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# Cross-cultural adaptation and validation of the Hospital Survey on Patient Safety questionnaire for a Chilean hospital

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## Abstract

**Background** Hospital Survey on Patient Safety version 2.0 (HSOSPS 2.0) from the Agency for Healthcare Research and Quality enables hospitals to gather the information needed to evaluate the patient safety culture within their institution. However, version 2.0 has not been widely implemented in Chile. This study aims to customize and validate the original HSOSPS 2.0 for a Chilean hospital.

**Methods** Translation and cross-cultural adaptation, content validity through a group of experts, and a pilot test with cognitive pretest were applied to 259 participants from the nursing team in 11 hospital services to study construct validity and reliability.

**Results** In the current study, a version of the questionnaire adapted to the Chilean cultural context showed excellent content validity with an index of 0.982 (S-CVI). After conducting exploratory factor analysis, a new model with 7 dimensions and 23 questions was proposed, down from the original 10 dimensions and 32 questions. This new model explains 71% of the variability. The model's goodness of fit indicators were CFI=0.995, TLI=0.994, and RMSEA=0.048. The results of McDonald's Omega showed high overall reliability with 0.9325.

**Conclusions** This study provides a validated measurement instrument that contributes to improving patient safety conditions at the level of the hospital nursing team in highly complex establishments in Chile. However, the dimensions, such as the number of items, were reduced. This questionnaire can be used in future nursing research by expanding the sample among health professionals in Chile.

**Relevance to clinical practice** Applying this version of the questionnaire will be highly beneficial for clinical administrators and nursing staff. It will improve their care practices and promote patient safety in public hospitals in Chile, as well as assist in enhancing nursing policies.

**Keywords** Validation study, Patient safety, Quality of health care, Nurses

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## Background

Patient safety has become one of the main priorities of health systems worldwide after the publication of various studies confirming that health care is a significant source of harm [1]. Specifically, the report *To Err is Human* [2] highlighted the causes and consequences of adverse events related to health care in the United States, stating that the problem is not the people who work in health care but the unsafe system where these people work.

The World Health Organization (WHO) points out that more than 40% of the 56 million deaths that occur each year could be preventable, with patient safety and adverse events being on the list of factors associated with them. Adverse events range between 12.7-14.2%, producing 16.8 million injuries annually in hospitalized patients. The main adverse events identified in the different health systems are adverse reactions to medications, thromboembolism, surgical wound infections, vascular and urinary catheters, pressure ulcers, nosocomial pneumonia and falls [3].

In Chile, a study of the annual incidence of adverse events conducted in 2009 in 32 Chilean hospitals found that 6.7% of hospital discharges presented adverse events related to health care, mostly associated with procedures and medications. This same study indicates that more than 85% of these events are considered preventable [4]. The occurrence of adverse events and their impact on the economy of health systems indicate that in the United States of America alone, medication errors cause at least one death per day and damage to approximately 1.3 million people per year and a global cost of US\$ 42 billion per year, that is, almost 1% of global health expenditure [5].

With this, the World Health Organization (WHO) initiated prevention studies and strategies to improve patient safety.

The Chilean health system is a mixed care system that includes public and private insurance. The public system is financed with taxes, providing free or subsidized care to those who cannot afford private health insurance [6]. The Carlos Van Buren Hospital is a public health, care, and teaching institution integrated into the Valparaíso - San Antonio Health Service network. It provides its health services to the community through a multidisciplinary team with highly complex specialized services, outpatient and inpatient. With an assigned population of 544,887 inhabitants aged 0 to 90 years or older, it is a reference center in neurosurgery, neuroradiology, and oncology.

In Chile, the National Health Strategy of the Ministry of Health (MINSAL) proposes four health objectives for the decade 2021-2030, among which it stands out as ensuring the quality of health care, with one of its strategic axes

being the quality of health care in a framework of respect for people's rights [7]. Therefore, it is essential to have validated instruments that measure patient safety culture and analyze organizations' and nurses' commitment to guide decision-making in improving healthcare quality.

In 2019, the Agency for Healthcare Research and Quality (AHRQ) designed and validated the Hospital Survey on Patient Safety version 2.0 (HSOSPS 2.0) public domain questionnaire. The AHRQ recommends its use over version 1.0, created in 2004 since it has only ten dimensions and 32 items v/s 12 dimensions and 42 items of version 1.0 [8]. The new version provides a more focused and direct survey to generate more reliable results. Version 2.0 is widely used internationally and has been validated in different countries such as China [9], Korea [10], Turkey [11], Indonesia [12] or Brazil [13].

This questionnaire allows hospitals to obtain the information necessary to assess the patient safety culture in their institution. However, in Chile, version 2.0 has not been applied; generally, the HSOPS version 1.0 has been applied without being cross-culturally adapted. This is the case of a study that was applied to evaluate the reliability and validity of version 1.0 in a hospital with similar characteristics to the present study [14]. Chile does not have studies that reveal the frequency of adverse events, and the patient safety culture is under development [15]. Moreover, it is necessary to promote the evaluation of hospital safety culture to contribute to continuous quality improvement.

This study's objective is to adapt and validate the original version of the AHRQ HSOPS 2.0 questionnaire for use in a Chilean hospital.

## Methods

### Design and scope

An instrumental study was conducted to adapt and validate the HSOPS 2.0 questionnaire [8] in a Chilean hospital. First, the translation and cross-cultural adaptation of the questionnaire was carried out. Second, the psychometric properties were studied. Specifically, content validity was studied with experts, and construct validity and reliability were analyzed using a cross-sectional study at the Carlos Van Buren Hospital. It is a highly complex hospital center belonging to the healthcare network of the Valparaíso-San Antonio health service that has 526 beds.

### Hospital survey on patient safety

The Hospital Survey on Patient Safety (HSOPS 2.0) comprises 32 items grouped into ten dimensions. These dimensions are D1 Teamwork, D2 Staffing and Work Pace, D3 Organizational Learning-Continuous Improvement, D4 Response to Error, D5 Supervisor,

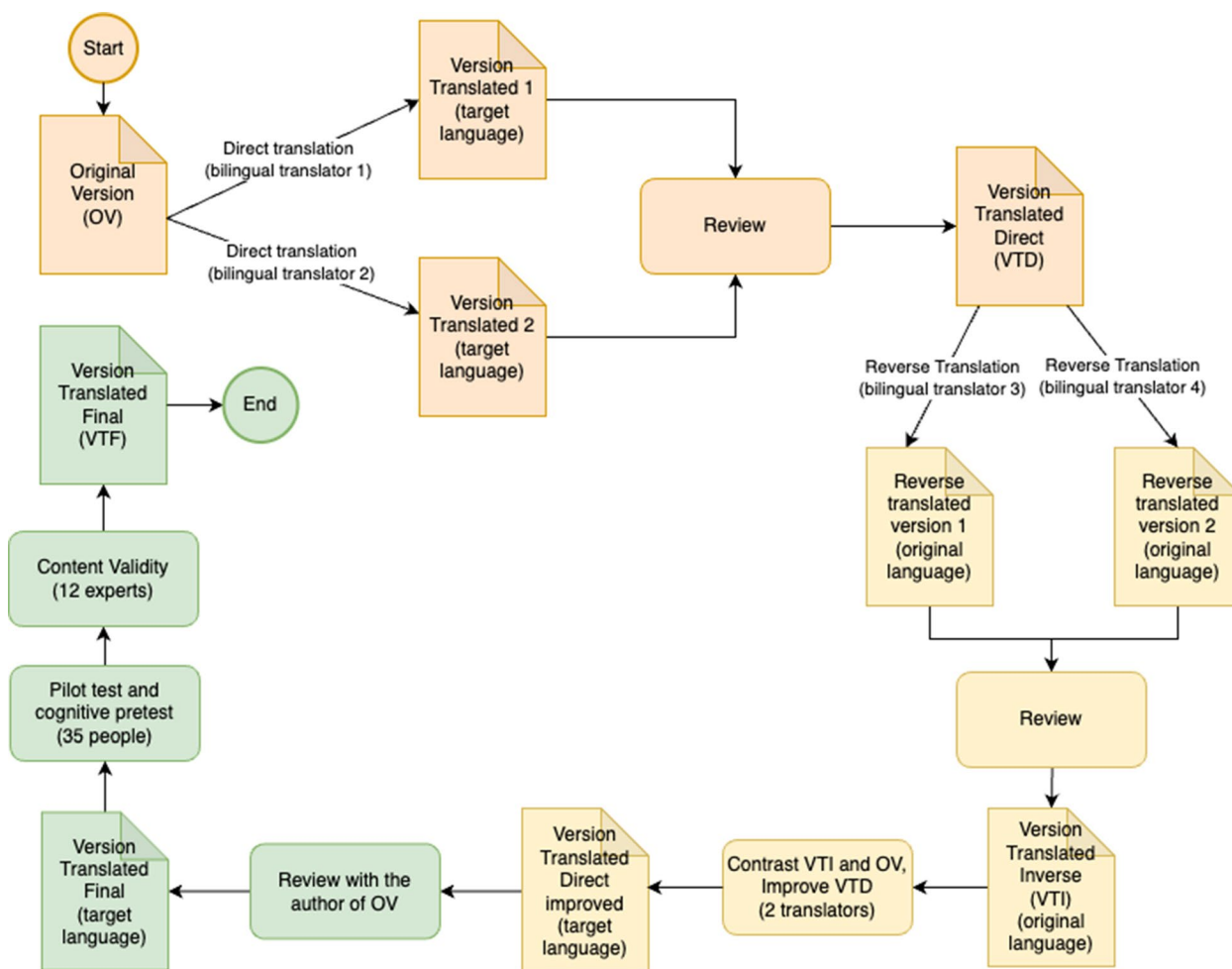
Manager, or Clinical Leader Support for Patient Safety, D6 Communication About Error, D7 Communication Openness, D8 Reporting Patient Safety Events, D9 Hospital Management Support for Patient Safety, and D10 Handoffs and Information Exchange. The original version 2.0 from the United States has good psychometric properties and reliability, measured with Cronbach’s Alpha, which ranges between 0.67 and 0.89 [8]. The HSOPS V2 has been cross-culturally validated and adapted in hospital nurse populations from China [9], South Korea [10], Turkey [11], Indonesia [12] and Brazil [13], always obtaining good results regarding their psychometric properties. The AHRQ provided written permission via email (CRM:00350728) to use the HSOPS 2.0 in English and carry out cross-cultural adaptation to the Chilean population.

**Cross-cultural adaptation and content validity**

The original version of the HSOPS 2.0 was translated in the sequence: direct translation, reverse translation, and final version into the official language of the destination country, following the recommendations of the literature [16]. See Fig. 1 for a detailed translation sequence.

Firstly, the original version (OV) was directly translated independently by two bilingual translators whose mother tongue was the official language of the country of destination, obtaining the translation in the original language into the target language. Subsequently, the researchers and the questionnaire author met to discuss the two translated versions, taking the items from the original version as a reference. At this meeting, a single version translated into the official language of the destination country (VTD) was agreed upon.

Secondly, two bilingual translators whose native language was the language of the country of origin of the questionnaire performed the reverse translation of the



**Fig. 1** Translation sequence from the Original Version (OV) to the Version Translated Final (VTF)

VTD version into the original language of the questionnaire. The process was developed blindly and independently (without knowing the original version). Subsequently, researchers and translators agreed on the reverse translation version (VTI) in a meeting. Finally, each item from the OV and VTI versions was evaluated and compared to look for inconsistencies in the VTI version. Two bilingual people with experience translating health sciences texts developed this step. The pertinent modifications were made to those items of the VTD version, and the item statement was faithfully written in the original language.

Thirdly, the researchers met with the author of the original questionnaire to identify translation alterations and confirm the final translated version (VTF) [17]. Similarly, a pilot test and cognitive pretest were carried out on 35 nurses and nursing assistants to check the questionnaire's understanding, response, coding, duration in time, and functioning [18].

The content validity of the VTF was studied through a group of 12 experts made up of 6 academic nurses with a master's degree and at least five years of teaching experience in healthcare management areas or research and six nurses with at least five years of experience in quality management and patient safety units in the hospital setting. They evaluated the Final Translated Version of the HSOPS 2.0 questionnaire using a 4-level Likert-type scale and provided feedback on the wording. Content validity was evaluated using Polit, Beck, and Owen's methodology, with an Item-Content Validity Index (I-CVI) score of over 0.78, indicating good validity [19]. I-CVI is the proportion of experts giving an item a relevance rating of 3 or 4. Also, the Scale-Content Validity Index (S-CVI) average (also nominated as S-CVI/Ave) was computed for each dimension and the whole instrument. S-CVI is calculated by averaging I-CVI scores for all items on the scale [20]. Two rounds of evaluation were conducted to achieve acceptable levels of content validity. The final version, translated into Spanish, is linked to this article in File 1 Supplementary Material.

### Construct validity and reliability

A cross-sectional study was conducted to determine the construct validity and reliability of the Chilean version of the HSOPS 2.0. The study population comprised nurses and nursing assistants from the Carlos Van Buren Hospital in Valparaíso (Chile). Nursing assistants were included because they are vital members of nursing teams in Chile, working alongside nurses to provide care to patients [21]. In medical-surgical units, they are responsible for delivering basic nursing care to hospitalized individuals, including hygiene and comfort, monitoring vital signs, administering medications, providing oxygen, and

preventing pressure ulcers. They always work under the supervision of the charge nurse.

The sample size was set between 5 and 10 subjects per questionnaire item, according to the recommendations in the literature. As the HSOSP 2.0 questionnaire has 32 items, a sample between 160-320 participants was considered sufficient. Data was collected between May and July 2021 through the Google Forms application sent by email from the hospital's nursing care management subdirector to 370 nursing and nursing assistants employed by the hospital. The online form included the version of the HSOPS 2.0 obtained after content validity. The response period was 60 days, and a weekly reminder was sent. Forms that were not wholly answered were excluded. A total of 259 participants responded to the questionnaire, reaching a ratio of 8 participants for each item [22], an adequate response rate of 70% [23] and reaching a minimum sample of 200 participants necessary to apply factor analysis [24], following the recommendations of the literature. The sample ( $n = 259$ ) consisted of 148 (57.1%) nurses and 111 (42.9%) nursing assistants. 90% ( $n = 233$ ) were women, 9.3% ( $n = 24$ ) were men, and 0.7% ( $n = 2$ ) identified as Others. No questionnaire was excluded. Table 1 presents a complete descriptive analysis of the sample.

Data was collected between May and July 2021 through the Google Forms application sent by email from the hospital's nursing care management subdirector. The online form included the version of the HSOPS 2.0 obtained after content validity. The response period was 60 days, and a weekly reminder was sent. Forms that were not wholly answered were excluded.

Construct validity was analyzed by applying a structural equation model to validate the model of the

**Table 1** Descriptive analysis of sociodemographic variables

	mean	sd
<b>Age</b>	33.85	9.9
	<b>n</b>	<b>%</b>
<b>Sex</b>		
Woman	233	90.0
Man	24	9.3
Other	2	0.7
<b>Profession</b>		
Nurse	148	57.1
Nursing Assistant	111	42.9
<b>Years working in the Hospital</b>		
Less than 1 year	65	25.1
From 1 to 5 years	115	44.4
From 6 to 10 years	38	14.7
11 or more years	41	15.8

original instrument, composed of 32 items grouped into ten dimensions, with data from the Chilean cultural context [25]. The Diagonally Weighted Least Squares (DWLS) estimator was used as ordinal variables were involved. The overall fit of the model was evaluated using the chi-square ( $\chi^2$ ;  $\chi^2/df \leq 2$ ) [26] and the goodness-of-fit indicators Comparative Fit Index ( $CFI > 0.95$  indicates good fit) and Tucker Lewis Index ( $TLI > 0.9$  indicates good fit) to compare the existing model with a null model.

Additionally, Root Mean Square Error of Approximation ( $RMSEA < 0.6$ ; considered acceptable) and Standardized Root Mean Residual ( $SRMR < 0.08$  considered acceptable) were used to confirm whether the sample fit the proposed model [25]. Furthermore, the collinearity between the dimensions was studied with the covariance matrix.

Because the adjustment of the original model did not obtain satisfactory values, the search for a modified structure began, for which it was decided to perform an exploratory factor analysis. To ensure that the data met the assumptions required for this procedure, the Kaiser-Meyer-Olkin (KMO) test was used for the instrument, and each variable, an overall Measure of Sampling Adequacy (MSA) value close to 1, suggests that factor analysis would be useful because correlations between variables are strong. Also, variables with MSA lower than 0.8 were removed since they show weak correlations with the other variables. Additionally, Bartlett's Test of Sphericity was used to determine whether the variables were sufficiently correlated to perform a factor analysis.

With these improvements in the original data, exploratory factor analysis was conducted to observe how the items were grouped into different factors or dimensions. The number of factors was determined with a parallel analysis [27]. A threshold of +1 factors was also considered according to the recommendations of Lim and Jang [28]. Factor loading was explored using the polychoric correlation matrix between items since they were ordinal variables. A factor loading greater than 0.3 points was considered to maintain an item in a particular dimension [24]. Finally, the new factor structure was confirmed by running a new structural equation model on the same sample. Reliability was studied with McDonald's Omega for categorical variables (adequate reliability if  $\omega > 0.8$ ) [29]. Statistical analysis was performed with R statistical software version 4.0.5. The Laavan package version 0.6-9 was used for the analysis of Structural Equations [30], the psych package for the factor analysis [31], and the semTools package for reliability analysis [32].

### Ethical considerations

The study was favorably evaluated by the scientific, ethical committee of the Valparaíso San Antonio Health Service in Chile on August 21, 2019, with record 04/2019, and by the deontological commission of the Universitat Jaume I on September 13, 2019, with file CD /43/2019. In addition, the ethical considerations provided in Law 20,585 on access to public information in Chile [33] and the principles of the Declaration of Helsinki [34]. Both the expert evaluators and all the nursing team participants electronically signed the informed consent, previously clarifying that their participation was completely voluntary and anonymous.

### Results

The results are detailed in three subsections: translation and cross-cultural adaptation, content validity, and construct validity and reliability.

#### Translation and cross-cultural adaptation

The items that required greater consensus due to the differences produced in the translation stages could be consulted in supplementary material Table S1. A brief comment on the solution adopted is indicated.

In the process of cultural adaptation, carried out by the group of consulted experts, nine items were modified, considering the suggestions of the cultural interpretation of some words or terms, in addition to the form of wording, for example, of written questions in negative that have a particular connotation in the Chilean population (See Table S2 in supplementary material). After this process, the final version of the HSOPS 2.0 was obtained, translated, and adapted to the Chilean context. The wording of the items, grouped into categories, can be consulted in Table 2.

#### Content validity

The HSOPS 2.0 obtained excellent overall content validity with a S-CVI=0.982. Similarly, all dimensions obtained S-CVI higher than 0.94. Table 2 presents global content validity results by dimensions and items. It is observed how all the items obtained an I-CVI greater than 0.78, with universal agreement (ICVI=1) in 81.3% ( $n = 26$ ) of the items. Similarly, five of the ten dimensions also gain universal agreement.

#### Construct validity and reliability

The goodness-of-fit indicators of the structural equation model indicated that the original structure of the questionnaire was no better than a model with 0 variance ( $\chi^2/df \leq 2.26$ ,  $CFI = 0.781$  and  $TLI = 0.741$ ). In addition, the model's residuals were analyzed to

**Table 2** Content Validity Index for each item (I-CVI) and Scale Content Validity Index (S-CVI) for each dimension

Item	Description	I-CVI
Dimension 1: Teamwork (S-CVI = 1.00)		
A1	In this unit, we work as a team efficiently.	1.00
A8	In this unit, we work collaboratively, independent of the existing workload.	1.00
A9	The members who work in this unit treat each other with respect.	1.00
Dimension 2: Pressure and work pace(S-CVI=0.94)		
A2	In this unit, we have enough staff to do all the work.	1.00
A3	In this unit, the staff has the ability to perform adequately in patient care.	1.00
A5	In this unit, there are temporary or permanently floating personnel.	0.92
A11	The work rate of this unit puts patient safety at risk.	0.83
Dimension 3: Organizational learning (S-CVI = 0.97)		
A4	This unit regularly review work processes and protocols to determine if changes are necessary to improve patient safety.	1.00
A12	In this unit, changes made to improve patient safety are periodically evaluated to see how well they are working.	1.00
A14	In this unit, the same problems that affect patient safety are allowed to continue to occur.	0.92
Dimension 4: Response to errors (S-CVI=1.00)		
A6	In this unit, staff perceive that their errors are taken into account when making a decision or granting a benefit.	1.00
A7	In this unit, when an incident is reported, the report focuses on the problem and not the personnel	1.00
A10	When staff make mistakes, this unit focuses more on learning from them than finding blame.	1.00
A13	In this unit, there is a lack of support for staff involved in errors that affect patient safety.	1.00
Dimension 5: Communication and receptivity (S-CVI=0.97)		
B1	My supervisor considers staff suggestions that seek to improve patient safety.	1.00
B2	My supervisor wants us to work faster during times of greatest demand, regardless of whether this means breaking protocols.	0.92
B3	My supervisor takes action to resolve patient safety issues that have been reported to him or her.	1.00
Dimension 6: Communication regarding errors(S-CVI=1.00)		
C1	We are informed about adverse events that occur in this unit.	1.00
C2	When there is an adverse event on this unit, we look at ways to prevent it from happening again.	1.00
C3	In this unit, we are informed about improvement decisions that are made based on the reported adverse events.	1.00
Dimension 7: Communication and receptivity (S-CVI=1.00)		
C4	In this unit, staff report if they see something that could harm the patient's care.	1.00
C5	When the staff of this unit sees that someone of higher authority is doing something that compromises the patient's safety, they report it.	1.00
C6	When this unit staff makes a report, authorities are open to hearing your observations and concerns regarding patient safety.	1.00
C7	The staff of this unit asks questions without fear when they observe a situation that compromises the patient's safety.	1.00
Dimension 8: Report events related to patient safety (S-CVI=0.96)		
D1	Think about your unit/work area. When an error is identified and corrected before the patient is affected. How often is it reported?	1.00
D2	Think about your unit/work area. When an error affects the patient without causing harm. How often is it reported?	0.92

**Table 2** (continued)

Item	Description	I-CVI
Dimension 9: Support given by administrators for patient safety (S-CVI=0.97)		
F1	The hospital’s mission demonstrates that patient safety is paramount.	0.92
F2	Hospital management provides human capital, material, and financial resources necessary to improve patient safety.	1.00
F3	Hospital management is interested in patient safety after an adverse event occurs.	1.00
Dimension 10: Transfer and exchange of information (S-CVI=1.00)		
F4	When transferring patients from one unit to another, information related to patient safety is omitted.	1.00
F5	During shift changes, information about patient care is lost.	1.00
F6	During shift changes, there is sufficient time to exchange all information relevant to patient care.	1.00

determine what percentage of the variance could not be explained by the model in the sample studied. It was observed that the model did not fit the data (RMSEA = 0.089; SRMR = 0.102). The details of the values of each item can be consulted in Table S3 of the supplementary material.

Because it was not possible to confirm that the original questionnaire structure was better than a model with zero variance (See supplementary material for details), an exploratory factor analysis was run. Previously, items A5, A6, A11, A13, A14, B2, F4, F5, and F6 were eliminated from the original version adapted to the Chilean context after running the KMO test because they had MSA values lower or equal to 0.8 (see also polychoric correlations in supplementary material Figure S1). After this improvement, the resulting dataset shows adequate for factor analysis since the KMO value for the instrument is 0.91. Also, Bartlett’s Test suggests that variables are sufficiently correlated ( $\chi^2 = 3958.921$ ,  $df = 496$ ,  $p$ -value < 0.001). Additionally, Table 3 presents a descriptive analysis of items to analyze their distribution.

The exploratory factor analysis grouped the 23 items into seven factors that explained 71% of the variance. Figure 2 shows the factor loading diagram with seven factors.

Factor F3 explained 14% of the variance and grouped all the items (A1, A8, and A9) of the original dimension D1 “Teamwork” and two of the four items (A7 and A10) of the original dimension D4 “Response to Error”. Factor F4 explained 13% of the variance and grouped the same items (C1, C2, and C3) as the original dimension D6, “Communication About Error”. Factor F5 explained 11% of the variance. It grouped two items (B1 and B3) from the original dimension D5 “Supervisor, Manager, or Clinical Leader Support for Patient Safety”, in addition to items A12 and C6 that in the original instrument were in dimension D3 “Organizational Learning-Continuous

**Table 3** Descriptive analysis of items

Item	Mean	SD	Median	Skew	Kurtosis
A1	4.272	0.782	4	-0.962	0.579
A2	2.882	1.193	3	-0.117	-1.095
A3	4.015	0.803	4	-0.742	0.38
A4	4.01	1.01	4	-0.975	0.378
A7	3.738	1.116	4	-0.671	-0.341
A8	4.077	0.908	4	-1.015	0.965
A9	4.226	0.92	4	-1.209	1.05
A10	3.826	1.05	4	-0.712	-0.185
A12	3.774	1.079	4	-0.867	0.257
B1	4.077	1	4	-1.108	0.711
B3	4.062	0.95	4	-1.125	1.087
C1	3.913	0.962	4	-0.725	0.359
C2	4.026	0.922	4	-0.679	-0.224
C3	4.113	0.935	4	-1.053	0.833
C4	4.379	0.696	4	-1.12	1.562
C5	4.21	0.82	4	-0.848	0.413
C6	3.944	1.056	4	-1.012	0.481
C7	4.231	0.869	4	-1.115	0.892
D1	4.169	0.872	4	-0.889	0.315
D2	4.308	0.778	4	-0.915	0.228
F1	3.949	0.842	4	-0.42	-0.49
F2	2.933	1.176	3	-0.061	-0.958
F3	3.441	1.065	3	-0.28	-0.457

Improvement” and in dimension D7 “Communication Openness”, respectively.

Factor F2 explained 9% of the variance and included all the items (F1, F2, and F3) of the original dimension D9 “Hospital Management Support for Patient Safety”. Factor F1 explained 9% of the variance and included all items (D1 and D2) of the original dimension D8 “Reporting Patient Safety Events”. Factor F6 explained 7% of the variance. It included two of the four items (A2 and A3)

of the original dimension D2 “Staffing and Work Pace”, in addition to adding item A4, which was initially found in dimension D3 “Organizational Learning-Continuous Improvement”. Finally, factor F7 explained 7% of the variance and grouped three of four items (C4, C5, and C7) of dimension D7, “Communication Openness” of the original instrument. The factor loading diagram with seven factors can be consulted in Fig. 2.

Of the original instrument’s ten dimensions, dimensions 6, 7, and 8 were precisely preserved. Dimension 1 added half of the items from dimension four, while dimensions 5 and 7 remained the same except for one item that was eliminated or moved to another

dimension. Dimension 2 retained half of its items, dimension three was distributed across other dimensions, and dimension 10 was eliminated. Table 4 presents the results of the exploratory factor analysis.

Subsequently, a new structural equation model was carried out, with the structure that resulted from the exploratory factor analysis, composed of 23 items grouped into seven dimensions (See Table 5). Goodness-of-fit indicators indicated that the proposed model was better than a model with 0 variances (CFI=0.995; TLI=0.994) and that the data adequately fit the model (RMSEA=0.048; SRMR=0.064).

**Table 4** Results of the exploratory factor analysis

Items	Factors						
	F3	F4	F5	F2	F1	F6	F7
A10	<b>0.79</b>	0.10	0.15	0.07	0.02	-0.14	-0.09
A7	<b>0.72</b>	0.14	0.05	0.05	0.04	-0.01	-0.10
A8	<b>0.69</b>	0.10	-0.08	0.05	-0.08	0.10	0.17
A9	<b>0.66</b>	-0.07	0.08	-0.09	0.11	0.08	0.22
A1	<b>0.58</b>	-0.05	0.08	-0.01	0.06	0.34	0.14
C2	0.07	<b>0.86</b>	-0.01	0.05	0.06	0.05	-0.05
C1	0.06	<b>0.78</b>	-0.04	-0.06	0.09	-0.05	0.02
C3	0.00	<b>0.71</b>	0.20	0.00	-0.04	0.05	0.14
B3	0.09	-0.02	<b>0.87</b>	0.06	0.03	-0.03	-0.03
B1	0.17	0.09	<b>0.64</b>	0.04	-0.04	0.05	0.16
A12	-0.09	0.14	<b>0.58</b>	0.05	0.16	0.34	-0.05
C6	0.08	0.21	<b>0.40</b>	0.18	0.01	-0.14	0.23
F1	-0.02	-0.05	0.05	<b>1.00</b>	0.02	-0.05	0.03
F3	0.07	0.24	-0.04	<b>0.55</b>	-0.07	0.25	-0.08
F2	0.17	0.02	-0.01	<b>0.43</b>	0.25	0.26	-0.19
D1	0.03	0.00	-0.01	0.00	<b>1.00</b>	0.02	-0.01
D2	-0.16	0.19	0.09	0.13	<b>0.57</b>	-0.15	0.23
A4	-0.01	0.27	0.20	0.08	0.03	<b>0.60</b>	0.05
A2	0.22	-0.11	0.17	0.02	0.08	<b>0.46</b>	-0.09
A3	0.17	0.00	-0.20	0.25	0.08	<b>0.42</b>	0.23
C5	0.06	0.04	0.09	0.03	0.18	0.08	<b>0.61</b>
C4	0.17	0.28	-0.08	0.12	0.11	0.01	<b>0.45</b>
C7	0.26	0.21	0.14	0.05	0.17	-0.13	<b>0.40</b>
Load <sup>a</sup>	3.41	3.03	2.49	2.11	2.01	1.56	1.63
Pr Var <sup>b</sup>	0.15	0.13	0.11	0.09	0.09	0.07	0.07
Cm Var <sup>c</sup>	0.15	0.28	0.39	0.48	0.57	0.64	0.71
Pr Exp <sup>d</sup>	0.21	0.19	0.15	0.13	0.12	0.10	0.10
Cm Pro <sup>e</sup>	0.21	0.40	0.55	0.68	0.80	0.90	1.00

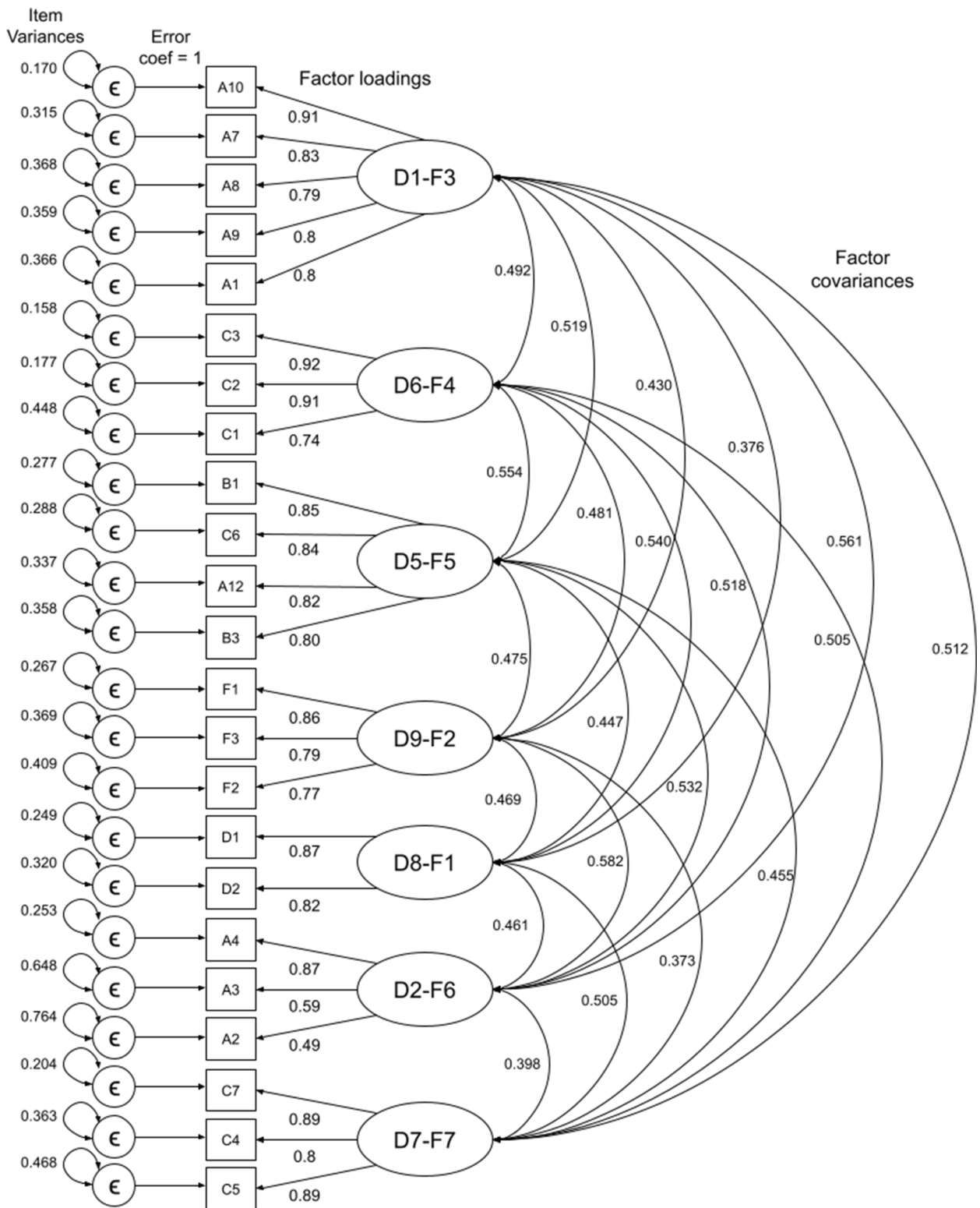
<sup>a</sup> Factor loading

<sup>b</sup>Proportion of variance

<sup>c</sup>Cumulative variance

<sup>d</sup>Proportion explained

<sup>e</sup>Cumulative proportion



**Fig. 2** Path diagram. It includes the variances of each item, the factor loading, and the covariances between factors

**Table 5** Results of the model of parameters (independent variables) in dimensions (latent variables) according to the structure proposed for the HSOPS 2.0 questionnaire adapted to the Chilean population

Factors:	Estimate <sup>a</sup>	Std.Err <sup>b</sup>	z-value <sup>c</sup>	P(>  z ) <sup>d</sup>	Std.all <sup>e</sup>	$\omega^f$
<b>D1F3 = <math>\tilde{\phantom{x}}</math></b>						
A1	1,000				0.796	0.930
A8	0.999	0.038	26,318	0.000	0.795	0.930
A9	1,005	0.040	24,948	0.000	0.800	0.930
A7	1,040	0.038	27,606	0.000	0.828	0.928
A10	1,144	0.040	28,501	0.000	0.911	0.928
<b>D6F4 = <math>\tilde{\phantom{x}}</math></b>						
C1	1,000				0.743	0.930
C2	1,221	0.042	28,950	0.000	0.907	0.928
C3	1,235	0.043	28,948	0.000	0.917	0.928
<b>D5F5 = <math>\tilde{\phantom{x}}</math></b>						
B1	1,000				0.850	0.928
B3	0.942	0.032	29,321	0.000	0.801	0.928
C6	0.992	0.032	30,936	0.000	0.844	0.930
A12	0.958	0.031	30,780	0.000	0.815	0.930
<b>D9F2 = <math>\tilde{\phantom{x}}</math></b>						
F1	1,000				0.856	0.929
F2	0.898	0.039	23,190	0.000	0.769	0.931
F3	0.928	0.038	24,250	0.000	0.794	0.930
<b>D8F1 = <math>\tilde{\phantom{x}}</math></b>						
D1	1,000				0.866	0.930
D2	0.952	0.045	21,362	0.000	0.824	0.930
<b>D2F6 = <math>\tilde{\phantom{x}}</math></b>						
A2	1,000				0.486	0.935
A3	1,221	0.081	15,026	0.000	0.593	0.932
A4	1,780	0.106	16,818	0.000	0.865	0.930
<b>D7F7 = <math>\tilde{\phantom{x}}</math></b>						
C4	1,000				0.798	0.930
C5	0.914	0.035	26,019	0.000	0.730	0.930
C7	1,118	0.039	28,661	0.000	0.892	0.930

<sup>a</sup> Estimate indicates the estimated value of each parameter.

<sup>b</sup> Std. Err. indicates the standard error for each model parameter.

<sup>c</sup> z-value is the Wald statistic that is calculated by dividing the estimated value by the error.

<sup>d</sup> P(> |z|) is the p\_value when testing the null hypothesis that the value of the parameter is equal to zero in the population.

<sup>e</sup> Std.all is the standardized value of each parameter, which includes the standardization of latent variables, also called "all-standardized solution"

<sup>f</sup> Reliability value if the item is deleted

Furthermore, the goodness-of-fit indicator  $\chi^2/df = 1.46$  ( $p < 0.001$ ) also confirmed the model's validity. Figure 2 presents the model using a path diagram that includes item variances, factor loading, and factor covariances.

The results of McDonald's Omega indicated a high overall reliability of the instrument ( $\omega = 0.9325$ ). Cronbach's alpha was also calculated for comparison with other studies ( $\alpha = 0.9313$ ). The validated HSOPS 2.0

instrument adapted to the Chilean population, with the items' wording grouped into new categories, can be consulted in Table S4 of the supplementary material.

## Discussion

This research is based on a nursing population and uses a method similar to previous translation and cross-cultural adaptation studies. Experts validate the translations; some words are modified or removed to fit the

Chilean context. For instance, the term “manager” is eliminated from dimension five, unlike the Brazilian study that keeps it. In dimension 2, we differ from the South Korean study, where they removed an item that does not apply to their context.

This study achieved excellent results in the S-CVI indicator, similar to studies in Turkey and Indonesia. Regarding per-item content validity, the I-CVI indicator of this study was in the range of 0.83 and 1.0, similar to the South Korean study [10], where I-CVI ranged between 0.8 and 1.0. However, negatively formulated items were detected that caused more significant discussion or disagreement among the experts, similar to what was reported in the study carried out in Peru [18] in the cross-cultural adaptation of the HSOPS 1.0 version, which could be a reflect of the culture installed in Chile and Latin America of interpreting answering these questions as “accusing” a peer or superior, causing the participant not to respond or provide a neutral response, despite being an anonymous survey.

As a result of this, the positive wording of the items mentioned in Table 2 is modified or adjusted: item A9 “There is a problem with disrespectful behavior by those working in this unit” to “The members who work in this unit treat each other with respect”, item A3 “Staff in this unit work longer hours than is best for patient care” by “In this unit, the staff can perform adequately in patient care”, item A5 “This unit relies too much on temporary, float, or PRN staff” for “In this unit there is temporary or permanently floating personnel”, item A6 “In this unit, staff feels like their mistakes are held against them” for “In this unit the staff perceives that their errors are taken into account when making a decision or grant a benefit”.

The study’s construct validity stage was challenging as the original instrument’s structure did not yield satisfactory results. A new HSOPS 2.0 structure was proposed, eliminating nine low-correlation items and adjusting the remaining 23 into seven dimensions. In a previous study for Kosovo, the dimensions reduction was also proposed for version 1.0 [35].

The most remarkable modification in this study was dimension 10, “Handoffs and Information Exchange”, which was eliminated because the items that comprised it (F4, F5, F6) had low correlation with the other instrument items. Previous studies, such as Brazil’s [13], did not eliminate this dimension but did report a low internal consistency indicator (Cronbach’s alpha = 0.50). Even when handoffs and information exchange are crucial in care nursing to guarantee patient safety [36], the wording of these items is related mainly to communication, an aspect already measured in new dimension 5, “Communication and receptivity”, in which communication is

evaluated to guarantee an opportune exchange of information for the patient safety.

The same occurs with dimension 2, “Staffing and Work Pace” which eliminates two of the four items in our proposal and adds an item from another dimension (D3). Dimension 2 reported a low value of Cronbach’s alpha in the studies from Brazil ( $\alpha = 0.41$ ) [13] and South Korea ( $\alpha = 0.61$ ) [10]; even in the original version in English, this value is less than 0.7 ( $\alpha = 0.67$ ).

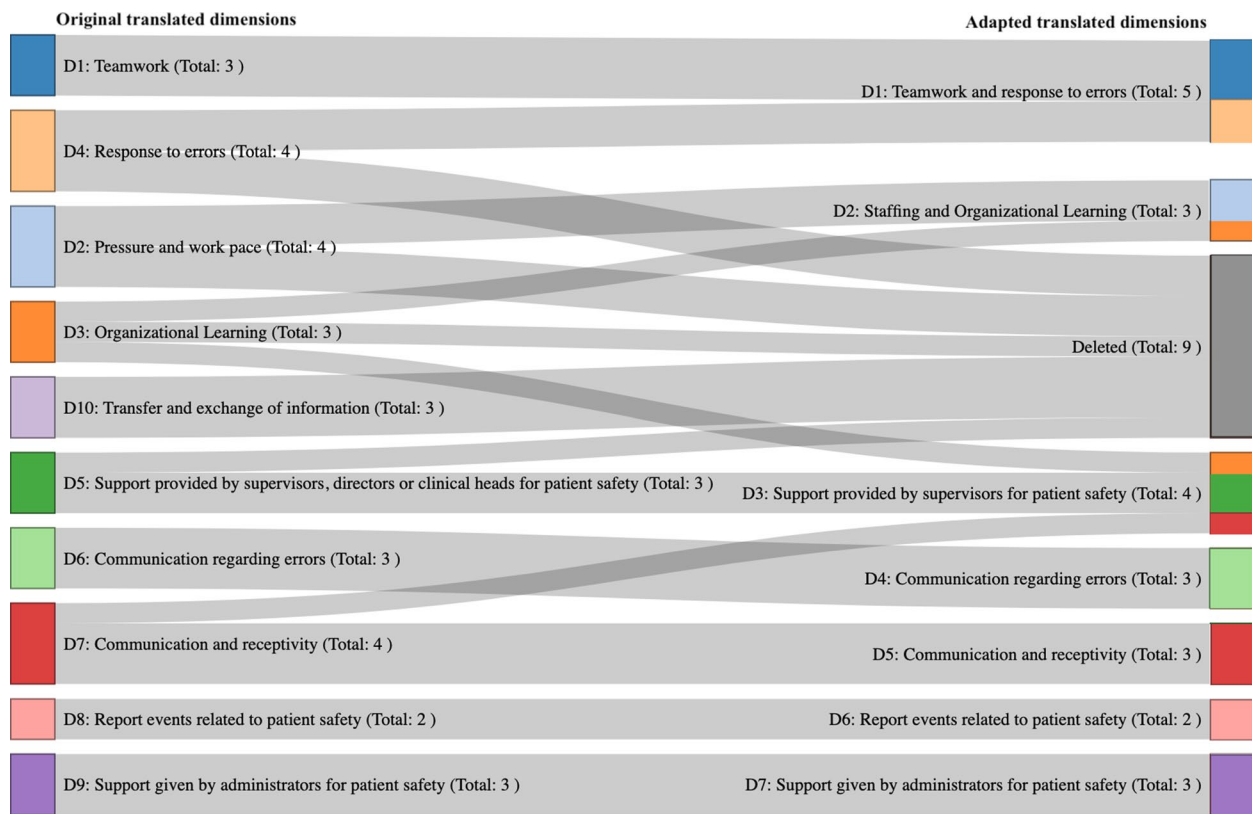
In dimension 5, “Supervisor, Manager, or Clinical Leader Support for Patient Safety”, where our study proposes eliminating one item and adding two items from other dimensions (D3 and D7), it was also reported with a non-optimal consistency ( $\alpha = 0.68$ ) in the Chinese cross-cultural adaptation study [9].

Given the fusion of dimension 1 with dimension 3, the proposed structure renamed dimension 1 “Teamwork and response to errors”. Dimension 2 was also renamed “Staffing and Organizational Learning”, given the inclusion of an item from the original dimension 3. Finally, dimension 5 was renamed “Support provided by supervisors for patient safety”. Dimensions 6, 7, 8, and 9 retained their names. All dimensions were renumbered to ensure clarity; see Fig. 3 for a detailed illustration of how original dimensions migrated to new ones. This detail is also presented in Table 6 (See Table S4 in the supplementary material for redaction items grouped by new dimensions.)

Each item’s movement from one dimension to another or deletion, statistically substantiated, was also carefully reviewed to ensure that the central aspect of the original dimension was preserved even when some of them were also modified in their wording for adaptation to Chilean culture and to indicate in some cases, the fusion of original dimensions in new ones.

The new dimension structure could reflect, in one aspect, the need to improve the original instrument (based on the discussed low indicators of reliability of some dimensions in the original and the adapted instrument to Brazil) or, on the other hand, it could be due to the cultural aspects of the Chilean population, previously discussed mainly associated with possible fear of authority or incommmodity to point out negative aspects.

Some limitations force us to consider these results cautiously. On the one hand, using a randomized sample would benefit future studies, as the current sampling method was non-probabilistic and based on convenience. Also, the results may not be generalizable since the survey was carried out in a single hospital in Chile and focused solely on nurses and nursing assistants as the study population. The data was collected online during the COVID-19 pandemic, which may have influenced the quantity and quality of responses. Still, future research



**Fig. 3** Sankey diagram of items from original translated dimensions (D) composing new adapted translated dimensions. Total indicates the number of items

**Table 6** Movement of items from Original to Adapted Dimensions. Detail of items and quantity (N)

Original dimension	Adapted dimension	Items	N
D1: Teamwork	D1: Teamwork and response to errors	A1, A8, A9	3
D2: Staffing and work pace	D2: Staffing and Organizational Learning	A2, A3	2
D2: Pressure and work pace	Deleted	A5, A11	2
D3: Organizational Learning	D2: Staffing and Organizational Learning	A4	1
D3: Organizational Learning	D3: Support provided by supervisors for patient safety	A12	1
D3: Organizational Learning	Deleted	A14	1
D4: Response to errors	D1: Teamwork and response to errors	A7, A10	2
D4: Response to errors	Deleted	A13	2
D5: Support provided by supervisors, directors or clinical heads for patient safety	D3: Support provided by supervisors for patient safety	B1, B3	2
D5: Support provided by supervisors, directors or clinical heads for patient safety	Deleted	B2	1
D6: Communication regarding errors	D4: Communication regarding errors	C1, C2, C3	3
D7: Communication and receptivity	D3: Support provided by supervisors for patient safety	C6	1
D7: Communication and receptivity	D5: Communication and receptivity	C4, C5, C6	3
D8: Report events related to patient safety	D6: Report events related to patient safety	D1, D2	2
D9: Support given by administrators for patient safety	D7: Support given by administrators for patient safety	F1, F2, F3	3
D10: Transfer and exchange of information	Deleted	F4, F5, F6	3

with a larger sample size is needed to validate the Chilean version. Finally, HSOPS 2.0, adapted to Chile, doesn't collect information about "Handoffs and Information Exchange", so other mechanisms should be used to measure the omission and loss of information.

Despite these limitations, the study's results are relevant since no validated questionnaire was identified in Chile to study safety culture, and few Latin American countries have validated instruments for this purpose [37]. Additionally, in Chile, quantifying patient safety and understanding the factors determining its magnitude is essential to address the commitments made in the 2005 Health Reform, promulgated and ratified in the 2020 - 2030 health objectives. Therefore, the version of the Hospital Survey on Patient Safety 2.0 will be an essential initial contribution to improving the patient safety culture in Chile.

It is recommended that the results of this study be used in two ways: first, by applying the fully translated and adapted HSOPS 2.0 to Chile with excellent content validity indicators but insufficient construct validation results (10 dimensions - 32 items), it can be consulted in the file 1 of the supplementary material. The second option is to apply the HSOPS 2.0 adapted to the Chilean population, with 23 items grouped into seven dimensions, where solid validation of the construct was demonstrated, which can be consulted in file 2 of the supplementary material.

## Conclusions

According to the study's objective, a version of the Hospital Survey on Patient Safety 2.0 was adapted and validated for a Chilean hospital. The Spanish version for the Chilean context has 7 dimensions and 23 items, down from the original English version, which had 10 dimensions and 32 items.

Cultural, social, and health system factors can affect nurses' perception of safety culture, leading to questionnaire modifications. Future studies will require a more diverse and broader sample of health professionals in Chile to advance the HSOPS 2.0 questionnaire's reliability and validity analysis.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12912-024-02409-7>.

Supplementary Material 1.

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## Authors' contributions

PHA participated in the conceptualization, investigation, validation, and writing. MRG participated in data curation, formal analysis, writing, and review-editing. VMGC participated in supervision, methodology, writing, and review-editing.

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## Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## Declarations

### Ethics approval and consent to participate

The study was favorably evaluated by the scientific, ethical committee of the Valparaíso San Antonio Health Service in Chile on August 21, 2019, with record 04/2019, and by the deontological commission of the Universitat Jaume I on September 13, 2019, with file CD /43/2019. Both the expert evaluators and all the nursing team participants electronically signed the informed consent, previously clarifying that their participation was completely voluntary and anonymous.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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