Proposal of a novel approach to the assessment of patient safety culture

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Abstract: The assessment of Patient Safety Culture (PSC) is often conducted using a quantitative approach based on questionnaires or a qualitative one focused on the deployment of Patient Safety Culture Maturity Models (PSCMM). These two approaches suffer from a number of limitations and their resolution is only possible by exploiting the possible complementarity that exists between them. Indeed, to overcome their inherent limits, it is imperative to merge the two PSC approaches in a single approach called quali-quantitative evaluation of PSC. This article fits into this context and aims to materialise the merger of PSC approaches through their co-deployment. This will make it possible to capitalise the scores of the HSOPSC dimensions in terms of PSC maturity levels.

Keywords: patient safety culture; assessment; HSOPSC questionnaire; maturity model.

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1   Introduction

Safety Culture (SC) is a recent concept that has been widely used in various high-risk industries to address safety issues due to organisational deficiencies (Le Coze, 2019). This concept first appeared after the Chernobyl nuclear accident in 1986 and has since attracted the attention of the scientific community in various sectors (Van Nunen et al., 2018). However, it is not until recently that it has shifted to the healthcare sector, where a positive Patient Safety Culture (PSC) is linked to a decrease in the number of adverse events and, therefore, an improvement in the quality and safety of care (Wang et al., 2014; Xie et al., 2017).

This link between PSC and safety performance has highlighted the need to measure and evaluate PSC within healthcare organisations (Musonda et al., 2018). For this, three approaches are used:

- The first is an anthropological (academic) approach, of a qualitative nature, based on observations, interviews and documentary studies whose results are considered as a description of the culture and not as an evaluation of it (Antonsen, 2017);

- The second approach is the pragmatic approach which is based on experience and experts' judgment, where the focus is set on the organisation's structure and its process (Hale et al., 2010). The aim is to focus on the behaviours to be modified and to propose corrective solutions such as the STOP-CARD initiative (Mouda et al., 2016);

- The last approach is the analytical (psychological) approach, in which PSC is considered as a multidimensional construct measured mainly by means of questionnaires. This semi-quantitative approach is the most used in the scientific

literature. For, it makes it possible to define the complex concept of PSC as a set of dimensions that can be quantified in mean scores, thus facilitating a comparative study (Díaz-Cabrera et al., 2007; Kines et al., 2011).

Regardless to the wide use of questionnaires in PSC evaluation, they seem to have many limitations (Antonsen, 2017). In this respect, Guldenmund (2000) pointed out that questionnaire evaluations are often carried out over a defined period of time. Therefore, it is considered by a number of authors as a superficial assessment of the current state of PSC (Antonsen, 2017). The second limitation is that these evaluations are conducted in an informal setting and, consequently, lack management support and no follow-up actions are undertaken (Boughaba et al., 2019).

To overcome these limitations, the current trend that marks PSC research is to frame this rather complex notion with Patient Safety Culture Maturity Models (PSCMM) (Waterson, 2014; Filho and Waterson, 2018; Le Coze, 2019). The concept of maturity models finds its origins in two main roots namely Quality Management Maturity Grid and Westrum's work on the typology of organisational cultures (Wendler, 2012). The latter defined a continuum that helped rank organisations based on their cultural level with pathological organisations at one end and generative (proactive) organisations at the other (Westrum, 1993, 2004). This continuum was adapted later to construct PSCMM (Hudson, 2007).

PSCMM have an objective to accompany an organisation in order to reach an advanced level of its PSC. This model can be used as an assessment or an improvement tool (Wendler, 2012; Filho and Waterson, 2018). The assessment can be constructed using a cultural ladder such as the one proposed in the Hearts & Minds program for the improvement of safety culture developed by the petrochemical company Shell. This assessment approach often uses a Likert-type scale in order to help deducing recommendations for reaching higher PSC maturity levels (Hudson, 2007; Maier et al., 2012).

The use of this model has been rapidly adapted to the healthcare sector where improvement initiatives have been proposed over the last decade (Frankel et al., 2008; Filho and Waterson, 2018). In this context, Fleming and Wentzell (2008) developed the Patient Safety Culture Improvement Tool (PSCIT), consisting of 9 elements grouped in 5 dimensions covering patient safety culture. Scores were assigned to these dimensions using a four-level maturity scale to help Canadian healthcare organisations in identifying gaps and improve their safety culture.

Similarly, Öhrn et al. (2011) proposed Patient Safety Dialogue (PSD) inspired by the Walk Rounds Leadership for Patient Safety developed by Frankel et al. (2003). This approach consists of organising a meeting with key staff members where three distinct areas of patient safety are given scores on a five-level maturity scale. These meetings were held every 18 months to monitor the development of PSC in three Swedish hospitals, where the proposed approach was tested and validated.

However, the Manchester Patient Safety Assessment Framework (MaPSaF) is considered to be the best-known and the most consistent PSCMM in terms of theoretical underpinnings (Parker, 2009; Law et al., 2010; Maier et al., 2012). Its aim is to help the United Kingdom's National Health System to adopt a just culture in which continuous improvement is encouraged. Firstly, this is done by performing an assessment of the current level of PSC within healthcare establishments that will classify them into five progressive levels (i.e., Pathological, Reactive, Calculative, Proactive and Generative).

Secondly, the evaluated establishments will be accompanied in the process of organisational change in order to reach a high level of PSC (Parker, 2009; Kirk et al., 2007).

Nevertheless, a PSCMM presents numerous limitations, in particular, when using qualitative tools (e.g., interviews, audits, observations, etc.) to evaluate PSC maturity. Their deployment needs a prohibitive amount of time and their results are often subjective. This type of evaluation is often conducted without providing a gradual approach to PSC promotion. Moreover, the existence of several PSC maturity models poses similarity problems (Hodgen et al., 2017).

To overcome the limits of quantitative and qualitative methods, Vincent et al. (2013) suggested the use of a combined approach (i.e., qualitative & quantitative) to evaluate PSC. However, the current trend is to use quantitative methods separately from qualitative ones. Thus, the purpose of this article is to propose a mixed and a systematic assessment approach of PSC. The merger between the two approaches is made possible using an approach inspired by discrete choices' method that makes it possible to quantify PSC maturity levels by reference to PSC dimensional scores.

2   Materials and methods

The recommended approach (see Figure 1) consists of a hybrid PSC assessment (i.e. quantitative and qualitative). Thus, the first step is based on a quantitative PSC evaluation using questionnaires. In this regard, Halligan and Zecevic (2011) identified the most cited questionnaires in the healthcare sector that are the, Hospital Survey on Patient Safety Culture (12 dimensions of PSC), Patient Safety Culture in Healthcare Organisations Survey (9 dimensions of PSC), Safety Attitudes Questionnaire (6 dimensions of PSC) and Modified Stanford Patient Safety Culture Survey Instrument (5 dimensions of PSC). The author confirms that the greater the number of dimensions, the better that PSC is framed.

Consequently, the HSOPSC questionnaire is by far the most used in the evaluation of PSC (Reis et al., 2018; Boughaba et al., 2019; Tlili et al., 2020). It was developed in 2004 under the supervision of the American Agency of Healthcare Research (Sorra et al., 2016), where it has already been tested and validated. Then, it was translated, tested and validated by the Coordination Committee for Clinical Evaluation and Quality in Aquitaine-France (Occelli et al., 2013).

In its French version, this questionnaire is organised in two sections (Boughaba et al., 2019): the first section, relating to general information, is composed of five questions while the second section makes it possible to explore the perceptions of staff regarding PSC in their work unit. This second section consists of 38 questions arranged in ten dimensions:

- Dim_1: Overall perceptions of patient safety;

- Dim_2: Frequency of reporting adverse events;

- Dim_3: Supervisor/manager expectations and actions promoting safety;

- Dim_4: Organisational learning-continuous improvement;

- Dim_5: Teamwork within units;

- *Dim$_6$*: Communication openness;

- *Dim$_7$*: Non-punitive response to error;

- *Dim$_8$*: Staffing;

- *Dim$_9$*: Management support for patient safety;

- *Dim$_{10}$*: Teamwork across hospital units.

In Figure 1, the recommended approach is based on the co-deployment of qualitative and quantitative assessments of PSC in order to map PSC dimensions in the form of maturity levels. The starting point of the recommended approach consists in determining the characteristics of the two assessment approaches (i.e. qualitative and quantitative) (see Table 1).

**Figure 1**   The proposed approach to the mixed assessment of PSC
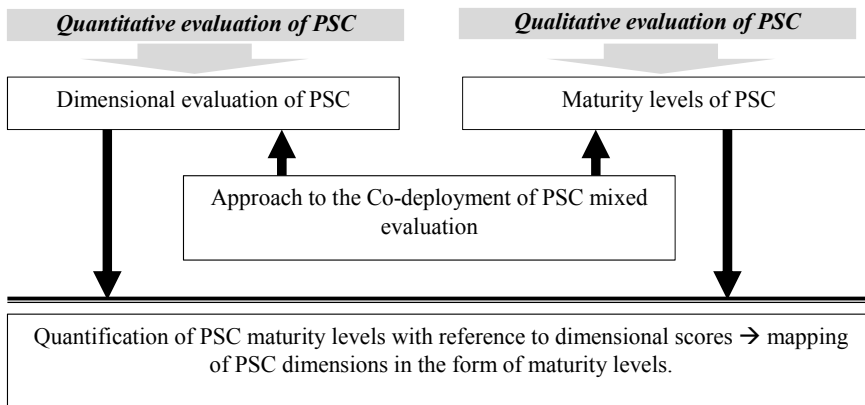
Table 1   Characterisation of the qualitative and quantitative PSC assessment approaches

Approach	Object	Attributes	Modalities
Quantitative	Dimensional score	Developed (D)	[0.75–1]
		Underdeveloped (UD)	[0.5–0.75]
		Non-developed (ND)	[0–0.5[
Qualitative	Maturity level	Pathological	No safety action
		Reactive	Reactive safety action
		Calculative	Formal safety action
		Proactive	Proactive safety action
		Generative	Sustained safety action (framed by continuous improvement)

The co-deployment of the two approaches consists in exploring these characteristics by deducing the 'plausible scenarios' making it possible to associate, initially, the 'modalities' of the qualitative approach to the 'attributes' of the quantitative one. Figure 2 presents all plausible scenarios retained for a given dimension of the HSOPSC questionnaire.

Figure 2   Plausible scenarios of the initial co-deployment of the two PSC assessment approaches

Safety actions	Non	Reactive	Formal	Proactive	Sustained	ND	UD	D	Scenarios
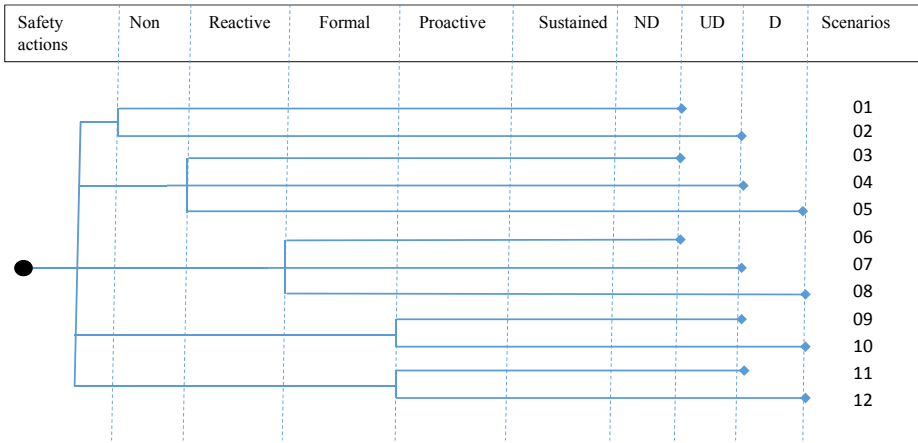
Secondly, the co-deployment of qualitative and quantitative approaches consists in reducing the tree of plausible scenarios in Figure 1 to retain only one attribute of the qualitative approach for a given modality of the quantitative approach. In other words, this step involves evaluating experts' preferences with regard to the twelve scenarios in Figure 2 that must be reduced to five.

This reduction makes it possible to concretise the co-deployment of PSC assessment approaches that will be materialised by the attribution of correspondences between maturity levels and modalities provided by the quantitative approach. Thus, maturity levels will ultimately be expressed as a function of PSC dimensional scores.

The correspondence 'maturity levels (ML_i) $\leftrightarrow$ dimensional scores (DS_j)' is done by expert judgment focused on the estimation of this correspondence in the form of expert preferences scored on a three-level scale (see Table 2).

Table 2   Correspondence appreciation scales «ML_i«DS_j»

Appreciation of correspondence	*Assessment array*
Low	[0–0.2]
Medium	[0.2–0.7]
Strong	[0.7–1]

Note that the assessments that will be provided by the experts, with reference to the scales in Table 2, can be made on an ad hoc basis or in the form of two values: one pessimistic and the other optimistic. Consequently, these assessments must respect the criterion of monotony. These assessments also express a membership function taking its values $C_{ML_i \leftrightarrow DS_j}$ in the three intervals of Table 2. Thus, the membership function of a correspondence:

$$\mu^{(k)}_{C_{ML_i \leftrightarrow DS_j}} = \left[\mu^{(k,1)}_{C_{ML_i \leftrightarrow DS_j}} \; ; \; \mu^{(k,2)}_{C_{ML_i \leftrightarrow DS_j}} \right] \tag{1}$$

with

$$\mu^{(k,1)}_{C_{ML_i \leftrightarrow DS_j}} \quad \mu^{(k,2)}_{C_{ML_i \leftrightarrow DS_j}} \qquad (2)$$

Equation (2) formalises the punctual or interval appreciation while respecting the criterion of monotony of the two interval appreciations. Indeed, the aggregation of expert opinions requires taking into consideration the respective weights of the experts to arrive at a collective assessment that corresponds to the weighted average of the assessments provided by all the experts equation (3):

$$\hat{C}_{ML_i \leftrightarrow DS_j} = \frac{1}{n} \left(\alpha_k \sum_{m=1}^{n} \mu^{(m)}_{C_{ML_i \leftrightarrow DS_j}} \right. \qquad (3)$$

To illustrate the advantages of the proposed approach to the co-deployment of quantitative and qualitative approaches, an application on a healthcare establishment is presented in the following section.

3 Results

Recall that the condition of using the mixed assessment of PSC requires the evaluation of PSC in a healthcare establishment. In this regard and to illustrate the use of this method, we will consider a study realised by Boughaba et al. (2019) where PSC has been evaluated using the HSOPSC questionnaire. According to these authors, this study is the only one carried out so far in Algeria on the quantitative evaluation of PSC.

The responses from the dissemination of the questionnaire on professionals in the studied establishment made it possible to obtain the results provided in Figure 3. Recall that the responses on the survey from hospital professionals are recorded on a 5-point scale ranging from (5) strongly agreeing to (1) strongly disagreeing. Scores 4 and 5 are considered "positive" in relation to SC, score 3 is "neutral" and scores 1 and 2 are considered "negative" in relation to SC. The dimensional score is obtained by dividing the total number of positive answers to questions in this dimension by the total of the answers to these questions:

$$S_{D_i} = \frac{np_i}{N_i} \ ; \ i = 1, ..., 10 \qquad (4)$$

with: S_{D_i} being the score of the *i*-th dimension of SC, np_i is the number of positive responses for this *i*-th dimension and N_i is the total number of responses for this *i*-th dimension including positive, negative and neutral responses.

The results of the scores of the ten dimensions provided by Figure 3 show that only three dimensions among the ten dimensions are above the threshold relating to the developed PSC. These are dimensions five, ten and one that have the following scores: 78.5%, 77.3% and 76.3%.

These results, although they highlight the problematic dimensions (Figure 3 and Table 3), do not allow us to estimate the level of maturity of the studied healthcare establishment.

Table 3   Scores of PSC dimensions

Dimension	Score
Dim_1. Overall perceptions of patient safety	76.3
Dim_2. Frequency of reporting adverse events	56.1
Dim_3. Supervisor/manager expectations and actions promoting safety	66.4
Dim_4. Organisational learning-continuous improvement	68.1
Dim_5. Teamwork within units	78.5
Dim_6. Communication openness	24.3
Dim_7. Non-punitive response to error	27.2
Dim_8. Staffing	14.3
Dim_9. Management support for patient safety	57.9
Dim_{10}. Teamwork across hospital units	77.3

Figure 3   Quantitative assessment of PSC in an Algerian healthcare establishment
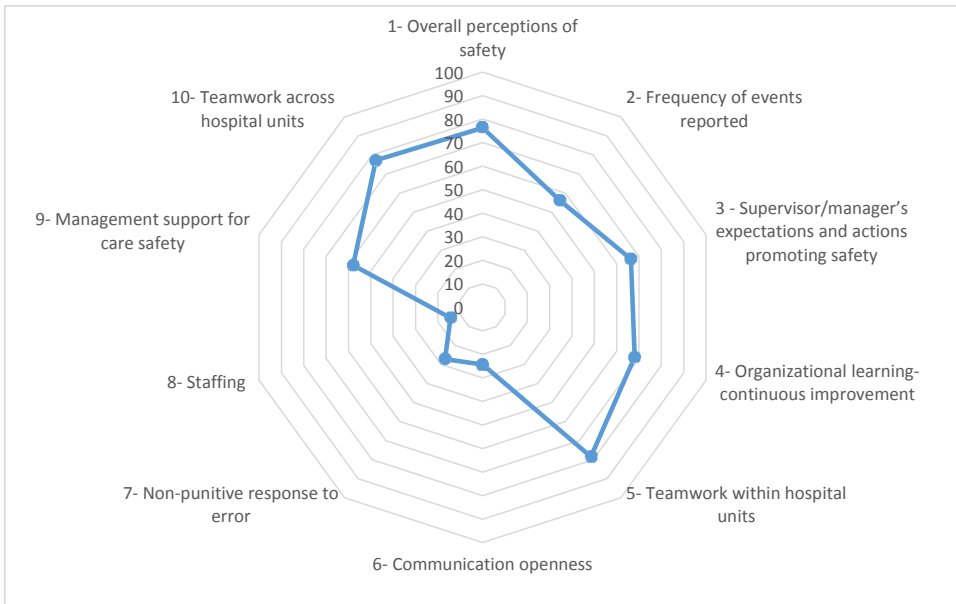
With the dimensional scores of the hospital studied being determined, the co-deployment of the two PSC approaches consists in asking the experts to provide their assessments in terms of their preferences for the scenarios in Figure 2.

Note that the use of experts makes it possible to purify the tree of scenarios in Figure 2 to reduce it only to scenarios deemed more credible. In this regard, seven experts from the academic and medical fields were consulted to provide their preferences on the twelve scenarios in Figure 2. Table 4 provides the results obtained from this consultation where the aggregation of experts' opinions has enabled us to retain the following five scenarios: {Sc_1, Sc_4, Sc_7, Sc_{10}, and Sc_{12}}.

Table 4 Experts' appreciation results for plausible scenarios for the co-deployment of PSC approaches

Scenario	Experts							Mean appreciation
	1	2	3	4	5	6	7	
Sc_1	1	0.9	1	0.7	0.8	1	0.9	**0.9**
Sc_2	0.2	0	0.1	0.1	0.2	0.1	0	0.1
Sc_3	0.2	0.1	0.1	0	0.2	0.1	0.2	0.1
Sc_4	0.4	0.6	0.7	0.9	0.6	0.7	0.8	**0.7**
Sc_5	0	0.1	0.3	0.2	0.3	0.1	0.4	0.2
Sc_6	0.2	0.3	0.4	0.1	0.2	0	0.2	0.2
Sc_7	0.5	0.4	0.8	0.9	0.4	0.5	0.7	**0.6**
Sc_8	0.2	0.3	0.1	0.1	0.2	0.1	0.3	0.2
Sc_9	0.3	0.4	0.1	0.5	0.2	0.1	0.3	0.3
Sc_{10}	0.8	0.9	0.8	0.6	0.7	0.6	0.9	**0.8**
Sc_{11}	0.4	0.5	0.4	0.7	0.2	0.6	0.2	0.4
Sc_{12}	1	0.9	0.8	0.9	1	0.7	0.8	**0.9**

With reference to the characteristics of the two PSC assessment approaches (Table 1), we deduce the following quantifications of PSC maturity levels:

- The pathological level is equivalent to the dimensional scores belonging to the interval [0–0.5[;

- The reactive and calculative levels correspond to the dimensional scores belonging to the interval [0.5–0.75];

- The proactive and generative levels correspond to dimensional scores belonging to the interval]0.75–1].

The quantification of obtained maturity levels is capitalsed in the form of a maturity model for the healthcare establishment retained in this study as an illustrative example of the co-deployment of the qualitative and quantitative approaches (see Table 5).

Table 5 Mapping of PSC dimensions in the form of maturity levels

Maturity level	Dimensions	Array
Pathological	Dim_6, Dim_7, Dim_8	[0–0.5]
Reactive / Calculative	Dim_2, Dim_3, Dim_4, Dim_9	[0.5–0.75]
Proactive / Generative	Dim_1, Dim_5, Dim_7	[0.75–1]

4 Discussion

A first comment relating to the scores of PSC dimensions (Table 5) is that the maturity level of PSC has not reached the generative level. Hence, the obligation to review the

policy of patient safety in a categorical manner in this establishment. The dimensions 'Non-punitive response to error', 'Staffing', 'Communication openness', 'Teamwork across hospital units' are non-developed with respective scores of 24.3%, 27.2% and 14.3% (i.e., pathological type). Therefore, these dimensions must be prioritised in the proposed promotion strategy due to their critical importance to improving patient safety. For example, staff's insufficiency to handle the workload has a direct impact on patient safety (Sabry et al., 2020). In terms of 'communication openness' and 'Non-punitive response to error', respondents gave negative feedback on the latter three dimensions that are considered essential for assuring patient safety. Hence, the NHS is characterised by a blame culture where professionals are sanctioned for errors (Fourar et al., 2020).

In addition, the dimensions 'Frequency of reporting adverse events', 'Supervisor/ manager expectations and actions promoting safety', 'Organisational learning-continuous improvement' and 'Management support for patient safety' are considered as underdeveloped and found to be of the calculative type. Thus, management must show commitment to safety issues and establish a reporting system that favours open communication and learning opportunities from adverse events. This will help the organisation in its efforts to reach the generative type and establish a sustainable patient safety.

Therefore, managers are urged to implement an action plan essentially focused on: (i) facilitating PSC development (i.e., commitment of top management to improve PSC as well as the strengthening of communication and the information flow) and (ii) strengthening PSC through rewards and punishments consistent with behaviours at work. In the latter case, it is important to guide PSC promotion measures by improving the physical environment and working conditions, adjusting working hours and recognising individual initiatives.

A second comment is that the maturity levels are deduced from the scores of each PSC dimension. Hence, the quali-quantitative evaluation of PSC. In addition, the advantage of presenting the levels in this form is that it indicates, from a PSC level, the possibilities offered to reach the highest level (developed). In other words, the co-deployment of PSC constitutes a real decision-making tool for PSC promotion within hospitals by acting in an optimised manner on the problematic dimensions.

5   Conclusion

The purpose of the mixed assessment of PSC is to overcome the limits of the dimensional approach and to provide a framework for a quantitative deduction of PSC maturity levels. It consists of using the obtained dimensional scores for the quantitative assessment of PSC maturity levels. The merit of this approach is that it serves as a decision-making tool for promoting PSC. Likewise, the contributions of this approach are multiple. For example, the possibility of including all the maturity levels that are mentioned in other models. Another contribution is that we project as a perspective for this study, to frame the evaluation of PSC maturity by the ISO 45001 standard and more particularly by the use of the "Relevant of PSC levels / Opportunities" and "Power / Influences of Stakeholders" grids. Indeed, and in addition to internal stakeholders (managers and workers), it is appropriate to integrate external stakeholders in the evaluation of PSC (public authorities, patients, customers and suppliers, etc.)

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