BMJ Open The barriers to medication error reporting by nurses and factors associated with it: a cross-sectional study in a tertiary hospital of southwest China

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ABSTRACT

Objectives To explore the reporting barriers and related factors of medication errors among nurses in hospitals in China and provide a reference for safe medication management in hospitals.

Design Cross-sectional, online survey.

Setting Responses were collected online from September 2022 to November 2022 across a specific tertiary hospital in Chengdu, China.

Participants Clinical registered nurse.

Primary outcome measure Measure the Barriers to Medication Administration Error (MAE) Reporting Questionnaire, Face-Saving Scale, the Index of Hierarchy of Authority and the Working Environment Questionnaire. Independent sample t-test, correlation analysis and multiple linear regression analysis were performed to identify factors associated with the barriers to MAE reporting.

Results 432 (97.30%) nurses responded. Nurses' standardised scores of barriers to MAE reporting were 3.01 (SD=1.01); the fear dimension items have the highest standardised score of 3.42 (SD=1.11). Working environment is negatively correlated with barriers to MAE reporting (r=-0.201, p<0.01); face-saving (r=0.866, p<0.01) and index of hierarchy of authority (r=0.799, p<0.01) are positively correlated with barriers to MAE reporting. All three were the main influencing factors of barriers to MAE reporting, which could explain 82.4% of the barriers' variance (R²=0.826, R²adj=0.824, F=253.665, p<0.001).

Conclusions Nurses' medication error reporting barriers mainly come from the fear of reporting consequences. The working environment is the protective factor of reporting barriers. Still, face-saving and the index of hierarchy of authority are the main risk factors. Improving the working environment may help reduce medication error reporting barriers. Still, more importantly, hospital managers need to take adequate measures to reduce nurses' sense of face-saving and power distance, which may be more helpful in reducing the barriers to medication error reporting and improving hospital medication safety management.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- \Rightarrow Clinical nurses are the representative sample, and the results have potential clinical intervention significance.
- \Rightarrow Followed rigorous methodological and reporting quidelines.
- \Rightarrow This study is cross-sectional; causal relationships between variables must be carefully determined.
- ⇒ Responses only include nurses from a tertiary hospital in Chengdu. Due to the influence of cultural or regional factors, the generalisation of the conclusions may be limited.

INTRODUCTION

Protected by copyright, including for uses related to text and data min Medication safety is essential to nurse quality and patient safety.¹ In 2017, the WHO published the Third Global Patient Safety ≥ Challenge (innocuous drug use) to reduce Medication administration error (MAE) is any preventable event that occurs during **g** medication management or use by 1 care professionals, patients or consumers at any stage.³ MAE accounts for about 1/4 of medical error events and is an integral part of safety management.⁴ Many MAEs may be minimal, with little clinical significance or no adverse effect on the patient; tragically, **O** however, some may lead to patient potential **g** or direct health damage, prolonged hospital stay or even death. In addition, MAE can increase the medical expenses for patients or hospitals and undermine the public's confidence in the medical services they provide in hospitals.⁵⁶ Globally, the annual cost of MAE reaches as high as US\$420 billion, accounting for nearly 0.7% of the total medical expenses worldwide; it is recognised as a public health and safety concern.²

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Critiquing the person involved in errors or encouraging them to be more careful does not prevent errors from occurring, as it does not change the fundamental conditions that lead to errors.⁶ Identifying and analysing the cause of MAE may be helpful to modify the management loophole, take active preventive measures and improve the safety of drug use.^{7–10} However, reliance on accurate and voluntary user reporting may be the key to analysing MAE and be an essential strategy for medication safety management.¹¹

In hospitals, MAE is the most common type of medication error. Rehan's study showed that 5 medication errors occur per 100 administrations.¹² The rates of MAE were reported at 41.6%-70% in Saudi Arabia and 41%–46% in Iran.^{13 14} Nurses are crucial in reporting and preventing MAE. They are the last line of defence for safe medication use in the medication management chain, including identifying and avoiding errors as well as errors made by physicians, pharmacists and other healthcare providers.¹⁵ Nursing staff voluntarily reporting and actively summarising experiences from error reporting may be the primary means to reduce the incidence of medication errors or improve the safety of medication use.⁷ Therefore, it is extremely essential to encourage and pay attention to nurses' reporting of MAE. However, disappointingly, studies show that nurses face many barriers when reporting MAE. According to Vrbnjak's investigation, only 37%-67% of medication errors are reported by nurses.^{14 16}

Previous studies have shown that work environment, personnel relations, management measures, organisational level and other factors were the impact factors of barriers to nurses' MAE reporting.^{17 18} According to our knowledge, the research on the barriers to and influencing factors of nurse MAE reporting needs to be more comprehensive in China, primarily since unique factors such as regional culture must be addressed. According to Hofstede's survey data, organisations such as China, Singapore and South Korea have higher power distance values and belong to countries with high power distances relative to most countries in the USA and Europe. For example, China's power distance value is 80, but the USA is 40.¹⁹ Besides, it is worth noting that of particular interest is that Chinese organisations tend to have 'Paternalistic' leadership; the managers are often seen as omnipotent elders.²⁰ Influenced by organisational culture, reporting barriers and influencing factors may have cultural characteristics in the Chinese nurse.^{21 22} Identifying the barriers to MAE reporting and the factors influencing reporting barriers, including cultural traits, may provide strategic assistance for the safe drug administration of nurses in China. To this end, we focused on the impact of work environment, power distance and face-saving on nurses' MAE reporting barriers in China.

Previous studies have shown that the better the hospital working environment, the more likely nurses are to report

adverse medical events voluntarily.^{21 23 24} Nurses may be less willing to take the time to fill out reports of medication errors with insufficient hardware, lack of space, limited medical supplies, etc, as this situation may have led to much extra time spent on non-nursing work.^{25 26} In addition, a positive organisational culture can also positively influence nurses' intention to report MAE.²⁷

The power distance refers to the individual's acceptance of the unequal distribution of power in the organisation and the emotional distance between **v** the superior and the subordinate.¹⁷ Under the influ-ence of Chinese traditional culture, the relationship between superiors and subordinates is more vertical; subordinates may have a higher power distance, particularly in women-led organisations with a single gender subject.²⁸ ²⁹ At the same time, individuals with high power distances may tend to rely on their superiors' **gr** attitude when making decisions.^{23 30} Based on cultural traditions and nursing organisational characteristics, hospital policies may encourage nurses to report **E** medication errors, but high power distance structures may be a hindrance.

Goffman believes that face is the positive social image r uses people strive to win in specific social interactions.³¹ In China, 'face' originates from 'shame culture' and has an undeniable dominance or influence on the behaviour of Chinese people.³² To achieve harmony and avoid group conflict, the Chinese will pay more of attention to saving face in interpersonal communication.³³ MAE belongs to adverse events or errors. Reporting MAE may not only damage one's colleagues or the organisation's face but also pose a threat to team harmony. Nurses may be less likely to report MAE proactively to preserve their or colleagues' or the group's face. Therefore, face-saving may be another , Þ critical factor hindering MAE reporting by Chinese nurses.^{21 34}

Present study

l training, ai Our study aims to understand the barriers reported nd by Chinese nurses and the impact of work environment, power distance and face-saving on MAE reporting barriers. The research findings are crucial for enriching the current literature on nurse-reported barriers to MAE. Still, they also offer strategic assistance for hospital nurses who are safe for medication **B** management. Based on existing research and theory, we propose three specific hypotheses. Hypothesis 1: 2 the main factors influencing reporting barriers for Chinese nurses in MAE are work environment, power distance perception and face-saving. Hypothesis 2: power distance perception and face engineering were significantly and positively associated with reporting disability in medical errors among Chinese nurses. Hypothesis 3: work environment significantly correlates negatively with reporting barriers for Chinese nurses in MAE.

METHODS Study design and setting

This was a cross-sectional study. Data were collected from September 2022 to November 2022 across a tertiary hospital in Chengdu, China. The anonymous questionnaire used the software 'questionnaire star,' was opened to all nurses; filled out and submitted was considered voluntary participation.

Measurement

Participation was voluntary, and participants were informed prior to starting the survey that all data collected were non-identifiable and would only be used for research purposes. Before the survey, trained professionals provided uniform and neutral explanations to answer questions or inquiries. The questionnaire stipulates that each individual can only respond once to ensure a 100% consent rate and prevent multiple responses. The questions explored the following four themes:

1. Demographic variables

The self-designed demographic questionnaire was used in this study to collect the characteristics of participants, including gender (male, female), age, marital status (married, single, others), positional rank (nurse, nurse practitioner, nurse-in-charge and above), educational background (college degree, bachelor's degree or graduate degree) and length of nursing service.

2. Barriers to MAE Reporting Questionnaire (BMAERQ)

The BMAERQ was initially developed by Wakefield et al,³⁵ and the Chinese version was translated and validated by Chiang et al.²¹ The questionnaire measures the barriers to nurse reporting through 'Why there are no reports of MAE', with a total of 16 items, including three subscales: fear (six items), reporting process (six items) and administrative barriers (four items). The scoring uses a Likert 6-point scale, with positive scoring (1=strongly disagree, 6=strongly agree), and higher scores indicate that nurses perceive more reporting barriers. In previous studies, it was indicating good reliability and validity; the retest reliability and content validity were 0.727 and 0.899, respectively, and Cronbach's α was 0.880.²¹ In this study, Cronbach's α of this questionnaire was 0.940.

3. Face-Concern Scale (FC) and Index of Hierarchy of Authority Questionnaire (C-IHA)

FC and C-IHA questionnaires were developed by Chinese scholar Chiang.²¹ FC consists of four items used to assess the degree to which nurses are concerned with and maintain the face-saving needs of their colleagues in reporting errors, such as 'Reporting can make colleagues who make mistakes feel embarrassed'. C-IHA consists of 6 items used to assess the power distance nurses feel in decision-making, such as 'Any decision we make must be approved by the nurse manager/leader'. Both questionnaires use a Likert 6-point rating scale, with positive scoring (1=strongly disagree, 6=strongly agree); higher scores indicate a higher degree of concern and maintenance of colleagues' faces or a higher perceived power distance. Both questionnaires use a Likert 6-point

rating scale, with positive scoring (1=strongly disagree, 6=strongly agree), where higher scores indicate a higher degree of concern and maintenance of colleagues' faces or a higher perceived power distance. Two questionnaires have good reliability and validity, with Cronbach's α of 0.70 for the FC scale and 0.80 for the C-IHA questionnaire in previous studies.²¹ In this study, Cronbach's α for the FC scale is 0.861, and Cronbach's α for the C-IHA questionnaire is 0.795.

4. Work Environment Questionnaire (WEQ)

WEQ was designed by Blegen *et al.*³⁶ The Chinese version was translated and validated by Jiang *et al*³⁷ and used to measure nurses' perception of the working environment in the hospital or department. The Chinese version of the questionnaire contains 19 items, divided 8 into four dimensions: medical configuration, human resources, quality management and colleague relationships. The questionnaire uses the Likert 5-point scoring method, with positive scoring ('1' means strongly disagree, '5' means strongly agree); the higher the score, the more satisfied the nurse is with the working environment of the department or hospital. In previous studies, Cronbach's α of the questionnaire was 0.61~0.78.^{21 36 37} Cronbach's α in this study was 0.837.

Participants

The hospital where the participants are located is a tertiary class A comprehensive academic institution hospital in southwestern China. The hospital's staff consists of 1578 health and administrative personnel, among which there are more than 600 nursing professionals. 444 nurses who met the research criteria were invited to participate in this study. The standards included the following: (1) obtaining $\overline{\mathbf{a}}$ a professional qualification certificate from the People's \blacksquare Republic of China; (2) having at least 1 year or more of clinical nursing experience; (3) nurses directly involved in medication therapy or medication management; (4) nurses voluntarily participated in this study. Nurses who failed to complete the investigation were excluded.

Patient and public involvement

As this study focused on clinical nurses, patients or the general public were not involved in the study design.

Statistical analysis

training, and similar technol This study used Excel 2019 and SPSS V.26.0 (IBM, Armonk, New York, USA) for data entry and analysis. The Harman single-factor test was used to test for common & method bias. Metric data were represented by mean±SD, 🞖 while count data were represented by frequency and percentage. The differences in characteristics between variables were compared using independent sample t-tests or χ^2 tests, and pairwise comparisons between multiple data sets were compared using the Least Significant Difference (LSD) method. The correlation between measurement data and barriers to MAE reporting was analysed using Pearson's correlation; the main influencing factors of barriers to MAE reporting were analysed

	Sample	BMAERQ scores		
Variable	n (%)	Mean (SD)	t/F	P value
Gender			-0.804	0.422
Male	24 (5.6)	45.5 (21.13)		
Female	408 (94.4)	48.24 (15.9)		
Age (years)			-2.746	0.006
≤30	190 (44)	45.65 (17.36)		
>30	242 (56)	50 (15.02)		
Length of nursing work (years)			-4.304	<0.001
≤10	225 (52.1)	44.95 (16.82)		
> 10	207 (47.9)	51.5 (14.83)		
Education			-0.235	0.815
Below bachelor degree	183 (42.4)	47.87 (16.2)		
Bachelor degree or above	249 (57.6)	48.25 (16.26)		
Positional ranks			5.951	0.003
Nurse	40 (9.3)	40.15 (15.92) ^b		
Nurse (junior)	57 (13.2)	46.84 (20.1) ^a		
Supervisor nurse (intermediate)	335 (77.5)	49.25 (15.26) ^a		
Marital status			6.584	0.002
Unmarried	119 (27.5)	43.58 (15.74) ^b		
Married	297 (68.8)	49.88 (16.39) ^a		
Divorced or widowed	16 (3.7)	48.31 (8.79) ^{ab}		

Least Significant Difference(LSD) was used for multiple comparisons, and the differences between groups were labelled with letters.

using multiple linear regression, the 'stepwise' method to perform regression analysis on the influencing factors of the barriers to MAE reporting (α inclusion ≤ 0.050 , α exclusion ≥ 0.100 ; variables significant in the t-test, χ^2 test or correlation analysis results were included. The significance level was set at α =0.05 (two-tailed).

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RESULTS

432 (97.30%) nurses answered in the electronic questionnaire. According to Harman's single-factor test results, there are 11-factor eigenvalues greater than 1. The explanatory rate of the first common factor is 30.080%, which is less than the critical value of 40%, indicating no apparent standard method bias in this study.³⁸

Demographic characteristics

Table 1 shows the demographic variables and their relationship to the BMAERQ scores. The majority of participants were females (n=408, 94.4%), with a mean age of 33.16 (SD=7.84), more than 60.0% were married (n=297, 68.8%), and most nurses had the intermediate professional rank (n=335, 77.5%). The barriers to MAE reporting score have statistically significant differences among age groups, work experience, job titles and marital status, but not among the genders and educational backgrounds.

Barriers to MAE reporting

Protected by copyright, including for uses related to text and data min The results showed that nurses' standardised scores of barriers to MAE reporting were 3.01 (SD=1.01), the fear dimension items had the highest standardised score of 3.42 (SD=1.11), the administrative barriers were 2.95 ⊳ (SD=1.17) and the reporting process was 2.63 (SD=1.07). 'Administrators' responses to MAE do not match the severity of the errors', 'Disagreement over MAE', and I, and 'Adverse consequences from reporting' have the higher standardised scores, respectively, as shown in table 2. l simi

Correlation analysis

lar technologies The survey results showed that WEQ is negatively correlated with barriers to MAE reporting (r=-0.201, p<0.01); FC (r=0.866, p<0.01) and C-IHA (r=0.799, p<0.01) are positively correlated with barriers to MAE reporting, as shown in table 3.

Multivariate regression analysis

The multivariate regression analysis results showed that age, length of nursing work, positional ranks, marital status, FC, C-IHA and WEQ were analysed as independent variables. The results showed that FC, C-IHA and WEQ were the influencing factors of barriers to MAE reporting, which could explain 82.4% of the variation in reporting barriers (R²=0.826, R²adj=0.824, F=253.665, p<0.001), as shown in table 4.

	Group	Standardised	Item
Variable	Mean (SD)	Mean (SD)	Mean (SD
Fear	20.53 (6.68)	3.42 (1.11)	
11. Adverse consequences from reporting			3.66 (1.46)
1. Not recognise MAE occurred			3.43 (1.55)
8. Being blamed for MAE results			2.97 (1.37)
3. Physicians' reprimand			2.96 (1.39)
7. Being recognised as incompetent			2.86 (1.39)
10. Patient's negative attitude			2.75 (1.36)
Administrative barriers	11.79 (4.68)	2.95 (1.17)	
12. Administrators' responses to MAE do not match the severity of the errors	e		4.03 (1.42)
15. Much emphasis on MAE as nursing quality provided			3.03 (1.43)
14. No positive feedback			2.94 (1.40)
16. Focus on individual rather than system factors to MAE			2.52 (1.21)
Reporting process	15.78 (6.41)	2.63 (1.07)	
2. Disagreement over MAE			3.86 (1.52)
5. Too much time for filling reports			3.42 (1.49)
9. Unrealistic expectation for administering drugs correctly			3.14 (1.44)
6. Think MAE not important enough to be reported			2.81 (1.37)
13. Unclear MAE definition			2.69 (1.35)
4. Too much time for contacting physicians			2.05 (1.31)
Barriers to MAE reporting	48.09 (16.22)	3.01 (1.01)	
MAE, medication administration error.			

DISCUSSION

This study explores the current status and influencing factors of reporting barriers for Chinese nurses regarding MAE. We found that fear is the main obstacle that hinders nurses from reporting MAE, including fear of being reprimanded or punished, fear of being perceived as incompetent and fear of negative attitudes from managers, colleagues and patients. It is consistent with Chiang et al's report.^{21 39} Similarly, there are also research reports that reporting MAE for oneself or others may lead to anxiety, shame, guilt and other psychological issues.⁷ Therefore, managers must adjust their attitudes and responses towards nurses' medication errors and focus on creating a

harmonious departmental atmosphere. On the one hand, Gunung managers can find the cause of medication errors from a systemic organisational perspective when reporting them. The approach of not blaming or blaming indi-≥ viduals may positively affect nurses' reporting of MAE.¹⁸ On the other hand, establishing and implementing a voluntary reporting error incentive mechanism are also ı, and necessary. It may help enhance nurses' candid reporting of MAE.⁴⁰ In addition, establishing smooth and effective reporting channels and reducing administrative barriers to reporting may also increase nurses' proactive reporting ilar technologies of MAE.⁴¹

Table 3 Barriers to MAE reporting correlation analysis (n=432)						
			WEQ	FC	C-IHA	BMAERQ
Variable	Mean	SD	r(P)	r(P)	r(P)	r(P)
WEQ	77.06	77.06	1			
FC	12.5	12.5	-0.161†	1		
C-IHA	19.52	19.52	-0.113*	0.702†	1	
BMAERQ *P < 0.05	48.09	48.09	-0.201†	0.866†	0.799†	1

†P < 0.01

BMAERQ, Barriers to Medication Administration Error Reporting Questionnaire; C-IHA, Index of Hierarchy of Authority Questionnaire; FC, Face-Concern Scale; WEQ, Work Environment Questionnaire.

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Table 4 Multiple regression analysis of barriers to MAE reporting (n=432)						
Variable	В	β	t	P value	VIF	
Constant	11.851	_	3.818	<0.001	_	
FC	2.012	0.591	20.715	<0.001	2.127	
C-IHA	1.004	0.377	13.303	<0.001	2.035	
WEQ	-0.111	-0.063	-3.088	0.002	1.973	

Dependent: barriers to MAE reporting; '-': blank entry.

C-IHA, Index of Hierarchy of Authority Questionnaire; FC, Face-Concern Scale; VIF, Variance Inflation Factor; WEQ, Work Environment Questionnaire.

Second, in this study, nurses' demographic characteristics had no significant impact on the reporting barriers of MAE. The work environment was negatively correlated with nurse-reported obstacles, serving as a protective factor for MAE reporting. This is consistent with our research hypothesis and the majority of previous studies;^{21 24 26} the better the working environment in the hospital, the fewer obstacles nurses voluntarily report after medical incidents. However, it is worth noting that the correlation between the work environment and reporting barriers in our study is relatively weak, consistent with Chiang,²¹ but much lower than the research results of Dalky et al. Their research reported that the work environment explained 65.1% of variations in nurses' MAE reporting.²⁶ The differences in research results may be related to the cultural characteristics of different countries, the sources of the nurses participating in this survey and the environmental conditions of the hospitals where the surveyed nurses are located. In this study, the survey subjects come from the same hospital, where the allocation of organisational resources, cultural atmosphere, and the representativeness and diversity of management may need to be increased. Future research could be conducted in different types of hospitals to determine the impact of the work environment on reporting barriers to medication errors among nurses.

Furthermore, as expected, power distance and facesaving are negatively correlated with nurse reporting barriers, an essential factor affecting medication errors reported by Chinese nurses, consistent with Chiang and Yang's research reports.²¹ ²² In the traditional cultural atmosphere of China, due to face-saving concerns, nurses may be unwilling to expose their mistakes in front of colleagues or willing to save colleagues' faces, choosing not to report their own or others' MAE. China is also a country with high power distance, where nursing organisations are predominantly female and tend to adopt a paternalistic management style. Nurses may have a higher level of power distance perception towards organisations. They may rely more on department managers to make decisions regarding error reporting. Therefore, the considerations of face-saving and the perception of power distance could seriously hinder the reporting of MAE.⁴² Reducing face and power distance and establishing a safe and valued fair organisational culture may help Chinese nurses report barriers to medication errors and may also

Protected be a key supporting factor for medication safety.^{17 43 44} For ŝ example, establishing a particular management group 8 that optimises the reporting management system for nurses' MAE and manages people or things through the system may be beneficial in reducing face-saving. It may also help reduce the control of managers over subordinates and the power distance barriers for nurses in reporting MAE.⁴⁵ Especially for nursing management organisations that are predominantly female, reducing Bu power distance may have more significant implications.⁴⁶ for uses relat

Limitations

This study is cross-sectional; causal relationships between variables must be carefully determined. The study only includes nurses from a tertiary hospital in Chengdu. Due to the influence of cultural or regional factors, the **5** generalisation of the conclusions may be limited. Future research should be expanded to verify and extend our results among populations from different regions and ethnic groups. This study focuses on the impact of cultural characteristics and work environment on nurses' reporting barriers and other factors that may influence or moderate nurses' reporting barriers. Future research could consider including potential influencing factors for the study.

CONCLUSION

In short, our study identified the main barriers reported by Chinese nurses in MAE and the critical influencing factors of these barriers. Face-saving and power distance were the main risk factors reported by Chinese nurses in MAE. At the same time, the work environment was a protective factor, but with a lesser impact. Improving the nurses' work environment may help reduce the barriers & reported in MAE. Still, more importantly, hospital administrators need to take adequate measures to reduce nurses' face-saving and power distance, which may be more helpful in reducing the barriers reported in MAE and improving medication safety management in hospitals. This study enriches the current research findings on barriers to nurse reporting, which also provides strategic support for the management of safe medication use by hospital nurses and has important theoretical and practical implications.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants. The study obtained approval from the Ethics Committee of the Sixth People's Hospital of Chengdu, China (approval number 2021-L-009). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The data used and analyzed during the current study are available from the corresponding author on reasonable request. The data are not publicly available due to privacy or ethical restrictions.

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