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Measuring patient safety culture in Chinese hospitals using the Hospital Survey on Patient Safety Culture (HSOPSC)

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Abstract

Background: Patient safety issues have received widespread attention all over the world. Measuring patient safety culture is an important part to manage and improve patient safety.

Objective: The purpose of this research is to test the validation of the Hospital Safety on Patient Safety Culture (HSOPSC) scale in the Chinese healthcare setting.

Method: This study used a sample of 2465 from a medical group. The following analysis methods were employed to understand the validity of the HSOPSC scale and the patient safety culture issues in the medical group: Exploratory Factor analysis (EFA) was performed to examine the applicability of the factor structure of the original questionnaire to the HM Hospital Group data. Two-sample T test and One-way ANOVA for discrimination according to variable conditions and Pearson's correlation also were conducted to understand the patient safety issues in Chinese hospitals.

Result: This study indicates towards a 7-factor model instead of the 10-dimenion HSOPSC scale. This study also identifies some cultural issues of using SPOPSC in Chinese hospital setting which will compromise the applicability of this instrument.

Conclusion: Cautions should be taken when using SPOPSC in Chinese hospitals. In addition, measuring patient safety culture in Chinese hospital per se is challenging due to the national culture.

Key Word: patient safety culture, hospital survey on patient safety culture, influential factors, measurement tool

JEL Classifications: General (M0)

Resumo

Antecedentes: As questões de segurança do paciente têm recebido atenção generalizada em todo o mundo. Medir a cultura de segurança do paciente é uma parte importante para gerenciar e melhorar a segurança do paciente.

Objetivo: O objetivo desta pesquisa é testar a validação da escala Hospital Safety on Patient Safety Culture (HSOPSC) no ambiente de saúde chinês.

Método: Este estudo usou uma amostra de 2.465 de um grupo médico. Os seguintes métodos de análise foram empregados para entender a validade da escala HSOPSC e as questões da cultura de segurança do paciente no grupo médico: A análise fatorial exploratória (EFA) foi realizada para examinar a aplicabilidade da estrutura fatorial do questionário original ao HM Hospital Group dados. O teste T de duas amostras e a ANOVA de uma via para discriminação de acordo com as condições variáveis e a correlação de Pearson também foram realizados para compreender as questões de segurança do paciente em hospitais chineses.

Resultado: Este estudo indica um modelo de 7 fatores em vez da escala HSOPSC de 10 dimensões. Este estudo também identifica algumas questões culturais do uso do SPOPSC em ambiente hospitalar chinês que irão comprometer a aplicabilidade deste instrumento.

Conclusão: Cuidados devem ser tomados ao usar HSOPSC em hospitais chineses. Além disso, medir a cultura de segurança do paciente no hospital chinês per se é um desafio devido à cultura nacional.

Palavra-chave: cultura de segurança do paciente, pesquisa hospitalar sobre cultura de segurança do paciente, fatores influentes, ferramenta de medição

Classificações JEL: Geral (M0)

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1 Introduction

1.1 Research background

In recent years, with the frequent occurrence of injuries and deaths in healthcare, patient safety has become a topic of global concern (Patel & Wu, 2016).

Patient safety refers to taking necessary medical services to prevent bad results or mistakes, including errors, deviations and accidents (Olsen, 2017). However, there is evidence that patient safety issues were not well controlled worldwide. The World Health Organization report pointed out that the number of deaths caused by medical errors has exceeded the 80% leading causes of death in humans (WHO, 2005). On average, 10% of patients was affected by a medical error, and 14% of patients affected by medical errors died. According to the World Health Organization one in 10 patients is injured while receiving hospital care, and 14 out of 100 hospitalized patients are affected by nosocomial infections (WHO, 2017).

Safety culture can be defined as the overarching but emergent healthcare property where professional attitudes and work climates result in system reliability and resilience to adverse outcomes (Gartshore et al., 2017). Due to factors related to patient safety, healthcare systems around the world have been taken many measures to improve patient safety, such as strengthening medical staff's knowledge through training on patient safety, formulating various guidelines, and adopting advanced information technology. There is evidence that the constructing of a patient safety culture could improve patient medical services' safety, change medical staff's attitude and value orientation towards patient safety, and fundamentally improve patient safety. Hospital culture and patient safety are interrelated as organizational failures, and system-driven errors contribute to the unintended events that produce poor quality outcomes (Maryam et al., 2018).

The measurement of patient safety culture has been widely carried out for a long (Sorra & Naomi, 2010). In China, patient safety issues are an important cause of medical disputes and violence (Wu & Wu, 2018). and the research on patient safety culture in China started late. So far, the studies of patient safety culture have been limited and there is no matured measurement scale to measure patient safety culture in Chinese hospital setting.

1.2 Research purposes

Against the above background, the primary purpose of this study is to test the validation of the Hospital Survey on Patient Safety Culture (HSOPSC), a widely used patient safety culture scale developed in the West in the Chinese healthcare setting. By so doing, this study will fill this gap in the literature and allow healthcare settings in the Chinese patient safety culture to know where to improve and initiate more study on patient safety culture in China.

Assessing the situation of patient safety culture is regarded as the first step to improving the safety culture situation (Yao, 2020). In this study, The Hospital Safety on Patient Safety Culture (HSOPSC) scale was used to evaluate the patient safety culture of a hospital group. HSOPSC was chosen because its measurement is specific. The result analysis has a unified quantitative standard, which is more conducive to medical settings identifying their safety management advantages and subscales to be improved. This study targeted HM hospital group, a hospital group with five hospitals and several clinicians. The study provided an opportunity to assess the shared beliefs of healthcare staff about patient safety culture, identify subscales of patient safety that need to be improved, and evaluate the effectiveness of relevant interventions. The evaluation results of patient safety culture will help create a strong safety culture and strengthen staff's attention to patient safety culture.

1.3 Thesis structure

The dissertation is structured as follows: chapter two reviews relevant literature on patient safety culture; chapter three will introduce the methodology; chapter four will present the findings and results; this study will discuss these findings and conclusion in chapter five.

2 Literature review

This study first reviewed the definition, characteristics, and functions of patient safety culture. Then, we summarized the status of patient safety culture research and expounded the significance of patient safety culture research to ensure patient safety.

2.1 Patient safety and patient safety culture

Patient safety means that there will be no damage to the patient's mental and physical defects or death (Sorra, 2004). Schein (1985) proposed that patient safety is to protect patients from accidental injury. Ensuring patient safety requires medical settings to establish standardized procedures and systems to minimize the possibility of errors (negligence, implementation, or planning errors) and prevent them to the utmost extent (Cooper et al., 2000).

Scholar (Gui et al., 2015) also proposed that patient safety refers to the necessary measures taken in medical services to avoid or prevent adverse results or errors, deviations and accidents. However, such a definition method can only reflect patient safety results and cannot comprehensively suggest correcting the existing safety situation. World health organization (WHO) published a research report on the international classification of patient safety obtained by the expert team after a three-year study (WHO, 2005). The report defined patient safety as a risk control process that reduces unnecessary healthcare-related harm to the lowest acceptable level. This concept includes broad meanings. It indicates that patient safety is a risk control process, not just a result (Wang, 2012). At present, China has been using this definition published by the WHO.

Patient safety culture was usually defined as the typical attitude and value trend of all employees in the organization toward patient safety issues (Sorra, 2004). Leadership, organizational learning, teamwork, reporting of adverse events, and patient safety culture assessment can reflect the status of the organization's safety culture. That also can improve the baseline data of the provider in patient safety for the organization. Tan et al. (2018) proposed the following five safety culture characteristics: 1) Smooth information: Managers know the organization's status, and grassroots employees are willing to report various significant and

minor errors 2) Be vigilant at all times: The organization maintains a high degree of vigilance and closely monitors the occurrence of various unexpected situations 3) Fairness: Even for unacceptable mistakes, the organization does not hold individuals accountable, forming a culture of no punishment 4) Flexible: The organization responds quickly to changes in the external environment 5) Continuous learning: The organization pursues improvement and is ready to learn new knowledge at any time.

Eline (2020) re-summarized the characteristics of safety culture that contains four primary characteristics: First, reporting: An atmosphere in which employees are willing to report abnormal events and approximate errors is formed. Second, just culture: in an atmosphere of mutual trust, but at the same time, it is necessary to make unmistakable which behaviors are acceptable. Employees were encouraged and even rewarded to provide necessary safety-related information. However, it is also necessary to draw a clear line between acceptable behaviors and unacceptable behaviors. Third, flexible: refers to the organization's ability to adjust management strategies promptly according to changing circumstances. Fourth, learning: The willingness and ability to draw correct conclusions from the security information system and make significant reforms when necessary. By comparing the different understandings of the safety culture characteristics between the two, a combination of a system view and a non-punitive culture.

In summary, safety culture improves the safety of the entire system. A good safety culture can fundamentally reduce the occurrence of unsafe incidents.

2.2 Measurement tools of patient safety culture

Measuring safety culture is an important strategy for improving patient safety and quality of healthcare, and safety culture is most frequently measured using a survey.

2.2.1 Comparison of measurement tools for patient safety culture

There are mainly the following four Patient Safety Culture Instrument (PSCI) scales in the world. Among different kinds of PSCI scales, the more mature and widely used measurement

tools are the Hospital Survey on Patient Safety Culture (HSOPSC), Safety Attitudes Questionnaire (SAQ), Patient Safety Climate in Healthcare Organizations (PSCHO), Manchester Patient Safety Framework (MaPSaF). These four measurement tools will mainly be introduced the characteristics as follows:

The Hospital Survey on Patient Safety Culture (HSOPSC), developed by the Agency for Healthcare Research and Quality (AHRQ) in 2004, is widely used internationally. The 42-item HSOPSC1.0 is a self-administered questionnaire that assesses 12 subscales of a healthcare organization's safety culture from the perspectives of hospital staff. In 2019, the AHRQ released a revised version of the survey, the HSOPSC 2.0, comprising 32 items across ten subscales. The thirty-two survey items are grouped into ten factors groupings of two or more survey items that assess the same areas of patient safety culture. Ten subscales are communication about error, communication openness, handoffs and information exchange, hospital management support for patient safety, organizational learning continuous improvement, reporting patient safety events, response to error, staffing and work pace, supervisor, manager, or clinical leader support for patient safety and teamwork.

For construct validity, Chen & Li (2010) used the principal component analysis extraction method and the Varimax rotation method, the total variance explained by the 12 factors covered by HSOPSC was 61.57 percent (KMO =0.868, p = 0.000). According to Fleming (2006), the reliability expressed as Cronbach's α for the AHRQ data ranged from 0.63 to 0.84. Smits et al. (2008) used exploratory factor analysis (EFA) and extracted 11 factors. The evaluation structure of HSOPSC is more specific, focusing on evaluating patient safety culture. Chinese scholar (Li & Liu, 2009) introduced the HSOPSC1.0 into China. Researchers have reported HSOPSC 's strong correlations among safety culture, adverse event frequency, and patient outcomes (Yao, 2020). The subjects of the assessment are medical staff, and the scale has a wide range of applications worldwide (Chen et al., 2017). HSOPSC focuses on evaluating of hospital safety culture, which is conducive for medical settings to clarify the advantages of their safety management and provide an improved basis for promoting a safety culture. The evaluation structure of HSOPSC was so detailed that there were unified quantitative standards for analysing of measurement results. However, there are some misunderstandings in the literature. Scholar (Wang, 2012) believed that the accuracy of the data in the subscale of 'Frequency of

Events Reported' was very biased. Furthermore, under the Chinese cultural background, it is difficult for subjects to accurately understand the difference between 'agree' and 'strongly agree', leading to deviations in the measurement results. The AHRQ recommends that the HSOPSC 2.0 should be used to measure patient safety culture instead of the original version HSOPSC 1.0 (Sorra, 2019).

Safety Attitudes Questionnaire (SAQ) was developed by Sexton et al. (2006). There are different versions of the SAQ, including adaptations of the survey for the intensive care unit, surgery, emergency department (ED), pharmacies, ambulatory care and so on (Clay et al., 2019). Although varieties of the SAQ can include up to 60 items, a minimum of 30 items to assess all six subdomains as follows: teamwork climate (six items), safety climate (seven items), job satisfaction (five items), stress recognition (four items), perceptions of management (four items) and working conditions (four items) (Sexton et al., 2006). Using the Likert 5 level scoring method, an average score of 75 (total 100) indicated a positive safety culture atmosphere. Reliability and validity measurement results showed that its combined reliability was .90, and Cronbach's α coefficient was .74 to .93 (Deilkas & Hofoss, 2008). Chen et al. (2017) randomly selected Shanghai hospitals to evaluate 211 clinical nurses. As a result, the Cronbach's α coefficient of each subscale of the scale was .72 to 0.85, and the overall Cronbach's α coefficient was .89. The correlation coefficient between each item and the overall scale was 0.66 to 0.84. The SAQ production process was rigorous, and SAQ had good reliability and validity, suitable for investigation of safety attitude of hospital nurses. Multiple measurement versions and a general simplified version have been developed for medical links such as intensive care unit, operating room, emergency department, outpatient department, delivery room and patient ward (Sexton et al., 2006). In Taiwan, Jiang et al. (2015) revised the SAQ; then the revised SAQ had 24 items in 5 subscales, showing good measurement characteristics. However, SAQ focuses on evaluating the safety attitude perception of medical staff rather than explicitly targeting safety culture (Fleming, 2006). As a tool for evaluating patient safety culture in medical settings, the survey population is limited. The status quo reflected by the survey results is relatively one-sided, which brings certain restrictions applying the scale.

Patient Safety Climate in Healthcare Organizations (PSCHO) was compiled by Singer et al. (2007). The PSCHO survey was developed as part of a Stanford-based patient safety research

program sponsored by the AHRQ (Singer et al., 2007). Constructs demonstrated substantial convergent and discriminant validity. Cronbach's α coefficients ranged from 0.50 to 0.89. The reliability and validity of the PSCHO scale were good. The original version of PSCHO had 82 items, and Singer et al. (2007) later modified it to include nine subscales with 38 items covering unit factors, individual factors, organizational factors and additional factors. The percentage problematic response (PPR) was used to reflect the organization's safety culture status.

The lower the PPR, the more positive the safety culture (Singer et al., 2007). There were too many versions of PSCHO. Hartmann et al. (2008) pointed out that there were significant differences between different versions. The advantage of PSCHO is that it requires the weighting of all scale data, which reflects the severe scale data processing. Nevertheless, PSCHO's disadvantage was that the item arrangement was relatively chaotic, leading to a messy structure of the evaluation results, which was not conducive to the scale data analysis (Hartmann et al., 2008). Although there are specific differences in the evaluation results among the various versions of PSCHO, the design of result processing by PSCHO is quite scientific. The analysis emphasizes the weighting of the data to reduce sampling bias and reflects the rigor of data statistics. In addition, compared with other questionnaire analysis methods, PSCHO presented the evaluation results with the question response rate, highlighting the problems of safety culture (Jiang et al., 2015). In response to PSCHO's shortcomings, Singer et al. suggested that any new items should be added to the end of the instrument to minimize differences in survey versions (Singer et al., 2007).

The Manchester Patient Safety Framework (MaPSaF) was compiled by Parker (2009) of the University of Manchester in the United Kingdom (U.K.). At first, MaPSaF was only conducted in primary medical settings in the U.K. Later, through the National Patient Safety Agency (NPSA), multiple versions were modified and developed. In order to apply to different medical departments, MaPSaF was widely promoted and applied in the British National Health Service (NHS) in 2006 (Parker, 2009). MaPSaF was built based on of two theoretical viewpoints in safety culture research: 1) Organizational culture existed in all organizations and was constantly evolving 2) Safety culture may be expressed through safety-related factors in the organization. Based on these two theoretical, a two-subscale matrix evaluation structure has been developed: the horizontal was pathological, reactive, calculative, proactive and generative

total five evolution stages. The vertical was a quality commitment, patient safety first, patient safety incident attribution & reporting, personnel management, security incident investigation, communication openness, organizational learning, security training & education and teamwork total nine evaluation subscales (Kirk et al., 2009). MaPSaF has been currently the only patient safety culture measurement tool based on qualitative research. Its advantage is that medical staff can recognize the multi-faceted attributes and dynamic safety culture changes more clearly. It can also unearth deep-level information of cultural connotations, and it can also unearth deep-level information of cultural connotations. Its characteristics can clarify the change, develop the patient safety culture trend, and provide valuable management suggestions for the measurement unit. The National Patient Safety Center established by the British NHS has made multiple versions of MaPSaF and applied it to the British healthcare system. MaPSaF reflects the dynamics and variability of the development of safety culture and can more specifically and accurately reflect the status quo of safety culture, but due to its dynamics, practical operation convenience is insufficient (Nie et al, 2013).

Compared with other tools, HSOPSC 2.0 scale measurement structure is so detailed that it is more conducive to medical settings to clarify their safety management advantages and improve subscales. In addition, AHRQ also provides measurement questionnaires and instruction manuals as well as a regular update. The rich database facilitates the comparative analysis of measurement results in different medical institutions. The database was established in 2007, and survey data of HSOPSC has been regularly collected and released every year. In addition, another significant advantage of this scale is that it evaluates the cultural subscales related to patient safety from the hospital level and the department level. This multi-level approach provides a certain degree of specificity and is a handy tool that can guide the level of intervention to improve patient safety culture (Sorra, 2019).

In summary, there are varying degrees of differences in the characteristics of each tool measurement, and each has its advantages and disadvantages. When the scales are used in different cultural contexts, the measurement performance needs to be further validated.

2.2.2 The use of HSOPSC in several countries with different cultural backgrounds

HSOPSC 2.0 includes ten subscales, a total of 32 items. In addition, there are two single items to measure the number of incident reports in the past 12 months and the overall level of the department. The items in the questionnaire include positive statements and negative statements. The answering method adopts the Likert five-level scale scoring method. The items were equally rated on a 5-point scale ranging from 1 (Strongly disagree) to 5 (Strongly agree), with higher scores indicating higher patient safety scores. The subscale score is the score of the item to which it belongs on average. Each subscale and item need to calculate the positive response rate (positive response rate/number of responses). The positive reaction rate of the subscale higher than 75% is regarded as the advantageous subscale, and the negative reaction rate of the subscale lower than 50% is regarded as the recessive subscale. At present, HSPOPSC has been translated into nearly 27 languages and used in more than 59 countries, some of which have carried out psychometric measurements after the introduction of HSOPSC (Zhang, 2020).

Researchers (Sorra & Naomi, 2010) analyzed the data of 50513 samples from 331 hospitals and 2267 departments to test the psychometric characteristics of HSOPSC. The results showed that all items indicated good discriminations and responsiveness. No item had a positive interview rate greater than 90%. The rate of missing data was also low, ranging from 1% to 8%. All the item factor loadings of item were above .40, ranging from .59 to .92, with an average above 0.7, with good reliability .63 to .84, with an average of .77, only the ‘Staffing’ Cronbach's alpha coefficient was lower than .7. In short, all the results suggested that the HSOPSC of each subscale and item showed good psychometric characteristics among the individual level, department level, and hospital level.

Smits (Smits et al., 2008) and others analyzed the data of 583 samples in 4 hospitals in the Netherlands to test the psychological measurement characteristics of the Dutch localized HSOPSC through exploratory factor analysis (EFA), confirmatory factor analysis, and internal consistency reliability. Smits et al. (2008) analyzed the 12-factor model of the scale by confirmatory factor analysis, and the results showed that the fit with the actual data was not ideal. Afterwards, the exploratory factor analysis (EFA) extracted 11 factors, which also showed good structural validity.

In order to explore the possibility of introducing HSOPSC to Japan, Shigeru et al. (2013) used the Japanese HSOPSC to survey 6,395 medical staff and analyzed the reliability of HSOPSC in Japan. Confirmatory factor analysis showed sufficiently high standard partial regression coefficients. The internal consistency coefficient of each subscale ranged from .46 to .88. The structural validity of each subscale was tested. The results showed that the factor structure of the Japanese HSOPSC was consistent with the original scale. The Japanese HSOPSC has acceptable internal consistency and structural validity.

Imcqc (2011) used Iran's HSOPSC to analyze data from 420 samples in an affiliated hospital of a university in Iran and tested the psychometric characteristics of the HSOPSC. The reliability and validity of the scale showed that the factor loadings of all the problems are acceptable and factors explained a total of 77.8% variance. Cronbach' α coefficient ranged between 0.57 and 0.80. Iran HSOPSC with 12 subscales was effective and reliable to measure patient safety culture.

Dutch expert Alquwez (2018) surveyed 3779 subjects from 45 hospitals. The 'Teamwork Within Units' scored the highest among all subscales, and the 'Handoffs & Transitions' also scored higher than other subscales except the 'Teamwork Within Units'. Due to various professional learning content and clinical work content is not the same, different medical staff' understanding of patient safety are different. It suggested that medical institutions uniformly conduct patient safety culture training for medical staff to form awareness of patient safety culture.

2.3 Application of HSOPSC in China

HSPOPSC was first introduced to China by Li & Liu (2009), and a survey of 472 nurses in a hospital was conducted. The total Cronbach' α coefficient of the scale was .889. Then Zhou (2011) applied the Chinese version of HSOPSC to 832 nurses in a hospital. The total Cronbach' α coefficient of the scale was .896. Exploratory factor analysis (EFA) revealed a total of 12 factors, and 12 factors could explain the total of 67.29% variance. Xiang (2012) used the Chinese version of HSOPSC to conduct a patient safety culture survey on 535 nursing staff in 7 hospitals in Guangzhou. After testing, the scale's total Cronbach' α coefficients was .853, and

the Cronbach' α coefficient of subscales were between .653 and .921, with good internal consistency. Meng & Sheng (2007) used HSOPSC to investigate and compare the nursing safety culture of secondary and tertiary hospitals in Shanghai. The results showed that the weaknesses were mainly in the Staffing subscale and Feedback and communication about error subscale. Taiwan scholar Chen et al. (2017) used HSOPSC to investigate the patient safety culture of 42 hospitals in Taiwan. The results showed that the subscale with the lowest positive response rate was the 'Staffing'. At the same time, this study paid particular attention to the findings of the regional cultural background. Zhou. (2011) used HSOPSC to conduct a large-scale patient safety culture survey in China, covering 32 hospitals in 15 cities. However, two subscales ('Frequency of events reported' and 'Handoffs & Transitions') were deleted in the survey process due to sensitivity issues. Then, the positive response rate of other subscales (except the former two subscales) in China was higher than the results of the U.S. Xiang et al. (2012) used HSOPSC to investigate the patient safety culture of nursing staff in Guangzhou's hospitals. The total Cronbach' α coefficients of the scale were .63 to .84. The results showed that there was a human shortage of nursing staff in Guangzhou's hospitals. Besides, 'Feedback and communication about error' results in Guangzhou hospital were consistent with the 'Feedback and communication about error' result in Shanghai hospital.

In China, scholars mainly focused on nursing relationship research. For example, Chen et al. (2017) explored the perception of nursing patient safety culture. In China, study by Li & Liu (2009) have focused on the status of the patient safety culture of nurses. This study described the advantaged subscales, and subscales need to be improved. Nurses have more opportunities to communicate with patients and have more time to devote to medical care than other categories of medical staff. Sun et al. (2017) explored the relationship between patient safety culture and the psychology of ICU nurses. Hu et al. (2018) explored the compassion of ICU nurses and their awareness of patient safety culture. However, there were few reports on the research on the overall relationship between patient safety culture and all categories of medical staff.

2.4 Influencing factors of patient safety culture

Study (Zhou, 2011) have shown that the demographic profile of medical staff had a particular impact on patient safety culture. By analyzing the influence of the demographic profile of medical staff on the patient's safety culture, it can be found that the factors that have a more significant impact on the patient's safety culture. Finding the significant effective factors in patient safety culture can provide a basis for hospital managers to conduct a targeted intervention. Through the review of previous studies, it is found that demographic profile has an impact on patient safety culture in the following aspects:

2.4.1 Unit/work area

Unit/work area is an essential factor that affects patient safety culture. Study by Lin et al. (2017) have shown that nurses in different unit/work areas have differences in the total score of patient safety culture. Jiang et al. (2015) also found that different unit/work areas have different influences on the score of patient safety culture when exploring the influential factors. Unit/work areas with fast-paced, arduous, and high pressure have lower patient safety culture scores (Kumb, 2020). In the research results of Lin et al. (2017), the highest patient safety score is in the outpatient unit area, and the lowest score of unit areas are obstetrics and gynecology.

2.4.2 Hospital tenure

Xiang et al. (2012) found that working years was negatively correlated with the patient safety culture score. Zhou (2011) surveyed nurses in a hospital, and the study showed that nurses who worked in the hospital for less than or equal to one-year patient safety culture scored higher. Study (Morello et al., 2013) showed that 54.12% of nurses with a low age were a high-risk group for unsafe medical events. Nurses who had worked for less than a year made nursing mistakes. 52.83% of errors were unsafe medical incidents. Therefore, most studies have classified the number of years of work and conducted a separate study on staff with a working experience of ‘less than or equal to one year’ as a single factor to explore the impact of different years of work on patient safety culture scores.

2.4.3 Work hours

Work time is also an essential factor related to patient safety culture score. Study (Zhou, 2011) have shown that the patient safety culture score of staff who work less than 8 hours one day is higher than those who work more than 8 hours' patient safety score. Hamdan (2018) used the patient safety culture total score as the dependent variable and statistically significant items as independent variables for multiple linear regression analysis. The results showed that the longer the weekly working hours promoted the low patient safety culture scores.

2.4.4 Interaction with patients

Whether to have direct contact with patients also has a particular impact on patient safety culture. The patient safety culture scores in the 'Staffing' and other direct contact patient group subscales are higher than the patient safety culture scores of the indirect contact patient group (Lu et al., 2016). It shows that direct contact with patients may also be an influencing factor of patient safety culture. Staff who contacted patients with different frequencies had statistical differences in each subscale and overall patient safety culture scores (Lin et al., 2017). Medical staff who frequently communicate with patients have higher patient safety culture scores than medical staff who do not have direct contact with patients (Lin et al., 2017). Explain the staff in directly contact with patients can better understand and cooperate with the relevant systems and policies issued by the managers. Provide a good promotion atmosphere for the organisation's patient safety and the department and provide timely information for some medical errors. A better solution is that when the work process needs to be changed, the medical staff who are in direct contact with the patient can effectively consider the patient's safety.

2.4.5 Staff position

Study (Xu, 2009) showed that different staff positions have different perceptions of patient safety culture, and nurses have better perceptions of patient safety culture than physicians. According to the results of Nie et al. (2013), nurses scored higher than physicians in terms of the 'Teamwork Within Units'. There are differences in the patient safety culture scores of

different staff positions. The scores from high to low are nurses, medical technicians, pharmacy, physicians (Liao, 2017). However, in Fu's study, staff position did not affect the patient safety culture score (Fu et al., 2021). If the staff position impacts patient safety culture, scores should be taken into consideration in this study.

Other factors also have an impact on patient safety culture. There are statistically significant differences in patient safety culture scores in different education backgrounds (Ding, 2019). The results showed that the higher the educational background, the higher the patient safety culture scores (Ding, 2019). It showed that the higher the educational background, the higher the risk prevention awareness, and the stronger the clinical management ability. Some factors have no impact on patient safety culture. Study (Zhou, 2011) have shown no significant correlation among gender, marital status and patient safety culture.

3 Methodology

3.1 Participants

This research targeted staff who were working in a privately-owned medical group. The privately-owned medical group was called HM Hospital Group in China. The medical group included five urban hospitals (Beijing, Shanghai, Guangzhou, Tianjin, and Qingdao city) and several clinics. Additional details regarding staff position, unit/work area and other demographic profiles are presented in Table 4.1. A total of 2465 completed questionnaires were collected from HM Hospital Group. HM Hospital Group upholds the modern hospital management philosophy and is committed to providing personalized, patient-centered medical services to patients from different countries and regions. After years of development, as one of the well-known comprehensive high-end private medical settings in China, HM Hospital Group operates five urban hospitals and more than ten clinics in China, including more than 500 full-time physicians, more than 1,000 part-time expert teams, more than 1,000 nursing teams, and more than 700 registered hospital beds. The staff participating in this study are officially on duty.

3.2 Procedure

For data collection, in most instances, electronic questionnaires were sent to participants to be answered and later returned to the researcher. Data collection was conducted in HM Hospital Group between December 2020 and January 2021. In most instances, electronic questionnaires were sent to participants to be answered and later returned to the researcher. After the survey, 2465 completed were returned (response rate 99%, the valid samples were 2465). The survey took approximately 5 to 10 min to complete. Participants could cease participation at any point without penalty.

3.3 Measurement

As introduced in 2.2.1, the HSOPSC 2.0 released by the AHRQ comprises 32 items across ten factors and a few demographical questions (Sorra, 2019). This study used translated versions of the scale in two different languages: English and Chinese. For the English version, the original scales were used. Regarding the version in Chinese, since it presents unique idiosyncrasies that may be addressed carefully and due to semantic doubts concerning the translation to Chinese，we decided to use Zhang's Chinese translation (Zhang, 2020). The English and Chinese versions differed only in language, and the professionals corrected the C-HSOPSC version. The HSOPSC 2.0 (Sorra, 2019) assesses safety climate from the staff perspective. HSOPSC was selected as the tool for testing for several reasons: a) Organizations can use it to assess their patient safety culture, track changes over time and evaluate the impact of patient safety interventions b) It had been designed for surveying all hospital personnel (clinical/non-clinical) c) It was considered one of the few healthcare safety climate instruments for which initial psychometric results had been reported d) Benchmark statistics of HSOPSC can be retrieved from the internet e) The questionnaire has been translated into 27 different languages, and it is currently used in more than 59 countries and thus use it will allow for future international comparisons.

Table 3.1 Scoring standard

Point	Agreement	Report frequency	Frequency	Grade
1	strongly disagree	no event reports	never	poor
2	disagree	1 to 2 event reports	rarely	fair
3	neither agree nor disagree	3 to 5 event reports	some-times	goof
4	agree	6 to 10 event reports	most of the time	very good
5	strongly agree does not apply or don’t know	11 or more event reports	always does not apply or don’t know	excellent

The 32 safety culture items in the HSOPSC 2.0 questionnaire are measured on 5-point response scales in terms of agreement (strongly disagree to strongly agree) or frequency (never to always), as well as an option for ‘does not apply or do not know’. There is also two single-item measure that asks respondents 1) to provide an overall rating of patient safety for their unit

(i.e., a patient safety grade) using a 5-point response scale (poor to excellent), and 2) how many patient safety's events they have reported.

To compare the findings between the current survey and the original U.S. survey, the percentage of positive responses for each subscale were calculated as recommended by the tool developers (Sorra, 2019). The positive response rate (number of positive responses/number of responses) must be calculated for each subscale. In all cases, a higher score would indicate a positive response. The positive response rate which is higher than 75% is the advantageous subscale, and lower than 50% is the subscale to be improved.

3.4 Data Analysis

IBMSPSS Statistics version 25 was used for all the statistical analyses. There were no missing values in the data set, as each item had to be responded to before moving on to the next question in the survey.

Only completed surveys were taken into analysis for this research. The survey had a total effective response of 2465. The demographic results were analyzed followed by an exploratory factor analysis (EFA) and a reliability analysis. The reliability of the items that measure the HSOPSC subscales and total were examined by Cronbach's Alpha which should be higher than 0.7 to ensure reliability. Then, the center limit theory (CLT) was used to assess if the study score distribution was normal, a Two-sample T-test and One-way analysis of variance for discrimination according to variable conditions and Pearson's correlation should be taken into consideration.

Descriptive statistical analysis: The variables that obey the normal distribution are described statistically with the $M \pm SD$ deviation according to their distribution characteristics. The overall score of patient safety culture and the positive response rate of each subscale are statistically described. We use percentages to describe each subscale's positive response rate.

Exploratory factor analysis (EFA) clarifies the in-depth connected items and allude in collaboration to a below composite (or factor). Therefore, the items can be lessened to the slightest potential number of understandings that make the most significant potential part of the variance clear.

The Principal Component Analysis (PCA) with varimax rotation was conducted to identify the emerging structure and ascertain if certain items should be removed to ensure construct validity. The construct validity tests if the variables reflect the construct that is supposed to be measured utilizing its structure. After certain items had been removed due to low commonalities, the PCA was conducted again to test their fit. The components and composing items were reviewed and labelled in HSOPSC subscales. The previous labelled HSOPSC subscales were used for this, and those components that did not fit correctly were re-labelled.

Additionally, the reliability test was run once more, targeting the whole instrument and the HSOPSC subscales separately.

One-way ANOVA was used to test the significance of the difference among the means of two or more samples. By analyzing and studying the contribution of the variation of each subscale to the total variation of patient safety culture, the influence of controllable factors on the research results can be determined. The normality assumption of the sample was also verified firstly before the two tests.

Pearson correlation analysis was used to examine inter-correlations among the patient safety subscales. Correlations greater than 0.7 would indicate that the subscales were measuring the same concept, and those subscales could be combined, and some items could be removed.

4 Results

4.1 Demographic Profile

Table 4.1 *Demographic profile of the research object (n=2465)*

Index	Hierarchy	Number (%)	Percent
Staff Position	Physician	370	15%
	Nurse	776	31.5%
	Pharmacist	99	4%
	Other Clinical Providers	174	7.1%
	Administration & Manger	623	25.3%
	FMS Team	331	13.4%
	Other	92	3.7%
Unit/Work Area	Gynaecology and obstetrics	283	11.5%
	Pediatrics	206	8.4%
	Surgery	110	4.4%
	Internal Medicine	147	5.9%
	Emergency	102	4.1%
	Dental	96	3.9%
	Family Medicine	135	5.5%
	Anesthesiology & OR	106	4.3%
	Patient ward	154	6.2%
	Pharmacy	98	4%
	Lab	82	3.3%
	Imaging	72	2.9%
	Administration & Other	874	35.5%
Organizational Tenure	less than 1 year	257	10.4%
	1 to 5 years	1223	49.6%
	6 to 10 years	737	29.9%
	11 or more years	248	10.1%
Work Unit Tenure	less than 1 year	334	13.5%
	1 to 5 years	1361	55.2%
	6 to 10 years	630	25.6%
	11 or more years	140	5.7%
Working Hours per Week	less than 30 hours per week	54	2.2%
	30 to 40 hours per week	1217	49.4%
	more than 40 hours per week	1194	48.4%
Direct contact with patients	Yes	1693	68.7%
	No	772	31.3%

The researcher completed data collection in HM Hospital Group with five hospitals and several clinics in January 2021. According to the research design and the inclusion criteria of the survey subjects (see 3.1 and 3.2).

A total of 2,465 were valid questionnaires recovered, with an effective recovery rate of 99.1%. As mentioned in table 4.1, the presented six domains were examined through a survey, offering an overview of some sociodemographic variables of respondents.

The demographic profile of the research subjects: among the 2465 research samples: there were 31.5% nurses (776), 25.3% administrations and managements (623), 15% physicians (370), 13.4% FMS Team (331, including security, cleaner), 7.1% other clinical providers (174), allied health, dietician, nutritionist, laboratory, pharmacy, radiology, technician), 4% pharmacists (99), 3.7% others (92).

Among the unit/work area, administration & others accounted for 35.5% (874), the gynaecology and obstetrics department accounted for 11.5% (283), Pediatrics accounts for 8.4% (206), Patient wards accounted for 6.2% (154), Internal medicine occupies 5.9% (147), Family Medicine accounts for 5.5% (135), Surgery accounts for 4.4% (110), Anesthesiology & OR occupies 4.3% (106), Emergency department accounts for 4.1% (102), Pharmacies accounted for 4% (98), Dentistry accounts for 3.9% (96), laboratories accounted for 3.3% (82), imaging departments accounted for 2.9% (72).

In terms of organizational tenure, 49.6% (1223) of the staff have worked in the hospital for 1 to 5 years working experience, 29.9% (737) of the staff have worked in the hospital for 6 to 10 years, 10.4% (257) of the staff have worked in the HM Hospital Group for less than 1 year working experience, and 10.1% (248) staff have 11 or more years working experience in HM Hospital Group.

In terms of work unit tenure, staff who have worked in this work area with 1 to 5 years working experience accounted for 55.2% (1361), workers with 6 to 10 years working experience accounted for 25.6% (630), workers with less than 1 year working experience accounted for 13.5% (334), and worker with 11 or more years working experience accounted for 5.7% (140).

In terms of working hours 49.4% (1217) of staff worked 30 to 40 hours per week, 48.4% (1194) of staff worked more than 40 hours per week, and 2.2% (54) of staff worked less than 30 hours per week.

Regarding whether staff had direct contact with the patient, 68.7% (1693) of the staff had direct contact with the patient, and 31.3% (772) did not directly contact the patient.

4.2 Exploratory Factor Analysis

To test the structural validity of HSOPSC, Principal component analysis (PCA) with varimax rotation was conducted to extract items, the items were put into the variable box together and extracted seven factors according to Kaiser´s criterion, the results showed seven factors with eigenvalues>1, indicating the extraction of seven principal components should be conducted. Next the 10 factor analysis with PCA based on original questionnaire is reported before the result of 7 factors.

4.2.1 Results of 10 Factors

For construct validity, we used the principal component analysis (PCA) extraction method and the Varimax rotation method, the total variance explained by the 10 factors covered by HSOPSC was 66.262% percent (KMO = 0.904, $p < 0.000$).

Bartlett´s test (Chi-Square=29829.587, df=496), suggesting appropriateness for factor analysis, and PCA was adequate. The PCA solution included ten components, with 32 items accounting and it seems not to lose too much information. But after the seventh factor, the increasing speed of the explained variance began to slow down, and the 7 factors have already explained 52.70% of the variance. While compared with the original HSOPSC 2.0 scale, the structure of 10 factors showed a poor fit to our data, and some problematic items were found. Even after doing the varimax rotation, there were still a lot of poor items. The items A9, B2, F3, A4, A12, C2, C3, A3, A5, A10, A13, which initially belonged to the original HSOPSC2.0 subscales, were relocated to this study's HSOPSC 10 factor results, showing high loadings greater than 0.50. Similarly, crossed structure and deviations appeared in the Staffing and Feedback and communication about error subscales. For example, item A3 (Hospital

management seems interested in the patient safety only after an adverse event happens.), originally from the Staffing subscales, were excluded based on low factor loadings, and A3 were moved to the Feedback and communication about error. The meaning of these items might indicate a type of staffing shortage. The original part of the management support for patient safety, item F3 (Hospital management seems interested in the patient safety only after an adverse event happens.) also showed high loadings with the 'Handoffs & Transitions' instead.

Moreover, item A9 (Hospital management seems interested in the patient safety only after an adverse event happens.) was not very well represented in this solution, which correlates moderately with both components 4 and 5. Original item A10 (When staff make errors, this unit focuses on learning rather than blaming individuals.) was very weakly correlated with components 10, loading lower than 0.3. It's too low to explain original item A10 for component 10.

Component 1 comprehended five items about some free speech through their work, and it could be named as 'Communication openness'(CO). Component 2 focused on four items regarding consideration by supervisor/manager of employee recommendations to improve patient safety, which is labelled as 'Supervisor/manager expectations and actions promoting patient safety'(SE). Component 3 consists of 4 items targeting important patient care information, is transferred across hospital units and during shift changes and therefore labelled as 'Handoffs and transitions'(HT). Component 4 comprehended five items about the performance of programs and systems in preventing errors, and it could be named as 'Interpersonal communication'(IC). Component 5 focused on 3 items, labelled as 'Teamwork within units'(TU). Component 6 consists of 2 items targeting how often events are reported and labelled as 'Frequency of events reported'(FER). Component 7 comprehended two items about employees' feeling its errors, and incidents reported against them, and it could be named as 'Non-punitive response to error' (NP). Component 8 focused on two staffing and workforce items labelled as 'Staffing'(ST). Component 9 that consists of two items targeting a working environment that promotes patient safety provided by hospital management and therefore labelled as 'Management support for patient safety'(MS). Component 10 consists of two items targeting discuss mistakes openly and therefore labelled as 'Feedback and communication about error'(FC).

Table 4.2 *Rotated component matrix -10 factors*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.059	25.185	25.185	8.059	25.185	25.185	3.671	11.471	11.471
2	2.825	8.828	34.013	2.825	8.828	34.013	2.739	8.558	20.03
3	2.322	7.257	41.27	2.322	7.257	41.27	2.673	8.354	28.384
4	1.502	4.694	45.964	1.502	4.694	45.964	2.61	8.156	36.54
5	1.422	4.443	50.407	1.422	4.443	50.407	2.069	6.466	43.006
6	1.298	4.055	54.462	1.298	4.055	54.462	1.793	5.602	48.608
7	1.098	3.432	57.894	1.098	3.432	57.894	1.631	5.096	53.704
8	0.998	3.119	61.013	0.998	3.119	61.013	1.559	4.872	58.576
9	0.861	2.692	63.705	0.861	2.692	63.705	1.409	4.404	62.979
10	0.818	2.557	66.262	0.818	2.557	66.262	1.05	3.282	66.262
11	0.789	2.466	68.728						
12	0.73	2.283	71.011						
13	0.703	2.198	73.209						
14	0.661	2.065	75.274						
15	0.599	1.873	77.147						
16	0.586	1.833	78.979						
17	0.579	1.811	80.79						
18	0.557	1.74	82.53						
19	0.54	1.689	84.219						
20	0.51	1.594	85.813						
21	0.505	1.577	87.39						
22	0.492	1.539	88.928						
23	0.451	1.41	90.338						
24	0.449	1.403	91.742						
25	0.422	1.317	93.059						
26	0.41	1.281	94.34						
27	0.395	1.236	95.576						
28	0.389	1.217	96.793						
29	0.32	0.999	97.792						
30	0.264	0.826	98.617						

31	0.238	0.743	99.36
32	0.205	0.64	100

Noted. Extraction Method: Principal Component Analysis.

Table 4.3 *Ten factors' total items and subscales factor loadings*

	Component									
	1	2	3	4	5	6	7	8	9	10
C5	0.787									
C6	0.766									
C3	0.760									
C4	0.759									
C2	0.728									
B3		0.733								
A1		0.721								
2										
B1		0.653								
A4		0.610			**0.334**					
F5			0.908							
F6			0.847							
F4			0.837							
F3			0.538							
A1				0.729						
4										
A5				0.658						
A1				0.587						
3										
A9				0.487	**0.468**					
B2		**0.331**		0.479						
A1					0.757					
A8		**0.325**			0.684					
A1		**0.396**			0.569		**0.335**			
0										
D2						0.925				
D1						0.916				

A6			0.847			
A7		**0.388**	0.605			
A2				0.838		
A1		**0.440**		0.599		
1						
F1					0.830	
F2					0.765	
C1	**0.394**					0.611
A3				**0.479**		0.540
C7			**0.327**			-0.381

4.2.2 Results of 7 Factors

The analysis of the construct validity, for example, assessing the links between items and relations between items and an underlying dimension, was made by performing exploratory factor analyses (EFA) to determine the degree of fit between our sample and a hypothesized measurement model. The data adequacy was examined by the KMO test, with a result of 0.894 and Bartlett's test $p<0.001$ (Barlett sphere test value is 27045.780, $df=378$), suggesting appropriateness for factor analysis, and PCA was adequate. According to Kaiser's Criterion, the results showed seven factors with eigenvalues>1. PCA drew the seven factors with 32 items. However, four items (A5, C1, C7R, F3) did not have a sufficient factor loading on any of the factors (all loadings < 0.50) and were eliminated. A5 (This unit relies too much on consultants/temporary staff), C1 (We are informed about errors that happen in this unit), C7R (In this unit, staff are afraid to ask questions when something does not seem right), F3 (Hospital management seems interested in the patient safety only after an adverse event happens). Therefore, the remaining 28 items have been proved to be valid. Lastly, construct reliability and internal correlation were tested to assist in better understanding of the measurement and concept of HSOPSC in China (See 4.3). Construct reliability also indicated the internal consistency of the seven dimensions. Internal correlation, on the other hand, showed the discriminant validity among the seven dimensions. We name each factor according to the characteristics of the item it contains. The result is as follows:

Factor 1: **Teamwork Within Units (TU).** A1, A4, A8, A10, A12, B1, B3, a total of seven items. The content mainly reflects that staff supports each other, treat each other with respect and work together as a team.

Factor 2: **Communication Openness (CO).** C2，C3，C4，C5，C6, a total of five items. The content mainly reflects: Staff freely speak up if they see something that may negatively affect a patient and feel free to question those with more authority.

Factor 3: **Feedback and communication about the error (FC).** A6，A7，A9，A13，A14，B2, a total of six items. The content reflects: staff are informed about errors, are given feedback about changes implemented, and discuss ways to prevent errors.

Factor 4: **Handoffs & Transitions (HT).** F4，F5，F6, a total of three items. The content mainly reflected: important patient care information is transferred across hospital units and during shift changes.

Factor 5: **Frequency of Events Reported (FER).** D1，D2, a total of two items. The content mainly reflected: 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 (Alquwez, 2018).

Factor 6: **Staffing (ST).** A2，A3，A11, a total of three items. The content reflects: there are enough staff to handle the workload, and work hours are appropriate to provide the best care for patients.

Factor 7: **Management Support for Patient Safety (MS).** F1，F2, a total of two items. The content reflects: hospital management provides a work climate that promotes patient safety and shows that patient safety is a priority.

Table 4.4 *Rotated component matrix -7 factors*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.533	26.904	26.904	7.533	26.904	26.904	3.665	13.09	13.09
2	2.587	9.239	36.143	2.587	9.239	36.143	3.415	12.196	25.286
3	2.054	7.336	43.479	2.054	7.336	43.479	3.162	11.294	36.58

4	1.459	5.212	48.691	1.459	5.212	48.691	2.418	8.635	45.214
5	1.405	5.019	53.71	1.405	5.019	53.71	1.769	6.319	51.533
6	1.288	4.599	58.309	1.288	4.599	58.309	1.528	5.457	56.989
7	1.039	3.711	62.02	1.039	3.711	62.02	1.409	5.03	62.02
8	0.895	3.196	65.215						
9	0.834	2.979	68.194						
10	0.78	2.786	70.98						
11	0.687	2.455	73.435						
12	0.628	2.241	75.677						
13	0.59	2.107	77.784						
14	0.559	1.998	79.782						
15	0.542	1.937	81.718						
16	0.515	1.84	83.559						
17	0.512	1.827	85.386						
18	0.496	1.771	87.158						
19	0.465	1.66	88.818						
20	0.453	1.616	90.434						
21	0.432	1.544	91.978						
22	0.414	1.477	93.455						
23	0.405	1.446	94.902						
24	0.393	1.405	96.307						
25	0.325	1.161	97.468						
26	0.265	0.947	98.415						
27	0.238	0.851	99.266						
28	0.205	0.734	100						

Note. Extraction Method: Principal Component Analysis.

Table 4.5 Seven factors' total items and subscales factor loadings

	Component						
	1	2	3	4	5	6	7
A4	0.690						
A8	0.686						
A10	0.652		0.331				
B1	0.651						

A1	0.645						
B3	0.593						
A12	0.593						
C5		0.773					
C3		0.771					
C6		0.764					
C4		0.759					
C2		0.741					
A7			0.689				
A6			0.661				
A14			0.634				
A13			0.620				
A9	0.360		0.554				
B2	0.312		0.544				
F5				0.907			
F6				0.862			
F4				0.825			
D2					0.928		
D1					0.915		
A2						0.823	
A11			0.450			0.606	
A3			0.321			0.544	
F1							0.833
F2							0.754

4.2.3 Comparison of 10 factors and 7 factors

Seven factors were drawn by EFA with 28 items. The items of 'Supervisor, Manager, or Clinical Leader Support for Patient Safety' (B1, B2R, B3), B1 and B3 blended into the factor 'Teamwork Within Units'. B2R blended into the factor 'Feedback and communication about error'. Two of the items of 'Organizational learning - continuous improvement' (A4, 12) from the HSOPSC 2.0 original version blended into the factor 'Teamwork Within Units'. The other one of the items A14R of 'Organizational learning - continuous improvement' blended into the

factor ‘Feedback and communication about error’. Four of the items of ‘Response to Error’ (A6R，A7R，A10，A13R) from the HSOPSC 2.0 original version blended into the factor ‘Teamwork Within Units’ and ‘Feedback and communication about error’. An update factor originated, ‘Feedback and communication about error’, which comprised six items from the original questionnaire (A6R，A7R，A9，A13R，A14R, B2R). Compared to the original factor ‘Communication about error’, the new factor focuses more on feedback. Communication is effective when feedback is more important. The factors of ‘Management support for patient safety’, ‘Frequency of events reported’ and ‘Handoffs and transitions’ from the U.S. study remained stable to the new scale.

Table 4.6 *Comparison of 10 factors and 7 factors*

Original Scale	10-factor results	7-factor results	Remark
Factor 1 Teamwork A1, A8, A9R	Factor 1 Teamwork within units A1, A8, A10	Factor 1: Teamwork Within Units A1, A4, A8, A10, A12, B1, B3	The content mainly reflects: Staff support each other, treat each other with respect, and work together as a team. If the common factors are 7, the content of this factor is more comprehensive and can better reflect the spirit of cooperation within the units.
Factor 2: Supervisor, Manager, or Clinical Leader Support for Patient Safety B1, B2R, B3	Factor 2: Supervisor/manager expectations and actions promoting patient safety: B1, B3, A4, A12	-	Supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures, and do not overlook patient safety problems. Review and evaluation should be considerate into supervisor’s support.
Factor 3: Hospital Management Support for Patient Safety F1, F2, F3R	Factor 3: Management support for patient safety F1, F2	Factor 7 Management support for patient safety F1，F2	Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority. F3 was deleted during the PCA process due to its poor structure
Factor 4: Organizational learning – Continuous Improvement A4, A12, A14R	Factor 4: Interpersonal communication A5R, A9R, A13R, A14R, B2R	-	Procedures and systems are good at preventing errors and there is a lack of patient safety problems.
Factor 5: Communication about error C1, C2, C3	Factor 5: Communication about error C1, C7R, A3R	Factor 3 Feedback and communication about error	Staff are informed about errors that happen, are given feedback about changes implemented, and discuss ways to prevent errors. A6, A7, A9, A13, and A14 are

		A6R，A7R，A9R，A13R，A14R, B2R	mostly related to errors, and being able to open up and communicate about errors is crucial
Factor 6: Communication openness C4, C5, C6, C7R	Factor 6: Communication openness C2, C3, C4, C5, C6	Factor 2 Communication openness C2，C3，C4，C5，C6	Staff freely speak up if they see something that may negatively affect a patient and feel free to question those with more authority.C2, C3 are about error communication summary and improvement.
Factor 7: Reporting Patient Safety Event D1, D2	Factor 7: Frequency of events reported D1, D2	Factor 5 Frequency of events reported D1, D2	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.
Factor 8 Staffing and Work Pace A2，A3R，A5R，A11	Factor 8 Staffing A2, A11	Factor 6 Staffing A2，A3R，A11	There are enough staff to handle the workload and work hours are appropriate to provide the best care for patients. A5 was deleted during the PCA process due to its poor structure.
Factor 9 Handoffs and Information Exchange F4R, F5R，F6	Factor 9 Handoffs and transitions F3, F4R, F5R, F6	Factor 4 Handoffs and transitions F4R，F5R，F6	Important patient care information is transferred across hospital units and during shift changes.
Factor 10 Response to Error A6R，A7R，A10，A13R	Factor 10 Non-punitive response to error A6R, A7R	-	Staff feel that their mistakes and event reports are not held against them and that mistakes are not kept in their personnel file.

4.3 Correlation Analysis

After obtaining the seven subscales, correlation analysis was performed to examine the correlation. Meanwhile, Cronbach' α coefficient was calculated to evaluate the consistency of each subscale of the total scale. Therefore, it can be verified whether it has good reliability and credibility as a measuring tool for HSOPSC. To test the reliability of the instrument, Cronbach's Alpha coefficient has been examined.

Table 4.7 *Reliability Estimates and Inter-Scale Correlations*

	Cronbach's α	Teamwork Within Units subscale	Communication Openness subscale	Feedback and communication about error subscale	HT subscale	Frequency of events reported subscale	Staffing subscale	Management support for patient safety subscale	Total
TU	0.833	1	.542**	-.620**	-.191**	.272**	-.144**	.418**	.485**
CO	0.872	.542**	1	-.517**	-.194**	.426**	-.181**	.338**	.623**
FC	0.767	**-.620****	-.517**	1	.356**	-.194**	.362**	-.324**	.048*
HT	0.856	-.191**	-.194**	.356**	1	-0.034	.119**	-.143**	.218**
FER	0.867	.272**	.426**	-.194**	-0.034	1	-.048*	.134**	.583**
ST	0.538	-.144**	-.181**	.362**	.119**	**-.048***	1	-.117**	.258**
MS	0.572	.418**	.338**	-.324**	-.143**	.134**	-.117**	1	.322**
Total	0.845	.485**	.623**	.048*	.218**	.583**	.258**	.322**	1

Note. **Correlation is significant at .01 level *Correlation is significant at .05 level
Teamwork Within Units (TU), Communication Openness (CO), Feedback and communication about error (FC), Handoffs & Transitions (HT), Frequency of events reported (FER), Staffing (ST), Management support for patient safety (MS)

Table 4.7 sums up the Cronbach coefficient α of the total HSOPSC scale as well as its seven subscales. Most of the scales showed acceptable internal consistency reliability estimates. The Cronbach's α coefficient of 'Teamwork Within Units', 'Communication Openness', 'Handoffs & Transitions', 'Frequency of events reported' and 'Feedback and communication about error' were all above 0.70 (0.833, 0.872, 0.856, 0.867, 0.767), which was in a strong credible range. The Cronbach's α coefficients of ST, Management support for patient safety subscales were all below 0.70 (0.538, 0.572). Furthermore, the total scale was also reliable, with a Cronbach's alpha of 0.845. This result showed that the HSOPSC scale and its subscales had good reliability.

As seen in Table 4.7, the total patient safety score was positively correlated with every subscale. The total patient safety score demonstrated a significant at 0.01 level of correlation with 'Communication Openness', 'Frequency of events reported', 'Teamwork Within Units',

'Management support for patient safety', 'Staffing', and 'Handoffs & Transitions'. However, the total score of patient safety culture and 'Feedback and communication about error' was weakly correlated, $r = .048$, $p < .05$.

Perform correlation analysis on the seven subscales and the total score. They are moderately and low-degree correlations, indicating that the changes in other subscales are relatively independent, which is a good subscale classification. Correlations more significant than 0.7 would indicate that the subscales were measuring the same concept, and those subscales could be combined, and some items could be removed (Calvache ,2020).

From the comparison of related relationships, it can be seen that in terms of patient safety culture scores, 'Communication Openness' has the most significant association with on the total patient safety culture scores, the association from largest to smallest: 'Communication Openness', 'Frequency of events reported', 'Teamwork Within Units', 'Management support for patient safety', 'Staffing', 'Handoffs & Transitions', 'Feedback and communication about error'.

4.4 Status of the patient safety culture of medical staff in hospital of HM Hospital Group

We were using Excel and SPSS25.0 software for data entry, sorting and analysis. $M \pm SD$ was used for analysis according to the overall description.

Table 4.8 *The overall situation of patient safety culture*

subscale	subscale	$M \pm SD$
Management support for patient safety (MS)	Factor7	4.31±0.67
Teamwork Within Units (TU)	Factor1	4.08±0.52
Communication Openness (CO)	Factor2	3.87±0.85
Frequency of events reported (FER)	Factor5	3.06±1.05
Staffing (ST)	Factor6	2.87±0.52
Handoffs & Transitions (HT)	Factor4	2.74±0.44
Feedback and communication about error (FC)	Factor3	2.27±0.60
Total	-	3.69±0.27

The total score of personnel safety culture is ($M = 3.69$, $SD = 0.27$), indicating that the personnel safety culture is at a medium level in general, and 7 aspects scores are from high to

low as follow: ‘Management support for patient safety’ (*M* = 4.3, *SD* = 0.6), ‘Teamwork Within Units’ (*M* = 4.08, *SD* = 0.52), ‘Communication Openness’ (*M* = 3.87, *SD* =0.85), ‘Frequency of events reported’ (*M* = 3.06, *SD* =1.05), ‘Staffing’ (*M* = 2.87, *SD* =0.52), ‘Handoffs & Transitions’ (*M* = 2.74, *SD* =0.44), ‘Feedback and communication about error’ (*M* = 2.27, *SD* =0.60).

4.4.1 The positive response rate of the hospital’s patient safety culture among subscales

The ranking of the positive response rates of all safety culture score subscales in this study was shown in Table 4.9. The positive response rates of the patient safety culture score average were 64.41%. The top two subscales were ‘Management support for patient safety’ and ‘Teamwork within units’. The positive rates were 85.99% and 84.83%, respectively. Among all of the subscales, the positive response rate of ‘Management support for patient safety’ and ‘Teamwork Within Units’ was more excellent than 75%, which was the advantageous subscale of HM Hospital Group.

Table 4.9 *The positive response rate of medical staff to the various subscales of the hospital’s patient safety culture*

subscale	Total number of responses	Number of positive reactions	Positive response rate	Rank
Management support for patient safety (MS)	7395	6359	85.99%	1
Teamwork Within Units (TU)	17255	14638	84.83%	2
Feedback and communication about error (FC)	14790	10118	68.41%	3
Handoffs & Transitions(HT)	7359	4961	67.41%	4
Communication Openness (CO)	12325	8240	66.85%	5
Staffing (ST)	7395	3203	43.31%	6
Frequency of events reported (FER)	4930	1680	34.07%	7
Total	71449	49235	68.90%	-

Compared with a Taiwan research (Chen & Li, 2010) study of 42 hospitals and 788 respondents. The average percentage of positive responses for "Teamwork within units" is 94% in Taiwan, which is much higher than that reported by this study (84.83%). For the "Management support for patient safety" dimension, the average percentage of positive responses for this study is 85.99%, which is higher than the Taiwan data (83%) (Chen & Li, 2010). In the database provided by AHRQ in the U.S. in 2010, 'Teamwork Within Units' was also the only subscale that entered the list of advantageous subscales. Although extensive sample survey results in Japan did not have subscales that can be included in the advantageous regions, 'Teamwork Within Units' still ranked first. (Shigeru et al., 2013). It has been shown that some subscales of patient safety culture had nothing to do with region, country, and culture but were related to the work characteristics of medical staff in the hospital environment.

In this study, there were two subscales with positive response rates below 50%, namely 'Staffing' and 'Frequency of events reported'. The two subscales needed to be improved. 'Staffing' was insufficient and the phenomenon can also be reflected in compared to Taiwan data (Chen & Li, 2010). This study showed that the positive response rate of the 'Staffing' was so low that it reached 43.31%. Taiwan data also showed a similar result with 39% 'Staffing' positive response rate (Chen & Li, 2010). In addition, according to the 2010 database of the Organization for Economic Co-operation and Development (OECD), the bed-to-care ratio in the U.S. was 1:3.4, and that in Taiwan was 1:0.8, which also explained that the positive response rate of hospitals in Taiwan of the Staffing was only 39% (Shigeru et al., 2013). In this study, 'Frequency of events reported' got a bottom of positive response rate at 34.07%. 52.8% of the staff never reported the event - the staff who have reported 1 to 2 events only account for 31.3%. Another Chinese study (Li & Liu, 2009) also showed that the 'Frequency of events reported' positive response rate was less than 50%.

4.4.2 Grade evaluation of hospital patient safety culture

The 2465 respondents rated the patient safety culture level among all the valid samples. Most of the respondents positively evaluated the patient safety culture level, and only 6.8% of the respondents marked the patient safety culture level as 'poor' or 'fair'.

Table 4.10 *Rating evaluation of patient safety culture of HM Hospital Group (n=2465)*

Category	Frequency	Constituent ratio（%）
Excellent	551	22.3%
Very Good	912	36.9%
Good	834	33.8%
Fair	108	4.3%
Poor	60	2.4%

4.4.2 Composition of the number of hospital adverse events reported

Table 4.11 *The composition of the number of adverse event reports (n=2465)*

Category	Frequency	Constituent ratio（%）
No event reports	1303	52.8%
1 to 2 event reports	772	31.3%
3 to 5 event reports	281	11.3%
6 to 10 event reports	63	2.5%
11 or more event reports	46	1.8%

The 2465 respondents (99.9%) responded to the number of hospital adverse event reports, and more than half of the respondents (52.8%) stated that they had not reported any adverse events in the past 12 months. The number of reports was reported mainly 1 to 2 cases, accounted for (31.3%), 3 to 5 cases accounted for (11.3%). More than 5 event reports only accounted for (4.3%).

Up to 52.8% of the employees in this study never reported the events. This data indicated that there was a serious problem with reporting events. The positive response rate of the 'Frequency of events reported' in this study is 34.07%, lower than the average level. The adverse event in this study also refers to when an error has been discovered and corrected before it occurs. The safety hazard is encouraged to report the adverse event. Suppose one event has a safety hazard that causes any harm to patients, while employees are also encouraged to report adverse events. Some adverse events may potentially harm patients, and employees are also encouraged to report adverse events. Nevertheless, the reporting rate of adverse events was still less than 50%, which showed that employees reporting adverse events needs to be improved. When employees discover hidden system safety hazards and make mistakes by themselves or others, they take the initiative to report or conceal the attitude of not reporting, reflecting the

safety culture level of medical institutions. It also shows that it is crucial to improve the adverse event reporting system further.

4.5 Comparison of patient safety culture status of different medical staff groups

In order to compare the status of patient safety culture scores in different groups of medical staff, this study analyzed the level of HSOPSC by using seven subscales and conducted the statistical analysis.

ANOVA analysis was used to test whether the seven subscales scores differed as a staff position, work area, organizational tenure, work unit tenure and working hours per week. Furthermore, Two-sample T-tests were performed to examine patient safety culture score differences in whether direct contact with patients or not. Mean scores and standard deviations of patient safety culture for medical staff in different demographic categories are reported in Appendix B -1.

The analysis showed that the overall HSOPSC score had no significant difference in working hours per week groups. Significant difference of 'Teamwork Within Units', 'Communication Openness', 'Feedback and communication about the error', 'Handoffs & Transitions', 'Frequency of Events Reported', 'Staffing', 'Management Support for Patient Safety' and overall HSOPSC score was found in staff position (F=27.45, p<0.001) and unit/work area (F=3.91, p<0.001), showing that FMS team (M=3.49, SD=0.36) and Others (M=3.57, SD=0.27) score of patient safety culture was significantly lower than Physician (M=3.75, SD=0.26), Nurse(M=3.73, SD=0.22), Pharmacist (M=3.79, SD=0.25), Other Clinical Providers (M=3.70, SD=0.21), and Administration & Manger (M=3.70, SD=0.25) patient safety culture score. As shown from Table 4.8, total patient safety culture score of Pharmacy (M=3.78, SD=0.25) was significantly higher than the patient safety score of Other & Administration (M=3.65, SD=0.27).

A one-way ANOVA analysis with multiple comparisons showed that overall HSOPSC patient safety scores with different organizational tenure were significant (F=3.98, p=0.008). Post hoc analyses using the Games-Howell post hoc criterion for significance indicated that the staff who have worked in HM Hospital Group for less than 1 year has the lowest patient safety culture score than the staff working 1 to 5 years, 6 to 10 years and 11 or more years.

After analysis of variance in work unit tenure, the ‘Communication Openness’ (F=5.58, p<0.001), ‘Frequency of events reported’ (F=8.05, p<0.001), ‘Staffing’ (F=3.56, p=0.014) and overall HSOPSC (F=6.75, p<0.001) patient safety score have significant differences. For scales with significant differences, the Scheffé method and the Games-Howell method are further used to compare pairs. Overall, the total patient safety culture score of staff who have worked for 6 to 10 years scored higher than staff who have worked for 1 to 5 years. Staff who have worked for less than one year and 11 or more years scored the lowest in the patient safety culture.

As for working hours per week, there were also significant differences in ‘Teamwork Within Units’ (F=4.82, p=0.009), ‘Communication Openness’ (F=4.48, p=0.013), ‘Feedback and communication about error’ (F=7.26. p<0.001), and ‘Staffing’ (F=7.38, p<0.001). The mean patient safety score of medical staff who worked less than 30 hours per week was lower than the score of medical staff who worked 30 to 40 hours per week and lower than staff who worked more than 40 hours per week (3.66±0.46 vs 3.68±0.26 vs 3.70±0.27).

There were also significant differences in HSOPSC total score (t=34.85, p<0.001), ‘Communication Openness’ scores (t=7.21, p<0.001), ‘Handoffs & Transitions’ (t=-4.40, p=0.005) and ‘Frequency of events reported’ (t=9.56, p<0.001) among medical staff with direct contact with patients. Through post-hoc analysis, we found that medical staff who have direct contact with patients (M=3.72, SD=0.25) had significantly higher levels of patient safety culture score than medical staff who do not have direct contact with patients (M=3.69, SD=0.31), p<0.001.

5 Discussion

5.1 Factor structure of C-HSOPSC

AHRQ's HSOPSC scale meets the growing demand for safety culture assessment in Western countries, especially in the U.S, where it originated. In this study, we adapted the HSOPSC 2.0 to the Chinese healthcare context (HM Hospital Group) and examined the properties of the instrument. A seven-factor model with 28 items with a different structure than the original English vision in the sample of HM Hospital Group.

The main difference was that the composite 'Supervisor, manager, or clinical leader support for patient safety' merged with 'Teamwork within units' except an item (B2). 'Organizational learning - continuous improvement' and 'Teamwork' merged with 'Teamwork within units' except an item (A14R). 'Response to error' merged with 'Communication about error' except an item (A10). The items C2 and C3 loaded slightly more on a new composite named 'Communication openness' instead of 'Communication about error'. In addition, item A9R loaded slightly more on 'Communication about error' instead of 'Teamwork', which renamed the new factor as 'Feedback and communication about error'. Finally, the original questionnaire removed four items (A5, C1, C7R, F3) from the original questionnaire. Thus, the scale of HSOPSC 2.0 in this study has only 28 items rather than 32 items, as shown in the U.S. 2019 version. Seven underlying factors offered 62.2% of the variance of the items. The initially proposed ten safety culture composites had explained 66.262% of the variance in ten factors.

In the EFA, only seven factors emerged compared to ten proposed for the original instrument. This result is in line with research on other adaptations of the HSOPSC where the subscales postulated by the US model were also not confirmed:

- Smits et al. (2017) found eleven factors for the Dutch hospitals.
- Waterson et al. (2020) found nine factors for the U.K. hospital based on 27 items after gradually removing items.
- Olsen (2017) found a six-factor solution based on 21 items.

For example, there are cross-loadings of the subscale items 'Organizational learning - continuous improvement' in the EFA, supporting results of the Dutch versions (Smits et al.,

2017). ‘Organizational learning - continuous improvement’ combines one subscale with ‘Feedback and communication about error’. Additionally, consistent with our findings, Waterson et al. (2020) found that for the British sample, ‘Staffing’ formed a single subscale after removing A5R. The two factors comprising ‘Communication Openness’ and ‘Feedback and communication about error’ and ‘Teamwork Within Units’ and ‘Management support for patient safety’ are supported by high intercorrelations of the respective subscales.

In general, study findings showed the seven factors’ good internal consistency, content validity, and construct validity, indicating that the C-HSOPSC can measure staff’s perceptions of patient safety culture in Chinese hospitals. But there are still some cultural differences that need to be explained.

This study attempted to analyze the impact of the patient safety culture. To find out the factors that significantly impact patient safety and provide a basis for hospital managers to intervene in a targeted manner. Through analysis, it was concluded that the factors that are associated with the patient safety culture of HM Hospital Group were staff position, organizational tenure, work unit tenure, working hours per week, and direct contact with patients.

From the perspective of staff categories, physicians had a higher level of awareness of safety culture than nurses, which was directly related to the characteristics of the lifetime management system and the internal safety training and education of the physician group. Familiarity with patient safety culture had an impact on patient safety culture. Physicians who were more familiar with safety culture theory and knowledge showed better safety culture behaviors.

The work area/unit was also an essential factor affecting the overall patient safety culture score. This study showed that emergency, dental, imaging, other & administration’s patient safety culture scored lower than obstetrics and gynecology, pediatrics, surgery, internal medicine, family medicine, anesthesiology & OR, patient wards, pharmacies, laboratories departments. For example, emergency perhaps due to its fast pace of work, heavy tasks, many emergencies, and more significant pressure, they were faced with more safety challenges.

This study showed that employees who have worked in the work area/unit for more years have a higher total patient safety score, except for those who have worked for more than 11

years. With the increasing working years, the staff had richer work experience, and they could look at safety issues cautiously. It is easier to identify potential safety hazards in the medical system. Therefore, there were more concerns about safety issues in hospitals. At the same time, senior employees lacked learning motivation and access to new information. Their enthusiasm for participating in hospital quality and safety management was low, resulting in a low overall patient safety culture score.

The staff who directly contacted the patient scored significantly higher than the patient safety culture score of the staff who did not directly contact the patient. Staff who were in direct contact with patients could understand the actual needs of patients through dialogue and communication and improve the corresponding safety guidelines of the work area. Staff would consciously provide medical services that the service would meet the needs of patients. At the same time, this study further explained the importance of the 'Communication Openness'. When medical staff fully understood the patient's condition and psychological state, they would complete their treatment or nursing services more efficiently. Then, unnecessary medical errors would be reduced in this way. Adverse events reduce the chance of being punished and create a good relationship between patients and medical staff.

The HSOPSC was suitable for clinical and research purposes and allowed clinicians and researchers to make comparisons. Managers could benefit from using the HSOPSC for benchmarking when hospital patient safety culture was improved in general. At the same time, managers about specific areas of improvement (i.e., shift-working, Staffing, and over-occupancy).

The results of this study showed acceptable levels of the overall perception of patient safety culture. This finding implied that staff in HM Hospital Group accepted the patient safety culture in different positions, but they still were far away from an excellent culture of patient safety. FMS team were critical units in each hospital, which required special attention because of their low patient safety score. Therefore, it was necessary to promote patient safety culture among FMS team staff of HM Hospital Group.

When it comes to correlations among the seven safety culture composites varied from 0.048 to 0.620 ($p < 0.01$), these correlations are deemed satisfactory and do not indicate problematic associations among dimensions. 'Teamwork Within Units' subscale showed its

highest correlations with ‘Feedback and communication about error’ subscale (r = -0.620). ‘Handoffs & Transitions’ has only a little interrelationship with the other safety culture sub-dimensions (the highest with ‘Management support for patient safety subscale’, r = -0.143).

The above results underline the crucial role of the hospital procedures in developing a cooperative and communication openness environment that cultivates a free process of evaluation about the adverse events, sharing data about the errors that take place, discussing how to prevent adverse events, and reporting the identified errors.

Finally, the highest intercorrelation was between ‘Teamwork Within Units’ subscale and ‘Feedback and communication about error subscale’ (r = -0.620). Considering that both composites shared some attention towards teamwork and communication, this outcome was not surprising. However, these composites share a common meaning, and they were not integrated into one concept.

5.2 Cultural issues in applying HSCOPSC in the Chinese hospital setting

Our results show some discrepancies between the HSOPSC model and the data in China, particularly for the dimensions of ‘Frequency of events reported’ and ‘Feedback and communication about error’. In Tables 4.8 and 4.9, there are severe discrepancies about ‘Frequency of events reported’. First, in the overall situation of patient safety culture table, ‘Frequency of events reported’ showed a good average score (*M* = 3.06, *SD* =1.05). However, in the positive response rate of the hospital’s patient safety culture table, ‘Frequency of events reported’ reached the bottom of the positive response rate among all subscales, only accounting for 34.07%. Part of the reason may be the differences between cultural environments, including differences in organizational behavior, differences in managerial management values, differences in organizational commitment, as well as differences in relationships within the organization. In the past, when an event or a mistake happened, it was people who were usually punished instead of finding the existence of the problem, nor solving the problem. It is supported by the fact that 52.8% of employees have never reported events.

In Chinese society, people care about others' attitudes and behaviors. Chinese people tend to have solid social conformity in concepts or behaviors and pursue interpersonal harmony. A

harmonious relationship can maintain a stable social order and become the collective emotion of the Chinese (Chen & Li, 2010). Chinese people tend to avoid direct discussion of adverse events as much as possible in actual work, and most of them choose to remain silent. Because the Chinese culture makes the Chinese tend to use indirect ways to express their opinions. Even if they disagree, they will not directly speak out, which prevents them from expressing their opinions freely. Culture plays an essential role in the interaction between managers and staff so that that cultural differences may affect staff's degree of supervision commitment. Therefore, the 'Feedback and communication about error' and 'Frequency of events report' dimensions of patient safety culture have different meanings for China and the U.S.

Many Chinese believe that 'Feedback and communication about error' may destroy the harmony between people. Therefore, when evaluating the 'Feedback and communication about error' dimension of HSOPSC in Chinese society, researchers need to pay attention to feedback and communication related to the psychological process of staff, because staff may be unwilling to speak freely due to some concerns. For example, when conducting patient safety culture surveys, medical institutions should use appropriate wording in 'Feedback and communication about error'.

Overall, HSOPSC has been verified by researchers in many countries and has proven to have many advantages. For example, HSOPSC has good psychological measurement characteristics, careful consideration of multiple dimensions, and comprehensive coverage of safety culture from top to bottom from leaders to ordinary employees. However, research on patient safety culture must consider cultural diversity. Although significant progress has been made in patient safety assessment in recent years, there is still a critical patient safety issue that has not been formally treated. It may require horizontal comparisons by researchers from multiple countries and revision of actual scales based on different national conditions to evaluate patient safety culture more scientifically.

5.3 Contribution and limitations of this research

Contribution: Compared with previous studies that mostly used SAQ and PSCHO, this study selected the HSOPSC 2.0 scale with broader subscales for investigation. An essential

contribution of this research is discovering the unreasonable structure of this scale in measurement, which is not applicable under the constraints of Chinese emotional culture. In previous studies, a single nurse or physician was selected as the research object. This study conducted a comprehensive survey of all medical staff, pharmacists, other clinical service providers, FMS teams, and other staff in the hospital. It made a more comprehensive survey by participating in the cultural status of all hospital staff. Reflect on the safety status of patients in the hospital.

Limitations: This study used a cross-sectional design, and the current study was potentially subject to common method bias. Without intervention measures with comparison, the influencing factors were not relevant, and only the HM Hospital Group was investigated. When the research results were extrapolated, they needed to be analyzed in light of specific circumstances. We were looking forward to encouraging future studies to follow the progress. It was suggested that future studies include intervention methods and measure the effectiveness of intervention methods.

One of the limitations in this study was the lack of evidence in different time survey results to compare the above results. Due to the coronavirus pandemic, hospital administrators thought it was not feasible, so they did not assess the stability over a while. Restricted by research conditions, there were certain shortcomings in the balance and represented of sampling. This study lacked intervention measures to improve patient safety.

5.4 Future research

Future studies may resolve these limitations by a longitudinal research design with a more representative sample and including objective measures such as patient complaints and specific physician-patient conflicts.

In addition, the patient safety culture assessment should be regarded as one of the critical research fields of patient safety. It should be incorporated into the medical evaluation indicators or standardized management processes. Integrate patient safety culture into specific medical

practices and management measures to promote better the quality of safety and health services provided by medical institutions to patients (Chen & Li, 2010).

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Appendix A - Hospital safety on patient safety culture scale (HSOPSC scale)

Thank you for your participation! The purpose of this questionnaire is to understand your attitudes and views on patient safety issues. This questionnaire is voluntary and anonymous. Please fill in according to your true feelings. All your answers are strictly confidential, please feel free to answer. It will take you about 15 minutes to complete this questionnaire. Consider each of the following questions about you and your current work situation. Select the number that honestly reflects how frequently you experienced these things in the last 12 months.

(1 =strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree, 9 = Does Not Apply or Don't Know).

(1 =never, 2 = rarely, 3 = sometimes, 4 = most of time, 5 = always, 9 = Does Not Apply or Don't Know).

Section	Items	Details
Section A: Your Unit/Work Area	A1	In this unit, we work together as an effective team.
	A2	We have enough staff to handle the workload.
	A3R	Staff in this unit work longer hours than is best for patient care.
	A4	This unit regularly reviews work processes to determine if changes are needed to improve patient safety.
	A5R	This unit relies too much on consultants/temporary staff.
	A6R	Staff feel like their mistakes are held against them.
	A7R	When an event is reported, it feels like the person is being written up, not the problem.
	A8	During busy times, staff in this unit help each other
	A9R	There is a problem with disrespectful behavior by those working in this unit
	A10	When staff make errors, this unit focuses on learning rather than blaming individuals.
	A11R	The work pace in this unit is so rushed that it negatively affects patient safety
	A12R	In this unit, changes to improve patient safety are evaluated to see how well they worked.
	A13	In this unit, there is a lack of support for staff involved in patient safety errors.
	A14R	This unit lets the same patient safety problems keep happening
Section B: Your Supervisor, Manager, or Clinical Leader	B1	My supervisor/manager seriously considers staff suggestions for improving patient safety.
	B2R	My supervisor/manager wants us to work faster during busy times, even if it means taking shortcuts.
	B3	My supervisor/manager takes action to address patient safety concerns that are brought to their attention.
Section C: Communication	C1	We are informed about errors that happen in this unit.
	C2	When errors happen in this unit, we discuss ways to prevent them from happening again.
	C3	In this unit, we are informed about changes that are made based on event reports.
	C4	In this unit, staff speak up if they see something that may negatively affect patient care.
	C5	When staff in this unit see someone with more authority doing something unsafe for patients, they speak up.

	C6	When staff in this unit speak up, those with more authority are open to their patient safety concerns.
	C7R	In this unit, staff are afraid to ask questions when something does not seem right.
Section D: Reporting Patient Safety Events	D1	When a mistake is caught and corrected before reaching the patient, how often is this reported?
	D2	When a mistake reaches the patient and could have harmed the patient, but did not, how often is this reported?
	D3	In the past 12 months, how many patient's the safety events have you reported?
Section E: Patient Safety Rating	E	Please give your work area/unit in this hospital an overall grade on patient safety. Mark ONE answer.
Section F: Your Hospital	F1	The actions of hospital management show that patient safety is a top priority.
	F2	Hospital management provides adequate resources to improve patient safety.
	F3R	Hospital management seems interested in the patient safety only after an adverse event happens.
	F4R	When transferring patients from one unit to another, important information is often left out.
	F5R	During shift changes, important patient care information is often left out.
	F6	During shift changes, there is adequate time to exchange all key patient care information.
Section G: Background Questions	G1	How long have you worked in this hospital?
	G2	How long have you worked in your current unit/work area？
	G3	Typically, how many hours per week do you work in this hospital?
	G4	In your position, do you typically have direct interaction or contact with patients?
Your Staff Position	-	What is your position (role) in this hospital? Select ONE answer that best describes your principal position function.
Your Unit/Work Area	-	What is your primary work area or unit in this hospital? Mark ONE answer by checking the box.

Source：Rockville, M. D，2019

Appendix B - 医院安全病人安全文化量表(HSOPSC 量表)

感谢您的参与!本问卷的目的是了解您对患者安全问题的态度和看法。这份问卷是自愿的，匿名的。请根据你的真实感受填写。所有的答案都是严格保密的，请随意回答。完成这个问卷大概需要 15 分钟。考虑以下关于你和你目前工作状况的每个问题。选择能真实反映你在过去 12 个月里经历这些事情的频率的数字。
(1 =非常不同意，2 =不同意，3 =不同意或不同意，4 =同意，5 =非常同意，9 =不适用或不知道)。

部分	条目	内容
A：工作科室	A1	在该部门中，我们是一个高效的团队
	A2	我们部门员工数量充足，可以满足工作需求
	A3R	该部门员工的工作时间超过了保证患者最佳服务的限度
	A4	该部门定期审查工作流程，以确定是否需要改变以提高患者安全
	A5R	该部门使用过多的外院专家/临时人员
	A6R	员工们觉得自己的错误是对自己不利的
	A7R	上报事件时，感觉报告是在针对某个人，而不是问题
	A8	工作繁忙时，该部门的工作人员互相帮助
	A9R	该部门工作人员存在不尊重他人的行为
	A10	当员工出现错误时，该部门重视学习，而不是责备个人
	A11R	该部门的工作节奏过于匆忙，对患者的安全造成了负面影响
	A12R	在该部门中，对改善患者安全的改变进行评估，以了解其效果如何
	A13	在该部门中，缺乏对涉及患者安全错误的员工的支持
	A14R	该部门让同样的病人安全问题不断发生
B: 你的领导/经理	B1	我的主管/经理会郑重考虑员工提出的提升患者安全的工作建议
	B2R	工作繁忙时，我的主管/经理会让我们加快工作，甚至走捷径
	B3	我的主管/经理采取行动解决引起他们注意的患者安全问题
C: 沟通交流	C1	我们被告知本部门发生的错误
	C2	当部门内发生错误时，我们讨论防止错误再次发生的方法
	C3	我们会收到根据事件报告做出了各项改进措施
	C4	当员工发现危害患者安全的问题，能够没有顾虑地指出
	C5	当部门内工作人员看到有更大权力的人在为病人做不安全的事情时，他们会大声说出来
	C6	当部门内的工作人员大声发言时，那些更有权力的人会对他们的病人安全问题敞开心扉
	C7R	在此部门，当情况不太对劲的时候，员工也不敢提问
D: 不良事件上报	D1	发生差错，但是在影响到患者前就得以发现和补救，这样的事件，报告频率如何？
	D2	发生差错，可能会伤害患者，但是实际上并没有，这样的事件，报告频率如何？
	D3	在过去 12 个月内，您报告了多少例患者安全事件?
E: 患者安全率	E	请对您所在的部门/区域，进行总体的患者安全等级评分
F: 医院	F1	患者安全是医院管理的重中之重
	F2	医院管理提供充足的资源，以提高患者安全
	F3R	医院管理层似乎只对不良事件发生后的患者安全感兴趣
	F4R	当病人从一个部门转到另一个部门时，重要信息往往被遗漏

	F5R	换班期间，重要的患者治疗信息往往被忽略
	F6	换班期间，有足够的时间交换所有关键的患者治疗信息
G: 背景问题	G1	您在医院工作多久了？
	G2	您在现在的部门工作多久了？
	G3	一般来说，您每周的工作时间是多长？
	G4	在您的日常工作中，您是否直接接触患者？
你的职位	-	您在医院是什么职位？请选择最能描述您主要工作职能的选项
你的工作科室	-	您在院内的主要工作区域/部门是什么？请从以下选项中选择

(1 =从不，2 =很少，3 =有时，4 =大多数时候，5 =总是，9 =不适用或不知道)。

Appendix C - Group comparisons on scores of the HSOPSC and seven subscales

Variable		Mean±Std. Deviation	F	Sig.	pairwise comparison
Staff Position					
Teamwork Within Units subscale	(a)Physician N=370	4.16±0.29	22.38	<0.001*	(a)(b)(c)(d)(e)>(f)(g)
	(b)Nurse N=776	4.11±0.47			
	(c)Pharmacist N=99	4.25±0.68			
	(d)Other Clinical Providers N=174	4.19±0.48			
	(e)Administration & Manger N=6	4.10±0.51			
	(f)FMS Team N=331	3.85±0.44			
	(g)Other N=92	3.82±0.54			
Communication Openness subscale	(a)Physician N=370	3.93±0.78	22.28	<0.001*	(a)(b)(c)(d)(e)>(f)(g)
	(b)Nurse N=776	3.98±0.65			
	(c)Pharmacist N=99	4.09±0.77			
	(d)Other Clinical Providers N=174	4.08±0.72			
	(e)Administration & Manger N=6	3.98±0.76			
	(f)FMS Team N=331	3.32±1.13			
	(g)Other N=92	3.33±1.22			
Feedback and communication about error subscale	(a)Physician N=370	2.24±0.63	14.17	<0.001*	(g)(f)> (a)(b)(e)(c)(d)
	(b)Nurse N=776	2.26±0.55			
	(c)Pharmacist N=99	2.07±0.70			
	(d)Other Clinical Providers N=174	2.11±0.56			
	(e)Administration & Manger N=6	2.22±0.59			
	(f)FMS Team N=331	2.46±0.59			
	(g)Other N=92	2.64±0.69			
Handoffs & Transitions subscale	((a)Physician N=370	2.78±0.44	7.34	<0.001*	(d)(a)(c)(g)(e)>(b)
	(b)Nurse N=776	2.67±0.42			
	(c)Pharmacist N=99	2.82±0.47			
	(d)Other Clinical Providers N=174	2.82±0.43			
	(e)Administration & Manger N=6	2.77±0.42			
	(f)FMS Team N=331	2.71±0.53			
	(g)Other N=92	2.84±0.43			
Frequency of events reported subscale	(a)Physician N=370	3.39±0.85	43.72	<0.001*	(c)(a)(b)(e)(d)>(g)(f)
	(b)Nurse N=776	3.18±0.96			
	(c)Pharmacist N=99	3.75±1.01			
	(d)Other Clinical Providers N=174	2.91±0.97			
	(e)Administration & Manger N=6	3.14±0.99			

	(f)FMS Team N=331	2.33±1.1			
	(g)Other N=92	2.46±1.12			
	(a)Physician N=370	2.83±0.53	6.16	<0.000*	(g)(f)>(a)(b)(c)(d)(e)
	(b)Nurse N=776	2.90±0.51			
	(c)Pharmacist N=99	2.83±0.52			
Staffing subscale	(d)Other Clinical Providers N=174	2.79±0.53			
	(e)Administration & Manger N=6	2.83±0.51			
	(f)FMS Team N=331	2.93±0.53			
	(g)Other N=92	3.10±0.54			
	(a)Physician N=370	4.31±0.73	8.83	<0.001*	(d)(e)(a)(b)(c)>(f)(g)
	(b)Nurse N=776	4.27±0.68			
Management support for patient safety subscale	(c)Pharmacist N=99	4.39±0.68			
	(d)Other Clinical Providers N=174	4.44±0.56			
	(e)Administration & Manger N=6	4.41±0.64			
	(f)FMS Team N=331	4.07±0.69			
	(g)Other N=92	4.31±0.67			
	(a)Physician N=370	3.75±0.26	27.45	<0.001*	(a)(b)(c)(d)(e)>(g)(f)
	(b)Nurse N=776	3.73±0.22			
	(c)Pharmacist N=99	3.79±0.25			
Total	(d)Other Clinical Providers N=174	3.70±0.21			
	(e)Administration & Manger N=6	3.70±0.25			
	(f)FMS Team N=331	3.49±0.36			
	(g)Other N=92	3.57±0.27			
Unit/Work Area					
	(a)Ob-Gyn（n=283)	4.16±0.54	6.51	<0.001*	
	(b)Pediatrics(n=206)	4.07±0.46			
	(c)Surgery(n=110)	4.11±0.53			
	(d) Internal Medicine (n=147)	4.10±0.47			
	(e) Emergency(n=102)	3.99±0.52			
Teamwork	(f)Dental(n=96)	3.91±0.54			
Within Units	(g)Family Medicine (n=135)	4.14±0.48			(a)(b)(c)(i)(j)(k)(h)(d)(g)>(e)(f)(l)(m)
subscale	(h)Anesthesiology&OR (n=106)	4.24±0.49			
	(i)Patient Ward(n=154)	4.15±0.44			
	(j)Pharmacy(n=98)	4.26±0.68			
	(k)Lab(n=82)	4.28±0.43			
	(l)Imaging(n=72)	4.01±0.54			
	(m)Other&Administration (n=874)	4.01±0.52			
	(a)Ob-Gyn（n=283)	4.00±0.83	3.85	<0.001*	
	(b)Pediatrics(n=206)	3.84±0.70			
Communicati	(c)Surgery(n=110)	3.85±0.87			
on Openness	(d) Internal Medicine (n=147)	3.91±0.69			(a)(c)(d)(g)(h)(i)(k)(l)>(b)(e)(f)(m)
subscale	(e) Emergency(n=102)	3.76±0.83			
	(f)Dental(n=96)	3.80±0.85			
	(g)Family Medicine (n=135)	3.99±0.76			

	(h)Anesthesiology&OR (n=106)	3.97±0.86			
	(i)Patient Ward(n=154)	3.91±0.76			
	(j)Pharmacy(n=98)	4.10±0.78			
	(k)Lab(n=82)	4.17±0.70			
	(l)Imaging(n=72)	3.83±0.73			
	(m)Other&Administration (n=874)	3.78±0.96			
Feedback and communication about error subscale	(a)Ob-Gyn（n=283)	2.22±0.59	5.77	<0.001*	(c)(f)(m)>(a)(b)(d)(e)(g)(i)(l)>(h)(j)(k)
	(b)Pediatrics(n=206)	2.31±0.54			
	(c)Surgery(n=110)	2.38±0.69			
	(d) Internal Medicine (n=147)	2.17±0.57			
	(e) Emergency(n=102)	2.35±0.64			
	(f)Dental(n=96)	2.38±0.53			
	(g)Family Medicine (n=135)	2.22±0.62			
	(h)Anesthesiology&OR (n=106)	2.06±0.44			
	(i)Patient Ward(n=154)	2.22±0.61			
	(j)Pharmacy(n=98)	2.07±0.71			
	(k)Lab(n=82)	2.07±0.52			
	(l)Imaging(n=72)	2.38±0.66			
	(m)Other&Administration (n=874)	2.34±0.61			
Handoffs & Transitions subscale	(a)Ob-Gyn（n=283)	2.62±0.33	6.38	<0.001*	(k)(l)(m)>(b)(c)(d)(e)(f)(g)(h)(i)(j)>(a)
	(b)Pediatrics(n=206)	2.71±0.38			
	(c)Surgery(n=110)	2.76±0.50			
	(d) Internal Medicine (n=147)	2.73±0.45			
	(e) Emergency(n=102)	2.73±0.46			
	(f)Dental(n=96)	2.70±0.47			
	(g)Family Medicine (n=135)	2.68±0.48			
	(h)Anesthesiology&OR (n=106)	2.69±0.45			
	(i)Patient Ward(n=154)	2.67±0.47			
	(j)Pharmacy(n=98)	2.82±0.48			
	(k)Lab(n=82)	2.83±0.44			
	(l)Imaging(n=72)	2.94±0.48			
	(m)Other&Administration (n=874)	2.79±0.46			
Frequency of events reported subscale	(a)Ob-Gyn（n=283)	3.07±1.08	6.29	<0.001*	(j)>(g)>(a)(b)(c)(d)(e)(f)(h)(i)(k)(l)>(m)
	(b)Pediatrics(n=206)	3.13±0.87			
	(c)Surgery(n=110)	3.16±0.94			
	(d) Internal Medicine (n=147)	3.06±0.94			
	(e) Emergency(n=102)	3.07±0.94			
	(f)Dental(n=96)	3.13±1.08			
	(g)Family Medicine (n=135)	3.37±0.97			
	(h)Anesthesiology&OR (n=106)	3.02±1.16			
	(i)Patient Ward(n=154)	3.16±1.01			
	(j)Pharmacy(n=98)	3.71±1.05			
	(k)Lab(n=82)	2.82±1.01			
	(l)Imaging(n=72)	3.07±1.02			

	(m)Other&Administration (n=874)	2.91±1.10			
	(a)Ob-Gyn（n=283)	2.91±0.50	3.32	<0.001*	
	(b)Pediatrics(n=206)	2.88±0.46			
	(c)Surgery(n=110)	2.96±0.52			
	(d) Internal Medicine (n=147)	2.73±0.48			
	(e) Emergency(n=102)	2.97±0.53			
	(f)Dental(n=96)	2.89±0.56			
Staffing subscale	(g)Family Medicine (n=135)	2.88±0.53			(a)(b)(c)(e)(f)(g)(i)(j)(k)(l)(m)>(d)>(h)
	(h)Anesthesiology&OR (n=106)	2.69±0.52			
	(i)Patient Ward(n=154)	2.97±0.52			
	(j)Pharmacy(n=98)	2.83±0.53			
	(k)Lab(n=82)	2.81±0.50			
	(l)Imaging(n=72)	2.85±0.68			
	(m)Other&Administration (n=874)	2.89±0.53			
	(a)Ob-Gyn（n=283)	4.35±0.66	4.23	<0.001*	
	(b)Pediatrics(n=206)	4.34±0.63			
	(c)Surgery(n=110)	4.31±0.63			
	(d) Internal Medicine (n=147)	4.28±0.71			
	(e) Emergency(n=102)	3.78±0.88			
Management support for patient safety subscale	(f)Dental(n=96)	4.34±0.65			(a)(b)(c)(d)(f)(g)(h)(i)(j)(k)(l)(m)>(e)
	(g)Family Medicine (n=135)	4.26±0.68			
	(h)Anesthesiology&OR (n=106)	4.24±0.70			
	(i)Patient Ward(n=154)	4.37±0.60			
	(j)Pharmacy(n=98)	4.39±0.71			
	(k)Lab(n=82)	4.39±0.59			
	(l)Imaging(n=72)	4.47±0.54			
	(m)Other&Administration (n=874)	4.33±0.66			
	((a)Ob-Gyn（n=283)	3.71±0.26	3.91	<0.001*	
	(b)Pediatrics(n=206)	3.70±0.22			
	(c)Surgery(n=110)	3.74±0.24			
	(d) Internal Medicine (n=147)	3.67±0.21			
	(e) Emergency(n=102)	3.68±0.26			
	(f)Dental(n=96)	3.67±0.29			
Total	(g)Family Medicine (n=135)	3.74±0.36			(j)>(a)(b)(c)(d)(e)(f)(g)(h)(i)(k)(l)>(m)
	(h)Anesthesiology&OR (n=106)	3.66±0.31			
	(i)Patient Ward(n=154)	3.72±0.29			
	(j)Pharmacy(n=98)	3.78±0.25			
	(k)Lab(n=82)	3.71±0.20			
	(l)Imaging(n=72)	3.74±0.34			
	(m)Other&Administration (n=874)	3.65±0.27			
Organizational Tenure					
Teamwork	(a)less than 1 year(n=257)	3.99±0.54	3.22	0.022*	(d)>(b)(c)>(a)
Within Units	(b)1 to 5 year(n=1223)	4.10±0.52			
subscale	(c)6 to 10 years(n=737)	4.08±0.50			

	(d)11 or more years(n=248)	4.10±0.52			
Communication Openness subscale	(a)less than 1 year(n=257)	3.67±1.12	3.73	0.011*	(b)(c)(d)>(a)
	(b)1 to 5 year(n=1223)	3.90±0.82			
	(c)6 to 10 years(n=737)	3.90±0.78			
	(d)11 or more years(n=248)	3.83±0.82			
Feedback and communication about error subscale	(a)less than 1 year(n=257)	2.37±0.69	2.11	0.097	
	(b)1 to 5 year(n=1223)	2.25±0.60			
	(c)6 to 10 years(n=737)	2.26±0.58			
	(d)11 or more years(n=248)	2.28±0.54			
Handoffs & Transitions subscale	(a)less than 1 year(n=257)	2.77±0.50	0.51	0.674	
	(b)1 to 5 year(n=1223)	2.73±0.44			
	(c)6 to 10 years(n=737)	2.74±0.45			
	(d)11 or more years(n=248)	2.72±0.37			
Frequency of events reported subscale	(a)less than 1 year(n=257)	2.83±1.20	4.83	0.003*	(b)(c)(d)>(a)
	(b)1 to 5 year(n=1223)	3.07±1.04			
	(c)6 to 10 years(n=737)	3.14±1.02			
	(d)11 or more years(n=248)	3.02±1.00			
Staffing subscale	(a)less than 1 year(n=257)	3.00±0.58	5.84	<0.001*	(a)>(b)(c)(d)
	(b)1 to 5 year(n=1223)	2.86±0.52			
	(c)6 to 10 years(n=737)	2.86±0.50			
	(d)11 or more years(n=248)	2.83±0.50			
Management support for patient safety subscale	(a)less than 1 year(n=257)	4.31±0.75	2.51	0.057	
	(b)1 to 5 year(n=1223)	4.33±0.67			
	(c)6 to 10 years(n=737)	4.31±0.64			
	(d)11 or more years(n=248)	4.20±0.65			
Total	(a)less than 1 year(n=257)	3.63±0.32	3.98	0.008*	(b)(c)(d)>(a)
	(b)1 to 5 year(n=1223)	3.69±0.27			
	(c)6 to 10 years(n=737)	3.70±0.26			
	(d)11 or more years(n=248)	3.69±0.27			
Work Unit Tenure					
Teamwork Within Units subscale	(a)less than 1 year(n=334)	4.03±0.53	1.43	0.233	
	(b)1 to 5 years(n=1362)	4.09±0.52			
	(c)6 to 10 years(n=630)	4.09±0.51			
	(d)11 or more years(n=140)	4.06±0.54			
Communication Openness subscale	(a)less than 1 year(n=334)	3.73±1.04	5.58	0.001*	(a)(b)>(d)(c)
	(b)1 to 5 years(n=1362)	3.89±0.82			
	(c)6 to 10 years(n=630)	3.93±0.77			
	(d)11 or more years(n=140)	3.68±0.89			
Feedback and communication about error subscale	(a)less than 1 year(n=334)	2.33±0.66	1.90	0.127	
	(b)1 to 5 years(n=1362)	2.25±0.60			
	(c)6 to 10 years(n=630)	2.25±0.58			
	(d)11 or more years(n=140)	2.31±0.57			

Handoffs & Transitions subscale	(a)less than 1 year(n=334)	2.72±0.474	0.93	0.426	
	(b)1 to 5 years(n=1362)	2.73±0.44			
	(c)6 to 10 years(n=630)	2.76±0.46			
	(d)11 or more years(n=140)	2.78±0.35			
Frequency of events reported subscale	(a)less than 1 year(n=334)	2.85±1.15	8.05	<0.001*	(c)>(b)>(a)(d)
	(b)1 to 5 years(n=1362)	3.08±1.04			
	(c)6 to 10 years(n=630)	3.18±1.01			
	(d)11 or more years(n=140)	2.90±1.06			
Staffing subscale	(a)less than 1 year(n=334)	2.96±0.56	3.56	0.014*	(a)>(b)(c)(d)
	(b)1 to 5 years(n=1362)	2.86±0.52			
	(c)6 to 10 years(n=630)	2.86±0.50			
	(d)11 or more years(n=140)	2.88±0.48			
Management support for patient safety subscale	(a)less than 1 year(n=334)	4.34±0.72	2.38	0.068	
	(b)1 to 5 years(n=1362)	4.30±0.67			
	(c)6 to 10 years(n=630)	4.33±0.63			
	(d)11 or more years(n=140)	4.17±0.68			
Total	(a)less than 1 year(n=334)	3.64±0.30	6.75	<0.001*	(c)>(b)>(a)(d)
	(b)1 to 5 years(n=1362)	3.69±0.27			
	(c)6 to 10 years(n=630)	3.72±0.26			
	(d)11 or more years(n=140)	3.66±0.28			
Working Hours per Week					
Teamwork Within Units subscale	(a)less than 30 hours per week (n=54)	4.07±0.52	4.82	0.009*	(a)(b)>(c)
	(b)30 to 40 hours per week (n=1217)	4.11±0.50			
	(more than 40 hours per week (n=1194)	4.05±0.54			
Communication Openness subscale	(a)less than 30 hours per week (n=54)	3.45±1.25	4.48	0.013*	(b)(c)>(a)
	(b)30 to 40 hours per week (n=1217)	3.91±0.80			
	(more than 40 hours per week (n=1194)	3.85±0.87			
Feedback and communication about error subscale	(a)less than 30 hours per week (n=54)	2.45±0.88	7.26	<0.001*	(a)>(c)>(b)
	(b)30 to 40 hours per week (n=1217)	2.22±0.59			
	(more than 40 hours per week (n=1194)	2.31±0.60			
Handoffs & Transitions subscale	(a)less than 30 hours per week (n=54)	2.82±0.80	1.26	0.288	
	(b)30 to 40 hours per week (n=1217)	2.72±0.43			
	(more than 40 hours per week	2.75±0.44			

	(n=1194)				
Frequency of events reported subscale	(a)less than 30 hours per week (n=54) (b)30 to 40 hours per week (n=1217) (more than 40 hours per week (n=1194)	2.84±1.33 3.03±1.03 3.11±1.06	2.60	0.078	
Staffing subscale	College degree or below(a)less than 30 hours per week (n=54) (b)30 to 40 hours per week (n=1217) (more than 40 hours per week (n=1194)	3.10±0.77 2.84±0.51 2.90±0.52	7.38	<0.001*	(a)>(c)>(b)
Management support for patient safety subscale	(a)less than 30 hours per week (n=54) (b)30 to 40 hours per week (n=1217) (more than 40 hours per week (n=1194)	4.21±0.72 4.34±0.65 4.28±0.69	2.47	0.088	
Total	(a)less than 30 hours per week (n=54) (b)30 to 40 hours per week (n=1217) (more than 40 hours per week (n=1194)	3.66±0.46 3.68±0.26 3.70±0.27	0.75	0.476	
Direct contact with patients					
Teamwork Within Units subscale	(a)Directly contacted with patients (n=1693) (b)Not directly contacted with patients (n=772)	4.12±0.51 4.00±0.52	5.44	0.466	
Communication Openness subscale	(a)Directly contacted with patients (n=1693) (b)Not directly contacted with patients(n=772)	3.95±0.75 3.69±1.02	7.21	<0.001*	a>b
Feedback and communication about error subscale	(a)Directly contacted with patients (n=1693) (b)Not directly contacted with patients(n=772)	2.24±0.60 2.32±0.60	-2.99	0.926	
Handoffs & Transitions subscale	(a)Directly contacted with patients (n=1693) (b)Not directly contacted with patients(n=772)	2.71±0.43 2.80±0.47	-4.40	0.005*	a<b

Frequency of events reported subscale	(a)Directly contacted with patients (n=1693)	3.20±0.98	9.56	<0.001*	a>b
	(b)Not directly contacted with patients(n=772)	2.77±1.14			
Staffing subscale	(a)Directly contacted with patients (n=1693)	2.87±0.52	-0.25	0.718	
	(b)Not directly contacted with patients(n=772)	2.88±0.52			
Management support for patient safety subscale	(a)Directly contacted with patients (n=1693)	4.31±0.67	0.63	0.971	
	(b)Not directly contacted with patients(n=772)	4.29±0.67			
Total	(a)Directly contacted with patients (n=1693)	3.72±0.25	34.85	<0.001*	a>b
	(b)Not directly contacted with patients(n=772)	3.61±0.31			

*The mean difference is significant at the 0.05 level