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RESEARCH NOTES

Evaluation of the frequency of dispensing electronically discontinued medications and associated outcomes

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ABSTRACT

Objectives: To determine if outpatient pharmacies of an academic medical center inadvertently dispense discontinued medications and, if so, if these inadvertently dispensed prescriptions contribute to subsequent hospital admissions and patient harm.

Methods: This was a single-center retrospective chart review. Prescription billing data were analyzed for electronic prescriptions for hypotensives, hypoglycemics, anticoagulants, antiplatelets, and statins picked up from 3 outpatient pharmacies within the health system over a period of 1 year. Prescriptions must have been written by a Michigan Medicine health system provider and were excluded if they were written, faxed, or phoned in. Timestamp of pick-up from the pharmacy was compared with timestamp of prescription discontinuation within the electronic health record (EHR). If the prescription was discontinued before pick-up, timestamps were also assessed to determine if the prescription order was discontinued in the EHR before final pharmacist verification. If a prescription was found to be picked up after it was discontinued, the patient chart was reviewed to determine if he or she was admitted within 30 days of the pick-up date.

Results: Overall, 10,649 individual electronic prescriptions met inclusion criteria. Of these, 526 (4.94%) were picked up after the prescription order was discontinued in the EHR. The prescription was discontinued before final pharmacist verification for 287 (54.56%) of these prescriptions. Three of these inadvertently dispensed prescriptions could have contributed to hospital admission 30 days after pick-up for 3 individual patients.

Conclusion: Electronic prescriptions that have been discontinued within the EHR continue to be dispensed to patients in the outpatient pharmacy setting. These inadvertently dispensed prescriptions have the potential to cause patient harm.

Medication errors account for at least 7000 deaths each year in the United States.[1] Electronic prescribing has multiple benefits within the outpatient pharmacy setting. Tools such as allergy checks, drug-drug interaction screening, maximum dose warnings, and weight-based dosage calculations work to improve accuracy and safety in an attempt to reduce errors when prescribing medications.[2] Declining medication error rates have also been seen as a positive aspect of electronic prescribing.[3,4] Errors related to illegibility, use of inappropriate abbreviations, and missing information have been reduced.[3] Medication errors and adverse drug reactions have also decreased with electronic prescribing.[4]

Although a decrease in medication errors was associated with electronic prescribing,[3,4] not all studies have shown a reduction in medication errors.[5] One type of error which is infrequently addressed concerns inadvertent dispensing of discontinued medications. A series of case reports detailing patient harm due to receiving discontinued medications showed the impact of this error.[6] One patient received a diuretic prescription from his pharmacy with a previous dose lower than his current instructions. When he took the medication as the provider ordered, he ran out early per the directions on the prescription and was not able to obtain an adequate supply of diuretic due to a refill-too-soon rejection. This resulted in the patient being hospitalized with a heart failure exacerbation.[6] Another case outlined a patient who was to receive a prescription for hydroxychloroquine, but the provider mistakenly wrote it for hydroxyurea. Although the

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provider discovered the error within the electronic health record (EHR), the pharmacy was not notified of the discontinued order, and the patient received both medications, resulting in a hospitalization for leukopenia and neutropenia.[6] A retrospective study conducted by Harvard Vanguard Medical Associates (HVMA) determined the number of prescriptions dispensed after discontinuation in a community setting. The investigators found that of 83,902 medication discontinuations in the EHR during a 12-month period, 1218 (1.5%) were still dispensed by the pharmacy, and 50 cases resulted in documented potential patient harm.[7] These findings show that dispensing discontinued prescriptions may be an unintended consequence of electronic prescribing.

Therefore, the goal of the present study was to determine if inadvertent dispensing of discontinued medications occurred in the outpatient pharmacies within our health system. If this was occurring, we also sought to investigate the potential that these medications may contribute to hospital utilization 30 days after dispensing.

Objectives

The primary objective of this study was to determine if prescription orders that are discontinued in the EHR are inadvertently dispensed in the outpatient pharmacy system. These prescriptions were also analyzed to determine if the prescription order was discontinued before or after pharmacist verification and whether the prescription order originated from an outpatient or an inpatient setting. Secondary objectives were to classify potential for harm from inadvertently dispensed prescriptions and to assess if these medications may contribute to hospital utilization within 30 days of prescription pick-up.

Methods

The study was a single-center retrospective chart review conducted at Michigan Medicine, a large academic medical center. At the time of this study, the Michigan Medicine system included 4 outpatient pharmacies serving patients and employees. The health system used 1 EHR across all inpatient and outpatient locations. The 4 outpatient pharmacies all used the same pharmacy dispensing software and had access to the health system's EHR, although the dispensing software was not directly linked with the EHR. Therefore, the outpatient pharmacies would receive new electronic prescriptions, but information about discontinued or changed electronic prescriptions was not transmitted between the 2 systems. Any prescription order changes or cancellations had to be physically called in to the pharmacy. However, the outpatient pharmacists did have access to the EHR as well as to the pharmacy dispensing software. Therefore, outpatient pharmacists could access patients' full EHRs, including current prescription lists.

Prescription billing data were used to identify all prescriptions picked up from July 1, 2015, to June 30, 2016, from 3 of the 4 outpatient pharmacies. This time period was selected because it was the 12 months before the start of this research. One pharmacy was not included, because it was located in an eye center and mainly dispensed ophthalmic products. Patients were included if they were 18 years of age or older at the time of medication pick-up. Medications included in the study sample were oral or injectable hypotensives, hypoglycemics, anticoagulants, antiplatelets, and statins. These were the same classes of medications evaluated in the previous study by HVMA, although they included only oral medications.[7] These classes were included because they are commonly used and have the potential to cause adverse events when used inappropriately.[8] Medications were selected for each category based on American Hospital Formulary Service classifications. Prescriptions had to be new (first fill) electronic prescriptions, written by a Michigan Medicine provider, and initially sent to 1 of the 3 included outpatient pharmacies. Prescriptions were excluded if they were written, faxed, or phoned in.

Data were collected from both the EHR and the pharmacy dispensing software. Data collected from the EHR included date and time of prescription discontinuation and if the prescription originated from an inpatient stay or an outpatient clinic, to determine if inadvertently dispensed prescriptions had originally been ordered from one of these locations more frequently. Data collected from the pharmacy dispensing software included date and time of pharmacist verification and pick-up. The order discontinuation timestamp from the EHR was compared with the timestamp of patient pick-up to determine if the prescription order was discontinued before the medication was picked up. The discontinuation timestamp was also compared with the pharmacist verification timestamp to determine if the prescription order was discontinued before or after the pharmacist performed the final verification. This was collected to determine if pharmacist check had an impact on finding discontinued prescription orders. If the prescription order was discontinued before pick-up, data were collected from the EHR to determine if the patient was readmitted or admitted within 30 days after the pick-up date. We included both admissions and readmissions in this analysis, because the inadvertently dispensed prescription(s) could have originated from a clinic visit, not only from a discharge event. If the patient was hospitalized multiple times within the 30-day window, first hospitalization was analyzed, because any subsequent hospitalizations may have resulted in a change in medication therapy.

If the patient was readmitted or admitted, a chart review was conducted to determine if the dispensed medication could have contributed to the readmission or admission event. One author reviewed all charts of patients receiving inadvertently dispensed medications to determine if the medication could have contributed to the admission. The chief reason for the patient presenting to the hospital was assessed to determine if the inadvertently dispensed medication could have contributed to the reason for hospitalization. All inadvertently dispensed prescriptions were also classified based on the potential for patient harm. Potential risk for patient harm was classified into 3 categories: "potential to harm," "no potential to harm," and "unknown." Prescriptions that fell into "potential to harm" included those that had a change in dosage or directions that were not updated before pick-up or a medication that the patient was supposed to discontinue. Medications with "no potential to harm" included orders where the patient received the correct medication but the specific order was discontinued before pick-up and was replaced by a new identical medication order. For example,