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Adaptation of the Agency for Healthcare Research and Quality's 'Hospital Survey on Patient Safety Culture' to the Bosnia and Herzegovina context

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ABSTRACT

Objectives Measuring staff perspectives on patient safety culture (PSC) can identify areas of concern that, if addressed, could lead to improvements in healthcare. To date, there is no validated measure to assess PSC that has been tested and adapted for use in Bosnia and Herzegovina (BiH). This research addresses the gap in the evidence through the psychometric assessment of the Agency for Healthcare Research and Quality's: 'Hospital Survey on Patient Safety Culture' (HSOPSC), to determine its suitability for the health system in BiH.

Setting Nine hospitals.

Participants Healthcare professionals (n=1429); nurse (n=823), doctors (n=328), other clinical personnel (n=111), non-clinical personnel (n=60), other (n=64), no response (n=43).

Primary and secondary outcome measures A translated version of HSOPSC was used to conduct psychometric evaluation including exploratory factor analysis and confirmatory factor analysis (CFA). Comparison between the original HSOPSC and the newly adapted 'Hospital Survey on Patient Safety Culture for Bosnia and Herzegovina' (HSOPSC-BiH) was carried out.

Results Compared with the original survey, which has 12 factors (42 items), the adapted survey consisted of 9 factors (29 items). The following factors from the original survey were not included in their original form: Communication Openness, Feedback and Communications about error, Overall Perceptions of Patient Safety and Organisational learning—Continuous Improvement. The results of the CFA for HSOPSC-BiH showed a better model fit compared with the original HSOPSC. The absolute and relative fit indices showed excellent model adjustment.

Conclusions The BiH version of Hospital Survey on Patient Safety Culture demonstrated satisfactory psychometric properties, with acceptable to good internal consistency and construct validity. Therefore, we recommend the HSOPSC-BiH as a basis for assessing PSC in BiH. This survey could provide insight into patient safety concerns in BiH so that strategies to overcome these issues could be formulated and implemented.

Strengths and limitations of this study

- This is the first study to evaluate and adapt the Hospital Survey on Patient Safety Culture for use in Bosnia and Herzegovina (HSOPSC-BiH).
- The HSOPSC-BiH is a reliable instrument to determine patient safety culture in BiH and findings could be used to inform areas of patient safety that need to be addressed and improved.
- Data were collected from a large pool of healthcare professionals across multiple hospitals in BiH but were based on self-report so could potentially be subject to recall or social desirability biases.

INTRODUCTION

Over the last two decades, the field of patient safety has developed in manifold directions. Early studies focused on understanding the extent and types of human error, and systemic errors that could lead to patient harm.[1–6] In recent years, the focus has shifted to investigating the role of human and organisational challenges such as leadership,[7] communication,[8–10] teamwork[11–13] and team training[14 15] in terms of influencing and avoiding harmful incidents. One key organisational factor, safety culture, has generated considerable interest and extensive discussions.[16–18] The term safety culture typically refers to 'the attitudes, beliefs, perceptions and values that employees share in relation to safety in the workplace'.[19] The construct of safety culture is related to 'safety climate' and is typically associated with 'the underlying assumptions and values that guide behaviour in organisations,' whereas safety climate focuses on 'the direct perceptions of individuals' of the underlying culture'.[20]

Patient safety culture (PSC) as well as its measurement have received considerable attention in Europe in recent years.[21–23] Identifying individuals safety concerns in relation to the healthcare system is often the first step in prioritising areas for improvement so that strategies to overcome safety-related issues can be sought and implemented.[24 25] Numerous instruments for the measurement

of PSC in Anglo-American countries have been developed (eg, Patient Safety Climate in Healthcare Organizations, Safety Attitudes Questionnaire, Safety Organizing Scale).[26–32] These instruments have also been applied in Europe[33–35]; some have been slightly adapted, while others only translated and psychometrically reviewed.[20 36–39] In the countries of former Yugoslavia—Slovenia[40] and Croatia[41]—the Hospital Survey on Patient Safety Culture 1.0 (released 2004) (HSOPSC) from the Agency for Healthcare Research and Quality (AHRQ)[42] has been developed and validated. However, adaptations in survey items are necessary to meet language requirements of different national, regional and healthcare contexts and to ensure that the questions are culturally relevant to the specific healthcare context in question.[20 43–45]

To complement and aid utilisation of the HSOPSC, the AHRQ published a users' guide[46] that while useful is limited in coverage because it only focuses on translation[47] and could be expanded to include advice regarding changes to items and dimensions and the reporting of findings.[20] While currently, the safety culture in Bosnia and Herzegovina (BiH) is measured through the HSOPSC, the validity of the survey items in the context of the population and healthcare system has not been tested and/or adapted.[48] HSOPSC that was used in BiH was translated into the Bosnian language. This survey was applied to the full extent (42 items and 12 factors) in some hospitals. The translation of this survey used in BiH was at a low linguistic level. Some items were completely incomprehensible due to inadequate translation. Therefore, there were significant differences in the extent, composition and language between HSOPSC used in BiH and survey HSOPSC-BiH validated by us later.

BiH has 13 ministries of health and 13 different healthcare systems: one for Republika Srpska (RS), one for Brčko District (BD), one for the Federation of Bosnia and Herzegovina (FBiH) level and ten cantonal healthcare systems in the FBiH.[49 50] In BiH, there are two entity-level agencies, the Agency for Quality and Accreditation in Healthcare in the Federation of Bosnia and Herzegovina (AKAZ)[51] and the Agency for Certification, Accreditation and Health Care Improvement of the Republic of Srpska (ASKVA)[52] responsible for the developing of quality and safety in healthcare including certification and accreditation of healthcare facilities. However, these agencies are focused on the certifications and accreditations and have not yet developed a validated questionnaire to measure PSC. According to the World Economic Forum, healthcare in BiH is the poorest in the region, ranking 73rd among 141 countries. Arguably, the development and use of a validated measure to assess PSC have the potential to help improve the delivery of healthcare in BiH.

The HSOPSC is the most widely used instrument for measuring PCS, both in Europe and internationally.[20 33 52] A recent meta-analysis on the HSOPSC revealed its use in 30 different countries,[20] including North America (n=8), South America (n=3), Europe—including Slovenia and Croatia (n=30), the Near East and the Middle East (n=15), and in the Far East (n=7).[20] Results revealed that the HSOPSC had to be adapted in every European and non-European country. The modified HSOPSC included 12 factors in Slovenia,[40] 11 in Croatia,[41] 8 in Switzerland,[36] 8 in Germany,[53] 10 in Scotland,[54] 11 in the Netherlands[55] and 9 in the UK.[56] Based on these findings, one could conclude that there is a great potential for the use of HSOPSC in other European countries.[20 34] Equally, however, given the adaptions made to the survey to further European countries' context, it is likely that adaptations to the HSOPSC may be required for the healthcare systems in BiH.[20]

The HSOPSC has 12 cultural dimensions, 2 outcome dimensions and 10 safety dimensions. The AHRQ has published a database that facilitates the benchmarking of findings from other users of the survey. The database for 2019, for example, consists of data drawn from 382 834 respondents across 630 hospitals in the USA. While comparable data from the BiH and Europe are not available,[57] this instrument allows for comparison with other European countries on the basis of studies[28] in which the factors and corresponding items are the same and which demonstrate satisfying validity and reliability.[20] The HSOPSC was validated in Croatian[41] and Slovenia[40] in the years 2014 and 2013, respectively, and showed very good results. Therefore, it is likely that this survey would also show similar results in BiH for the Bosnian language, given it is a Slavic language with a very similar culture.[58] With this in mind, this research aimed to examine the suitability of the original HSOPSC for use within the BiH healthcare systems and to identify how it should be adapted for use in BiH.

METHODS

The original HSOPSC comprises 42 items spread across 12 factors. The 12 factors from original survey were: Teamwork Within Units, Supervisor/Manager Expectations and Actions Promoting Patient Safety, Organizational Learning—Continuous Improvement, Management Support for Patient Safety, Overall Perceptions of Patient Safety, Feedback & Communication About Error, Communication Openness, Frequency of Events Reported, Teamwork Across Units, Staffing, Handoffs and Transitions and Non-punitive Response to Errors. Each item is rated on a five-point Likert scale ranging from 'strongly disagree' (1), to 'strongly agree' (5). Of the 42 items, 18 are asked from a 'negative' viewpoint and are subsequently reverse-scored.[27 31] For example, 'Staff feel like their mistakes are held against them' or 'Important patient care information is often lost during shift changes'.[46] We validated the survey in three phases. The first phase involved translating the survey. Phase 2 included a data sample (recruitment procedure). Phase 3 comprised data analysis. An overview of the methodology of the validation of the survey is shown in figure 1.

Phase 1: Translation of the survey

BiH has three official languages (Bosnian, Croatian and Serbian), all of them being similar Slavic languages. Four

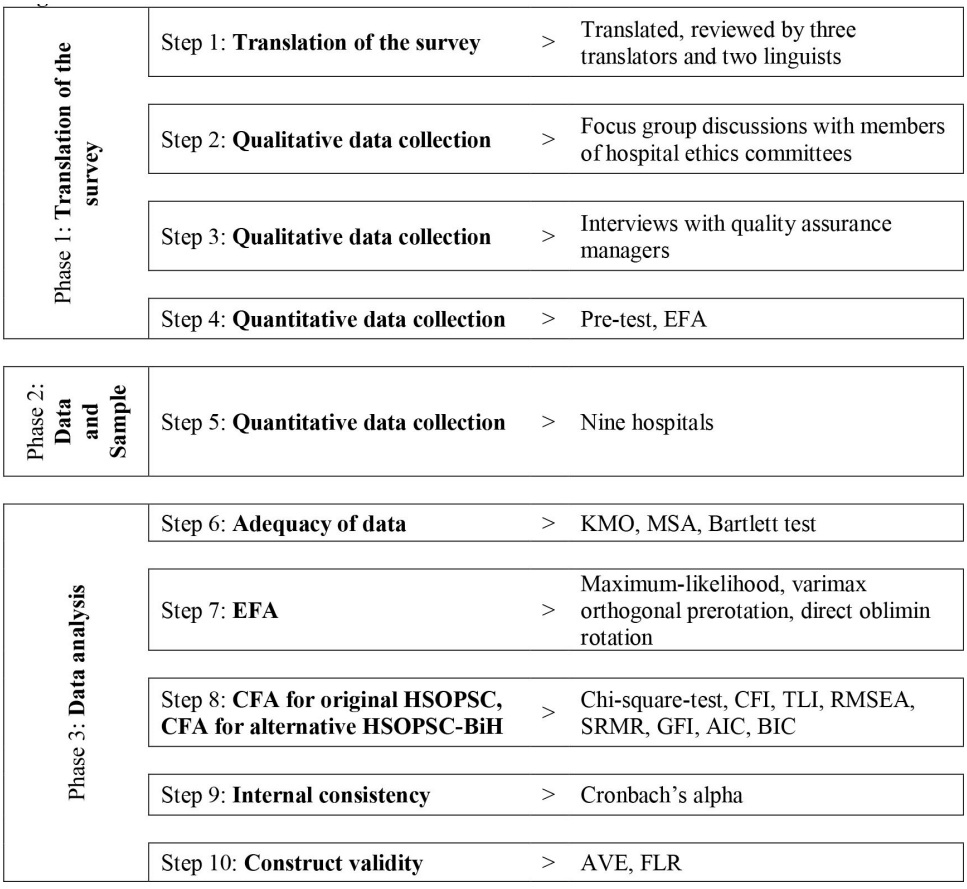

Figure 1 Methodological overview of three phases of validation of the HSOPSC-BiH. AIC, Akaike information criterion; AVE, average extracted variance; BIC, Bayesian information criterion; CFI, comparative fit coefficient; EFA, exploratory factor analysis; FLR, Fornell-Larcker criterion; GFI, goodness of fit index; HSOPSC-BiH, Hospital Survey on Patient Safety Culture for Bosnia and Herzegovina; KMO, Kaiser criterion; MSA, measure of sample adequacy; RMSEA, root mean square error of approximation; SRMR, standardised root mean square residual; TLI, Tucker-Lewis index

steps were taken to translate the survey. In the first step, the survey was translated into the Bosnian language by the first author (SD), then reviewed by three translators before being checked by two linguists. In the second step, the translated survey (referred to here as the HSOPSC-BiH) was sent to individuals (doctors, nurses, technicians, therapists, pharmacists and managers) that were part of ethics committees to provide feedback on how easy the questions were to understand and their suitability to different healthcare systems in BiH. Five to seven people were represented in the focus groups. Feedback was elicited through focus groups. In step 3, we interviewed nine quality assurance managers in nine hospitals to obtain their feedback on the HSOPSC-BiH's fit. Semistructured expert interviews were conducted in their hospitals and interviews lasted between 30 and 45 min. In step 4, we conducted a pretest in three hospitals (n=99).[48] In the pretest we calculated exploratory factor analysis (EFA) to check whether HSOPSC-BiH is a good basis for the health systems in BiH.

Phase 2: Data Sample

All hospitals in FBiH and RS were contacted and invited to participate in the survey (step 5 in adapting the survey process). A total of nine hospitals (six hospitals were from FBiH and three from RS) took part in our survey, which was conducted between September 2016 and February 2017. We have provided the information (scope) on the study to all hospital directors and unit leaders. Afterwards, we have met personally with each hospital director and unit leader to answer their questions. In the next step, all unit leaders explained the study's purpose to all employees in a meeting and responded to questions. Hard copies of the survey were distributed since hospitals generally have insufficient means to enable an online survey (initial scoping of the most appropriate method to collect the data revealed that only 30%–40% of healthcare professionals had access to computer and internet access in the hospital which is why surveys were distributed in-person). The director of each participating hospital appointed a person responsible for collecting the filled-out survey forms. Participants also had the option of depositing the survey in a box placed in each clinic/department. Data collection lasted for 1 to 4 weeks. The hospitals' directors periodically reminded the employees to complete the surveys throughout the duration of data collection.

Phase 3: Data analysis

In steps 6 through 10, the data was analysed. SPSS V.23 was used to analyse the data. Only surveys that had no missing values (ie, all answers completed) were included. All items with negative questions were recoded, so that the anchoring of the five-point Likert scale was all in the same (positive) direction. In step 6, we evaluated the Kaiser criterion (Kaiser Meyer Olkin), the measure of sample adequacy (MSA) and the Bartlett test to test the factor analysis data's adequacy. The EFA was used in step 7 to obtain the factor structure of the translated HSOPSC for BiH. These factors were later used as a basis for modelling with confirmatory factor analysis (CFA). The EFA was calculated to examine whether an optimal factor structure of the translated instrument HSOPSC-BiH exists. In the EFA, maximum likelihood, with varimax orthogonal prerotation, and direct oblimin rotation were calculated. Convergent and discriminant validity was guaranteed because all items with low factor loadings and high 'cross and side loadings' between first and second loadings were excluded.

In the eighth step, two CFA were performed in the study. The first CFA was performed to verify that the original model (12-factor structure) of the AHRQ's HSOPSC (def.: Original model HSOPSC is the model developed by AHRQ for the USA) was consistent with the empirical data (empirical data are data that we have collected in BiH) of this survey. The second CFA was conducted to check whether the developed alternative model of the Hospital Survey on Patient Safety Culture in Bosnia and Herzegovina (HSOPSC-BiH) (def.: alternative model HSOPSC-BiH is the model developed by us in this study) was in line with the empirical data of this survey. The χ^2 test was used as a 'descriptive' measure of quality and set in relation to the df. Based on that, a good model fit is assumed, if the ratio of χ^2 test to df is ≤5. Furthermore, the probability level was calculated. However, this result is not reflective of the stability of the factor structure and is not a measure of model validity or accuracy. To avoid the problems of the χ^2 test, further, the absolute fit indices were calculated. The first absolute fit index calculated was an inference statistic measure: the root mean square error of approximation (RMSEA). The second absolute fit index was a descriptive measure: the goodness of fit index (GFI). Furthermore, an incremental or comparative fit index was calculated by using the comparative fit coefficient (CFI). Another possibility for checking the model fit is the difference between the empirical variance–covariance of a variable and the model theoretically calculated variance–covariance of this variable. This was calculated using a descriptive measure, the standardised root mean square residual (SRMR). The final coefficient in this study for the model fit evaluation was the Tucker-Lewis index (TLI).

After the model fit testing, the internal consistency were tested in the ninth step. For this, the internal consistency with Cronbach's α was calculated for the alternative HSOPSC-BiH. Finally, in step 10, the models were tested at the construct level. At this level, the CFA can be used to determine the average extracted variance (AVE) and discriminant validity using the Fornell-Larcker criterion (FLR). Since two real models—the original model HSOPSC and the alternative model, HSOPSC-BiH, have been developed in this study, they were directly compared with each other using the above-mentioned individual significance tests and other coefficients with the aid of the Akaike information criterion (AIC)[59] and the Bayesian information criterion (BIC).[60] The AIC and the BIC were used to evaluate which model had a better model fit.

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Results of phase 1: Translation of the survey

The main finding from the focus groups was that not all professional groups would understand the items from the factor 'staffing'. Further checking through analysis supported this view, thus all items relating to 'staffing' were excluded during the EFA. Minor revisions to wording of items (E8, E1, F4, F10 and G7r) was suggested. For example, item F4—'There is good cooperation between hospital units that need to work together' was changed to 'Among the hospital units that need to work together, cooperation is good'. The quality assurance managers believed that all negatively worded items were time-consuming, in that it would result in the survey taking more than 15 min to complete. They also suggested minor wording changes of items B3, C5, H13, I2 and A3r which we have implemented. For example, item H13—'After we introduce changes to improve patient safety, we evaluate the effectiveness 'was changed to 'When we make changes to improve patient safety, we evaluate the effectiveness'. EFA in the pretest showed that HSOPSC-BiH is a very good basis for developing a questionnaire for BiH—however, we had a very different factor structure to the original HSOPSC. The results gained from the focus groups, interviews and the pre-test all suggested that the HSOPSC-BiH is well suited for our analysis.

Results of phase 2: Data and sample

The survey was sent to 4850 potential participants, 2617 returned the questionnaire (response rate of 54%). Out of this, 1429 from nine hospitals were fully completed and eligible for analysis (see table 1). We excluded those with missing values in line with other similar research.[41] Our sample was derived from 13 different hospital units and five professional groups—nurse/registered nurse, doctor/specialist/assistant, other clinical personnel, non-clinical personnel and other.

Table 1 Professionals characteristics

	Nurse/ registered nurse	Doctor/ specialist/ assistant	Other clinical personnel	Non-clinical personnel	Other	Total
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Hospitals						
Hospital A	46 (5.6)	11 (3.4)	56 (50.5)	7 (11.7)	15 (23.4)	135 (9.7)
Hospital B	6 (0.7)	4 (1.2)	1 (0.9)	4 (6.7)	1 (1.6)	16 (1.2)
Hospital C	347 (42.2)	164 (50.0)	22 (19.8)	18 (30.0)	19 (29.7)	570 (41.1)
Hospital D	51 (6.2)	11 (3.4)	5 (4.5)	4 (6.7)	0 (0.0)	71 (5.1)
Hospital E	38 (4.6)	14 (4.3)	2 (1.8)	4 (6.7)	4 (6.3)	62 (4.5)
Hospital F	46 (5.6)	10 (3.0)	0 (0.0)	0 (0.0)	3 (4.7)	59 (4.3)
Hospital G	30 (3.6)	8 (2.4)	3 (2.7)	3 (5.0)	16 (25.0)	60 (4.3)
Hospital H	15 (1.8)	2 (0.6)	2 (1.8)	5 (8.3)	1 (1.6)	25 (1.8)
Hospital I	244 (29.6)	104 (31.7)	20 (18.0)	15 (25.0)	5 (7.8)	388 (28.0)
Total	823 (100.0)	328 (100.0)	111 (100.0)	60 (100.0)	64 (100.0)	1386 (100.0)
Units in hospitals						
Many different hospital units/no specific unit	27 (3.7)	12 (4.0)	5 (4.8)	1 (2.0)	1 (1.6)	46 (3.7)
Medicine (non-surgical)	162 (22.0)	58 (19.4)	9 (8.7)	2 (4.0)	2 (3.3)	233 (18.6)
Surgery	208 (28.2)	90 (30.1)	8 (7.7)	7 (14.0)	5 (8.2)	318 (25.4)
Radiology	25 (3.4)	9 (3.0)	9 (8.7)	1 (2.0)	4 (6.6)	48 (3.8)
Paediatrics	33 (4.5)	20 (6.7)	2 (1.9)	3 (6.0)	3 (4.9)	61 (4.9)
Emergency department	13 (1.8)	2 (0.7)	0 (0.0)	1 (2.0)	0 (0.0)	16 (1.3)
Intensive care unit	81 (11.0)	9 (3.0)	2 (1.9)	2 (4.0)	2 (3.3)	96 (7.7)
Psychiatry/mental health	32 (4.3)	15 (5.0)	1 (1.0)	10 (20.0)	1 (1.6)	59 (4.7)
Rehabilitation	38 (5.2)	11 (3.7)	55 (52.9)	7 (14.0)	7 (11.5)	118 (9.4)
Pharmacy	0 (0.0)	0 (0.0)	2 (1.9)	0 (0.0)	1 (1.6)	3 (0.2)
Laboratory	11 (1.5)	1 (0.3)	4 (3.8)	1 (2.0)	0 (0.0)	17 (1.4)
Anaesthesiology	4 (5.7)	46 (15.4)	2 (1.9)	0 (0.0)	1 (1.6)	91 (7.3)
Other	65 (8.8)	26 (8.7)	5 (4.8)	15 (30.0)	34 (55.7)	145 (11.6)
Total	737 (100.0)	299 (100.0)	104 (100.0)	50 (100.0)	61 (100.0)	1251 (100.0)

Results of phase 3: Data analysis

The results of the adequacy of data were very good. The value of the KMO coefficient was 0.929, and the MSA coefficient values for individual items ranged from 0.682 to 0.967 (with only eight items having an MSA coefficient of less than 0.9 and only two items below 0.8). The Bartlett test was also significant (χ^2 [861]=209650.94, p=0.0001). Thus, it was found that the data from BiH provides a very suitable basis for the application of the EFA.[61]

Exploratory factor analysis—alternative model

The factor analysis revealed an alternative model for the HSOPSC-BiH comprising a total of 29 items across nine factors (see table 2). The alternative model HSOPSC-BiH has four unit factors (Supervisors and managers' expectations and actions promoting safety; Teamwork within units; Communication openness and feedback on errors; and Non-punitive response to errors), three hospital factors (Hospital management support for patient safety; Teamwork across hospital units; and Hospital handoffs and transitions) and two outcome factors (Overall perceptions of safety and continuous improvement; and Frequency of event reporting). Five factors from the original model HSOPSC (Communication Openness; Feedback and Communication about Error; Overall Perceptions of Patient Safety' Organisational learning—Continuous Improvement; and Staffing) were not included. Two of these factors 'Communication Openness' and 'Feedback and Communication about Error' were merged together into one factor called 'Communication openness and feedback on errors' in the alternative HSOPSC-BiH. Other two factors related to individual factors—'Overall Perceptions of Patient Safety' and 'Organisational learning—Continuous Improvement' were merged in another factor called 'Overall perceptions

Table 2 Factors with loadings for the HSOPSC-BiH alternative model

Item	Factor loading*								
	1	2	3	4	5	6	7	8	9
Factor 1: Supervisors' and managers' expectations and actions promoting safety									
A1—My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	−0.893	−0.005	−0.026	−0.014	−0.002	−0.019	−0.006	0.013	−0.007
A2—My supervisor/manager seriously considers staff suggestions for improving patient safety	−0.779	−0.010	0.022	0.025	−0.021	0.035	−0.015	0.020	0.013
Factor 2: Teamwork within units									
B1—People support one another in this unit	−0.007	0.848	−0.067	0.040	−0.040	0.023	0.008	0.006	−0.002
B4—People treat each other with respect in this unit	−0.002	0.834	−0.014	−0.021	0.053	0.025	−0.003	−0.009	0.022
B3—When a lot of work needs to be done quickly, we work together as a team	−0.033	0.541	0.142	0.057	0.038	−0.091	0.068	0.006	0.008
Factor 3: Communication openness and feedback on errors									
C2—Staff will freely speak up if they see something that may negatively affect patient care	−0.004	0.059	0.551	−0.050	0.025	0.038	−0.023	0.043	0.100
C4—Staff feel free to question the decisions or actions of those with more authority	−0.095	−0.093	0.465	0.090	0.084	0.040	−0.019	−0.050	−0.086
C3—We are informed about errors that happen in this unit	0.056	0.023	0.766	0.027	−0.052	−0.025	0.022	0.094	0.021
C5—In this unit, we discuss ways to prevent errors from happening again	−0.113	0.029	0.574	0.064	−0.016	0.054	−0.020	0.017	0.069
C1—We are given feedback about changes put into place based on event reports	−0.073	0.072	0.417	−0.050	0.088	0.059	0.140	−0.103	0.060
Factor 4: Non-punitive response to errors									
D12r—When an event is reported, it feels like the person is being written up, not the problem (reversed item)	−0.041	0.097	0.012	0.708	0.084	−0.044	−0.006	−0.065	0.046
D8r—Staff feel like their mistakes are held against them (reversed item)	0.012	−0.002	0.004	0.669	−0.007	0.021	0.054	−0.037	−0.016
D16r—Staff worry that mistakes they make are kept in their personnel file (reversed item)	0.013	−0.074	0.013	0.516	−0.029	0.030	−0.049	0.130	0.002
Factor 5: Hospital management support for patient safety									
E8—The actions of hospital management show that patient safety is a top priority	−0.021	0.036	−0.034	0.045	0.813	−0.007	0.024	−0.004	0.000
E1—Hospital management provides a work climate that promotes patient safety	−0.083	0.046	0.046	0.037	0.525	0.073	0.043	0.001	0.051
Factor 6: Teamwork across hospital units									
F2r—Hospital units do not coordinate well with each other (reversed item)	−0.042	−0.038	0.089	0.038	0.087	0.473	0.037	0.138	−0.004
F4—There is good cooperation among hospital units that need to work together	−0.050	0.017	0.133	0.040	−0.041	0.459	0.166	0.104	0.033
F10—Hospital units work well together to provide the best care for patients	0.017	0.166	0.037	0.071	0.035	0.413	0.256	0.048	0.037
Factor 7: Hospital handoffs and transitions									
G5r—Important patient care information is often lost during shift changes (reversed item)	−0.005	−0.037	0.019	0.033	−0.007	0.044	0.733	−0.064	0.034
G3r—Things 'fall between the cracks' when transferring patients from one unit to another (reversed item)	−0.021	0.045	−0.033	−0.015	0.040	0.018	0.532	0.250	0.017
G7r—Problems often occur in the exchange of information across hospital units (reversed item)	−0.023	−0.049	0.051	0.015	0.054	0.078	0.495	0.176	0.001
G11r—Shift changes are problematic for patients in this hospital (reversed item)	−0.053	0.148	0.011	0.056	0.071	−0.077	0.479	−0.023	0.012
Factor 8: Overall perceptions of safety and continuous improvement									
H6—We are actively doing things to improve patient safety	−0.062	0.052	0.262	−0.012	0.031	0.115	−0.090	0.421	0.030

Continued

Table 2 Continued

Item	Factor loading* 1	2	3	4	5	6	7	8	9
H13—After we make changes to improve patient safety, we evaluate their effectiveness	−0.156	−0.067	0.074	0.012	0.075	0.132	0.060	0.377	0.077
H15—Patient safety is never sacrificed to get more work done	0.001	0.127	0.027	0.059	−0.026	0.143	−0.050	0.414	0.004
H18—Our procedures and systems are good at preventing errors from happening	−0.091	0.012	−0.013	0.100	0.000	−0.018	0.157	0.406	0.026
Factor 9: Frequency of event reporting									
I2—When a mistake is made, but has no potential to harm the patient, how often is this reported?	0.022	0.000	−0.022	−0.002	0.041	−0.026	0.033	−0.024	0.879
I1—When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	−0.040	−0.029	0.030	−0.042	−0.002	−0.022	−0.013	0.017	0.796
I3—When a mistake is made that could harm the patient, but does not, how often is this reported?	0.024	−0.013	−0.002	0.063	−0.032	0.044	−0.031	0.005	0.749
Excluded									
Supervisors' and managers' expectations and actions promoting safety									
A3r—Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts (reversed item)									
A4r—My supervisor/manager overlooks patient safety problems that happen repeatedly (reversed item)									
Teamwork within units									
B11—When one area in this unit gets busy, others help out									
Communication openness									
C6r—Staff are afraid to ask questions when something does not seem right (reversed item)									
Hospital management support for patient safety									
E9r—Hospital management seems interested in patient safety only after an adverse event happens (reversed item)									
Teamwork across hospital units									
F6r—It is often unpleasant to work with staff from other hospital units (reversed item)									
Organisational learning—continuous improvement									
H9—Mistakes have led to positive changes here									
Overall perceptions of safety									
H10r—It is just by chance that more serious mistakes do not happen around here (reversed item)									
H17r—We have patient safety problems in this unit (reversed item)									
Staffing									
J2—We have enough staff to handle the workload									
J5r—Staff in this unit work longer hours than is best for patient care (reversed item)									
J7r—We use more agency/temporary staff than is best for patient care (reversed item)									
J14r—We work in 'crisis mode' trying to do too much, too quickly (reversed item)									

*Extraction Method: Maximum Likelihood, Rotation Method: Oblimin with Kaiser Normalisation.
HSOPSC-BiH, Hospital Survey on Patient Safety Culture for Bosnia and Herzegovina.

of safety and continuous improvement' in the HSOPSC-BiH. All items of the factor 'Staffing' were excluded. A total of 13 items with less than 0.4 factor loading and high 'cross and side loadings' between first and second loadings were excluded (see table 2).[62] Only one item ('After we make changes to improve patient safety, we evaluate their effectiveness') with a factor loading of less than 0.4 (load=0.377) was left as an exception, as this had very low cross and side loadings.

Confirmatory factor analysis

The results of the CFA for the original model HSOPSC (χ^2 [753]=3536.527, p=0.0001) showed an adequate model fit (see table 3). The χ^2 test was highly significant. The two absolute fit indices showed acceptable model fit (RMSEA=0.051, SRMR=0.055), however, an absolute fit index was unacceptable (GFI=0.878). By contrast, the relative fit indices were well below the lower thresholds for an acceptable model fit (CFI=0.863, TLI=0.843).

The results of the CFA for the alternative model HSOPSC-BiH (χ^2 [341]=948.809, p=0.0001) showed a better model fit than the original model HSOPSC. The χ^2 test was also highly significant, and unlike the original model HSOPSC, the χ^2 test set in relation to the df showed a perfect model fit (χ^2 test/df=2.782). The absolute fit

Table 3 Model fit indices for original HSOPSC and alternative HSOPSC-BiH models

Model fit index	Criterion	Original HSOPSC 12-factor model	Alternative HSOPSC-BiH 9-factor model
χ^2	/	3536.527	948.809
df	/	753	341
P	Significant p values expected*	0	0
χ^2/df	<5**	4.695	2.782
CFI	>0.90*	0.863	0.959
TLI	>0.90*	0.843	0.951
RMSEA	<0.07*	0.051	0.035
SRMR	<0.08*	0.055	0.033
GFI	>0.9***	0.878	0.956
AIC		3836.2	1136.8
ΔAIC†	>10****		2699.4
BIC		4626.2	1631.6
ΔBIC‡		2994.6	

Threshold values references: *,[80] **,[81] ***,[82] ****.[83]
†ΔAIC=AICO – AICA.
‡ΔBIC=BICO – BICA.
AIC, Akaike information criterion; BIC, Bayesian information criterion; CFI, comparative fit coefficient; GFI, goodness of fit index; HSOPSC-BiH, Hospital Survey on Patient Safety Culture for Bosnia and Herzegovina; RMSEA, root mean square error of approximation; SRMR, standardised root mean square residual; TLI, Tucker-Lewis index.

Table 4 Internal consistency and construct validity of alternative model

Dimensions	No of items	Cronbach's alpha	AVE	FLR
Unit level				
Supervisors' and managers' expectations and actions promoting safety	2	0.820	0.70	0.80
Teamwork within units	4	0.817	0.61	0.77
Communication openness and feedback about errors	3	0.780	0.43	1.08
Non-punitive response to errors	5	0.676	0.42	0.71
Hospital level				
Hospital management support for patient safety	3	0.728	0.57	1.02
Teamwork across hospital units	2	0.706	0.46	1.13
Hospital handoffs and transitions	3	0.731	0.41	1.09
Outcome				
Overall perceptions of safety and continuous improvement	4	0.670	0.34	1.24
Frequency of event reporting	3	0.846	0.65	0.56

AVE, average extracted variance; FLR, Fornell-Larcker criterion.

indices (RMSEA=0.035, SRMR=0.033, GFI=0.956) and the relative fit indices (CFI=0.959, TLI=0.951) showed excellent model fit. Lower AIC/BIC values of the alternative HSOPSC-BiH showed a better model fit compared with the original model HSOPSC. The factor analysis showed that the original model HSOPSC, developed by the AHRQ in the USA, was not applicable with all its 12 factors in BiH. The difference between models illustrates that the alternative model HSOPSC-BiH has more support.

Reliability and construct validity

The reliability of the individual factors of the alternative HSOPSC-BiH ranged from 0.670 to 0.846, whereas only two factors had reliability results below the adequate Cronbach's α of 0.70 (see table 4).[63] The construct validity of the original model HSOPSC with the AVE showed acceptable results (AVE ≥0.5) for only one factor, that is, frequency of event reporting (AVE=0.65). All other factors were below 0.5 and therefore failed to reach the required value. The results according to the FLR were slightly better, being acceptable for only two factors—Non-punitive response to error (FLR=0.96) and Frequency of event reporting (FLR=0.57) (FLR ≤1).

The construct validity of the alternative HSOPSC-BiH failed to reach the required value of AVE for five factors. However, the AVE was at a good level for four factors. Similar values were seen in the FLR. Consequently, the FLR was good for only four factors. It is worth mentioning that all other factors—except for the factor 'Overall perceptions of safety' (FLR=1.24)—were close to the required limit. Thus, the values of the four factors ranged from 1.02 to 1.13.

DISCUSSION

In this study, we evaluated the psychometric properties of the HSOPSC-BiH. The original model HSOPSC demonstrated a poor fit with our data. Several international studies reported similar findings. The modified HSOPSC had 11 factors in Croatia,[41] 8 in Switzerland,[36] 10 in Scotland,[54] 11 in the Netherlands[55] and 9 in the UK.[56] Therefore, the original model HSOPSC has been modified to the specific BiH cultural conditions and Bosnian language. However, we were able to develop an alternative model with 9 factors and 29 items.

The factors 'Communication Openness and Feedback' and 'Communication about Error' were merged together into one factor. These two factors had six items before the EFA and those items were very similar. It may be because these factors had very similar items, that they merged into one factor. Only one item was excluded and five items remained in a newly created factor. Furthermore, the factors, 'Overall Perceptions of Patient Safety' and 'Organisational learning—Continuous Improvement' also became one factor. These factors were perhaps particularly unstable in the translated versions, indicating the need for a change in the item set to support the use of the survey in other countries. The factor 'Staffing' was completely eliminated during the EFA. Items from the factor 'Staffing' were probably not well adapted to the specific cultural environment of BiH. The focus groups suspected that the items from the factor 'Staffing' will not fit well with the context of the healthcare systems in BiH. The quality assurance managers confirmed the opinion of focus groups during the interviews. Our EFA analysis confirmed the prognoses of these experts. All items from the factor 'Staffing' should be newly formulated and adapted to a given country's specific health system and checked at the next survey. Other HSOPSC psychometric studies have found similar internal consistency problems with the factors such as 'Overall Perceptions of Safety,'[33 36 53 56 64] 'Hospital Management Support for Patient Safety,'[56 64] or 'Staffing'.[41 56 64] In these studies, the same factors 'Communication Openness—Continuous Learning' and 'Feedback and Communication about Error' were often merged together into one common factor.[33 40 53 54 65 66] In sum, our alternative model has become shorter than the original model and thus comparable to the HSOPSC 2.0 from AHRQ, which has 10 factors and 32 items.[67] In HSOPSC 2.0, all of our 13 excluded items have either been dropped (5 items) or changed (6 items). Only two items have remained unchanged. This is also a sign that our excluded items are no longer relevant or need a change.

Ten of 13 excluded items were phrased in a negative form (eg, 'Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts'). There are several arguments against using reversed-coded items, (1) one of which is that answering even a few items in the wrong form (negative form) will reduce the reliability by interfering with the correlations among the items. (2) Another argument is that it does not really solve the problem of acquiescence bias, which is why it is usually recommended.[68] (3) Generally, factors with predominantly negatively worded items report less positive results.[52 69] (4) Finally, to have a clean methodology, it is recommended to put items exclusively in a positive form.[68] Since there are evident method differences, the results must be interpreted carefully during the factor analysis and the results' comparison.[64]

Contextual specificity of the construct of safety culture[70] and different healthcare systems in BiH are certainly important reasons for limited internal consistency and construct validity in our study. Also, the fact that PSC is a new topic in BiH may be another reason. Mainly because PSC as a topic is relatively new in BiH, it may be that health professionals had problems understanding certain terms. For example, 'event' or 'speak up'. Training health professionals about PSC can improve this in the future.[64] In other countries where HSOPSC has been validated, population characteristics and different types of healthcare systems have been cited as reasons for different factor structures.[36 53 64 71 72] These differences might weaken the instrument's validity.[73]

Future research is needed to examine the construct validity of the new instrument and assess its measurement invariance. Specifically, when measurements are to be compared between higher-level units (eg, organisations or organisational subunits), these measurements have to satisfy the necessity of the condition of measurement invariance (equivalence, eg, Jak *et al*),[74] that is, individuals with the same true scores have the same observed scores (corrected for measurement error), independent of which higher-level unit they are nested in. Conversely, if the condition of measurement invariance is violated, measurements cannot be compared across higher-level units.

Limitations

The study has several limitations. First, we only included surveys in our psychometric analysis with no missing data (some of our items had >50% missing values so we had to exclude them and wanted to be consistent in approach). While we did this to improve our findings' accuracy, this approach is in line with similar research conducted in the area.[41] This meant our sample size was reduced as a result. Nonetheless, we still managed to collect data from a large sample of healthcare professionals from a wide geographic area so we believe our findings are representative of findings that would be expected in a larger population. Second, the alternative model HSOPSC-BiH failed to reach the required value of construct validity for five factors. However, all five factors—except for the factor 'Overall perceptions of safety'—were very close to the required limit. Third, we conducted interviews with healthcare professionals to understand how the survey should be adapted so it is most fit for purpose in the BiH context. It would have been interesting to have also interviewed healthcare professionals about the study results to explore in more detail (qualitatively) their perspectives on how areas of safety concerns they raised could potentially be mitigated. Fourth, we conducted a CFA after EFA on the same data set. Generally, it is recommended to perform EFA and CFA in separate samples (split-sample validation). However, it is acknowledged that EFA and CFA could be tested on the same data set when there is no sufficient theoretical basis.[75–77] The questionnare HSOPSC-BiH used in this study is not based on a theory. Finally, we have used the Bosnian language survey in hospitals with a mixture of official languages. However, there is evidence in science that anyone who speaks one of the

three languages, eg, Croatian also perfectly understands the other languages, eg, Serbian.[78] This is the case in this study because today, the official three languages (Bosnian, Croatian and Serbian) in BiH were one language (Serbo-Croatian) until 1995. And the split in the Serbo-Croatian language was not a natural one, but rather a political one. There is also a Declaration on the Common Language signed by more than 2000 famous linguists and writers from four countries (BiH, Croatia, Serbia and Montenegro) that says that Bosnian, Croatian and Serbian are a common standard language of the polycentric type.[79] Moreover, quality assurance managers, focus groups and all health professionals in our study did not mention that the Bosnian language survey is a problem of comprehension in BiH hospitals with a mixture of languages.

CONCLUSION

The HSOPSC-BiH demonstrated acceptable psychometric properties, with acceptable to good internal consistency and construct validity. Whereas the original HSOPSC showed a poor fit to empirical data, we developed an alternative model HSOPSC-BiH with an acceptable model fit. An important message to take from this research is that even a small step in the direction of developing a survey for measuring PSC could make a significant positive impact on research into patient safety and patient safety practice in BiH. We believe that this was not just a tool development study but also one that has the potential to improve PSC practices in BiH. This research could help to increase awareness among health professionals on the subject of PSC by encouraging them (through the use of the survey) to report safety areas of concern and also to critically question their own practices with respect to. Analogous to other studies and with our qualitative and quantitative analysis, we have shown that all negative items need a minor or major wording revision and should be put in a positive form. Finally, we recommend using HSOPSC-BiH in its full form to determine areas of PSC that need to be improved. Still, we advise caution while interpreting the data on Overall perceptions of safety. This will allow the hospitals to introduce factor-based interventions, which will lead to targeted organisational development.

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REFERENCES

1 Michel P, Quenon JL, de Sarasqueta AM, *et al*. Comparison of three methods for estimating rates of adverse events and rates of preventable adverse events in acute care hospitals. *BMJ* 2004;328:199.
2 Vincent C, Amalberti R. *Safer healthcare: strategies for the real world*. Springer International Publishing, 2016.
3 Mendes W, Martins M, Rozenfeld S, *et al*. The assessment of adverse events in hospitals in Brazil. *Int J Qual Health Care* 2009;21:279–84.
4 Sari AB-A, Sheldon TA, Cracknell A, *et al*. Extent, nature and consequences of adverse events: results of a retrospective casenote review in a large NHS Hospital. *Qual Saf Health Care* 2007;16:434–9.
5 Soop M, Fryksmark U, Köster M, *et al*. The incidence of adverse events in Swedish hospitals: a retrospective medical record review study. *Int J Qual Health Care* 2009;21:285–91.
6 Sousa P, Uva AS, Serranheira F, *et al*. Estimating the incidence of adverse events in Portuguese hospitals: a contribution to improving quality and patient safety. *BMC Health Serv Res* 2014;14:311.
7 Ring L, Fairchild RM. Leadership and patient safety: a review of the literature. *J Nurs Regul* 2013;4:52–6.
8 Starmer AJ, Spector ND, Srivastava R, *et al*. Changes in medical errors after implementation of a handoff program. *N Engl J Med* 2014;371:1803–12.
9 Haynes AB, Weiser TG, Berry WR, *et al*. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med* 2009;360:491–9.
10 Archer S, Hull L, Soukup T. Development of a theoretical framework of factors affecting patient safety incident reporting: a theoretical review of the literature. *BMJ Open* 2017;7:e017155.
11 Rosenbaum L. Divided we fall. *N Engl J Med* 2019;380:684–8.
12 Rosenbaum L. Cursed by knowledge - building a culture of psychological safety. *N Engl J Med* 2019;380:786–90.
13 Rosenbaum L. The not-my-problem problem. *N Engl J Med* 2019;380:881–5.
14 Jones KJ, Skinner AM, High R. A theory-driven, longitudinal evaluation of the impact of team training on safety culture in 24 hospitals. *BMJ Qual Saf* 2013;22:394–404.
15 Thomas L, Galla C. Building a culture of safety through team training and engagement. *BMJ Qual Saf* 2013;22:425–34.
16 Griffin MA, Curcuruto M. Safety climate in organizations. *Annu Rev Organ Psychol Organ Behav* 2016;3:191–212.
17 He Y, Wang Y, Payne SC. How is safety climate formed? A meta-analysis of the antecedents of safety climate. *Organ Psychol Rev* 2019;9:124–56.
18 Jiang L, Lavaysse LM, Probst TM. Safety climate and safety outcomes: a meta-analytic comparison of universal vs. industry-specific safety climate predictive validity. *Work & Stress* 2019;33:41–57.
19 Cox S, Cox T. The structure of employee attitudes to safety: a European example. *Work & Stress* 1991;5:93–106.

20 Waterson P, Carman E-M, Manser T. Hospital survey on patient safety culture (HSPSC): a systematic review of the psychometric properties of 62 international studies. *BMJ Open* 2019;9:e026896.
21 The Health Foundation. Measuring safety culture, 2011. Available: https://www.health.org.uk/sites/default/files/MeasuringSafetyCulture.pdf [Accessed 17 Nov 2019].
22 Giuliani F, Meier M, van Vegten-Schmalzl A. *Patient safety culture: theory, methods and application*. Boca Raton: CRC Press, 2017.
23 van Nunen K, Li J, Reniers G, *et al*. Bibliometric analysis of safety culture research. *Saf Sci* 2018;108:248–58.
24 Farokhzadian J, Dehghan Nayeri N, Borhani F. The long way ahead to achieve an effective patient safety culture: challenges perceived by nurses. *BMC Health Serv Res* 2018;18:654.
25 Cappelen K, Harris A, Aase K. Variability in staff perceptions of patient safety culture in Norwegian nursing homes—a longitudinal cross-sectional study. *Saf Health* 2018;4:585.
26 Singer T, Seymour B, O'Doherty J. Empathy for pain involves the affective but not sensory components of pain. *Science* 2004;303:1157–62.
27 Sorra J, Nieva V. Hospital survey on patient safety culture 2004, 2004. Available: https://proqualis.net/sites/proqualis.net/files/User%20guide%20HSOPSC.pdf
28 Sexton JB, Helmreich RL, Neilands TB. The safety attitudes questionnaire: psychometric properties, benchmarking data, and emerging research. *BMC Health Serv Res* 2006;6:44.
29 Zohar D, Livne Y, Tenne-Gazit O. Healthcare climate: a framework for measuring and improving patient safety. *Crit Care Med* 2007;35:1312–7.
30 Vogus TJ, Sutcliffe KM. The impact of safety organizing, trusted leadership, and care pathways on reported medication errors in hospital nursing units. *Med Care* 2007;45:997–1002.
31 Sorra JS, Dyer N. Multilevel psychometric properties of the AHRQ Hospital survey on patient safety culture. *BMC Health Serv Res* 2010;10:199.
32 Ginsburg LR, Tregunno D, Norton PG, *et al*. 'Not another safety culture survey': using the Canadian patient safety climate survey (Can-PSCS) to measure provider perceptions of PSC across health settings. *BMJ Qual Saf* 2014;23:162–70.
33 Hammer Antje MT. The use of the Hospital survey on patient safety culture in Europe. In: Waterson P, ed. *Patient safety culture: theory, methods and application*. Boca Raton: CRC Press, 2017.
34 Manser T, Brösterhaus M, Hammer A. You can't improve what you don't measure: Safety climate measures available in the German-speaking countries to support safety culture development in healthcare. *Z Evid Fortbild Qual Gesundhwes* 2016;114:58–71.
35 Parker D. Managing risk in healthcare: understanding your safety culture using the Manchester patient safety framework (MaPSaF). *J Nurs Manag* 2009;17:218–22.
36 Pfeiffer Y, Manser T. Development of the German version of the hospital survey on patient safety culture: dimensionality and psychometric properties. *Saf Sci* 2010;48:1452–62.
37 Steyrer J, Latzke M, Pils K, *et al*. Development and validation of a patient safety culture questionnaire in acute geriatric units. *Gerontology* 2011;57:481–9.
38 Hammer A, Ernstmann N, Ommen O, *et al*. Psychometric properties of the hospital survey on patient safety culture for hospital management (HSOPS_M). *BMC Health Serv Res* 2011;11:165.
39 Zimmermann N, Küng K, Sereika SM, *et al*. Assessing the Safety Attitudes Questionnaire (SAQ), German language version in Swiss university hospitals--a validation study. *BMC Health Serv Res* 2013;13:347.
40 Robida A. Hospital survey on patient safety culture in Slovenia: a psychometric evaluation. *Int J Qual Health Care* 2013;25:469–75.
41 Brborović H, Šklebar I, Brborović O, *et al*. Development of a Croatian version of the US Hospital survey on patient safety culture questionnaire: dimensionality and psychometric properties. *Postgrad Med J* 2014;90:125–32.
42 Agency for Healthcare Research & Quality. Surveys on Patient Safety Culture (SOPS) hospital survey, 2013. Available: https://www.ahrq.gov/sops/surveys/hospital/index.html [Accessed 8 Nov 2019].
43 Ginsburg L, Gilin Oore D. Patient safety climate strength: a concept that requires more attention. *BMJ Qual Saf* 2016;25:680–7.
44 Jackson J, Sarac C, Flin R. Hospital safety climate surveys: measurement issues. *Curr Opin Crit Care* 2010;16:632–8.
45 Schwendimann R, Zimmermann N, Küng K, *et al*. Variation in safety culture dimensions within and between US and Swiss Hospital units: an exploratory study. *BMJ Qual Saf* 2013;22:32–41.
46 Sorra J, Yount N, Famolaro T. AHRQ hospital survey on patient safety culture version 2.0: user's guide, 2019. Available: https://www.ahrq.gov/sops/surveys/hospital/ index.htm
47 Agency for Healthcare Research and Quality. Translation guidelines for the AHRQ surveys on patient safety culture, 2019. Available: https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patientsafetyculture/resources/transguide.pdf
48 Offermanns G, Draganovic S. Safety culture in hospitals: a quantitative study. *Eur J Public Health* 2016;26.
49 Cain J, Duran A, Fortis A. *Health care systems in transition: Bosnia and Herzegovina*. Copenhagen: European Observatory on Health Care Systems, 2002.
50 Martić M, Đukić O. Health care system in BiH: Financing challenges and reform options? *Friedrich-Ebert-Stiftung* 2017.
51 Agency for Quality and Accreditation in Healthcare in the Federation of Bosnia and Herzegovina. Certification and accreditationstandards for hospitals, 2020. Available: http://www.akaz.ba/udoc/U11DE320_Standardi_bolnice_juli_2020.pdf [Accessed 1 Mar 2021].
52 Reis CT, Paiva SG, Sousa P. The patient safety culture: a systematic review by characteristics of hospital survey on patient safety culture dimensions. *Int J Qual Health Care* 2018;30:660–77.
53 Gambashidze N, Hammer A, Brösterhaus M, *et al*. Evaluation of psychometric properties of the German Hospital survey on patient safety culture and its potential for cross-cultural comparisons: a cross-sectional study. *BMJ Open* 2017;7:e018366.
54 Sarac C, Flin R, Mearns K, *et al*. Hospital survey on patient safety culture: psychometric analysis on a Scottish sample. *BMJ Qual Saf* 2011;20:842–8.
55 Smits M, Christiaans-Dingelhoff I, Wagner C, *et al*. The psychometric properties of the 'Hospital Survey on Patient Safety Culture' in Dutch hospitals. *BMC Health Serv Res* 2008;8:230.
56 Waterson P, Griffiths P, Stride C, *et al*. Psychometric properties of the hospital survey on patient safety culture: findings from the UK. *Qual Saf Health Care* 2010;19:e2.
57 Agency for Healthcare Research & Quality. SOPS Hospital database, 2018. Available: https://www.ahrq.gov/sops/databases/hospital/index.html [Accessed 8 Nov 2019].
58 Dabić M, Tipurić D, Podrug N. Cultural differences affecting decision-making style: a comparative study between four countries. *J Bus Econ Manag* 2014;16:275–89.
59 Akaike H. Information theory and an extension of the maximum likelihood principle. In: Nikolaevich Petrov B, Csáki F, eds. *2nd International Symposium on information theory*. Akadémiai Kiadó, 1973: 267–81.
60 Schwarz G. Estimating the dimension of a model. *Ann. Statist* 1978:461–4.
61 Field A. *Discovering statistics using SPSS: (and sex and drugs and rock 'n' roll)*. 3rd edn (reprinted). Los Angeles, Calif: Sage, 2011.
62 Hair JF. *Multivariate data analysis*. 7th edn. Upper Saddle River, NJ: Pearson Prentice Hall, 2010.
63 Field A. *Discovering statistics using IBM SPSS statistics*. 5th edn. Los Angeles, London, New Delhi, Singapore, Washington DC, Melbourne: Sage, 2018.
64 Gambashidze N, Hammer A, Manser T. Psychometric properties of the Georgian version of hospital survey on patient safety culture: a cross-sectional study. *BMJ Open* 2019;9:e030972.
65 Perneger TV, Staines A, Kundig F. Internal consistency, factor structure and construct validity of the French version of the hospital survey on patient safety culture. *BMJ Qual Saf* 2014;23:389–97.
66 Bodur S, Filiz E. Validity and reliability of Turkish version of "Hospital Survey on Patient Safety Culture" and perception of patient safety in public hospitals in Turkey. *BMC Health Serv Res* 2010;10:28.
67 Agency for Healthcare Research and Quality. SOPS hospital survey 2.0 (released 2019), 2019. Available: https://www.ahrq.gov/sops/surveys/hospital/index.html [Accessed 4 Mar 2021].
68 Krosnick JA, Presser S. Question and questionnaire design. In: Marsden P, Wright J, eds. *Handbook of survey research*. Emerald Group Publishing Limited, 2010: 263–13.
69 Famolaro T, Yount N, Hare R. *Hospital survey on patient safety culture: 2018 user database report*. Rockville, MD: Agency for Healthcare Research and Quality, 2018.
70 Coyle IR, Sleeman SD, Adams N. Safety climate. *J Safety Res* 1995;26:247–54.
71 Al Salem G, Bowie P, Morrison J. Hospital survey on patient safety culture: psychometric evaluation in Kuwaiti public healthcare settings. *BMJ Open* 2019;9:e028666.
72 Ginsburg L, Gilin D, Tregunno D, *et al*. Advancing measurement of patient safety culture. *Health Serv Res* 2009;44:205–24.
73 Hedsköld M, Pukk-Härenstam K, Berg E, *et al*. Psychometric properties of the hospital survey on patient safety culture, HSOPSC, applied on a large Swedish health care sample. *BMC Health Serv Res* 2013;13:332.
74 Jak S, Oort FJ, Dolan CV. Measurement bias in multilevel data. *Struct Equat Model: Multidiscipl J* 2014;21:31–9.

75 Fabrigar LR, Wegener DT, MacCallum RC, *et al*. Evaluating the use of exploratory factor analysis in psychological research. *Psychol Methods* 1999;4:272–99.
76 van Prooijen J-W, van der Kloot WA. Confirmatory analysis of Exploratively obtained factor structures. *Educ Psychol Meas* 2001;61:777–92.
77 Worthington RL, Whittaker TA. Scale development research. *Couns Psychol* 2006;34:806–38.
78 Bailyn JF. To what degree are Croatian and Serbian the same language? Evidence from a translation study. *J Slavic Linguistic* 2010;18.
79 Postsecondary Education Network Sarajevo,. Dekleracija O zajedničkom jeziku (Eng. Declaration on the common language),, 2020. Available: https://jezicinacionalizmi.com/deklaracija/ [Accessed 5 Mar 2021].
80 Burnham KP, Anderson DR. *Model selection and multimodel inference: a practical information-theoretic approach*. 2nd edn. New York, NY: Springer, 2010.
81 Schumacker RE, Lomax RG. *A beginner's guide to structural equation modeling*. 4th edn. New York, London: Routledge Taylor & Francis Group, 2016.
82 Byrne BM. *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. 3rd edn. New York, NY, London: Routledge, 2016.
83 Burnham KP, Anderson DR. *Model selection and multimodel inference: a practical information- theoretic approach*. New York: Springer, 2002.