

Completeness of medication prescriptions: Prescription errors study in Hail region, Saudi Arabia (PeSHR)



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ABSTRACT

Prescription error is a common and preventable cause of adverse drug events and emerging as a public healthcare concern. It has been responsible for many morbidity, mortality, healthcare cost and litigations. Information regarding the pattern and the burden related to prescription error is limited in Saudi Arabia, particularly, in the Hail region. The study aims to identify the types and frequency of prescription errors in two major hospitals in the Hail Region, Saudi Arabia. A retrospective chart review of prescriptions issued over a two-month period (October–November 2014) was conducted using a validated form. Hand-written prescriptions from the out-patient clinic and Emergency Room were selected using simple random sampling and reviewed to identify any prescription error by two clinical pharmacists. A prescription error was defined and classified based on Neville's classification. Final data were analyzed using descriptive statistics. Data from 1000 prescriptions was extracted and reviewed. At least one prescription error was identified in all the prescriptions (100%). Type A errors identified were missing information related to dose (42%), diagnosis (47%), file number (78%), patient's body weight (100%) and age (63%). Of the 1000 prescriptions reviewed, 78% did not have a file number, 63% without the patient's name. Type D error was identified to be poor handwriting (28%), missing prescription date (34%), patient's sex (22%) and name (0.8%), prescribing date (34%), physician signature (27%) and stamp (16%). The frequency of prescription error at tertiary healthcare hospitals in the Hail Region, Saudi Arabia is high and preventable. Interventions to ensure adherence to good prescription practice, effective communication between healthcare professionals and computerized physician order entry are therefore needed to prevent the burden associated with the prescription error.

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1. Introduction

Prescription error is defined as a prescribing decision or prescription writing process that results in an unintentional, significant reduction in the probability that treatment will be timely and effective or in an increase in the risk of harm when compared with generally accepted practice. Prescription errors include any mistake in the

patient identity, identity of the prescribed drug, formulation, dose, route, timing, frequency or duration of administration (Velo and Minuz, 2009). The prevalence of prescription error is common and becoming a significant healthcare-related problem, especially in developing countries (Alsulami et al., 2013; Chiatti et al., 2012). Prescription errors that result in adverse effects are estimated to account for 70% of all medication errors (Velo and Minuz, 2009). A systematic review of studies on medication errors in Middle East countries has shown that up to 90.5% of errors were related to prescriptions (Alsulami et al., 2013). In the United Kingdom where the computerized physician order entry (CPOE) is widely practiced, a prescription error of 9–15% of medication orders for hospital inpatients was reported. In addition, there is a growing concern

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over limitations related to prescription errors (Ghaffar et al., 2015).

Fortunately, a prescription error can be detected and prevented. A previous study has shown that 78% of potentially harmful prescribing errors were intercepted by pharmacists at a pediatric unit of an academic hospital in the United States (US) (Wang et al., 2007). In addition, human error at an individual level or at an institutional level were factors associated with prescription errors that can be a target to prevent occurrence. Recent data suggest that newly qualified physicians are twice more likely to commit a prescription error compared to senior physicians (Seden et al., 2013).

In Saudi Arabia, the prevalence of prescription error is common and a contributor to many adverse events leading to morbidity and healthcare cost (Kamel et al., 2018; Khoja et al., 2011). Previous studies conducted at different healthcare settings in Saudi Arabia have reported a prevalence of 18.7% among five public and five primary healthcare clinics, (Khoja et al., 2011) and 89% of the medication errors identified at a tertiary hospital (Alshaikh et al., 2013). There have been efforts to prevent prescription errors in Saudi Arabia. The Ministry of Health and some teaching hospitals have introduced e-prescriptions to improve safety, (Albarrak et al., 2014; MOH, 2019) however, this has not been scaled up to other healthcare facilities in the Kingdom (Qureshi et al., 2014) including some hospitals in the Hail region. To our knowledge, there was no data on a prescription error from healthcare facilities in the Hail region, Saudi Arabia. Therefore, our objective was to investigate the prevalence and types of prescription errors at two major tertiary healthcare facilities in the Hail region, Saudi Arabia.

2. Methods

2.1. Study design

This study is a retrospective chart review of patients' prescriptions over a period of two months in 2014.

2.2. Study setting

This study was conducted at the two tertiary hospitals in the Hail region, Saudi Arabia. A three hundred and sixty-five (365) bed capacity referral hospital, and a 250-bed capacity general hospital. The two hospitals were major healthcare facilities in the region. Hail region is one of the 13 regions of the Kingdom of Saudi Arabia, located in the northern part of the country.

2.3. Study population/data source

The study population included the prescriptions of all categories of patients at the outpatient department and ER of the two tertiary hospitals in the Hail region, Saudi Arabia. Prescriptions were

considered eligible for inclusion if they are prescribed (hand-written) from October 2014 to November 2014 on day shifts. Prescriptions were excluded if they were issued during the night shift. Data were sourced from the patients' prescription records at pharmaceutical administration department of the two hospitals. The record is domiciled at the pharmaceutical department and served as the archive for storing all prescriptions in the facilities.

2.4. Samples size calculation

The sample was determined using the following formula: There was no previous study from the two study settings to use in the sample size calculation, however, a proportion of 49% prescription error from a similar study in Saudi was used (Kamel et al., 2018). The sample size was calculated as follows:

$$n = \left(\frac{z}{d}\right)^2 p(1-p)$$

where n is sample size; Z is Z-statistic for a level of confidence; p is proportion; d is margin of errors.

Assuming Z value is 1.96, and the margin of error of 0.05, the minimum sample size was calculated to be 383.

2.5. Sampling technique

Patients' prescriptions were selected based on simple random sampling from the records. Prescriptions were assigned with numbers, and a random number for the random sampling was generated using an online random number generator (Stat Trek, 2019). The numbers generated were used in the selection of the prescriptions.

2.6. Data collection

Information was extracted using a data collection form as shown in Table 1. The form was developed, reviewed by experts in the field and pre-tested prior to the study. The data collection consisted of 11 items; patient name, age, sex, weight, file number, diagnosis, physician's stamp, signature, prescribing date, dose and handwriting legibility. The form has two options of "yes" "no", and the reviewers were asked to tick each item in the form as "yes" to indicate a presence of information, and "no" as the absence of information in the prescription. The data collection was done by two clinical pharmacists who were trained on how to extract the data from the database. The two pharmacists reviewed the prescriptions independently to identify any error. To ensure quality control and internal validity of the data extraction, the pharmacists divided and shared the prescriptions into two halves for the data collection. Each of the collected data was reviewed by each pharmacist, and any disagreement was resolved by consensus. The inter-rater reliability between the two data collectors was determined

using Cohen’s kappa (k). The k value was calculated using the Online Kappa calculator (Randolph, 2008).

Table 1: Data collection form

S/N	Item	Option	
		Yes	No
1	Patient name		
2	Age		
3	Sex		
4	Weight		
5	File number		
6	Diagnosis		
7	Dose information		
8	Handwriting legibility		
9	Physician stamp		
10	Physician signature		
11	Prescribing date		

2.7. Operational definition

2.7.1. Definition of prescription error

In this study, prescription was defined as any error occurs when any of the following components are missing in a prescription order of a patient; patients’ name, age, sex, weight, file number, diagnosis, prescribing date, dose information, physicians’ stamp, signature, and illegible handwriting (Velo and Minuz, 2009).

2.7.2. Classification of prescription error

The prescription errors identified were classified based on Neville’s et al. (1989) classification:

- Type A (potentially serious to the patient)
- Type D (trivial)

2.8. Data analysis

Descriptive analyses of the prevalence and nature of prescribing errors were conducted using GraphPad Prism version 6.04 for Windows, GraphPad Software, La Jolla California USA. The prevalence of prescription error was calculated by dividing the number of uncompleted prescriptions to the total number of included prescriptions. Categorical variables were presented as frequency and percentage.

3. Results

One thousand (1000) prescription orders were included and analyzed in this study. The kappa value among the reviewers was found to be 0.8. At least one error (missing patient’s weight) was detected in all the included prescriptions.

3.1. Types of prescription errors

Fig. 1, Fig. 2, and Fig. 3 demonstrated the different categories of prescription errors identified in this study. Two major types of prescription errors were identified based on Neville’s et al. (1989) classification (Type A and D).

3.1.1. Type A

Two broad categories of errors were identified under this class. The first category were prescription errors, related to the patient’s weight, age and file number (Fig. 1). From the 1000 prescriptions studied, 635 prescriptions (63.5%) did not include the patient’s age, 780 prescriptions (78%) did not include the patient’s file number, and interestingly, 1000 prescriptions (100%) did not include the patient’s weight information.

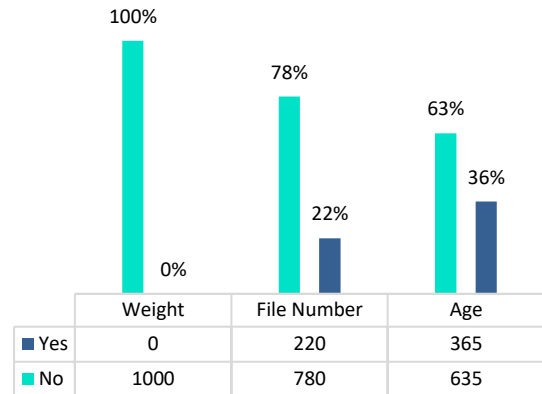


Fig. 1: categories of prescription errors (Type A)

The second category is an error related to the missing diagnosis and medication dose in the prescription accounting to about 45% of the total prescription errors detected. Out of the 1000 prescriptions analyzed, 478 (47.8%) of prescriptions did not contain the patient’s diagnosis, and 424 (42.4%) prescriptions did not contain the medication dose information (Fig. 2).

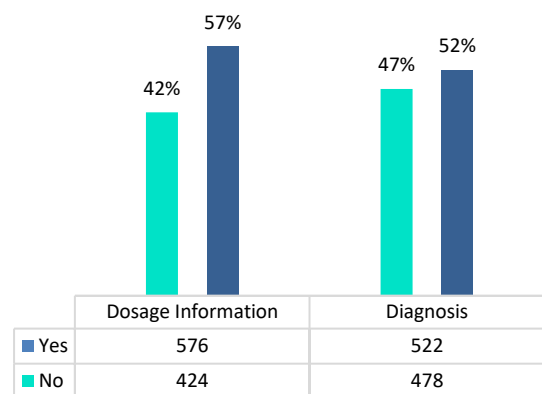


Fig. 2: categories of prescription errors (Type A)

3.1.2. Type D

This type of prescription error that was related to missing prescriber’s information (physician signature and stamp), prescription date and the basic information of the patient, including name and sex in the prescription. Out of the 1000 prescriptions analyzed, 8 prescriptions (0.8%) did not contain the patient name, 228 (22.8%) prescriptions lacked the patient sex, 272 (27.2%) prescriptions lacked the prescriber signature, 169 (16.9%) prescriptions

lacked the prescriber stamp and 343 (34.3%) prescriptions lacked a prescription date. Finally, 714 (71.4%) prescriptions were legible and 282 (28.2%) were not legible (Fig. 3).

4. Discussion

To our knowledge, this is the first study conducted at healthcare facilities in the Hail region, Saudi. In this study, we consider prescription error as any missing information or an error in the dose of medications prescribed to the patients. This was to ensure a comprehensive understanding of the nature of prescription at the study settings. However, our definition was different from a similar study in Saudi (Khoja et al., 2011).

Our findings have shown that the physicians at these healthcare facilities do not include the patient's weight in their prescription. This finding was similar to a study investigated the compliance to good prescription at Central hospital in Asir City, Saudi Arabia (Irshaid et al., 2005).

The study showed that none of the patients' prescriptions at the facility contains patients' weight and address. In this study, more than half of the prescription errors detected were related to missing information such as the patient's age and file number. Our finding is similar to a study conducted at a general practice in Jeddah, Saudi (Kamel et al., 2018). The study reported a missing patients' age in 65% of the patients' prescriptions. In comparison with international studies, a study from Pakistan revealed that patients' weight and age were not mentioned in approximately 65% and 80% respectively (Atif et al., 2018), while in another study in India, patients' weight was appeared to be missing in all prescriptions (Phalke et al., 2011). The elderly and children are very sensitive to medication doses. Therefore, the patient's age and weight should be written on all prescriptions with more focus on these populations so as to enable the pharmacist to ensure the dose is appropriate for the intended patient (Tariq and Scherbak, 2019).

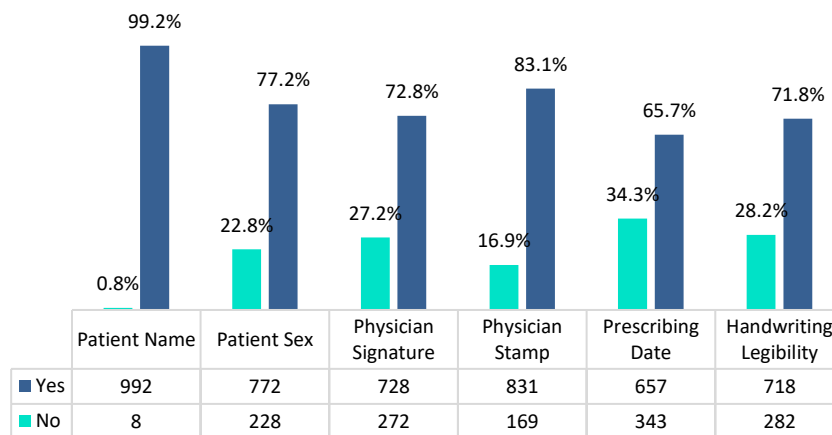


Fig. 3: categories of prescription errors (Type D)

In this study, about 40% of the prescription errors were due to missing information related to dose information and diagnosis. This finding was lower than a study conducted another region of Saudi Arabia (Irshaid et al., 2005). The study showed that 94% of the prescriptions contained missing information regarding the medication dose and 34% with incomplete or no diagnosis stated. Another study conducted at community pharmacies in Jeddah, Saudi Arabia, has shown that 49% of prescriptions received at the pharmacy did not contain information related to the diagnosis and 38% without the recommended dose (Kamel et al., 2018). This type of error can be potentially life-threatening to the patient, as the pharmacist may not be in full knowledge of the patient's conditions, and the extent of the condition. Thus, an overdose or sub therapeutic dosing may occur if the pharmacist used his judgment on the dosing without contacting the prescriber.

We found in our study a less frequency of prescription errors related to missing information regarding the patients' name and sex, physician

signature and stamp, prescription date, and handwriting legibility. This was similar to other studies conducted in other regions of Saudi Arabia (Alshaiikh et al., 2013; Irshaid et al., 2005; Kamel et al., 2018). A study conducted among a university hospital in Riyadh have reported a frequency of 17.0% of prescription error due to unclear prescriber's handwriting (Ghaffar et al., 2015). In a similar study conducted at a hospital pharmacy in Asir, Saudi Arabia, the name of patients was missing in 5.4%, prescribers name in 16.7%, and signature in 18.1% of the issued prescriptions (Irshaid et al., 2005). Compared with other international studies, a study in Yemen reported that 99.12% of prescriptions filled at community pharmacies were of poor handwriting (Al-Worafi et al., 2018). However, another study conducted in Riyadh using electronic prescription reported a zero (0.0%) of missing information patients' prescriptions (Albarrak et al., 2014).

Generally, results of systematic reviews of studies on medication errors conducted in the Middle East (Alsulami et al., 2013), and South-East Asia countries

(Salmasi et al., 2015) were the practice of handwritten prescription was predominant, the prevalence of prescription error was found to be high. The prescription error of up to 90% was identified from these regions, this is in agreement with our findings. This suggests a call for interventions to improve drug-related safety by preventing prescription errors.

Several preventive measures to reduce prescription errors have been recommended in the past. These included improving communication between pharmacists and physicians, implementation of e-prescriptions, and writing prescriptions in plain English language and names of drugs in generic names (Al-Worafi et al., 2018; Wang et al., 2007). Hospital pharmacists have been shown to play an integral part in reducing prescription errors by reviewing prescriptions prior to dispensing, (Wang et al., 2007) and these have been shown to reduce adverse drug events associated with prescription errors (Lourenco et al., 2016). Electronic prescriptions have been adopted in some hospitals in Saudi Arabia and have shown to improve patient safety by reducing serious medication errors (Albarrak et al., 2014; MOH, 2019; Qureshi et al., 2014). Albarrak et al. (2014) conducted a study to compare the legibility and completeness of handwritten and e-prescription at a tertiary hospital in Riyadh, Saudi Arabia. E-prescription was found to have a 0.0% rate of incompleteness as compared to handwritten prescriptions (Albarrak et al., 2014). Only 2.5% errors were detected in e-prescription compared to 37% errors in handwritten prescriptions (Albarrak et al., 2014). Considering the proportion of prescription with illegible handwriting (28.2%) identified in this study, a policy to ensure physicians adhered to good prescription practice through writing prescriptions clearly and in plain English will prevent prescription errors. Additionally, prescriptions with missing or incomplete information should be rejected by the pharmacist and returned to the prescriber for correction. The policy should be "incomplete prescriptions equal to no prescription". Furthermore, the two settings in this study do not have direct telephone lines for communication between healthcare practitioners, compared to some hospitals in Saudi Arabia. These may have been the reason for the high prescription errors reported. Therefore, the provision of this system will enable incomplete prescriptions to be verified for instant corrections by the prescribers. The direct line would also allow the pharmacist to be actively involved in the process of prescribing, which has been proven to be effective in reducing the incidents of preventable errors (Lourenco et al., 2016). Finally, interventions such as physician education on the good prescription practices, incorporation of topics related to ration of prescription practice into the curriculum of continuing educational program of physicians and tutorial classes of final year medical students who are about to join the clinical practice, would go a long way in preventing errors due to prescriptions.

5. Strength and limitations

This study was the first to report prescription errors from the Hail region, Saudi Arabia, and we believed that our findings will guide the implementation of interventions to prevent further occurrences. We included a sample size of 1000 prescriptions (more than the calculated sample size) from the two tertiary health facilities to ensure comprehensiveness of the collected information. However, this study has the following limitations; First, it was conducted in two facilities in one city, hence, may limit the generalization of the study findings to the other facilities in Saudi Arabia. Secondly, prescriptions issued to patients during night shifts were excluded. This may have underestimated the frequency of prescription errors reported in this study. Therefore, future studies should include more hospitals from multiple cities in the Kingdom of Saudi Arabia.

6. Conclusion

The prevalence of prescription errors at tertiary healthcare facilities in the Hail region, Saudi Arabia was high. The frequency of potentially life-threatening prescription errors was found to be high. Interventions such as effective communication among healthcare providers, implementation of electronic prescriptions systems, physician education on prescription and pharmacist's involvement in the prescription process should be implemented to improve patient safety.

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Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

References

- Albarrak AI, Al Rashidi EA, Fatani RK, Al Ageel SI, and Mohammed R (2014). Assessment of legibility and completeness of handwritten and electronic prescriptions. *Saudi Pharmaceutical Journal*, 22(6): 522-527. <https://doi.org/10.1016/j.jsps.2014.02.013> PMID:25561864 PMCID:PMC4281619
- Alshaikh M, Mayet A, and Aljadhey H (2013). Medication error reporting in a university teaching hospital in Saudi Arabia. *Journal of Patient Safety*, 9(3): 145-149. <https://doi.org/10.1097/PTS.0b013e3182845044> PMID:23370218
- Alsulami Z, Conroy S, and Choonara I (2013). Medication errors in the Middle East countries: A systematic review of the literature. *European Journal of Clinical Pharmacology*, 69(4): 995-1008.

- <https://doi.org/10.1007/s00228-012-1435-y>
PMid:23090705 PMCID:PMC3621991
- Al-Worafi YM, Patel RP, Zaidi STR, Alseragi WM, Almutairi MS, Alkhoshaiban AS, and Ming LC (2018). Completeness and legibility of handwritten prescriptions in Sana'a, Yemen. *Medical Principles and Practice*, 27: 290-292.
<https://doi.org/10.1159/000487307>
PMid:29402821 PMCID:PMC6062689
- Atif M, Azeem M, Sarwar MR, Malik I, Ahmad W, Hassan F, and Rana M (2018). Evaluation of prescription errors and prescribing indicators in the private practices in Bahawalpur, Pakistan. *Journal of the Chinese Medical Association*, 81(5): 444-449.
<https://doi.org/10.1016/j.jcma.2017.12.002>
PMid:29548936
- Chiatti C, Bustacchini S, Furneri G, Mantovani L, Cristiani M, Misuraca C, and Lattanzio F (2012). The economic burden of inappropriate drug prescribing, lack of adherence and compliance, adverse drug events in older people. *Drug Safety*, 35(1): 73-87.
<https://doi.org/10.1007/BF03319105> **PMid:23446788**
- Ghaffar UB, Ahmed SM, and Faraz A (2015). A review of the frequency of medical error in Saudi Arabia: An emerging concern. *Journal of Evidence Based Medicine and Healthcare*, 2(52): 8692-8695.
<https://doi.org/10.18410/jebmh/2015/1205>
- Irshaid YM, Al Homrany M, Hamdi AA, Adjepon Yamoah KK, and Mahfouz AA (2005). Compliance with good practice in prescription writing at outpatient clinics in Saudi Arabia. *Eastern Mediterranean Health Journal*, 11(5-6): 922-928.
- Kamel FO, Alwafi HA, Alshaghab MA, Almutawa ZM, Alshawwa LA, Hagraas MM, and Tekian AS (2018). Prevalence of prescription errors in general practice in Jeddah, Saudi Arabia. *Medical Teacher*, 40(sup1): S22-S29.
<https://doi.org/10.1080/0142159X.2018.1464648>
PMid:29703122
- Khoja T, Neyaz Y, Quresh NA, Mogzoub MA, Haycox A, and Walley T (2011). Medication errors in primary care in Riyadh city, Saudi Arabia. *EMHJ-Eastern Mediterranean Health Journal*, 17(2): 156-159.
<https://doi.org/10.26719/2011.17.2.156> **PMid:21735951**
- Lourenco LM, Bursua A, and Groo VL (2016). Automatic errors: A case series on the errors inherent in electronic prescribing. *Journal of General Internal Medicine*, 31(7): 808-811.
<https://doi.org/10.1007/s11606-016-3606-5>
PMid:26883522 PMCID:PMC490794
- MOH (2019). E-prescription service. Ministry of Health, Riyadh, Saudi Arabia. Available online at:
<https://bit.ly/2ITRY91>
- Neville RG, Robertson F, Livingstone S, and Crombie IK (1989). A classification of prescription errors. *The Journal of the Royal College of General Practitioners*, 39(320): 110-112.
- Phalke VD, Phalke DB, Syed MA, Mishra A, Sikchi S, and Kalakoti P (2011). Prescription writing practices in a rural tertiary care hospital in Western Maharashtra, India. *The Australasian Medical Journal*, 4(1): 4-8.
<https://doi.org/10.4066/AMJ.2011.515>
PMid:23393497 PMCID:PMC3562966
- Qureshi NA, Al-Bedah AM, and Koenig HG (2014). Handwritten to electronic prescriptions: Emerging views and practices, Saudi Arabia. *Journal of Advances in Medicine and Medical Research*, 4(28): 4607-4626.
<https://doi.org/10.9734/BJMRR/2014/10962>
- Randolph JJ (2008). Online kappa calculator (Computer software). Available online at:
<https://bit.ly/32pUD20>
- Salmasi S, Khan TM, Hong YH, Ming LC, and Wong TW (2015). Medication errors in the Southeast Asian countries: A systematic review. *PLoS One*, 10(9): e0136545.
<https://doi.org/10.1371/journal.pone.0136545>
PMid:26340679 PMCID:PMC4560405
- Seden K, Kirkham JJ, Kennedy T, Lloyd M, James S, Mcmanus A, and Coleman C (2013). Cross-sectional study of prescribing errors in patients admitted to nine hospitals across North West England. *BMJ Open: Leading General Medical Journal*, 3(1): e002036.
<https://doi.org/10.1136/bmjopen-2012-002036>
PMid:23306005 PMCID:PMC3553389
- Stat Trek (2019). Random number generator. Available online at:
<https://bit.ly/20TKua1>
- Tariq RA and Scherbak Y (2019). Medication errors. Available online at:
<https://bit.ly/2P5sbeY>
- Velo GP and Minuz P (2009). Medication errors: Prescribing faults and prescription errors. *British Journal of Clinical Pharmacology*, 67(6): 624-628.
<https://doi.org/10.1111/j.1365-2125.2009.03425.x>
PMid:19594530 PMCID:PMC2723200
- Wang JK, Herzog NS, Kaushal R, Park C, Mochizuki C, and Weingarten SR (2007). Prevention of pediatric medication errors by hospital pharmacists and the potential benefit of computerized physician order entry. *Pediatrics*, 119(1): e77-e85.
<https://doi.org/10.1542/peds.2006-0034> **PMid:17200262**