

ORIGINAL PAPER

THE PSYCHOMETRIC PROPERTIES OF “HOSPITAL SURVEY ON PATIENT SAFETY CULTURE” IN A CZECH ENVIRONMENT

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Abstract

Aim: To analyze the psychometric properties of the Hospital Survey on Patient Safety Culture (HSOPS) in internal care units at a specific teaching hospital in the Czech Republic. **Design:** The paper has the character of a cross-sectional validation study. **Methods:** The study was conducted between November 2015 and January 2016. The convenience sample consisted of 207 registered nurses working in internal care units at a specific faculty hospital in the Czech Republic. Analysis of the psychometric properties of the HSOPS was conducted using Principal Component Analysis (PCA) and reliability testing. **Results:** Acceptable psychometric properties of the HSOPS were verified in our study. We confirmed 12 components of the HSOPS, the same number stated in the original version from the Agency for Healthcare Research and Quality (AHRQ). The reliability of the instrument was evaluated using the Cronbach alpha coefficient, and is considered acceptable. **Conclusion:** These findings can help healthcare institutions to raise awareness of patient safety culture and to gain a comprehensive overview of the individual dimensions of patient safety culture. In the future, the instrument could help to compare the components of patient safety culture, not only at a national but also at an international level.

Keywords: factor analysis, Hospital survey on patient safety culture, internal care units, instrument, nurse, patient safety culture, reliability.

Introduction

The subject of patient safety is currently the subject of increased interest from health organizations throughout the world. The World Health Organization (WHO) stated in 2014 that it is a serious worldwide problem, due to its crucial impact on the quality of care provided (Chen, Li, 2010; Pousette et al., 2017). All definitions of patient safety result from improvements in health-care in general. For the first time, the concept of patient safety was defined by the Institute of Medicine as “preventing harm to patients” (Institute of Medicine, 2004). Since then, it has become a key priority of various healthcare systems all over the world (Güneş Gürlek, Sönmez, 2013). In the Czech Republic, the development of safe care is regarded as a spontaneous process. In 1997, the Council of Europe issued a recommendation concerning the quality of care provided and the safety of patients. However,

issues relating to patient safety only began to be addressed after the the wording of this subject had been formulated in terms of risk management (Škrla, Škrlová, 2008). Today, as part of the Czech Republic’s involvement in international quality projects and health risk management development and deployment (e.g., the European Patient Safety Network, the World Alliance for Patient Safety, and others) there is a consensus on coordination and harmonization in such projects, as well as on the use of preventive approaches and innovative options in providing safe patient care (Kalvachová, 2011).

Improvement in results in terms of patient safety is considered necessary to creating a positive patient safety culture (Alqattan, Cleland, Morrison, 2018). According to the Agency for Healthcare Research and Quality (AHRQ), patient safety culture is defined as the product of individual and grouped values, attitudes, experience, competencies, and behavior patterns which determine the organizational structure, its style, and professionalism, as well as health and safety management (Rockville et al., 2016). Patient safety culture consists of individual dimensions which

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can be assessed using specific instruments, e.g., the Hospital Survey on Patient Safety (AHRQ, 2015). Particular dimensions were well described in a study by Bartoničková et al. (2018). Establishing patient safety culture in healthcare facilities leads to improvements in patient safety (Bahrami et al., 2014). The implementation of patient safety culture in practice is essential in the prevention of harm to patients (Ito et al., 2011). The Ministry of Health of the Czech Republic is currently working on a strategy to improve patient safety culture throughout its healthcare system. An ideal step towards the implementation of these concepts would be the introduction of patient safety culture in healthcare institutions, creating a situation in which both health professionals and patients would perceive safety as a priority (Kalvachová, 2011). Certain international health accreditation societies assess safety culture directly, and, at the same time, provide healthcare facilities with a direct view of patient safety determinants to identify strong and weak areas of safe care provided (Mikušová, Rusnáková, 2012). Abroad, the creation of patient safety culture is recommended, for example, by the Institute of Medicine, the World Alliance for Patient Safety, the National Patient Safety Agency in the UK, the Agency for Healthcare Research and Quality in the US and the Australian Commission for Safety and Quality in Australia (Nie et al., 2013; Ammouri et al., 2015).

It is clear from international studies that the creation of a culture of safety in healthcare organizations leads to improved patient safety, and its implementation in practice is important in preventing injury to patients' health (Ito et al., 2011; Bahrami et al., 2014). The first stage in the development of this culture must include an assessment of the organization's existing culture of safety. This evaluation provides healthcare organizations with a clear overview of the areas of patient safety that require urgent attention. A considerable benefit is the possibility of re-evaluating patient safety culture numerous times, and also being able to compare results with other organizations (Stavrianopoulos, 2012).

According to Ammouri et al. (2015), to improve safety and quality of care, and to increase the positive results in general of patient care, healthcare institutions should be called upon to assess their own patient safety culture. Fifteen questionnaires used by the aforementioned institutions to assess their patient safety culture have been created to date (Morello et al., 2013). These questionnaires have been validated and compared with each other. Each measures a slightly different set of dimensions of patient safety culture. A wide range of tools enables organizations to choose

that which best fits their purpose of assessing patient safety culture (Sorra, Dyer, 2010).

Compared with other questionnaires, the "Hospital Survey on Patient Safety Culture" (HSOPS) shows a high degree of validity and reliability (Davoodi et al., 2013). The HSOPS questionnaire was developed by Westat in collaboration with the AHRQ, based on an overview of publications on the subject, and the assessment of the dimensions of similar tools used to assess patient safety culture (Perneger, Staines, Kundig, 2014). A pilot study of the questionnaire was conducted in 21 hospitals in the USA, and consisted of a total of 79 items grouped into 14 dimensions (Waterson et al., 2010; Perneger, Staines, Kundig, 2014). The results of the study led to a reduction in the number of measurable dimensions to 12, showing a high internal level of cohesion observed by means of factor analysis (Al Doweri et al., 2015). The questionnaire was issued by the AHRQ in 2004 (Sorra, Nieva, 2004), following a thorough review. Since its release, interest in administering the questionnaire has grown throughout the world. In 2012, the number of countries in which this questionnaire had been distributed was 45, and it had been translated into 24 languages (Moghri et al., 2013). It is widely used in the USA, and has gained importance and visibility in Europe as well (Ocelli et al., 2013). It has been endorsed by the European Union Patient Safety Network and by the Council of Europe's project to improve patient safety (Perneger, Staines, Kundig, 2014). It has also been the subject of several studies in the Czech Republic (Filka, Kotrbová, 2012; Pokojová, Bártlová, 2018a). However, until now there has been no evidence published of its verification, which is the subject of this study. The original version of the questionnaire was intended to be used for all staff in hospitals, but a subset of employees (e.g., nurses) may also be selected (Rockville et al., 2016). Nurses represent the most numerous group of healthcare workers, and their work is very diverse (Bartoničková et al., 2018). It is precisely because they spend much more time with the patients than other workers that their perception of safety practices in the assessment of safety culture is considered to be crucial (Listyowardojo, Nap, Johnson, 2012). Due to the importance of the profession, we have therefore adapted the aims of this study to reflect the perceptions of nurses and their working environment, mainly because nursing is referred to as the key to the provision of safe and quality care in most literature on the subject (You et al., 2013).

Aim

The study aimed to verify the psychometric properties of the Czech version of the HSOPS questionnaire on nurses working in the internal care units of one particular faculty hospital in the Czech Republic, and thus to standardize the questionnaire for the socio-economic environment of the Czech Republic.

Methods

Design

The contribution has the characteristics of a cross-sectional validation study.

Sample

A convenience sample consisting only of nurses was used in our study. Nurses were chosen since they are the most numerous of any group of healthcare workers and are also those who most often encounter patient safety issues. The nurses were selected through a purposive selection procedure according to predefined criteria. Those included in the study had completed the adaptation process in the selected faculty hospital in the Czech Republic, and in the aforementioned internal care units. Nurses were not included if working in managerial positions. In total, 299 questionnaires were distributed to all internal care units in a faculty hospital in the Czech Republic. 207 questionnaires were then used for statistical processing (the return rate was 69.3%).

Most respondents (67.1%) worked in standard care units, 18.4% of respondents worked in intensive care units, and the smallest number of respondents (14.5%) worked in long-term care units. A majority of nurses reported total work experience in a range from one year to five years (29.0%), and also work experience at the current workplace from one year to five years (31.9%). Nurses reported having from 40 to 59 weekly working hours (58.5%), and all of the nurses (100.0%) reported having direct contact with patients. The length of practice in the current profession or specialist field most reported by nurses was in a range from six to ten years (21.3%).

Data collection

The research was conducted from November 2015 to January 2016, and was conducted using the HSOPS standardized questionnaire. The questionnaire had previously been translated into Czech by doc. MUDr. Jozef Filka, Ph.D. In addition, it had been translated by a number of university students, but never in the context of a modified linguistic validation process. After obtaining approval for its translation and subsequent distribution from the AHRQ, the HSOPS questionnaire was validated in Czech

according to the methodology of Wild et al. (2005). Problematic items were thoroughly analyzed and corrected at each step. The questionnaire had to meet the following criteria: clarity, simplicity, and a logical arrangement of items. During pre-research, in which six randomly selected respondents assessed the clarity of the items of the questionnaire, respondents misunderstood all three points relating to the item: “Frequency of events reported” in Part D. These items were more precisely specified, formulated, and processed. All other items were confirmed as comprehensible by the respondents. The results of the validation led to the creation of a final Czech version of the questionnaire entitled “*Hospital Survey on Patient Safety Culture*”. The tool reflects 12 dimensions of patient safety culture, and two assigned items (Sorra, Nieva, 2004). The HSOPS is a tool for all healthcare professionals, but in our study, it was used only for nurses. It contains a total of 42 items grouped into nine parts (A–I). The introduction of the tool includes instructions on its correct completion and explains the concepts of “adverse event” and “patient safety” in order for the respondents to better comprehend the given concepts. Parts A–D and F form the core of the questionnaire and can be used to define the individual dimensions of patient safety culture. These dimensions can also be labeled as individual components (Teamwork within units; Supervisor/manager expectations and actions promoting patient safety; Organisational learning and continuous improvement; Communication openness; Feedback and communication about error; Nonpunitive response to errors; Staffing; Management support for patient safety; Teamwork across units; Handoffs and transitions; Overall perception of patient safety; and Frequency of events reported). In Table 1, we present the individual dimensions together with the letter and number marked statements, as they appear in the original version. The options for the respondents are offered in the questionnaire in the form of a five point Likert scale from: 1 – strongly disagree; 2 – disagree; 3 – neither; 4 – agree; 5 – strongly agree; and from 1 – ever; 2 – rarely; 3 – sometimes; 4 – most of the time; 5 – always. The assigned items are included in part E (Patient Safety Grade) and part G (Number of Events Reported), and are complementary to the overall assessment of patient safety culture. Part H consists of six items regarding basic information pertaining to the respondents and/or sociodemographic data relating to the respondents (e.g., length of hospital practice, length of practice in the current hospital work area/unit, weekly working hours, job classification, direct contact with patients, and length of practice in the current profession or specialist field). At the end of the questionnaire

Table 1 Overview of HSOPS dimensions

Dimensions of HSOPS	Statements from the original version
Unit / department level	
teamwork within units	A1, A3, A4, A11
supervisor/manager expectations and actions promoting patient safety	B1, B2, B3, B4
organizational learning and continuous improvement	A6, A9, A13
communication openness	C2, C4, C6
feedback about error and communication openness	C1, C3, C5
nonpunitive response to errors	A8, A12, A16
staffing	A2, A5, A7, A14
Aspects of the hospital	
management support for patient safety	F1, F8, F9
teamwork across units	F4, F10, F2, F6
handoffs and transitions	F3, F5, F7, F11
Resulting variables	
overall perception of patient safety	A15, A18, A10, A17
frequency of events reported	D1, D2, D3

(Part I), respondents are given the opportunity to express their views freely. Therefore, the overall results of the research can be interpreted in terms of these thematic parts (A–I) or dimensions (Sorra et al., 2014). Since we focused on evaluation of the questionnaire and its individual components, areas not directly related to these dimensions (parts E, G, H, I) were not evaluated. The overall results of this study are, therefore, an interpretation of the psychometric properties of the core of the questionnaire (parts A–D and F), so as to verify the psychometric properties of the provision of patient care, and to evaluate the components of patient safety culture from the perspective of nurses.

Data analysis

Statistical analysis was performed using the statistical software SPSS version 25. The basic characteristics of the sample (mean values, SD) were reported using descriptive statistics. The data distribution test (test of normality – Shapiro-Wilk test) was applied to our sample. The Kaiser-Meyer-Olkin (KMO) test for sampling adequacy was calculated, as was Barlett's test of sphericity (χ^2), to determine whether continuing with the further analysis was appropriate. In addition, Principal Component Analysis (PCA) with Varimax rotation and Kaiser Normalization was applied. PCA was used to establish whether components from the original instrument of the HSOPS correlated with the Czech version of the HSOPS in our sample. To examine the reliability of the Czech version of the HSOPS, the Cronbach alpha coefficient was calculated for each component, as well as for the instrument as a whole.

Results

First, we used the sample distribution test (Shapiro-Wilk test) to indicate the normal distribution of our sample (0.854; $p = 0.321$). According to the result from the KMO test (0.775) and from Barlett's test of sphericity ($\chi^2 = 3208.327$; $p = 0.000$), the sample size was adequate, allowing further analysis of the psychometric properties of our sample. We applied Principal Component Analysis (PCA) with Varimax rotation and Kaiser Normalization. Rotation converged in 11 iterations. The findings suggested the use of 12 components of the HSCOPS instrument, consistent with the original version of the instrument (Sorra, Nieva, 2004). The results from the PCA are presented in Table 2. The total variance explained, including eigenvalues (ranging from 1.041 to 8.201), and communalities (ranging from 0.485 to 0.791), is also presented in Table 2. Twelve components explained 63.8% of total variance.

The Cronbach alpha coefficient was calculated for each newly developed component, as well as for the instrument as a whole (Table 2). Reliability of the instrument as a whole was confirmed by the high value of the Cronbach alpha coefficient ($\alpha = 0.879$). Basic descriptive statistics (mean values, SD) are also presented in Table 2. Cronbach alpha coefficient is a measurement of how strongly items correlate. A zero value indicates no correlation between items, while a value of one denotes a perfect correlation. If items are too close to one another, item information is usually redundant. Therefore, a good value for a Cronbach's alpha measurement is between 0.70 and 0.90. The reliability of the scales was compared to the results of the original HSOPS (Sorra, 2004), which established ≥ 0.60 as an acceptable level for Cronbach's alpha. In our study the acceptable values

Table 2 Descriptive statistics, reliability and factor structure of the Czech version of the HSOPS instrument (Part 1)

Components with their statements from HSOPS in Czech conditions		mean	SD	Cronbach alpha	Factor loadings	Communalities	Eigenvalues
Teamwork across units				0.817			8.201
F2	Hospital units do not coordinate well with each other	3.10	1.09		0.798	0.683	
F7	Problems often occur in the exchange of information across hospital units	3.24	1.00		0.721	0.662	
F6	It is often unpleasant to work with staff from other hospital units	3.26	0.97		0.710	0.600	
F4	There is good cooperation between hospital units that need to work together	3.56	0.86		0.699	0.643	
F10	Hospital units work well together to provide the best care for patients	3.57	0.85		0.603	0.649	
Teamwork within units				0.806			2.587
A1	People support one another in this unit	4.03	0.82		0.799	0.791	
A3	When a lot of work needs to be done quickly, we work together as a team to get the work done	4.01	0.81		0.752	0.676	
A4	In this unit, people treat each other with respect	3.80	0.80		0.716	0.720	
A11	When one area in this unit gets really busy, others help out	3.98	0.79		0.690	0.698	
Feedback and communication about error				0.673			2.474
C3	We are informed about errors that happen in this unit	4.06	0.80		0.779	0.683	
C2	Staff will speak up freely if they see something that may negatively affect patient care	3.82	0.93		0.682	0.649	
C1	We are given feedback about changes put into place based on event reports	3.76	1.20		0.666	0.667	
C5	In this unit, we discuss ways to prevent errors from happening again	3.92	0.86		0.541	0.608	
C4	Staff feel free to question the decisions or actions of those with more authority	3.67	1.21		0.456	0.485	
Frequency of events reported				0.784			2.208
D3	When a mistake is made that could harm the patient, but does not, how often is this reported?	3.25	1.50		0.825	0.716	
D2	When a mistake is made, but has no potential to harm the patient, how often is this reported?	2.97	1.29		0.824	0.714	
D1	When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?	3.58	1.43		0.793	0.710	
Organizational learning and continuous improvement				0.619			1.794
A13	After we make changes to improve patient safety, we evaluate their effectiveness	3.74	0.71		0.744	0.649	
A6	We actively do things to improve patient safety	4.27	0.53		0.682	0.637	
A18	Our procedures and systems are good at preventing errors from happening	3.94	0.73		0.467	0.576	
A12	When an event is reported, it feels like the person is being written up, not the problem	3.59	1.00		0.411	0.550	

Table 2 Descriptive statistics, reliability and factor structure of the Czech version of the HSOPS instrument (Part 2)

Components with their statements from HSOPS in Czech conditions		mean	SD	Cronbach alpha	Factor loadings	Communalities	Eigenvalues
Supervisor/manager expectations & actions promoting patient safety				0.698			1.779
B2	My supervisor/manager seriously considers staff suggestions for improving patient safety	3.98	0.83		0.726	0.693	
B1	My supervisor/manager gives praise when he/she sees a job done according to established patient safety procedures	4.10	0.85		0.674	0.761	
A9	Mistakes have led to positive changes here	4.27	0.53		0.443	0.601	
B4	My supervisor/manager overlooks patient safety problems that happen over and over	4.20	0.79		0.311	0.543	
Nonpunitive response to errors				0.585			1.714
A16	Staff worry that mistakes they make are kept in their personnel file	3.42	0.98		0.666	0.593	
A10	It is just by chance that more serious mistakes don't happen around here	3.89	1.16		0.610	0.595	
A8	Staff feel like their mistakes are held against them	3.51	1.00		0.549	0.578	
Critical situations on the unit				0.578			1.539
A14	We work in "crisis mode" trying to do too much, too quickly	2.61	0.99		0.761	0.638	
B3	Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	3.65	1.00		0.741	0.668	
C6	Staff are afraid to ask questions when something does not seem right	3.85	1.06		0.421	0.663	
Management support for patient safety				0.629			1.238
F8	The actions of hospital management show that patient safety is a top priority	3.76	0.81		0.746	0.760	
F1	Hospital management provides a work climate that promotes patient safety	3.72	0.81		0.599	0.636	
F9	Hospital management seems interested in patient safety only after an adverse event happens	3.72	0.95		0.557	0.614	
Handoffs and transitions				0.574			1.134
F3	Things "fall between the cracks" when transferring patients from one unit to another	4.07	0.85		0.695	0.576	
F11	Shift changes are problematic for patients in this hospital	3.95	0.79		0.513	0.562	
A7	We use more agency/temporary staff than is best for patient care	3.82	0.91		0.437	0.500	
F5	Important patient care information is often lost during shift changes	4.12	0.93		0.177	0.548	
Staffing				0.525			1.078
A5	Staff in this unit work longer hours than is best for patient care	3.72	1.11		0.713	0.644	
A17	We have patient safety problems in this unit	4.02	0.89		0.568	0.577	
A2	We have enough staff to handle the workload	2.22	1.12		0.449	0.605	
Overall perception of patient safety				-			1.041
A15	Patient safety is never sacrificed to get more work done	3.52	1.08		0.717	0.667	
HSOPS				0.879			

for Cronbach's alpha coefficient (0.817–0.619) were determined in the following components: Teamwork across units; Teamwork within units; Feedback about error and communication openness; Frequency of events reported; Organisational learning and continuous improvement; Supervisor / manager expectations and actions promoting patient safety; and Management support for patient safety. The values of the Cronbach alpha coefficient (0.585–0.525) for other components were not sufficient to meet the criteria of the AHRQ (Nonpunitive response to errors; Handoff and transmissions; Staffing; and Critical situations on the unit).

Discussion

In the study, we focused on checking the psychometric properties of the HSOPS questionnaire in terms of the Czech healthcare system and its practices, and those of the nurses in internal care units in a faculty hospital. 207 questionnaires compliant with pre-defined requirements were used for this verification (return rate: 69.3%). According to the results of the KMO test and Bartlett's test of sphericity, the sample size of the respondents was initially determined to be adequate; therefore we proceeded to analyze the psychometric properties of our sample further. Principal Component Analysis (PCA) with Varimax rotation and Kaiser Normalization was subsequently applied to the sample of nurses. On the basis of this analysis, the individual evaluated statements forming the core of the patient safety culture questionnaire were divided into twelve components. The final set of components as defined by our study, including the individual statements, has the same number of individual dimensions as the original version of the HSOPS from the AHRQ, similar to other studies (Hellings et al., 2007; Chen, Li, 2010; Sorra, Dyer, 2010; Hammer et al., 2011; Ito et al., 2011; Robida, 2013; Eiras et al., 2014; Perneger, Staines, Kundig, 2014). If we analyze the set of components in our study in more detail, we find that some statements were included under different components to those in the original version, whereas others remained unchanged. PCA indicated that the components *Communication openness* and *Feedback and communication about error* should be combined as one, under the proposed title *Feedback about error and Communication openness*. This combination is also recommended in an American study (Blegen et al., 2009), an Arabic study (Najjar et al., 2013) and in a Scottish study (Sarac et al., 2011). In addition, we would propose assigning a new component entitled *Critical situations in the unit* since the statements mainly concerned critical situations that could arise in a unit. Unfortunately, only one statement remained in the component *Overall perception of patient safety*

after PCA. We have kept it as a separate component, although it was not possible to verify it in terms of reliability through Cronbach's alpha. While it could be assigned to two other components, after subsequent reliability testing, their Cronbach alpha value decreased. Therefore, we suggest that in future research related to psychometric properties this statement should be included under another component, with the proviso that the instrument will be based only on eleven components, or that other statements be assigned to this component. As our sample contained a low number of respondents, further psychometric verification of this tool in the context of Czech practice is required. For further studies, we suggest extending the research to include other types of workplace rather than just workplaces with an internal focus. Since Sorra, Nieva (2004) stated that new components might be implemented following analysis, many authors, who have identified them as part of the instrument, have done so. Hedsköld et al. (2013) suggest assigning statements to 14 components, adding two dimensions entitled *Information and support to patients and families who have suffered an adverse event* and *Information and support to staff who have been involved in an adverse event*. The same number is recommended by Nordin et al. (2013), adding *Information and support to patients/relatives at adverse events* and *Information to staff* dimensions. The division of the instrument into 11 components has been demonstrated by, for example, the authors of a Dutch study (Smits et al., 2008) and a Norwegian study (Haugen et al., 2010) combining dimensions of *Organizational learning – continuous improvement* with *Feedback and communication about error*; and also in an American study (Blegen et al., 2009), and an Arabic study (Najjar et al., 2013), combining the same components as mentioned in our research: *Communication openness* and *Feedback and communication about error*. In a Turkish study (Bodur, Filiz, 2010), a Scottish study (Sarac et al., 2011) and a French study (Ocelli et al., 2013) the authors recommend the division of the statements into ten components. Bodur and Filiz (2010) propose combining *Feedback and communication about error* with *Management expectations and actions promoting patient safety* into a single component, and *Teamwork across units* and *Management support for patient safety* into another. Sarac et al. (2011) suggest combining the dimensions of *Feedback and communication about error* with *Communication openness*, and *Staffing* with *Overall perceptions about patient safety*. Ocelli et al. (2013), propose combining the dimensions of *Organizational learning – continuous improvement* with *Feedback and communication about error*, and *Teamwork*

across hospital units with *Handoffs and transitions*. UK authors Waterson et al. (2010) recommend dividing the questionnaire into nine components, while the authors of a study conducted in Kosovo (Brajshori, Behrens, 2016) recommend dividing the questionnaire into only eight components.

Cronbach alpha coefficients of components identified by PCA analysis in our study suggested that more than half of the individual components of patient safety culture had an acceptable level of reliability (from $\alpha = 0.619$ for *Organisational learning and continuous improvement* to $\alpha = 0.817$ for *Teamwork across units*). The lowest Cronbach alpha value was recorded for the component *Staffing* ($\alpha = 0.525$). However, comparison of reliability with the original version of the AHRQ questionnaire showed that the component *Staffing* also had the lowest value (Sorra, Nieva, 2004). Likewise, the *Staffing* component had the lowest Cronbach alpha value in many other studies, ranging from $\alpha = 0.119$ to $\alpha = 0.64$ e.g., Sorra, Dyer (USA, 2010); Jordan Al-Nawafleh et al. (Turkey, 2016); Bodur, Filiz (Portugal, 2010); Eiras et al. (Norway, 2014); Haugen et al. (Netherlands, 2010); Ito et al. (Japan, 2011); Nordin et al. (Sweden, 2013); Ocelli et al. (France, 2013); Pfeiffer, Manser (Germany, 2010); Reis et al. (Brazil, 2016); Sarac et al. (Scotland, 2011); Smits et al. (Netherlands, 2008); and Waterson et al. (UK, 2010). In other studies, the lowest Cronbach alpha values were found in different components such as; *Overall perception of patient safety* (Blegen et al., 2009; Brajshori, Behrens, 2016); *Organizational learning and continuous improvement* (Hammer et al., 2011; Robida, 2013; Hedsköld et al., 2013; Vlayen et al., 2015); and *Nonpunitive response to errors* (Olsen, 2008). According to the AHRQ, the overall acceptable level of reliability for the Cronbach's alpha coefficient (α) is ≥ 0.60 ; in our research, the lower values for acceptable level of reliability were recorded for different components to those mentioned above: *Nonpunitive response to errors* ($\alpha = 0.585$); *Handoffs and transitions* ($\alpha = 0.574$); and for the new component identified by PCA in our study *Critical situations on the unit* ($\alpha = 0.578$). Since the component *Overall perception of patient safety* contained only one statement from the questionnaire after PCA, Cronbach's alpha could not be calculated. If it were assigned to other components, their Cronbach alpha would be reduced. The highest value for Cronbach's alpha in our research was recorded for the component *Teamwork across units* ($\alpha = 0.817$), which was not confirmed by any foreign studies. The second highest value was recorded for *Teamwork within units* ($\alpha = 0.806$), a value similar to that accorded in a study conducted in California by Blegen et al. (2009). In many studies, the highest value was for the

component *Frequency of events reported* ranging from $\alpha = 0.91$ to $\alpha = 0.78$ (e.g., in the original study of the questionnaire by Sorra, Nieva (2004); Olsen (2008); Smits et al. (2008); Bodur, Filiz (2010); Haugen et al. (2010); Pfeiffer, Manser (2010); Sorra, Dyer (2010); Waterson et al. (2010); Ito et al. (2011); Sarac et al. (2011); Hedsköld et al. (2013); Najjar et al. (2013); Nordin et al. (2013); Ocelli et al. (2013); Robida (2013); Eiras et al. (2014); Perneger, Staines, Kundig (2014); Vlayen et al. (2015); Al-Nawafleh et al. (2016); Brajshori, Behrens (2016); and Reis et al. (2016) in our research it was identified as the third highest, at $\alpha = 0.784$. In other studies, the component *Management support for patient safety* (Hammer et al., 2011) and *Nonpunitive response to errors* (Nie et al., 2013) had the highest values. An overview of Cronbach alpha values can be found in the study by Pokojová, Bártlová (2018b), but only for European countries. In our study, more than half of the components showed an acceptable level of reliability ($\alpha \geq 0.60$), and the total Cronbach alpha coefficient was determined as $\alpha = 0.879$ for the questionnaire as a whole.

Limitations of the study

The limitations of this study pertain to the fact that results were verified for only one profession (nurses), in one particular health care institution, and with a somewhat small sample of respondents. The main limitation of our study is the introduction of the twelfth component: *Overall perception of patient safety* with only one statement included for this component. Consequently, we were unable to calculate the Cronbach alpha value for this component. Since it is not possible to have a component with a single statement, it is therefore necessary to conduct further research leading to the verification of the psychometric properties of the HSOPS questionnaire in a Czech context, and thus to explore the factor structure of this instrument again.

Conclusion

There are increasing efforts to improve patient safety worldwide, and healthcare providers are being encouraged to start assessing the safety culture in their workplaces. Assessment of patient safety culture by examining its dimensions using the HSOPS is probably one of the best ways to meet safety culture requirements, in particular to understand how employees think and behave when providing care in terms of patient safety. Since to date no stable and definitive translation of this questionnaire has been made in the Czech Republic, our aim was to verify a Czech translation of the HSOPS performed according to the methodology of Wild et al. (2005) and

relating to Czech practice in internal departments, from the perspective of nurses. The results of our cross-sectional validation study confirm that the psychometric characteristics of the HSOPS questionnaire in the Czech Republic show acceptable results. The questionnaire has been shown to be reliable in assessing patient safety culture on a psychometric basis, and can be safely used in practice. Through its use, it is possible to raise awareness of patient safety culture and to gain a more comprehensive overview of the different safety culture dimensions in healthcare providers' workplaces. Verification of the Czech version of the HSOPS following PCA analysis demonstrated the effectiveness of all 12 components, the same number as stated in the original version from the AHRQ. Analysis of the reliability of the questionnaire using Cronbach alpha revealed that the individual components of patient safety culture identified by PCA in our research had an acceptable level in more than half of the reviewed cases. To use the Czech version of the questionnaire in the future, it is first necessary to carry out further research on patient safety culture, mainly because the assessed components of patient safety culture could then be compared, not only in the context of Czech practice but also at an international level. If the Czech version we have created were to be used with a greater number of respondents and is more thoroughly verified in Czech conditions, managers would then be able to use it in practice to identify the strong and weak areas of care provided. Nurse managers would then be able to implement the changes, following assessment of safety in practice, and also to reevaluate them, thereby initiating the process of implementing changes, which would kickstart improvement in overall patient safety in their workplaces.

Ethical aspects and conflict of interest

All literature resources were cited. The study was approved by the Ethical Committee of the Faculty of Health Sciences at Palacký University in Olomouc (UPOL-143765 / 1040-2015). Prior to the commencement of the investigation, approval from the Deputy Secretary for Nursing Care at Motol University Hospital was granted, and, subsequently, (after nurses gave their consent) approval for the distribution of questionnaires was also given. By completing the questionnaires, the nurses automatically agreed to the processing of the results of the survey.

Author contributions

Conception and design (DB, ZM), data analysis and interpretation (DB, DK, RK), manuscript draft (DB, DK), critical revision of the manuscript (DB, DK, ZM, ŠT, KŽ), final approval of the manuscript (DB, DK, ZM, RK, ŠT, KŽ).

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