The Importance of Computerized Drug Interaction Checker and Interconnecting System between Hospitals, Clinics and Community Pharmacy to Avoid Drug-Drug Interactions in United Arab Emirates

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Abstract

The aim of this study was to measure the drug-drug interactions (DDIs) through analysis of outpatient's prescriptions in The University Hospital Sharjah and Sharjah Healthcare Center.

The study was a retrospective observational prescription analysis held in Sharjah United Arab Emirates for a period of two months, from September to October 2015. The prescriptions with two or more oral and injectable medications were chosen. The drugs in each prescription were then entered into the drug interaction checker software. In Sharjah Healthcare Center, a total of 246 prescriptions were analyzed, of which 140 prescriptions were included. Among these 140 prescriptions; 23 and 26 had DDIs according to the Micromedexsolutions and Medscape software, respectively. However, in University Hospital, of 1160 selected prescriptions, 550 were included among which 31 and 82 prescriptions had DDIs according to the Micromedexsolutions and Medscape database respectively. The use of computerized evidence based drug interaction checker software along with interconnecting system between hospitals, healthcare centers and community pharmacy could minimize possible DDIs and errors.

Key words:

Drug-drug interaction, Interaction checkers, Hospital Pharmacy, Community Pharmacy, UAE

Introduction:

The simultaneous and extended utilization of two or more medications in a treatment, due to the patient's pathological complaint, the necessity for action, or effect complementation is known as polypharmacy [1]. A drug-drug interaction (DDI) occurs when an effect of one drug is changed by the prior or simultaneous administration of another drug which may result in desired effects, reduced efficacy and effectiveness or an increase in toxicity [2]. Adverse drug reactions (ADRs) can occur as a result of DDIs which can lead to hospitalization; according to the previous study DDIs may cause up to 3% of all hospitalization [3]. In 1995 in the United States the Med watch program of Food and Drug Administration reported 6894 mortalities due to ADRs including DDIs [4]. Avoidance of

possibly harmful DDIs is important to prevent medication related morbidity and mortality and improve medication safety in the outpatient's settings [5]. DDIs subdivided into four categories include: contraindication, major interactions which may be life-threatening, moderate interactions which may result in exacerbation of the patient's condition and require alteration in therapy, and mild interactions which do not significantly affect the therapy effect [6].

Drug interactions could be easily prevented among medication errors [7]. Pharmacist is the patients final contact with the health care system before therapy initiates and the last line of defense against potentially harmful DDIs [5]. The specific computerized drug interaction checker system is important to reduce possible interactions as it is no longer practical for physicians or pharmacist to rely on memory alone to avoid potential drug interactions [1,8], but this computerized system is not enough alone. Patients often fail to give complete medication information to their physicians, which may cause drug duplications or drug interactions [9]. How the healthcare system can overcome this problem is controversial. The relationship between the number of medications per prescriptions and possibility of DDIs and solutions to overcome DDIs are the main aims of this study.

Methods:

The study was conducted in the Sharjah, United Arab Emirates (UAE). It was accompanied in Sharjah Healthcare Center (SHCC) and University Hospital Sharjah (UHS) during September and October 2015. It was a retrospective study and prescriptions were randomly chosen from the pharmacy in only outpatient's settings. Outpatients with two or more oral and injectable medications were included in the study and prescriptions with the external use medications (topical, eye and ear preparations) were excluded. There was no specifications of age and gender.

A drug interaction check was performed using the www.micromedexsolutions.com and www.medscape.com databases. The Medscape is a freely accessible checker while the Micromedexsolutions was on limited use. The Micromedexsolutions was accessible from the Drug Information Center in Al-Qasemi Hospital, where they provide account for their trainees. According to Micromedexsolutions tool, drug interactions are categorized as unknown, minor, moderate, major, and contraindication which indicated the possible risks of occurrence of DDIs in patients, but not the actual severity of DDIs. At the same time, according to the Medscape, drug interactions are categorized as no interaction, minor, significant and serious.

The initial part of the study designed to provide information regarding each site of study separately followed by a comparison between the two sites.

Results:

In SHCC, 246 prescriptions were picked of which 140 prescriptions were included. According to the Micromedexsolutions, among these 140 prescriptions, 23 (16.42%) prescriptions had DDIs. These 23 prescriptions comprised only one contraindication, 31 moderate, 5 major, and 2 minor interactions. Whereas according to the Medscape, among these 140 prescriptions, 26 (18.57%) prescriptions had DDIs including 10 minor, 37 significant, and 3 serious interactions. In SHCC, gliclazide was prescribed for diabetes mellitus which does not exist in Medscape. Therefore, it was not possible to check its interaction with other medications.

In UHS, 1160 prescriptions were selected randomly with 550 prescriptions being included. According to the Micromedexsolutions, among these 550 prescriptions, 31 (5.63%) prescriptions showed DDIs. These 31 prescriptions included 30 moderate, 10 major, 5 mild and one contraindication interactions. However, according to the Medscape, among these 550 prescriptions, 82 (14.9%) prescriptions had DDIs including 26 minor, 75 significant, and 7 serious interactions. As demonstrated in the results, the number of DDIs found in Micromedexsolution was significantly lower compared to the number of DDIs found in Medscape database.

Table 1 summarizes minor, moderate, major, and contraindication DDIs occurring in both UHS and SHCC according to the results obtained from Micromedexsolutions. The Micromedexsolutions was chosen over the Medscape as it provides evidence based information regarding DDIs

Table 1: DDIs according to the Micromedexsolutions

Minor	
1. Cefuroxime + Norethindrone 2. Antacids + Hyoscyamine 3. Antacids + Ascorbic acid 4. Antacids + Iron 5. Antacids + Azithromycin 6. Iron + Calcium Carbonate 7. Aspirin + Ranitidine	30. Bisoprolol + Metformin/Sitagliptin 31. Bisoprolol + Celecoxib 32. Perindopril + Indapamide 33. Perindopril + Metformin/Sitagliptin 34. Lisinopril + Indapamide 35. Lisinopril + Metformin 36. Rosuvastatin + Antacids 37. Rosuvastatin + Clarithromycin 38. Atorvastatin + Clopidogrel 39. Atorvastatin + Amiodarone 40. Ciprofloxacin + Calcium 41. Ciprofloxacin + Antacids 42. Iron + Omeprazole 43. Calcium + Indapamide 44. Sitagliptin + Glimepiride 45. Sildenafil + Tamsulosin
Moderate	
1. Meloxicam + Perindopril 2. Meloxicam + Amlodipine 3. Meloxicam + Aspirin 4. Meloxicam + Indapamide 5. Meloxicam + Atenolol 6. Aspirin + Bisoprolol 7. Aspirin + Atenolol 8. Aspirin + Lisinopril 9. Aspirin + Perindopril 10. Aspirin + Nitroglycerin	Major

11. Aspirin + Amlodipine 12. Aspirin + Indapamide 13. Aspirin + Hydrochlorothiazide 14. Aspirin + Insulin 15. Aspirin + Glimepiride 16. Aspirin + Antacids 17. Insulin + Losartan 18. Insulin + Valsartan 19. Insulin + Telmisartan 20. Insulin + Perindopril 21. Insulin + Carvedilol 22. Insulin + Bisoprolol 23. Insulin + Metformin/Sitagliptin 24. Levothyroxine + Antacids 25. Levothyroxine + Ca2+ carbonate 26. Levothyroxine + Simethicone 27. Levothyroxine + Pantoprazole 28. Levothyroxine + Omeprazole 29. Atenolol + Metformin/Sitagliptin	1. Ciprofloxacin + Metformin 2. Ciprofloxacin + Gliclazide 3. Clarithromycin + Metronidazole 4. Clarithromycin + Atorvastatin 5. Azithromycin + Domperidone 6. Amiodarone + Bisoprolol 7. Amiodarone + Dabigatran 8. Amiodarone + Quetiapine 9. Clopidogrel + Aspirin 10. Clopidogrel + Amlodipine 11. Clopidogrel + Omeprazole 12. Fenofibrate + Fluvastatin 13. Orphenadrine + Codeine
	Contraindication
	1.Potassium + scopolamine

Discussion:

Conferring to the previous study [8], several pharmacists discover that computerized drug interaction screening systems detect a large number of DDIs of questionable clinical significance, but according to our study, the system that was selected can play an important role to minimize the number of DDIs and can help the physician or pharmacist with evidence based information to resolute whether the interaction is clinically significant or not.

In SHCC, most of the patients were suffering from chronic diseases. One of the physician in SHCC declared that mostly they just copy and paste the same prescriptions for those chronic patients who visit the center to refill their medications. For those patients with hyperlipidemia on statins, the doctor prescribed meloxicam as prophylaxis to avoid myopathy. It is not required to give meloxicam or other NSAIDs for prophylaxis as they increase risk of gastric problem which require further investigation and medications. As the number of medications per prescription increase, the chance for possible DDIs will be higher [10]; it is the physician's responsibility to avoid prescribing unnecessary medications. Based on the results of some studies [11], the rates of potential drug

interactions for patients receiving two or more drugs range from 24.3% to 42%. Therefore, the greater the number of drugs, the higher the possibility of DDIs.

There are major interactions between statins and clarithromycin which may increase the serum concentration of statin, or between amiodarone and bisoprolol enhancing the chance of bradycardia and cause cardiac arrest (use Levobunolo instead). This might also occur between amiodarone and dabigatran consider therapy modification, or between clopidogrel and omeprazole which must be avoided and ranitidine could be used instead. Also, clarithromycin and domperidone show interactions where clarithromycin is strong CYP3A4 inhibitors and may increase the serum concentration of domperidone [12]. It is under the physician responsibility to see whether the benefits outweigh the risks or whether to switch the medication to another class to decrease risk of DDIs. In case of major DDIs as it could cause morbidity and mortality, physicians and pharmacists must be aware of them and keep the patients under close observation in case benefit of drug regimen outweighs the risk [7].

Aspirin shows interactions with numerous medications. According to Micromedexsolutions, most of these interactions occur when the aspirin given in the dose to work as NSAIDs and not anticoagulant. Therefore, it is physician's or pharmacist's duty to judge the clinical significance of the interactions in specific situation.

The number of prescriptions with DDIs in UHS was significantly lower than SHCC as the UHS was connected to the Trakcare system which screen and detect possible DDIs. Consequently, it is important for the clinic or the hospital to be connected to the computerized drug interaction screening system.

The SHCC was connected to the other governmental hospitals and clinics which provides patients' medical records and history while UHS was not connected to any. These connections are considerably essential for the hospital, health care center, and even community pharmacy to avoid medication duplication and possible DDIs as patients regularly fail to provide complete prescription and OTC medication history. The pharmacy must record the OTC and herbal remedies used by the patient to the medication history and files.

Conclusion:

DDIs can be shunned by using the computerized drug interaction screening systems, but the system must provide evidence based information and the healthcare provider must evaluate whether the benefit of using it outweighs the risk. It is highly essential for hospitals, healthcare centers, and community pharmacies to be connected to each other and record patient's history to decrease possible errors.

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