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Drug Related-Problems in Emergency Departments and The Role of Clinical Pharmacists: A Multi-Center Study in Iraq

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ABSTRACT

Drug related problems (DRPs) are common in emergency departments (EDs), where the fast-paced environment increases the risk of medication errors and adverse drug events. Limited data are available from Iraq. Accordingly, the current study aimed to assess the prevalence, causes and severity of DRPs in Iraqi EDs and to evaluate the impact of clinical pharmacist interventions. A cross-sectional multi-center study was conducted in March 2024 at four major hospitals in Al-Najaf, Iraq. Adult patients (n=500) presenting to ED for non-surgical conditions were included. DRPs were identified and classified using PNCE version 9.0 system. Pharmacist interventions and their acceptance were documented. Data were analysed using SPSS version 28. DRPs were identified among 80.2% of patients. Drug-drug interactions (39.4%), ineffective medications (39.8%) and cost effectiveness problems (36.2%) were the most common causes. Regarding severity, 55.9% of the total DRPs were mild, 25.1% moderate and 19.1% sever. A total of 685 pharmacist intervention were recorded, most commonly were changing in drug instructions (30.4%). Overall, 59.4% of interventions were fully accepted by the physicians resulting in solving of 36.4% of the total DRPs. DRPs are highly prevalent in Iraqi EDs, with nearly one in five classifieds as sever. Clinical pharmacist interventions were effective and frequently accepted, underscoring the importance of integrating pharmacists into ED team to improve patient safety.

Keywords: Emergency medicine, Medication errors, Pharmacist interventions.

I. INTRODUCTION

Emergency department (ED) represent the frontline of healthcare, serving as the main entry point for urgent medical care. They operate around the clock and handle a wide variety of acute conditions in both adult and children. In addition, EDs are critical in reducing morbidity and mortality rates, making patients safety a key priority in this setting (Almasi et al., 2022; Aringhieri et al., 2017; Pini et al., 2021). Globally, unsafe medical care is a leading cause of preventable harm, disability and death (Shuyi et al., 2024 Tevžič et al., 2021). ED environment is particularly vulnerable due its fast space, high patient turnover, frequent use of high-risk medications in addition to limited time for comprehensive medication review (Donelan et al., 2024; Morgan et al., 2018a). These factors increase the likelihood of medication errors and adverse effects.

DRPs are broadly defined as an events or circumstances that interfere with optimal pharmacotherapy and may lead to undesirable clinical outcomes. According to Pharmaceutical Care Network Europe (PNCE), DRPs can arise from prescribing, dispensing, administration or from unexpected harmful effects (Pharmaceutical Care Network Europe (PNCE), 2020). DRPs include medication errors, adverse drug reactions besides issues related to treatment cost and adherence (Adem et al., 2021; Memon et al., 2024). Several studies confirmed that DRPs are common in EDs. A recent meta-analysis

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found that approximately 22.6% involve errors, with 42% of these errors being potentially harmful (Nguyen et al., 2024). In pediatric EDs, errors rates reach 10-15%, with dosing mistakes being the most frequent (Alsabri et al., 2024). Clinical pharmacists play an important role in reducing DRPs. Their interventions have been shown to improve prescribing practice, prevent medication errors, identify adverse drug reactions as well lowering healthcare costs (Alsheyyab et al., 2024; Miarons et al., 2021; Morgan et al., 2018; Pérez-Moreno et al., 2017; Pouliot et al., 2019). In many countries, the integration of pharmacists in EDs has demonstrated significant improvement in medication safety and patient care. In Iraq, limited data are available on the prevalence and severity of DRPs in ED. No large-scale multi-center study has yet assessed the scope of contribution of clinical pharmacist in this setting. Therefore, this study aimed to identify and categorize the causes and severity of DRPs in EDs of Iraqi hospitals and to evaluate the impact of clinical pharmacist interventions on these problems.

II. METHODS AND MATERIALS

The current study was an observational, cross-sectional multicenter study conducted in March 2024 in Al-Najaf city, Iraq. Data were collected from the EDs of four hospitals belong to Al-Najaf Health Directorate: Al-Najaf Teaching Hospital (498 bed), Al-Sadder Medical City (454 bed), Al-Hakeem General Hospital (282 bed) and Al-Furat teaching hospital (350 beds). The study was approved by the Scientific Committee of Research at Al-Najaf Health Directorate (Approval NO. 3360, January 23, 2024).

A total of 500 patients older than 18 years who admitted to the ED during day time shift (8.00 am-3.00 pm) were included. Patients presented with non-surgical medical complains requiring emergency care. While exclusion criteria included patients admitted from outpatient clinics, those with incomplete medical records as well as pediatrics, surgical and obstetric/gynecological cases.

Data collection: for each patients the following information were recorded: Demographics that include age, gender and residence; clinical characteristics that included past medical history, medication history, comorbidities, chief complain in addition to duration of ED stay; prescribing medications in ED admission and identified DRPs, their etiology and severity. Data collection was performed by clinical pharmacist (MSc in clinical pharmacy) in collaboration with two emergency medicine clinical pharmacists (PGY training program) in each hospital. For classification of DRPs, the Pharmaceutical Care Network Europe (PNCE) version 9 (2020) classification system was used to assess the causes and severity of DRPs. Each case was independently reviewed by the clinical pharmacist and verified by the ED pharmacist. All interventions that performed by ED pharmacists to resolve DRPs were documented and classified at three levels, prescriber level (proposed or discussed changes with the physician), patient level (counselling, referral or providing written information) and at drug level (e.g., dose adjustment, drug substitution, initiation or discontinuation). The acceptance of these interventions by the physicians was also recorded and categorized as fully accepted, partially accepted or not accepted.

Data were entered in to Microsoft Excel 2023 and analyzed by using SPSS version 28. Descriptive statistics were applied according to variable type. For continuous variables (age, duration of EDs stay, number of medications, number of DRPs and number pf pharmacist interventions) were summarized as frequencies and percentages. Categorical variables (gender, residence, presence of DRPs, severity level and intervention acceptance) were also summarized as frequency and percentage.

III. RESULTS AND DISCUSSION

Regarding sociodemographic and clinical characters, a total of 500 patients were included. the most common age group was 51-60 years (25.4%), while only 11.4% were above 70 years. Males represented 53.4% of the sample. Most patients lived in urban areas (73.8%). More than half (56.2%) had history of chronic medication use prior ED admission (Table 1). Hypertension and DM were the most frequent comorbidities, followed by IHD and HF. Cancer and liver disease were least common (Figure 1).

TABLE 1: DEMOGRAPHIC CHARECTERS OF SURVYED PATIENTS

Variable	NO.	%
Age (year)		
≤ 30	66	13.2
31 – 40	89	17.8
41 – 50	106	21.2
51 – 60	127	25.4
61 – 70	55	11
71 – 80	40	8
> 80	17	3.4
Gender		
Male	267	53.4
Female	233	46.6
Residence	0	0
Urban	369	73.8
Rural	131	26.2
Past medication history		
Yes	281	56.2
No	219	43.8

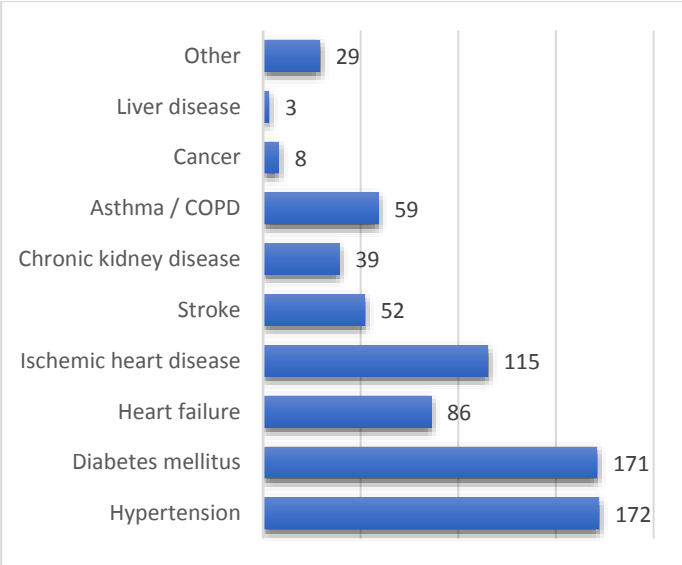


FIGURE 1: COMORBIDITIES AMONG SURVYED PATIENTS.

The leading chief complaints for ED admission were chest pain (20.4%) and abdominal pain (18.8%) (Figure 2). Nearly half of patients (46.2%) stayed in the ED for less than 24 hours, while 6% remained more than four days (Figure 3). Regarding the prescribed medications in ED, 28.6% of patients received 3-4 drugs, while 6.6% received more than 10 medication (Figure 4).

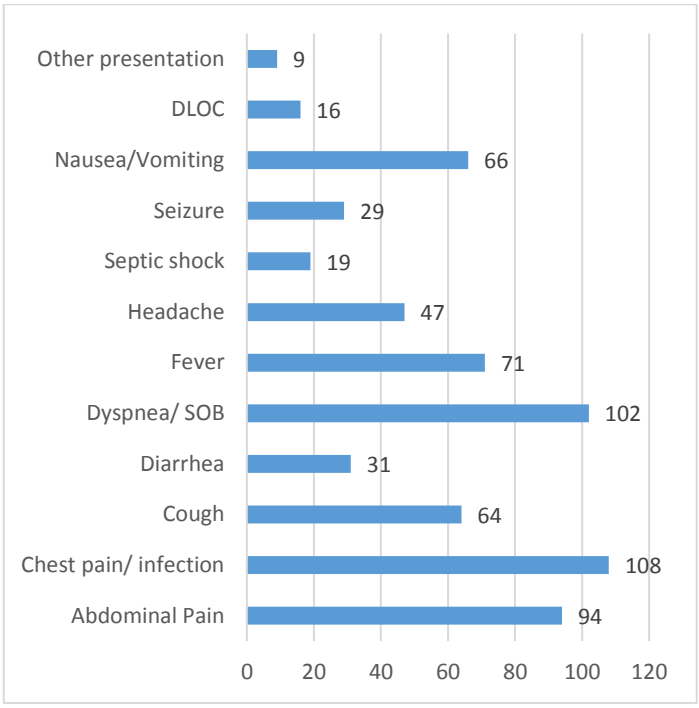


FIGURE 2: CHIEF COMPLAINT OF ED ADMISSION AMONG SURVYED PATIENTS.

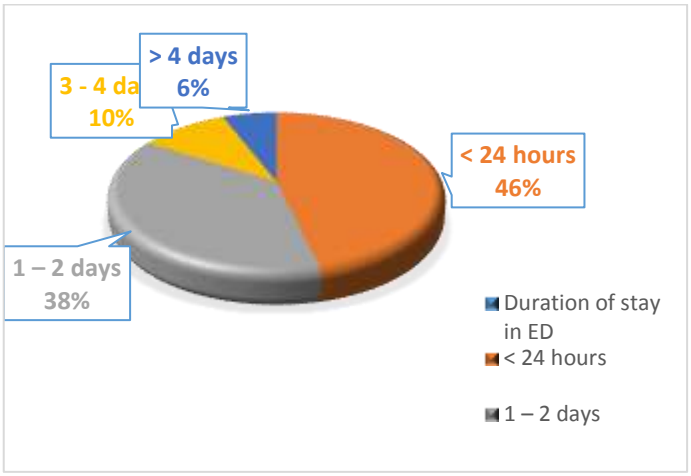


FIGURE 3: DURATION OF STAY IN ED AMONG SURVYED PATIENTS

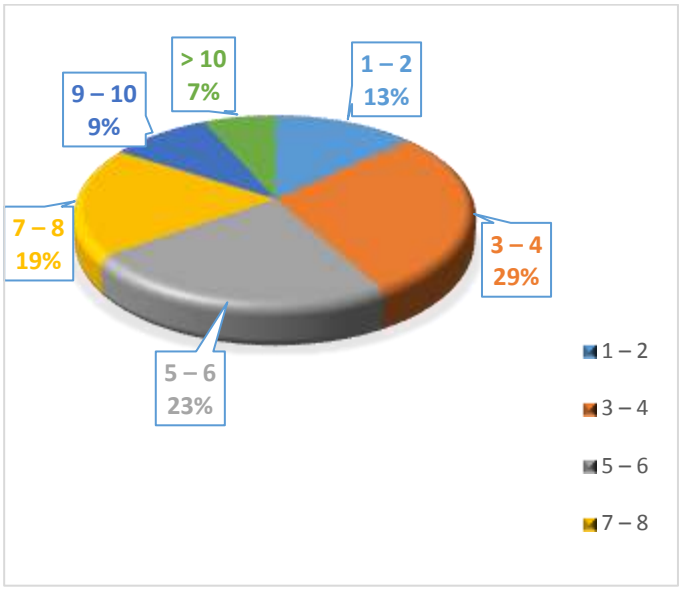
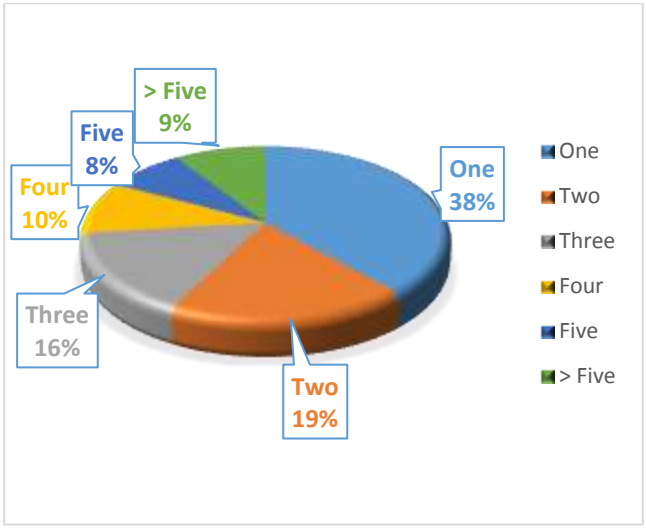


FIGURE 4: DISTRIBUTION OF THE NUMBER OF PRESCROBED MEDICATIONS IN ED AMING SURVYED PATIENTS.

Concerning DRPs, a total of 1049 DRPs were identified (2.089 problem per patient), only 19.8% of patients had no DRPs during their stay. In contrast, 80.2% experienced at least one DRP (Figure 5). Out of the total 1049 identified DRPs, 55.9% were mild, 25.1% were moderate and 19.1% were sever (Figure 6).



FGURE 5: FREQUANCY DISTRIBUTION OF DRP AMONG SURVYED PATIENTS

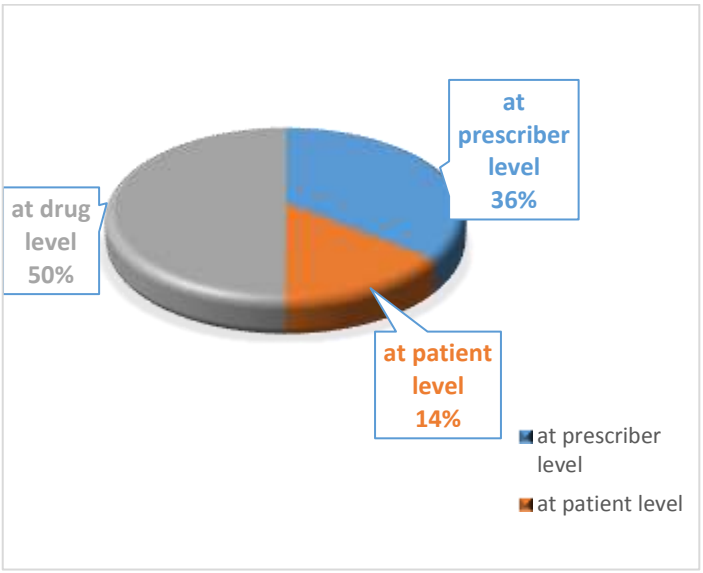


FIGURE 6: PROFILE OF ED PHARMASISTS INTERVENTIONS AGAINST DRPS.

A total of 1907 causes were identified. The most frequent were ineffective drug followed by drug-drug interactions and cost effectiveness problems, where those affecting 39.8%, 39.4% and 36.2% of patients and representing 10.44%, 10.33% and 9.49% of the total causes respectively (Table 2).

TABLE 2: MAIN ETIOLOGY OF DRPS REPORTED AMONG SURVYED PATIENTS.

Detected Causes of DRPs	NO.	% Of total patients	% Of total DRP causes
Inappropriate drug according to guidelines	120	24	6.29
Contraindicated drug for the case	41	8.2	2.15
Drug with no indication	40	8	2.10
Drug- drug interaction	197	39.4	10.33
Inappropriate combination	164	32.8	8.60
Inappropriate duplication	75	15	3.93
Too many drugs/indication	60	12	3.15
Cost effectiveness problem	181	36.2	9.49
Unnecessary treatment	30	6	1.57
Too low dose	105	21	5.51
Too high dose	120	24	6.29
Too low frequency	12	2.4	0.63
Too high frequency	124	24.8	6.50

Wrong, unclear or missing instructions	80	16	4.20
Non available drug	76	15.2	3.99
Non provided information	9	1.8	0.47
In appropriate Duration of treatment	27	5.4	1.42
Not administered drug	9	1.8	0.47
Patient take less than prescribed dose	13	2.6	0.68
Patient take more than prescribed dose	13	2.6	0.68
Food interaction	3	0.6	0.16
Inappropriate timing	24	4.8	1.26
Inappropriate drug form	5	1	0.26
Not effective drug	199	39.8	10.44
Untreated symptoms	138	27.6	7.24
Possibly occurring AEs	42	8.4	2.20
Total	1907		100.00

Regarding ED pharmacist interventions against DRPs, a total 685 intervention were performed. 49.9% of them were at drug level, mainly changing in drug administration instructions and dose adjustment. 35.6% were at prescriber level and 14.4% were at patient level (mainly counselling) (Table 3). A 59.4% of the total ED pharmacists' interventions were fully accepted, 16.4% were partially accepted while 16.4% were not accepted (Figure 7). Pharmacist intervention resulted in solving about one third (36.13%) of the total DRPs. 47.66% remained unresolved while16.21% were unknown whether solved or not (Figure 8).

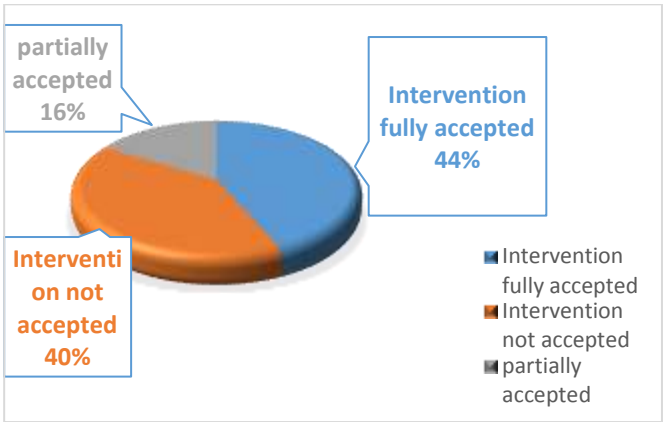


FIGURE 7: ACCEPTANCE OF ED PHARMACISTS INTERVENTIONS AGAINST DRPS.

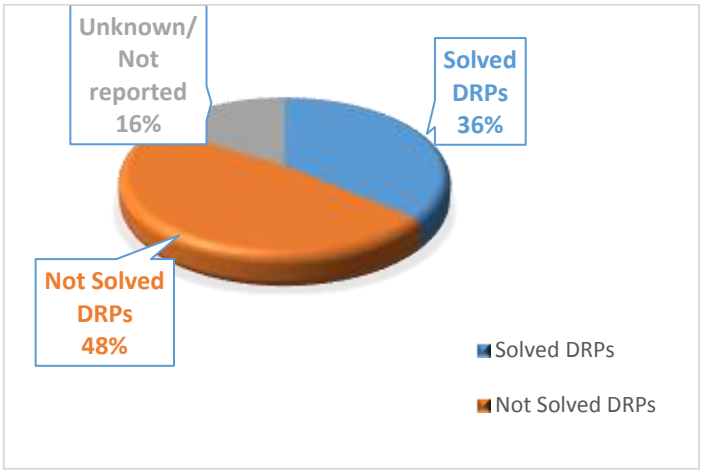


FIGURE 8: OUTCOMES OF ED PHARMACIST INTERVENTIONS AGAINST DRPS.

TABLE 3: THE DOCUMANTED ED PHARMACISTS INTERVENTIONS AGAINST DRPS.

Intervention	No	% Of total patients	% Of total interventions
at prescriber level	**244**		**35.62**
Intervention proposed to prescriber	126	25.2	18.39
Intervention discussed with prescriber	118	23.6	17.23
at patient level	**99**		14.45
Patient counselling	80	16	11.68
Provide written information	10	2	1.46
Patient referred to prescriber	9	1.8	1.31
at drug level	**342**		**49.93**
Drug changed	32	6.4	4.67
Drug Stopped	41	8.2	5.99
Drug Paused	10	2	1.46
Drug Started (added)	30	6	4.38
Dose changed	73	14.6	10.66
Formulation changed	4	0.8	0.58
Using instructions changed	152	30.4	22.19
Total	**685**		**100.00**
Intervention fully accepted	297	59.4	43.36
Intervention not accepted	276	55.2	40.29
partially accepted	112	22.4	16.35
Total	**685**		**100.00**

This multi-center study revealed a high prevalence of DRPs among adult patients admitted to the EDs in Iraq. More than four out of five patients had experienced at least one DRP and nearly one in five DRPs were classified as a sever DRP. The most common causes were ineffective medications, drug-drug interactions beside cost effectiveness problems. Clinical pharmacist interventions addressed these issues with more than half of the recommendations were fully accepted by physicians.

The findings of the current study are consistent with the international studies showing that EDs are high risk environments of DRPs (Haag et al., 2022; Morgan et al., 2018). However, the prevalence in this cohort (80.2%) is much higher than that reported in many European and north American studies, where DRP rates range from 30-60% (Miarons et al., 2021; Pouliot et al., 2019). This variation may reflect variation in healthcare infrastructures, medication availability and underdeveloped routine clinical pharmacy services in most Iraqi EDs. Additionally, the demographic and clinical characters of included patients can explain some of these findings regarding DRPs. About quarter of surveyed patients were older than 60 years where comorbidities were common among them. More than half of patients were on chronic drug use before ED visit, managed by more than five medications with more than 24-hour admission. All these were documented as a risk factor for developing DRPs. These results explain by the fact increasing prevalence of EDs visits among the elderly where multiple comorbidities were significantly associated with DRPs among them (Haag et al., 2022b; Lumjeaksuwan et al., 2021; Phoemlap et al., 2024; Ukkonen et al., 2019). Additionally, reconciliation errors are highly prevalent specially among elderly patients with polypharmacy (Ruiz-Millo et al., 2018).

In this study, the most frequent DRP causes were ineffective medications, drug-drug interactions and cost related problems are in line with the reports from other middle eastern countries (Alsheyyab et al., 2024; Pérez-Moreno et al., 2017). The high proportion of ineffective medications may be attributed to outdated prescribing practice and limited access to updated treatment guidelines. While cost effectiveness problems reflect the ongoing challenges of balancing affordability with optimal care resources-limited settings.

The intervention acceptance rate (59.4%) indicates positive collaboration between pharmacists and physicians in the EDs. Comparable acceptance level (55-70%) have been reported in regional and international studies ((Alsheyyab et al., 2024; Morgan et al., 2018). This suggests that physicians increasingly recognize the value of pharmacists in improving patients' safety, especially in complex clinical environments. The clinical implications of this study are significant. Integrating clinical pharmacists into ED teams can improve medication safety, optimize therapy and reduce preventable adverse outcomes. Current findings support global recommendations for multidisciplinary approach in emergency care and highlight the need to expand pharmacist led services in Iraqi hospitals.

Recent Iraqi studies highlighted the importance of pharmacist intervention on patients' quality of life and medication adherence (Bash & Rabea, 2025; Suker & AL-Ameen, 2024).

This study has several strengths. It is the first cross-sectional, multi-center evaluation for DRPs in Iraqi EDs with relatively large sample size. It also used standardized PNCE classification, ensuring comparability with international studies. However, some limitations must be acknowledged data collection excluded pediatrics, surgical and obstetric patients that limiting generalizability ang may also underestimate the overall prevalence. Additionally, single city estimation that may not represent other regions in Iraq. Accordingly, further research should conduct to estimate DRPs in boarder range of Iraqi hospitals and including all patients' populations. Interventional studies are also needed to measure the direct impact of clinical pharmacists on reducing DRPs and improving patients' outcomes. Furthermore, assessing the economic implications of pharmacist interventions would provide valuable evidence for health care policymakers.

IV. CONCLUSION

DRPS are highly prevalent in Iraqi EDs, with a considerable proportion being sever. Clinical pharmacists' interventions were effective and often acceptable, highlighting the importance of integrating pharmacists in to the ED team to improve patients' safety as well as optimizing therapeutic efficacy.

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