Research Article
AMERICAN JOURNAL OF PHARMACY AND HEALTH RESEARCH
www.ajphr.com
2015, Volume 3, Issue 9
ISSN: 2321–3647(online)

Clinical Pharmacists' Development and Quality Assurance of Medication Orders in a Computerized Order Entry System

Justin W. Tenney[1]*, Kelly Horton[1]
1. Clinical Pharmacist, Sidra Medical and Research Center.

ABSTRACT

This study is to evaluate the development process of medication orders in a computer system for a soon to be opened women and children's hospital. To determine which therapeutic categories include medications that may have less defined dosing regimens. Medication orders were built into the Computerized Order Entry (COE) system and evaluated individually by pharmacists from various clinical practice backgrounds. These pre-constructed, quick entry medication orders will present common medication attributes in a drop down menu when a physician searches for a desired medication. The medication orders involved 14 components that were evaluated by the clinical pharmacists. For a medication order to be considered complete, it had to be reviewed by two consecutive pharmacists who did not see any further necessary changes to the previous pharmacist's medication order. The number of pharmacists required to have 3 pharmacists in consecutive agreement on the medication order ranged from 3 to 9 pharmacists. The therapeutic group that required the most pharmacist evaluations to reach consensus was antimicrobials and the therapeutic category that required the least amount of pharmacist reviews was antidiabetic medications. After 6 pharmacists had reviewed the medication orders, 25.7% of the antimicrobials were without three consecutive pharmacist approvals. The most common change made after 5 reviews were completed was adjustments to age and weight filters. As there was variability in the number of pharmacist reviews required to reach completion, greater attention to detail should be considered in therapeutic areas that required more evaluations to reach a consensus.

Keywords: Pharmacist, Computerized Physician Order Entry, Therapeutic Classes.

*Corresponding Author Email: tenneyjw@gmail.com
Received 26 August 2015, Accepted 03 September 2015

Please cite this article as: Tenney JW *et al.*, Clinical Pharmacists' Development and Quality Assurance of Medication Orders in a Computerized Order Entry System. American Journal of Pharmacy & Health Research 2015.

INTRODUCTION

The effects of a computerized physician order Entry (CPOE) system on prescribing practices has been documented to include individual details of how a medication order such as frequency of medications that can influence prescribing patterns[1]. This shows that minor details of medication order in an electronic computer system such as the frequency, infusion time, or the age and weight limits incorporated with the order can have significant effects on the orders usage. As prescribers are often limited on time, they need to rely on and have assurance that these preconstructed, quick medication orders are safe and accurate. The cost of implementing a CPOE system has a wide, variable range of expected costs for the implementation and maintenance phases[2,3]. ASHP has developed and published guidelines on the involvement and description of pharmacists role on implementation of CPOE[4]. The ASHP guidelines discuss the utility and importance of having a multi-disciplinary team involving pharmacists in the building stages of a CPOE system. Preconstructed, quick entry orders are one of the most commonly used features within a CPOE system[5]. These must be evidence-based and precise as many prescribers will be using these, and as one mistake can effect numerous patients due to their high usage. Quality assurance of these orders is of paramount importance in regards to patient safety. The objective of this study is to identify which therapeutic categories have drugs that have less clear dosing regimens and are subject to more debate within a team of pharmacists while building a CPOE system for a women and children's hospital. The aim of the study also included an analysis to identify which components of a medication order led to disagreement between the pharmacists. These components likely have the least uniformity or nonexistent guidelines on appropriate usage. By identifying these medication order characteristics, we can isolate areas with more clinical uncertainty and focus more time and resources on these areas to ensure best patient outcomes.

MATERIALS AND METHOD

An international team of 12 pharmacists from the USA, Canada, and the United Kingdom were tasked with building the order sentences, then developing and performing quality analysis for the order sentences. The pharmacists had variable years of experience and different education backgrounds including Pharm.D. B.S., M.Pharm, and residency training. The order sentences will then be automatically populated into a computerized physician order entry (CPOE) system for all oral, subcutaneous, or intramuscular and IV injection, topical, otic, and ophthalmic administration routes. These order sentences did not include chemotherapy or orders for continuous infusions. The order sentences were to include dosing schemes that will be commonly used by prescribers in a soon to be opened women and children's hospital. The primary reference used by all the pharmacists to construct the order sentences was LexiComp® (Hudson, OH), Micromedex™ (Greenwood Village, CO), and Pediatric Injectable Drugs 10th Edition. For an order sentence to be considered complete, it had to undergo two independent pharmacist evaluations without any modifications made to the order sentence. If changes were made and documented during the independent review, a third pharmacist would review the order sentence and then a fourth pharmacist would perform the review and so on until the completion criterion of two independent pharmacist review with no changes was complete. The original pharmacist who built the order sentence was not counted towards the two pharmacist reviews without any changes, therefore it took a minimum of 3 pharmacists to build and approve a medication sentence. The pharmacists reviewed the order sentences on their own without any external input from other medical personnel. The changes made to the order sentence were not seen by the original pharmacist. The drug sentences to be evaluated were initially assigned alphabetically, but were later assigned to each pharmacist based on therapeutic class to ensure pharmacists with the most experience in that field were evaluating medications pertinent to their field of expertise. When defining terms for ages we used the following World Health Organization (WHO) definitions that state: neonate is less than 30 days old, infant is 30-364 days old, child is 1 year to less than 13 years old, adolescent is 13 to less than 18 years old, and an adult is greater than 18 years or older. The pharmacists made the edits for the order sentences in the Bedrock® computer system, which is then translated into the Cerner® electronic computer system. The general goal of the pharmacists was to have no more than the 4-5 most common dosing regimens appeared in a drop down menu for each medication route. For a therapeutic category to be included in the study, it had to have at least 25 medications in the group. The included and excluded drug classes can be seen in Figures 1 and 2, respectively. IRB approval was not needed for this study.

RESULTS AND DISCUSSION

Of the 1291 medications, 1078 were included in the study. (See Figure 1) 76 medications were excluded because they were classified as chemotherapy and chemotherapy agents were not built into the CPOE.(See Figure 2) The other 137 were excluded because they did not belong to a large enough therapeutic category. The largest therapeutic category was cardiovascular drugs with 116. The smallest therapeutic category included was anesthesia/paralytics. The average category size was 63 medications.

Therapeutic Classes Included	Number of Drugs	Therapeutic Classes Included	Number of Drugs
Cardiovascular	116	Hormonals	42
Antimicrobials	113	Antidotes	41
Psychiatry/Neurology	113	Diabetes	40
Topicals	90	Hematology	33
Gastrointestinal	79	Cough and Cold	32
Opthalmic, Otic, Nasal Agents	78	Respiratory	31
Biologicals, Vaccines	75	Human Immunodeficiency Virus	31
Analgesics	73	Anesthesia, Paralytics	25
Vitamins, Minerals, & Electrolytes	66		

Figure 1: Therapeutic classes included in the study

Therapeutic Classes Excluded	Number of Drugs	Therapeutic Classes Excluded	Number of Drugs
Anti-gout	4	Osteoporosis	5
Contrast	9	Urological/anticholinergic	11
IVF/TPN	24	Oncology (For other reasons)	76

Figure 2: Therapeutic classes excluded from the study

Medication Order Items Evaluated	
Strength or volume of dose	Route of administration
Strength or volume of dose unit	Frequency
Infusion duration	PRN option chosen
Age filters	Appropriate PRN reasoning
Weight filters	Need for additional order sentences
Drug form	Indication (if unique)
Infusion duration unit	Special instructions

Figure 3: The fourteen components evaluated by the pharmacists

Figure 4 shows the percentage of orders that were completed by each drug class after a 5th, 6th, or 7th pharmacist had evaluated the order. After five pharmacist reviews, hematology (93.9%) and diabetes (87.5%) were the most complete as a three consecutive pharmacist consensus was obtained more quickly, whereas Antimicrobials (66.4%) and Antidotes (68.3%) were the least complete. antimicrobials (74.3%) and psychology/neurology (78.8%) were the only two categories that were less than 80% complete after six pharmacist reviews. After seven pharmacist reviews, eight out of the seventeen therapeutic categories were not 100% complete. The medication orders involved 14 components that were evaluated by the clinical pharmacists. (See Figure 3) We identified that the majority of issues still requiring evaluation by the 6th pharmacist review or later were pertaining to age and weight filters. (See Figure 5) After 6 pharmacist reviews, age and weight filters were accountable for over half of the remaining disagreements between the pharmacists. Each individual therapeutic category that was not 100% completed by the 6th review had age and weight filters contributing in part to the disagreement between pharmacists. Knowledge of which therapeutic categories have more controversial dosing schemes could permit pharmacists, physicians, or other healthcare providers to apply more focus when evaluating the proper usage of drugs from the more multifarious drug classes versus the others. Hospitals may desire to have more policies and protocols aimed to standardize the usage of therapeutic categories that required more reviews based on the results of this study. Also second checking the dosing or discussing the dosing with other healthcare providers may be of additional benefit for these less straightforward drug classes to ensure what was ordered is what was intended. Results from this study can also provide information on where adequate or more qualified pharmacist staffing is needed to ensure appropriate dosing, frequency, and other medication order attributes. The results of this study raise awareness of where more consideration could be applied when determining proper medication order parameters. Several factors may contribute to the variance seen among the therapeutic classes. One such factor may be medications with limited dosing routes allows for less variable options. Another contributing reason for this variance may include less defined recommendations from evidence based guidelines or regulatory authorities. Categories with many drugs used for off-label indications could also lead to more vagueness. Identifying the appropriate age for use in pediatric patients may be difficult as many drugs that are used in pediatrics do not actually have approval for use in pediatrics.[6-10] Also, the younger the patient is then the higher the chances are that proper medication use information is deficient.[11] Therapeutic categories with more intravenous medications, (i.e. anesthesia, paralytics, or biologicals) may need more modifications due to infusion time variability which would not be an issue for categories with many more drugs that have oral or other route options. Acuity, level of danger associated, and urgency can all be contributing factors for drugs given in emergency situations that might require more standardized recommendations. Classes with more recently developed and marketed drugs generally have less data so they will have less distinct guidelines on appropriate use. The finding that age and weight filters were one of the most difficult areas for pharmacists to agree upon was an unexpected discovery. Although we expected some issues in this area as this medication order build is for a pediatric hospital, this extent of disagreements in age and weight filters for the pediatric orders was greater than anticipated. The idea was that these are relatively set by regulatory agencies and pediatric guidelines, but there seems to be many medications without clear guidance on the lower limit of patient's age to utilize the medication, and what is the best dosing scheme for these patients. Limitations of this study include the categorization of medications classes leaves some room for interpretation. Another limitation is that we were unable to document the quantity of changes made by the pharmacists. Whether an order sentences needed one change or several changes it was documented as a change. So although medications may need several changes it isn't differentiated which required many changes versus fewer changes in a single evaluation. Lastly, the study only included evaluations by pharmacists and not other healthcare professionals.

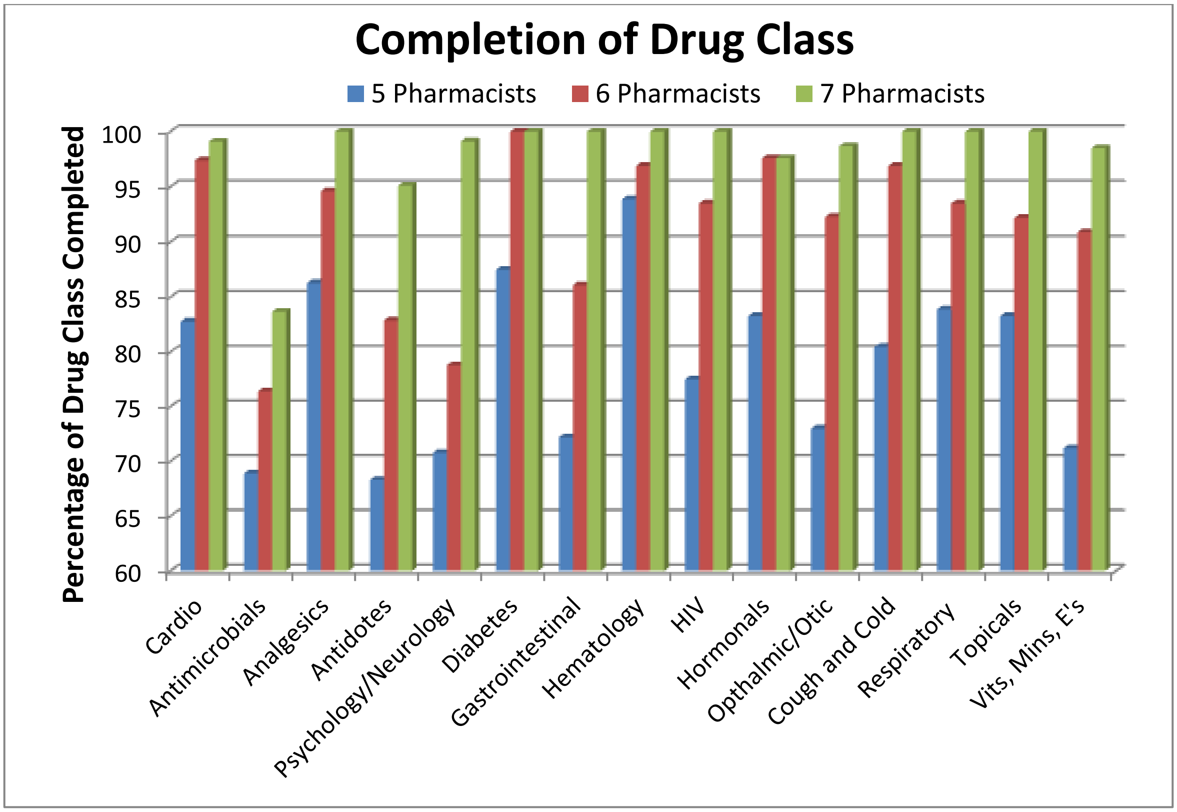

Figure 4: The percentage of each drug class completed after five(blue), six(red), and seven(green) pharmacists have completed their reviews of the medication orders within that drug class

Drug Class	Age or Weight Filters	% of Incomplete after 6th Pharmacist Review
Antimicrobials	14	48.3%
Analgesics	2	50%
Antidotes	2	28.6%
Cough and Cold	1	100%
Biologicals, Vaccines	14	100%
Cardiovascular	3	100%
Diabetes	0	N/A
Gastrointestinal	6	54.5%
Hematology	1	100%
HIV	1	50%
Hormonals	1	100%
Opthalmic, Otic, Nasal	5	83.3%
Psychiatry, Neurology	15	62.5%
Respiratory	3	100%
Topicals	4	57.1%
Vitamins, Minerals, Electrolytes	2	33.3%

Figure 5: Age or weight filter as a cause of pharmacist disagreement.

CONCLUSION

Antimicrobials, antidotes, psychology/neurology, vitamins, minerals, and electrolytes appear to have less uniform dosing schemes, so reaching a consensus on common dosing practices in these therapeutic categories may be more of a challenge in comparison to agents from other therapeutic categories.

REFERENCES

1. Bates DW, Teich JM, Merchia PR, et al. Effects of computerized physician order entry on prescribing practices. Arch Intern Med. 2000; 160:2741–7.
2. Birkmeyer JD, Birkmeyer CM, Skinner JS. Economic Implications of the Leapfrog Safety Standards. Washington, DC: The Leapfrog Group, 2001.
3. Computerized Physician Order Entry: Costs, Benefits, and Challenges—A Case Study Approach. Long Beach, CA: First Consulting Group; January 2003.
4. American Society of Health-System Pharmacists. ASHP guidelines on pharmacy planning for implementation of computerized provider- order entry systems in hospitals and health systems. Am J Health-Syst Pharm. 2011; 68:e9–31.

5. Payne TH, Hoey PJ, Nichol P et al. Preparation and use of preconstructed orders, order sets, and order menus in a computerized provider order entry system. J Am Med Inform Assoc. 2003; 10:322–9.
6. Roberts R, Rodriguez W, Murphy D, Crescenzi T. Pediatric Drug Labeling: Improving the Safety and Efficacy of Pediatric Therapies. JAMA. 2003; 290 (7): 905-911. doi:10.1001/jama.290.7.905.
7. Gravilov V, Lifskitz M, Levy J, Gorodischer R. Unlicensed and "off label" medication use in a general pediatrics ambulatory hospital unit in Israel. Isr Med Assoc J.2000; 2:595-597.
8. McIntyre J, Conroy S, Avery A, Corns H, Choonara I. Unlicensed and "off label" prescribing of drugs in general practice. Arch Dis Child.2000;83:498-501.
9. ‘t Jong WT, Vulto A, DeHoog M, Schimmel KJ, Tibboel D, Van den Anker JN. Unapproved and off label use of drugs in a children's hospital. N Engl J Med.2000;343:1125.
10. Conroy S, Choonara I, Impicciatore P. et al. Survey of unlicensed and "off label" drug use in pediatric wards in European countries. BMJ.2000;320:79-82.
11. US Food and Drug Administration. Pediatric Exclusivity Provision: Status Report to Congress. Rockville, Md: Food and Drug Administration; 2001.