

## Review Article

# Medication errors analysis in Asia and Australia: A systematic review

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## ABSTRACT

Despite Medication errors (MEs) become worldwide problem, the majority of the studies especially in Asia only carried out in Middle East and very little known about MEs in Asia and Australia. This study aimed systematically to identify and review research done on MEs and their causative factors in Asian and Australian countries. The literature search was conducted from 24 April 2022 using PubMed, ScienceDirect, Google Scholar, ProQuest, and Scopus as the literature search area databases. The collection of research results in a systematic review using the BOOLEAN operator to specify the search scope. The total articles generated were 7,799 articles and resulted in 40 articles in full text and met the requirements so that an analysis. Based on studies that have been reviewed, prescribing errors and dispensing errors are the most type than others and high workload is the most common factors.

**Keywords:**

Asia, Australia, Cause of Errors, Medication Errors

## 1. INTRODUCTION

Medication errors (MEs) are incidents that result in inappropriate drug services, put patients at risk, or both while medications are in the hands of patients or health-care professionals<sup>1</sup>. The incidence of MEs can be prevented, but there are still cases where the prevalence is high and ends fatal. IOM (Institute of Medicine) 1,999 publicly reported that at least 44,000 and even 98,000 patients died in hospitals in one year as a result of MEs<sup>2</sup>.

Every country in the world has a special committee in terms of reporting medication errors, one of which is the countries in Asia Pacific, such as Asia and Australia<sup>3</sup>. Although being worldwide issue<sup>4</sup>, the majority of the medication error studies especially in Asia have been carried out in Middle East countries. While the issue has been relatively neglected in Asia and Australia. This systematic literature aims to systematically identify and review studies on the incidence of MEs and its causal factors in Asia and Australia in order to analyze them in general.

## 2. METHODS

### 2.1. Study selection

This systematic study concentrated on the type of medication errors and their influencing factors in Asia and Australia. The process of articles selection includes filtering the article's title and abstract before assessing the article's quality, based on Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA)<sup>5</sup>.

### 2.2. Literature search strategy

The literature search was conducted from April 24, 2022 using PubMed, ScienceDirect, Google Scholar, ProQuest, and Scopus as literature search area databases. This literature search process is focused on the topic of the systematic review, namely "Medication Errors Analysis in Asia and Australia". A literature search strategy using BOOLEAN operators such as "AND" and "OR" were used to help specify the search terms.

In the process of searching the literature using inclusion criteria and exclusion criteria, taking into account

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**Table 1.** Inclusion and exclusion criteria of article.

Inclusion Criteria	Exclusion Criteria
Articles published in the period 2017-2022	Articles published less than period 2017-2022
Articles discuss medication errors analysis in Asia and Australia	Articles does not discuss about medication error analysis
	Articles discussed about medication errors analysis in other countries, not including Asia and Australia
Articles can be accessed in full text, and free of charge	Articles cannot be accessed in full text and paid

the possibility of the article to be analyzed. Inclusion criteria are criteria that need to be met by each member of the population that can be taken as a sample. Exclusion criteria are criteria for members of the population that cannot be taken as a sample. We used inclusion and exclusion criteria of literature search in Table 1.

### 2.3. Quality assessment

The researcher selected and filtered some articles to be used in this systematic review. Titles and abstracts of articles were independently checked by two authors using the Joanna Briggs Institute (JBI) critical appraisal<sup>6</sup>. JBI critical appraisal was chosen because it has been proven valid for assessing the quality of cross-sectional, case control, cohort, randomized controlled trials (RCTs), systematic reviews, and quasi-experimental research methodologies. The results of this appraisal can then be used to inform synthesis and interpretation of the results of the study. The score given in the JBI critical appraisal is 70% for high-quality articles, 50%-70% for medium-quality articles, and below 50% for low quality articles<sup>7</sup>.

### 2.4. Data extraction

Data extraction was carried out by team researchers. The extracted data include author(s), year, country, methodology, settings, number of participants, total number of MEs, and factor contributing MEs<sup>8</sup>. Disagreements or discrepancies in the data extraction were resolved by discussion among the authors. To eliminate discrepancies, the data extraction forms should be standardized, so that the 2 reviewers are collecting the same information from each study<sup>9</sup>. The presentation of data extraction can be seen in Table 2 and Table 3.

## 3. RESULTS

### 3.1. Study selection

The total articles generated were 7,799 articles generated from databases. The article screening resulted in 39 articles in full text and met the requirements so that an analysis of the articles could be carried out. The article search process is presented in the form of a PRISMA diagram<sup>5</sup> which can be seen in Figure 1.

### 3.2. Literature search result

There are 37 articles that discuss the incidence of MEs and their factors in Asia, where the articles consist of 9 articles from Southeast Asia<sup>10-18</sup>; 3 articles from East Asia<sup>19-21</sup>; 7 articles from South Asia<sup>22-28</sup> and 18 articles from West Asia<sup>29-46</sup>. A total of 2 articles discuss the incidence of MEs and their factors in Australia<sup>47-48</sup>. Figure 2 demonstrated the number of studies obtained each of Asian and Australian countries.

### 3.3. Quality assessment

The results of evaluating the quality of the articles using the JBI critical appraisal give score range 50%-87, 50%, so methodologically it was said to be medium and high quality. Discrepancies in this quality assessment were resolved by discussions. In the case of discrepant judgements, a third author (SAK) was involved. The results of the quality assessment can be seen in Table 2 and Table 3.

### 3.4. Data extraction

The results of data extraction presented on Table 4 and Table 5.

## 4. DISCUSSION

The number of studies on MEs conducted in Asia is unfortunately very limited (39 only), and out of 48 countries only 24 countries reported the incidence of MEs. Likewise with the number of studies on MEs conducted in Australia. Only 2 incidents of MEs have been reported from the country. Most studies discuss dispensing errors and prescribing errors both of Asia and Australia. Furthermore, this systematic review did not address some clinical consequences from MEs because of ethical reasons and making it difficult to assess the overall clinical impact of errors. Thus, an overview of MEs and their causal factors is sufficiently better carried out in this systematic review.

Medications are important things of the provision of health care. While the safe use of drugs can improve human life, medication errors can have equally important consequences. There has never been a previous systematic review analyzing MEs in Asia or Australia. Therefore, with this systematic review, we seek to review

**Table 2.** Quality assessment results of cross-sectional study.

Author, Year, Country	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study subjects and the setting described in detail?	3. Was the exposure measured in a valid and reliable way?	4. Were objective, standard criteria used for measurement of the condition?	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	Score
(Hasna et al., 2020); Indonesia	No	Yes	Yes	No	No	No	Yes	Yes	50.00%
(Hon et al., 2020); Malaysia	Yes	Yes	Yes	No	No	No	Yes	Yes	62.50%
(Shitu et al., 2020); Malaysia	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Sulistiadi et al., 2020); Indonesia	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Widyanti & Reyhannisa, 2020); Indonesia	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Apsay et al., 2018); Philippines	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Chang et al., 2018); Malaysia	Unclear	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Lerdorisophon et al., 2018); Thailand	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Pasco et al., 2017); Philippines	Unclear	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Yoon & Sohng, 2021); South Korea	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Yang et al., 2019); China	Yes	No	Yes	Yes	No	No	Yes	Yes	62.50%
(Useng et al., 2018); Taiwan	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Dhande et al., 2021); India	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Islam et al., 2021); Bangladesh	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Kandasamy et al., 2021); India	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Karki et al., 2021); Nepal	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Rasool et al., 2020); Pakistan	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Zirpe et al., 2020); India	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Jamshaid et al., 2018); Pakistan	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Alyami et al., 2022); Saudi Arabia	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Alharabi et al., 2021); Saudi Arabia	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Aljuaid et al., 2021); Saudi Arabia	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Almazrou et al., 2021); Saudi Arabia	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Alrowily et al., 2021); Saudi Arabia	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Alsaleh et al., 2021); Kuwait	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Soubra & Karout, 2021); Lebanon	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Gogazeh, 2020); Jordan	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Mohamed Ibrahim et al., 2020); United Arab Emirates	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Ahmed et al., 2019); Kuwait	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Shaikh & Al-Ruzaiqi, 2019); Oman	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Al-worafi, 2018); Yemen	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Aljasmii et al., 2018); Bahrain	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Karimian et al., 2018); Iran	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Mohammed Al-Worafi et al., 2018); Yemen	No	Yes	Yes	Yes	No	No	Yes	Yes	62.50%
(Stewart et al., 2018); Qatar	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Ali et al., 2017); Saudi Arabia	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75.00%
(Isaacs et al., 2021); Australia	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	87.50%
(Bourke et al., 2021); Australia	No	Yes	Unclear	Unclear	Yes	Yes	Yes	Unclear	50.00%

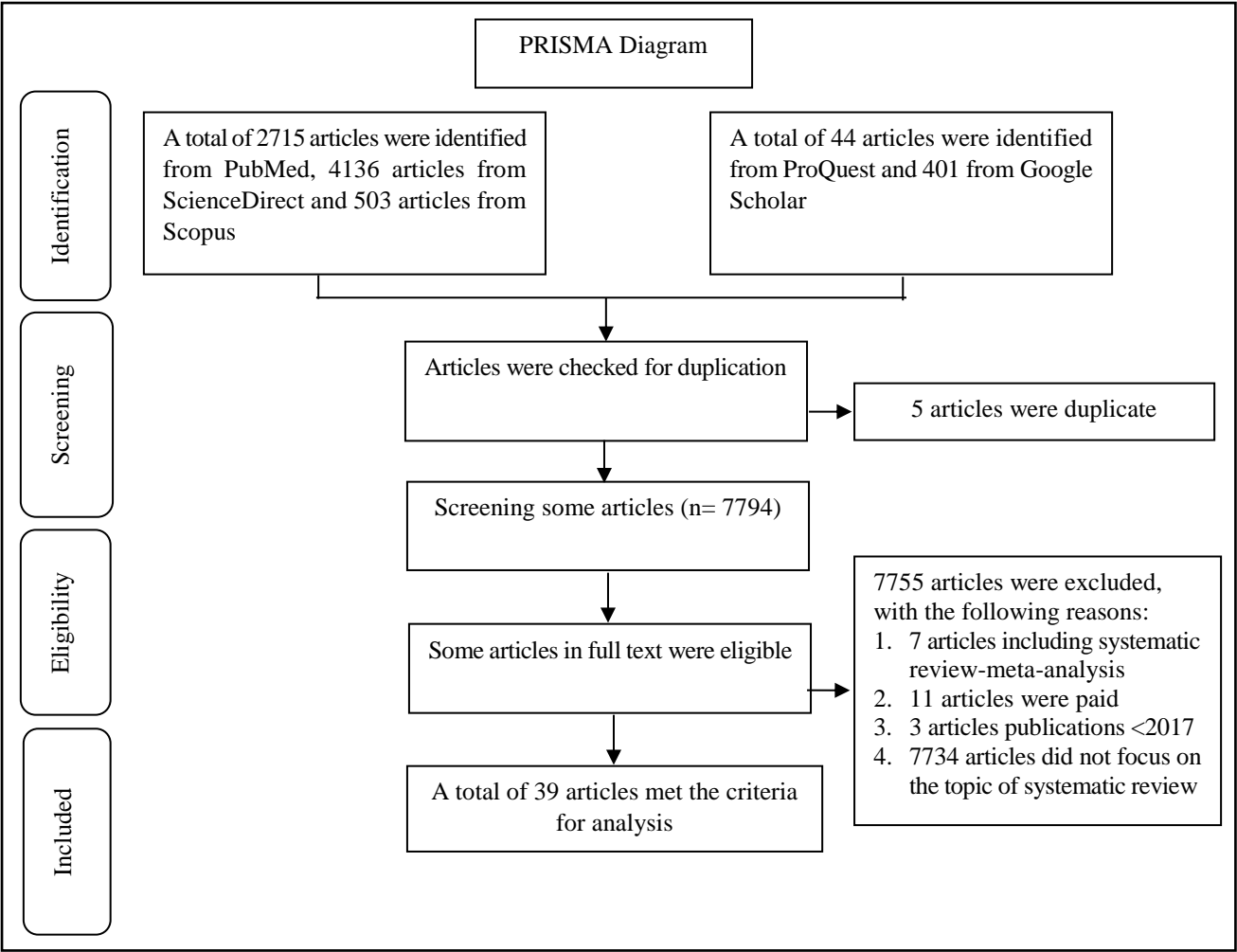


Figure 1. Literature Search Strategy (5).

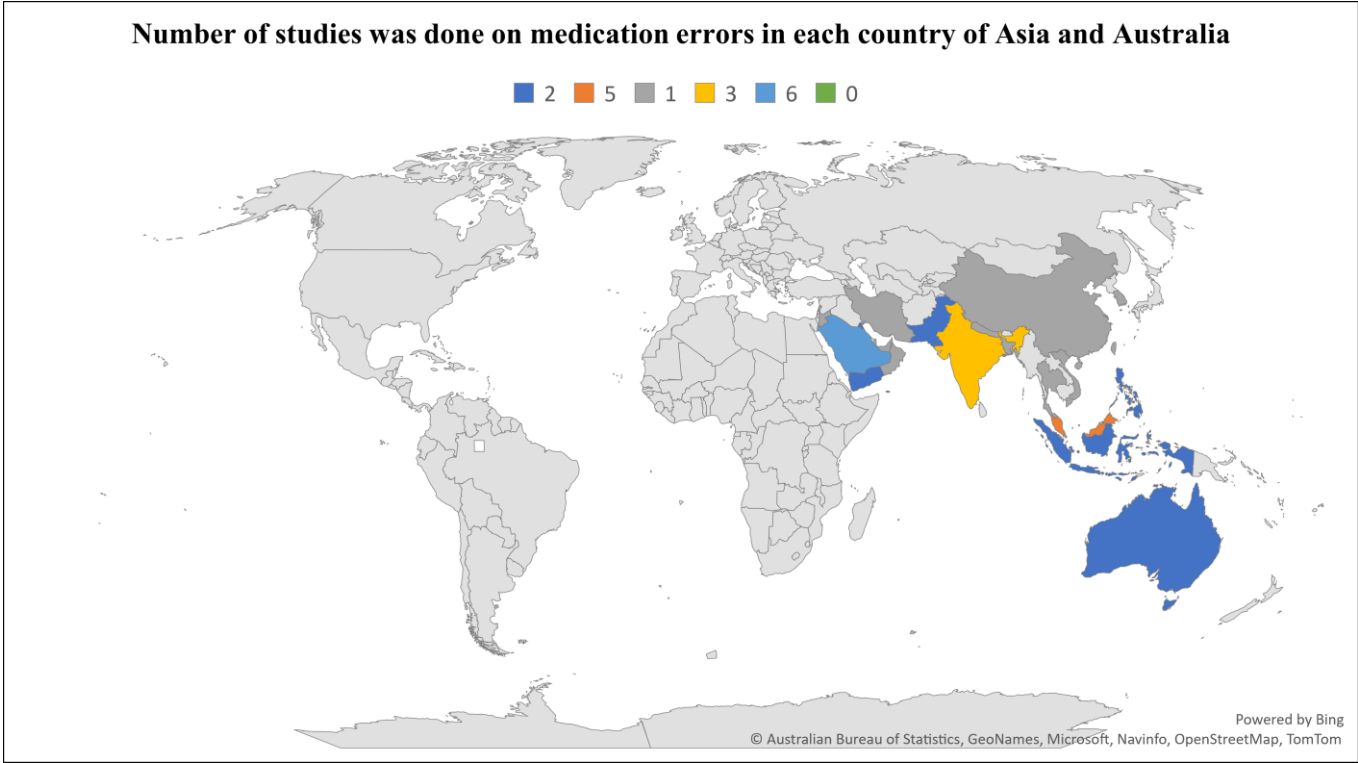


Figure 2. Number of studies was done on medication errors in each country of Asia and Australia.

Table 3. Quality assessment results of cohort study.

Author, Year, Country	1. Were the two groups similar and recruited from the same population?	2. Were the exposures measured similarly to people both exposed and unexposed groups?	3. Was the exposure measured in a valid and reliable way?	4. Were confounding factors identified?	5. Were strategies to deal with confounding factors stated?	6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	7. Were the outcomes measured in a valid and reliable way?	8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	10. Were strategies to address incomplete follow up utilized?	11. Was appropriate statistical analysis used?	Score
(Al-Ramahi et al., 2017); Palestine	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	72.73%

Table 4. Data extraction of medication errors in Asia.

South-East Asia			Settings and number of participant		Type of MEs		Factor contributing MEs	
Author(s), year, country	Study design							
(Hasna et al., 2020); Indonesia	Observational study		Six respondents, at hospital X, Indonesia		1. Dispensing errors 2. Administration errors		1. Not yet implemented e-prescribing system 2. The dispensing service has not yet been monitored and evaluated 3. Drug storage has not been monitored and evaluated 4. SOP of medical process lack of socialization 5. Monitoring and evaluation of drug preparation services has not been carried out 6. The evaluation and execution of drug delivery and education have not been done 7. The pharmaceutical technical staffs accuracy of identification when handing over the medication has never been monitored 8. Queue machine maintenance has not been carried out; 9. Shift SOP is not easy to understand	
(Hon et al., 2020); Malaysia	A cross-sectional observational study		General pediatric ward in the Universiti Kebangsaan Malaysia Medical Centre 225 pediatric patients with a total of 694 prescriptions		Prescribing errors Administration errors Other errors		1. Necessary information not provided 2. Inappropriate dose selection 3. Invalid prescriptions	
(Shitu et al., 2020); Malaysia	Observational study with cross-sectional approach		Setting: Emergency Department of the Hospital Universiti Sains Malaysia (HUSM) 311 participants.		Administration errors Others errors		1. Incorrect transcription on the part of doctors and nurses 2. Illegible handwriting 3. Lack of knowledge	

Table 4. Data extraction of medication errors in Asia. (cont.)

South-East Asia				
Author(s), year, country	Study design	Settings and number of participant	Type of MEs	Factor contributing MEs
(Sulistiadhi et al., 2020); Indonesia	Observational qualitative design	Class D General Hospitals, Ciracas, East Jakarta.	Dispensing errors; Prescribing errors; Other errors;	1. High workload 2. Inappropriate use of facilities 3. Human factors
(Widyanti & Reyhannisa, 2020); Indonesia	Observational study	160 participants Pharmacy Department of Indonesian Public Hospital in Bandung city 401 participants	Documentation errors Administration errors; Prescribing errors; Transcription errors	1. Information overload 2. Delayed necessary action 3. Fatigue 4. Inadequate infrastructure 5. Mentally burnout 6. Temporal workload
(Apsay et al., 2018); Philippines	Descriptive quantitative study	Four nursing schools in Iligan city, Philippines	Other errors	1. Lack of knowledge 2. Administrative factors 3. Personal factors 4. Environmental factors
(Lerdisirisonopon et al., 2018); Thailand	Prospective multi-center observational study	388 participants Settings: 22 university and non-university hospital across Thailand. 85 participants	Dispensing errors; Documentation errors; Administration errors	1. Lack of knowledge 2. Lack of experience 3. Haste 4. Miscommunication 5. Misjudgment 6. Problem with labeling
(Chang et al., 2018); Malaysia	Observational study with cross-sectional approach	Setting: Pharmacy Department of the Raja Permaisuri Bainun Hospital, Ipoh. 11,009 participants	Prescribing errors	Illegible prescriptions and handwriting
(Pasco et al., 2017); Philippines	Retrospective, descriptive chart review study	Setting: Philippine General Hospital 480 charts	1. Prescribing errors 2. Administration errors. 3. Other errors	1. Illegible prescriptions and handwriting 2. High-patient-to-doctor and patient-to-nurse ratio 3. Lack of experience 4. Unspecified route of drugs
East-Asia				
(Yoon & Sohng, 2021); South Korea	Retrospective study reported by analyzed near misses and ADEs (January 2014-December 2018)	Setting: Incheon St. Mary's Hospital 805 samples	Dispensing errors Administration errors	Clinical experience, work hours, location, detection time.
(Yang et al., 2019); China	Cross-sectional study	Setting: Tertiary care hospital in China, 65,407 patients and 150,611 prescriptions	Prescribing errors.	1. Heavy workload 2. Electronic prescribing system has not yet been implemented
(Tseng et al., 2018); Taiwan	Consensus of an expert panel	Setting: Tungs' Taichung Metro Harbor Hospital in Taiwan 2013: 202 samples 2014: 140 samples	Dispensing errors	1. Fatigue 2. Sleep disruption 3. distraction



**Table 4.** Data extraction of medication errors in Asia. (cont.)

<b>South Asia</b>				
<b>Author(s), year, country</b>	<b>Study design</b>	<b>Settings and number of participant</b>	<b>Type of MEs</b>	<b>Factor contributing MEs</b>
(Dhande et al., 2021); India	Retrospective observational study	Setting: tertiary care hospital in Western India  1311 MEs	Dispensing errors	High workload
(Islam et al., 2021); Bangladesh	A descriptive co relational study design	Setting: Cox'sbazar Medical College Hospital, Bangladesh	Administration errors	Mental stress High workload
(Kandasamy et al., 2021); India	Prospective cross-sectional study	79 study participants Setting: Patient Counseling Department of a Multispecialty Hospital in Coimbatore, India	Prescribing errors Dispensing errors Both prescribing and dispensing errors	Complexity of medical care.
(Karki et al., 2021); Nepal	Cross-sectional study	500 prescriptions Setting: Internal Medicine Department of LMC TH, Tansen, Palpa, Nepal	Prescribing errors Dispensing errors	1. High Workload 2. Distractions 3. Mentally burnout 4. Polypharmacy
(Rasool et al., 2020); Pakistan	Cross-sectional, observational, prospective study	425 prescriptions Settings: public and private hospitals in different areas of South Punjab, Pakistan	Prescribing errors; Dispensing errors	1. Unavailable complete electronic medical record of patient 2. Fatigue 3. High workload
(Zirpe et al., 2020); India	Prospective observational study	803 participants Setting: Tertiary Care Hospital, India  6,705 charts	Transcription errors Prescribing errors Administration errors Others errors Dispensing errors	1. Invalid prescription 2. Wrong dose 3. Omission 4. Therapeutic duplication 5. Wrong dilution 6. Wrong frequency 7. Wrong time 8. Wrong route
(Jamshaid et al., 2018); Pakistan	Quantitative cross-sectional study	Setting: Outpatient Pediatric Department of Public Sector Hospital, Lahore, Pakistan  240 prescriptions	Prescribing errors Dispensing errors	1. Electronic prescribing system has not yet been implemented 2. Less regulated non-hospital setting procedures
<b>West-Asia</b>				
(Alyami et al., 2022); Saudi Arabia	An ecological cross-sectional retrospective study	Setting: King Khaled Hospital of Najran  4860 incidents	Prescribing errors Transcription errors Dispensing errors Others errors	1. Knowledge factors. 2. Complexity of medical care 3. Missed documentation during administration 4. Lack of verification
(Alharailbi et al., 2021); Saudi Arabia	Retrospective review of orders in the Medication Error Electronic Report Forms (MEERF)	Setting: Large tertiary care setting in Riyadh, Saudi Arabia  315166 prescriptions	Prescribing errors	1. Lack of documenting clinical information 2. Necessary information not provided 3. Miscommunication of drug orders 4. High workload

Table 4. Data extraction of medication errors in Asia. (cont.)

West-Asia				
Author(s), year, country	Study design	Settings and number of participant	Type of MEs	Factor contributing MEs
(Alharailbi et al., 2021); Saudi Arabia	Retrospective review of orders in the Medication Error Electronic Report Forms (MEERF)	Setting: Large tertiary care setting in Riyadh, Saudi Arabia 315166 prescriptions	Prescribing errors	5. Improper medical history retrieval 6. Improper order verification 7. Inconsistent supply of medications
(Aljuaid et al., 2021); Saudi Arabia	Retrospective analysis of MEs	Setting: university teaching hospital in Riyadh, Saudi Arabia. 2626 incidents	Dispensing errors Prescribing errors Others errors Administration errors	1. Limited number of staff during night shifts and the weekend 2. Mentally burnout 3. Fatigue and sleep deprivation
(Almazrou et al., 2021); Saudi Arabia	This was a retrospective study of MEs and ADRs	Setting: KSMC, Saudi Arabia 343 MEs and 416 ADRs	Prescribing errors; Dispensing errors Administration errors Others errors	1. Human factors 2. Necessary information not provided 3. Environmental factors 4. Knowledge factors 5. L/ASA-drug problems 6. Unavailable drugs 7. Drug storage or delivery problem 8. Drug delivery device problem
(Alrowily et al., 2021); Saudi Arabia	Analysis of error reports using data reported	Settings: The Pharmacovigilance Electronic Reporting Service in the Saudi FDA 199 MEs incident	Prescribing errors Dispensing errors Administration errors Others errors	Polypharmacy
(Alsaleh et al., 2021); Kuwait	A descriptive cross-sectional study	Settings: Four main secondary care hospitals in Kuwait 215 participants	Prescribing errors Administration errors Other errors Transcription errors Documentation errors Dispensing errors	1. High workload 2. Handover of medication related information 3. Electronic prescribing system has not yet been implemented 4. Human factors 5. Complexity of medical care 6. Incorrect electronic data entry
(Soubra & Karout, 2021); Lebanon	A prospective observational study that used a cross-sectional design	Settings: Beirut City (Capital of Lebanon) and four Lebanese governorates (Mount Lebanon, North, South, and Beqaa) 286 participants	Dispensing errors	1. Work overloads/time pressures 2. Illegible handwriting 3. Distractions 4. similar drug naming/packaging
(Gogazeh, 2020); Jordan	A cross-sectional	Setting: all Jordanian regions (north, middle, south) 300 participants	Dispensing errors	1. Illegible handwriting 2. high workload 3. similar drug naming/packaging 4. Pharmacy dispensary area design 5. Distractions 6. Pharmacy assistants 7. Fatigue
(Mohamed Ibrahim et al., 2020); United Arab Emirates	Prospective observational study	Settings: 7 regions of UAE. 350 participants	Dispensing errors	1. Similar drug naming/packaging 2. Medicine replaced with near expired one 3. Off-label use without counselling



Table 4. Data extraction of medication errors in Asia. (cont.)

West-Asia				
Author(s), year, country	Study design	Settings and number of participant	Type of MEs	Factor contributing MEs
(Mohamed Ibrahim et al., 2020); United Arab Emirates	Prospective observational study	Settings: 7 regions of UAE. 350 participants	Dispensing errors	4. Heavy workload 5. Distractions 6. Complex prescription 7. Lack of experience 8. Out of stock medicine replaced with another one
(Ahmed et al., 2019); Kuwait	Cross-sectional study, a quantitative research approach	Setting: Kuwaiti tertiary hospital 203 participants	Dispensing errors Prescribing errors Administration errors	1. Miscommunications 2. Fatigue 3. High workload 4. Electronic prescribing system has not yet been implemented 5. Diagnosis/efficiency of doctors 6. Carelessness 7. Untrained personnel 8. Lack of national prescribing guidelines 9. Lack of experienced administrative workers
(Shaikh & Al-Ruzaiqi, 2019); Oman	Prospective observational study	Settings: different Governorates in Sultanate of Oman 350 participants	Prescribing errors Dispensing errors Administration errors	1. Skill factors 2. Miscommunications 3. Prescribing, dispensing, and administering wrong drug 4. Knowledge factors
(Al-worafi, 2018); Yemen	A Prospective study	Setting: Ibb, Yemen 13 participants	Dispensing errors	1. Illegible handwriting 2. Similar medications naming/packaging 3. More than one patient at the same time
(Aljasmí et al., 2018); Bahrain	Retrospective study	Setting: Bahrain Defense Force Hospital 379 prescriptions	Prescribing errors	Illegible handwriting non-official or unconventional abbreviations
(Karimian et al., 2018); Iran	Retrospective study	Settings: national pharmacovigilance center (PCV) within Iran's Food and Drug Administration 17 988 ADR reports 1231 cases	1. Documentation errors 2. Prescribing errors 3. Administration errors 4. Dispensing errors	1. Fatigue 2. Illegible handwriting 3. Environmental factors
(Mohammed Al-Worafi et al., 2018); Yemen	Cross-sectional study	Setting: capital city of Sana'a, Yemen 23 participants	Prescribing errors	1. electronic prescribing system has not yet been implemented 2. Untrained staffs
(Stewart et al., 2018); Qatar	A sequential explanatory mixed methods design	Setting: Hamad Medical Corporation (HMC) 19 participants.	1. Prescribing errors 2. Administration errors 3. Dispensing errors 4. Other errors	1. Skill based mistakes 2. Knowledge factors 3. Technology based mistakes 4. Necessary information not provided 5. Incomplete order

**Table 4.** Data extraction of medication errors in Asia. (cont.)

<b>West-Asia</b>				
<b>Author(s), year, country</b>	<b>Study design</b>	<b>Settings and number of participant</b>	<b>Type of MEs</b>	<b>Factor contributing MEs</b>
<b>(Stewart et al., 2018); Qatar</b>	A sequential explanatory mixed methods design	Setting: Hamad Medical Corporation (HMC)	1. Prescribing errors 2. Administration errors 3. Dispensing errors 4. Other errors	6. Wrong selecting and ordering 7. Wrong labeling 8. L.A.S.A medication 9. Missing communication and information 10. Environmental factors 11. Organizational factors
		19 participants.		
<b>(Ali et al., 2017); Saudi Arabia</b>	Retrospective analysis	Setting: King Saud Medical City (KSMC) 912,500 prescriptions	Prescribing errors; Dispensing errors; Other errors; Administration errors	Knowledge factors
<b>(Al-Ramahi et al., 2017); Palestine</b>	Observational cohort study	Settings: three government hospitals in Palestine 400 participants	Prescribing errors	Electronic prescribing system has not yet been implemented

**Table 5.** Data Extraction of Medication Errors in Australia.

<b>Australia</b>				
<b>Author(s), year, country</b>	<b>Study design</b>	<b>Settings and number of participant</b>	<b>Type of MEs</b>	<b>Factor contributing MEs</b>
<b>(Bourke et al., 2021); Australia</b>	A retrospective review of iatrogenic medication errors	Setting: The Victorian Poisons Information Centre (VPIC) 357 incidents	1. Dispensing errors 2. Administration errors 3. Prescribing errors	1. Miscalculation dose 2. Lack of concentration 3. Similar naming/packaging of drugs
<b>(Isaacs et al., 2021); Australia</b>	Cross-sectional study	Setting: large regional hospital in Australia 1882 MEs incident	1. Administration-only errors 2. Prescribing-only errors 3. Administration and prescribing errors 4. Storage, handling, dispensing errors 5. Dispensing/supply-only 6. Administration and dispensing 7. Prescribing and dispensing errors 8. Missing entries	1. Lack of knowledge 2. Lack of experience 3. High workload

studies on the identification of the types and numbers of MEs and the factors that cause MEs in Asia and Australia to gain insight into the extent of the problem in these regions.

#### 4.1. Type of medication errors

##### Dispensing errors

About 29% of studies report dispensing errors in Asia and Australia. The term “dispensing error” refers to a discrepancy between a prescription and the medication that the pharmacy distributes to the patient or the ward based on this prescription, including the dispensing of a medicine with lower pharmaceutical or informational quality<sup>31</sup>. There are 14 studies reported wrong drug including into dispensing errors<sup>17,21,23,25,31-36,39-40,43-44,49</sup>, so wrong dose is the most common type of errors. In addition, wrong dose is also included in dispensing errors. A total of 13 studies reported wrong dose including into dispensing errors<sup>17,19,22,25,28,32-34,37-38,44,47,49</sup>. An example of wrong drug that is included in dispensing errors is Morphine in prescription, but Ephedrine that have dispensed, which was done by study in Thailand<sup>17</sup>.

There are 6 studies reported wrong label including into dispensing errors<sup>17,23,34,36,39,49</sup>, for example in Thailand Fentanyl 5 mcg/ml labelled as 10 mcg/ml<sup>17</sup>. Four studies from Taiwan, Yemen, UAE, and Saudi Arabia reported that wrong quantity of drugs are including into dispensing errors<sup>21,33-34,41</sup>. Wrong drug frequency which is including into dispensing errors were reported by 5 studies<sup>22,25,28-29,44</sup>, for example in Pakistan is too long or too short dosing frequency<sup>22</sup>. Wrong strength and concentration of drugs which are including into dispensing errors were reported by 7 studies<sup>17,21,29,33-34,44,47</sup>.

##### Prescribing errors

About 28%-29% studies report prescribing errors in Asia and Australia. Pasco *et al.* defining about prescribing errors include incorrect drug selection, dose, dosage form, and illegible prescriptions<sup>18</sup>. There are 13 studies report wrong dose including into prescribing errors, so wrong dose is the most common type of prescribing errors. There are including overdose, underdose, extradoses and wrong unit leading to wrong dose (typing errors)<sup>20,25,28-29,37-38,41-45,47-48</sup>. An example of an incorrect drug that is included in prescribing errors is Levofloxacin ear drops prescribed wrong as Levofloxacin eye drops, which was done by study in Pakistan<sup>20</sup>.

Another type of prescribing errors are wrong patient identification<sup>13</sup>, which was done by study in Philippines. Six studies from Indonesia, Pakistan, India, Saudi Arabia, and Australia explain that incomplete prescription identities are include into prescribing errors<sup>11,14,20,23,42,47</sup>. Zirpe *et al.* explain that incomplete prescription is the

major reason for transcription error. In most of the prescriptions, dose of the drug was missing, which ultimately resulted in delay and administration of wrong dose to the patient<sup>25</sup>. Several studies mention that prescribing errors are also consist of inappropriate dose<sup>14</sup> and inappropriate diagnosis<sup>20</sup>, such as unmentioned diagnosis<sup>29,42,45</sup>. Three studies from Yemen, Saudi Arabia, and Kuwait mention that prescribing errors including invalid indications, such as drug prescribed without clinical indication<sup>28</sup> and wrong indication<sup>40-41</sup>. Four studies give example of wrong route which is including into prescribing error is incorrect route of administration of drug in prescriptions<sup>29,42,44-45</sup>. Two studies from China and Saudi Arabia explain about contraindications and adverse drug interactions are include into prescribing errors<sup>20,45</sup>.

#### 4.2. Factor causing MEs

There are 16 studies reported that high workload is the most common factor that causing MEs<sup>13-14,19-20,24,26-28,32,34,37,39,42-43,45,47</sup>. Based on study that has done in Australia, the frequency of MEs increases when staff are inexperienced and during times of heavy workload. Human factors like knowledge factors, miscommunications, and fatigue also lead to cause MEs. There are 14 studies explain about human factors lead to errors<sup>11-13,15,17,29,35-37,42-44,47</sup>.

System factors like misinformation, unavailable Standard Operational Procedure, technical errors, lack of hospital information system like e-prescribing system and illegible handwriting also lead to cause MEs. There are 13 studies explain about system factors lead to errors<sup>13-14,16-18,20,22,30,35,38,44-45,49</sup>. Based on study that has done in Pakistan, lack of e-prescribing system is more vulnerable to medication errors<sup>22</sup>.

Environmental factors like improper room temperature, facilities and design, inadequate lightning, disorganized medications, interruptions, and inadequate infrastructure<sup>13-15,21,24,31-33,35,40,44</sup> also lead to cause MEs. Based on study that has done in Qatar, interruptions can distract concentration of staff so it can lead to MEs<sup>35</sup>.

#### 5. CONCLUSION

In conclusion, this review presents the reporting of MEs and their causative factors in Asia and Australia. With all the limitations that exist, it is hoped that further research will be carried out on this issue, especially in Central Asian countries. Collective efforts and standards are needed to improve MEs reporting and documentation so as to minimize the occurrence of these errors.

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### Conflict of Interest

The authors state that they have no interests in opposition.

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ATA and SAK conceived of the problem and article screening process. ATA and NMY developed the data extraction form and performed study quality assessment. SAK and NMY verified the table presented in Results section. All authors discussed the results and contributed to the final manuscript.

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