

An investigation of near miss organizational learning in nursing organization: A mixed method study

Tingting Feng

School of Nursing, Chinese Academy of Medical Sciences & Peking Union Medical College

Xin Zhang

School of Nursing, Chinese Academy of Medical Sciences & Peking Union Medical College

Lingling Tan

Department of Nursing, The Second Affiliated Hospital of University of South China

Yuanyuan Su

School of Nursing, The University of South China

Huaping Liu (✉ huapingliu@pumc.edu.cn)

School of Nursing, Chinese Academy of Medical Sciences & Peking Union Medical College

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Abstract

Background: Near miss organizational learning is important for perspective and proactive risk management. Although nursing organization is the largest component of the healthcare system and always act as the final safety barrier, there is little research about the current status of near miss organizational learning. Thus, we conducted this research to explore near miss organizational learning in a Chinese nursing organization at first and lay a solid foundation for future improvement.

Methods: This is mixed method research with an explanatory sequence. It was conducted in a Chinese nursing organization of a tertiary hospital under the guidance of the 4I Framework of Organizational Learning. The quantitative study explored near miss organizational learning with 600 nurses by random sampling. Then, we applied purposive sampling to recruit 16 nurses across managerial levels from low-, middle- and high-scored nursing units and conducted semi-structured interviews. Descriptive statistics, structured equation modelling and content analysis were applied in the data analysis. The GRAMMS checklist was used to report this study.

Results: Only 33% of participants recognized near miss correctly, and 4% of participants always reported near miss. The 4I Framework of Organizational Learning was verified in the surveyed nursing organization ($\chi^2=0.775$, $P=0.379$, $RMSEA<0.01$), and the current organizational learning behaviour was not conducive to near miss organizational learning due to poor group-level learning ($b_{GG}=0.284$) and poor learning absorption ($b_{Misalignment}=-0.339$). In addition, researchers developed 13 codes, 9 categories and 5 themes to deduct the near miss organizational learning, which is characterized by nurses' unfamiliarity with near miss, preference and the dominance of first-order problem solving behaviour, the suspension of near miss learning since group level and poor absorption of learning.

Conclusions: This is pioneering research to investigate near miss organizational learning in nursing organizations under a solid theoretic foundation. The results showed that the performance of near miss organizational learning is unsatisfying even in nursing organization of tertiary hospital; therefore, the situation may be worse in primary hospitals. Thus, more studies should be done to investigate near miss organizational learning and propose useful strategies for improvement.

Introduction

Patient safety is an urgent and serious global public health concern. An estimated of 134 million adverse events occur annually and cause 2.6 million deaths in hospitals worldwide(1). Although learning from error is an important way to improve patient safety, only a few health organizations have achieved ideal performance. Recently, an increasing number of healthcare managers have recommended applying organizational learning for error learning to improve patient safety one step further(2, 3).

Near miss is an incident that did not reach the patient. It occurs more frequently than adverse events and provides early warnings of the system's vulnerabilities at no cost to the patient (2, 4), making it a more valuable learning source for healthcare organizations than adverse events. In addition, learning from near

miss is critical for healthcare organizations to transfer from their traditional retrospective, passive risk management to a prospective, proactive risk management(5). However, due to its salient nature, it is more difficult to grasp and learn from than that of adverse events; for example, a recent study revealed that there were only 25 near misses reported in a Chinese tertiary hospital in 2018, much less than the number of adverse events(6). Despite the importance of near miss organizational learning, most studies concerned the prevalence, contributing factors, the underreporting issue and the quality improvement project(7, 8), only a few tried to study near miss through the organizational learning perspective, and most of them were without the guidance of organizational learning theory(9, 10).

Organizational learning was first proposed in the 1960s, and the classic definition regards it as a process of detecting and correcting errors through which organizations can update their cognition and behaviour, thus promoting their organizational performance(11, 12). Organizational learning theory has flourished during the past 60 years, among which the 4I Framework of Organizational Learning is widely acknowledged. It has been accepted in many countries across various industries. In particular, the director of the Research Center for China Industry-University-Research Cooperation Issues has recommended applying the 4I Framework of Organizational Learning in error learning within organizations(13, 14). In addition, theory developers have established a corresponding measuring instrument to facilitate its conduction(15). Thus, considering accuracy and user friendliness, researchers selected the 4I Framework of Organizational Learning to guide this research.

In the 4I Framework of Organizational Learning, organizational learning is formed through the interaction between intuiting, interpreting, integrating and institutionalizing across the individual-, group- and organizational- level. Intuiting is the process of preconscious pattern recognition and pattern comprehension, which will influence subsequent coping behaviour. The interpreting at the individual level is the explanation through words and/or actions of an insight or idea to one's self and to others. The interpretation at the group level is the development of a shared mental model. The integrating at the group level is the process of mutual adjustment among group members and the formation of collective actions. The integrating at the organizational level is the process of synthesizing and integrating group-level learning stocks. Institutionalizing is the process of setting well-tested knowledge into organizational memory, forming new rules and procedures. In addition, the theory developer stressed that organizational learning and its absorption have a positive relationship with organizational performance (16).

Although healthcare organizations have realized the importance of near miss organizational learning, near miss organizational learning research is scarce worldwide. Considering that nurses are the largest occupational sector of the healthcare workforce and their important role in patient safety(17), we first investigated near miss organizational learning in a Chinese nursing organization of a tertiary hospital.

The research questions were developed under the guidance of the 4I Framework of Organizational Learning, including the following:

1. What are the characteristics of organizational learning? (Quantitative & Qualitative)
2. How about the performance of near miss organizational learning?
 - 1) How well do nurses recognize near miss in their work? What about their intention towards different types of coping behaviours? What is their coping behaviour in real clinics following near miss? (Quantitative & Qualitative)
 - 2) How do they develop shared mental model? How do they conduct collective action towards near miss? (Group-level learning: interpreting and integrating); (Qualitative)
 - 3) How do nursing organization integrate near miss learning from various units? How about the institutionalization about near miss learning? (Qualitative)

According to the research questions, researchers conducted a comprehensive literature review and noticed that there are some instruments for organizational learning behaviour and near miss learning at the individual level. Considering that near miss learning at the group level and organizational level are the processes of dialogue and adaptation and the existence of regulations (unit or organization), a qualitative research design may offer more accurate and rich results. Thus, we decided to apply the mixed method research design. On the one hand, we can provide a comprehensive description of near miss organizational learning across different levels within the surveyed organization; on the other hand, we can perform data triangulation, ensure the trustworthiness and off-setting weaknesses of quantitative and qualitative research, and provide stronger inferences to research questions(18).

Methods

Study design

We applied the explanatory sequenced mixed method design and followed the good reporting of a mixed method study (GRAMMS) framework to report this study (Appendix 1)(19). First, we conducted quantitative research to obtain a general understanding of near miss organizational learning. Then, we selected key informants from the high-, middle- and low-performance nursing units for interviews to perform data triangulation and enrich the previous stage's research results.

Setting and participants

The study was conducted in a Chinese nursing organization of a tertiary hospital from October 2020 to January 2021. This nursing organization contains 61 nursing units and 1132 nurses. The registered nurses who worked in the front-line clinic were eligible participants. Those who worked in positions other than nursing or on sick leave were excluded. In the quantitative study, the minimum sample size is recommended to range from 285 to 291 based on the size of the organization's population (1100-1200), and with the estimation of an approximately 50% validation questionnaire rate, the sample size was determined to be 600(20). The participants were identified by the staff list and recruited through random

sampling. In the qualitative study, we enrolled participants from high-, middle- and low-performance nursing units by purposive sampling. Data collection and content analysis were conducted at the same time, and the interview was stopped until data saturation.

Data collection

Researchers distributed the survey link, name list and a detailed explanation of the research to head nurses, and they delivered the survey link to respondents. Since the survey contained two questionnaires (85 items), we conducted the survey in two consecutive weeks.

After the completion of the survey, we applied purposive sampling to recruit participants for semi-structured interviews. We divided the surveyed nursing units into high-, middle- and low-scored groups and selected one unit as a representative in each group. Then, we interviewed nurses from various managerial levels from selected units. Interviewees were offered informed consent and asked for permission before audiotaping the interview. The audiotapes were transcribed verbatim, checked for accuracy and imported into NVivo 11.0 after the completion of the interview.

Measures

According to the research questions and the 4I Framework of Organizational Learning, we measured two outcomes: organizational learning behaviour and near miss organizational learning (Table 1).

Table 1 Near miss organizational learning outcomes and their measurement

Variable	Level	Outcomes	Measurement
Organizational learning behaviour	Individual	Individual level learning stocks (II)	Chinese version of Strategic Learning Assessment Map
	Group	Group level learning stocks (GG)	
	Organizational	Organizational level learning stocks (OO)	
	Across all levels	Feed-forward learning flows (FF)	
	Across all levels	Feed-back learning flows (FB)	
	Across all levels	Organizational performance (PERF)	
Near miss organizational learning performance	Individual	Intuition	1.Quiz about near miss definition & Interview question Q1 2.The Scale for Second-order Problem Solving Behavioural Intention following Near Miss & Interview question Q2
		Interpretation	Quiz about near miss reporting behaviour & Interview question Q3
	Group	Interpretation	Interview question Q4
		Integration	Interview question Q5
	Variable	Level	Outcomes
Measurement			
Near miss organizational learning performance	Organizational	Integration	Interview question Q6
		Institutionalizing	Interview question Q7

The following are the details of these measurements:

The Chinese version of Strategic Learning Assessment Map

The Strategic Learning Assessment Map is an instrument built on the 4I Framework of Organizational Learning. It can offer an overall description of organizational learning and diagnose the existing problems (15). It contains six domains: individual-level learning stocks (II), group-level learning stocks

(GG), organizational-level learning stocks (OO), feed-forward learning flows (FF), feedback learning flows (FB) and organizational performance (PERF). Each domain has 10 items. All items are rated on a 7-point Likert scale (1=strongly disagree, 7= strongly agree), and the higher the score is, the better the performance. In addition, we can use an equation to calculate the misalignment. The misalignment can reflect the learning absorption, and the equation is $Misalignment = (\bar{x}_{II} + \bar{x}_{GG} + \bar{x}_{OO}) / 3 - (\bar{x}_{FF} + \bar{x}_{FB}) / 2$. This instrument has been used in North America and European countries(13, 15); it has already been translated and culturally adapted into Chinese. The Cronbach's α for the overall scale and its subscales ranged from 0.97 to 0.99, the I-CVI was 0.87 and the S-CVI/Ave was 0.98(21).

Quiz about near miss definition

Researchers developed an item by asking them to select the correct definition among four choices, including definitions of near miss, adverse event, hazard and sentinel event; the higher the accuracy, the better the intuition (4).

The Scale for Second-order Problem Solving Behavioural Intention following Near Miss

Intention for behaviours following near miss can be grouped into two categories: the intention for the first- and second-order problem solving behaviour following near miss(22), among which only the second-order problem solving behaviour can promote the near miss organizational learning and reduce future risk. Researchers applied the Scale for Second-Order Problem Solving Behavioural Intention following Near Miss to test nurses' intention of near miss coping behaviours (22, 23). Its S-CVI/Ave is 1.0, the overall Cronbach's α is 0.909 and the Cronbach's α for its subscales ranges from 0.799 to 0.875. It contains five dimensions: reporting intention, sharing intention among colleagues, intention for cause exploration, practice changing intention and continuous improvement intention. It has 23 items, and all items are rated on a 5 Likert scale, 1=strongly disagree, 5 = strongly agree; the higher the score is, the more likely nurses are to engage in second-order problem solving behaviour.

Problem solving behaviours following near miss

It is widely acknowledged that problem solving behaviours generally include first- and second-order problem solving behaviours. First-order problem solving behaviour occurs when nurses do a quick fix and continue to finish a task that is blocked or interrupted. Whereas second-order problem solving behaviour occurs when nurses do a quick fix, take action to address underlying causes and bring the problem to managers' attention, error reporting can generally be regarded as a sign of second-order problem solving behaviour(23). Researchers evaluated reporting behaviour following near miss by a self-reported item borrowed from the Hospital Survey on Patient Safety Culture(24). This item is 'when a mistake is made in your hospital work area/unit, but is caught and corrected before affecting the patient, how often is this reported?', the participants can choose never, rarely, sometimes, most of the time, or always to describe their reporting behaviours. Their choice can reflect their preference for different types of problem-solving behaviour.

Semi-structured interview guideline

Qualitative interviews were jointly performed through individualized interviews and focus group interviews to avoid power differentials and their negative influence. The interview guideline (Table 2) was developed based on the 4I Framework of Organizational Learning. Researchers conducted individualized interviews with nurse leaders (N=4) and three focus group interviews with 12 nurses at the non-managerial level.

Table 2 Semi-structured interview guideline

Domain	Semi-structured questions
Individual level learning	Q1: Are you familiar with near miss, what is your comprehension?
	Q2: What will you do if you encountered with a near miss in your work? And how about your colleagues?
	Q3: Have you ever reported near miss?
Group level learning	Q4: How does your nursing unit deal with near miss?
	Q5: Are there any regulations?

Domain	Semi-structured questions
Organizational level learning	Q6: How does your nursing organization deal with near miss?
	Q7: Are there any regulations?

Data analysis

Statistical analysis

Quantitative data analysis Quantitative data were imported and analysed by SPSS 24.0. Means, standard deviations and percentiles were used for statistical description. The hypothesis testing of the Strategic Learning Assessment Map were analysed by structural equation modelling (SEM) using AMOS 25.0. In addition, alpha level was set at $p < 0.05$.

Qualitative analysis Qualitative data were analysed using content analysis (deductive and inductive) by two independent researchers with the following steps: (1) build an analysis matrix under the 4I Framework of Organizational Learning(see Appendix 2); (2) researchers reviewed the transcribed text thoroughly and repeatedly, therefore to be familiar with the text content; (3) researchers analysed and compared their coding with the initial three interviews, then they discussed the discrepancies and developed the initial version of codebook; (4) researchers analysed the following interview and categorized all the codes into the analysis matrix;(5) researchers went through the text for another circle

and conducted inductive content analysis, deciding whether there are new codes or categories should be added and then decided the final version of codebook(25).

Integration of data and emergent themes

To integrate qualitative and quantitative data, the findings are displayed together and merged under the analysis matrix.

Validity and reliability/Rigor

We applied various methods to guarantee the credibility, dependability, confirmability and transferability of our research(26).

Credibility ☒ The qualification of researchers is essential to ensure the credibility of research. All researchers were experienced nursing researchers in quantitative studies and qualitative studies, thus ensuring the credibility of our research. ☒ In this research, we applied both quantitative and qualitative research to investigate near miss organizational learning (methodological triangulation); in addition, our data were collected from various sources, including surveys, interviews and records in the Adverse Event Reporting System (data triangulation); furthermore, two researchers participated and discussed the coding work until a consensus was made during content analysis (investigator triangulation).

Dependability & Confirmability Researchers recorded every research procedure and all the details on a computer, and research members checked these audits regularly.

Transferability Researchers provided detailed information about the nursing organization, the theory and instruments we applied in this survey; therefore, risk managers in other similar healthcare organizations can easily apply our research results.

Ethical considerations

The study was reviewed and approved by the Ethics Committee of the School of Nursing, Chinese Academy of Medical Sciences & Peking Union Medical College (IRB approval number:201902). All participants were voluntarily participating in this research and we obtained their informed consent before the survey and interview.

Results

Characteristics of nursing organization and participants

A total of 560 nurses from 46 nursing units completed the Strategic Learning Assessment Map, and 376 valid questionnaires were analysed. There were 341, 33 and 2 nurses from the non, middle- and high-managerial levels, respectively, and their length of employment in this hospital was 8 (4,11) years. A total of 598 nurses completed the second survey, including the Scale for Intention of Second-Order Problem

Solving Behavioural following Near Miss, the definition and reporting behaviours towards near miss. There were 349 valid questionnaires in the second round. The participants' length of employment in this hospital was 10 (5, 12.75) years, and their length of employment in their nursing unit was 7 (3, 10) years.

Organizational learning

Score of Organizational learning

Through Table 3, we noticed that the mean score of every dimension in the Strategic Learning Assessment Map was less than 6 (6=agree), higher than that of previous studies but still has room for improvement(13, 15). Among all the dimensions, the individual-level learning stocks scored the highest, and the feed-forward learning flows scored the lowest.

Table 3 Survey results of organizational learning (N=376)

Dimension	Mean (SD)
Individual-level learning stocks	5.85(0.93)
Group-level learning stocks	5.83(0.91)
Organizational-level learning stocks	5.76(0.91)
Feed-forward learning flows	5.74(0.92)
Feed-back learning flows	5.77(0.95)
Organizational performance	5.59(0.94)
Misalignment	0.06(0.41)

Characteristics of organizational learning

The SEM results verified the 4I Framework of Organizational Learning, supporting that individual-, group- and organizational-level learning stocks have a positive relationship with organizational performance and that misalignment has a negative relationship with organizational performance (Fig. 1). The model-fit indices are $\chi^2=0.775$, $P=0.379$, $RMSEA<0.01$.

The regression equation is organizational performance= -0.77 misalignment +0.33 individual-level learning stocks+0.29 group-level learning stocks+0.32 organizational-level learning stocks+ 0.15, and the standardized regression coefficients are as follows: $b_{II}=0.334$, $b_{GG}=0.284$, $b_{OO}=0.313$, and $b_{Misalignment}=-0.339$.

Performance of near miss organizational learning

Near miss recognition

Only 33% of surveyed nurses recognized near miss correctly, and most of them regarded it as a sentinel event (8%), adverse event (17%) or hazard (42%).

The second-order problem solving behaviour intention following near miss

Among all the dimensions, the reporting intention scored lowest, indicating that they have stronger intention of first-order problem solving behaviour in their work (Table 4).

Table 4 The Second-order Problem Solving Behaviour Intention following Near Miss (N=349)

Dimension	Mean (SD)
Practice changing intention	4.20(0.59)
Sharing intention among colleagues	4.17(0.53)
Intention for cause exploration	4.22(0.53)
Reporting intention	4.13(0.65)
Continuous improvement intention	4.22(0.56)

Reporting behaviours towards near miss

A total of 50.7% of surveyed nurses indicated that they rarely or never reported near miss to the Adverse Event Reporting System (Fig. 2), and this result is consistent with their stronger intention of first-order problem solving behaviour.

Coding of near miss organizational learning

In accordance with the survey score, we divided the 46 surveyed nursing units into a high-scored group (n=12), a middle-scored group (n=21) and a low-scored group (n=13). Then, we selected one nursing unit in each group for the qualitative study. These nursing units are department of gynaecology, emergency department and urology department. We recruited 16 nurses across different managerial levels within these nursing units and conducted interviews until data saturation. The general information is shown in Table 5. After content analysis, we finally developed 5 themes, 9 categories and 13 codes to describe the near miss organizational learning. The result of content analysis can be seen in Appendix 2.

Table 5 General information of interviewees(N=16)

Number	Department or nursing unit	Position
N1	Nursing department	Vice director (Patient safety)
N2	Department of Gynaecology	Head nurse
N3		Nurse (Patient safety)
N4		Nurse
N5		Nurse
N6		Nurse
N7		Urology Department
N8	Nurse (Patient safety)	
N9	Nurse	
N10	Nurse	
N11	Emergency Department	Head nurse
N12		Nurse (Patient safety)
N13		Nurse
N14		Nurse
N15		Nurse
N16		Nurse

Integration of data and emergent themes

Researchers merged the quantitative and qualitative research results under the analysis matrix (Table 6), through which we can see that the quantitative and qualitative research results described near miss organizational learning in a similar way but enriched each other at the same time.

Table 6 The integration of data and emergent themes

Theme	Category	Quantitative Data	Code
Individual level learning	Intuiting	33% respondents recognised near miss correctly	Unfamiliarity with near miss
		The intention of reporting is the lowest among other dimensions (4.13± 0.65)	Stronger intention of the first-order problem solving behaviour
	Interpreting	50.7% respondents indicated that they have never or rarely reported near miss to the Adverse Event Reporting System There were only 22 records of near miss in the Adverse Event Reporting System in 2020.	Dominance of the first-order problem solving behaviour
Group level learning	Interpreting	The group level learning contributes the least to the organizational performance ($b_{GG}=0.284$)	Unsystematic near miss learning in the nursing unit
	Integrating		Lack of evaluation and recording of near miss learning in the nursing unit
Organizational level learning	Integrating	The mean score of FB10(When making decisions for the future, we do not seem to have any memory of the past) is the lowest among all items of Strategic Learning Assessment Map($\bar{x}=4.90$)	Lack of integration of learning stocks among different nursing units
	Institutionalizing		Lack of standardized near miss management document Non-existence of the institutionalizing work of near miss organizational learning

Theme	Category	Quantitative Data	Code
Feed-forward learning	Rare feed-forward learning		Suspension of near miss organisational

Feed-back learning	Inconsistent comprehension towards near miss management	The misalignment is large ($b_{\text{misalignment}} = -0.339$)	learning since the group level
			No need to report in the individual level
			No need to report in the group level
			Required to report to the organizational level
	Poor utilization of near miss in improve patient safety		No feed back towards near miss learning

Discussion

The organizational learning behaviour and near miss organizational learning performance in surveyed nursing organizations is similar to that of other nursing organizations among Chinese tertiary hospitals; thus, the research results in this study have good representativeness(21). The research results indicated that the current organizational learning behaviour is detrimental to near miss organizational learning and that the learning performance is far from satisfaction.

Characteristics of organizational learning

Based on the 4I Framework of Organizational Learning, group-level learning is the key link between individual-level learning and organizational-level learning, but the results showed that group-level learning stocks contributed the least to organizational performance. Meanwhile, the misalignment was much larger than that of previous studies and played an eye-catching negative role in organizational performance ($b_{\text{Misalignment}} = -0.339$) (13, 15). These two main features warned that near miss organizational learning may be hampered at the group level.

Effects of near miss organizational learning

The individual-level learning of near miss

Unfamiliarity with near miss. The quantitative and qualitative results all supported that nurses were unfamiliar with near miss. Although they considered near miss important to patient safety, most of them cannot tell the difference between near miss, adverse event and hazard, and this confusion will influence nurses' intention and coping strategies negatively.

Stronger intention of the first-order problem solving behaviour. The results exhibited an obvious preference of the first-order problem solving behaviour among nurses over that of the second-order problem solving behaviour, which is consistent with other researchers' results(8).

First-order problem solving behaviour dominates. In most cases, nurses did not report near miss to the Adverse Event Reporting System, therefore, first-order problem solving behaviour dominates. In addition, their preference for informal reporting to the department rather than the formal Adverse Event Reporting System is consistent with the results of previous research (27). This result enlightened us that group level is more important than the organizational level in near miss organizational learning, and we should make full use of this character and lay more authority at the group level.

The group-level learning of near miss

The suspension of the learning since the group level is eye-catching, which can be supported by the unsatisfying performance at the group level in the organizational learning model ($b=0.284$) and nurses' descriptions of their regulation and management towards near miss in their units. Most interviewees said they never reported near miss to group level, and they have no systematic plan for analysing, ameliorating action and evaluation towards near miss in their unit. In addition, there is always no feedback to group members. Although sometimes they conducted action and accumulated some valuable experiences, these near miss learning stocks were not documented well. For example, they are prone to share near misses in WeChat to keep their colleagues alert, but this method cannot facilitate the formation of organizational memory, and it is difficult to resort when needed.

The organizational-level learning of near miss

Due to the suspension of near miss learning at the group level, it is very hard for the continuation of near miss organizational learning. The surveyed nursing organization has few group learning stocks to integrate; in fact, there were only 22 near miss records in the Adverse Event Reporting System in 2020; therefore, it is incapable of reflecting the real situation and conducting prospective, proactive risk management (28). Even worse, the institutionalization of near miss organizational learning is missing.

Problems exist in both feed-forward and feed-back learning

Although it is required to report near miss to the Adverse Event Reporting System based on regulation, most nurses did not comply with it. Researchers also noticed that there are contradictory perspectives towards near miss reporting protocols at the individual-, group- and organizational- levels. These two features indicated poor feedback learning towards near miss in this nursing organization, and they greatly damaged organizational learning (12). Meanwhile, nurses' stronger intention and more frequent conduction of first-order problem solving behaviour hampered feed-forward learning; thus, current near miss knowledge cannot be refined and stored as organizational memory.

Limitations

There are some limitations in our research. First, we only conducted the survey and interview in one nursing organization in a Chinese tertiary hospital; thus, we should interpret the results with caution. In addition, most of the outcome indicators are assessed subjectively through retrospection; thus, our results may be influenced by recall bias and social approval tendency.

Conclusion

Near miss organizational learning is important for prospective, proactive risk management, but our research has indicated that near miss organizational learning is much more difficult than expectation, and the current organizational learning behaviour is not conducive to near miss organizational learning. In addition, the theory and instruments we applied in this research were proven to be useful in facilitating hospital managers to assess their near miss organizational learning. To conclude, to conduct prospective, proactive risk management and improve patient safety further, more research towards near miss organizational learning should be done in the future.

Declarations

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Authors' contributions

All authors have agreed on the final version of the manuscript. Tingting Feng, Huaping Liu, Xin Zhang and Lingling Tan made substantial contribution to the conception, design, data collection and supervision of the research. Tingting Feng and Yuanyuan Su performed the data analysis altogether. Tingting Feng drafted the manuscript, Huaping Liu, Xin Zhang and Lingling Tan helped the revision.

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Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

Declarations

Ethical approval and consent to participate

The study was approved by the Ethics Committee of the School of Nursing, Chinese Academy of Medical Sciences & Peking Union Medical College (IRB approval number:201902). We obtained participants' informed consent before the survey and interview. All methods were performed in accordance with the relevant guideline and regulations.

Consent for publication

Not applicable.

Competing Interest

None.

Author details

¹ School of Nursing, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China.² Department of Nursing, The Second Affiliated Hospital of University of South China, Hengyang, Hunan Province, China.³ School of Nursing, The University of South China, Hengyang, Hunan Province, China.

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Figures

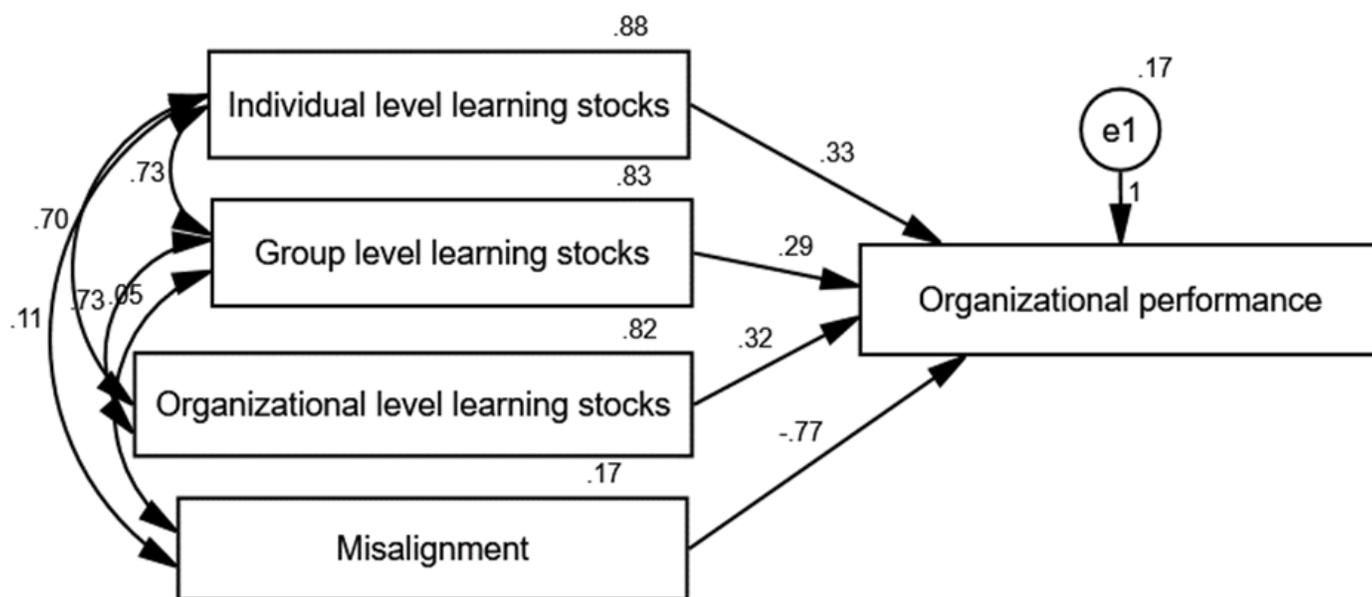


Figure 1

Characteristics of organizational learning in surveyed nursing organizations

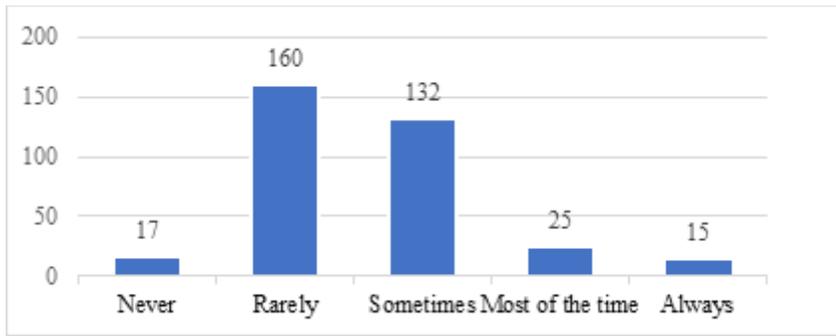


Figure 2

Near miss reporting behaviours towards near miss

Supplementary Files

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- [Appendix2Analysismetrics.docx](#)
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