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Research and Applications

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Examining medication ordering errors using AHRQ network of patient safety databases

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ABSTRACT

Background: Studies examining the effects of computerized order entry (CPOE) on medication ordering errors demonstrate that CPOE does not consistently prevent these errors as intended. We used the Agency for Healthcare Research and Quality (AHRQ) Network of Patient Safety Databases (NPSD) to investigate the frequency and degree of harm of reported events that occurred at the ordering stage, characterized by error type.

Materials and Methods: This was a retrospective observational study of safety events reported by healthcare systems in participating patient safety organizations from 6/2010 through 12/2020. All medication and other substance ordering errors reported to NPSD via common format v1.2 between 6/2010 through 12/2020 were analyzed. We aggregated and categorized the frequency of reported medication ordering errors by error type, degree of harm, and demographic characteristics.

Results: A total of 12 830 errors were reported during the study period. Incorrect dose accounted for 3812 errors (29.7%), followed by incorrect medication 2086 (16.3%), and incorrect duration 765 (6.0%). Of 5282 events that reached the patient and had a known level of severity, 12 resulted in death, 4 resulted in severe harm, 45 resulted in moderate harm, 341 resulted in mild harm, and 4880 resulted in no harm.

Conclusion: Incorrect dose and incorrect drug orders were the most commonly reported and harmful types of medication ordering errors. Future studies should aim to develop and test interventions focused on CPOE to prevent medication ordering errors, prioritizing wrong-dose and wrong-drug errors.

Key words: patient safety, ordering errors, computerized provider order entry (CPOE)

BACKGROUND

It has been estimated that preventable harm among hospitalized patients results in 44 000 to 98 000 premature deaths per year.[1] A report published in 2022 by the Office of the Inspector General (OIG) found that 1 in 4 hospitalized Medicare patients experienced an adverse event that caused harm. Nearly half of these adverse events were categorized as preventable and the most common type of patient harm events were medication errors (43%). Comparing these results to the first national report published by OIG in 2010, the incidence rate of patient harm events decreased by only 2%, from 27 to 25%.[2]

Consistent with the findings of the OIG report, a large systematic review and meta-analysis found that 1 in 30 patients are exposed to

preventable medication harm, with the highest rates of preventable medication harm resulting from errors at the ordering stage (58%).[3] Despite the promise of computerized provider order entry systems (CPOE) to prevent ordering errors, medication ordering errors continue to occur frequently, causing harm and death.[4] CPOE systems lack adequate protections to prevent many common and harmful medication ordering errors. In one study of CPOE-related medication errors, investigators intentionally reenacted common scenarios of order errors in testing environments, finding that of all the erroneous orders tested, 79.5% were able to be placed and 28.0% were placed "easily."[5]

In 2017, the World Health Organization launched a global medication safety challenge to decrease preventable medication harm by 50%.[6] In the United States, there are multiple national initiatives aimed at reducing medication ordering errors. As of 2021, the Centers for Medicare & Medicaid Services requires hospitals to attest annually that they perform a safety assessment of their CPOE and clinical decision support (CDS) systems using the Safety Assurance Factors for Electronic Health Record Resilience (SAFER) Guides published by the Office of the National Coordinator for Health Information Technology (ONC).[7] Additionally, the Leapfrog Group, which assesses and grades the safety of thousands of hospitals, includes a CPOE evaluation tool developed by leading patient safety experts as part of their annual survey.[8,9] This tool simulates erroneous ordering scenarios and identifies the ability of the CPOE and CDS systems to prevent potential medication ordering errors. Despite these efforts, there is still room for substantial improvements.

Preventing medication ordering errors requires identifying the types of errors that occur most frequently, as well as those that have the greatest potential for harm. Furthermore, exploring the etiology of medication errors, beneficial fail-safes, and the settings in which errors are most likely to occur are critical to understanding how to prevent these errors. Prior research described the types of common medication ordering errors and their underlying causes, but lack consistent and systematic methods of data collection, analysis, and reporting across studies.[5,6,10] The most recent evaluation of medication ordering errors using a national dataset analyzed over 10 000 CPOE-related medication errors reported to the United States Pharmacopeia MEDMARX reporting system between 2003 and 2010.[5] However, since the Centers for Medicare & Medicaid Services (CMS) published the final rule providing incentive payments for the "meaningful use" of EHR technology in 2010,[11] there has not been an evaluation of medication ordering errors using a large national database.

The Patient Safety Quality Improvement Act enacted in 2005 led to the development and adoption of Common Formats, standardized reporting that enables aggregation of national safety event data. The Agency for Healthcare Research and Quality (AHRQ) Network of Patient Safety Databases (NPSD) is a national repository of safety events reported to 95 patient safety organizations (PSOs) across the United States. According to a 2019 report by the OIG, 59% of 3334 acute-care hospitals participating in Medicare work with a PSO.[2,12] NPSD dashboards and chartbooks publicly report events by 8 error types (Medications or Other Substances, Blood Products, Falls, Pressure Ulcers, Surgery or Anesthesia, Devices, Perinatal, or Other). Medication or Other Substances errors are the most frequent type of error reported, and a high proportion occur at the ordering stage.[13] However, detailed data about medication ordering errors are not publicly available.

Therefore, the aim of this study was to examine medication ordering errors in the decade following the start of the meaningful use program, using national medication ordering errors reported to PSOs and aggregated in AHRQ's NPSD. We describe the types of ordering errors, the extent of harm, and the factors contributing to these errors using aggregate data pertaining to medication errors that occurred at the ordering stage. Specifically, we identified the types of medication ordering errors that were most frequent and caused the most harm, in order to identify opportunities to enhance decision support to improve medication safety.

MATERIALS AND METHODS

Design and inclusion

This was a retrospective observational study of safety events reported by all healthcare systems participating in a PSO from June 2010 through December 2020. PSOs are organizations made up of numerous healthcare institutions that voluntarily join in order to gain further insight into potential systemic weaknesses. Healthcare institutions that join PSOs submit safety event data for analysis, and PSOs in turn submit deidentified safety event data to the NPSD for national aggregation. Institutions that submit data to PSOs include academic medical centers, community and specialty hospitals, community health centers, group practices, and clinics.

Data source

The NPSD data used in this analysis were provided by AHRQ. PSOs use the Common Formats, which are standardized forms to collect data on patient safety events. Common Formats are completed by the providers reporting the error or by quality improvement staff in a centralized office, depending on the policies of the individual healthcare system submitting the report. PSOs provide data to the Patient Safety Organization Privacy Protection Center (PSOPPC), which ensures the data are nonidentifiable before transmittal to NPSD for aggregation and analysis. The nonidentifiable data are delivered to the NPSD by ActioNet under Contract No. HHSA290201700002C. For this analysis, investigators requested data through a standardized request form. Events categorized as related to Medication and Other Substances, specifically at the ordering stage, were requested. There were 4 Common Format forms included in this analysis: a specific form related to Medication or Other Substances errors and 3 other forms which are general forms used in reporting all error types. These included the Healthcare Event Reporting Form (HERF), Patient Information Form (PIF), and Summary of Initial Report (SIR).[14] We used the discrete categories present on the Common Format form v1.2; free-text boxes were not available to the authors due to privacy concerns. For the purposes of this study medications included all substance types; biological products, nutritional products, contrast media, medical gases, and breast milk. According to the policies of the Institutional Review Board (IRB), IRB review was not required as this was a secondary analysis of aggregate data collected and provided to investigators with permission by a federal agency.

Outcomes

Patient and reporter characteristics

We used the discrete categories present on the Common Format form v1.2 to identify the demographic characteristics of patients involved in the event, including age group, race, and the clinical

setting where the event occurred, and the type of provider who reported the event.

Types of events

Patient safety events were categorized as defined in the Common Format, as near-miss events or incidents. Near-miss events were defined as errors that were intercepted and did not reach the patient. Incidents were defined as events that reached the patient and were further classified by degree of harm. As outlined in the Medication or Other Substances form, providers were able to further characterize ordering events by selecting 1 of 15 incorrect actions: incorrect patient; incorrect medication/substance; incorrect dose(s); incorrect route of administration; incorrect timing; incorrect rate; incorrect duration of administration or course of therapy; incorrect dosage form (eg, sustained release instead of immediate release); incorrect strength or concentration; incorrect preparation (including inappropriate cutting of tablets, compounding, mixing, etc.); medication/substance known to be an allergen to the patient; medication/substance known to be contraindicated for the patient; incorrect patient/family action (eg, self-administration error); and "other" incorrect action. The "other" category had a free-text option, which was unavailable to the authors due to privacy concerns. As all events were reported as incorrect actions, near-miss events and incidents were considered "errors" for this analysis.

Definition of harm

We used the discrete categories present on the Common Format form v1.2 to identify the extent of harm caused by these events. Incidents were categorized into degrees of harm: death, severe harm, moderate harm, mild harm, no harm. For the purposes of the Common Format questionnaire, severe harm was defined as any bodily or psychological injury that interferes significantly with functional ability or quality of life. Moderate harm included bodily or psychological injury adversely affecting functional ability or quality of life, but not to the level of severe harm. Mild harm included those with bodily or psychological injury resulting in minimal symptoms or loss of function leading to additional treatment, monitoring and/or increased length of stay. No harm was defined as those errors that reached the patient, but no harm was evident.

Contributing factors

Lastly, we examined factors that contributed to the event. We also identified the level of preventability that the reporter attributed to the event. For near-miss errors, we identified what factors the reporter attributed to the error being caught prior to reaching the patient.

Data analysis

All data reported as a Medication or Other Substances event at the ordering stage via the Common Format v1.2, within the prespecified period, were provided to the investigators for analysis. AHRQ provided counts grouped by incorrect action categories for each data point requested. These included counts for incorrect action by detailed extent of harm, type of substance involved, patient age group, patient race, clinical setting, reporter, contributing factors, preventability, and action which prevented a near-miss event. Counts of less than 3 were suppressed to comply with deidentification requirements.

We calculated the percentage of total event reports which were related to medications and the percentage of medication reports which originated at the ordering stage. We then aggregated the data to report counts and percentages, using the number of medication events reported as the denominator: patient and reporter characteristics, type of error (near miss and incidents), extent of harm, contributing factors, and preventability. Events were then stratified by frequency of events *and* extent of harm. Events categorized as missing or unknown were excluded from analyses.

Role of funding source

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RESULTS

There were a total of 2 079 529 event reports in all categories between December 2009 through December 2020. Of these, 424 855 (20.4%) were related to medications; medication event reporting began in June 2010. A total of 125 484 (29.5%) were due to medication errors (the remaining were secondary to adverse drug events that were nonerrors). A total of 73 785 medication errors had a known stage of error origination; 18 976 (25.7%) errors originated at the ordering stage. However, 1 PSO had issues mapping to specific incorrect actions and these events were excluded. A total of 12 830 medication errors were included in the analysis.

Patient and reporter characteristics

Table 1 shows the characteristics of patients, clinical settings, and reporters involved in the reported events. Of 12 830 events, there were 8191 incidents which reached the patient; 3761 involved adults (18–64 years; 45.9%) and 3385 involved geriatric patients (≥65 years; 41.3%); 2266 (69.2%) involved patients identified as White and 695 (21.2%) identified as Black. Of 12 817 events where clinical setting of the error was available, 6403 (50.0%) of reported events occurred in inpatient settings, followed by 2213 (17.3%) in specialty areas, 937 (7.3%) in emergency departments, and 922 (7.2%) in outpatient settings. Of the 3671 events in which the type of provider who reported the errors was available, 2456 (66.9%) were reported by pharmacists, 1065 (29.0%) by nurses or advanced practice providers, and 69 (1.9%) by physicians.

Types of errors and extent of harm

The frequency of reported ordering errors by type of error, and by report type (near miss vs incident), is shown in Table 2. Of the total medication ordering errors, the most frequently reported categories identified were incorrect dose, incorrect medication, and incorrect duration. Incorrect dose accounted for 3812 errors (29.7%), incorrect medication for 2086 errors (16.3%), and incorrect duration for 765 errors (6.0%).

Of 8191 incidents, 5282 had a known level of severity: 12 reported events resulted in death, 4 resulted in severe harm, 45 resulted in moderate harm, 341 resulted in mild harm, and 4880 resulted in no harm. Of 14 known error types, incorrect medication or incorrect dose accounted for 67% of total events and 80% of events that caused severe harm or death. Incorrect medication alone accounted for 50% of known events that caused severe harm or death (Figure 1). There were 7 total deaths related to known error types. Of these errors 3 were due to incorrect medication, 2 were

due to incorrect dose, 1 was due to incorrect duration and 1 was due to failure to identify an allergen.

Incidents constituted 8191 (63.8%) or approximately two-thirds of total reported errors with the remaining 4639 (36.2%) being near-miss events. Across all event types, the proportion of near-miss events approximated the proportion of incidents. For example, incorrect dose accounted for 28.4% of all incidents and 32.1% of all near-miss events; incorrect route represented only 1.3% of all incidents and 1.9% of total near-miss events (Table 2).

Among 3812 incorrect dosing events, 1701 (44.6%) were characterized as overdose, 822 (21.6%) as underdose, 502 (13.2%) as missed dose, and 283 (7.4%) as extra dose (Figure 2A). Incorrect strength/concentration was reported as too high in 208 of 354 (58.7%) of events and too low in 99 of 354 (28.0%) events (Figure 2B).

Table 1. All ordering errors by patient and reporter characteristics

Clinical characteristic	*N* (% of total errors)
Age group (years)[a], $n = 8191$	
Pediatrics (≤17)	898 (11.0)
Adult (18–64)	3761 (45.9)
Geriatrics (≥65)	3385 (41.3)
Race[a], $n = 8191$	
White	2266 (69.2)
Black	695 (21.2)
Missing	298 (9.1)
More than one race	9 (0.3)
Native American	7 (0.2)
Clinical setting, $n = 12\,830$	
Inpatient care area	6403 (50.0)
Intensive care unit (ICU, CCU, and NICU)	2213 (17.3)
Emergency department	937 (7.3)
Outpatient	922 (7.2)
Other location in facility	688 (5.4)
Pharmacy	575 (4.5)
Operating room	445 (3.5)
Unknown	375 (2.9)
Other location	143 (1.1)
L&D	44 (0.34)
Radiology	43 (0.34)
Missing	[b]
Lab	[b]
Reporter, $n = 3671$	
Pharmacist	2456 (66.9)
Nurse or advanced practice provider	1065 (29.0)
Physician	69 (1.9)
Allied health professional	47 (1.3)

[a]Includes incident events only.
[b]Data suppressed due to privacy concerns.

Contributing factors

The most common contributing factors leading to incidents were issues related to human factors, reported in 2168 (18.3%) events, and issues related to communication, reported in 1501 (12.7%) events. Within human factors, inattention was selected in 1723 (79.5%) of events. Within communication, miscommunication among staff or team members was selected in the majority of events (Figure 3).

The extent to which an error was potentially preventable was reported for 4799 ordering errors. Of these errors, 3781 (78.8%) were reported as preventable, with 2334 (48.6%) categorized as "almost certainly" preventable and 1447 (30.1%) categorized as "likely" preventable. The mechanism of recovery was reported for 1226 near-miss errors. Of these, 518 (42.3%) errors were caught by a spontaneous action of another practitioner or staff member. An established fail-safe built into the ordering process was reported as the mechanism of recovery for 459 errors (37.4%) (Figure 4).

DISCUSSION

Previous studies have identified medication CPOE errors as a major cause of adverse events.[3,15] This is the first study to analyze voluntary reported medication ordering errors utilizing a large national database since CMS implemented the meaningful use program, as well as the first study to use national medication ordering errors reported to PSOs and aggregated in AHRQ's NPSD. Our results show that the most frequent types of errors were related to incorrect dose and incorrect medication, accounting for 67% of known ordering errors and 80% of known events which caused severe harm or death. The vast majority of errors, nearly 80%, were characterized as definitely or likely preventable. However, only 37% of near-miss

Table 2. Type of error categorized by incidents and near-miss events

Type of error	Incidents *n* (% of incidents)	Near-misses *n* (% of near-misses)	Total *n* (% of total)
Incorrect dose	2323 (28.4)	1489 (32.1)	3812 (29.7)
Incorrect medication	1509 (18.4)	577 (12.4)	2086 (16.3)
Incorrect duration	550 (6.7)	215 (4.6)	765 (6.0)
Incorrect timing	543 (6.6)	180 (3.9)	723 (5.6)
Incorrect strength/concentration	152 (1.9)	202 (4.4)	354 (2.8)
Incorrect patient	115 (1.4)	184 (4.0)	299 (2.3)
Incorrect form	144 (1.8)	107 (2.3)	251 (2.0)
Incorrect rate	124 (1.5)	69 (1.5)	193 (1.5)
Incorrect route	106 (1.3)	87 (1.9)	193 (1.5)
Incorrect preparation	64 (0.8)	56 (1.2)	120 (0.9)
Medication contraindicated	45 (0.5)	45 (1.0)	90 (0.7)
Medication known allergen	41 (0.5)	32 (0.7)	73 (0.6)
Incorrect patient/family action	57 (0.7)	3 (0.1)	60 (0.5)
Expired medication	3 (0.0)	0 (0.0)	3(0.0)
Other incorrect action	2405 (29.4)	1390 (30.0)	3795 (29.6)
Total	8191	4639	12 830

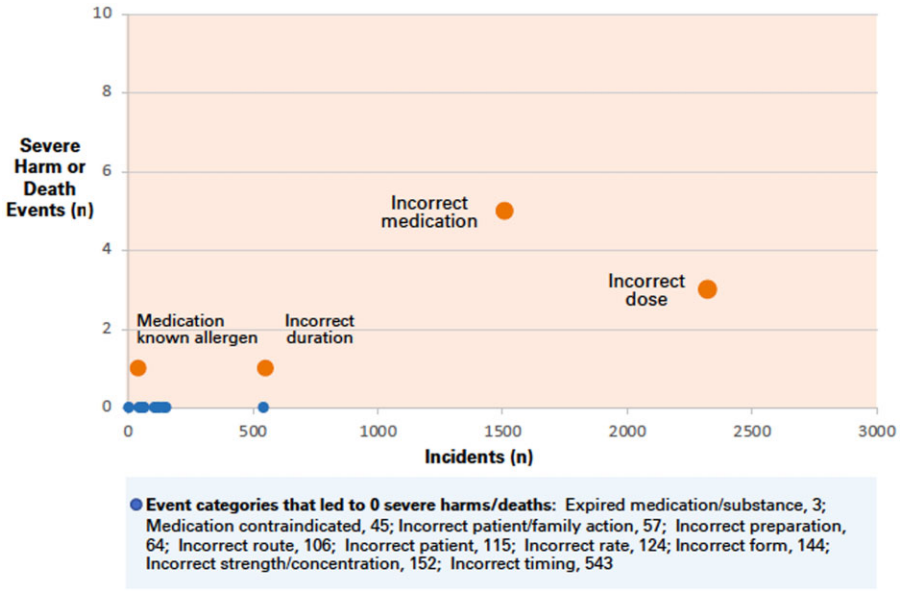

Figure 1. Type of incorrect action by total number of incidents and events that caused severe harm or death.

errors were prevented by protective mechanisms built into CPOE systems.

Our results build upon prior studies, which focused on ordering errors during the time period when CPOE was first utilized and decision support was in its infancy. Whereas Schiff et al[5] looked at all CPOE errors reported to the MEDMARX voluntary reporting system from 2003 to 2010, our analysis looked at all voluntary reported ordering errors 10 years later, from 2010 to 2020, a time period when CPOE systems were more widely used and had the capacity for more advanced decision support. Although direct comparisons cannot be made between studies due to differing reporting systems, uses, definitions, and methodology, incorrect dosing, timing, and duration remained among the most common types of ordering errors.[5] Specifically, incorrect dosing errors remained the leading cause of ordering errors. Although the reason for dosing errors was unavailable in our study, the high proportion of these events overall and those that caused severe harm and death further highlight the need for CPOE interventions to prevent medication dosing errors.

Incorrect medication errors were the second most common type of error in our study, accounting for 16.3% of overall events and 50% of known events that caused severe harm or death. Wrong medication ordering errors are difficult to detect in CPOE and thus the focus of few interventional studies. A small subset of prior research has focused on look-alike/sound-alike error detection algorithms as well as interventions to prevent these errors.[16] However, the positive predictive value of these automated tools has been low and the impact of interventions is thus far uncertain. One intervention focused on preventing wrong medication errors uses indication alerts that force clinicians to rethink ordering medications with no corresponding problem on the patient's problem list.[17] However, its impact on clinical care is uncertain. Indication-based prescribing is an area which should be further explored and has the potential to minimize both wrong dose and wrong medication ordering errors. Indication based prescribing changes the workflow of CPOE. Instead of relying on the clinician to choose ordering characteristics based on a specific medication the CPOE selects the correct drug based on indication and calculates the correct dosage, frequency and timing of a medication based upon indication and a combination of clinical data including renal function, weight, and age.

It is clear that CPOE systems still have large potential for improvements despite extensive efforts and substantial investments over the past decade.[18] In our data, nearly 80% of events were characterized as preventable, demonstrating that many medication ordering errors are still avoidable and present an opportunity for intervention. However, near-miss errors were most frequently intercepted by chance, either through recognition by the ordering provider or by the "spontaneous action" of another practitioner, rather than by failsafe mechanisms built into CPOE systems. Similarly, in an evaluation of more than 2000 hospitals between 2009 and 2018 using the Leapfrog Group CPOE EHR tool, Classen et al[8] found that the percentage of simulated medication ordering errors successfully identified, through alert, warning, or soft or hard stop, only improved from 52.9% to 65.6%. This means that on an average, one-third of potentially harmful errors were still not caught.

In contrast, CDS tools aimed to prevent errors are often triggered unnecessarily resulting in high rates of alert fatigue and ultimately overrides of those alerts.[19] In fact, a systematic review found that between 46% and 92% of alerts were overridden.[20] In a multicenter survey of Veterans Affairs providers, 87% stated that the number of CDS alerts in the healthcare system EHR were excessive, with almost 70% of physicians indicating that they received more alerts than they could handle.[21] These results point toward the need of a redesign of CPOE as discussed above, with a shift from reliance on alerts to prevent potential ordering errors to a more proactive stance which would identify appropriate medication regimens and associated ordering parameters. Ordering medications based on indication rather than drug is an example of innovative technology that guides the clinician to select the right medication and ordering characteristics initially, based on indication and clinical characteristics. This has the potential to greatly minimize reliance on alerts and ultimately reduce the rates of harmful ordering errors.[22,23] In fact, a prototype which was utilized to recommend medication regimens based on indication and clinical factors rather than medication

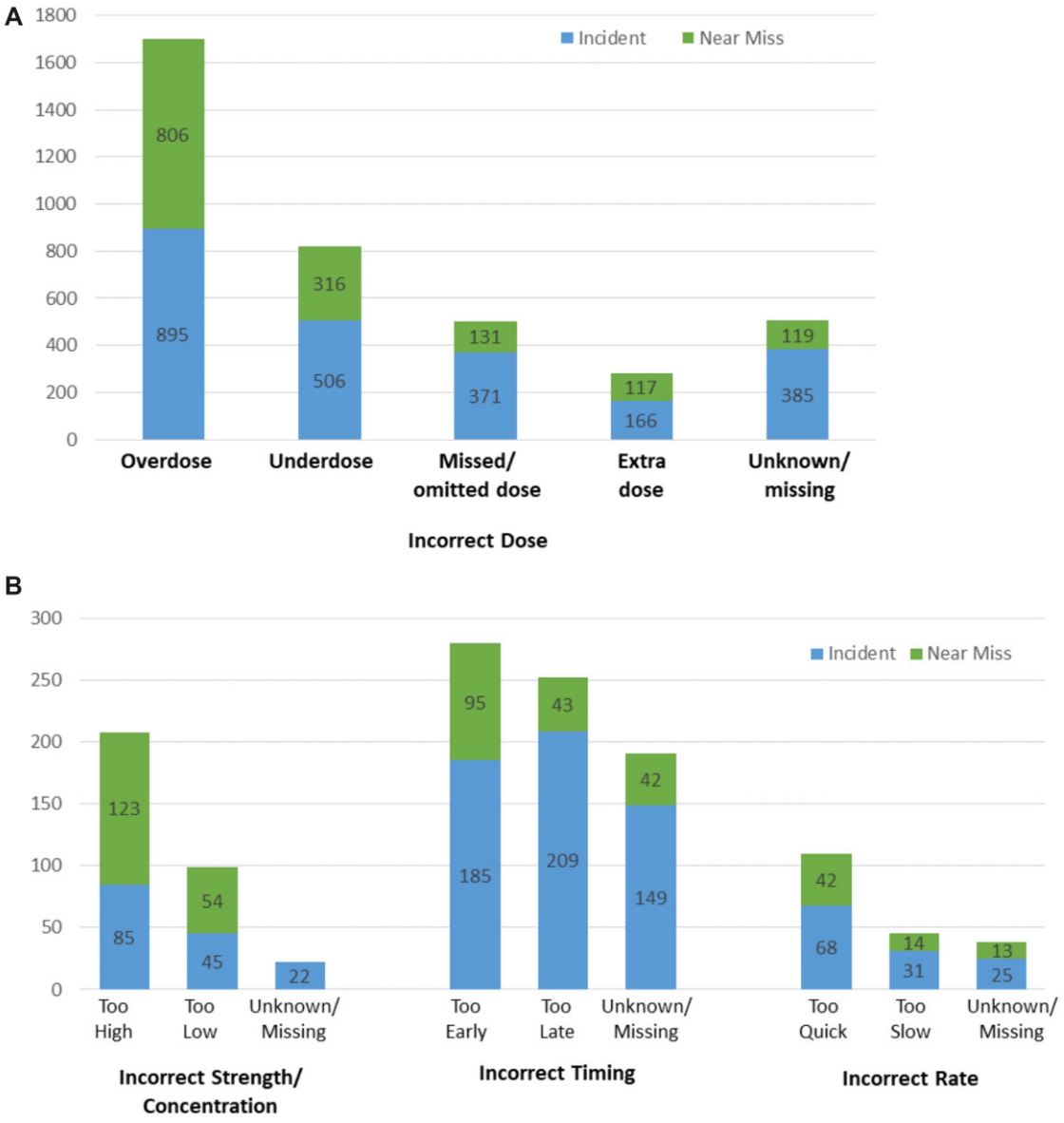

Figure 2. (A, B) Direction of errors reported as incorrect dose, incorrect strength/concentration, incorrect timing, and incorrect rate.

resulted in a significantly decreased risk of ordering errors; 5.5% using the indication based prototype versus 29.7% with standard order entry (difference 24.22%; 95% CI, 15.4–33.1%, $P < 0.001$).[24]

This study has several limitations. First, the NPSD is vastly underutilized as highlighted in a recent report to Congress, which was drafted by the Health and Medicine Division of the National Academies of Sciences, Engineering and Medicine (NAM).[25] Congress required AHRQ produce a report summarizing the effect of implementation of the NPSD on patient safety outcomes. The NAM was then required by Congress to evaluate this report prior to Congress review. This report highlighted the underutilization of the NPSD by active PSOs. Therefore, the number of events are likely vastly underestimated. The report concludes that the AHRQ should explore strategies to minimize the burden of PSO reporting by exploring various techniques, such as artificial intelligence.

Secondly, this study is limited by the inherent nature of voluntary reporting that was used to attain data. As voluntary reporting also severely underestimates the frequency of errors that occur, these results may not adequately capture the magnitude of errors and associated harm.[26] In contrast to the estimated 98 000 deaths per year reported in the Institute of Medicine report *To Error is Human*, which used deaths from medical errors identified by chart reviews to derive the estimate,[1] in this national database there were only 5571 deaths reported from all types of medical errors over a 10-year period.[13] Thus, despite the significant number of harmful medication ordering errors in the NPSD, the actual number of harmful ordering errors may be as much as 175-times more than is captured in this national database. As a result, the estimated number of deaths due to ordering errors is also likely vastly underestimated and could be over 2000 deaths per year. Specifically, ordering the incorrect dose could lead to over 350 deaths per year, and ordering the incorrect medication could lead to as many as 525 deaths per year. Although only approximations, these estimates highlight the need for interventions to prevent medication ordering errors.

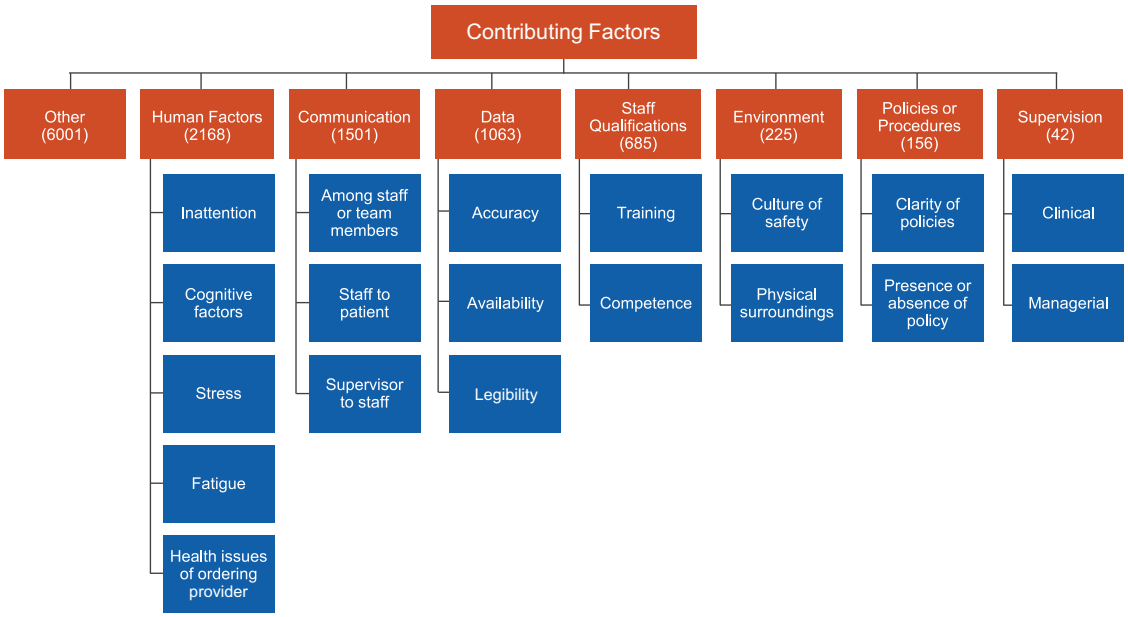

Figure 3. Human and environmental factors that contributed to errors as identified by error reporters. Categories and subcategories ranked in descending order, from most commonly to least commonly reported.

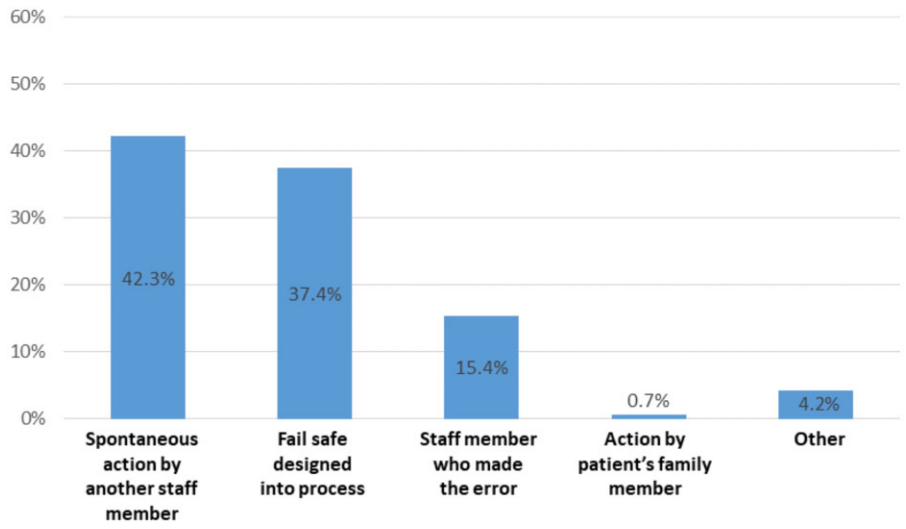

Figure 4. Near-miss errors by mechanism of recovery. For this analysis, all near-miss errors in which the mechanism of recovery was unknown or missing were excluded (74%).

Thirdly, outpatient ordering errors accounted for only 7% of all errors reported during this timeframe despite the majority of orders arising in the outpatient environment. The relatively small numbers of errors in the outpatient environment may indicate vast underreporting of voluntary reported errors in this setting. Further work should focus on the outpatient setting to create automated measures for the detection of medication ordering errors.

Finally, the number of missing data fields is high and the denominator is unknown such that rates cannot be calculated. The Common Format can be further optimized by the addition of free-text boxes which would provide a more in-depth analysis of reported errors. However, despite these limitations, this analysis uses a large, national 10-year database which enabled a deeper level of examination of voluntarily reported medication ordering errors than was previously possible.

CONCLUSION

We utilized AHRQ NPSD Common Format data to extract discrete fields associated with medication ordering errors and analyzed ordering errors by type and severity. The study analyzed data from 2010 to 2020, a time period when CPOE systems were widely used and had the capacity for advanced decision support. We found incorrect medication and dosing events were among the most

common type of errors, and resulted in a high proportion of the events that caused severe harm and death. Future studies should aim to develop and test interventions focused on CPOE to prevent medication ordering errors, prioritizing wrong-dose and wrong-drug errors. Specifically, indications-based prescribing has the potential to minimize both types of these harmful ordering errors.

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AUTHOR CONTRIBUTIONS

AG contributed to the planning, conduct, and reporting of the work described in the article. AR contributed to the conduct and reporting of the work described in the article. JRA contributed to the planning, conduct, and reporting of the work described in the article. DC contributed to the reporting of the work described in the article. PR contributed to the reporting of the work described in the article. ADC contributed to the conduct and reporting of the work described in the article. DK contributed to the reporting of the work described in the article. DJB contributed to the reporting of the work described in the article. DCC contributed to the reporting of the work described in the article. JSA contributed to the planning, conduct, and reporting of the work described in the article.

CONFLICT OF INTEREST STATEMENT

No conflicts exist for any of the listed authors.

DATA AVAILABILITY

The deidentified NPSD data is available from the Agency for Healthcare Research and Quality.

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