

A Longitudinal Study to Analyze the Perceptions of Departed and On-the-Job Nurses in Patient Safety Culture

Yun-Ning Liu, Hsin-Hung Wu, Chih-Hsuan Huang, and Yii-Ching Lee

Abstract— The aims of this study are to first compare whether on-the-job and departed nurses have different perceptions on the patient safety culture based on the Chinese version of the safety attitudes questionnaire and then identify critical dimension(s) that affect the overall satisfaction of the patient safety culture from the viewpoints of these two types of nurses. No studies have been found to evaluate the perception differences of the patient safety culture from viewpoints of both departed and on-the-job nurses. This study uses the internal datasets by a retrospective approach to compare if on-the-job and departed nurses have different perceptions in the patient safety culture from a regional teaching hospital in Taiwan from 2016 to 2018. For departed nurses, perceptions of management and teamwork climate are critical dimensions to influence the overall satisfaction followed by working conditions. For on-the-job nurses, working conditions are the only variable appeared from 2016 and 2018 having the largest impact on the overall satisfaction of the patient safety culture. Safety climate and perceptions of management are considered as the second important dimensions to affect the overall satisfaction. Perceptions of management and teamwork climate are the two critical dimensions to affect the overall satisfaction of the patient safety culture for departed nurses, whereas working conditions are the most essential dimension to influence the overall satisfaction followed by perceptions of management and safety climate for on-the-job nurses. Improving working conditions and safety climate might be a means of reducing the nurse turnover in practice based on the findings.

Index Terms— patient safety culture, Chinese version of the safety attitudes questionnaire, resigned nurse, on-the-job nurse

I. INTRODUCTION

Patient safety is an important issue in the world since it will not only cause direct harms to patients but also bring huge economic burden and reputation damages to medical institutions [1]. Australian Institute of Health and Welfare [2], Sousa et al. [3], and World Health Organization [4] pointed out that the rates of medical negligence in Japan, United

Kingdom, and Australia were from 2.9% to 16.6%, indicating that there was room for the improvement of healthcare quality in the medical field. Studies such as Huang et al. [5] and Huang et al. [6] showed that patient safety culture in healthcare organizations is a means to assess the attitude of medical staff towards active patient care. Most importantly, an organization's safety culture is the basic determinant of the development of medical services and patient safety [7,8,9].

To improve the medical quality and safety of patients in the process of medical treatments, it is important for healthcare organizations to establish a patient-centered organizational culture [7,10]. If medical institutions establish a patient safety culture with unimpeded communications, it is more likely to carry out interdisciplinary cooperation and division of labor among hospital departments [6]. Improving patient safety culture could result in less nursing turnover and absenteeism [11,12]. Additionally, a good patient safety culture can reduce job burnout and patient injury, alleviate physician-patient disputes, and improve patient trust and satisfaction [13,14]. Healthcare organizations should focus on the improvement of medical malpractice through improving the hospital working environment, modifying the working system, reducing redundant processes, and creating patient safety culture in the healthcare process [1,15]. That is, patient safety issue is no longer just the implementations that hospitals focus on improving patient safety but extend to the creation and evaluation of patient safety culture. In other words, improving medical staff's perception of patient safety culture is an important way to promote patient safety [5].

There are many instruments to measure patient safety culture, among which the most used questionnaire is the safety attitudes questionnaire (SAQ). The original SAQ developed by Sexton et al. [16] has six dimensions and has been widely used worldwide to assess the patient safety culture in healthcare organizations [16-21]. In Taiwan, the Joint Commission of Taiwan developed the eight dimensions of the Chinese version of the SAQ (CSAQ) based on the original SAQ with good psychometric properties and internal consistency to measure the patient safety culture of healthcare organizations. Since then, the CSAQ has become the official questionnaire for healthcare organizations in Taiwan to measure the patient safety culture in a yearly basis [7,22-24]. The detailed information regarding the dimensions and questions of the CSAQ can be referred to Lee et al. [7].

Compared with the SAQ, two more dimensions (emotional exhaustion and work-life balance) were integrated into the CSAQ. By using either the SAQ or CSAQ, several

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dimensions are suggested to be given a high priority to improve the patient safety culture. For example, Lee et al. [25] and Shieh et al. [26] stated that teamwork climate, job satisfaction, and working conditions are main critical dimensions that should be closely monitored to effectively strengthen the patient safety culture. The importance of management leadership should not be ignored in building patient safety culture as it represents the approval of managerial actions to achieve patient safety [5]. Wu et al. [8] investigated the perceptions of patient safety culture among different medical staff and found that perceptions of management, safety climate, and emotional exhaustion are essential factors affecting the overall satisfaction of the patient safety culture. In addition to patient safety improvement, Zhang et al. [11] found that six dimensions of patient safety culture have contributed to decreasing absenteeism and turnover.

Medical staff typically initiate contact with patients and do so most frequently. They are the primary providers of medical services and play a crucial role in ensuring patient safety and minimizing medical errors [6,18,27]. In particular, nurses' attitudes toward patient safety culture are especially critical because nurses have direct and close interactions with patients and significantly impact the quality of healthcare [12,27-30]. Moreover, nurses normally have the responsibilities of informing patients about potential medical risks, protecting patient safety, and reporting adverse events [31].

Many studies have provided evidence on the benefits of establishing a patient safety culture, most of which are focused on the perceptions of patient safety-centered care among medical staff and their potential turnover intention [6,7,32-34]. Most of the research objects related to patient safety were on-the-job nurses, and the impact of departed nurses on patient safety attitudes was less discussed [12]. To our knowledge, rare research has been found to compare the differences in the patient safety culture and its overall satisfaction by using SAQ or CSAQ between on-the-job and departed nurses.

By combining both, hospital management will be able to know the perception differences of the CSAQ between departed and on-the-job nurses and to observe what and how the dimension(s) impact the overall satisfaction of the patient safety culture from two different groups. With that in mind, the contributions of this study are to first examine the perception differences of the dimensions from the CSAQ and then explore the relationships between the dimensions and the overall satisfaction of the patient safety culture between these two groups to provide a comprehensive insight and managerial strategies for the enhancement of patient safety culture.

II. RESEARCH METHOD

This study uses the internal datasets by a retrospective approach to compare if departed and on-the-job nurses have different perceptions in the patient safety culture in terms of the dimensions of the CSAQ from a regional teaching hospital in Taiwan from 2016 to 2018. The clinical trial was approved by the Institutional Review Board of Cheng Ching General Hospital (HP190028). The need for informed consent was

waived by the Institutional Review Board due to the retrospective study design. The settings of this study regarding resigned and on-the-job nurses are as follows. Nurses who filled out the CSAQ in October-November 2016, 2017, and 2018 but left their jobs in 2017, 2018, and 2019, respectively, are defined as departed nurses, whereas nurses who are still on-the-job are on-the-job nurses. Therefore, the effective numbers of departed nurses in 2016, 2017, and 2018 are 50, 68, and 46, respectively. The effective numbers of on-the-job nurses in 2016, 2017, and 2018 are 341, 396, and 386, respectively. The demographic variables regarding both departed and on-the-job nurses from 2016 to 2018 are summarized in Table I.

In the CSAQ questionnaire, seven dimensions use a five-point Likert's scale ranging from strongly disagree to strongly agree with the respective numerical values of 1 to 5, whereas the work-life balance dimension uses a four-point scale to measure the frequency, i.e., less than 1 day per week, 1-2 days per week, 3-4 days per week, and 5-7 days per week [35]. Because the work-life balance dimension uses a different scale and measures the frequency rather than agreement, this study removes it for further analysis. There are eleven questions with negative wordings such that each respondent's numerical score is reversed. In addition, the score for each dimension is calculated by aggregating the scores of the individual questions within that particular dimension. Moreover, this case hospital adds one additional question to assess the overall satisfaction of the patient safety culture by a five-point scale from very dissatisfied to very satisfied with the numerical values of 1 to 5, respectively, for each respondent.

This study has twofold. First, Mann-Whitney U test is employed to evaluate whether departed and on-the-job nurses have different perceptions in the patient safety culture in terms of the dimensions with $\alpha = 0.05$ from 2016 to 2018. Each year the numbers of departed nurses are relatively small compared with those of on-the-job nurses. In addition, the normal distributions or approximations of the scores from departed nurses are unknown, it is better to employ a non-parametric approach (Mann-Whitney U test) to replace the sample t-test in practice. Second, linear regression with forward selection with the criteria of F-to-enter (F test) ≤ 0.05 is used to find critical dimension(s) that impact the overall satisfaction of the patient safety culture from the viewpoints of these two groups from 2016 to 2018. Seven dimensions are the independent variables, whereas the overall satisfaction of the patient safety culture is the dependent variable. In addition, the severity of multicollinearity of seven input variables is assessed by variance inflation factor (VIF) [36]. The presence of autocorrelation in the residuals of variables is performed by Durbin-Watson statistic [37].

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TABLE I
DEMOGRAPHIC VARIABLES OF BOTH DEPARTED AND ON-THE-JOB NURSES FROM 2016 TO 2018

Demographic Variable	Departed nurses in 2016 Frequency (%)	On-the-job nurses in 2016 Frequency (%)	Departed nurses in 2017 Frequency (%)	On-the-job nurses in 2017 Frequency (%)	Departed nurses in 2018 Frequency (%)	On-the-job nurses in 2018 Frequency (%)
Gender						
Male	2 (4.0)	12 (3.5)	4 (5.9)	21 (5.3)	2 (4.3)	23 (6.0)
Female	48 (96.0)	329 (96.5)	64 (94.1)	375 (94.7)	44 (95.7)	363 (94.0)
Age						
Less than 20	4 (8.0)	7 (2.1)	1 (1.5)	6 (1.5)	0 (0)	3 (0.8)
21-30	35 (70.0)	135 (39.6)	51 (75.0)	163 (41.2)	34 (73.9)	169 (43.8)
31-40	7 (14.0)	129 (37.8)	10 (14.7)	133 (33.6)	9 (19.6)	112 (29.0)
41-50	4 (8.0)	58 (17.0)	5 (7.4)	82 (20.7)	2 (4.3)	84 (21.8)
51-60	0 (0)	12 (3.5)	1 (1.5)	12 (3.0)	1 (2.2)	17 (4.4)
61 and above	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)
Supervisor/Manager						
Yes	5 (10.0)	33 (9.7)	4 (5.9)	34 (8.6)	2 (4.3)	43 (11.1)
No	45 (90.0)	308 (90.3)	64 (94.1)	362 (91.4)	44 (95.7)	343 (88.9)
Respondents reporting events in the past 12 months						
No	31 (62.0)	198 (58.1)	38 (55.9)	247 (62.4)	28 (60.9)	216 (56.0)
1-5	17 (34.0)	136 (39.9)	28 (41.2)	140 (35.4)	15 (32.6)	156 (40.4)
6-10	1 (2.0)	6 (1.8)	1 (1.5)	3 (0.8)	3 (6.5)	11 (2.8)
11-15	1 (2.0)	1 (0.3)	1 (1.5)	5 (1.3)	0 (0)	1 (0.3)
More than 16	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	2 (0.5)
Job status						
Full time	36 (72.0)	315 (92.6)	53 (77.9)	369 (93.2)	28 (60.9)	365 (94.6)
Contract	4 (8.0)	10 (2.9)	1 (1.5)	13 (3.3)	4 (8.7)	11 (2.8)
Part time	2 (4.0)	3 (0.9)	5 (7.4)	0 (0)	2 (4.3)	4 (1.0)
Agency	8 (16.0)	13 (3.8)	9 (13.2)	14 (3.5)	12 (26.1)	6 (1.6)
Experience in organization						
Less than 6 month	15 (30.0)	34 (10.0)	5 (7.4)	43 (10.9)	3 (6.5)	33 (8.5)
6 to 11 months	7 (14.0)	31 (9.1)	4 (5.9)	12 (3.0)	5 (10.9)	15 (3.9)
1 to 2 years	14 (28.0)	55 (16.1)	38 (55.9)	88 (22.2)	20 (43.5)	75 (19.4)
3 to 4 years	5 (10.0)	43 (12.6)	11 (16.2)	52 (13.1)	11 (23.9)	55 (14.2)
5 to 10 years	6 (12.0)	79 (23.2)	5 (7.4)	87 (22.0)	4 (8.7)	87 (22.5)
11 to 20 years	2 (4.0)	88 (25.8)	4 (5.9)	98 (24.7)	3 (6.5)	96 (24.9)
21 years or more	1 (2.0)	11 (3.2)	1 (1.5)	16 (4.0)	0 (0)	25 (6.5)
Experience in position						
Less than 6 month	17 (34.0)	43 (12.6)	6 (8.8)	44 (11.1)	4 (8.7)	40 (10.4)
6 to 11 months	7 (14.0)	32 (9.4)	5 (7.4)	18 (4.5)	6 (13.0)	20 (5.2)
1 to 2 years	16 (32.0)	59 (17.3)	37 (54.4)	95 (24.0)	22 (47.8)	79 (20.5)
3 to 4 years	3 (6.0)	53 (15.3)	12 (17.6)	61 (15.4)	8 (17.4)	60 (15.5)
5 to 10 years	7 (14.0)	86 (25.2)	6 (8.8)	96 (24.2)	4 (8.7)	98 (25.4)
11 to 20 years	0 (0)	63 (18.5)	2 (2.9)	76 (19.2)	2 (4.3)	75 (19.4)
21 years or more	0 (0)	5 (1.5)	0 (0)	6 (1.5)	0 (0)	14 (3.6)
Education						
Junior high school and below	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)
Senior high school	0 (0)	4 (1.2)	0 (0)	4 (1.0)	0 (0)	4 (1.0)
College/University	47 (94.0)	326 (95.6)	66 (97.1)	379 (95.7)	46 (100)	370 (95.9)
Graduate school and above	3 (6.0)	11 (3.2)	2 (2.9)	12 (3.0)	0 (0)	12 (3.1)
Direct patient contact						
No	2 (4.0)	12 (3.5)	0 (0)	11 (2.8)	1 (2.2)	6 (1.6)
Rare	4 (8.0)	21 (6.2)	2 (2.9)	27 (6.8)	5 (10.9)	24 (6.2)
Very often	44 (88.0)	308 (90.3)	66 (97.1)	358 (90.4)	40 (87.0)	356 (92.2)

2016 to 2018. Seven dimensions are the independent variables, whereas the overall satisfaction of the patient safety culture is the dependent variable. In addition, the severity of multicollinearity of seven input variables is assessed by variance inflation factor (VIF) [36]. The presence of autocorrelation in the residuals of variables is performed by Durbin-Watson statistic [37].

III. RESULTS

Table II summarizes the mean rank values of both departed and on-the-job nurses from 2016 to 2018. Departed nurses have higher mean rank values than on-the-job nurses in safety climate from 2016 to 2018. In contrast, neither departed

nurses nor on-the-job nurses have the dominance for the rest of six dimensions from 2016 to 2018. That is, on-the-job nurses have better mean rank values in either one or two years. However, Mann-Whitney U test shows that none of seven dimensions has any statistical difference consistently between these two groups except for emotional exhaustion in 2018. That is, departed nurses feel less burnout than on-the-job nurses in 2018. For the rest of dimension-year combinations, the perceptions of the patient safety culture in terms of dimensions are not statistically different between departed and on-the-job nurses.

TABLE II
MEAN RANK VALUES AND RESULTS OF MANN-WHITNEY U TEST FOR TWO GROUPS

Dimension	Year	Mean Rank of departed nurses	Mean Rank of on-the-job nurses	Mann-Whitney U Test	Z	Exact sig. (2-tailed)	Post hoc results
Teamwork climate	2016	206.77	194.42	7986.5	-0.724	0.470	
	2017	221.85	234.33	12740.0	-0.712	0.478	
	2018	229.10	215.00	8298.5	-0.727	0.469	
Safety climate	2016	220.66	192.38	7292.0	-1.662	0.097	
	2017	233.16	232.39	13419.0	-0.044	0.965	
	2018	241.33	213.54	7736.0	-1.435	0.152	
Job satisfaction	2016	193.36	196.39	8393.0	-0.179	0.858	
	2017	225.70	233.67	13001.5	-0.458	0.648	
	2018	226.90	215.26	8399.5	-0.605	0.547	
Stress recognition	2016	214.42	193.30	7604.0	-1.247	0.213	
	2017	246.06	230.17	12542.0	-0.912	0.363	
	2018	199.02	218.58	8074.0	-1.015	0.311	
Perceptions of management	2016	208.62	194.15	7894.0	-0.858	0.392	
	2017	226.08	233.60	13027.5	-0.434	0.665	
	2018	227.51	215.19	8371.5	-0.641	0.523	
Working conditions	2016	207.42	194.33	7954.0	-0.782	0.435	
	2017	227.55	233.35	13127.5	-0.335	0.738	
	2018	236.39	214.13	7963.0	-1.163	0.246	
Emotional exhaustion	2016	184.35	197.71	7942.5	-0.787	0.433	
	2017	204.07	237.38	11531.0	-1.900	0.057	
	2018	250.75	212.42	7302.5	-1.987	0.047	Departed > On-the-job

Linear regression with forward selection is employed in the second part of the study to identify critical dimension(s) that could significantly affect the overall satisfaction of the patient safety culture from viewpoints of both departed and on-the-job nurses. For departed nurses, VIF values from 2016 to 2018 are less than 3, indicating multicollinearity is relatively low [36]. The values of Durbin-Watson statistic are 1.952, 1.876, and 1.963 indicating residuals are not correlated when the test statistic's value is close to 2 [37]. Two models with adjusted R squared values of 0.598 and 0.663, one model with adjusted R squared value of 0.427, and two models with adjusted R squared values of 0.440 and 0.533 are significant at $\alpha = 0.05$ for the respective 2016, 2017, and 2018. From Table III, perceptions of management are the first selected variable in these two models followed by teamwork climate, and both standardized coefficients are positive values in 2016. That is, perceptions of management and teamwork climate have positive influences on the overall satisfaction of the patient safety culture, and perceptions of management have a stronger impact than teamwork climate based on the standardized coefficients. In 2017, working conditions is the only selected variable and has a positive impact on the overall perception of the patient safety culture. In 2018, two dimensions have been selected with the sequences of perceptions of management and teamwork climate. Both dimensions have positive influences on the overall satisfaction of the patient safety culture. Besides, perceptions of management with a larger standardized coefficient have a stronger influence than teamwork climate with a smaller standardized coefficient.

For on-the-job nurses, VIF values from 2016 to 2018 are

less than 4, indicating multicollinearity is relatively low [36]. The values of Durbin-Watson statistic are 2.013, 1.784, and 1.961 indicating residuals are not correlated when the test statistic's value is close to 2 [37]. Three models with adjusted R squared values of 0.420, 0.452, and 0.465, four models with adjusted R squared value of 0.413, 0.459, 0.469, and 0.479, and three models with adjusted R squared values of 0.465, 0.490, and 0.510 are significant at $\alpha = 0.05$ for the respective 2016, 2017, and 2018. In 2016, working conditions, safety climate, and perceptions of management are the selected variables in the third model, and these three standardized coefficients are all positive values as shown in Table IV. Besides, working conditions have the strongest influence on the overall satisfaction of the patient safety culture followed by safety climate and perceptions of management. In 2017, working conditions, job satisfaction, safety climate, and stress recognition are the selected variables in the fourth model. The standardized coefficients of working conditions, job satisfaction, and safety climate are positive, while the standardized coefficient of stress recognition is negative. Besides, working conditions have the strongest influence on the overall satisfaction of the patient safety culture. It is worth to note that the overall satisfaction decreases when on-the-job nurses perceive higher stress levels. In 2018, working conditions, perceptions of management, and emotional exhaustion are the selected dimensions in the third model. The standardized coefficients are all positive values and working conditions have the largest coefficient indicating that this dimension has the largest and positive impact on the overall satisfaction of the patient safety culture.

TABLE III
COEFFICIENTS OF MODELS IN FROM 2016 TO 2018 FOR DEPARTED NURSES

Year	Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Standard error	Beta		
2016	2	(Constant)	-0.025	0.387	-0.064	0.949
		Perceptions of management	0.142	0.031	0.528	< 0.001
		Teamwork climate	0.068	0.021	0.365	0.002
2017	1	(Constant)	0.592	0.390	1.516	0.134
		Working conditions	0.188	0.026	0.660	< 0.001
2018	2	(Constant)	0.011	0.521	0.021	0.983
		Perceptions of management	0.108	0.034	0.417	0.003
		Teamwork climate	0.086	0.028	0.409	0.003

TABLE IV
COEFFICIENTS OF MODELS FOR ON-THE-JOB NURSES FROM 2016 TO 2018

Year	Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Standard error	Beta		
2016	3	(Constant)	0.546	0.175	3.119	0.002
		Working conditions	0.080	0.020	0.297	< 0.001
		Safety climate	0.036	0.011	0.226	0.001
		Perceptions of management	0.060	0.020	0.217	0.003
2017	4	(Constant)	0.725	0.194	3.742	< 0.001
		Working conditions	0.096	0.016	0.337	< 0.001
		Job satisfaction	0.047	0.011	0.241	< 0.001
		Safety climate	0.028	0.009	0.187	0.002
		Stress recognition	-0.023	0.008	-0.106	0.004
2018	2	(Constant)	0.199	0.175	1.134	0.257
		Working conditions	0.117	0.017	0.435	< 0.001
		Perceptions of management	0.067	0.017	0.252	< 0.001
		Emotional exhaustion	0.021	0.005	0.152	< 0.001

IV. DISCUSSION

This is a pioneer study that uses a longitudinal approach to analyze the internal datasets from 2016 to 2018. Though the perceptions in terms of dimensions of the CSAQ are not statistically significant except for emotional exhaustion dimension in 2018, the results of linear regression are different. For departed nurses, perceptions of management and teamwork climate are the variables to positively influence the overall satisfaction of the patient safety culture in 2016 and 2018. In 2017, working conditions is the only variable to positively impact the overall satisfaction. Based on a three-year analysis, perceptions of management and teamwork climate are more important to impact the overall satisfaction followed by working conditions. From the perspectives of departed nurses, more positive perceptions of management, teamwork climate, and working conditions are associated with higher overall satisfaction with the patient safety culture.

In contrast to departed nurses, on-the-job nurses have more similarities. Working conditions are the only variable appeared from 2016 and 2018 and have the largest standardized coefficient showing this dimension has the strongest influence on the overall satisfaction of the patient safety culture in this case hospital. Safety climate and perceptions of management are the selected variables in two out of three years. Job satisfaction, stress recognition, and emotional exhaustion are also appeared during one of the three-year periods.

By comparing the results of linear regression from both departed and on-the-job nurses, perceptions of management are the consensus dimension that affect the overall

satisfaction of the patient safety culture. In contrast, working conditions are not the variable to consistently influence the overall satisfaction from resigned nurses' viewpoints as well as safety climate. From the viewpoints of hospital management, improving perceptions of management can enhance both departed and on-the-job nurses' satisfaction on the patient safety culture. However, enhancing working conditions as well as safety climate need to be placed in a high priority to reduce the turnover of on-the-job nurses.

V. CONCLUSIONS

A longitudinal study conducted at a regional teaching hospital in Taiwan analyzes the differences in perceptions of patient safety culture between departed and on-the-job nurses. Perceptions of management and teamwork climate are the critical dimensions to positively influence the overall satisfaction of the patient safety culture for departed nurses, whereas working conditions are the most critical dimension to affect the overall satisfaction followed by perceptions of management and safety climate positively for on-the-job nurses. Therefore, improving working conditions and safety climate might be a means of reducing the nurses' turnover in practice based on the findings.

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