

The Impact of a Clinical Pharmacist in the Emergency Department of an Academic Hospital in the Kingdom of Saudi Arabia

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Abstract: Introduction: The department of emergency medicine (DEM) has a high-risk environment due to its unique and complex workflow. Many high-risk medications are ordered and administered at patients' bedsides without being checked by a pharmacist first, which may lead to an increase in the incidence of patient medication errors (MEs). Objective: The current study evaluated the needs of the clinical pharmacy service in the DEM at King Saud University Medical City (KSUMC), Riyadh, Saudi Arabia. Methods: A cross-sectional retrospective study was conducted between Jan 2016 to Dec 2017 and the documentation of clinical pharmacist interventions was extracted from Esihi database. Results: A total of 2,255 interventions for 862 patients were documented. The recommended interventions were as follows: 645 (dose adjustments), 108 (therapeutic substitutions), and 354 interventions (initiating drug therapy). Adverse drug reactions (ADRs) were reported in 16 patients, and drug interactions were managed in 26 patients. The DEM responded to 713 information inquires and 290 pharmacokinetic consultations. Drug discontinuations included 39 incidents (where unjustified drug prescription occurred), 37 (where contraindications were involved), and 19 (where duplicate therapy was involved). The most common interventions were related to the following drugs: antibiotics (34%), anticoagulants (15%), and anticonvulsants (10%). The acceptance rates for the EM clinical pharmacist recommendations increased from 93.9% in 2016 to 99% in 2017. The most common outcome for interventions was to optimize the therapeutic effects of the drugs that were administered (73%). Reconciliation was done in 796 patients. Conclusions: The clinical pharmacy service plays a critical role in the management of patients in the emergency department (ED).

Key words: ED, clinical pharmacist, interventions, pharmacy services.

1. Introduction

The department of emergency medicine (DEM) has a high-risk environment due to its unique and complex workflow [1]. Indeed, the prevalence of adverse drug events related to emergency department (ED) visits is high [2], with almost 17% patients requiring

hospitalization [3, 4]. During highly stressful situations such as cardiopulmonary resuscitation, trauma, and rapid sequence intubation procedures, many high-risk medications are ordered and administered at the bedside without being checked by a pharmacist, which may lead to an increase in the incidence of medication errors (MEs) and adverse drug reactions (ADRs). It has been reported that discharge prescriptions from the ED have a ME rate of approximately 13.4% [5].

In such scenarios, clinical pharmacists can play a critical role through monitoring both the prescription

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and administration of high-risk medications in order to ensure minimal MEs and ADRs. Recent international studies substantiate the need of clinical pharmacists to be active members of the DEM medical team. In fact, the presence of clinical pharmacists has been shown to have a positive impact on the efficient functioning of the ED [6-8]. Clinical pharmacy consultation services can provide drug-related information to physicians, residents, students, and nurses whenever required [6, 7, 9-11]. Consequently, the clinical pharmacist has an important role in reducing potential ADRs and assuring medication safety to the patients through identifying and preventing MEs and ensuring appropriate medication use [9, 11-19]. By obtaining the medication history of a patient as well as engaging in reconciliation and discharge counseling, a clinical pharmacist operating in the DEM can contribute towards better patient outcomes, improved patient understanding of the proper use of medications, and enhanced medication compliance. All of these positive improvements subsequently lead to a lower re-admission rate [20-22]. Such measures are also cost effective because they decrease the number of recurrent hospital admissions, enhance patient medication compliance, promote the discontinuation of any undictated drug therapy, dose adjustments, and prevent MEs [9, 10, 13, 19, 23]. Accordingly, the clinical pharmacist becomes an integral part of the medical team in critical care units and general medicine wards.

King Khalid University Hospital (KKUH) is part of King Saud University Medical City (KSUMC): it is primarily a teaching hospital with a 712 functioning bed capacity [23]. In 2015, an emergency medicine (EM) clinical pharmacist role was integrated into the interdisciplinary team at the DEM.

The role of a clinical pharmacist in Saudi Arabia has been discussed in many national studies. However, none of these studies have described the role of a clinical pharmacist in the ED. This study, therefore, is the first study to assess both the role and the need for a clinical pharmacist in the ED at a major Saudi Arabian

hospital. This study will serve as a resource for other health institutions whilst outlining the various clinical pharmacy services within the DEM.

The primary objective of this study was to assess and evaluate the role of a clinical pharmacist in the DEM by evaluating and classifying the interventions that was performed to patients. The secondary objective of this study was to highlight the important role that an EM clinical pharmacist plays and to evaluate the degree to which ER physicians will accept the recommendations made by EM clinical pharmacist.

2. Materials and Methods

A cross-sectional retrospective two-year study was conducted between January 2016 and December 2017 at the Adult ED of KKUH, KSUMC, Riyadh, Saudi Arabia. An EM clinical pharmacist was contracted to work for the Adult DEM on a full time basis, 5 days a week. The hours of their shift were from 07:30 to 16:30.

The following details were taken from the Esihi database and were documented: (1) Information from the patients' medical charts that included data regarding patient medications, laboratory, and culture results; (2) All clinical interventions recommended by the EM clinical pharmacist to the DEM physician during medical rounds; (3) The DEM physician's acceptance or rejection of the EM clinical pharmacist's recommendations; (4) Information pertaining to all patients who received reconciliation and medication counseling by the EM clinical pharmacist.

Medication history was taken from the patient or his/her caregiver. Medication reconciliation was done for patients prior to their transfer from the DEM. Medication counseling was done for patients discharged from the DEM. Counseling included explaining to the patient his/her medication indications, dosages, preferred administration times, common side effects etc., The importance of

adherence to their medication program was emphasized by explaining to the patient the expected comorbidity resulting from non-compliance. Patients were instructed regarding the severe adverse drug effects that they may encounter as well as when they would need to revisit the DEM.

Data were analyzed using the SPSS[®] statistical package, Version 20.0 (SPSS Inc., Chicago, IL, USA) for Windows[®]. With *p*-value of <0.05 considered statistically significant. Descriptive statistics are reported mean and medians ± standard deviation or as frequencies and percentages, as appropriate. Chi-squared tests were used to determine association between qualitative variables.

The retrieval data were accessible to all DEM staff. Co-investigators were also allowed to access this data. In order to assess the role of a clinical pharmacist, working as part of the medical team in the DEM, the acceptance rate of the EM clinical pharmacist's recommendations by the DEM physician was calculated and compared over the two years that the study was conducted. The expected outcomes related to the EM clinical pharmacist were categorized based on the following: (1) optimal therapeutic effects; (2) prevention of ADRs; and (3) cost-effectiveness.

3. Results

Approximately, 7,155 and 9,153 patients were admitted to the Adult DEM at KKHU in 2016 and 2017, respectively. A total of 2,255 interventions were documented by the EM clinical pharmacist during the two-year study period. Interventions relating to 862 patients were examined over the duration of the study

period. The majority of the patients were male 53% (454), and the mean age of participants was 41 ± 20 years old. (Table 1) The documented clinical intervention type definitions are presented in Table 2. Common interventions included the following: Dose adjustments (645, 29%), switching to optimal drug therapy (108, 5%), and initiating drug therapy recommended by the EM clinical pharmacist (354, 16%). ADRs were distinguished in 16 (0.7%) patients, and interactions were managed in 26 (1.2%) patients to prevent drug failure. The EM clinical pharmacist responded to 713 (32%) drug-related and drug-management information questions as well as 290 (13%) pharmacokinetic/pharmacodynamics consultations. The EM clinical pharmacist recommended drug discontinuation for 39 (1.7%) drugs in order to avoid the unjustified prescription of such drugs. Significantly, 37 (1.6%) drugs were discontinued due to contraindications, and 19 (0.8%) drugs were discontinued due to its duplication in the therapeutic plan (see Fig. 1).

Average interventions per patient were 6 ± 4 interventions. The number of interventions between severity of patient condition were statistically significant (*p* < 0.05).

Table 1 Patient demographic data.

Parameters	N (%)
Patients	862
Age, years (±SD)	41 ± 20
Age range, years	14 – 97
Gender	
Male	454 (53)
Female	408 (47)

Table 2 Definition of the various different types of clinical intervention.

Clinical intervention type	Definition
Adverse drug reaction (ADR)	The patient has signs or symptoms that suggest either toxicity or an allergic reaction, or another adverse side effect induced by a drug.
Avoiding unjustified prescription	Patient is taking a drug without any indication for its usage.
Convert drug administration route from parenteral to oral	The EM clinical pharmacist recommends the conversion of the patient's parenteral drugs to its oral equivalent (whenever oral drugs are applicable to the patient's condition, that is).
Discontinue drug due to its contraindication	The patient is on a drug which is absolutely contraindicated to his/her medical condition (s).

(table 2 continued)

Clinical intervention type	Definition
Discontinue the duplicate therapy	The patient is on two or more drugs in combination with one another (although the patient is not displaying any apparent adverse clinical effects). However, the drug combination is inappropriate, or there is little or no evidence of its synergistic efficacy.
Dose adjustment	The patient is either on the wrong dose or the wrong route of administration, or the wrong frequency, or the wrong sub-therapeutic dose/supra-therapeutic dose, or the wrong administration duration.
Drug inquires/management	Any direct question or inquiry was addressed to the EM clinical pharmacist regarding the patient's pharmacological regimen.
Initiated drug therapy (untreated indication)	The patient has problems relating to the actual or potential conditions that require pharmacological treatment that was not preformed.
Pharmacokinetic/pharmacodynamics consultation	Any recommendation related to therapeutic drug monitoring which includes the targeted drug level in the blood, monitoring parameters, sampling time.
Preventing drug failure (interaction)	The patient is on drugs or food, which in combination with each other will cause a major interaction to occur which might lead to therapeutic failure or cause adverse effects. Drug discontinuation or dose adjustment will therefore be required.
Switch to optimal drug therapy (therapeutic substitution)	The patient is on a particular therapeutic regimen; however, the EM clinical pharmacist has recommended therapeutic substitutions in order to optimize the efficacy based on the latest literature.

Adapted from standard and guidelines for pharmacists performing clinical interventions. March 2011, pharmaceutical society of Australia.

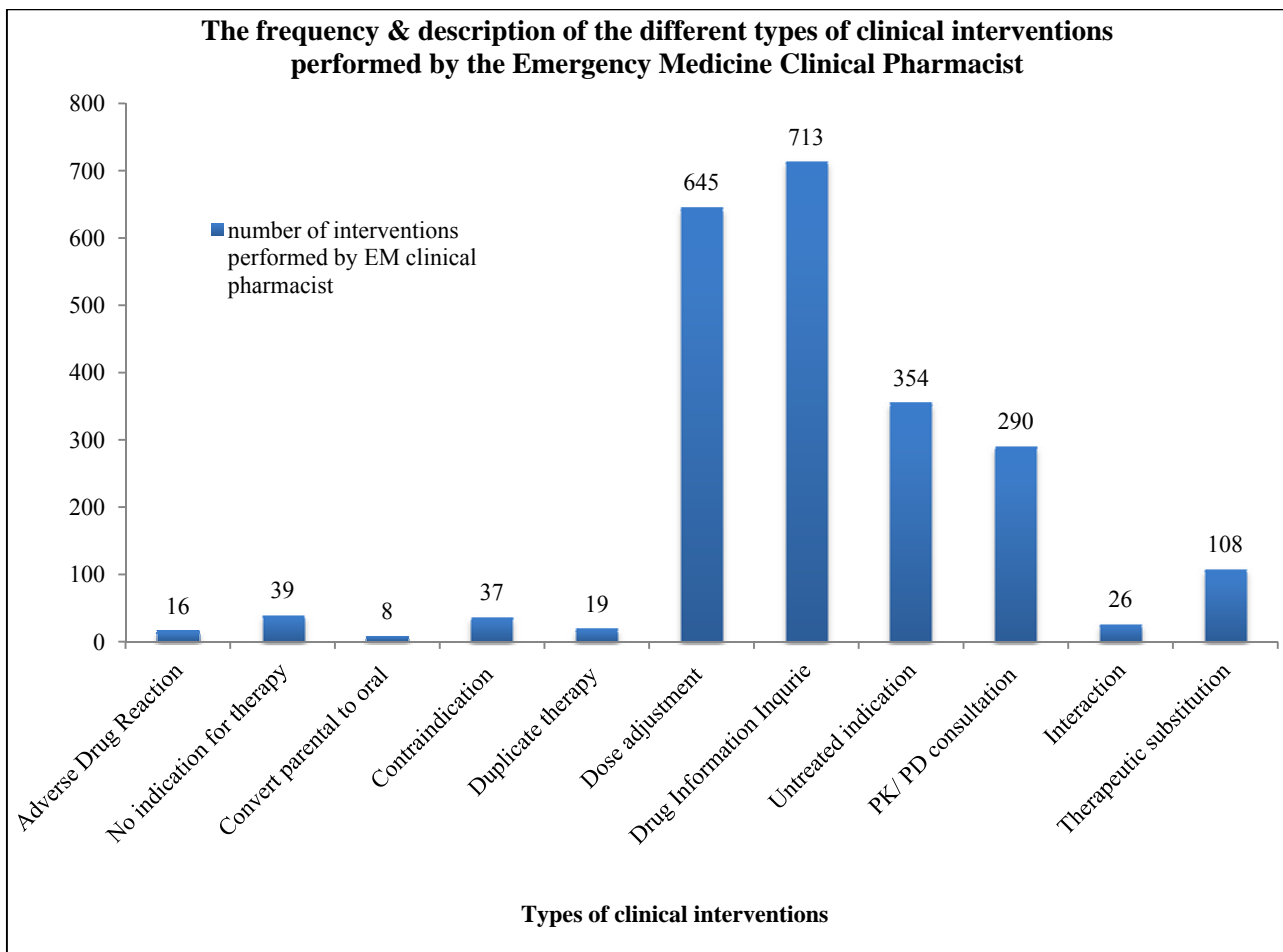


Fig. 1 The frequency & description of the different types of clinical interventions performed by the emergency medicine clinical pharmacist.

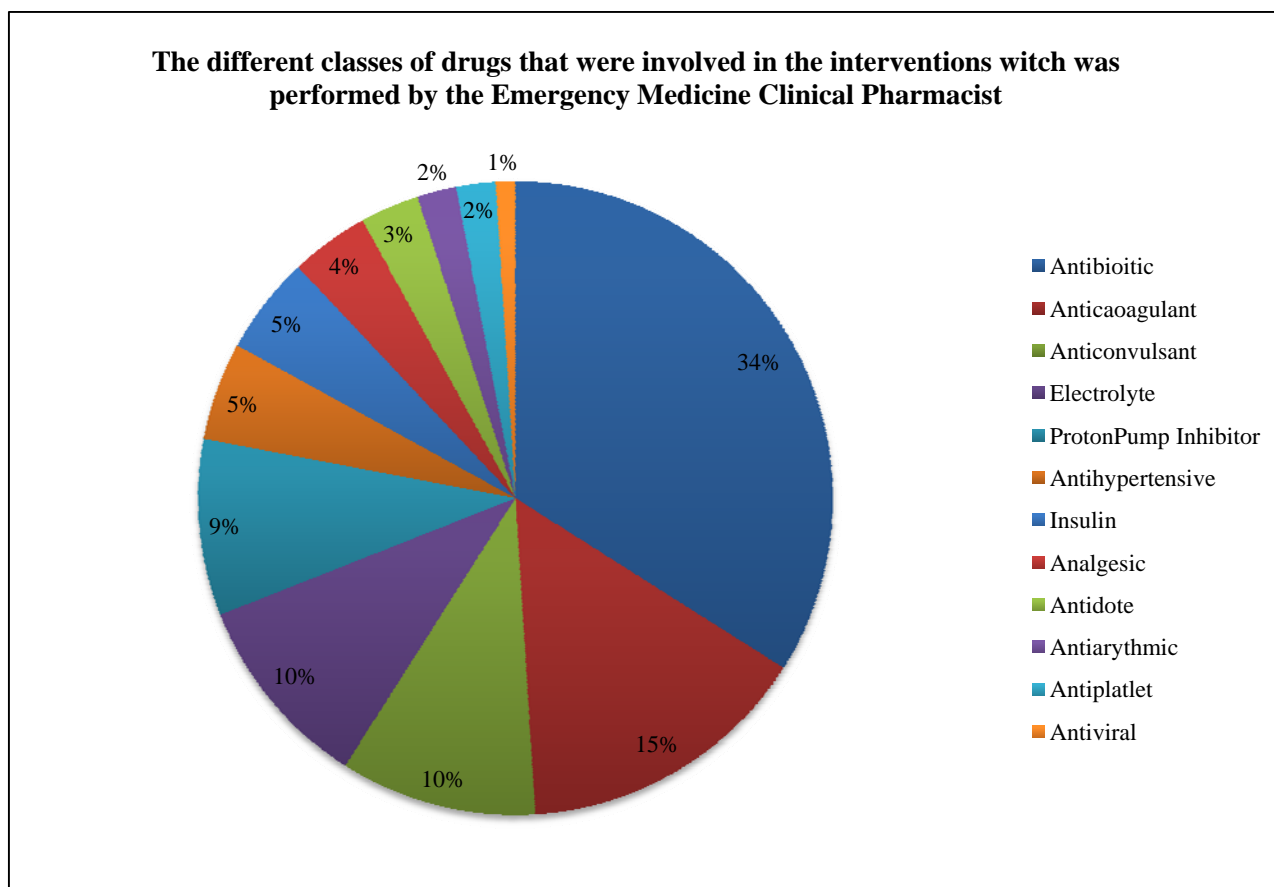


Fig. 2 The different classes of drugs that were involved in the interventions were performed by the emergency medicine clinical pharmacist.

Table 3 Outcomes of the clinical intervention performed by the emergency medicine clinical pharmacist.

Outcome	Number	%
Optimize therapeutic effects	1,648	73%
Avoid potential harm or adverse drug reaction	541	24%
Direct cost saving measure only	66	3%

The clinical interventions were analyzed according to their pharmacological classes. The interventions related to the use of antibiotic drugs were most (34%), followed by anticoagulant drugs (15%), and anticonvulsant drugs (10%) (see Fig. 2). Such interventions led to the achievement of optimal therapeutic effects (73%), the prevention of ADRs (24%), and ultimately proved to be cost-effective (3%), too (see Table 3).

Reconciliation was done for 796 patients. The average time spent with a patient was 15-20 minutes per patient per visit. The acceptance rates for the EM clinical pharmacist's recommendations by the DEM

physician were 93.9% in 2016 and 99% in 2017, respectively.

4. Discussion

The clinical pharmacist's role in the ED includes direct interaction with patients, reviewing patient medication charts, providing patient-specific drug doses and recommendations, and participating in emergency codes, especially those related to trauma, cardiac arrest, and STEMI [24-30].

The current study was conducted in order to understand the role of a clinical pharmacist in the therapeutic management of various interventions at

the DEM. The EM clinical pharmacist was shown to have a significant impact in the DEM. This was, essentially, a finding that was observed based on the number of documented interventions. The interventions related to drug enquiry and management recommendations included correct drug selection and dose adjustments in order to prevent MEs and to optimize patient care. The clinical pharmacist helped in optimizing patient care by determining and recommending patient-specific drugs and monitoring pharmacokinetic and pharmacodynamic consultations. Indeed, the benefit in terms of cost for such an approach was demonstrated when the clinical pharmacist managed the pharmacokinetic monitoring services [31-34]. In this study the EM clinical pharmacist not only recommended the dose but also the sampling time for specific drug level depend on its pharmacokinetics parameters. And thus will decrease the cost of unnecessary labs ordered. Moreover, the clinical pharmacist in the current study was able to provide assistance in the categorization of interventions according to drug class which is in line with similar findings in other studies [35, 36]. In addition, a large percentage of reconciliations were done for patients. This is where pharmacists play a valuable role in cost saving through their preventing unnecessary medications from being prescribed to patients [37]. The DEM pharmacist managed to reduce the incidence of medication discrepancies between home and admission orders, too [38]. The number of therapeutic substitution recommendations performed through the reconciliation process indicates the critical role of the clinical pharmacist.

This study also showed that the acceptance rate of the clinical pharmacist's recommendations by the DEM physician increased over the two-year period. This not only indicates higher reliability but, also, the beneficial involvement of a clinical pharmacist when s/he works in conjunction with the DEM medical team. In fact, as much as 24% of the outcomes which resulted from the clinical pharmacist's interventions

were related to avoiding potential harm or ADRs in patients as well as optimizing patient health and safety.

The current study has some limitations, however. The chart reviewing was not performed to all patients present to DEM. Due to the fact that the EM clinical pharmacist was available only during working hours at the DEM for 5 days of the week only, their intervention during other non-functioning times would often be delayed. Moreover, some biases cannot be ruled out from the results since only the EM clinical pharmacist evaluated the outcome of their interventions.

This is a novel study which assessed the need for a clinical pharmacist in the DEM in a Saudi Arabian hospital setting. The results of this study support the need for a clinical pharmacist in the DEM in order to improve the safety of patients and the quality of care that they are afforded. The results highlight the important role of a clinical pharmacist in managing patient visiting DEM. The results of this study also seem to demonstrate the beneficial collaboration between the clinical pharmacist and the physicians within the DEM.

Such studies should be performed over a long period of time at multiple centres and at multiple hospitals across Saudi Arabia in order to understand the effectiveness of the EM clinical pharmacist. In addition, the EM clinical pharmacist should be available at all shifts to manage any intervention needed to improve the patient safety and outcomes. More personnel should be recruited to serve as EM clinical pharmacist owing to their critical role.

5. Conclusions

This study shows the important role of the clinical pharmacy service in the EM department. The presence of an EM clinical pharmacist during each shift in the DEM is recommended in order to tackle any intervention management outcomes. We hope this study will serve as a reference to other institutions and

encourage them to adopt the presence of a clinical pharmacist in their DEM.

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Conflicts of Interest

The authors declare that there were no competing interests regarding the content of this article.

References

- [1] Johnston, A., Abraham, L., Greenslade, J., Thom, O., Carlstrom, E., Wallis, M., and Crilly, J. 2016. "Review Article: Staff Perception of the Emergency Department Working Environment: Integrative Review of the Literature." *Emergency Medicine Australasia* 28 (1): 7-26.
- [2] Jatau, A. I., et al. 2015. "Prevalence of Drug-Related Emergency Department Visits at Teaching Hospital in Malaysia." *Drug Real World Outcome* 2 (4): 387-95.
- [3] Budnitz, D. S., Pollock, D. A., Weidenbach, K. N., Mendelsohn, A. B., Schroeder, T. J., and Annet, J. L. 2006. "National Surveillance of Emergency Department Visits for Outpatient Adverse Drug Events." *JAMA* 296 (15): 1858-66.
- [4] Budnitz, D. S., Shehab, N., Kegler, S. R., and Richards, C. L. 2007. "Medication Use Leading to Emergency Department Visits for Adverse Drug Events in Older Adults." *Ann Intern Med* 147 (11): 755-65.
- [5] Murray, K. A., Belanger, A., Devine, L. T., Lane, A., and Condren, M. E. 2017. "Emergency Department Discharge Prescription Errors in an Academic Medical Center." *Proc (Bayl Univ Med Cent)* 30 (2): 143-6.
- [6] Splawski, J., Horner, D., and Tao, K. A. 2017. "Survey of Staff Perceptions of an Emergency Medicine Pharmacist Program in a Community Hospital: A Brief Report." *Ann Emerg Med*. 69 (3): 308-14.
- [7] Coralic, Z., et al. 2014. "Staff Perception of an on-Site Clinical Pharmacist Program in an Academic Emergency Department after One Year." *West J Emerg Med*. 15 (2): 205-10.
- [8] Thomas, M. C., Acquisto, N. M., Shirk, M. B., and Patanwala, A. E. 2016. "A National Survey of Emergency Pharmacy Practice in the United State." *Am J Health Syst Pharm*. 73 (6): 386-94.
- [9] Cohen, V., et al. 2009. "Effect of Clinical Pharmacists on Care in the Emergency: A Systematic Review." *American Journal of Health-Systemic Pharmacy* 66 (15): 1353-61.
- [10] Abdulaziz, H., Al Anany, R., Elmalik, A., Saad M., Prabhu, K., Al-Tamimi, H., Salah, S. A., and Cameron, P. 2016. "Impact of Clinical Services in a Short Stay Unit of a Hospital Emergency Department in Qatar." *Int J Clin Pharm*. 38 (4): 776-9.
- [11] Patanwala, A. E., Sanders, A. B., Thomas, M. C., Acquisto, N. M., Weant, K. A., Baker, S. N., Merritt, E. M., and Erstad, B. L. 2012. "A Prospective, Multicenter Study of Pharmacist Activities Resulting in Medication Error Interception in the Emergency Department." *Ann Emerg Med*. 59 (5): 369-73.
- [12] Hendeerson, K. I., Gotel, U., and Hill, J. 2015. "Using a Clinical Pharmacist in the Emergency Department." *Emerg Med J* 32: 998-9.
- [13] Lada, P., and Jr, D. G. 2007. "Documentation of Pharmacists' Interventions in an Emergency Department and Associated Cost Avoidance." *Am J Health Syst Pharm* 64 (1): 63-8.
- [14] Selbst, S. M., Fein, J. A., Osterhoudt, K., and Ho, W. 1999. "Medication Errors in Pediatric Emergency Department." *Pediatric Emergency Care* 15 (1): 1-4.
- [15] Bwerra ,Martinez , Garcia. 2015. "The Effect on Potential Adverse Drug Events of a Pharmacy-Acquired Medication History in an Emergency Department: A Multicenter, Doubled-Blind, Randomized, Controlled, Parallel-Group Study." *BMC Health Ser Res*. 15: 337.
- [16] West, L. M., Cordina, M., and Cunningham, S. 2012. "Clinical Pharmacist Evaluation of Medication Inappropriateness in the Emergency Department of a Teaching Hospital in Malta." *Pharmacy Practice* 10 (4): 181-7.
- [17] Miranda, T. M., Petriccione, S., Ferracini, F. T., and Borges Filho, W. M. 2012. "Intervention Performed by Clinical Pharmacist in the Emergency Department." *Einstein* 10 (1): 74-8.
- [18] Pérez-Moreno, M. A., Rodríguez-Camacho, J. M., Calderón-Hernanz, B., Comas-Díaz, B., and Tarradas-Torras, J. 2017 "Clinical Relevance of Pharmacist Intervention in an Emergency Department." *Emerg Med J*. 34 (8): 495-501.
- [19] Proper, J. S., Wong, A., Plath, A. E., Grant, K. A., Just, D. W., and Dulhunty, J. M. 2015. "Impact of Clinical Pharmacist in the Emergency Department of an Australian Public Hospital: A before and after Study." *Emerg Med Australas* 27 (3): 232-8.
- [20] Becerra-Camargo, J., Martinez-Martinez, F., and Garcia-Jimenez, E. 2013. "A Multicenter, Double-Blind, Randomised, Controlled, Parallel-Group Study of the Effectiveness of a Pharmacist Acquired Medication History in An Emergency Department." *BMC Health Service Research* 13: 337.

- [21] Vasileff, H. M., Whitten, L. E., Pink, J. A., Goldsworthy, S. J., and Angley, M. T. 2009. "The Effect on Medication Errors of Pharmacist Charting Medication in an Emergency Department." *Pharmacy World & Science* 31 (3): 373-9.
- [22] Pharmaceutical Society of Australia. 2011. "Standard and Guidelines for Pharmacists Performing Clinical Interventions."
- [23] Administration Department, King Saud University Medical City. (Jan 2018)
- [24] Zhai X. B., Tian D. D., and Liu X. Y. 2015. "The Role of the Clinical Pharmacist in Reducing Mortality in Hospitalized Cardiac Patients: A Prospective, Nonrandomized Controlled Trial Using Propensity Score Methods" *Int J Clin Pharmacol Ther* 53 (3): 220-9.
- [25] Farsaei S., Karimzadeh I., Elyasi S., Hatamkhani S., and Khalili H. 2014. "Glycemic Control in the Infectious Diseases ward; Role of Clinical Pharmacist Interventions". *J Infect Dev Ctries.* 8 (4):480-9.
- [26] Wymore, E. S., Casanova, T. J., Broekemeier, R. L., Jr. Martin, J. K. 2008. "Clinical Pharmacist's Daily Role in the Emergency Department of a Community Hospital." *Am J Health-Syst Pharm.* 65 (5): 395-9.
- [27] Randolph, T. C. 2009. "Expansion of Pharmacists' Responsibilities in an Emergency Department." *Am J Health-Syst Pharm.* 66 (16): 1484-7.
- [28] Case, L. L., and Paparella, S. 2007. "Safety Benefits of a Clinical Pharmacist in the Emergency Department." *J Emerg Nurs.* 33 (6): 564-6.
- [29] Paparella, S. 2008. "Drug Storage in the Emergency Department: When Accessibility ≠ Safety." *J Emerg Nurs.* 34: 355-6.
- [30] Otoum, S. 2013. "Relationship between Availability of Emergency Department-Based Clinical Pharmacy Services and Incidence of Medication Errors in Emergency Departments: A Systematic Review." *Gulf Medical Journal* 2 (1): 3-9.
- [31] American Society of Health-System Pharmacists. 1998. "ASHP Statement on the Pharmacist's Role in Clinical Pharmacokinetic Monitoring." *Am J Health-Syst Pharm.* 55 (16): 1726-7.
- [32] Streetman, D. S., Nafziger, A. N., Destache, C. J., and Jr. Bertino, A. S. 2001. "Individualized Pharmacokinetic Monitoring Results in Less Aminoglycoside-Associated Nephrotoxicity and Fewer Associated Costs." *Pharmacotherapy* 21 (4): 443-51.
- [33] Bond, C. A., and Raehl, C. L. 2005. "Clinical and Economic Outcomes of Pharmacist-Managed Aminoglycoside or Vancomycin Therapy." *Am J Health Syst Pharm.* 62 (15): 1596-605.
- [34] Schumock, G. T., Butler, M. G., Meek, P. D., Vermeulen, L. C., Arondekar, B. V., and Bauman, J. L. 2003. "Evidence of the Economic Benefit of Clinical Pharmacy Services: 1996-2000." *Pharmacotherapy* 23 (1): 113-32.
- [35] Foster, R. A., Kuper, K., Lu, Z. K., Bookstaver, P. B., Bland, C. M., and Mahoney, M. V. 2017. "Pharmacists' Familiarity with and Institutional Utilization of Rapid Diagnostic Technologies for Antimicrobial Stewardship." *Infect Control Hosp Epidemiol* 38 (7): 863-6.
- [36] Koroluk, K., Cicinelli, E., Farrell, A., and Battistella, M. 2017. A Systematic Review to Describe the Role of the Pharmacist in Outpatient Antimicrobial Stewardship Programs and Interventions. PROSPERO 2017 CRD42017065755.
- [37] Sawyer, R. T., Odom, J. M., Jennings, J., Orr, J., and Cass, A. L. 2016. "Discharge Medication Reconciliation by Pharmacists to Improve Transitions Following Hospitalization (DEPTH)." *GHS Proc.* 1 (1): 32-7.
- [38] Kent, A. J., Harrington, L., and Skinner, J. 2009. "Medication Reconciliation by a Pharmacist in the Emergency Department: A Pilot Project." *Can J Hosp Pharm.* 62 (3): 238-42.