6.8)	2 (1.6)	47 (7.4)
≥21	21 (16.2)	3 (7.2)	1 (0.9)	15 (12.1)	6 (5.1)	1 (0.8)	47 (7.4)

a) Hospital Survey on Patient Safety Culture (HSOPSC): electronic tool to assess the patient safety culture, based on a previously adapted version.¹²

and degrees of freedom <3 ($X^2/gf=2.82$; $p\text{-value}<0.001$). The RMSEA criterion reinforced that the model tested was good, since the p -value found was over 0.05, highlighting failure in refute the null hypothesis, supporting the model tested (estimate=0.046/90%CI=0.044;0.048; RMSEA probability $\leq 0.05=0.998$). Two other tests also confirmed the adequacy of the multidimensional model, presenting values from 0.90 to 0.95 (CFI=0.944 and TLI=0.936).

The standard model shows that almost all the indicators – except the questions ‘We use more temporary/agency staff than is best for patient care’ and ‘Staff worry that mistakes they make are kept in their personnel file’ – presented factorial load over 0.40, showing weak indicators for their respective factors.

However, as there are statistically significant factorial loads ($p<0.05$), they could be kept as indicators in the confirmatory factor analysis (Table 3). The tool also presented better psychometric properties than the first Brazilian version^{12,13} (Table 4).

Discussion

The translated and validated version of the HSOPSC presented good internal consistency and excellent reliability to measure the safety culture in Brazilian hospitals within different management systems. The electronic application enabled a practical data collection and analysis, and is available for all Brazilian hospitals.

Table 2 – Reliability of the dimensions of the Portuguese version on the Hospital Survey on Patient Safety Culture (HSOPSC),^a according to data from the municipality of Natal, Rio Grande do Norte, 2015

Dimensions and items	Correlation between the item and the total dimension	Cronbach's alpha after the item exclusion	Cronbach's alpha of the dimension
1. Teamwork within units			0.70
People support one another in this unit	0.46	0.66	
When a lot of work needs to be done quickly, we work together as a team to get work done.	0.54	0.61	
In this unit, people treat each other with respect.	0.46	0.66	
When one area in this unit gets really busy, others help out.	0.52	0.62	
2. Supervisor/Manager expectations and actions promoting patient safety			0.73
My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	0.51	0.67	
My supervisor/manager seriously considers staff suggestions for improving patient safety	0.64	0.59	
Whenever pressure builds up, my supervisor/ manager wants us to work faster, even if it means "taking shortcuts"	0.42	0.71	
My supervisor/manager overlooks patient safety problems that happens over and over	0.50	0.67	
3. Organizational learning/ continuous improvement			0.61
We are actively doing things to improve patient safety	0.42	0.51	
Mistakes have led to positive changes here	0.41	0.53	
After we make changes to improve patient safety, we evaluate their effectiveness	0.44	0.49	
4. Management support for patient safety			0.74
Hospital management provides a work climate that promotes patient safety	0.60	0.61	
The actions of hospital management show that patient safety is a top priority	0.63	0.68	
Hospital management seems interested in patient safety only after an adverse event happens	0.48	0.76 ^b	
5. Overall perceptions of patient safety			0.63
It is just by chance that more serious mistakes do not happen around here.	0.31	0.63	
Patient safety is never sacrificed to get more work done	0.30	0.64 ^b	
We have patient safety problems in this unit	0.55	0.45	
Our procedures and systems are good at preventing errors from happening	0.51	0.49	
6. Feedback and communication about error			0.74
We are given feedback about changes put into place based on event reports	0.56	0.66	
We are informed about errors that happen in this unit	0.57	0.65	
In this unit, we discuss ways to prevent errors from happening again	0.57	0.66	
7. Communication openness	0.59		0.59
Staff will freely speak up if they see something that may negatively affect patient care	0.44	0.44	
Staff feel free to question the decisions or actions of those with more authority	0.42	0.47	
Staff are afraid to ask questions when something does not seem right	0.35	0.56	

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Table 2 – Conclusion

Dimensions and items	Correlation between the item and the total dimension	Cronbach's alpha after the item exclusion	Cronbach's alpha of the dimension
8. Frequency of events reported			0.87
When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	0.72	0.84	
When a mistake is made, but has no potential to harm the patient, how often is this reported?	0.78	0.78	
When a mistake is made, that could harm the patient, but does not, how often is this reported?	0.75	0.82	
9. Teamwork across units	0.67		0,67
Hospital units do not coordinate well with each other	0.36	0.67	
There is good cooperation among hospital units that need to work together	0.53	0.55	
It is often unpleasant to work with staff from other hospital units	0.37	0.66	
Hospital units work well together to provide the best care for patients	0.57	0.54	
10. Staffing		0.59	0,59
We have enough staff to handle the workload	0.45	0.46	
Staff in this unit work longer hours than is best for patient care.	0.52	0.39	
We use more temporary/agency staff than is best for patient care	0.12	0.67b	
We work in "crisis mode" trying to do too much, too quickly.	0.42	0.49	
11. Handoffs and Transitions		0.73	0,73
Things "fall between the cracks" when transferring patients from one unit to another	0.43	0.72	
Important patient care information is often lost during shift changes	0.59	0.63	
Problems often occur in the exchange of information across hospital units	0.56	0.64	
Shift changes are problematic for patients in this hospital	0.51	0.67	
12. Nonpunitive response to errors		0.53	0,53
Staff feel like their mistakes are held against them	0.36	0.41	
When an event is reported, it feels like the person is being written up, not the problem.	0.36	0.40	
Staff worry that mistakes they make are kept in their personnel file	0.31	0.48	
Cronbach's alpha of the full survey	–	–	0.92

a) Hospital Survey on Patient Safety Culture (HSOPSC): electronic tool to assess the patient safety culture, based on a previously adapted version.¹²

b) Values which the internal consistency would change with the item removal.

The tool presented better psychometric properties than the first Brazilian version.^{12,13} This may be, in part, due to the improvement opportunities from the initial stage of translation,¹⁴ which aimed to reduce ambiguities and improve terminology, resulting in a more clear text and similar with the original propose.¹⁵ As examples of such improvements, we can cite the expression 'events report', which was replaced by 'events notification', aligned with the jargon of adverse events used in Brazil.²² The

expression 'report' does not imply that the occurrence has been notified in data records, different from what is intended with organizational learning, through the investigation of causes and actions, with the objective of reducing health risk.

The reliability of the tool in general (for all the survey items) was excellent^{19,20} – Cronbach's alpha=0.92 – and slightly higher than the one found in other studies;^{12,13,23} however, it is important to remember that this result is

Table 3 – Standard factorial loads for items of the Hospital Survey on Patient Safety Culture (HSOPSC),^a applied in the municipality of Natal, Rio Grande do Norte, 2015

Dimensions and items	Estimates	Standard-error	Standard-error estimates	P-value (two-tailed) ^b
1. Teamwork within units				
When a lot of work needs to be done quickly, we work together as a team to get work done	0.75	0.02	26.9	<0.001
In this unit, people treat each other with respect	0.63	0.03	20.7	<0.001
When one area in this unit gets really busy, others help out	0.68	0.03	21.0	<0.001
2. Supervisor/Manager expectations and actions promoting patient safety				
My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	0.72	0.02	35.8	<0.001
My supervisor/manager seriously considers staff suggestions for improving patient safety	0.79	0.01	42.5	<0.001
Whenever pressure builds up, my supervisor/ manager wants us to work faster, even if it means taking shortcuts	0.64	0.02	23.4	<0.001
My supervisor/manager overlooks patient safety problems that happens over and over	0.68	0.02	26.4	<0.001
3. Organizational learning-continuous improvement				
We are actively doing things to improve patient safety	0.65	0.02	25.4	<0.001
Mistakes have led to positive changes here	0.58	0.03	18.0	<0.001
After we make changes to improve patient safety, we evaluate their effectiveness	0.72	0.02	27.2	<0.001
People support one another in this unit	0.65	0.03	20.8	<0.001
4. Management support for patient safety				
The hospital management provides a work climate that promotes patient safety	0.82	0.01	52.7	<0.001
The actions of hospital management show that patient safety is a top priority	0.80	0.01	51.3	<0.001
Hospital management provides a work climate that promotes patient safety	0.60	0.02	24.6	<0.001
5. Overall perceptions of patient safety				
It is just by chance that more serious mistakes do not happen around here.	0.47	0.03	14.6	<0.001
Patient safety is never sacrificed to get more work done	0.42	0.03	13.7	<0.001
We have patient safety problems in this unit	0.71	0.02	33.8	<0.001
Our procedures and systems are good at preventing errors from happening	0.77	0.01	42.8	<0.001
6. Feedback and communication about error				
We are given feedback about changes put into place based on event reports	0.71	0.02	32.7	<0.001
We are informed about errors that happen in this unit	0.69	0.02	29.3	<0.001
In this unit, we discuss ways to prevent errors from happening again	0.82	0.01	43.0	<0.001
7. Communication openness				
Staff will freely speak up if they see something that may negatively affect patient care	0.74	0.03	22.8	<0,001
Staff feel free to question the decisions or actions of those with more authority	0.71	0.02	25.4	<0,001
Staff are afraid to ask questions when something does not seem right	0.44	0.03	12.7	<0,001

Continue on next page

Table 3 – Conclusion

Dimensions and items	Estimates	Standard-error	Standard-error estimates	P-value (two-tailed) ^b
8. Frequency of events reported				
When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	0.87	0.01	67.7	<0.001
When a mistake is made, but has no potential to harm the patient, how often is this reported?	0.88	0.01	76.7	<0.001
When a mistake is made, that could harm the patient, but does not, how often is this reported?	0.86	0.01	68.7	<0.001
9. Teamwork across units				
Hospital units do not coordinate well with each other	0.50	0.02	17.3	<0.001
There is good cooperation among the hospital units that need to work together	0.73	0.01	42.0	<0.001
It is often unpleasant to work with staff from other hospital units	0.57	0.02	22.3	<0.001
Hospital units work well together to provide the best care for patients	0.79	0.01	50.3	<0.001
10. Staffing				
We have enough staff to handle the workload	0.65	0.02	25.7	<0.001
Sometimes, the patient is not provided with the best care because the workload is high	0.74	0.02	32.1	<0.001
We use more temporary/agency staff than is best for patient care	0.12 ^c	0.03	3.24	<0.001
We work under pressure, trying to do too much, too quickly	0.66	0.03	21.8	<0.001
11. Handoffs and transitions				
Things “fall between the cracks” when transferring patients from one unit to another	0.56	0.02	20.5	<0.001
Important patient care information is often lost during shift changes	0.72	0.02	32.8	<0.001
Problems often occur in the exchange of information across hospital units	0.73	0.02	33.4	<0.001
Shift changes are problematic for patients in this hospital	0.70	0.02	28.61	<0.001
12. Nonpunitive response to errors				
Staff feel like their mistakes are held against them	0.42	0.04	8.84	<0.001
When an event is reported, it feels like the person is being written up, not the problem	0.97	0.07	13.8	<0.001
Staff worry that mistakes they make are kept in their personnel file	0.32 ^c	0.04	7.21	<0.001

a) Hospital Survey on Patient Safety Culture (HSOPSC): electronic tool to assess the patient safety culture, based on a previously adapted version.¹²

b) Z test for factorial loads with 5% significance level.

c) Factorial loads under 0.4.

usually high when there is a higher number of items. About the dimensions with lower values on reliability (Cronbach's alpha), 'Nonpunitive response to error', 'Communication openness', and 'Staffing', we should take other factors possibly related into consideration. The first dimension aforementioned – 'Nonpunitive response to error' – also presents issues related to low reliability in other studies.^{17,23}

Concerning 'Communication openness', the value obtained may be related to the proposed translation or even to the culture variation, capable of interfering on

the understanding of the questions; still, it is important to highlight that this dimension may be considered acceptable (approximately 0.60), within the classification parameter. Regarding 'Staffing', its low internal consistency is related to the item 'We use more temporary/agency staff than is best for patient care'; after this latter was excluded, the dimension internal consistency reached an acceptable level, because in the analyzed hospital contexts, there were no temporary/agency workers that would fit into the inclusion criteria for the research.

Table 4 – Reliability measured by Cronbach's alpha per dimension of the original survey, other Brazilian studies and the present study conducted in the municipality of Natal, Rio Grande do Norte, 2015

Dimension	Number of items	Original USA ^{a,9}	Brazilian Adaptation	Brazilian reliability study ^{b,23}	Present study
Frequency of reported events	3	0.84	0.91	0.91	0.87
Overall perceptions of patient safety	4	0.74	0.52 ^c	0.52 ^c	0.63
Expectations and actions of the unit/service direction/supervision that favor safety	4	0.75	0.76	0.76	0.73
Organizational learning/ continuous improvement	3	0.76	0.56 ^c	0.56 ^c	0.61
Team work at the unit/service	4	0.83	0.66 ^c	0.66 ^c	0.70
Communication openness	3	0.72	0.69	0.69	0.59
Feedback and communication about error	3	0.78	0.72 ^c	0.72 ^c	0.74
Nonpunitive response to errors	3	0.79	0.35 ^c	0.35 ^c	0.53
Staffing	4	0.63	0.20 ^c	0.20 ^c	0.59
Management support for patient safety	3	0.83	0.84	0.84	0.74
Teamwork across units	4	0.80	0.67	0.67	0.67
Handoffs and Transitions	4	0.80	0.70 ^c	0.69 ^c	0.73
Total	42	–	0.90^c	0.91^c	0.92

a) USA: United States

b) Study that measured again the reliability of items of the Hospital Survey on Patient Safety Culture (HSOPSC), electronic tool to assess the patient safety culture, based on a previously adapted version.¹²

c) Lower Cronbach's alpha, compared to results of the present study

Regarding the dimension 'Nonpunitive response to error', there are some important aspects to consider. This dimension was also little consistent (Cronbach's alpha <0.60) in the other Brazilian adaptation,¹² which may show little applicability of the items for the Brazilian context. A reason for this finding may be found in the Brazilian punitive culture, which induces respondents to omit non-consistent answers in all three items of this dimension.

The concept analysis and per items, the semantic analysis by the specialists group, the translations proofreading^{12,15,17} and the factor analysis conducted confirmed the multidimensional structure of the survey, leading to the consensus that if it was adapted to the national context, there would be impairments in the comparison with other studies. Other assessments conducted^{24,25} showed that the design composed by 12 dimensions of the original instrument were not applicable to other countries' realities. In the validation of this instrument in Holland,²⁵ for example, the best adjusted model presented 11 dimensions. Another validation, conducted in Germany,²⁴ also obtained a dimension structure smaller than the original: the German tool presented eight dimensions after adjustment. Therefore, when compared to other studies,^{24,25} the

validation proposed in this research is closer to the original, conducted by AHRQ.⁹

The computer program developed for this study may help the collection and data analysis, reduce the application costs and enable the monitoring of patient safety culture in Brazilian hospitals. Notwithstanding, this study presented some limitations. One of them is a time limitation, given the dynamic characteristic of safety culture: it is possible that the items and questions considered valid now, may become obsolete with the development of safety culture in Brazilian hospitals. Another limitation is operational: some professionals who are not used to accessing their e-mails may not have answered the survey sent to them. The disadvantage of a low response rate of electronic surveys, compared to paper-based surveys, may be solved with data collection in person.²⁶ This type of collection, by mobile electronic devices, increases the response rate and does not hamper the efficacy of electronic collection and analysis.

We recommend health managers interested in using this assessment tool to, initially, confirm with their staff their electronic addresses. They should also provide electronic devices (computers, tablets, or smartphones) so the staff can fill in the survey in their workplace, to stimulate responses and to obtain information on the

patient safety culture in the assessed hospital. The access to these data and the full diagnose about the safety culture of the assessed institution provide subsidies to intervention plans in the dimensions diagnosed with culture problems, improving the patient safety and the quality of the health care provided.

This study presents the Hospital Survey on Patient Safety Culture – HSOPSC – as a valid and reliable tool, with suitable psychometric properties for the assessment of patient safety culture in Brazilian hospitals. Regarding the feasibility of the survey, we recommend the data collection to be done by e-mail and, if necessary, in person too, to achieve a higher number of responses. It is important to highlight that the computer program developed by the proposed tool counts with an automatic analysis tool, which makes the data collection easier and helps hospital managers build reports, improving

feedback to the staff and directors about their actions related to hospital patient safety culture.

Authors' contributions

Andrade LEL, Melo LOM, Silva IG, Souza RM, Freitas MR, Batista AM contributed to conception and design of the study and critical review of the manuscript's intellectual content. Lima ALB contributed to the critical review of the intellectual content, analysis and interpretation of the results. Gama ZAS contributed to the conception and design of the study, critical review of the intellectual content, analysis and interpretation of the results. All the authors participated in the manuscript's writing, approved its final version and declared to be responsible for all aspects of the study, ensuring its accuracy and integrity.

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