BMJ Open

# Similarities and differences on the associations between patient safety culture dimensions and self-reported outcomes in two different culture settings: National cross sectional study in Palestinian and Belgian Hospitals



| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2018-021504 |
| Article Type: | Research |
| Date Submitted by the Author: | 04-Jan-2018 |
| Complete List of Authors: | Najjar, Shahenaz; KU Leuven, Health Service Research Group, School of Public Health; King Abdullah International Medical Research Center, population health research section<br>Baillien, Elfi; Katholieke Universiteit Leuven, Marketing and Organisation Studies (MO)<br>Vanhaecht, Kris; KU Leuven, Health Service Research Group, School of Public Health<br>Hamdan, Motasem ; Al Quds University Faculty of Medicine, Public Health<br>Euwema, Martin; KU Leuven , Occupational & Organisational Psychology and Professional Learning<br>Vleugels, Arthur; KU Leuven, Health Service Research Group, School of Public Health<br>Sermeus, Walter; KU Leuven, Health Service Research Group, School of Public Health<br>Hellings , J; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen<br>Schrooten, Ward; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen<br>Vlayen, A; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen |
| Keywords: | Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Public health < INFECTIOUS DISEASES |
| | |

# Similarities and differences on the associations between patient safety culture dimensions and self-reported outcomes in two different culture settings: National cross sectional study in Palestinian and Belgian Hospitals

Shahenaz Najjar, Elfi Baillien, Kris Vanhaecht, Motasem Hamdan, Martin Euwema, Arthur Vleugels, Walter Sermeus, Ward Schrooten, Johan Hellings, Annemie Vlayen

**Corresponding author: Dr. Shahenaz Najjar**

Health Services Research Group, School of Public Health, KULeuven, University of Leuven, Belgium. Currently, King Abdullah International Medical Research Center/King Saud bin Abdulaziz University for Health Sciences, Population Health Department-Hospital–NGHA, Riyshnajjadh, Saudi Arabia

Currently address:

Population Health Research Section

King Abdullah International Medical Research Center (KAIMRC new building)

King Saud Bin Abdulaziz University for Health Sciences

King Abdulaziz Medical City – Riyadh

Ministry of National Guard - Health Affairs

P.O. Box 3660, Riyadh 11481, Saudi Arabia

Mail Code: 1515 (KAIMRC)

Tel: +966 11 429 4444 Ext. 94372

e-mail: shnajjar@gmail.com

Fax: +966 (11) 80 43050, +966(11) 429-4440

Dr. Elfi Baillien: University of Leuevn, Brussel, Belgium

Dr. Kris Vanhaecht: University of Leuevn, Leuven, Belgium

Dr. Motasem Hamdan: Al-Quds University, Jerusalem, Palestine

Dr. Martin Euwema: University of Leuevn, Leuven, Belgium

Dr. Arthur Vleugels: University of Leuevn, Leuven, Belgium

Dr. Walter Sermeus: University of Leuevn, Leuven, Belgium

Dr. Ward Schrooten: Universiteit Hasselt, Diepenbeek, Belgium

Dr. Johan Hellings: Universiteit Hasselt, Diepenbeek, Belgium

Dr. Annemie Vlayen: Universiteit Hasselt, Diepenbeek, Belgium

**Key words**: Patient safety, Patient safety culture, health services, Palestine, Belgium.

**Word count (excluding title page, reference, figures):**

- **Abstract: 300**
- **Strengths and limitations of this study: 123**
- **Main manuscript: 3856**

## Abstract

**Objectives**: To test the relationships between patient safety culture dimensions and self-reported outcomes across different cultures. And gain insight in the cultural differences regarding patient safety culture.

**Design:** Observational, cross sectional study design.

**Setting:** 90 Belgian hospitals and 13 Palestinian hospitals.

**Participants:** 2,836 healthcare professionals matched on profession, tenure and working hours.

**Primary and secondary outcome measures:** The validated version of HSOPSC was used. An exploratory factor analysis was conducted across the participated countries. Reliability was tested using Cronbach's alpha. The study examined the specific predictive value of the patient safety culture dimensions and its self-reported outcome measures across different cultures and countries. Hierarchical regression analyses and bivariate analyses were performed using IBM SPSS version 20.0 (SPSS Inc.,Chicago,IL,USA).

**Results:** Eight safety dimensions and four outcomes were distinguished in both countries. Cronbach's alpha was $\alpha \geq 0.60$. Significant correlations were found between safety culture dimensions and at least one of the outcomes in both samples (*p-value between* <0.05 & <0.001). Hierarchical analyses showed the relationship between the four outcomes and each best predictor. Overall perception of safety was highly predicted by hospital management support in Palestine ($\beta=0.16$, $p<0.001$), and staffing in Belgium ($\beta=0.24$, $p<0.001$). Frequency of events was mostly predicted by feedback and communication in both countries (Palestine;$\beta=0.24$, $p<0.001$, Belgium;$\beta= 0.35$,$p<0.001$). Overall grade on patient safety was predicted by organizational learning in Palestine ($\beta=0.19$, $p<0.001$) and staffing in Belgium ($\beta=0.19$, $p<0.001$). Number of events reported was predicted by staffing in Palestine ($\beta=-0.20$, $p<0.001$) and feedback and communication in Belgium ($\beta=0.11$, $p<0.01$).

**Conclusion:** To promote patient safety in Palestine and Belgium, staffing and communication regarding errors should be improved in both countries. Initiatives to improve hospital management support and the establishment of constructive learning systems would be especially beneficial for patient safety in Palestine. HSOPSC is an appropriate cross-cultural instrument for patient safety culture.

**Strengths and limitations of this study**

- Our study enables us to draw conclusions regarding the varying associations among HSOPSC patient safety culture dimensions and self-reported patient safety outcomes across different cultural settings.
- This is the first study to explore the predictive value of HSOPSC in a matched sample of two different countries.
- Using matched samples design is useful, allowing researchers to maintain a good degree of validity and to achieve rationalized and focused research question.
- However, our results attest the international and cross-cultural validity of the HSOPSC; more studies are needed to provide further evidence in this regard.
- Our study exclusively relied on subjective self-reported measures; future research on linking objective actual adverse events data with safety culture dimensions would be better to clarify the direction of this relation.

## Background

Patient safety is a major focus in the improvement of healthcare quality [1-3]. This has led to an increased interest in patient safety culture assessments in healthcare organizations [4]. Clinical outcomes and adverse event rates have been used as indicators for patient safety in previous studies [5]. Earlier research has demonstrated a link between organizational culture, outcomes and adverse event rates [6-8], financial performance [9] and patient satisfaction [10]. The development of a positive safety culture may help to integrate the concern for safety into the daily functioning of organizations and into the routines of individuals and teams [6]. In this study, safety culture is viewed as the presence of values, beliefs, norms, behaviors and attitudes that may contribute to patient safety [11]. Hospitals that invest in patient safety culture may enable staff not only to prevent and solve safety problems, but to learn collectively from problems that occur at the frontline of care delivery [8,12,13]. Several studies have highlighted the perception of patient safety and staff attitudes toward safety [14-16]. Others have reported on the psychometric evaluation of safety culture tools [17-21].

A range of tools has been developed to measure safety culture; for example, patient safety cultures in healthcare organizations, hospital surveys on patient safety and safety attitude questionnaires [22,23]. These instruments can elicit patient safety-related assessments from healthcare staff at (1) a hospital level, (2) a unit level and (3) a professional level [16,24]. The original American Hospital Survey on Patient Safety Culture (HSOPSC) was released by the Agency for Healthcare Research and Quality in November 2004. The survey is one of the most applied instruments for the assessment of patient safety culture. Moreover, it has been widely translated and validated in several languages and countries, including Belgium, England, Norway, Scotland, the Netherlands and Palestine [17-21]. The survey is intended to help hospitals assess the extent to which their cultures emphasize the importance of patient safety, encourage error reporting and the open discussion of error, and create an atmosphere

of continuous learning and improvement. It combines 10 different dimensions that are expected to have a favorable impact on four self-reported patient safety outcomes [14,17].

Despite efforts to measure safety culture in terms of dimensions and outcomes to improve patient safety, few studies have examined the specific predictive value of the dimensions in terms of HSOPSC outcomes [25]. Research to date has not detailed the relationships between the HSOPSC safety culture dimensions and its self-reported outcome measures across countries. In Belgium and Palestine, the governments promote the HSOPSC instrument as a tool to support the development of patient safety interventions or initiatives at hospitals. Both governments have called for further insight regarding the tool's prevention qualities within and between different cultural contexts [15]. Based on these arguments, the first aim of this study was to test which HSOPSC safety culture dimensions are associated with self-reported outcome measures. Second, we aim to investigate whether the cultural context impacts on these associations. These findings offer further insight into the similarities and differences regarding associations between the dimensions and outcomes of hospital workers in two very different cultural settings. The results also further attest to the value of the HSOPSC to increase patient safety in a range of settings.

## Method

### Design, setting and sample

A cross-sectional study design was used. In total, 90 acute Belgian hospitals and 13 Palestinian hospitals were included in the study. In Belgium, workshops were organized for participating hospitals in which the objectives and survey were explained. The Dutch and French validated versions of HSOPSC were distributed organization-wide to 90 acute hospitals that participated in a federal patient safety program between 2007 and 2009 (baseline safety culture measurement [15]). The 90 hospitals comprised 58 Dutch-speaking

hospitals, 31 French-speaking hospitals and one that was both Dutch- and French-speaking. In total, 68 hospitals used a paper-based survey, 15 used an electronic survey and seven applied a mixed method for survey administration. Technical assistance was available during the periods of data collection. Hospitals were invited to participate in a Belgian comparative research on a voluntary, confidential and free of charge basis. A total of 91,852 questionnaires were distributed and 47,648 were returned (response rate of 51.9%). The comparative database was managed by a neutral academic institution and was not accessible by governmental authorities.

In Palestine, safety culture baseline data were collected from September 2010 to August 2011 in 13 hospitals: 11 public hospitals and two general non-governmental hospitals situated in the West Bank. All hospitals were Arabic-speaking and used a paper-based Arabic validated survey. Workshops were organized at the participating hospitals to explain the objectives and survey. A paper version of the questionnaire was distributed and participants were informed about the purpose of the study. They were also told that their participation was anonymous, voluntary and confidential. Technical assistance was accessible during the periods of data collection. A total of 3,153 questionnaires were distributed and 1,690 were returned (response rate of 53.6%), of which 1,418 could be used for this study. The collected database was managed by an independent academic institution. There are no funders to report for this submission.

In both samples the survey was distributed anonymously to all healthcare staff that had direct (physicians, nurses, clinical staff, pharmacists, radiology staff and laboratory staff) or indirect (all hospital supervisors, managers, administrators, and support and administrative staff) interaction with patients.

For the purposes of this study, the Belgian sample was matched to the Palestinian sample by selecting a matched subsample based on staff position, years of experience at the hospital and

number of hours worked per week. Specifically, we used the Palestinian set (N = 1,418) to randomly (blind) select 1:1 matching participants regarding position, tenure and working hours from the Belgian sample. When more than one matching participant could be identified, we randomly (blind) selected one of the participants that fitted the criteria.

The Belgian and Palestinian samples consisted of a total of 2,836 healthcare staff (1,418 respondents from each country). The subsample comprised the following staff categories: nurses (38.6%), head nurses (9.4%), nursing aid staff (5.7%), physicians (17.9%), pharmacists (2.9%) and other healthcare staff (25.5%). The size of the sample hospitals ranged from small (less than 150 beds) to large (more than 200 beds). The research was fully supported and ethically approved by the governments' departments of health, and all the hospitals approached participated in our study.

**Instrument and measures**

The HSOPSC consists of 42 items and is designed to measure 10 safety culture dimensions and four outcome measures. Items are scored on a 5-point Likert scale ranging from 1 = 'strongly disagree' to 5 = 'strongly agree' or from 1 = 'never' to 5 = 'always'. Respondents were also asked to provide some demographic information (e.g., their work area/unit, staff position, whether they have direct interaction with patients) [14]. Safety culture dimensions and self-reported outcomes are shown in Table 1.

Using the matched samples from both countries, the relations between all dimensions and outcomes of the HSOPSC were assessed. Five-point response scales were used (1=strongly disagree to 5=strongly agree).

*Independent variables*: For both samples, the safety culture dimensions mentioned in Table 1 were used. All dimensions consist of multiple items.

*Dependent variables:* Four self-reported outcome measures were used as dependent variables (Table 1). Two composite outcomes have multiple items. Patient safety grade and number of events are single-item measures.

*Control variables*: The following controls were measured in both samples and were included in all analyses: staff position, years of working experience at the hospital and number of hours worked per week.

**Statistical analysis**

First, we conducted exploratory factor analyses (EFA) using the Palestinian and matched Belgian data to test whether we could detect the same dimension structure in both samples. We aimed for acceptable levels of reliability (Cronbach's $\alpha \geq 0.60$) as recommended in the HSOPSC user guide [26]. Based on EFA analyses, we distinguished eight safety dimensions and two outcome dimensions in both the Palestinian and Belgian data (Table 2). The other two outcome measures were single items: patient safety grade and number of events reported. Cronbach's alpha values for both the Palestinian and Belgian databases are presented in Table2.

Second, we conducted hierarchical regression analyses for both the Palestinian and Belgian samples using IBM SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). A composite average score was created calculating the average responses to the items within a dimension. As 5-point response scales were used, the composite scores were any value between 1 and 5. Regression analyses were conducted to determine the extent to which the safety culture dimensions predicted the four self-reported dimensions. Multiple R ($R^2$) was used to indicate the proportion of variance explained by the model. An indication of the predictive value of the safety culture dimensions was confirmed using standardized beta values (β), which provide better insight into the 'importance' of each predictor in the model and its contribution in

predicting the outcome measures. The following controls were used in all regression analyses: experience at hospital (years), working hours (hours) and staff position.

## Ethical approval

To ensure the privacy of the respondents, the survey was conducted anonymously. The researchers obtained ethical approval from the governments' departments of health and institutional permits from the participated hospitals. Formal ethical approval and patient consent form were not necessary for this type of study.

## Results

### Participants' characteristics

Most participants were nurses 761 (53.7%) and 254 (17.9%) were physicians. Most of the participants had between 1 and 5 years of experience in their current work unit. Details on the matched sample and participants' characteristics for both Palestinian and Belgian respondents are described in Table 3.

### Correlation between dimensions and outcomes of HSOPSC

Table 4 presents the results of two correlation tables; namely, Palestinian correlations shown below the diagonal and Belgian correlations above. Preliminary Pearson correlation analyses (Table 4) revealed some differences between the Palestinian and Belgian samples. The analyses showed significant positive correlations for overall perceptions of patient safety with all dimensions in both samples. Regarding frequency of event reporting, the data also showed a positive correlation with all dimensions in both samples. However, in the Belgian sample, no correlation was found between staffing and frequency of events. In both samples, most dimensions had a positive association with overall grade for patient safety. Regarding the number of events reported, the Palestinian sample had a significant and negative relationship

with four dimensions: supervisor/manager expectations and actions promoting safety, non-punitive response to error, staffing and teamwork across hospital units and hospital handoffs and transitions. The negative correlation means that an inverse relationship exists between two variables; when one variable increases that the other one will be decreases. This was also the case for the Belgian sample, with the number of events reported found to be associated with teamwork within hospital units, organizational learning–continuous improvement, support from hospital management for patient safety, staffing and teamwork across hospital units and during hospital handoffs and transitions. All correlations were negative except for organizational learning.

**Hierarchical regression analyses**

Regression analyses were used to investigate the predictive value of the safety culture dimensions regarding the four self-reported outcome measurements. General results are discussed below. To follow the detailed results please see Table 5.

*Overall perceptions of safety (OPS)*

The safety dimensions explained 16% and 36% of the variance of overall perceptions of safety (OPS) in Palestine and Belgium respectively. OPS outcome was predicted in both countries by teamwork within hospital units, organizational learning–continuous improvement, supervisor/manager expectations and actions promoting safety, support from hospital management for patient safety, teamwork across hospital units and during hospital handoffs and transitions, and feedback and communication openness regarding errors. The standardized beta values (β) was ranged between 0.06 – 0.24 (*p*-value; <0.05 – <0.001). Adding to the above mentioned predictors for OPS staffing was a predictor for Belgian sample only ((β = 0.24, *p*<0.001).

*Frequency of events reporting (FER)*

In Palestine and Belgium, the safety dimensions explained 22% and 18% of the variance of frequency of event reporting (FER) outcome respectively. This outcome was predicted by teamwork across hospital units and during hospital handoffs and transitions, staffing, and feedback and communication openness regarding errors with β-value between 0.06 – 0.35 (*p*-value; <0.05 – <0.001). Organizational learning–continuous improvement (β=0.14, *p*<0.001), and hospital management support for patient safety (β=0.10, $p < 0.001$) were additional good predictors for the Palestinian sample.

*Overall grade on patient safety (OGPS)*

20% of the OGPS was predicted by safety dimensions in Palestine and 33% in Belgium. The results revealed two similar predictors between the two countries namely; supervisor/manager expectations and actions promoting safety and teamwork across hospital units and during hospital handoffs and transitions with β-value between 0.12 - 0.17 (*p*<0.001). In addition to the mentioned predictors above, organizational learning–continuous improvement (β = 0.19, $p < 0.001$), non-punitive response to error (β = 0.09, $p < 0.001$) were significant predictors for OGPS in Palestine. And, teamwork within hospital units (β = 0.11, $p < 0.001$), support from hospital management for patient safety (β = 0.17, $p < 0.001$, staffing (β = 0.19, $p < 0.001$) and feedback and communication openness regarding errors (β = 0.15, $p < 0.001$) in Belgium.

*Number of events reported (NER)*

The dimensions predicted only 1% of the NER in Palestine and 5% in Belgium. Supervisor actions promoting safety and Communication openness regarding errors were good predictors in both countries (β between 0.05 - 0.16, *p*<0.05 - *p*<0.001). In Palestine, non-punitive response to error (β = -0.08, $p < 0.01$), and staffing (β = -0.20, $p < 0.001$) were also predictors for NER. Moreover, teamwork within hospital units (β = -0.07, $p < 0.05$), organizational learning–continuous improvement (β = 0.09, $p$ <0.01), hospital management support for

patient safety (β = -0.07, $p < 0.05$), and teamwork across hospital units and during hospital handoffs and transitions (β = -0.08, $p < 0.01$) were predictors in Belgium.

## DISCUSSION

This study enabled us to draw conclusions regarding the extent that each HSOPSC safety dimension specifically contributes to outcome dimensions. It is the first study to explore the predictive value of HSOPSC in a matched sample of two different countries. As such, it provides information about (a) the impact of the various safety culture dimensions on patient safety outcomes and (b) cross-cultural differences in this respect between Palestinian and Belgian hospitals. Thus, our research furthers the understanding regarding the influence of initiatives to improve specific outcome measures and thereby patient safety. Overall, our findings emphasize that the HSOPSC is a valid survey instrument to improve outcomes related to safe healthcare for patients. The study results demonstrate that at least two of the HSOPSC dimensions contribute to one of the self-reported outcome measures in each country. Thus, our findings attest to the value of the dimensions regarding patient safety outcomes. Only one dimension, non-punitive response to error, was found to have no association with any of the outcome measures in Belgium. A possible explanation could be that this dimension has a low internal consistency level and, therefore, it affected the assessment of its predictive value in the Belgian sample. Despite this finding, every outcome measure was found to have an association with at least two HSOPSC dimensions in the Palestine and Belgium samples. Only a small number of differences were detected between both samples.

The results for both the Palestine and Belgium samples showed that hospitals should focus on investing in interventions that enable feedback and enhance communication openness regarding errors, sustain teamwork within and across hospital units, maintain organizational learning–continuous improvement, and improve hospital handoffs and transitions. These

interventions will improve perceptions of OPS. As such, our analyses and results explicitly reveal 'important' dimensions in view of safety outcomes, and these dimensions are shown to be the same for both Palestinian and Belgian hospitals. Under such circumstances, implementing strategies and tools such as TeamSTEPPS may improve teamwork [26]. This tool not only improves teamwork within and across units, but it also strengthens communication and feedback skills regarding errors and can enable the establishment of a learning system based on previous mistakes.

Event reporting is fundamental to detect patient safety problems and represents a core prerequisite of effective clinical risk management [25,27]. This outcome is of special importance because these items tap into the frequency of the actual reporting of an act, assessing the willingness to report unsafe events. The outcome indicates that a higher error reporting rate leads to a stronger culture of accountability. The results showed, in both the Palestine and Belgium samples, that this outcome is mainly influenced by maintaining open lines of information and communication in the unit. These observations align with Pfeiffer and Manser [25]. Moreover, improvements to staffing and teamwork may also influence this outcome. Palestinian respondents found that managers who consider patient safety as a top priority and build constructive learning systems based on previous mistakes encourage their staff to report adverse events. This result is also commonly reported in the published literature [1,27].

The overall grade for patient safety (OGPS), particularly in building a constructive learning system based on previous mistakes in Palestine and improving staffing levels in Belgium, was found to be significant. In other words, although our results showed many similarities between the matched set of Palestinian and Belgian healthcare professionals, we also found cultural differences regarding OGPS. Consistent with previous studies, having enough staffing [28] and learning opportunities from previous mistakes [6] increased the likelihood of

staff reporting good or excellent safety grades in Belgium. Other contributing dimensions are maintaining manager expectations and actions in promoting safety, improving teamwork across hospital units and supporting hospital handoffs and transitions in both countries. In Palestine, our study also revealed that a higher score on OGPS relates to greater support regarding non-punitive response to error. Additionally, initiatives to improve teamwork within units, support from hospital management for patient safety, staffing and feedback and communication openness regarding errors may also act to advance OGPS in Belgium.

As safety culture dimensions only explained 1% (Palestine) and 5% (Belgium) of number of events reporting (NER), influencing safety culture dimensions will have less impact on patient safety outcomes compared with other outcome dimensions ($R^2_{OPS\text{-}Palestine}$ = 16%; $R^2_{OPS\text{-}Belgium}$ = 36%; $R^2_{FER\text{-}Palestine}$ = 22%; $R^2_{FER\text{-}Belgium}$ = 18%; $R^2_{OGPS\text{-}Palestine}$ = 20%; $R^2_{OGPS\text{-}Belgium}$ = 33%). As such, the HSOPSC seems to work particularly well in predicting OPS, FER, and OGPS, and in both the Belgian and Palestinian samples. A possible explanation for why NER is less well explained through the safety dimensions could be that the HSOPSC safety dimensions have a broad scope regarding patient safety and, consequently, work less well for this very specific outcome. A further explanation could be that our results stem not from a low predictive value, but from the underreporting of adverse events. Underreporting would then result in a low mean and low variance regarding this outcome dimension. Table 2 does indeed indicate a low mean regarding this dimension ($M_{Palestine}$ = 1.89; $M_{Belgium}$ = 2.26), yet does not reveal low variance in terms of respondents' replies ($SD_{Palestine}$ = 1.27; $SD_{Belgium}$ = 1.22). A final explanation could be that respondents found it difficult to answer this question based on experience, as they may not themselves know how many events have been reported. Therefore, hospitals seeking to invest in patient safety must not only measure NER, they should also link the safety dimensions to objective measurements of NER.

To summarize, our results suggest that improved self-reported outcome measures regarding patient safety in both Palestine and Belgium are more likely to be achieved through better teamwork across units and during hospital handoffs and transitions, encouraging feedback and communications regarding errors, and implementing actions to promote safety. Furthermore, improving teamwork within hospital units, providing a work climate that promotes safety as a top priority of hospital management and resolving staffing problems will also influence most outcome measures in Belgium [29,30]. In Palestine, bringing errors to the attention of managers and other staff and using mistakes as valuable learning opportunities [3] may also have an impact on safety outcome measures.

**Limitations and future research**

The current study has some methodological limitations that should be addressed. First, the study used a cross-sectional design; therefore, claims of causal relationships are not possible. Second, as the present study exclusively relied on subjective measures that reflect the willingness of respondents to report events, and more specifically, the reporting of near misses, the results may be contaminated by the common method bias of these self-reported outcome measures. Future research should examine the relationship between HSOPSC dimensions and actual adverse events rates to clarify the direction of this relation by linking objective data with safety culture dimensions. Nevertheless, this study is the first to provide further insight regarding the value of the HSOPSC in terms of (a) the impact of the safety culture dimensions on patient safety outcomes and (b) in different cultural settings. Third, the associations between the safety and outcome dimensions of the HSOPSC were investigated using a matched sample (to rule out possible bias because of the sample differences between the two countries) using linear regression analyses. However, we cannot exclude the limitation of this design. The design uses the most influential variables, which are in fact approximations from the researchers' perspective. These assumptions might be incorrect and

could lead to major confounding variables. Despite these methodological restrictions, previous research has shown that matched samples designs are useful, allowing researchers to perform streamlined and focused research programs whilst maintaining a good degree of validity [31]. Another possible concern is that as most respondents were nurses and other health professionals, the results may reflect their own perceptions and thus affect our association results. However, we should not forget that nurses are the most represented staffing group in hospitals, and that our sample also included physicians, pharmacists, administrative and quality and safety staff. Finally, the Cronbach's alpha values for some of the composite scores measuring patient safety culture were low ($\alpha < 0.70$). Low scores may affect the correlation results, as in the Palestinian sample where all dimensions were positively associated with the OGPS (except staffing). This specific dimension has shown a low internal consistency in most psychometrics evaluation studies of HSOPSC [26,32]. It seems necessary to review and update the items of this dimension to improve its internal consistency. Our results further attest to the international and cross-cultural validity of the HSOPSC. Future research could, however, investigate the relationships between the safety and outcome dimensions in other countries to provide further evidence in this regard.

## Conclusion

Patient safety should be a priority in healthcare systems. Investment in several patient safety culture dimensions would be a worthwhile endeavor to improve the culture of patient safety in hospitals. We found that interventions to improve staffing and feedback and communication regarding errors were the more powerful initiatives to improve patient safety culture outcomes in both countries. Furthermore, interventions from hospital management that actively support safety and the building of constructive learning systems based on previous mistakes should improve perceptions of safety in Palestinian hospitals. As there were only a few differences between the Belgian and Palestinian samples, we conclude that HSOPSC can be considered

an international and cross-cultural instrument. The differentiations that exist mainly concern which dimensions have a greater influence on specific outcomes than others.

## List of abbreviations

| | |
|---|---|
| AHRQ | Agency for healthcare research and quality |
| β | Standardized beta values |
| FB&ComE | Feedback and communication openness about errors |
| FER | Frequency of event reporting |
| HMS | Hospital management support for patient safety |
| HSOPSC | Hospital survey on patient safety culture |
| NER | Number of events reported |
| NPRE | Non-punitive response to error |
| OGPS | Overall grade of patient safety |
| OPS | Overall perceptions of safety |
| OrgLearn | Organizational learning–continuous improvement |
| Staff | Staffing |
| Sup./Man._actions | Supervisor/manager expectations and actions promoting safety |
| TW _units | Teamwork within hospital units |
| TWacross_HHT | Teamwork across hospital units and hospital handoffs and transitions |

## Competing interests

The authors declare that they have no competing interests.

## Authors' contributions

SN performed the overall statistical analyses and drafted the manuscript. EB actively contributed to the statistical analyses, the interpretation of the results, and to the manuscript. MH coordinated data collection (Palestine) and critically revised the manuscript. AVle and

ME participated in critically revising the manuscript for important intellectual content. WSer and WSch participated in the analyses and interpretation of the data, and contributed to the manuscript. KV and JH were involved in the study design and revised the manuscript critically. JH coordinated the data collection (Belgium). AVla was involved in the study design, manuscript outline, and contributed to the manuscript and data preparation (Belgian data). All authors have read and approved the final manuscript.

**Acknowledgements**

We particularly acknowledge all participant hospitals and their staff who devoted time to completing the surveys. We extend our gratitude to the Palestinian and Belgian governments for their cooperation and supporting this research.

## References


1. Schwendimann R, Zimmermann N, Ku¨ng K, et al. **Variation in safety culture dimensionswithin and between US and Swiss Hospital Units: an exploratory study**. *BMJ Qual Saf*.2013;**22**(1):32-41.
2. Donaldson LJ, Fletcher MG. **The WHO World Alliance for Patient Safety: towards the years of living less dangerously.** *Med J Aust* 2006;**184**:S69e72.
3. Najjar S, Hamdan M, Euwema MC, et al. **The Global Trigger Tool shows that one out of seven patients suffers harm in Palestinian hospitals: challenges for launching a strategic safety plan**, *Int J Qual Health Care* 2013;25:640–647, https://doi.org/10.1093/intqhc/mzt066.
4. Institute of Medicine. **To err is human: Building a safer health system**.Washington, D.C: *The National Academy press*, 2000.
5. Wakefield JG, Jorm CM. **Patient safety a balanced measurement framework**. *Aust Health Rev* 2009;**33** (3):382-9.
6. Stone PW, and Gershon PR. **Nurse Work Environments and Occupational Safety in Intensive Care Units**.J Nurs Adm 2009;**39**(7-8 Suppl):S27-34
7. Mardon RE, Khanna K, Sorra J, et al. **Exploring relationships between hospital patient safety culture and adverse events**. *J Patient Saf* 2010; **6:226**-32.
8. Singer S, Lin S, Falwell A, et al. **Relationship of safety climate and safety performance in hospitals**. *Health Serv Res* 2009; **44:399**-421.
9. Kotter JP, and Heskett JL. **Corporate Culture and Performance**. *New York: Free Press*.
10. Carman JM, Shortell SM, Foster RW, et al. **Keys for Successful Implementation of Total Quality Management in Hospitals**.*Health Care Manage Rev.* 2010;**35**(4):283-93

11. Institute of Medicine. **Crossing the Quality Chasm: A New Health System for the 21st Century**. *Washington, DC: National Academy Press*.

12. Edmondson AC. **Psychological Safety and Learning Behavior in Work Teams**. *Administrative Science Quarterly* 1999;**44** (2)*:* 350–83.

13. Hansen LO, Williams MV, and Singer SJ. **Perceptions of Hospital Safety Climate and Incidence of Readmission.** *Health Serv Res* 2011;**46**(2):596-616.

14. Sorra J, Famolaro T, Dyer N, et al. Hospital Survey on Patient Safety Culture: 2012 User Comparative Database Report. Prepared by Westat, Rockville, MD, under Contract No. HHSA 290200710024C. AHRQ Publication No. 12-0017, January 2012. Agency for Healthcare Research and Quality, Rockville, MD. http://www.ahrq.gov/qual/hospsurvey12/index.html

15. Vlayen A, Hellings J, Claes N, Peleman H, Schrooten W. **A nationwide Hospital Survey on Patient Safety Culture in Belgian hospitals: setting priorities at the launch of a 5-year patient safety plan**. *BMJ Qual Saf* 2012;**21**(9):760-7.

16. Deilkas E, Hofoss D. **Patient safety culture lives in departments and wards: multilevel partitioning of variance in patient safety culture**. *BMC Health Serv Res* 2010;**10**:85.

17. Sorra J, & Dyer N: **Multilevel psychometric properties of the AHRQ hospital survey on patient safety culture**. *BMC Health Serv Res* 2010;**10**:199.

18. Waterson PE, 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. doi:10.1136/qshc.2008.031625.

19. Sarac C, Flin R, Mearns K, et al. **Hospital survey on patient safety culture: psychometric analysis on a Scottish sample**. *Qual Saf Health Care* 2011; **20**(10):842-8.

20. Olsen E. **Reliability and validity of the Hospital Survey on Patient Safety Culture at a Norwegian hospital.** In: Øvretveit J, Sousa P, eds. Quality and Safety Improvement Research: Methods and Research Practice from the International Quality Improvement Research Network (QIRN). Lisbon: *National School of Public Health* 2008:173-86

21. Najjar S, Hamdan M, Baillian E, et al. **The Arabic version of the hospital survey on patient safety culture: a psychometric evaluation in a Palestinian sample**. *BMC Health Serv Res* 2013; **13**:193. doi: 10.1186/1472-6963-13-193.

22. Colla JB, Bracken AC, Kinney LM, et al. **Measuring patient safety climate: a review of surveys**. *Qual Saf Health Care* 2005; **14**:364–366.

23. Sexton JB, Helmreich RL, Neilands TB, et al. **The Safety Attitudes Questionnaire: Psychometric Properties, Benchmarking Data, and Emerging Research**. *BMC Health Serv Res* 2006;**6**:44.

24. Sammer CE, Lykens K, Singh KP, et al. **What is patient safety culture? A review of the literature**. *J Nurs Scholarsh* 2010;**42**(2):156–65.

25. Pfeiffer Y, Manser T. **Development of the German version of the Hospital Survey on Patient Safety Culture: Dimensionality and psychometric properties**. *Safety Science* 2010; **48** (10):1452–1462.

26. Sorra JS, Nieva VF. **Hospital Survey on Patient Safety Culture**. AHRQ Publication No. 04-0041. Rockville, MD: Agency for Healthcare Research and Quality; 2004.

27. Westrum R, **A typology of organisational cultures**. Qual Saf Health Care 2004;**13** (Suppl. 2): pp. ii22–ii27.

28. Aiken A, Sermeus W, Van den Heede K, et al. **Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12**

**countries in Europe and the United States**. *BMJ* 2012;**344**:e1717doi: 10.1136/bmj.e1717.

29. Keller SM. **Effects of extended work shifts and shift work on patient safety, productivity, and employee health**. *AAOHN J* 2009;**57** (12):497–502

30. Mark BA, Harless DW and Berman WF. **Nurse Staffing and Adverse Events in Hospitalized Children**. *Policy Polit Nurs Pract* 2007;**8**(2): 83-92.

31. Stuart EA. **Matching methods for causal inference: A review and a look forward**. *Stat Sci* 2010;**25**(1): 1–21

32. El-Jardali F, Jafar M, Dimmasi H, et al. **The current state of patient safety culture in Lebanese hospitals: a study at baseline**. *Int J Qual Health Care* 2010;**22**:386–95.

**Table 1:** Definitions of patient safety culture dimensions and outcomes

| Safety culture dimensions | Items |
|---|---|
| **Communication openness:** Staff freely speak up if they see something that may negatively affect a patient and feel free to question those with more authority | • Staff will freely speak up if they see something that may negatively affect patient care.<br>• Staffs feel free to question the decisions or actions of those with more authority.<br>• Staffs are afraid to ask questions when something do not seem right. |
| **Feedback and communication about error**: Staff are informed about errors that happen, given feedback about changes implemented, and discuss ways to prevent errors | • We are given feedback about changes put into place based on event reports.<br>• We are informed about errors that happen in this unit.<br>• In this unit, we discuss ways to prevent errors from happening again. |
| **Hospital handoffs and transitions**: Important patient care information is transferred across hospital units and during shift changes | • Things "fall between the cracks" when transferring patients from one unit to another.<br>• Important patient care information is often lost during shift changes.<br>• Problems often occur in the exchange of information across hospital units.<br>• Shift changes are problematic for patients in this hospital. |
| **Hospital management support for patient safety**: Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority | • Hospital management provides a work climate that promotes patient safety.<br>• The actions of hospital management show that patient safety is a top priority.<br>• Hospital management seems interested in patient safety only after an adverse event happens. |
| **Safety culture dimensions** | **Items** |
| **Non-punitive response to error**: Staff feel that their mistakes and event reports are not held against them and that | • Staffs feel like their mistakes are held against them.<br>• When an event is reported, it feels like the person is being written up, not the problem. |

| | |
|---|---|
| mistakes are not kept in their personnel file | • Staff worry that mistakes they make are kept in their personnel file. |
| **Organizational learning—Continuous improvement**: Mistakes have led to positive changes and changes are evaluated for effectiveness | • We are actively doing things to improve patient safety.<br>• Mistakes have led to positive changes here.<br>• After we make changes to improve patient safety, we evaluate their effectiveness. |
| **Staffing**: There are enough staff to handle the workload and work hours are appropriate to provide the best care for patients | • We have enough staff to handle the workload.<br>• Staff in this unit work longer hours than is best for patient care.<br>• We use more agency/temporary staff than is best for patient care.<br>• We work in "crisis mode," trying to do too much, too quickly. |
| **Supervisor/manager expectations and actions promoting safety**: Supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures, and do not overlook patient safety problems | • My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures.<br>• My supervisor/manager seriously considers staff suggestions for improving patient safety.<br>• Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts.<br>• My supervisor/manager overlooks patient safety problems that happen over and over. |
| **Safety culture dimensions** | **Items** |
| **Teamwork across hospital units**: Hospital units cooperate and coordinate with one another to provide the best care for patients | • There is good cooperation among hospital units that need to work together.<br>• Hospital units work well together to provide the best care for patients.<br>• Hospital units do not coordinate well with each other.<br>• It is often unpleasant to work with staff from other hospital units. |

| | |
|---|---|
| **Teamwork within hospital units**: Staff support each other, treat each other with respect, and work together as a team | • People support one another in this unit.<br>• When a lot of work needs to be done quickly, we work together as a team to get the work done.<br>• In this unit, people treat each other with respect.<br>• When one area in this unit gets really busy, others help out. |

| Self-reported outcome measures | Items |
|---|---|
| **Frequency of events reported**: Mistakes of the following types are reported: (1) mistakes caught and corrected before affecting the patient, (2) mistakes with no potential to harm the patient, and (3) mistakes that could harm the patient but do not | • When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?<br>• When a mistake is made, but has no potential to harm the patient, how often is this reported?<br>• When a mistake is made that could harm the patient, but does not, how often is this reported? |
| **Overall perceptions of patient safety**: Procedures and systems are good at preventing errors and there is a lack of patient safety problems | • Patient safety is never sacrificed to get more work done.<br>• Our procedures and systems are good at preventing errors from happening.<br>• It is just by chance that more serious mistakes don't happen around here.<br>• We have patient safety problems in this unit |

| Self-reported outcome measures | Items |
|---|---|
| **Patient safety grade**: Overall grade on patient safety for their work area/unit | • Please give your work area/unit in this hospital an overall grade on patient safety. |
| **Number of events reported**: The number of events they reported over the past 12 months | • In the past 12 months, how many event reports have you filled out and submitted? |

**Table 2:** Dimensions and Cronbach's Alpha of HSOPSC in Palestine and Belgium

| OUTCOME MEASURES | Mean (SD) Palestine | Mean (SD) Belgium | Cronbach's alpha Palestine Datasets | Cronbach's alpha Belgium Datasets |
|---|---|---|---|---|
| Frequency of Event Reporting (FER) | 3.09 (1.05) | 3.23 (0.96) | 0.87 | 0.86 |
| Overall Perceptions of Safety (OPS) | 3.35 (0.94) | 3.29 (0.75) | 0.75 | 0.73 |
| **SAFETY CULTURE DIMENSIONS** | | | | |
| Supervisor/manager expectations & actions promoting safety (Sup./Man.actions) | 3.32 (0.78) | 3.54 (0.68) | 0.74 | 0.74 |
| Organizational Learning—Continuous improvement (OrgLearn) | 3.52 (0.84) | 3.39 (0.59) | 0.73 | 0.61 |
| Feedback & Communication Openness about Errors (FB&ComE) | 3.32 (0.81) | 3.43 (0.72) | 0.76 | 0.80 |
| Teamwork Within Hospital Units (TW _units) | 3.76 (0.82) | 3.81 (0.69) | 0.80 | 0.79 |
| No punitive Response To Error(NPRE) | 2.33 (0.77) | 3.13 (0.75) | 0.63 | 0.69 |
| Staffing (Staff) | 3.41 (0.88) | 2.99 (0.71) | 0.67 | 0.61 |
| Hospital Management Support for Patient Safety (HMS) | 3.01 (0.95) | 3.09 (0.69) | 0.76 | 0.77 |
| Teamwork Across Hospital Units & Hospital Handoffs & Transitions(TWacross_HHT) | 3.23 (0.81) | 2.95 (0.58) | 0.78 | 0.75 |

Mean scores reported on scale 1–5, with 1= 'strongly disagree' to 5= 'strongly agree'

**Table 3:** Participants' characteristics

| Characteristics | | Whole Sample | Palestine Sample *N* =1418 | Matched Belgian Sample *N* = 1418 | Difference |
|---|---|---|---|---|---|
| Direct contact or interaction with patient | Yes | 2524 (88.9%) | 1284 (90.5%) | 1240 (87.4%) | $\chi^2$ (1) = 6.972; $p$ = .008 |
| | No | 312 (11.0%) | 134 (9.4%) | 178 (12.5%) | |
| Experience at current work area/unit | *<1year* | 452 (15.9%) | 218 (15.4%) | 234 (16.5%) | $\chi^2$ (5) = 16.879; $p$ = .005 |
| | *1 to 5 years* | 1206 (42.5%) | 621 (43.8%) | 585 (41.3%) | |
| | *6 to 10 years* | 552 (19.5%) | 250 (17.6%) | 302 (21.3%) | |
| | *11 to 15 years* | 281 (09.9%) | 162 (11.4%) | 119 (8.4%) | |
| | *16 to 20 years* | 184 (06.5%) | 81 (5.7%) | 104 (7.3%) | |
| | *>21 years* | 160 (05.6%) | 86 (6.1%) | 74 (5.2%) | |
| Hospital size (beds) | *Small (<150)* | 700 (24.7%) | 612 (43.1%) | 88 (6.2%) | $\chi^2$ (2) = 1370.8; $p$ = .000 |
| | *Medium (150 to 249)* | 632 (22.3%) | 546 (38.5%) | 86 (6.1%) | |
| | *Large (≥250)* | 1504 (53.0%) | 260 (18.4%) | 1244 (87.7%) | |

**Table 4:** Correlation matrixes (Belgian sample above the diagonal, Palestinian sample below the diagonal)

| | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Hospital years experience | _ | .03 | .05 | -.05 | .05* | -.01 | -.03 | .02 | -.05 | -.09** | .01 | -.06* | .04 | -.04 | .15** |
| 2. Working hours | .03 | _ | -.02 | .03 | -.03 | -.02 | .02 | -.10** | -.07** | -.11** | .01 | -.01 | -.03 | -.02 | .04 |
| 3. Staff position | .05 | -.02 | _ | -.02 | -.04 | -.01 | .05 | .07** | -.14** | .15** | .00 | .09** | -.05 | .06* | .08** |
| 4. TW _units | -.05 | .03 | .06* | _ | .31** | .36** | .36** | .20** | .24** | .22** | .44** | .30** | .21** | .33** | -.06* |
| 5. OrgLearn | .01 | .05* | .04 | .41** | _ | .43** | .27** | .31** | .19** | .13** | .46** | .32** | .24** | .25** | .06* |
| 6. Sup./Man._actions | .01 | .04 | .05 | .24** | .27** | _ | .37** | .36** | .25** | .27** | .54** | .42** | .24** | .38** | -.05 |
| 7. NPRE | .03 | -.02 | .06* | .08** | .08** | .13** | _ | .27** | .22** | .30** | .35** | .30** | .19** | .25** | -.00 |
| 8. HMS | -.01 | .08** | .05* | .26** | .27** | .29** | .26** | _ | .35** | .31** | .35** | .42** | .19** | .39** | -.07** |
| 9. TWacross_HHT | -.04 | .01 | .02 | .29** | .24** | .35** | .22** | .34** | _ | .24** | .27** | .29** | .18** | .36** | -.12** |
| 10. Staff | -.02 | -.00 | .02 | -.04 | -.04 | .13** | -.11** | -.06* | .02 | _ | .23** | .42** | .05 | .37** | -.08** |
| 11. FB&ComE | -.02 | .03 | .07** | .34** | .36** | .33** | .17** | .34** | .27** | -.04 | _ | .37** | .41** | .40** | .04 |
| 12. OPS | -.01 | .06* | .04 | .25** | .26** | .28** | .13** | .27** | .24** | .02 | .25** | _ | .19** | .53** | -.16** |
| 13. FER | .03 | .07** | .02 | .25** | .31** | .22** | .13** | .29** | .29** | .07* | .38** | .23** | _ | .21** | .11** |
| 14. OGPS | .10** | .15** | .03 | .20** | .31** | .28** | .18** | .23** | .28** | -.01 | .20** | .19** | .23** | _ | -.13** |
| 15. NER | .01 | -.02 | .00 | .00 | -.04 | -.19** | -.07** | -.04 | -.10** | -.22** | -.01 | -.09** | .01 | -.10** | _ |

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

**TW _units**: Teamwork within hospital units, **OrgLearn**: Organizational learning—Continuous improvement, **Sup./Man._actions**: Supervisor/manager expectations and actions promoting safety, **NPRE**: Non-punitive response to error, **HMS**: Hospital management support for patient safety, **TWacross_HHT**: Teamwork across hospital units and hospital handoffs and transitions, **Staff**: Staffing, **FB&ComE**: Feedback and communication openness about error, **OPS**: Overall perceptions of patient safety, **FER**: Frequency of events reported, **OGPS**: overall grade of patient safety, **NER**: Number of events reported

**Table 5:** Summary of the hierarchical regression analyses: Predicting the outcomes of the HSOPC in matched samples of Palestinian and Belgian hospital workers (β)

| | *Palestine (N =1418 )* | | | | | | | | *Belgium (N = 1418)* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcome** | **Overall perceptions of Safety (OPS)** | | **Frequency of events reporting (FER)** | | **Overall grade on patient safety (OGPS)** | | **Number of events reported (NER)** | | **Overall perceptions of Safety (OPS)** | | **Frequency of events reporting (FER)** | | **Overall grade on patient safety (OGPS)** | | **Number of events reported (NER)** | |
| *Predictors* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* |
| Hospital tenure | -.01 | -.00 | .02 | .04 | .09*** | .09*** | .01 | .01 | -.06** | -.04* | .04 | .04 | -.04 | -.02 | .15*** | .13*** |
| Working hours | .06** | .04 | .07** | .04 | .15*** | .12*** | -.02 | -.02 | -.00 | .04 | -.03 | -.03 | -.02 | .03 | .03 | .02 |
| Staff function | .04 | .00 | .03 | -.01 | .03 | .00 | -.00 | .01 | .09*** | .06** | | -.04 | .06 | .04 | | 08** |
| TW _units | | .10*** | | .04 | | .03 | | .04 | | .06** | | .02 | | .11*** | | -.07* |
| OrgLearn | | .10*** | | .14*** | | .19*** | | -.03 | | .10*** | | .04 | | -.00 | | .09** |
| Sup./Man._actions | | .13*** | | .00 | | .14*** | | -.16*** | | .17*** | | .00 | | .12*** | | -.08* |
| NPRE | | .05 | | .03 | | .09*** | | -.08** | | .03 | | .04 | | -.03 | | .04 |
| HMS | | .16*** | | .10*** | | .05 | | .01 | | .19*** | | .04 | | .17*** | | -.07* |
| TWacross_HHT | | .07** | | .13*** | | .14*** | | -.05 | | .08** | | .06* | | .17*** | | -.08** |
| Staff | | .02 | | .09*** | | -.01 | | -.20*** | | .24*** | | -.07** | | .19*** | | -.05 |
| FB&ComE | | .08** | | .24*** | | .01 | | .05* | | .06* | | .35*** | | .15*** | | .11** |
| $R^2$ | .00 | .16*** | .00* | .22*** | .03*** | .20*** | -.00 | .01** | .00*** | .36*** | .00 | .18*** | .00 | .33*** | .02*** | .05*** |

The highest absolute values of the standardized beta are shaded. * $p<.05$; ** $p<.01$; *** $p<.001$

**TW _units**: Teamwork within hospital units, **OrgLearn**: Organizational learning—Continuous improvement, **Sup./Man._actions**: Supervisor/manager expectations and actions promoting safety, **NPRE**: Non-punitive response to error, **HMS**: Hospital management support for patient safety, **TWacross_HHT**: Teamwork across hospital units and hospital handoffs and transitions, **Staff**: Staffing, **FB&ComE**: Feedback and communication openness about error, **OPS**: Overall perceptions of patient safety, **FER**: Frequency of events reported, **OGPS**: overall grade of patient safety, **NER**: Number of events reported

BMJ Open

# Similarities and differences in the associations between patient safety culture dimensions and self-reported outcomes in two different culture settings: A national cross-sectional study in Palestinian and Belgian hospitals



| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2018-021504.R1 |
| Article Type: | Research |
| Date Submitted by the Author: | 13-Apr-2018 |
| Complete List of Authors: | Najjar, Shahenaz; King Abdullah International Medical Research Center, Population Health Department – Hospital - MNG-HA.; KU Leuven, Health Service Research Group, School of Public Health<br>Baillien, Elfi; Katholieke Universiteit Leuven, Marketing and Organisation Studies (MO)<br>Vanhaecht, Kris; KU Leuven, Institute for Healthcare Policy<br>Hamdan, Motasem ; Al Quds University Faculty of Medicine, Public Health<br>Euwema, Martin; KU Leuven , Occupational & Organisational Psychology and Professional Learning<br>Vleugels, Arthur; KU Leuven, Health Service Research Group, School of Public Health<br>Sermeus, Walter; KU Leuven, Health Service Research Group, School of Public Health<br>Schrooten, Ward; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen<br>Hellings , J; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen<br>Vlayen, A; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen |
| Primary Subject Heading: | Health services research |
| Secondary Subject Heading: | Health services research, Public health, Health policy |
| Keywords: | Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Public health < INFECTIOUS DISEASES |
| | |

# Similarities and differences in the associations between patient safety culture dimensions and self-reported outcomes in two different culture settings: A national cross-sectional study in Palestinian and Belgian hospitals

Shahenaz Najjar, Elfi Baillien, Kris Vanhaecht, Motasem Hamdan, Martin Euwema, Arthur Vleugels, Walter Sermeus, Ward Schrooten, Johan Hellings, Annemie Vlayen

**Corresponding author: Dr. Shahenaz Najjar**

King Abdullah International Medical Research Center/King Saud bin Abdulaziz University for Health Sciences, Population Health Department – Hospital - MNG-HA.

Address:

Population Health Research Section

King Abdullah International Medical Research Center (KAIMRC new building)

King Saud Bin Abdulaziz University for Health Sciences

King Abdulaziz Medical City, Riyadh

Ministry of National Guard - Health Affairs

P.O. Box 3660, Riyadh 11481, Saudi Arabia

Mail Code: 1515 (KAIMRC)

Tel: +966 11 429 4444 Ext. 94372

e-mail: shnajjar@gmail.com

Fax: +966 (11) 80 43050, +966(11) 429-4440

Dr. Elfi Baillien: University of Leuven, Brussels, Belgium

Dr. Kris Vanhaecht: University of Leuven, Leuven, Belgium

Dr. Motasem Hamdan: Al-Quds University, Jerusalem, Palestine

Dr. Martin Euwema: University of Leuven, Leuven, Belgium

Dr. Arthur Vleugels: University of Leuven, Leuven, Belgium

Dr. Walter Sermeus: University of Leuven, Leuven, Belgium

Dr. Ward Schrooten: University of Hasselt, Diepenbeek, Belgium

Dr. Johan Hellings: University of Hasselt, Diepenbeek, Belgium

Dr. Annemie Vlayen: University of Hasselt, Diepenbeek, Belgium

**Key words**: Patient safety, patient safety culture, health services, Palestine, Belgium.

**Word count (excluding title page, reference, figures):**

- **Abstract: 300**
- **Strengths and limitations of this study: 118**
- **Main manuscript: 4336**

## Abstract

**Objectives**: To investigate the relationships between patient safety culture (PSC) dimensions and PSC self-reported outcomes across different cultures and to gain insights in cultural differences regarding patient safety culture.

**Design:** Observational, cross-sectional study.

**Setting:** Ninety Belgian hospitals and 13 Palestinian hospitals.

**Participants:** A total of 2,836 healthcare professionals matched for profession, tenure and working hours.

**Primary and secondary outcome measures:** The validated versions of the Belgian and Palestinian Hospital Survey on Patient Safety Culture (HSOPSC) were used. An exploratory factor analysis was conducted. Reliability was tested using Cronbach's alpha (α). In this study, we examined the specific predictive value of the PSC dimensions and its self-reported outcome measures across different cultures and countries. Hierarchical regression and bivariate analyses were performed.

**Results:** Eight PSC dimensions and four PSC self-reported outcomes were distinguished in both countries. Cronbach's alpha was α ≥0.60. Significant correlations were found between PSC dimensions and its self-reported outcome (*P*-value range <0.05 to <0.001). Hierarchical regression analyses showed overall perception of safety was highly predicted by hospital management support in Palestine (β=0.16, *P*<0.001), and staffing in Belgium (β=0.24, *P* <0.001). The frequency of events was largely predicted by feedback and communication in both countries (Palestine: β=0.24, *P*<0.001; Belgium: β=0.35, *P*<0.001). Overall grade for patient safety was predicted by organizational learning in Palestine (β=0.19, *P*<0.001) and staffing in Belgium (β=0.19, *P* <0.001). Number of events reported was predicted by staffing in Palestine (β=-0.20, *P*<0.001) and feedback and communication in Belgium (β=0.11, *P*<0.01).

**Conclusion:** To promote patient safety in Palestine and Belgium, staffing and communication regarding errors should be improved in both countries. Initiatives to improve hospital management support and establish constructive learning systems would be especially beneficial for patient safety in Palestine. Future research should address the association between safety culture and hard patient safety measures such as patient outcomes.

**Strengths and limitations of this study**

- Our study enables us to draw conclusions regarding the varying associations among PSC dimensions and self-reported patient safety outcomes across different cultural settings.
- This is the first study to explore the predictive value of the HSOPSC in matched samples from two different countries.
- Using a matched samples study design is useful, allowing researchers to establish a good degree of validity and to investigate a rationalized and focused research question.
- Our results verify the international and cross-cultural validity of the HSOPSC; however, more studies are needed to provide further evidence in this regard.
- Our study relied exclusively on subjective self-reported measures; future research on linking actual adverse events data with PSC dimensions objectively is required to clarify this relationship.

## Background

Patient safety is a major focus in the improvement of the quality of healthcare [1-3]. This has led to an increased interest in patient safety culture (PSC) assessments in healthcare organizations [4]. Clinical outcomes and adverse event rates have been used as indicators of patient safety in previous studies [5]. Earlier research has demonstrated a link between organizational culture, outcomes and adverse event rates [6-8], financial performance [9] and patient satisfaction [10]. The development of a positive PSC may help to integrate the concern for safety into the daily functioning of organizations and into the routines of individuals and teams [6]. In this study, PSC is defined as the presence of values, beliefs, norms, behaviors and attitudes that may contribute to patient safety [11]. Hospitals that invest in PSC may enable staff not only to prevent and solve safety problems, but also to learn collectively from problems that occur at the frontline of healthcare delivery [8,12,13]. Several studies have highlighted the perception of patient safety and staff attitudes toward safety [14-16]. Others have reported on the psychometric evaluation of PSC tools [17-21].

A range of tools has been developed to measure PSC; like, PSC in healthcare organizations, hospital surveys on patient safety and safety attitude questionnaires [22,23]. These instruments can be used elicit patient safety-related assessments by healthcare staff at: (1) a hospital level, (2) a unit level and (3) a professional level [16,24]. The original American Hospital Survey on Patient Safety Culture (HSOPSC) was released by the Agency for Healthcare Research and Quality in November 2004. The survey is one of the most commonly applied instruments for the assessment of PSC. Moreover, it has been widely translated and validated in several languages and countries, including Belgium, England, Norway, Scotland, the Netherlands and Palestine [17-21,25,26]. The survey is intended to help hospitals assess the extent to which their cultures emphasize the importance of patient safety, encourage both

the reporting and open discussion of errors, and create an atmosphere of continuous learning and improvement.

The original HSOPSC consists of 42 items loading on 12 dimensions: two outcome dimensions and 10 safety dimensions. The 10 different PSC dimensions are expected to have a favorable impact on the two composite outcome dimensions (multiple items) and the two single-item outcomes [14,17]. The four outcomes are self-reported patient safety outcomes.

Despite efforts to measure PSC in terms of dimensions and outcomes to improve patient safety, few studies have examined the specific predictive value of the dimensions in terms of HSOPSC outcomes [27]. Research to date has not detailed the relationships between the HSOPSC dimensions and its self-reported outcome measures across countries. The governments of Belgium and Palestine promote the HSOPSC as a tool to support the development of patient safety interventions or initiatives in hospitals. The workforce of the Ministry of Health Hospitals in the West Bank in 2016 was estimated at 4,023 personnel, comprising 649 physicians, 1,860 nurses and midwives, 590 paramedical, 66 pharmacists and 858 administrative and support staff. Our study included hospitals that are operated in both governmental and non-governmental sectors in Belgium and Palestine. We assumed that there were no staff-related differences that would influence the PSC between the two countries. Both governments have called for further investigations into the effectiveness of the HSOPSC within and between different cultural contexts [15]. Thus, the first aim of this study was to determine which HSOPSC dimensions are associated with self-reported outcome measures. Second, we aimed to investigate the impact of cultural context on these associations. These findings offer further insights into the similarities and differences regarding associations between the PSC dimensions and outcomes of hospital workers in two very different cultural settings. The results also further attest to the value of the HSOPSC to increase patient safety in a range of settings.

## Methods

### Design, setting and sample

A cross-sectional study design was used. In total, 90 acute Belgian hospitals and 13 Palestinian hospitals were included in the study. In Belgium, workshops were organized for participating hospitals in which the objectives and survey were explained. The Dutch and French validated versions of the HSOPSC were distributed organization-wide to 90 acute hospitals that participated in a federal patient safety program between 2007 and 2009 (baseline PSC measurement [15,25,26]). These hospitals comprised 58 Dutch-speaking hospitals, 31 French-speaking hospitals and one that was both Dutch- and French-speaking. In total, 68 hospitals used a paper-based survey, 15 used an electronic survey and seven applied a mixed method for survey administration. Technical assistance was available during the periods of data collection. Hospitals were invited to participate in a Belgian comparative study on a voluntary, confidential and free-of-charge basis. A total of 91,852 questionnaires were distributed, of which 47,648 were returned (response rate 51.9%). The comparative database was managed by a neutral academic institution and was not accessible to government authorities.

In Palestine, PSC baseline data were collected from September 2010 to August 2011 in 13 hospitals: 11 public hospitals and two general non-governmental hospitals situated in the West Bank. All hospitals were Arabic-speaking and used a validated paper-based Arabic language survey [21]. Workshops were organized at the participating hospitals to explain the objectives and survey. A paper version of the questionnaire was distributed and participants were informed about the purpose of the study. They were also told that their participation was anonymous, voluntary and confidential. Technical assistance was accessible during the periods of data collection. A total of 3,153 questionnaires were distributed, of which 1,690

were returned (response rate 53.6%), of which 1,418 could be used for this study. The collected database was managed by an independent academic institution.

For both the Belgian and Palestinian samples, the survey was distributed anonymously to all healthcare staff that had direct (physicians, nurses, clinical staff, pharmacists, radiology staff and laboratory staff) or indirect (all hospital supervisors, managers, administrators, and support and administrative staff) interaction with patients. The survey was self-administered and then placed in sealed envelopes without any respondent identification. Collection points/boxes were identified for returning the completed questionnaires.

For the purposes of this study, the Belgian sample was matched to the Palestinian sample by selecting a matched subsample based on staff position, years of experience at the hospital and number of hours worked per week. Specifically, we used the Palestinian set ($N$ = 1,418) to randomly (blind) select 1:1 matching participants regarding position, tenure and working hours from the Belgian sample. When more than one matching participant was identified, we randomly (blind) selected one of the participants that fitted the criteria. The matched sample was selected manually by the data management department.

The Belgian and Palestinian samples consisted of a total of 2,836 healthcare staff (1,418 respondents from each country). The subsample comprised the following staff categories: nurses (38.6%), head nurses (9.4%), nursing aid staff (5.7%), physicians (17.9%), pharmacists (2.9%) and other healthcare staff (25.5%). The sample hospitals ranged in size from small (fewer than 150 beds) to large (more than 200 beds). The research was fully supported and ethically approved by the Departments of Health of the Belgian and Palestinian governments, and all the hospitals approached participated in our study.

**Funding statement**

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

**Instruments and measures**

The HSOPSC consists of 42 items and is designed to measure 10 PSC dimensions and four outcome measures. Items are scored on a 5-point Likert scale ranging from 1 = 'strongly disagree' to 5 = 'strongly agree' or from 1 = 'never' to 5 = 'always'. Respondents were also asked to provide some demographic information (e.g., their work area/unit, staff position, whether they have direct interaction with patients) [14]. PSC dimensions and self-reported outcomes are shown in Table 1.

Using the matched samples from both countries, the relationships between all dimensions and outcomes of the HSOPSC were assessed. Five-point response scales were used (1 = 'strongly disagree' to 5 = 'strongly agree').

*Independent variables*

For both samples, the PSC dimensions shown in Table 1 were used. All PSC dimensions consist of multiple items.

*Dependent variables*

Four self-reported outcome measures were used as dependent variables (Table 1). Two composite outcomes have multiple items scored on a 5-point Likert scale, of which the labels vary throughout the dimensions as follows: (1) frequency with events reported from 1 = 'strongly disagree' to 5 = 'strongly agree'; and (2) overall perceptions of patient safety from 1 = 'never' to 5 = 'always'. Patient safety grade and number of events are ordinal, ranging from 1 to 5 (1 = 'failing' to 5 = 'excellent') and from 1 to 6 (1 = 'no event' to 6 = 'more than 21 events'), respectively; both are single-item measures.

*Control variables*

The following controls were measured in both samples: staff position is categorical; years of working experience at the hospital is numerical, ranging from 1 to 6 (1 = 'less than 1 year' to 6 = '21 years or more'); and number of hours worked per week is numerical, ranging from 1

to 6 (1 = 'less than 20 hours per week to 6 = '100 hours or more per week'). The control variables were selected based on previous research and/or their significant correlations with the outcomes [28,29].

**Statistical analysis**

A total of 2,836 healthcare staff was participated in the study. For the purposes of our analysis, negatively worded items were reversed coded so that a higher score reflected a more positive response. First, we conducted exploratory factor analyses (EFA) using the Palestinian and matched Belgian data to test whether we could detect the same dimension structure in both samples. We aimed for acceptable levels of reliability (Cronbach's $\alpha \geq 0.60$) as recommended in the HSOPSC user guide [30]. Based on the EFA analyses, we optimized the model by defining 10 PSC dimensions instead of the original 12 HSOPSC dimensions in both the Palestinian and Belgian data. Four original dimensions were revealed as two dimensions. One combined 'communication openness' and 'feedback about error' in one dimension and the other combined 'teamwork across hospital units' and 'hospital handoffs and transitions' (Table 2). The other two outcome measures were individual items: 'patient safety grade' and 'number of events reported'. Cronbach's $\alpha$ values for both the Palestinian and Belgian databases are presented in Table 2.

Second, we conducted hierarchical regression analyses for both the Palestinian and Belgian samples using IBM SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). Regression Analyses are particularly suitable for analyses of variance in which we aim to test whether and to what extend the variance on the dependent variables (and as reported by the respondents) can be explained by the independent variables; which is reflected by $R^2$. By including hierarchical analyses, we are able to detect how much extra variance ($R^2$ change) in the PSC outcomes is explained by introducing the PSC dimension in the analyses on top of the control variables [31]. A composite average score was generated by calculating the

average responses to the items within a dimension. As 5-point response scales were used, the composite scores generated were any value between 1 and 5. Regression analyses were conducted to determine the extent to which the PSC dimensions (modeled as independent variables) predicted the four self-reported dimensions (modeled as dependent variables). Multiple R ($R^2$) was used to indicate the proportion of variance explained by the model. An indication of the predictive value of the PSC dimensions was confirmed using standardized beta values (β). A standardized beta coefficient is a standardized partial correlation coefficient that allows us to compare the strength of the effect of each predictor/independent variable in predicting the outcome/dependent variable, with higher absolute values of the beta coefficient indicating a stronger effect. Based on their significant correlation with the four outcomes over the Palestine and Belgian samples, the following controls were used in all regression analyses: experience at hospital (years), working hours (hours) and staff position. The control variables included in both countries were consistent to assure we could compare the results.

**Data sharing statement**

The data that support the findings of this study are available from the correspondent author upon reasonable request and with permission of University of Leuven and University of Hasselt.

**Patient and public involvement**

Patient and public were not involved in the study.

**Ethical approval**

To ensure the privacy of the respondents, the survey was conducted anonymously. The researchers obtained ethical approval from the Departments of Health of the Belgian and Palestinian governments and institutional permits from the participating hospitals. Formal ethical approval and informed patient consent were not necessary for this type of study.

## Results

### Participants' characteristics

Most participants were nurses 761 (53.7%) and 254 (17.9%) were physicians. Most of the participants had between 1 and 5 years of experience in their current work unit. Details of the matched sample and participants' characteristics for both Palestinian and Belgian respondents are described in Table 3.

### Correlation between PSC dimensions and outcomes of the HSOPSC

Table 4 presents the results of two correlation tables; namely, Palestinian correlations shown below the diagonal and Belgian correlations above. Preliminary Spearman's correlation analyses (Table 4) revealed some differences between the Palestinian and Belgian samples. The analyses showed significant positive correlations between overall perceptions of patient safety and most of the dimensions in both samples. Regarding the frequency of event reporting, the data also showed a positive correlation with most of the dimensions in both samples. In both samples, most dimensions had a positive association with overall grade for patient safety. Regarding the number of events reported, the Palestinian sample had a significant and negative relationship with four dimensions: supervisor/manager expectations and actions promoting safety, non-punitive response to error, staffing and teamwork across hospital units and hospital handoffs and transitions. A negative correlation indicates the existence of an inverse relationship between two variables; that is, an increase in one variable is associated with a decrease in the other variable. This was also the case for the Belgian sample, with the number of events reported found to be associated positively with organizational learning–continuous improvement, and negatively with support from hospital management for patient safety, staffing and teamwork across hospital units and during hospital handoffs and transitions.

**Hierarchical regression analyses**

Regression Analyses were used to investigate the predictive value of the PSC dimensions regarding the four self-reported outcome measurements. The detailed results are shown in Table 5 and the results are discussed generally below.

*Overall perceptions of safety (OPS)*

The PSC dimensions explained 16% and 36% of the variance of overall perceptions of safety (OPS) in the Palestinian and Belgian samples, respectively. OPS outcome was predicted in both countries by teamwork within hospital units, organizational learning–continuous improvement, supervisor/manager expectations and actions promoting safety, support from hospital management for patient safety, teamwork across hospital units and during hospital handoffs and transitions, and feedback and communication openness regarding errors. The standardized beta (β) values ranged from 0.06 to 0.24 (*P*-values: <0.05 to <0.001). In addition to the previously mentioned predictors of OPS, staffing was a predictor for the Belgian sample only (β = 0.24, $P < 0.001$).

*Frequency of event reporting (FER)*

In the Palestinian and Belgian sample, the PSC dimensions explained 22% and 18% of the variance of frequency of event reporting (FER) outcome, respectively. This outcome was predicted by teamwork across hospital units and during hospital handoffs and transitions, staffing, and feedback and communication openness regarding errors with β-values ranging from 0.06 to 0.35 (*P*-values <0.05 to <0.001). Organizational learning–continuous improvement (β = 0.14, $P$ <0.001), and hospital management support for patient safety (β = 0.10, $P$ <0.001) were also good predictors for the Palestinian sample.

*Overall grade on patient safety (OGPS)*

In total, 20% of the OGPS was predicted by PSC dimensions in the Palestinian sample and 33% in the Belgian sample. The results revealed two similar predictors in the two countries,

namely supervisor/manager expectations and actions promoting safety and teamwork across hospital units and during hospital handoffs and transitions, with β-values ranging from 0.12 to 0.17 ($P$ <0.001). In addition to the previously mentioned predictors, organizational learning–continuous improvement (β = 0.19, $P$ <0.001) and non-punitive response to error (β = 0.09, $P$ <0.001) were significant predictors of OGPS in Palestine. Furthermore, teamwork within hospital units (β = 0.11, $P$ <0.001), support from hospital management for patient safety (β = 0.17, $P$ <0.001), staffing (β = 0.19, $P$ <0.001) and feedback and communication openness regarding errors (β = 0.15, $P$ <0.001) were significant predictors of OGPS in Belgium.

*Number of events reported (NER)*

The PSC dimensions predicted only 1% of the NER in Palestine and 5% in Belgium. Supervisor actions promoting safety and communication openness regarding errors were good predictors in both countries (β ranging from 0.05 to 0.16, $P$-values ranging from <0.05 to <0.001). In Palestine, non-punitive response to error (β = -0.08, $P$ <0.01), and staffing (β = -0.20, $P$ <0.001) were also predictors of the NER. Moreover, teamwork within hospital units (β = -0.07, $P$ <0.05), organizational learning–continuous improvement (β = 0.09, $P$ <0.01), hospital management support for patient safety (β = -0.07, $P$ <0.05), and teamwork across hospital units and during hospital handoffs and transitions (β = -0.08, $P$ <0.01) were predictors in Belgium.

## DISCUSSION

This study enabled us to draw conclusions regarding the extent to which each HSOPSC safety dimension contributes specifically to outcome dimensions. It is the first study to explore the predictive value of HSOPSC in matched samples from two different countries. As such, it provides information about: (a) the impact of the various PSC dimensions on patient safety outcomes, and (b) cross-cultural differences in this respect between Palestinian and Belgian hospitals. Thus, our research provides an improved understanding of the influence of

initiatives to improve specific outcome measures on patient safety culture. Overall, our findings emphasize that the HSOPSC is a valid instrument that can be used to improve outcomes related to safe healthcare for patients. The results of our study demonstrate that at least two of the HSOPSC dimensions contribute to one of the self-reported outcome measures in each country. Thus, our findings attest to the value of the PSC dimensions regarding patient safety outcomes. Only one dimension, non-punitive response to error, was found to have no association with any of the outcome measures in Belgium. A possible explanation for this could be that this dimension has a low internal consistency level and, therefore, affected the assessment of its predictive value in the Belgian sample. Despite this finding, only a small number of differences were detected between the two samples.

The results obtained for both the Palestinian and Belgian samples showed that hospitals should focus on investing in interventions that enable feedback and enhance communication openness regarding errors, sustain teamwork within and across hospital units, maintain organizational learning–continuous improvement, and improve hospital handoffs and transitions. These interventions will improve OPS. As such, our analyses and results explicitly reveal 'important' PSC dimensions in terms of safety outcomes, and these PSC dimensions are shown to be the same for both the Palestinian and Belgian hospitals. Under such circumstances, implementing strategies and tools such as TeamSTEPPS may improve teamwork within and across units, in addition to strengthening communication and feedback skills regarding errors to enable the establishment of a learning system based on previous mistakes [30].

Event reporting is fundamental to the detection of patient safety problems and represents a core prerequisite of effective clinical risk management [27,32]. This outcome is of particular importance because these items reflect the frequency of the actual reporting of an act, and the willingness to report unsafe events, with higher error reporting rates leading to a stronger

culture of accountability. The results showed that, in both the Palestinian and Belgian samples, this outcome is influenced mainly by maintaining open lines of information and communication in the unit. These observations are consistent with those reported by Pfeiffer and Manser [27]. Moreover, improvements in staffing and teamwork may also influence this outcome. Palestinian respondents found that managers who consider patient safety to be a top priority and build constructive learning systems based on previous mistakes encourage their staff to report adverse events. This result is also commonly reported in the published literature [1,32].

Respondents were asked to provide an OGPS in their work area/unit and to indicate the number of events they reported over the past 12 months.

The overall grade for patient safety (OGPS) was found to be particularly significant in building a constructive learning system based on previous mistakes in Palestine and in improving staffing levels in Belgium. In other words, although our results revealed many similarities between the matched set of Palestinian and Belgian healthcare professionals, we also found cultural differences regarding OGPS. In accordance with previous studies, having enough staff [33] and opportunities to learn from previous mistakes [6] increased the likelihood of staff reporting good or excellent safety grades in Belgium. Other contributing PSC dimensions are maintaining manager expectations and actions in promoting safety, improving teamwork across hospital units and supporting hospital handoffs and transitions in both countries. Our study also revealed that, in Palestine, a higher score for OGPS relates to greater support regarding non-punitive response to error. Additionally, initiatives to improve teamwork within units, support from hospital management for patient safety, staffing and feedback and communication openness regarding errors may also act to improve OGPS in Belgium.

As PSC dimensions explained only 1% (Palestine) and 5% (Belgium) of the number of events reported (NER), influencing PSC dimensions will have less impact on patient safety outcomes compared with other PSC outcomes ($R^2_{\text{OPS-Palestine}} = 16\%$; $R^2_{\text{OPS-Belgium}} = 36\%$; $R^2_{\text{FER-Palestine}} = 22\%$; $R^2_{\text{FER-Belgium}} = 18\%$; $R^2_{\text{OGPS-Palestine}} = 20\%$; $R^2_{\text{OGPS-Belgium}} = 33\%$). As such, the HSOPSC seems to be particularly effective for the prediction of OPS, FER, and OGPS, in both the Belgian and Palestinian samples. It can be speculated that the finding that NER is less well explained through the PSC dimensions is caused by the broad scope of the HSOPSC PSC dimensions regarding patient safety, which consequently renders this instrument less effective for this very specific outcome. A further explanation could be that our results stem not from a low predictive value, but from the under-reporting of adverse events, which would result in a low mean and low variance regarding this outcome dimension. A final explanation could be that respondents found it difficult to answer this question based on experience, as they may not themselves know how many events have been reported. Therefore, hospitals seeking to invest in patient safety must not only measure NER, but should also link the PSC dimensions to objective measurements of NER.

To summarize, our results suggest that improved self-reported outcome measures regarding patient safety in both Palestine and Belgium are more likely to be achieved through better teamwork across units and during hospital handoffs and transitions, encouraging feedback and communications regarding errors, and implementing actions to promote safety. Furthermore, improving teamwork within hospital units, providing a work climate that promotes the adoption of safety as a top priority by hospital management and resolving staffing problems will also influence most outcome measures in Belgium [34,35]. In Palestine, bringing errors to the attention of managers and other staff and using mistakes as valuable learning opportunities [3] may also have an impact on safety outcome measures.

**Limitations and future research**

The current study has some methodological limitations that should be noted. First, the study used a cross-sectional design; therefore, claims of causal relationships are not possible. Second, as the present study relied exclusively on subjective measures that reflect the willingness of respondents to report events, and more specifically, the reporting of near misses, the results may be distorted by the common method bias of these self-reported outcome measures. Future research should examine the relationship between PSC dimensions and actual adverse event rates to clarify this relationship by linking objective data with PSC dimensions. Nevertheless, this study is the first to provide further insights into the value of the HSOPSC in terms of: (a) the impact of the PSC dimensions on patient safety outcomes, and (b) in different cultural settings. Third, the associations between the safety and PSC outcomes of the HSOPSC were investigated using a matched sample (to rule out possible bias due to sample differences between the two countries) using linear regression analyses. However, we cannot ignore the limitation of this design, which uses the most influential variables that are, in fact, approximations made from the researchers' perspective. These assumptions might be incorrect and could lead to the introduction of major confounding variables. Despite these methodological restrictions, previous research has shown that matched samples designs are useful, allowing researchers to conduct streamlined and focused research while maintaining a good degree of validity [36]. Another possible concern is that as most respondents were nurses and other health professionals; thus, the results may reflect the personal perceptions of the respondents and affect our association results. However, we should not forget that nurses are the most highly represented staffing group in hospitals, and that our sample also included physicians, pharmacists, administrative and quality and safety staff. Finally, the Cronbach's alpha values for some of the composite scores measuring PSC were low ($\alpha < 0.70$), which may affect the correlation results, as in the Palestinian sample where all PSC dimensions were

positively associated with the OGPS (except staffing). This specific dimension has shown a low internal consistency in most psychometric evaluation studies of the HSOPSC [28,30], indicating that it is necessary to review and update the items of this dimension to improve its internal consistency. Our results further attest to the international and cross-cultural validity of the HSOPSC. The relationships between the PSC and self-reported outcomes in other countries will provide further evidence in this regard.

**Conclusion**

We found that perceptions of staffing and feedback and communication regarding errors were important predictive dimensions of PSC self-reported outcome measures in both countries. But we also found some contradictory results in our matched sample. Future research should focus on enriching the evidence of the linking of safety culture and hard patient safety outcomes in order to assess the practical validity of safety culture surveys. The divergences of patient safety perceptions in both countries implicate the need of local priority setting and a tailor-made approach for improvement strategies in hospitals. A great challenge lies in the field of implementation science, testing the effectiveness of safety culture strategies.

**List of abbreviations**

| | |
|---|---|
| AHRQ | Agency for healthcare research and quality |
| β | Standardized beta values |
| FB&ComE | Feedback and communication openness about errors |
| FER | Frequency of event reporting |
| HMS | Hospital management support for patient safety |
| HSOPSC | Hospital survey on patient safety culture |
| NER | Number of events reported |
| NPRE | Non-punitive response to error |
| OGPS | Overall grade of patient safety |
| OPS | Overall perceptions of safety |
| OrgLearn | Organizational learning–continuous improvement |
| Staff | Staffing |
| Sup./Man._actions | Supervisor/manager expectations and actions promoting safety |
| TW _units | Teamwork within hospital units |
| TWacross_HHT | Teamwork across hospital units and hospital handoffs and transitions |

**Competing interests**

The authors declare that they have no competing interests.

**Authors' contributions**

SN performed the overall statistical analyses and drafted the manuscript. EB actively contributed to the statistical analyses, the interpretation of the results, and to the preparation of the manuscript. MH coordinated data collection (Palestine) and critically revised the

manuscript. AVle and ME participated in critically revising the manuscript for important intellectual content. WSer and WSch participated in the analyses and interpretation of the data and contributed to the preparation of the manuscript. KV and JH were involved in the study design and revised the manuscript critically. JH coordinated the data collection (Belgium). AVla was involved in the study design, manuscript outline, and contributed to the manuscript and data preparation (Belgian data). All authors have read and approved the final manuscript.

**Acknowledgments**

We particularly acknowledge all participant hospitals and their staff who devoted time to completing the surveys. We extend our gratitude to the Palestinian and Belgian governments for their cooperation and supporting this research.

## References

1. 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**(1):32–41.
2. Donaldson LJ, Fletcher MG. **The WHO World Alliance for Patient Safety: towards the years of living less dangerously.** *Med J Aust* 2006; **184**:S69e72.
3. Najjar S, Hamdan M, Euwema MC, et al. **The Global Trigger Tool shows that one out of seven patients suffers harm in Palestinian hospitals: challenges for launching a strategic safety plan**, *Int J Qual Health Care* 2013; 25:640–647, https://doi.org/10.1093/intqhc/mzt066.
4. Institute of Medicine. **To err is human: Building a safer health system**. Washington, D.C: *The National Academy press*, 2000.
5. Wakefield JG, Jorm CM. **Patient safety a balanced measurement framework**. *Aust Health Rev* 2009; **33** (3):382–389.
6. Stone PW, and Gershon PR. **Nurse Work Environments and Occupational Safety in Intensive Care Units**. J Nurs Adm 2009; **39**(7-8 Suppl):S27–34
7. Mardon RE, Khanna K, Sorra J, et al. **Exploring relationships between hospital patient safety culture and adverse events**. *J Patient Saf* 2010; **6**:226–32.
8. Singer S, Lin S, Falwell A, et al. **Relationship of safety climate and safety performance in hospitals**. *Health Serv Res* 2009; **44**:399–421.
9. Kotter JP, and Heskett JL. **Corporate Culture and Performance**. *New York: Free Press*,1992.
10. Carman JM, Shortell SM, Foster RW, et al. **Keys for Successful Implementation of Total Quality Management in Hospitals**. *Health Care Manage Rev.* 2010; **35**(4):283–93

11. Institute of Medicine. **Crossing the Quality Chasm: A New Health System for the 21st Century**. *Washington, DC: National Academy Press,* 2001.
12. Edmondson AC. **Psychological Safety and Learning Behavior in Work Teams**. *Administrative Science Quarterly* 1999; **44**(2):350–83.
13. Hansen LO, Williams MV, and Singer SJ. **Perceptions of Hospital Safety Climate and Incidence of Readmission.** *Health Serv Res* 2011; **46**(2):596–616.
14. Sorra J, Famolaro T, Dyer N, et al. **Hospital Survey on Patient Safety Culture: 2012 User Comparative Database Report**. Prepared by Westat, Rockville, MD, under Contract No. HHSA 290200710024C. AHRQ Publication No. 12-0017, January 2012. Agency for Healthcare Research and Quality, Rockville, MD. http://www.ahrq.gov/qual/hospsurvey12/index.html
15. Vlayen A, Hellings J, Claes N, Peleman H, Schrooten W. **A nationwide Hospital Survey on Patient Safety Culture in Belgian hospitals: setting priorities at the launch of a 5-year patient safety plan**. *BMJ Qual Saf* 2012;**2 1**(9):760–7.
16. Deilkas E, Hofoss D. **Patient safety culture lives in departments and wards: multilevel partitioning of variance in patient safety culture**. *BMC Health Serv Res* 2010; **10**:85.
17. Sorra J, Dyer N: **Multilevel psychometric properties of the AHRQ hospital survey on patient safety culture**. *BMC Health Serv Res* 2010; **10**:199.
18. Waterson PE, 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. doi:10.1136/qshc.2008.031625.
19. Sarac C, Flin R, Mearns K, et al. **Hospital survey on patient safety culture: psychometric analysis on a Scottish sample**. *Qual Saf Health Care* 2011; **20**(10):842–8.

20. Olsen E. **Reliability and validity of the Hospital Survey on Patient Safety Culture at a Norwegian hospital.** In: Øvretveit J, Sousa P, eds. Quality and Safety Improvement Research: Methods and Research Practice from the International Quality Improvement Research Network (QIRN). Lisbon: *National School of Public Health* 2008:173–86

21. Najjar S, Hamdan M, Baillian E, et al. **The Arabic version of the hospital survey on patient safety culture: a psychometric evaluation in a Palestinian sample**. *BMC Health Serv Res* 2013; **13**:193. doi: 10.1186/1472-6963-13-193.

22. Colla JB, Bracken AC, Kinney LM, et al. **Measuring patient safety climate: a review of surveys**. *Qual Saf Health Care* 2005; **14**:364–366.

23. Sexton JB, Helmreich RL, Neilands TB, et al. **The Safety Attitudes Questionnaire: Psychometric Properties, Benchmarking Data, and Emerging Research**. *BMC Health Serv Res* 2006; **6**:44.

24. Sammer CE, Lykens K, Singh KP, et al. **What is patient safety culture? A review of the literature**. *J Nurs Scholarsh* 2010; **42**(2):156–65.

25. Hellings J, Schrooten W, Klazinga N, Vleugels A. **Challenging patient safety culture: survey results**. *Int J Health Care Qual Assur*. 2007; **20**(7):620-32.

26. Vlayen A, Hellings J, Claes N, Abdou EA, Schrooten W. **Measuring safety culture in belgian psychiatric hospitals: validation of the dutch and French translations of the hospital survey on patient safety culture.** *J Psychiatr Pract.* 2015; **21**(2):124-39.

27. Pfeiffer Y, Manser T. **Development of the German version of the Hospital Survey on Patient Safety Culture: Dimensionality and psychometric properties**. *Safety Science* 2010; **48** (10):1452–1462.

28. El-Jardali F, Jafar M, Dimmasi H, et al. **The current state of patient safety culture in Lebanese hospitals: a study at baseline**. *Int J Qual Health Care* 2010; **22**:386–95.
29. Hickner J, Smith SA, Yount N, et al **Differing perceptions of safety culture across job roles in the ambulatory setting: analysis of the AHRQ Medical Office Survey on Patient Safety Culture**. *BMJ Qual Saf* 2016 Aug; **25**(8):588-94.
30. Sorra JS, Nieva VF. **Hospital Survey on Patient Safety Culture**. AHRQ Publication No. 04-0041. Rockville, MD: Agency for Healthcare Research and Quality; 2004.
31. Hayes, A. F. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. New York, NY, US: Guilford Press 2017.
32. Westrum R, **A typology of organisational cultures**. *Qual Saf Health Care* 2004; **13** (Suppl. 2): pp. ii22–ii27.
33. Aiken A, Sermeus W, Van den Heede K, et al. **Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States**. *BMJ* 2012; **344**:e1717doi: 10.1136/bmj.e1717.
34. Keller SM. **Effects of extended work shifts and shift work on patient safety, productivity, and employee health**. *AAOHN J* 2009; **57** (12):497–502
35. Mark BA, Harless DW and Berman WF. **Nurse Staffing and Adverse Events in Hospitalized Children**. *Policy Polit Nurs Pract* 2007; **8**(2): 83–92.
36. Stuart EA. **Matching methods for causal inference: A review and a look forward**. *Stat Sci* 2010; **25**(1):1–21

**Table 1:** Definitions of patient safety culture dimensions and outcomes

| Patient safety culture dimensions | Items |
|---|---|
| **Communication openness:** Staff freely speak up if they see something that may negatively affect a patient and feel free to question those with more authority. | • Staff will freely speak up if they see something that may negatively affect patient care.<br>• Staff feel free to question the decisions or actions of those with more authority.<br>• Staff are afraid to ask questions when something does not seem right. |
| **Feedback and communication about errors**: Staff are informed about errors that happen, given feedback about changes implemented, and discuss ways to prevent errors. | • We are given feedback about changes put into place based on event reports.<br>• We are informed about errors that happen in this unit.<br>• In this unit, we discuss ways to prevent errors from happening again. |
| **Hospital handoffs and transitions**: Important patient care information is transferred across hospital units and during shift changes. | • Things "fall between the cracks" when transferring patients from one unit to another.<br>• Important patient care information is often lost during shift changes.<br>• Problems often occur in the exchange of information across hospital units.<br>• Shift changes are problematic for patients in this hospital. |
| **Hospital management support for patient safety**: Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority. | • Hospital management provides a work climate that promotes patient safety.<br>• The actions of hospital management show that patient safety is a top priority.<br>• Hospital management seems interested in patient safety only after an adverse event happens. |
| **Non-punitive response to error**: Staff feel that their mistakes and event reports are not held against them and that mistakes are not kept in their file. | • Staff feel like their mistakes are held against them.<br>• When an event is reported, it feels like the person is being written up, not the problem.<br>• Staff worry that mistakes they make are kept in their file. |

| | |
|---|---|
| **Organizational learning–Continuous improvement**: Mistakes have led to positive changes and changes are evaluated for effectiveness. | • We are actively doing things to improve patient safety.<br>• Mistakes have led to positive changes here.<br>• After we make changes to improve patient safety, we evaluate their effectiveness. |
| **Staffing**: There is enough staff to handle the workload and work hours are appropriate to provide the best care for patients. | • We have enough staff to handle the workload.<br>• Staff in this unit work longer hours than is best for patient care.<br>• We use more agency/temporary staff than is best for patient care.<br>• We work in 'crisis mode', trying to do too much, too quickly. |
| **Supervisor/manager expectations and actions promoting safety**: Supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures, and do not overlook patient safety problems. | • My supervisor/manager offers praise when he/she sees a job done according to established patient safety procedures.<br>• My supervisor/manager seriously considers staff suggestions for improving patient safety.<br>• Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts.<br>• My supervisor/manager overlooks patient safety problems that happen repeatedly. |
| **Teamwork across hospital units**: Hospital units cooperate and coordinate with one another to provide the best care for patients. | • There is good cooperation among hospital units that need to work together.<br>• Hospital units work well together to provide the best care for patients.<br>• Hospital units do not coordinate well with each other.<br>• It is often unpleasant to work with staff from other hospital units. |
| **Teamwork within hospital units**: Staff support each other, treat each other with respect, and work together as a team. | • People support one another in this unit.<br>• When a lot of work needs to be done quickly, we work together as a team to get the work done.<br>• In this unit, people treat each other with respect. |

| | |
|---|---|
| | • When one area in this unit gets really busy, others help out. |
| **Self-reported outcome measures** | Items |
| **Frequency of events reported**: Mistakes of the following types are reported: (1) Mistakes caught and corrected before affecting the patient; (2) Mistakes with no potential to harm the patient: and (3) Mistakes that could harm the patient but do not. | • When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?<br>• When a mistake is made, but has no potential to harm the patient, how often is this reported?<br>• When a mistake is made that could harm the patient, but does not, how often is this reported? |
| **Overall perceptions of patient safety**: Procedures and systems are good for the prevention of errors and there are minimal patient safety problems. | • Patient safety is never sacrificed to get more work done.<br>• Our procedures and systems are good for the prevention of errors.<br>• It is just by chance that more serious mistakes don't happen around here.<br>• We have patient safety problems in this unit. |
| **Patient safety grade**: Overall grade for patient safety for their work area/unit. | • Please give your work area/unit in this hospital an overall grade for patient safety. |
| **Number of events reported**: The number of events reported over the past 12 months. | • In the past 12 months, how many event reports have you filled out and submitted? |

**Table 2: Percentage positive scores for patient safety dimensions and Cronbach's alpha of Hospital survey on patient safety culture (HSOPSC) in Palestine and Belgium**

| Patient safety culture dimensions | Percent positive response Palestine | Percent positive response Belgium | Cronbach's alpha Palestine | Cronbach's alpha Belgium |
|---|---|---|---|---|
| Teamwork within hospital units | 75% | 73% | 0.80 | 0.79 |
| Organizational learning–Continuous improvement | 64% | 49% | 0.73 | 0.61 |
| Supervisor/manager expectations & actions promoting safety | 55% | 58% | 0.74 | 0.74 |
| No punitive response to error | 17% | 38% | 0.63 | 0.69 |
| Hospital management support for patient safety | 42% | 33% | 0.76 | 0.77 |
| Teamwork across hospital units & hospital handoffs & transitions | 45% | 27% | 0.78 | 0.75 |
| Staffing | 58% | 37% | 0.67 | 0.61 |
| Feedback & communication | 49% | 51% | 0.76 | 0.80 |
| Openness about errors | | | | |
| **Patient safety culture outcomes** | | | | |
| Frequency of event reporting | 39% | 44% | 0.87 | 0.86 |
| Overall perceptions of safety | 55% | 47% | 0.75 | 0.73 |
| Overall grade of patient safety | 49% | 39% | NA | NA |
| Number of events reported | 45% | 69% | NA | NA |

**Table 3: Participants' characteristics**

| Characteristics | | Whole sample | Palestinian sample *N* = 1418 | Matched Belgian sample *N* = 1418 |
|---|---|---|---|---|
| Direct contact or interaction with patient | Yes | 2524 (88.9%) | 1284 (90.5%) | 1240 (87.4%) |
| | No | 312 (11.0%) | 134 (9.4%) | 178 (12.5%) |
| Experience at current work area/unit | *<1 year* | 452 (15.9%) | 218 (15.4%) | 234 (16.5%) |
| | *1 to 5 years* | 1206 (42.5%) | 621 (43.8%) | 585 (41.3%) |
| | *6 to 10 years* | 552 (19.5%) | 250 (17.6%) | 302 (21.3%) |
| | *11 to 15 years* | 281 (09.9%) | 162 (11.4%) | 119 (8.4%) |
| | *16 to 20 years* | 184 (06.5%) | 81 (5.7%) | 104 (7.3%) |
| | *>21 years* | 160 (05.6%) | 86 (6.1%) | 74 (5.2%) |
| Hospital size (beds) | *Small (<150)* | 700 (24.7%) | 612 (43.1%) | 88 (6.2%) |
| | *Medium (150 to 249)* | 632 (22.3%) | 546 (38.5%) | 86 (6.1%) |
| | *Large (≥250)* | 1504 (53.0%) | 260 (18.4%) | 1244 (87.7%) |

**Table 4: Spearman's correlation matrixes (Belgian sample above the diagonal, Palestinian sample below the diagonal)**

| | *1* | *2* | *3* | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | *13* | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Hospital years' experience | _ | 0.01 | -0.05 | 0.06* | -0.02 | -0.03 | 0.00 | -0.06* | -0.09** | -0.00 | -0.08** | 0.04 | -0.06* | 0.16** |
| 2. Working hours | 0.01 | _ | 0.03 | -0.03 | -0.02 | 0.02 | -0.09** | -0.07* | -0.11** | 0.02 | 0.00 | -0.02 | -0.02 | 0.03 |
| 3. TW _units | -0.05 | 0.05* | _ | 0.28** | 0.35** | 0.33** | 0.18** | 0.21** | 0.21** | 0.42** | 0.29** | 0.22** | 0.30** | -0.05 |
| 4. OrgLearn | 0.00 | 0.09** | 0.35** | _ | 0.40** | 0.24** | 0.28** | 0.17** | 0.09** | 0.43** | 0.29** | 0.24** | 0.21** | 0.10** |
| 5. Sup./Man._actions | -0.01 | 0.03 | 0.24** | 0.25** | _ | 0.34** | 0.33** | 0.22** | 0.23** | 0.51** | 0.41** | 0.24** | 0.34** | -0.04 |
| 6. NPRE | 0.03 | -0.03 | 0.07* | 0.07** | 0.13** | _ | 0.28** | 0.20** | 0.29** | 0.32** | 0.30** | 0.18** | 0.22** | -0.00 |
| 7. HMS | -0.02 | 0.09** | 0.25** | 0.28** | 0.27** | 0.25** | _ | 0.33** | 0.30** | 0.35** | 0.39** | 0.19** | 0.39** | -0.07** |
| 8. TWacross_HHT | -0.04 | 0.02 | 0.27** | 0.23** | 0.34** | 0.21** | 0.33** | _ | 0.23** | 0.24** | 0.28** | 0.17** | 0.34** | -0.11** |
| 9. Staff | -0.04 | -0.02 | -0.05 | -0.04 | 0.09** | -0.12** | -0.08** | 0.01 | _ | 0.20** | 0.40** | 0.05 | 0.35** | -0.08** |
| 10. FB&ComE | -0.02 | 0.06* | 0.31** | 0.33** | 0.32** | 0.14** | 0.31** | 0.24** | -0.03 | _ | 0.36** | 0.41** | 0.38** | 0.05 |
| 11. OPS | -0.02 | 0.06* | 0.24** | 0.28** | 0.29** | 0.11** | 0.26** | 0.24** | 0.01 | 0.26** | _ | 0.20** | 0.51** | -0.15** |
| 12. FER | 0.02 | 0.08** | 0.24** | 0.32** | 0.23** | 0.13** | 0.27** | 0.28** | 0.06* | 0.37** | 0.23** | _ | 0.21** | 0.12** |
| 13. OGPS | 0.09** | 0.17** | 0.22** | 0.32** | 0.25** | 0.16** | 0.25** | 0.30** | -0.05 | 0.22** | 0.19** | 0.25** | _ | -0.12** |
| 14. NER | 0.00 | -0.01 | 0.01 | -0.03 | -0.11** | -0.07* | -0.03 | -0.08** | -0.16** | 0.01 | -0.07** | 0.05* | -0.09** | _ |

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

**TW _units**: Teamwork within hospital units; **OrgLearn**: Organizational learning–Continuous improvement; **Sup./Man._actions**: Supervisor/manager expectations and actions promoting safety; **NPRE**: Non-punitive response to error; **HMS**: Hospital management support for patient safety; **TWacross_HHT**: Teamwork across hospital units and hospital handoffs and transitions; **Staff**: Staffing; **FB&ComE**: Feedback and communication openness about error; **OPS**: Overall perceptions of patient safety; **FER**: Frequency of events reported; **OGPS**: Overall grade for patient safety; **NER**: Number of events reported.

**Table 5: Summary of the hierarchical regression analyses: Predicting the outcomes of the Hospital survey on patient safety culture (HSOPSC) in matched samples of Palestinian and Belgian hospital workers (β)**

| | *Palestine (N =1418 )* | | | | | | | | *Belgium (N = 1418)* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcome** | **Overall perceptions of safety (OPS)** | | **Frequency of event reporting (FER)** | | **Overall grade for patient safety (OGPS)** | | **Number of events reported (NER)** | | **Overall perceptions of safety (OPS)** | | **Frequency of event reporting (FER)** | | **Overall grade for patient safety (OGPS)** | | **Number of events reported (NER)** | |
| *Predictors* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* |
| Hospital tenure | -0.01 | -0.00 | 0.02 | 0.04 | 0.09*** | 0.09*** | .01 | .01 | -0.06** | -0.04* | 0.04 | 0.04 | -0.04 | -0.02 | 0.15*** | 0.13*** |
| Working hours | 0.06** | 0.04 | 0.07** | 0.04 | 0.15*** | 0.12*** | -.02 | -.02 | -0.00 | 0.04 | -0.03 | -0.03 | -0.02 | 0.03 | 0.03 | 0.02 |
| Staff function | 0.04 | 0.00 | 0.03 | -0.01 | 0.03 | 0.00 | -.00 | .01 | 0.09*** | 0.06** | | -0.04 | 0.06 | 0.04 | | 0.08** |
| TW_units | | 0.10*** | | 0.04 | | 0.03 | | .04 | | 0.06** | | 0.02 | | 0.11*** | | -0.07* |
| OrgLearn | | 0.10*** | | 0.14*** | | 0.19*** | | -.03 | | 0.10*** | | 0.04 | | -0.00 | | 0.09** |
| Sup./Man._actions | | 0.13*** | | 0.00 | | 0.14*** | | -.16*** | | 0.17*** | | 0.00 | | 0.12*** | | -0.08* |
| NPRE | | 0.05 | | 0.03 | | 0.09*** | | -.08** | | 0.03 | | 0.04 | | -0.03 | | 0.04 |
| HMS | | 0.16*** | | 0.10*** | | 0.05 | | .01 | | 0.19*** | | 0.04 | | 0.17*** | | -0.07* |
| TWacross_HHT | | 0.07** | | 0.13*** | | 0.14*** | | -.05 | | 0.08** | | 0.06* | | 0.17*** | | -0.08** |
| Staff | | 0.02 | | 0.09*** | | -0.01 | | -.20*** | | 0.24*** | | -0.07** | | 0.19*** | | -0.05 |
| FB&ComE | | 0.08** | | 0.24*** | | 0.01 | | .05* | | 0.06* | | 0.35*** | | 0.15*** | | 0.11** |
| $R^2$ | .00 | 0.16*** | .00* | 0.22*** | 0.03*** | 0.20*** | -0.00 | 0.01** | 0.00*** | 0.36*** | 0.00 | 0.18*** | 0.00 | 0.33*** | 0.02*** | 0.05*** |

The highest absolute values of the standardized beta are shaded. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

**TW _units**: Teamwork within hospital units; **OrgLearn**: Organizational learning–Continuous improvement; **Sup./Man._actions**: Supervisor/manager expectations and actions promoting safety; **NPRE**: Non-punitive response to error; **HMS**: Hospital management support for patient safety; **TWacross_HHT**: Teamwork across hospital units and hospital handoffs and transitions; **Staff**: Staffing; **FB&ComE**: Feedback and communication openness about error; **OPS**: Overall perceptions of patient safety; **FER**: Frequency of events reported; **OGPS**: overall grade of patient safety; **NER**: Number of events reported.

**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

# Similarities and differences in the associations between patient safety culture dimensions and self-reported outcomes in two different culture settings: A national cross-sectional study in Palestinian and Belgian hospitals

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 & 3 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 3 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 6 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 6 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 7 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 7 & 8 |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | 7 & 8 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 9 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 8 & 9 |
| Bias | 9 | Describe any efforts to address potential sources of bias | *9* |
| Study size | 10 | Explain how the study size was arrived at | 8 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 9 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 10 & 11 |

| | | | |
|---|---|---|---|
| | | (*b*) Describe any methods used to examine subgroups and interactions | 10 |
| | | (*c*) Explain how missing data were addressed | NA |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | 10 & 11 |
| | | (*e*) Describe any sensitivity analyses | NA |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 10 |
| | | (b) Give reasons for non-participation at each stage | NA |
| | | (c) Consider use of a flow diagram | NA |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 11 |
| | | (b) Indicate number of participants with missing data for each variable of interest | NA |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 12 – 14 |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 12 – 14 |
| | | (*b*) Report category boundaries when continuous variables were categorized | NA |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | NA |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 12 – 14 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 14 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 17 - 18 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 15-18 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 18 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | NA |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

# Similarities and differences in the associations between patient safety culture dimensions and self-reported outcomes in two different culture settings: A national cross-sectional study in Palestinian and Belgian hospitals



| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2018-021504.R2 |
| Article Type: | Research |
| Date Submitted by the Author: | 20-May-2018 |
| Complete List of Authors: | Najjar, Shahenaz; King Abdullah International Medical Research Center, Population Health Department – Hospital - MNG-HA.; KU Leuven, Health Service Research Group, School of Public Health<br>Baillien, Elfi; Katholieke Universiteit Leuven, Marketing and Organisation Studies (MO)<br>Vanhaecht, Kris; KU Leuven, Institute for Healthcare Policy<br>Hamdan, Motasem ; Al Quds University Faculty of Medicine, Public Health<br>Euwema, Martin; KU Leuven , Occupational & Organisational Psychology and Professional Learning<br>Vleugels, Arthur; KU Leuven, Health Service Research Group, School of Public Health<br>Sermeus, Walter; KU Leuven, Health Service Research Group, School of Public Health<br>Schrooten, Ward; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen<br>Hellings , J; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen<br>Vlayen, A; Universiteit Hasselt Faculteit Geneeskunde en Levenswetenschappen |
| Primary Subject Heading: | Health services research |
| Secondary Subject Heading: | Health services research, Public health, Health policy |
| Keywords: | Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Public health < INFECTIOUS DISEASES |
| | |

# Similarities and differences in the associations between patient safety culture dimensions and self-reported outcomes in two different culture settings: A national cross-sectional study in Palestinian and Belgian hospitals

Shahenaz Najjar, Elfi Baillien, Kris Vanhaecht, Motasem Hamdan, Martin Euwema, Arthur Vleugels, Walter Sermeus, Ward Schrooten, Johan Hellings, Annemie Vlayen

**Corresponding author: Dr. Shahenaz Najjar**

King Abdullah International Medical Research Center/King Saud bin Abdulaziz University for Health Sciences, Population Health Department – Hospital - MNG-HA.

Address:

Population Health Research Section

King Abdullah International Medical Research Center (KAIMRC new building)

King Saud Bin Abdulaziz University for Health Sciences

King Abdulaziz Medical City, Riyadh

Ministry of National Guard - Health Affairs

P.O. Box 3660, Riyadh 11481, Saudi Arabia

Mail Code: 1515 (KAIMRC)

Tel: +966 11 429 4444 Ext. 94372

e-mail: shnajjar@gmail.com

Fax: +966 (11) 80 43050, +966(11) 429-4440

Dr. Elfi Baillien: University of Leuven, Brussels, Belgium

Dr. Kris Vanhaecht: University of Leuven, Leuven, Belgium

Dr. Motasem Hamdan: Al-Quds University, Jerusalem, Palestine

Dr. Martin Euwema: University of Leuven, Leuven, Belgium

Dr. Arthur Vleugels: University of Leuven, Leuven, Belgium

Dr. Walter Sermeus: University of Leuven, Leuven, Belgium

Dr. Ward Schrooten: University of Hasselt, Diepenbeek, Belgium

Dr. Johan Hellings: University of Hasselt, Diepenbeek, Belgium

Dr. Annemie Vlayen: University of Hasselt, Diepenbeek, Belgium

**Key words**: Patient safety, patient safety culture, health services, Palestine, Belgium.

**Word count (excluding title page, reference, figures):**

- **Abstract: 300**
- **Strengths and limitations of this study: 118**
- **Main manuscript: 4336**

## Abstract

**Objectives**: To investigate the relationships between patient safety culture (PSC) dimensions and PSC self-reported outcomes across different cultures and to gain insights in cultural differences regarding patient safety culture.

**Design:** Observational, cross-sectional study.

**Setting:** Ninety Belgian hospitals and 13 Palestinian hospitals.

**Participants:** A total of 2,836 healthcare professionals matched for profession, tenure and working hours.

**Primary and secondary outcome measures:** The validated versions of the Belgian and Palestinian Hospital Survey on Patient Safety Culture (HSOPSC) were used. An exploratory factor analysis was conducted. Reliability was tested using Cronbach's alpha (α). In this study, we examined the specific predictive value of the PSC dimensions and its self-reported outcome measures across different cultures and countries. Hierarchical regression and bivariate analyses were performed.

**Results:** Eight PSC dimensions and four PSC self-reported outcomes were distinguished in both countries. Cronbach's alpha was α ≥0.60. Significant correlations were found between PSC dimensions and its self-reported outcome (*P*-value range <0.05 to <0.001). Hierarchical regression analyses showed overall perception of safety was highly predicted by hospital management support in Palestine (β=0.16, *P*<0.001), and staffing in Belgium (β=0.24, *P* <0.001). The frequency of events was largely predicted by feedback and communication in both countries (Palestine: β=0.24, *P*<0.001; Belgium: β=0.35, *P*<0.001). Overall grade for patient safety was predicted by organizational learning in Palestine (β=0.19, *P*<0.001) and staffing in Belgium (β=0.19, *P* <0.001). Number of events reported was predicted by staffing in Palestine (β=-0.20, *P*<0.001) and feedback and communication in Belgium (β=0.11, *P*<0.01).

**Conclusion:** To promote patient safety in Palestine and Belgium, staffing and communication regarding errors should be improved in both countries. Initiatives to improve hospital management support and establish constructive learning systems would be especially beneficial for patient safety in Palestine. Future research should address the association between safety culture and hard patient safety measures such as patient outcomes.

**Strengths and limitations of this study**

- Our study enables us to draw conclusions regarding the varying associations among PSC dimensions and self-reported patient safety outcomes across different cultural settings.
- This is the first study to explore the predictive value of the HSOPSC in matched samples from two different countries.
- Using a matched samples study design is useful, allowing researchers to establish a good degree of validity and to investigate a rationalized and focused research question.
- Our results verify the international and cross-cultural validity of the HSOPSC; however, more studies are needed to provide further evidence in this regard.
- Our study relied exclusively on subjective self-reported measures; future research on linking actual adverse events data with PSC dimensions objectively is required to clarify this relationship.

## Background

Patient safety is a major focus in the improvement of the quality of healthcare [1-3]. This has led to an increased interest in patient safety culture (PSC) assessments in healthcare organizations [4]. Clinical outcomes and adverse event rates have been used as indicators of patient safety in previous studies [5]. Earlier research has demonstrated a link between organizational culture and hospital outcomes, adverse event rates [6-8], financial performance [9] or patient satisfaction [10]. The development of a positive PSC may help to integrate the concern for safety into the daily functioning of organizations and into the routines of individuals and teams [6]. In this study, PSC is defined as the presence of values, beliefs, norms, behaviors and attitudes that may contribute to patient safety [11]. Hospitals that invest in PSC may enable staff not only to prevent and solve safety problems, but also to learn collectively from problems that occur at the frontline of healthcare delivery [8,12,13]. Several studies have highlighted the perception of patient safety and staff attitudes toward safety [14-16]. Others have reported on the psychometric evaluation of PSC tools [17-21].

A range of tools has been developed to measure PSC; like, PSC in healthcare organizations, hospital surveys on patient safety and safety attitude questionnaires [22,23]. These instruments can be used elicit patient safety-related assessments by healthcare staff at: (1) a hospital level, (2) a unit level and (3) a professional level [16,24]. The original American Hospital Survey on Patient Safety Culture (HSOPSC) was released by the Agency for Healthcare Research and Quality in November 2004. The survey is one of the most commonly applied instruments for the assessment of PSC. Moreover, it has been widely translated and validated in several languages and countries, including Belgium, England, Norway, Scotland, the Netherlands and Palestine [17-21,25,26]. The survey is intended to help hospitals assess the extent to which their cultures emphasize the importance of patient safety, encourage both

the reporting and open discussion of errors, and create an atmosphere of continuous learning and improvement.

The original HSOPSC consists of 42 items loading on 12 dimensions: two outcome dimensions and 10 safety dimensions. The 10 different PSC dimensions are expected to have strong relationships with the two composite outcome dimensions (frequency with events reported and overall perceptions of patient safety) and the two single-item outcomes (Patient safety grade and number of events reported) [14,17]. The four outcomes are self-reported patient safety outcomes.

Despite efforts to measure PSC in terms of dimensions and outcomes to improve patient safety, few studies have examined the specific predictive value of the dimensions in terms of HSOPSC outcomes [17,20,27]. Research to date has not detailed the relationships between the HSOPSC dimensions and its self-reported outcome measures across countries. Being part of this patient safety collaborative project between Palestinian and Belgian academic institutions allowed us to do this comparison. The two health care systems are different, one from developed countries (Belgium), having universal coverage, higher spending per capita, higher human resources ratios and system functioning in stable conditions compared to another system from a developing country (Palestine) that has national insurance system with high out-of-pocket spending (40%), especially for pharmaceuticals, lower physician density (1.6 in Palestine comparing to 2.96 in Belgium per 1000 inhabitants), and lower density of practicing nurses (3.0 to 9.51 per 1000 population). [28,29,30] Despite these differences, both countries have ongoing initiatives to improve patient safety of care. The governments of Belgium and Palestine promote the HSOPSC as a tool to support assessing patient safety culture and providing baseline data to support the development of patient safety interventions or initiatives in hospitals. Our study included hospitals that are operated in both governmental and non-governmental sectors in Belgium and Palestine. We assumed that there were no staff-

related differences that would influence the PSC between the two countries. Both governments have called for further investigations into the effectiveness of the HSOPSC within and between different cultural contexts [15]. Thus, the first aim of this study was to determine which HSOPSC dimensions are associated with self-reported outcome measures. Second, we aimed to investigate the impact of cultural context on these associations. These findings offer further insights into the similarities and differences regarding associations between the PSC dimensions and outcomes of hospital workers in two very different cultural settings. The results also further attest to the value of the HSOPSC to increase patient safety in a range of settings.

## Methods

### Design, setting and sample

A cross-sectional study design was used. In total, 90 acute Belgian hospitals and 13 Palestinian hospitals were included in the study. In Belgium, workshops were organized for participating hospitals in which the objectives and survey were explained. The Dutch and French validated versions of the HSOPSC were distributed organization-wide to 90 acute hospitals that participated in a federal patient safety program between 2007 and 2009 (baseline PSC measurement [15,25,26]). These hospitals comprised 58 Dutch-speaking hospitals, 31 French-speaking hospitals and one that was both Dutch- and French-speaking. In total, 68 hospitals used a paper-based survey, 15 used an electronic survey and seven applied a mixed method for survey administration. Technical assistance was available during the periods of data collection. Hospitals were invited to participate in a Belgian comparative study on a voluntary, confidential and free-of-charge basis. A total of 91,852 questionnaires were distributed, of which 47,648 were returned (response rate 51.9%). The comparative

database was managed by a neutral academic institution and was not accessible to government authorities.

In Palestine, PSC baseline data were collected from September 2010 to August 2011 in 13 hospitals: 11 public hospitals and two general non-governmental hospitals situated in the West Bank. All hospitals were Arabic-speaking and used a validated paper-based Arabic language survey [21]. Workshops were organized at the participating hospitals to explain the objectives and survey. A paper version of the questionnaire was distributed and participants were informed about the purpose of the study. They were also told that their participation was anonymous, voluntary and confidential. Technical assistance was accessible during the periods of data collection. A total of 3,153 questionnaires were distributed, of which 1,690 were returned (response rate 53.6%), of which 1,418 could be used for this study. The collected database was managed by an independent academic institution.

For both the Belgian and Palestinian samples, the survey was distributed anonymously to all healthcare staff that had direct (physicians, nurses, clinical staff, pharmacists, radiology staff and laboratory staff) or indirect (all hospital supervisors, managers, administrators, and support and administrative staff) interaction with patients. The survey was self-administered and then placed in sealed envelopes without any respondent identification. Collection points/boxes were identified for returning the completed questionnaires.

For the purposes of this study, the Belgian sample was matched to the Palestinian sample by selecting a matched subsample based on staff position, years of experience at the hospital and number of hours worked per week. Specifically, we used the Palestinian set ($N$ = 1,418) to randomly (blind) select 1:1 matching participants regarding position, tenure and working hours from the Belgian sample. When more than one matching participant was identified, we randomly (blind) selected one of the participants that fitted the criteria. The matched sample was selected manually by the data management department.

The Belgian and Palestinian samples consisted of a total of 2,836 healthcare staff (1,418 respondents from each country). The subsample comprised the following staff categories: nurses (38.6%), head nurses (9.4%), nursing aid staff (5.7%), physicians (17.9%), pharmacists (2.9%) and other healthcare staff (25.5%). The sample hospitals ranged in size from small (fewer than 150 beds) to large (more than 200 beds). The research was fully supported and ethically approved by the Departments of Health of the Belgian and Palestinian governments, and all the hospitals approached participated in our study.

**Funding statement**

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

**Instruments and measures**

The HSOPSC consists of 42 items and is designed to measure 10 PSC dimensions and four outcome measures. Items are scored on a 5-point Likert scale ranging from 1 = 'strongly disagree' to 5 = 'strongly agree' or from 1 = 'never' to 5 = 'always'. Respondents were also asked to provide some demographic information (e.g., their work area/unit, staff position, whether they have direct interaction with patients) [14]. PSC dimensions and self-reported outcomes are shown in Table 1.

Using the matched samples from both countries, the relationships between all dimensions and outcomes of the HSOPSC were assessed. Five-point response scales were used (1 = 'strongly disagree' to 5 = 'strongly agree').

*Independent variables*

For both samples, the PSC dimensions shown in Table 1 were used. All PSC dimensions consist of multiple items.

*Dependent variables*

Four self-reported outcome measures were used as dependent variables (Table 1). Two composite outcomes have multiple items scored on a 5-point Likert scale, of which the labels vary throughout the dimensions as follows: (1) frequency with events reported from 1 = 'strongly disagree' to 5 = 'strongly agree'; and (2) overall perceptions of patient safety from 1 = 'never' to 5 = 'always'. Patient safety grade and number of events are ordinal, ranging from 1 to 5 (1 = 'failing' to 5 = 'excellent') and from 1 to 6 (1 = 'no event' to 6 = 'more than 21 events'), respectively; both are single-item measures.

*Control variables*

The following controls were measured in both samples: staff position is categorical; years of working experience at the hospital is numerical, ranging from 1 to 6 (1 = 'less than 1 year' to 6 = '21 years or more'); and number of hours worked per week is numerical, ranging from 1 to 6 (1 = 'less than 20 hours per week to 6 = '100 hours or more per week'). The control variables were selected based on previous research and/or their significant correlations with the outcomes [31,32].

**Statistical analysis**

A total of 2,836 healthcare staff participated in the study. For the purposes of our analysis, negatively worded items were reversed coded so that a higher score reflected a more positive response. First, we conducted exploratory factor analyses (EFA) using the Palestinian and matched Belgian data to test whether we could detect the same dimension structure in both samples. We aimed for acceptable levels of reliability (Cronbach's $\alpha \geq 0.60$) as recommended in the HSOPSC user guide [33]. Based on the EFA analyses, we optimized the model by defining 10 PSC dimensions instead of the original 12 HSOPSC dimensions in both the Palestinian and Belgian data. Four original dimensions were revealed as two dimensions. One combined 'communication openness' and 'feedback about error' in one dimension and the other combined 'teamwork across hospital units' and 'hospital handoffs and transitions'

(Table 2). The other two outcome measures were individual items: 'patient safety grade' and 'number of events reported'. Cronbach's α values for both the Palestinian and Belgian databases are presented in Table 2.

Second, we conducted hierarchical regression analyses for both the Palestinian and Belgian samples using IBM SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). Regression Analyses are particularly suitable for analyses of variance in which we aim to test whether and to what extend the variance on the dependent variables (and as reported by the respondents) can be explained by the independent variables; which is reflected by $R^2$. By including hierarchical analyses, we are able to detect how much extra variance ($R^2$ change) in the PSC outcomes is explained by introducing the PSC dimension in the analyses on top of the control variables [34]. A composite average score was generated by calculating the average responses to the items within a dimension. As 5-point response scales were used, the composite scores generated were any value between 1 and 5. Regression analyses were conducted to determine the extent to which the PSC dimensions (modeled as independent variables) predicted the four self-reported dimensions (modeled as dependent variables). Multiple R ($R^2$) was used to indicate the proportion of variance explained by the model. An indication of the predictive value of the PSC dimensions was confirmed using standardized beta values (β). A standardized beta coefficient is a standardized partial correlation coefficient that allows us to compare the strength of the effect of each predictor/independent variable in predicting the outcome/dependent variable, with higher absolute values of the beta coefficient indicating a stronger effect. Based on their significant correlation with the four outcomes over the Palestine and Belgian samples, the following controls were used in all regression analyses: experience at hospital (years), working hours (hours) and staff position. The control variables included in both countries were consistent to assure we could compare the results.

**Data sharing statement**

The data that support the findings of this study are available from the correspondent author upon reasonable request and with permission of University of Leuven and University of Hasselt.

**Patient and public involvement**

Patient and public were not involved in the study.

**Ethical approval**

To ensure the privacy of the respondents, the survey was conducted anonymously. The researchers obtained ethical approval from the Departments of Health of the Belgian and Palestinian governments and institutional permits from the participating hospitals. Formal ethical approval and informed patient consent were not necessary for this type of study.

**Results**

**Participants' characteristics**

Most participants were nurses 761 (53.7%) and 254 (17.9%) were physicians. Most of the participants had between 1 and 5 years of experience in their current work unit. Details of the matched sample and participants' characteristics for both Palestinian and Belgian respondents are described in Table 3.

**Correlation between PSC dimensions and outcomes of the HSOPSC**

Table 4 presents the results of two correlation tables; namely, Palestinian correlations shown below the diagonal and Belgian correlations above. Preliminary Spearman's correlation analyses (Table 4) revealed some differences between the Palestinian and Belgian samples. The analyses showed significant positive correlations between overall perceptions of patient safety (OPS) and most of the dimensions in both samples. Regarding the frequency of event

reporting (FER), the data also showed a positive correlation with most of the dimensions in both samples. In both samples, most dimensions had a positive association with overall grade for patient safety (OGPS). Regarding the number of events reported (NER), the Palestinian sample had a significant and negative relationship with four dimensions: supervisor/manager expectations and actions promoting safety, non-punitive response to error, staffing and teamwork across hospital units and hospital handoffs and transitions. A negative correlation indicates the existence of an inverse relationship between two variables; that is, an increase in one variable is associated with a decrease in the other variable. This was also the case for the Belgian sample, with the number of events reported found to be associated positively with organizational learning–continuous improvement, and negatively with support from hospital management for patient safety, staffing and teamwork across hospital units and during hospital handoffs and transitions.

**Hierarchical regression analyses**

Regression analyses were used to investigate the predictive value of the PSC dimensions regarding the four self-reported outcome measurements. The detailed results are shown in Table 5 and the results are discussed generally below.

*Overall perceptions of safety (OPS)*

The PSC dimensions explained 16% and 36% of the variance of OPS in the Palestinian and Belgian samples, respectively. OPS outcome was predicted in both countries by teamwork within hospital units, organizational learning–continuous improvement, supervisor/manager expectations and actions promoting safety, support from hospital management for patient safety, teamwork across hospital units and during hospital handoffs and transitions, and feedback and communication openness regarding errors. The standardized beta (β) values ranged from 0.06 to 0.24 (*P*-values: <0.05 to <0.001). In addition to the previously mentioned predictors of OPS, staffing was a predictor for the Belgian sample only ($\beta = 0.24$, $P < 0.001$).

*Frequency of event reporting (FER)*

In the Palestinian and Belgian sample, the PSC dimensions explained 22% and 18% of the variance of FER outcome, respectively. This outcome was predicted by teamwork across hospital units and during hospital handoffs and transitions, staffing, and feedback and communication openness regarding errors with β-values ranging from 0.06 to 0.35 (*P*-values <0.05 to <0.001). Organizational learning–continuous improvement (β = 0.14, *P* <0.001), and hospital management support for patient safety (β = 0.10, *P* <0.001) were also good predictors for the Palestinian sample.

*Overall grade on patient safety (OGPS)*

In total, 20% of the OGPS was predicted by PSC dimensions in the Palestinian sample and 33% in the Belgian sample. The results revealed two similar predictors in the two countries, namely supervisor/manager expectations and actions promoting safety and teamwork across hospital units and during hospital handoffs and transitions, with β-values ranging from 0.12 to 0.17 (*P* <0.001). In addition to the previously mentioned predictors, organizational learning–continuous improvement (β = 0.19, *P* <0.001) and non-punitive response to error (β = 0.09, *P* <0.001) were significant predictors of OGPS in Palestine. Furthermore, teamwork within hospital units (β = 0.11, *P* <0.001), support from hospital management for patient safety (β = 0.17, *P* <0.001), staffing (β = 0.19, *P* <0.001) and feedback and communication openness regarding errors (β = 0.15, *P* <0.001) were significant predictors of OGPS in Belgium.

*Number of events reported (NER)*

The PSC dimensions predicted only 1% of the NER in Palestine and 5% in Belgium. Supervisor actions promoting safety and communication openness regarding errors were good predictors in both countries (β ranging from 0.05 to 0.16, *P*-values ranging from <0.05 to <0.001). In Palestine, non-punitive response to error (β = -0.08, *P* <0.01), and staffing (β = -0.20, *P* <0.001) were also predictors of the NER. Moreover, teamwork within hospital units

(β = -0.07, *P* <0.05), organizational learning–continuous improvement (β = 0.09, *P* <0.01), hospital management support for patient safety (β = -0.07, *P* <0.05), and teamwork across hospital units and during hospital handoffs and transitions (β = -0.08, *P* <0.01) were predictors in Belgium.

## DISCUSSION

This study enabled us to draw conclusions regarding the extent to which each HSOPSC safety dimension contributes specifically to outcome dimensions. It is the first study to explore the predictive value of HSOPSC in matched samples from two different countries. As such, it provides information about: (a) the impact of the various PSC dimensions on patient safety outcomes, and (b) cross-cultural differences in this respect between Palestinian and Belgian hospitals. Thus, our research provides an improved understanding of the influence of initiatives to improve specific outcome measures on patient safety culture. Overall, our findings emphasize that the HSOPSC is a valid instrument that can be used to improve outcomes related to safe healthcare for patients. The results of our study demonstrate that at least two of the HSOPSC dimensions contribute to one of the self-reported outcome measures in each country. Thus, our findings attest to the value of the PSC dimensions regarding patient safety outcomes. Only one dimension, non-punitive response to error, was found to have no association with any of the outcome measures in Belgium. A possible explanation for this could be that this dimension has a low internal consistency level and, therefore, affected the assessment of its predictive value in the Belgian sample. Despite this finding, only a small number of differences were detected between the two samples.

The results obtained for both the Palestinian and Belgian samples showed that hospitals should focus on investing in interventions that enable feedback and enhance communication openness regarding errors, sustain teamwork within and across hospital units, maintain organizational learning–continuous improvement, and improve hospital handoffs and

transitions. These interventions will improve OPS. As such, our analyses and results explicitly reveal 'important' PSC dimensions in terms of safety outcomes, and these PSC dimensions are shown to be the same for both the Palestinian and Belgian hospitals. Under such circumstances, implementing strategies and tools such as TeamSTEPPS may improve teamwork within and across units, in addition to strengthening communication and feedback skills regarding errors to enable the establishment of a learning system based on previous mistakes [33].

Event reporting is fundamental to the detection of patient safety problems and represents a core prerequisite of effective clinical risk management [27,35]. This outcome is of particular importance because these items reflect the frequency of the actual reporting of an act, and the willingness to report unsafe events, with higher error reporting rates leading to a stronger culture of accountability. The results showed that, in both the Palestinian and Belgian samples, this outcome is influenced mainly by maintaining open lines of information and communication in the unit. These observations are consistent with those reported by Pfeiffer and Manser [27]. Moreover, improvements in staffing and teamwork may also influence this outcome. Palestinian respondents found that managers who consider patient safety to be a top priority and build constructive learning systems based on previous mistakes encourage their staff to report adverse events. This result is also commonly reported in the published literature [1,35].

The overall grade for patient safety (OGPS) was found to be particularly significant in building a constructive learning system based on previous mistakes in Palestine and in improving staffing levels in Belgium. In other words, although our results revealed many similarities between the matched set of Palestinian and Belgian healthcare professionals, we also found cultural differences regarding OGPS. In accordance with previous studies, having enough staff [36] and opportunities to learn from previous mistakes [6] increased the

likelihood of staff reporting good or excellent safety grades in Belgium. Other contributing PSC dimensions are maintaining manager expectations and actions in promoting safety, improving teamwork across hospital units and supporting hospital handoffs and transitions in both countries. Our study also revealed that, in Palestine, a higher score for OGPS relates to greater support regarding non-punitive response to error. Additionally, initiatives to improve teamwork within units, support from hospital management for patient safety, staffing and feedback and communication openness regarding errors may also act to improve OGPS in Belgium.

As PSC dimensions explained only 1% (Palestine) and 5% (Belgium) of the number of events reported (NER), influencing PSC dimensions will have less impact on patient safety outcomes compared with other PSC outcomes ($R^2_{\text{OPS-Palestine}} = 16\%$; $R^2_{\text{OPS-Belgium}} = 36\%$; $R^2_{\text{FER-Palestine}} = 22\%$; $R^2_{\text{FER-Belgium}} = 18\%$; $R^2_{\text{OGPS-Palestine}} = 20\%$; $R^2_{\text{OGPS-Belgium}} = 33\%$). As such, the HSOPSC seems to be particularly effective for the prediction of OPS, FER, and OGPS, in both the Belgian and Palestinian samples. It can be speculated that the finding that NER is less well explained through the PSC dimensions is caused by the broad scope of the HSOPSC PSC dimensions regarding patient safety, which consequently renders this instrument less effective for this very specific outcome. A further explanation could be that our results stem not from a low predictive value, but from the under-reporting of adverse events, which would result in a low mean and low variance regarding this outcome dimension. A final explanation could be that respondents found it difficult to answer this question based on experience, as they may not themselves know how many events have been reported. Therefore, hospitals seeking to invest in patient safety must not only measure NER, but should also link the PSC dimensions to objective measurements of NER.

To summarize, our results suggest that improved self-reported outcome measures regarding patient safety in both Palestine and Belgium are more likely to be achieved through

better teamwork across units and during hospital handoffs and transitions, encouraging feedback and communications regarding errors, and implementing actions to promote safety. Furthermore, improving teamwork within hospital units, providing a work climate that promotes the adoption of safety as a top priority by hospital management and resolving staffing problems will also influence most outcome measures in Belgium [37,38]. In Palestine, bringing errors to the attention of managers and other staff and using mistakes as valuable learning opportunities [3] may also have an impact on safety outcome measures.

**Limitations and future research**

The current study has some methodological limitations that should be noted. First, the study used a cross-sectional design; therefore, claims of causal relationships are not possible. Second, as the present study relied exclusively on subjective measures that reflect the willingness of respondents to report events, and more specifically, the reporting of near misses, the results may be distorted by the common method bias of these self-reported outcome measures. Future research should examine the relationship between PSC dimensions and actual adverse event rates to clarify this relationship by linking objective data with PSC dimensions. Nevertheless, this study is the first to provide further insights into the value of the HSOPSC in terms of: (a) the impact of the PSC dimensions on patient safety outcomes, and (b) in different cultural settings. Third, the associations between the safety and PSC outcomes of the HSOPSC were investigated using a matched sample (to rule out possible bias due to sample differences between the two countries) using linear regression analyses. However, we cannot ignore the limitation of this design, which uses the most influential variables that are, in fact, approximations made from the researchers' perspective. These assumptions might be incorrect and could lead to the introduction of major confounding variables. Despite these methodological restrictions, previous research has shown that matched samples designs are useful, allowing researchers to conduct streamlined and focused research while maintaining a

good degree of validity [39]. Another possible concern is that as most respondents were nurses and other health professionals; thus, the results may reflect the personal perceptions of the respondents and affect our association results. However, we should not forget that nurses are the most highly represented staffing group in hospitals, and that our sample also included physicians, pharmacists, administrative and quality and safety staff. Finally, the Cronbach's alpha values for some of the composite scores measuring PSC were low ($\alpha < 0.70$), which may affect the correlation results, as in the Palestinian sample where all PSC dimensions were positively associated with the OGPS (except staffing). This specific dimension has shown a low internal consistency in most psychometric evaluation studies of the HSOPSC [21,33], indicating that it is necessary to review and update the items of this dimension to improve its internal consistency. Our results further attest to the international and cross-cultural validity of the HSOPSC. The relationships between the PSC and self-reported outcomes in other countries will provide further evidence in this regard.

## Conclusion

We found that perceptions of staffing and feedback and communication regarding errors were important predictive dimensions of PSC self-reported outcome measures in both countries. But we also found some contradictory results in our matched sample. Future research should focus on enriching the evidence of the linking of safety culture and hard patient safety outcomes in order to assess the practical validity of safety culture surveys. The divergences of patient safety perceptions in both countries implicate the need of local priority setting and a tailor-made approach for improvement strategies in hospitals. A great challenge lies in the field of implementation science, testing the effectiveness of safety culture strategies.

**List of abbreviations**

| | |
|---|---|
| AHRQ | Agency for healthcare research and quality |
| β | Standardized beta values |
| FB&ComE | Feedback and communication openness about errors |
| FER | Frequency of event reporting |
| HMS | Hospital management support for patient safety |
| HSOPSC | Hospital survey on patient safety culture |
| NER | Number of events reported |
| NPRE | Non-punitive response to error |
| OGPS | Overall grade of patient safety |
| OPS | Overall perceptions of safety |
| OrgLearn | Organizational learning–continuous improvement |
| Staff | Staffing |
| Sup./Man._actions | Supervisor/manager expectations and actions promoting safety |
| TW _units | Teamwork within hospital units |
| TWacross_HHT | Teamwork across hospital units and hospital handoffs and transitions |

**Competing interests**

The authors declare that they have no competing interests.

**Authors' contributions**

SN performed the overall statistical analyses and drafted the manuscript. EB actively contributed to the statistical analyses, the interpretation of the results, and to the preparation of the manuscript. MH coordinated data collection (Palestine) and critically revised the

manuscript. AVle and ME participated in critically revising the manuscript for important intellectual content. WSer and WSch participated in the analyses and interpretation of the data and contributed to the preparation of the manuscript. KV and JH were involved in the study design and revised the manuscript critically. JH coordinated the data collection (Belgium). AVla was involved in the study design, manuscript outline, and contributed to the manuscript and data preparation (Belgian data). All authors have read and approved the final manuscript.

**Acknowledgments**

We particularly acknowledge all participant hospitals and their staff who devoted time to completing the surveys. We extend our gratitude to the Palestinian and Belgian governments for their cooperation and supporting this research.

## References

1. 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**(1):32–41.
2. Donaldson LJ, Fletcher MG. **The WHO World Alliance for Patient Safety: towards the years of living less dangerously.** *Med J Aust* 2006; **184**:S69e72.
3. Najjar S, Hamdan M, Euwema MC, et al. **The Global Trigger Tool shows that one out of seven patients suffers harm in Palestinian hospitals: challenges for launching a strategic safety plan**, *Int J Qual Health Care* 2013; 25:640–647, https://doi.org/10.1093/intqhc/mzt066.
4. Institute of Medicine. **To err is human: Building a safer health system**. Washington, D.C: *The National Academy press*, 2000.
5. Wakefield JG, Jorm CM. **Patient safety a balanced measurement framework**. *Aust Health Rev* 2009; **33** (3):382–389.
6. Stone PW, and Gershon PR. **Nurse Work Environments and Occupational Safety in Intensive Care Units**. J Nurs Adm 2009; **39**(7-8 Suppl):S27–34
7. Mardon RE, Khanna K, Sorra J, et al. **Exploring relationships between hospital patient safety culture and adverse events**. *J Patient Saf* 2010; **6**:226–32.
8. Singer S, Lin S, Falwell A, et al. **Relationship of safety climate and safety performance in hospitals**. *Health Serv Res* 2009; **44**:399–421.
9. Kotter JP, and Heskett JL. **Corporate Culture and Performance**. *New York: Free Press*,1992.
10. Carman JM, Shortell SM, Foster RW, et al. **Keys for Successful Implementation of Total Quality Management in Hospitals**. *Health Care Manage Rev.* 2010; **35**(4):283–93

11. Institute of Medicine. **Crossing the Quality Chasm: A New Health System for the 21st Century**. *Washington, DC: National Academy Press,* 2001.
12. Edmondson AC. **Psychological Safety and Learning Behavior in Work Teams**. *Administrative Science Quarterly* 1999; **44**(2):350–83.
13. Hansen LO, Williams MV, and Singer SJ. **Perceptions of Hospital Safety Climate and Incidence of Readmission.** *Health Serv Res* 2011; **46**(2):596–616.
14. Sorra J, Famolaro T, Dyer N, et al. **Hospital Survey on Patient Safety Culture: 2012 User Comparative Database Report**. Prepared by Westat, Rockville, MD, under Contract No. HHSA 290200710024C. AHRQ Publication No. 12-0017, January 2012. Agency for Healthcare Research and Quality, Rockville, MD. http://www.ahrq.gov/qual/hospsurvey12/index.html
15. Vlayen A, Hellings J, Claes N, Peleman H, Schrooten W. **A nationwide Hospital Survey on Patient Safety Culture in Belgian hospitals: setting priorities at the launch of a 5-year patient safety plan**. *BMJ Qual Saf* 2012;**2 1**(9):760–7.
16. Deilkas E, Hofoss D. **Patient safety culture lives in departments and wards: multilevel partitioning of variance in patient safety culture**. *BMC Health Serv Res* 2010; **10**:85.
17. Sorra J, Dyer N: **Multilevel psychometric properties of the AHRQ hospital survey on patient safety culture**. *BMC Health Serv Res* 2010; **10**:199.
18. Waterson PE, 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. doi:10.1136/qshc.2008.031625.
19. Sarac C, Flin R, Mearns K, et al. **Hospital survey on patient safety culture: psychometric analysis on a Scottish sample**. *Qual Saf Health Care* 2011; **20**(10):842–8.

20. Olsen E. **Reliability and validity of the Hospital Survey on Patient Safety Culture at a Norwegian hospital.** In: Øvretveit J, Sousa P, eds. Quality and Safety Improvement Research: Methods and Research Practice from the International Quality Improvement Research Network (QIRN). Lisbon: *National School of Public Health* 2008:173–86

21. Najjar S, Hamdan M, Baillian E, et al. **The Arabic version of the hospital survey on patient safety culture: a psychometric evaluation in a Palestinian sample**. *BMC Health Serv Res* 2013; **13**:193. doi: 10.1186/1472-6963-13-193.

22. Colla JB, Bracken AC, Kinney LM, et al. **Measuring patient safety climate: a review of surveys**. *Qual Saf Health Care* 2005; **14**:364–366.

23. Sexton JB, Helmreich RL, Neilands TB, et al. **The Safety Attitudes Questionnaire: Psychometric Properties, Benchmarking Data, and Emerging Research**. *BMC Health Serv Res* 2006; **6**:44.

24. Sammer CE, Lykens K, Singh KP, et al. **What is patient safety culture? A review of the literature**. *J Nurs Scholarsh* 2010; **42**(2):156–65.

25. Hellings J, Schrooten W, Klazinga N, Vleugels A. **Challenging patient safety culture: survey results**. *Int J Health Care Qual Assur*. 2007; **20**(7):620-32.

26. Vlayen A, Hellings J, Claes N, Abdou EA, Schrooten W. **Measuring safety culture in belgian psychiatric hospitals: validation of the dutch and French translations of the hospital survey on patient safety culture.** *J Psychiatr Pract.* 2015; **21**(2):124-39.

27. Pfeiffer Y, Manser T. **Development of the German version of the Hospital Survey on Patient Safety Culture: Dimensionality and psychometric properties**. *Safety Science* 2010; **48** (10):1452–1462.

28. West Bank and Gaza **Public Expenditure Review of the Palestinian Authority. Towards Enhanced Public Finance Management and Improved Fiscal Sustainability**. Washington DC: World Bank; 2016. http://documents.worldbank.org/curated/en/320891473688227759/pdf/ACS18454-REVISED-FINAL-PER-SEPTEMBER-2016-FOR-PUBLIC-DISCLOSURE-PDF.pdf. accessed 18, May 2018.

29. WHO. **Country Cooperation Strategy WHO - BELGIUM 2016-2022.** http://www.euro.who.int/__data/assets/pdf_file/0009/329778/CCS-Belgium-2016-2022-en.pdf. Accessed 18, May 2018.

30. Palestinian Central Bureau of Statistics. Statistics from Palestine. https://thisweekinpalestine.com/wp-content/uploads/2014/11/Statistics-from-Palestine.pdf. Accessed May 18, 2018

31. El-Jardali F, Jafar M, Dimmasi H, et al. **The current state of patient safety culture in Lebanese hospitals: a study at baseline**. *Int J Qual Health Care* 2010; **22**:386–95.

32. Hickner J, Smith SA, Yount N, et al **Differing perceptions of safety culture across job roles in the ambulatory setting: analysis of the AHRQ Medical Office Survey on Patient Safety Culture**. *BMJ Qual Saf* 2016 Aug; **25**(8):588-94.

33. Sorra JS, Nieva VF. **Hospital Survey on Patient Safety Culture**. AHRQ Publication No. 04-0041. Rockville, MD: Agency for Healthcare Research and Quality; 2004.

34. Hayes, A. F. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. New York, NY, US: Guilford Press 2017.

35. Westrum R, **A typology of organisational cultures**. *Qual Saf Health Care* 2004; **13** (Suppl. 2): pp. ii22–ii27.

36. Aiken A, Sermeus W, Van den Heede K, et al. **Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12**

**countries in Europe and the United States**. *BMJ* 2012; **344**:e1717doi: 10.1136/bmj.e1717.

37. Keller SM. **Effects of extended work shifts and shift work on patient safety, productivity, and employee health**. *AAOHN J* 2009; **57** (12):497–502.
38. Mark BA, Harless DW and Berman WF. **Nurse Staffing and Adverse Events in Hospitalized Children**. *Policy Polit Nurs Pract* 2007; **8**(2): 83–92.
39. Stuart EA. **Matching methods for causal inference: A review and a look forward**. *Stat Sci* 2010; **25**(1):1–21.

**Table 1:** Definitions of patient safety culture dimensions and outcomes

| Patient safety culture dimensions | Items |
|---|---|
| **Communication openness:** Staff freely speak up if they see something that may negatively affect a patient and feel free to question those with more authority. | • Staff will freely speak up if they see something that may negatively affect patient care.<br>• Staff feel free to question the decisions or actions of those with more authority.<br>• Staff are afraid to ask questions when something does not seem right. |
| **Feedback and communication about errors**: Staff are informed about errors that happen, given feedback about changes implemented, and discuss ways to prevent errors. | • We are given feedback about changes put into place based on event reports.<br>• We are informed about errors that happen in this unit.<br>• In this unit, we discuss ways to prevent errors from happening again. |
| **Hospital handoffs and transitions**: Important patient care information is transferred across hospital units and during shift changes. | • Things "fall between the cracks" when transferring patients from one unit to another.<br>• Important patient care information is often lost during shift changes.<br>• Problems often occur in the exchange of information across hospital units.<br>• Shift changes are problematic for patients in this hospital. |
| **Hospital management support for patient safety**: Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority. | • Hospital management provides a work climate that promotes patient safety.<br>• The actions of hospital management show that patient safety is a top priority.<br>• Hospital management seems interested in patient safety only after an adverse event happens. |

| | |
|---|---|
| **Non-punitive response to error**: Staff feel that their mistakes and event reports are not held against them and that mistakes are not kept in their file. | • Staff feel like their mistakes are held against them.<br>• When an event is reported, it feels like the person is being written up, not the problem.<br>• Staff worry that mistakes they make are kept in their file. |
| **Organizational learning–Continuous improvement**: Mistakes have led to positive changes and changes are evaluated for effectiveness. | • We are actively doing things to improve patient safety.<br>• Mistakes have led to positive changes here.<br>• After we make changes to improve patient safety, we evaluate their effectiveness. |
| **Staffing**: There is enough staff to handle the workload and work hours are appropriate to provide the best care for patients. | • We have enough staff to handle the workload.<br>• Staff in this unit work longer hours than is best for patient care.<br>• We use more agency/temporary staff than is best for patient care.<br>• We work in 'crisis mode', trying to do too much, too quickly. |
| **Supervisor/manager expectations and actions promoting safety**: Supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures, and do not overlook patient safety problems. | • My supervisor/manager offers praise when he/she sees a job done according to established patient safety procedures.<br>• My supervisor/manager seriously considers staff suggestions for improving patient safety.<br>• Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts.<br>• My supervisor/manager overlooks patient safety problems that happen repeatedly. |
| **Teamwork across hospital units**: Hospital units cooperate and | • There is good cooperation among hospital units that need to work together. |

| | |
|---|---|
| coordinate with one another to provide the best care for patients. | • Hospital units work well together to provide the best care for patients.<br>• Hospital units do not coordinate well with each other.<br>• It is often unpleasant to work with staff from other hospital units. |
| **Teamwork within hospital units**: Staff support each other, treat each other with respect, and work together as a team. | • People support one another in this unit.<br>• When a lot of work needs to be done quickly, we work together as a team to get the work done.<br>• In this unit, people treat each other with respect.<br>• When one area in this unit gets really busy, others help out. |
| **Self-reported outcome measures** | Items |
| **Frequency of events reported**: Mistakes of the following types are reported: (1) Mistakes caught and corrected before affecting the patient; (2) Mistakes with no potential to harm the patient: and (3) Mistakes that could harm the patient but do not. | • When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?<br>• When a mistake is made, but has no potential to harm the patient, how often is this reported?<br>• When a mistake is made that could harm the patient, but does not, how often is this reported? |
| **Overall perceptions of patient safety**: Procedures and systems are good for the prevention of errors and there are minimal patient safety problems. | • Patient safety is never sacrificed to get more work done.<br>• Our procedures and systems are good for the prevention of errors.<br>• It is just by chance that more serious mistakes don't happen around here.<br>• We have patient safety problems in this unit. |
| **Patient safety grade**: Overall | • Please give your work area/unit in this hospital an overall |

| | |
|---|---|
| grade for patient safety for their work area/unit. | grade for patient safety. |
| **Number of events reported**: The number of events reported over the past 12 months. | • In the past 12 months, how many event reports have you filled out and submitted? |

**Table 2: Percentage positive scores for patient safety dimensions and Cronbach's alpha of Hospital survey on patient safety culture (HSOPSC) in Palestine and Belgium**

| Patient safety culture dimensions | Percent positive response Palestine | Percent positive response Belgium | Cronbach's alpha Palestine | Cronbach's alpha Belgium |
|---|---|---|---|---|
| Teamwork within hospital units (TW_units) | 75% | 73% | 0.80 | 0.79 |
| Organizational learning–Continuous improvement (OrgLearn) | 64% | 49% | 0.73 | 0.61 |
| Supervisor/manager expectations & actions promoting safety (Sup./Man._actions) | 55% | 58% | 0.74 | 0.74 |
| No punitive response to error (NPRE) | 17% | 38% | 0.63 | 0.69 |
| Hospital management support for patient safety (HMS) | 42% | 33% | 0.76 | 0.77 |
| Teamwork across hospital units & hospital handoffs & transitions (TWacross_HHT) | 45% | 27% | 0.78 | 0.75 |
| Staffing (Staff) | 58% | 37% | 0.67 | 0.61 |
| Feedback & communication openness about errors (FB&ComE) | 49% | 51% | 0.76 | 0.80 |
| **Patient safety culture outcomes** | | | | |
| Frequency of event reporting (FER) | 39% | 44% | 0.87 | 0.86 |
| Overall perceptions of safety (OPS) | 55% | 47% | 0.75 | 0.73 |
| Overall grade of patient safety (OGPS) | 49% | 39% | NA | NA |
| Number of events reported (NER) | 45% | 69% | NA | NA |

**Table 3: Participants' characteristics**

| Characteristics | | Whole sample | Palestinian sample *N* = 1418 | Matched Belgian sample *N* = 1418 |
|---|---|---|---|---|
| Direct contact or interaction with patient | Yes | 2524 (88.9%) | 1284 (90.5%) | 1240 (87.4%) |
| | No | 312 (11.0%) | 134 (9.4%) | 178 (12.5%) |
| Experience at current work area/unit | *<1 year* | 452 (15.9%) | 218 (15.4%) | 234 (16.5%) |
| | *1 to 5 years* | 1206 (42.5%) | 621 (43.8%) | 585 (41.3%) |
| | *6 to 10 years* | 552 (19.5%) | 250 (17.6%) | 302 (21.3%) |
| | *11 to 15 years* | 281 (09.9%) | 162 (11.4%) | 119 (8.4%) |
| | *16 to 20 years* | 184 (06.5%) | 81 (5.7%) | 104 (7.3%) |
| | *>21 years* | 160 (05.6%) | 86 (6.1%) | 74 (5.2%) |
| Hospital size (beds) | *Small (<150)* | 700 (24.7%) | 612 (43.1%) | 88 (6.2%) |
| | *Medium (150 to 249)* | 632 (22.3%) | 546 (38.5%) | 86 (6.1%) |
| | *Large (≥250)* | 1504 (53.0%) | 260 (18.4%) | 1244 (87.7%) |

**Table 4: Spearman's correlation matrixes (Belgian sample above the diagonal, Palestinian sample below the diagonal)**

| | *1* | *2* | *3* | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | *13* | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Hospital years' experience | _ | 0.01 | -0.05 | 0.06* | -0.02 | -0.03 | 0.00 | -0.06* | -0.09** | -0.00 | -0.08** | 0.04 | -0.06* | 0.16** |
| 2. Working hours | 0.01 | _ | 0.03 | -0.03 | -0.02 | 0.02 | -0.09** | -0.07* | -0.11** | 0.02 | 0.00 | -0.02 | -0.02 | 0.03 |
| 3. TW _units | -0.05 | 0.05* | _ | 0.28** | 0.35** | 0.33** | 0.18** | 0.21** | 0.21** | 0.42** | 0.29** | 0.22** | 0.30** | -0.05 |
| 4. OrgLearn | 0.00 | 0.09** | 0.35** | _ | 0.40** | 0.24** | 0.28** | 0.17** | 0.09** | 0.43** | 0.29** | 0.24** | 0.21** | 0.10** |
| 5. Sup./Man._actions | -0.01 | 0.03 | 0.24** | 0.25** | _ | 0.34** | 0.33** | 0.22** | 0.23** | 0.51** | 0.41** | 0.24** | 0.34** | -0.04 |
| 6. NPRE | 0.03 | -0.03 | 0.07* | 0.07** | 0.13** | _ | 0.28** | 0.20** | 0.29** | 0.32** | 0.30** | 0.18** | 0.22** | -0.00 |
| 7. HMS | -0.02 | 0.09** | 0.25** | 0.28** | 0.27** | 0.25** | _ | 0.33** | 0.30** | 0.35** | 0.39** | 0.19** | 0.39** | -0.07** |
| 8. TWacross_HHT | -0.04 | 0.02 | 0.27** | 0.23** | 0.34** | 0.21** | 0.33** | _ | 0.23** | 0.24** | 0.28** | 0.17** | 0.34** | -0.11** |
| 9. Staff | -0.04 | -0.02 | -0.05 | -0.04 | 0.09** | -0.12** | -0.08** | 0.01 | _ | 0.20** | 0.40** | 0.05 | 0.35** | -0.08** |
| 10. FB&ComE | -0.02 | 0.06* | 0.31** | 0.33** | 0.32** | 0.14** | 0.31** | 0.24** | -0.03 | _ | 0.36** | 0.41** | 0.38** | 0.05 |
| 11. OPS | -0.02 | 0.06* | 0.24** | 0.28** | 0.29** | 0.11** | 0.26** | 0.24** | 0.01 | 0.26** | _ | 0.20** | 0.51** | -0.15** |
| 12. FER | 0.02 | 0.08** | 0.24** | 0.32** | 0.23** | 0.13** | 0.27** | 0.28** | 0.06* | 0.37** | 0.23** | _ | 0.21** | 0.12** |
| 13. OGPS | 0.09** | 0.17** | 0.22** | 0.32** | 0.25** | 0.16** | 0.25** | 0.30** | -0.05 | 0.22** | 0.19** | 0.25** | _ | -0.12** |
| 14. NER | 0.00 | -0.01 | 0.01 | -0.03 | -0.11** | -0.07* | -0.03 | -0.08** | -0.16** | 0.01 | -0.07** | 0.05* | -0.09** | _ |

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

**TW _units**: Teamwork within hospital units; **OrgLearn**: Organizational learning–Continuous improvement; **Sup./Man._actions**: Supervisor/manager expectations and actions promoting safety; **NPRE**: Non-punitive response to error; **HMS**: Hospital management support for patient safety; **TWacross_HHT**: Teamwork across hospital units and hospital handoffs and transitions; **Staff**: Staffing; **FB&ComE**: Feedback and communication openness about error; **OPS**: Overall perceptions of patient safety; **FER**: Frequency of events reported; **OGPS**: Overall grade for patient safety; **NER**: Number of events reported.

**Table 5: Summary of the hierarchical regression analyses: Predicting the outcomes of the Hospital survey on patient safety culture (HSOPSC) in matched samples of Palestinian and Belgian hospital workers (β)**

| | *Palestine (N =1418 )* | | | | | | | | *Belgium (N = 1418)* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Outcome** | **Overall perceptions of safety (OPS)** | | **Frequency of event reporting (FER)** | | **Overall grade for patient safety (OGPS)** | | **Number of events reported (NER)** | | **Overall perceptions of safety (OPS)** | | **Frequency of event reporting (FER)** | | **Overall grade for patient safety (OGPS)** | | **Number of events reported (NER)** | |
| *Predictors* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* | *Step1* | *Step2* |
| Hospital tenure | -0.01 | -0.00 | 0.02 | 0.04 | 0.09*** | 0.09*** | .01 | .01 | -0.06** | -0.04* | 0.04 | 0.04 | -0.04 | -0.02 | 0.15*** | 0.13*** |
| Working hours | 0.06** | 0.04 | 0.07** | 0.04 | 0.15*** | 0.12*** | -.02 | -.02 | -0.00 | 0.04 | -0.03 | -0.03 | -0.02 | 0.03 | 0.03 | 0.02 |
| Staff function | 0.04 | 0.00 | 0.03 | -0.01 | 0.03 | 0.00 | -.00 | .01 | 0.09*** | 0.06** | | -0.04 | 0.06 | 0.04 | | 0.08** |
| TW_units | | 0.10*** | | 0.04 | | 0.03 | | .04 | | 0.06** | | 0.02 | | 0.11*** | | -0.07* |
| OrgLearn | | 0.10*** | | 0.14*** | | 0.19*** | | -.03 | | 0.10*** | | 0.04 | | -0.00 | | 0.09** |
| Sup./Man._actions | | 0.13*** | | 0.00 | | 0.14*** | | -.16*** | | 0.17*** | | 0.00 | | 0.12*** | | -0.08* |
| NPRE | | 0.05 | | 0.03 | | 0.09*** | | -.08** | | 0.03 | | 0.04 | | -0.03 | | 0.04 |
| HMS | | 0.16*** | | 0.10*** | | 0.05 | | .01 | | 0.19*** | | 0.04 | | 0.17*** | | -0.07* |
| TWacross_HHT | | 0.07** | | 0.13*** | | 0.14*** | | -.05 | | 0.08** | | 0.06* | | 0.17*** | | -0.08** |
| Staff | | 0.02 | | 0.09*** | | -0.01 | | -.20*** | | 0.24*** | | -0.07** | | 0.19*** | | -0.05 |
| FB&ComE | | 0.08** | | 0.24*** | | 0.01 | | .05* | | 0.06* | | 0.35*** | | 0.15*** | | 0.11** |
| $R^2$ | .00 | 0.16*** | .00* | 0.22*** | 0.03*** | 0.20*** | -0.00 | 0.01** | 0.00*** | 0.36*** | 0.00 | 0.18*** | 0.00 | 0.33*** | 0.02*** | 0.05*** |

The highest absolute values of the standardized beta are shaded. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

**TW _units**: Teamwork within hospital units; **OrgLearn**: Organizational learning–Continuous improvement; **Sup./Man._actions**: Supervisor/manager expectations and actions promoting safety; **NPRE**: Non-punitive response to error; **HMS**: Hospital management support for patient safety; **TWacross_HHT**: Teamwork across hospital units and hospital handoffs and transitions; **Staff**: Staffing; **FB&ComE**: Feedback

and communication openness about error; **OPS**: Overall perceptions of patient safety; **FER**: Frequency of events reported; **OGPS**: overall grade of patient safety; **NER**: Number of events reported.

**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

# Similarities and differences in the associations between patient safety culture dimensions and self-reported outcomes in two different culture settings: A national cross-sectional study in Palestinian and Belgian hospitals

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 & 3 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 3 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 6 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 6 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 7 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 7 & 8 |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | 7 & 8 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 9 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 8 & 9 |
| Bias | 9 | Describe any efforts to address potential sources of bias | *9* |
| Study size | 10 | Explain how the study size was arrived at | 8 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 9 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 10 & 11 |

| | | | |
|---|---|---|---|
| | | (*b*) Describe any methods used to examine subgroups and interactions | 10 |
| | | (*c*) Explain how missing data were addressed | NA |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | 10 & 11 |
| | | (*e*) Describe any sensitivity analyses | NA |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 10 |
| | | (b) Give reasons for non-participation at each stage | NA |
| | | (c) Consider use of a flow diagram | NA |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 11 |
| | | (b) Indicate number of participants with missing data for each variable of interest | NA |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 12 – 14 |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 12 – 14 |
| | | (*b*) Report category boundaries when continuous variables were categorized | NA |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | NA |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 12 – 14 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 14 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 17 - 18 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 15-18 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 18 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | NA |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.