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Medication error trends in Middle Eastern countries: A systematic review on healthcare services

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Abstract:

Medication errors (MEs) are a critical worldwide concern and can cause genuine clinical ramifications for patients. Studies concerning such errors have not been undertaken as much in the Middle Eastern region. The aim of this study was to systematically review and identify studies done in the Middle Eastern nations to recognize the principle contributory factors included and to estimate the prevalence in the region. A review of the retrospective, prospective, cohort, and case-control studies based on MEs in the Middle Eastern nations was directed in January 2020 utilizing the accompanying databases: Embase, Medline, PubMed, Ebsco, Cochrane, Scopus, and Prospero. The search methodology incorporated all ages and in English only dating back to 2010. The search methodology included articles about MEs in the Middle East with errors in people of all ages, articles in English, and articles dating back to 2010. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses appraisal instrument was used to assess the quality of the included articles. Individual data extraction, pooled analysis, and the accompanying databases were used for data analysis of the MEs in eligible studies. Fifteen of the 18 articles reviewed from four Middle Eastern countries had low risk of bias, while three out of 18 had medium risk of bias. A total of 58,221 reported people were studied, with a total of 34,730.9 reported MEs. The pooled analysis showed that numbers of errors were mainly prescribing errors ($n = 22,715.25$), general prescription errors ($n = 8097.16$), and commission errors ($n = 158.2$). Iran had the highest rate amid the reported administration errors, at 25.07% ($599.11/2388.9$). Measuring a patient's clinical laboratory values was another less common type of prescription ME. Lebanon reported to have the highest monitoring errors, with a rate of 13.13% ($277.91/2117$). A negative trend was shown in the amount of MEs in the vast majority of the nations under the examination. The under-reporting or uncertain information recommended that significant changes are needed in the healthcare sector. There is solid need of literature on healthcare services in the region to completely understand and address the MEs and issues.

Keywords:

Administration error(s), dispensing error(s), drug error(s), medication error(s), Middle East, prescription mistake(s)

Background

Medication errors (MEs) have impacted patient over the decades and are conveying serious concerns worldwide.^[1] They are rated as one of the highest causes of death and are considered one among

the most common causes of morbidity and mortality in the hospital setting.^[2] Bates *et al.* found that MEs were occurring at a rate of 5/100 medication orders.^[1]

In definition, ME is "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer."^[3] ME

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events may be related to professional practice, healthcare products, procedures, and systems.^[4,5] These include prescribing, order communication, product labeling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use.^[4,5] Many studies suggested that, despite global advances in healthcare practices, about 1 in 3 antibody-dependent enhancement was almost always associated with MEs and was preventable.^[4,5]

MEs and adverse drug reactions are one among the main triggers of preventable deaths and the most important challenges threatening the patient's safety. The highly common error was inappropriate medication use and most frequently occurred in the administration process.^[6] Medication process included prescribing, ordering, dispensing, administration, discharge summary, transcription, and monitoring; ME could have occurred at any point in this process. Healthcare professionals (HCPs) such as physicians, nurses, and pharmacists were involved.^[6-8]

The cause of these errors was that the drug might be given at the wrong time, to the wrong patient, wrong drug administration or dispensing, and wrong dose and dosage form.^[6,8] Other causes of ME are failing to order the right drug, the drug form being not available, and lack of knowledge.^[8] These errors might be active, latent, or error-producing conditions such as pressure, overlaps, and fatigue.^[7] One key restriction emphasized in various studies is the absence of an approach to measure and determine errors where, in the Middle East countries, especially in the underdeveloped counties, lack of knowledge among HCPs was determined as a contributory cause.^[7]

The aim of this study was to critically review, synthesize, and demonstrate available indication of MEs among patients in different healthcare settings in the Middle Eastern countries, highlighting the different errors that may occur.

Materials and Methods

This systematic review of the retrospective, prospective, cohort, and case-control studies adhered to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines for reporting. PRISMA checklist is attached as an additional file.

Inclusion criteria

The study was aimed at collecting the causes and occurrences of MEs in the region; we used only studies that occurred and were reported in the countries recognized as the Middle Eastern countries such as Saudi Arabia, Oman, Iran, and Bahrain. We also used

studies that included both Middle Eastern countries and non-Middle Eastern countries by simple separation and by using only the data from the desired counties. Certain types of studies that were beneficial to the study were considered as they were often helpful in explaining the causes of the ME discussed. Studies included retrospective, prospective, cohort, and case-control. All studies published between 2010 and 2020 were included.

Exclusion criteria

Countries that were not recognized as the Middle Eastern countries were not included. Articles and studies before 2010 were an exclusion criterion. Errors not related to medication were excluded. Articles not written in the English language were excluded from the study.

Keywords

Keywords used in the search to narrow down the search and make the results more concise and tailored to our study included medication error, dispensing error, Middle East report, prescription mistakes, administration error, drug errors. Words that explained MEs were also used in the search such as drug, mistakes, incorrect drug error, incorrect dose error, wrong route of administration error. Boolean operators, AND and OR, were utilized in the search to further narrow the results.

Terms definition

- **Prescription error:** Most common type of error relating to errors in the prescription writing process^[8]
- **Administrative error:** Refers to any errors that involves a difference between what the patient was given and what the prescription ordered^[8]
- **Omission error:** Failure of patient to take or of HCP to administer an ordered dose to a patient^[8]
- **Commission error:** As opposed to omission, this is the error of administering the wrong procedure, drug, or site^[8]
- **Transcription error:** Is any difference found between the physician medication order and the medication order that was transcribed regarding a patient^[8]
- **Monitoring error:** The lack of an appropriate drug therapy review process^[8]
- **Interaction error:** A prescribing process error where drugs that interact are prescribed to a patient due to the lack of knowledge on interactions.^[8]

Search strategy

To gather enough data on the research topic, databases and tools employed in the study include Medline, Ebsco, Cochrane, PubMed, Scopus, Prospero, and Embase. The search method in these databases included using keywords mentioned below in various combinations with the exclusion and inclusion criteria using Boolean operators.

Review process

A quality evaluation of the literature was directed by an independent reviewer, who evaluated each of the significant papers dependent on the appraisal tool adjusted from Lisbay, Nielsen & Mainz.^[9] The criteria were adjusted to apply to any ME study, instead of just simple observational studies. After disregarding duplicates, the key phrases delivered many articles going back to 2010, with the exception of one article dated back to 2008. Just studies of the occurrence and nature of MEs in the Middle Eastern countries were incorporated. All quality analysis was based on the PRISMA reporting criteria.^[10]

The review process and evaluation for the risk of bias for each article were based on the PRISMA reporting criteria used for the evaluation of the quality of an article; this includes a number of criteria or requirements; and based on the presence or absence of these PRISMA reporting criteria in each article, the risk of bias was allotted.^[11] Those articles having most of the required criteria on the list allotted low risk of bias (high quality) and those articles that do not meet most of the requirements allotted a medium risk of bias (good quality).

Results

Out of the studies reviewed and extracted, 18 articles with complete information were used in the review. The articles were then further assessed to types of MEs studied in each article and pooled analysis. Middle Eastern countries such as Saudi Arabia, Iran, Bahrain, and Lebanon were the countries involved in the analysis.

General data extraction

After disregarding duplicates, the search terms delivered many articles going back to 2010. Just studies of the occurrence and nature of MEs in the Middle Eastern countries were incorporated giving a total of 567. The title and abstract were then explored for applicability, and an amount of references screened were found to be 120 [Figure 1]. Of these, 88 were erased due to the fact that they were not identified with MEs in the Middle Eastern countries; another 8 were identified with adverse effects and common errors, and studies about MEs by and large; 4 focused on guidelines for the safety of patient. Subsequently, 24 references were at first esteemed applicable. In any case, just 18 of these concentrated the occurrence of MEs specifically in the Middle Eastern countries with complete outcome data; the rest were considered unimportant.

Quality assessment

After application of the internal study quality, it was

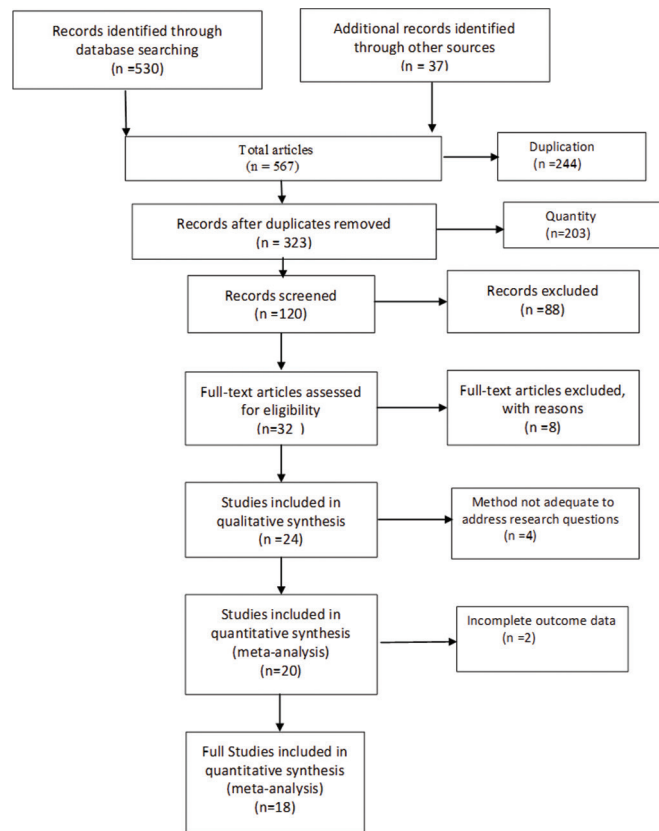


Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-analyses Diagram

discussed with the reviewer. Internal and external reviews of 18 studies were done. The following extractions were done according to the following figures: 15 out of 18 total articles had low risk of bias, while 3 out of 18 had medium risk of bias. Out of 9 prospective cohort studies, 8 were determined to have low risk of bias. Out of 6 retrospective cohort studies, 4 were determined with a low risk of bias as well. Out of 3 cross-sectional studies, all showed low risk of bias [Figure 2].

Countrywide distribution

Eighteen articles were chosen out from the Middle Eastern countries that met the inclusion criteria of the research. Five (27.8%) of the studies were from Iran, 8 (44.4%) studies were done in Saudi Arabia, 3 studies (16.6%) were from Bahrain, and 2 (11.1%) were Lebanon. Studies on MEs were not found for other Middle Eastern countries such as Kuwait, Yemen, Iraq, and Syria [Table 1].

Pooled analysis

From the 18 articles identified, a total of 58,221 populations were studied, which included a total of 34,730.9 identified errors. Some articles did not represent all the fields that were looked for in this research [Table 2]. The largest number of errors was mainly prescription drug errors related: about 22715.25

in omission errors, 8097.16 in general prescription drug errors, and 1585.2 in commission errors. Concomitantly, there was about 781.91 transcription errors and 629.11 administration errors. Monitoring errors were observed to be 346.14. 83.84 skill-related errors were found. Finally, 95.3 interaction errors in total were found^[12-28] [Figure 3].

Prescription drug errors

Overall prescription drug errors were the highest reported type of ME between the Middle Eastern countries. Lebanon had the highest general prescription error rate amid reported MEs, at 74.52% (1577.68/2117).^[27,28] Iran was second highest with a reported rate of 54.16% (1293.99/2388.9).^[14-18]

Following were rates of 45.68% (2458.79/5382) and 4.33% (1076/24843) from Saudi Arabia^[12-14] and Bahrain,^[19-26] respectively.

Omission errors

Failure to prescribe a drug product indicated for a patient was found to be the highest type of prescription drug errors reported in the Middle East. Bahrain reported to have the most omission errors among prescription MEs with a rate of 89.28% (22,180/24,843).^[12-14] Second highest of omission errors reported was Saudi Arabia with a rate of 7.68 (413.49/5382).^[19-26] Iran and Lebanon follow with a rate of 5.09% (121.76/2388.9)^[14-18] and 0%, respectively^[27,28] [Figure 4].

Table 1: Data spreadsheet with country-wise distribution

Study	Total sample (%)	Total case errors (%)	Prescription drug errors (%)	Monitoring errors (%)	Drug interactions (%)	Transcription errors (%)	Commission errors (%)	Omission errors (%)
Bahrain								
Al Khaja et al. (2018)	2090	712	712	-	-	-	-	-
Aljasmi et al. (2018)	992	439	364	-	-	-	-	-
Al Khaja et al. (2008)	16,091	23,692	-	-	-	-	1512	22180
Iran								
Afsaneh et al. (2014)	1031	707	127	53	37	102	-	78
Tahere et al. (2018)	379	205	94	2	-	-	-	-
Zeraatchi et al. (2013)	1291	204	124	-	-	31	-	33
Izadpanah et al. (2018)	-	41.9	0.50 (1.2)	-	-	-	3.39 (8.1)	6.82 (16.3)
Karimian et al. (2018)	17,988	1231	948.49 (77.05)	1.23 (0.10)	-	-	-	3.94 (0.32)
Saudi Arabia								
Assiri et al. (2019)	2000	162	150	12	-	-	-	--
Al-Dorzi et al. (2019)	414	98	98	-	-	-	-	-
Albarrak et al. (2014)	398	76	44	-	2	-	-	-
Al-Khani et al. (2013)	203 reports	2073	2073	-	-	-	-	-
Al-Dhawaliie (2011)	1580	113	93.79 (83)	-	11.3 (10)	7.91 (7)	-	--
Khoja et al. (2011)	5299	990	621	-	-	369	-	-
Al-Jeraisy et al. (2011)	2380	1333	1016	-	45	272	-	-
Abdulghani et al. (2017)	3085	537	53.7 (10)	-	-	-	69.81 (13)	413.49 (77)
Lebanon								
Al-Hajje et al. (2012)	1826	1103	617.68 (56)	223.91 (20.3)	-	-	-	-
Chamoun et al. (2016)	1174	1014	960	54	-	-	-	-
Total	58,221	34,730.9	8097.16	346.14	95.3	781.91	1585.2	22,715.25

Commission errors

Medication being prescribed, or dispensed incorrectly, were another common type of prescription ME. Bahrain had the highest commission prescription error rate of about 6.09% (1512/24,843).^[12-14] Saudi Arabia was the second highest, with a reported rate of 1.30% (69.81/5382).^[19-26] Iran^[14-18] and Lebanon^[27,28] follow with rates of 0.14% (3.39/2388.9) and 0%, respectively.

Transcription errors

Deviations and missteps in transcribing medication orders were a less common type of prescription ME. Saudi Arabia had the highest rate amid reported MEs at

12.06% (648.91/5382).^[19-26] Iran was second highest with a reported rate of 5.57% (133/2388.9).^[14-18]

Monitoring errors

Measuring a patient's clinical laboratory values was another less common type of prescription ME. Lebanon reported to have the highest monitoring errors with a rate of 13.13% (277.91/2117).^[27,28] Iran was the second highest with a reported rate of 2.35% (56.23/2388.9).^[14-18] followed by Saudi Arabia^[19-26] and Bahrain^[12-14] with the least rates of 0.22% (12/5382)^[12-14] and 0%, respectively.

Interaction errors

Drug-to-drug interaction errors were the least common type of prescription medication. Iran reported to have the highest interaction errors among the Middle East countries with a rate of 1.54% (37/2388.9).^[14-18] Saudi Arabia was the second highest, with a reported rate of 1.08% (58.3/5382).^[19-26]

Administration errors

Wrong patient, medication, time, dose, and route were the other types of ME reported among the Middle Eastern countries. Iran had the highest rate amid reported administration errors at 25.07% (599.11/2388.9).^[14-18] Saudi Arabia was the second highest, with a reported rate of 0.56% (30/5382).^[19-26] Skill-related errors were the most common type of administration error reported. Iran had the highest rate amid reported MEs at 0.37% (8.84/2388.9).^[14-18] Bahrain was the second highest, with a reported rate of 0.30% (75/24,843).^[12-14]

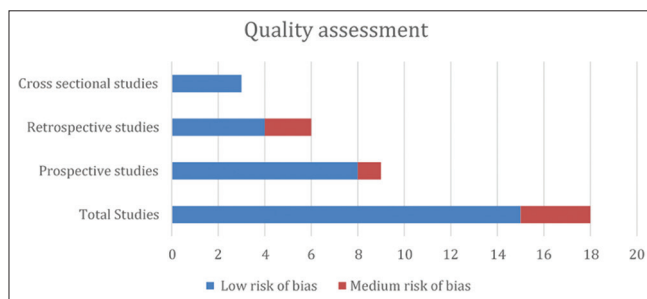


Figure 2: Quality assessment of article included in this systematic review (risks of bias)

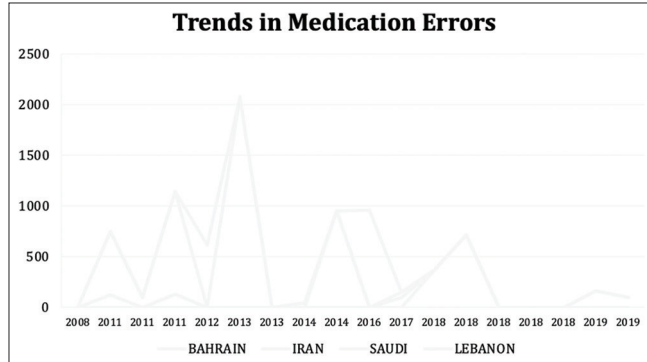


Figure 3: Prescription error trend over year

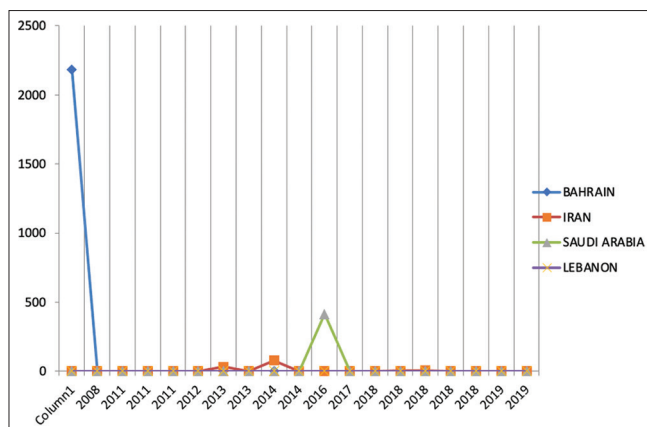


Figure 4: Omission errors trend over time

Discussion

The aim of this review was to review studies of MEs in the Middle East. This review indicated that there have been scarcely any investigations of MEs in the Middle East. Furthermore, the quality of investigations in the Middle East was poor. Poor information on ME reporting and pharmacology was a main consideration in a large number of the articles. This review has indicated that the studies on MEs distributed in Middle Eastern nations are constrained.

Year-wise trends were seen throughout the Middle Eastern countries. Lebanon's overall MEs reported increased 20% from 2012 to 2016.^[28] From 60.4% case errors total in Al-Hajje *et al.*'s study to 86.4% in Chamoun *et al.*'s study, MEs did not decrease but rather increase, respectively. Types of MEs reported were the exact same (prescription drug errors, and prescription monitoring errors).^[27,28] The vast majority of the investigations in the Middle Eastern nations assessed MEs during the prescribing stage, with general prescription errors being 23.3% of all MEs reported. A high rate of prescribing MEs is known to be a worldwide issue.^[27,28] In a previous study made

Table 2: Pooled data for administration errors country-wise distribution pattern

Study	Total sample (%)	Total case errors (%)	Administration errors (%)	Skill related (%)
Bahrain				
Al Khaja <i>et al.</i> (2018)	2090	712	-	-
Aljasmi <i>et al.</i> (2018)	992	439	-	75
Al Khaja <i>et al.</i> (2008)	16,091	23,692	-	-
Iran				
Afsaneh <i>et al.</i> (2014)	1031	707	310	-
Tahere <i>et al.</i> (2018)	379	205	109	-
Zeraatchi <i>et al.</i> (2013)	1291	204	16	-
Izadpanah <i>et al.</i> (2018)	-	41.9	22.3 (53.3)	8.84 (21.1)
Karimian <i>et al.</i> (2018)	17,988	1231	141.81 (11.52)	-
Saudi Arabia				
Assiri <i>et al.</i> (2019)	2000	162	-	-
Al-Dorzi <i>et al.</i> (2019)	414	98	-	-
Albarrak <i>et al.</i> (2014)	398	76	30	-
Al-Khani <i>et al.</i> (2013)	203 reports	2073	-	-
Al-Dhawaliie (2011)	1580	113	-	-
Khoja <i>et al.</i> (2011)	5299	990	-	-
Al-Jeraisy <i>et al.</i> (2011)	2380	1333	-	-
Abdulghani <i>et al.</i> (2017)	3085	537	-	-
Lebanon				
Al-Hajje <i>et al.</i> (2012)	1826	1103	-	-
Chamoun <i>et al.</i> (2016)	1174	1014	-	-
Total	58,221	34,730.9	629.11	83.84

to identify and quantify prescription errors, majority had prescription errors, and this is consistent with our discoveries.^[29] Sixty-five percent of the prescriptions were found to have a total of 1012 errors.^[29] These errors were mostly minor such as spelling, date omissions, and patient information.^[29]

Taking into account the per prescription tally error in the Al Khaja *et al.*'s study^[12,14], overall a decreasing trend of MEs has been occurring in Bahrain. Limited data are available to be able to distinguish a fair trend in Bahrain's reported ME rates. Saudi Arabia also had an overall decreasing trend of MEs, of about 47.9% from 2011 to 2019. Finally, looking at Iran, it is shown that there is a 9% decrease in reported MEs. Current data are enough to make a solid trend. We looked at an analysis of MEs reported through the Food and Drug Administration Adverse Event Reporting System.^[30] There was an 25% increase throughout the years 2010–2015 of ME reports.^[30] In previous studies, the framework and essential settings were identified and alluded to obstructions, necessities, culture, objectives, difficulties, and openings that confronted an error reporting framework.^[31] A through educational framework is required to improve practices among healthcare practitioners. Recent trends of medication errors in the literature showed improvement in error reporting system thus improving overall incidence in Gulf region.^[32] In Saudi Arabia, more prescriptions and samples were analyzed, 398–2000, as the years

progressed, from 2014 to 2019, making information on errors more readily available.

Among the Middle Eastern countries, Bahrain reported the most MEs. Omission prescription error was the highest reported ME at a rate of 89.28% (22,180/24,843).^[12-14] Commission error was the second highest type of error in Bahrain at a rate of 6.09% (1512/24,843).^[12-14] Less common was prescription drug errors at a rate of 4.33% (1076/24,843).^[12-14] Finally, skill-related errors were also reported at a low rate of 0.30% (75/24,843).^[12-14] In the study of Al Khaja *et al.*, there are 84.7% of drug items with reported errors and each drug item had more than one incident, making the total case errors more than the total sample.^[12-14] It is conceivable that the prescribing pace of prescribing mistakes in the Middle Eastern nations is higher than that revealed in different nations on the planet; however, it could likewise be because of methodological contrasts.

Lebanon follows with the second most reported MEs. General prescription error was the highest reported ME at a rate of 74.52% (1577.68/2117). Monitoring errors were also reported at a rate of 13.13% (277.91/2117). Site and location have a contributing effect to risk of MEs.^[14] In Bahrain, family physicians versus general practitioners were studied a reported frequency of 52.5% and 76.4% physician committed errors, respectively.^[14] One study reported ME trends and effects related to environment.^[33] The risk of MEs declined 35.4% (mean) in

different hospitals with the implementation of process or reporting redesign. These findings support the research argument of this study that environment and reporting process plays an important role in reducing MEs.^[33] Compared to smaller clinics or hospitals, open spaces can enable collaboration between healthcare workers.

Saudi Arabia had a lower rate of reported MEs. General prescription errors were the most reported ME at a rate of 45.69% (2458.79/5382). Transcription errors were the next reported with a rate of 12.06% (648.91/5382).^[30] Omission error, a type of prescription error, was less common with a rate of 7.68% (413.49/5382). Other types of errors were drug-interactions, administration, and monitoring with the incidence of 1.08% (58.3/5382), 0.56% (30/5382), and 0.22% (12/5382), respectively.^[19-26]

Iran reported the least amount of MEs. General prescription errors were the most reported type of error with a rate of 54.17% (1293.99/2388.9).^[19,31] Administration errors were the second most reported errors, with a rate of 25.08% (599.11/2388.9). Then, transcription errors come reported at a rate of 5.57% (133/2388.9). Omission errors was also reported at a slightly lower rate of 5.09% (121.76/2388.9).^[28,32,34] Monitoring, interaction, skill-related administration error, and commission error were least reported with rates of 2.35% (56.23/2388.9), 1.55% (37/2388.9), 0.37% (8.84/2388.9), and 0.14% (3.39/2388.9), respectively.^[14-18]

Limitations

Retrieval of possibly related studies was limited because the countries original language included in the study were Arabic and Persian. The search approach was restricted to English language and those with the original language were excluded. Studies regarding ME and types of ME were found majorly in some countries, Saudi Arabia specifically, and lacking in other countries. Moreover, the understanding and summary of the gathered information were impeded because of the distinctions in the methodology taken by each creator to report, characterize, define, and order information. Incomplete data resulted in insufficient evaluation of types and incidence of ME in Middle Eastern countries. Therefore, it is not feasible to generalize the findings in this report to the whole Middle Eastern region. The novelty of this study is the comparison of data from different countries. This systematic review is also focusing and recommending the need of primary research data on healthcare services and MEs in the region.

Conclusions

This study suggested a definitive ME reported in Middle-eastern countries. There are several different types of reported errors; most studies related to MEs

in the Middle Eastern countries were relatively few in number or nonexistent. Some of the articles' quality was either poor or not concise. A negative trend in the amount of ME was identified in most of the countries under the study. There is strong need of literature on healthcare services in the region. The under-reporting or inconclusive data suggested major reforms are required in healthcare sector.

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Conflicts of interest

There are no conflicts of interest.

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