

Clinician Perceptions on the Use of Free-Text Communication Orders

Swaminathan Kandaswamy¹ Zoe Pruitt² Sadaf Kazi^{2,3} Jenna Marquard⁴ Saba Owens²
Daniel J. Hoffman⁵ Raj M. Ratwani^{2,3} Aaron Z. Hettinger^{2,3}

¹Department of Pediatrics, Emory University, School of Medicine, Atlanta, Georgia, United States

²MedStar Health National Center for Human Factors in Healthcare, MedStar Health Research Institute, Washington, District of Columbia, United States

³Department of Emergency Medicine, Georgetown University School of Medicine, Washington, District of Columbia, United States

⁴Department of Mechanical and Industrial Engineering, University of Massachusetts Amherst, Amherst, Massachusetts, United States

⁵Robert H. Smith School of Business, University of Maryland College Park, Maryland, United States

Address for correspondence Swaminathan Kandaswamy, PhD, 100 Woodruff Cir Suite 400, Atlanta, GA 30322, United States (e-mail: Swaminathan.kandaswamy@emory.edu).

Appl Clin Inform 2021;12:484–494.

Abstract

Objective The aim of this study was to investigate (1) why ordering clinicians use free-text orders to communicate medication information; (2) what risks physicians and nurses perceive when free-text orders are used for communicating medication information; and (3) how electronic health records (EHRs) could be improved to encourage the safe communication of medication information.

Methods We performed semi-structured, scenario-based interviews with eight physicians and eight nurses. Interview responses were analyzed and grouped into common themes.

Results Participants described eight reasons why clinicians use free-text medication orders, five risks relating to the use of free-text medication orders, and five recommendations for improving EHR medication-related communication. Poor usability, including reduced efficiency and limited functionality associated with structured order entry, was the primary reason clinicians used free-text orders to communicate medication information. Common risks to using free-text orders for medication communication included the increased likelihood of missing orders and the increased workload on nurses responsible for executing orders.

Discussion Clinicians' use of free-text orders is primarily due to limitations in the current structured order entry design. To encourage the safe communication of medication information between clinicians, the EHR's structured order entry must be redesigned to support clinicians' cognitive and workflow needs that are currently being addressed via the use of free-text orders.

Conclusion Clinicians' use of free-text orders as a workaround to insufficient structured order entry can create unintended patient safety risks. Thoughtful solutions designed to address these workarounds can improve the medication ordering process and the subsequent medication administration process.

Keywords

- ▶ electronic health records and systems
- ▶ communication
- ▶ safety
- ▶ workaround

received
December 16, 2020
accepted after revision
April 28, 2021

© 2021. Thieme. All rights reserved.
Georg Thieme Verlag KG,
Rüdigerstraße 14,
70469 Stuttgart, Germany

DOI <https://doi.org/10.1055/s-0041-1731002>.
ISSN 1869-0327.

Background and Significance

Effective nurse–physician communication is vital to improving patient outcomes,^{1,2} but communication failures contribute to a majority of sentinel events in hospitals.³ The Joint Commission has identified improving provider communication and medication safety as key goals of the Hospital National Patient Safety Goals for 2020.⁴ One major tool for provider communication is the electronic health record (EHR), which is increasingly used in place of verbal communication.⁵ EHRs allow communication through structured (e.g., medication orders) and unstructured pathways (e.g., clinician notes). Structured pathways such as computerized physician order entry (CPOE) are designed for highly specified and discrete information that can be checked against information elsewhere in the system. This cross-checking function enables detecting information mismatch and mitigating medication errors such as incorrect doses, duplicate medications, and allergic reactions before the error reaches the patient.⁶

Unstructured pathways in the EHR, such as clinicians' notes, free-text fields in medication orders, and free-text orders, have very few content restrictions. A free-text order is a stand-alone order with a text field of limited characters used for asynchronous communication. Because of the nature of free-text content, the information entered into these orders is not checked against information in the system. The lack of safety checks makes free-text orders a potentially risky method of entering medication information into the EHR. Free-text orders have many different names, including free-text orders, free-text communication orders, nonmedication orders, and communication orders. The use of free-text orders for communicating medication information can lead to unintended consequences if they contain unreliable and inconsistent information.⁷ Palchuk et al reviewed 2,914 electronic prescriptions that contained free-text fields and found discrepancies in 16.1% of the prescriptions.⁸ Most (83.8%) of the discrepancies could lead to adverse events, and many (16.8%) could lead to severe adverse events involving a hospital admission or death.⁸ Despite these risks, previous research found that free-text orders are commonly used to enter medication information. One study found that 9.3% of diabetes medications were entered via free-text orders.⁹ The study showed that analyzing EHR data can uncover the prevalence and severity of the use of free text to order medications. However, the study analyzed only one type of medication and the identification of reasons for the use of free-text to order medication was based on the author's perspectives, not on clinician feedback. Another two studies found that 42% of free-text orders^{10,11} contained medication information. Studies on the use of other free-text digital tools for communication have also found similar rates of medication information.¹² Studies on improving clinician communication have focused on the effectiveness of specific communication tools or communication strategies. However, they have not studied improving the effective use of free-text orders in acute settings.^{13–16} There is currently a gap in knowledge between the known prevalence of medication information in free-text

orders and clinicians' rationales for using free-text orders to communicate medication information. Bridging this knowledge gap is essential for understanding how to redesign systems to address these issues.

Objectives

In this pilot study, we investigated why clinicians use free-text orders to enter medication information. We developed clinical case scenarios that varied in clinical workflow and EHR interaction complexity to investigate: (1) why ordering clinicians use free-text orders, (2) clinician perceptions of risks associated with using free-text orders, and (3) potential solutions to improve EHR communication.

Methods

Setting

All participants worked at a Mid-Atlantic teaching hospital. Participants were recruited through convenience sampling via email to a departmental email distribution list and compensated for participation. In this study, we use clinicians to refer to health professionals, including physicians and nurses. Several previous studies focus on these two groups to understand and improve clinician communication.^{17–20} We included physicians and nurses because they are the primary creators and receivers, respectively, of free-text orders. Physician and nurse participants from the general floor and ICUs were recruited to understand common challenges and avoid divergence from specialty-specific challenges or workflows. The health system uses the Millennium EHR (Cerner Corporation, Kansas City, Missouri, United States).²¹ EHR with hospital-level customizations (e.g., order sets, alerts, etc.). The health system's institutional review board approved this study.

Clinical Case Scenarios

A human factors expert (S.K. [1]) and a clinical expert (A.Z.H.) conducted a content analysis of a sample of free-text orders to identify themes driving the use of free-text orders.¹⁰ These themes were used to construct clinical scenarios for the interview. The scenario foci and related verbatim text are shown in **Table 1**. The case scenarios helped participants think about various cases and foster discussion around why free-text orders would be used in such scenarios. While the scenarios were targeted, we also asked participants to describe example cases where providers would use free-text orders in addition to the specific scenarios.

Interviews

Clinician interviews are a common approach for understanding the use of technology in clinician-to-clinician communications. Human factors experts (S.K. [1], D.H., Z.P., and S.K. [2]) conducted 16 semi-structured clinician interviews (eight physicians and eight nurses). The interview guide comprised two broad sections. Section 1 comprised open-ended questions about medication-related communication preferences in each of the six scenarios. Physicians were asked to describe

Table 1 Clinical Scenarios

Scenario number	Scenario focus	Scenario text (verbatim)
1	Hold medication	Ms. Gonzales has a surgery scheduled for tomorrow. She is on the anticoagulation medication enoxaparin (Lovenox) and you want her off the medication 12 h prior to the surgery.
2	Patient status administration	Mr. Smith is on an insulin protocol and may have a procedure in the afternoon requiring NPO status. You want to let nursing know to hold insulin if he is NPO for the procedure and does not eat lunch.
3	Sequential administration	Mr. Williams is on anticoagulation medication heparin drip. You want to move him from heparin to Eliquis (apixaban). Specifically, you want to stop the heparin drip 30 min before giving the first dose of Eliquis (apixaban).
4	Partial cancellation	Ms. Jones is on IV potassium. She has received the first two doses from the potassium chloride 10 meq IV Q1h \times four doses order and her level has normalized. Now, you want to cancel the third and fourth doses of potassium, from the potassium chloride 10 meq IV Q1h \times four doses.
5	Rate change	Mr. Lee is on diltiazem drip, and you want to increase the rate from 10 to 12 mg/hour.
6	standby	Your patient Ms. Garcia with hypertensive emergency has improved substantially. Her blood pressure is currently 140/80 on a rate of 0.5 mg/hour and she will be getting switched to oral medications. You are unsure if she will need nicardipine drip so you want to keep nicardipine on standby in case her condition worsens.

Abbreviation: NPO, nil per os or nothing by mouth.

how they would communicate medication information in each scenario. Nurses were asked how they would expect medication information to be communicated, where they would look for medication information in the EHR, and how they would communicate the completion of the medication-related task in each scenario. In section 2, we asked participants about risks and reasons for using free-text orders (see [►Supplementary Material](#) [available in the online version] for interview guide). A digital survey was administered after the interview to collect demographic data.

Data Analysis

Interviews were audio-recorded and concurrently captured through live note-taking. Human factors experts independently analyzed the physician (S.K. [1]) and nurse (Z.P. and S.O.) interviews using notes and referred to the audio recording if they needed additional information. Participant's communication preferences in using structured orders, free-text orders, or verbal communication for each scenario were captured through frequency counts.

Thematic analyses focused on two questions: (1) when and why are free-text orders used? and (2) what are the consequences of using free-text orders? Coders independently read interview notes to identify and extract participants' responses to our focal research questions. Comments expressing similar concepts across participants were grouped into themes. After independently coding the physician and nurse interviews, authors (S.K. [1] and Z.P.) compared themes across the two participant groups. Through discussion, themes were deconstructed and recombined to improve cohesion and relationship to the research question. Similar themes were grouped together, disparate themes

were kept separate, and themes were renamed to better describe their contents. The internal clinician team verified these themes for validity. All analysis was performed by using Microsoft Excel 2019 (Microsoft Corporation, Redmond, Washington, United States).

Results

Eight physicians (one attending physician and seven resident physicians), and eight nurses working in medical/surgical and ICUs participated in the study. Not all nurses volunteered demographic data. Participants differed in their level of clinical experience (attending = 13 years; residents [$n = 7$] = 3.6 years, standard deviation [SD] = 1.1; nurses [$n = 6$] = 7.9 years, SD = 3.8). Participants also differed in their level of experience with the Cerner EHR (attending = 4 years; residents [$n = 7$] = 1.3 years, SD = 3.2; nurses [$n = 6$] = 6.2 years, SD = 1.8).

Communication Preferences of Physicians and Nurses

Participants were asked to report communication methods that they would expect to utilize for each given scenario. Participant's self-reported methods for communicating medication information are reported in [►Fig. 1](#). All physicians ($n = 8$) indicated that they would place medication orders through structured orders in at least four of the six scenarios. Similarly, at least six nurses expected to review the medication information either in the medication orders tab or the electronic Medication Administration Record (eMAR) to retrieve orders in all scenarios. Most physicians ($n = 7$) also expected to use verbal communication in five scenarios, but fewer nurses ($n = 5$) expected to communicate order

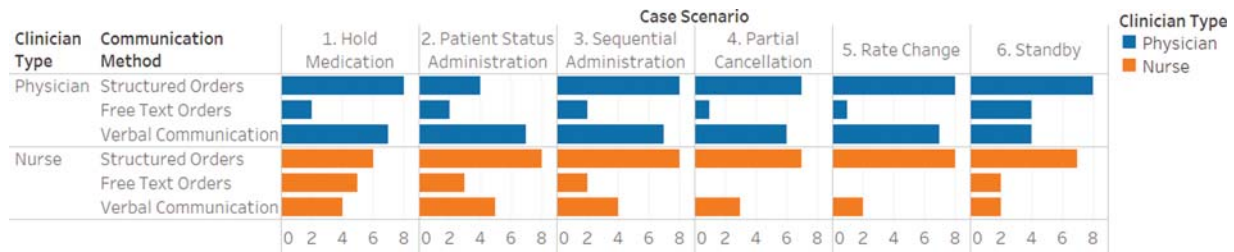


Fig. 1 Preferences in use of structured orders, free-text orders, and verbal communication in six clinical case scenarios.

completion verbally. Five physicians and seven nurses expected to use free-text orders in addition to structured orders in at least one scenario.

Reasons for Using Free-Text Orders

Participants were asked to describe why they believed ordering clinicians used free-text orders to communicate medication information. Despite risks, both physicians and nurses mentioned several reasons to use free-text orders. Eight themes emerged from participant responses on why clinicians use free-text orders including lack of EHR efficiency, need for redundancy, need for documentation, need for context, lack of EHR functionality, need for team situation awareness, support for asynchronous workflows, and training (→Table 2).

Risks with Communication Using Free-Text Orders

Participants were asked to describe any risks that they perceived in the use of free-text orders. Five risk categories were identified from participant responses. These included missing orders, increased workload, conflicting information, and lack of safety checks (→Table 3). All nurses ($n=8$) and most physicians ($n=5$) mentioned at least one problem with using free-text orders to communicate medication information.

Potential Changes to Improve Communication of Medication Information

Participants were asked to provide recommendations for improving medication information in the EHR. First, participants wanted new structured orders to be added to their

Table 2 Reasons for using free-text orders with example quotes of clinicians mentioning these reasons

Theme	Description	Example quote from physicians	Example quote from nurses
Lack of EHR efficiency	Structured orders can be difficult to complete, difficult to locate, inefficient, or ineffective. For example, (1) difficulty modifying or updating existing structured orders; (2) difficulty accessing information from the comments section of structured orders; (3) confusing visual display of discontinued orders.	“Special comments vs. special instructions pop up in different areas for nurses. Not sure which one they can see.”	“Our residents have a lot on their plate, so they are moving fast and may be just click on the first thing that comes up.”
Need for redundancy	Communicating medication information through multiple mechanisms is safer because it increases the likelihood of the order recipient receiving the information.	“Just to make sure as a safety net. I did inform the nurse verbally. I also change the order in the computer but want to make sure.”	“It is safer to have (medication information) in more places. If they do not check this thing, they will check this other thing.”
Need for documentation	Verbal communication of medications and care plans should be recorded in the EHR for future reference.	“I use (free-text orders) for things that I want to stay on record.”	“If it is not spelled out in the order, it would be more prudent to ask the physician to write it in the communication order because it is easier—the nurse needs it written to cover their butt.”
Need for context		“Can explain why you want to keep it (medication) and	“If a physician is trying to be very

(Continued)

Table 2 (Continued)

Theme	Description	Example quote from physicians	Example quote from nurses
	Explaining the reason for medication orders gives the order recipient a potentially useful perspective for patient care.	rationale for doing it. So they will be relaxed and you are also relaxed.”	clear about what they want they would use the communication section.”
Lack of EHR functionality	The EHR does not allow all medication tasks to be executed through structured orders. For example, (1) sequential medications ^a ; (2) temporarily holding medications ^b ; (3) dynamic medication requirement ^c ; and (4) updates on patient status (e.g., “okay to use central lines”).	“For most nonmedication orders, we use because there is no specific order in the system. For okay to travel off monitor, okay to use central line, there is no order. So, I would use nonmedication order. If order for NPO is already there, there is an order for discontinue medication in that case I would just follow that order.”	NA
Need for team situation awareness	Appropriate care relies on all team members being informed about the care plan. For example, (1) ensuring information transmission; (2) allowing nonparticipants of handoffs, like pharmacists, to be updated; (3) tracking and updating team members about important changes to the care plan; and (4) reminding them of outstanding tasks.	“It (free-text orders) not only helps nurses, but also night-time residents.”	NA
Support for asynchronous workflows	When the order recipient is busy and cannot communicate verbally, the EHR is used to communicate information.	“They want to put that in just to make sure that they have made the nurse aware if they cannot get in touch with nurse verbally.”	NA
Training	Medication information is communicated through the EHR via workflows learned from colleagues and mentors.	“I have been told to use communication orders; I was told it is for nurses to see. It is a way for nurse to see orders. Communication between nurse and resident is through that order.”	NA

Abbreviations: EHR, electronic health record; NA, not applicable.

^aSequential medications: medications intended to be administered in sequence within a specific time range.

^bTemporarily holding medications: suspending a medication order temporarily without returning it to pharmacy because the medication may be required a short time after.

^cDynamic medication requirement: intermittent medication schedules such as insulin drips where nurses must consider dynamic changes in the patients' status and goals before administering specific medications or deciding the appropriate dose.

Table 3 Physician and nurse reported risks with using free-text order

Risk	Description	Example quote from physicians	Example quote from nurses
Missing orders	Order recipients may not see free-text orders in the EHR leading to treatment delays.	“Several times, these communication orders get lost or the nurse never reviewed them.”	“There was a patient with an NG tube placed and an X-ray is supposed to confirm that. Patient was on a floor and they had the X-ray, but it was never read. There was an order that said okay to use the line, but no one looked, and the tube feed infused into the patient's lungs.”
Increased workload	Additional work due to the use of free-text orders. For examples, (1) relying on other channels of	“It is (free-text order) a one-way communication. Even if we put a communication order, they do	“If you do not check the tab, you will not see the order.”

Table 3 (Continued)

Risk	Description	Example quote from physicians	Example quote from nurses
	communication due to a lack of feedback from free-text orders; (2) manually refreshing the orders tab to receive updates; and (3) manually tracking free-text order tasks because free-text orders do not populate in the electronic task list.	whatever they were able to understand from it. It is dangerous, we do not know what they have done and how much they have understood out of that order. And what they have done cannot be communicated back to me."	
Conflicting information	Discrepancies between medication information from outdated free-text orders and between free-text orders and structured orders. For example, (1) route; (2) dose; (3) timing; and (4) medication name.	"I can use for med orders (in free-text orders), for something like "patient can keep their nebulizer at bedside" like an ongoing thing. Otherwise if you put communication order in there, it is there and you do not want it to keep happening and you want it to happen once; the orders sits there once it's there."	"Patients could 'have up to a hundred (free-text orders) if they have been in the hospital for a long time'; "we need to look at date on order or else we will not know if the order is still relevant."
Lack of safety checks	Free-text orders do not undergo pharmacy review, clinical decision support, or bar code scanning due to unstructured content.	NA	"If it is not input through CPOE, the order is not approved by pharmacy."

Abbreviations: CPOE, computerized physician order entry; EHR, electronic health record; NA, not applicable.

EHR. They wanted new structured orders to replace common free-text orders (e.g., order for okay to use central line) and for the handful of paper orders at their hospital (e.g., continuous drips of heparin and insulin) to be orderable through the EHR. Second, physicians and nurses wanted free-text medication orders to be more usable. They suggested features like status tracking (e.g., order reviewed by nurse and order implemented by nurse), free-text integration with the electronic task list, alerts firing when new free-text orders appear, making free-text orders easier to see in the EHR, relabeling free-text orders as medication specific when appropriate, making it easier to discontinue old free-text orders, and housing all medication orders in the same location in the EHR. Participants also requested that medication information, whether free-text or structured, be accessible in the same location. Fourth, participants suggested that free-text orders facilitate two-way medication-relevant communication between the ordering and receiving provider. Lastly, participants envisioned building a clinical decision support tool to check the text of free-text order against relevant medication safety parameters (e.g., dose, frequency, and route), alternative ordering options (e.g., standard medication orders), and medications the patient is already on.

Discussion

In this study, we explored clinicians' perceptions of the use of free-text orders to communicate medication information. The results show that clinicians have varied perceptions of when and why free-text orders are used, their impact on medication-related communication and subsequent patient

safety risks, and several ideas for improvements to the design of structured and free-text orders.

In the scenarios, clinicians often reported using structured orders for scenarios that introduced new medications or dose changes. New medications and dose changes must be entered through the structured order systems to be evaluated by pharmacists and accessible through automated medication dispensing cabinets. However, despite its necessity, the structured ordering system was difficult to use for both the ordering physician and the nurse. Further, not all medications could be ordered through the structured order system, especially complex, atypical, or urgent medication information, resulting in the use of free-text orders as a workaround.

The scenarios also revealed that providers use verbal communication and free-text orders in addition to structured orders to convey medication information as a workaround for EHR communication barriers. The clinicians expressed that they required consistent communication with their team to maintain situation awareness and context, but that communication also needed to be asynchronous and support the different workflows of physicians and nurses. However, maintaining consistent communication in the EHR with structured orders was described as challenging and unreliable (i.e., the nurse not seeing notes on a structured order, and the structured order not providing sufficient context for the order), resulting in the use of workarounds. One of these workarounds is sending redundant medication information in free-text orders to document it in multiple places in the EHR, where it will hopefully be seen. This finding is supported by previous research.²²⁻²⁴

Physicians mentioned multiple reasons for using free-text orders, while nurses mentioned fewer reasons for using free-text orders. The difference between physicians and nurses is likely due to physicians (and advance practice providers) being responsible for writing orders and documenting clinical reasoning for their team members. As a result, more physicians were concerned about categories of “lack of EHR functionality,” “need for team situation awareness,” and “need for documentation.” “Need for redundancy” was mentioned equally by both nurses and physicians. This similarity between physicians and nurses is likely because both recognize the need to ensure that information is not missed. More nurses than physicians mentioned the “need for context” as a reason to use free-text orders, which possibly reflects the nurse’s desire for clarity when executing orders.

Although clinicians recognize risks associated with using free-text orders, risk perceptions differ across roles. Unlike structured orders, medication information entered through free-text orders may not be visible in the standard nursing workflow (e.g., EHR nurse task list), increasing the risk of missed orders. Canceling free-text orders is not a part of the clinician’s workflow, which leads to outdated free-text orders cluttering the patient’s chart, and more importantly, conflicting information across old and new orders. These unintended workflow consequences put additional workload burdens on the order recipient, typically the nurse, to locate, track, and clarify free-text orders. In alignment with previous studies, while physicians are cognizant of the challenges with the EHR, they often are unaware of the unintended consequences or errors associated with using workarounds.²⁵ The difference in risk perceptions and rationale for using free-text orders points to a probable lack of understanding of other clinician groups’ workflow. An inter-professional program to observe and learn workflows and challenges of other clinician groups may enhance effective communication.²⁶

Our findings on the risk of free-text orders align with previous research highlighting how EHR usability issues disrupt clinician work and can contribute to patient harm.^{27–29} Free-text orders present technical deficiencies compared with structured orders. The information entered to free-text orders cannot be checked for accuracy and safety by the computer (i.e., checking for proper dosing, allergies, medication interactions, or altering previous orders). The lack of dose and allergy checking could result in wrong medication or wrong dose errors. Free-text orders present workflow challenges for nurses because they populate differently from structured orders in the EHR. Nurses’ most common concern in interviews was missing free-text orders, resulting in omission or delays in care. Consequently, there are many ways that free-text orders can negatively impact patient safety and result in suboptimal care.

We propose 12 potential solutions to improve structured order reliability and communication in the EHR to reduce the use of free-text orders and the resulting risks to patient safety (→ **Table 4**). Recognizing that many solutions involving EHRs require longer time horizons to implement, we also provide guidelines on the timeline for implementing the

proposed solutions. Near-term solutions focus on immediate changes that a healthcare system may have greater control to put in place in less than 4 months. Longer term solutions are focused on technology changes that may require vendor engagement or policy changes that often require a longer time horizon beyond 4 months. The proposed solutions seek to balance implementation time, effectiveness, and sustainability.³⁰ → **Table 4** also indicates which solutions were suggested by participants during the study and those strategies identified by the authors.

Prior studies on communication within the EHR have looked at adoption and usage while only providing superficial recommendations such as improved interface and training, without concrete design alternatives.³¹ The identification of the clinician perceptions on risks and rationale for the use of free-text orders and potential solutions will add to the literature on enhancing clinician communication within the EHR. Some of these recommendations, such as the use of closed-loop feedback for effective communication, are already well known.¹³ Other solutions, such as surveillance, are novel and need to be tested before large-scale implementation.

While the recommendations are targeted to address clinician needs, usability issues, and risks identified in this study, we need robust methods to design and implement solutions. Substantial changes require vendors and healthcare systems to allocate resources to perform usability testing of medication ordering systems before, during, and after hospital EHR implementation to understand work systems, minimize workarounds and identify unintended consequences.^{32,33}

Limitations

One limitation of our study is the use of a single EHR and hospital site and a relatively small number of participants; consequently, our interviews’ results may not be generalizable to other sites, other EHRs, or larger clinical populations. While interviewing a more diverse set of participants may glean additional information, our themes have a level of face validity that suggests these findings are a realistic set of issues to be remedied. Additionally, the recommendations in → **Table 4** could serve as a checklist for health systems using another vendor EHRs. Second, the physician participants were mostly residents, who typically have more experience with the EHR than the attendings in an academic setting who sometimes rely on residents to enter patient orders and may be more familiar with workaround strategies requiring free-text orders. Third, we asked participants to discuss how they would communicate medication information, but we did not ask about each specific communication method. Hence, the data may be biased to participant recollection. Additionally, our analysis is limited due to the use of notes instead of transcripts, limiting our results by forgoing speech nuances, as well as the lack of member checking.

The recommendations we pose are based on the reasons and risks of using free-text orders presented by participants

Table 4 Recommendations for improving risks associated with free-text orders

	Risk/reason theme	Recommendation	Rationale	Solution suggested by study participant	Implementation timeline and primary impact
1	Lack of EHR functionality	Notify all clinicians of the potential risks associated with entering medication information in free-text orders.	Some of the risks discovered in this study point toward incomplete risk assessment of clinicians due to lack of awareness of what other roles see in the EHR.	No	Immediate
2	Lack of EHR functionality	Create structured orders for the use of lines and tubes (e.g., “okay to use central line” or “okay to use NG tube”) including tracking and documentation of placement, approval for use, maintenance and discontinuation of lines, tubes, and drains.	Tracking and documentation of placement, approval for use, maintenance, and discontinuation of lines, tubes, and drains is often challenging. When information is fragmented across the EHR, delays, increased workload, and patient harm can result.	Yes	Near term
3	Lack of EHR functionality	Allow all medications to be ordered through a single electronic system rather than retaining paper processes for select medications.	Combining electronic and paper processes can create confusion because medication information is distributed in different locations. Consequently, legacy paper processes can lead to treatment delays.	Yes	Near term
4	Lack of EHR functionality	Enable the ability to place a medication in “standby” status and account for potential unintended consequences.	Medications may need to be temporarily placed on standby based on the patient’s condition. Canceling and reordering a medication complicates clinician workload.	Yes	Long term
5	Lack of EHR functionality	Allow two orders to be placed in a specific, clinically relevant sequence. Linked orders should be visually connected to highlight requirements of sequencing and give appropriate alerts for high-risk medications.	Certain medications need to be given in a specific order. Lack of easy and efficient ways to communicate and ensure administration these medications in sequence can result in error and serious patient harm.	Yes	Long term
6	Lack of EHR efficiency	Enable nurse/pharmacist review when a medication is discontinued.	Clinicians may not recognize when an order is discontinued and the patient may continue receiving the medication erroneously, which could lead to harm. In addition, orders that are accidentally canceled may be missed by other clinicians if not reviewed.	Yes	Near term
7	Lack of EHR efficiency	Ensure accuracy of CPOE orders and smart IV pump drip rates, taking into consideration nurse titrating protocols to ensure accuracy between EHR and medication administrations.	For some high-risk medications, ordering providers use free-text to update the titration parameters of nurse-driven protocols. When these are written as part of a free-text order they are detached from original structured order and can be	No	Near term

(Continued)

Table 4 (Continued)

	Risk/reason theme	Recommendation	Rationale	Solution suggested by study participant	Implementation timeline and primary impact
			missed and increase workload.		
8	Lack of EHR functionality, training	Healthcare system should have a surveillance system in place to review use of free-text orders and potential hazards.	Surveillance can help health-care systems identify systems issues and poor local workflows, including the use of free-text orders as a workaround.	No	Long term
9	Lack of efficiency, need for team situation awareness	Ensure free-text communications embedded within structured medication orders or order sets are safely and properly displayed to different team members.	Information in the comment sections of structured orders is sometimes not visible to all team members or information display is not ideal making it hard to retrieve and act on the information.	No	Near term
10	Lack of EHR efficiency, need for team situation awareness	Enable visual indication that an order has changed since the user last checked the order.	To act on changes to an order, it is important that order recipients know when and what aspects of the order have changed. Without this information, treatment delays and medication errors can occur.	Yes	Long term
11	Need for redundancy, training	Create guidelines for safe and effective use of free-text orders.	Free-text orders are often used as a workaround strategy for ordering providers, which can lead to unintended consequence. Outlining when free-text orders are and are not appropriate can facilitate more effective use of this communication tool.	No	Long term
12	Support for asynchronous workflows; need for context	Enable two-way communication regarding orders including use of two-way messaging applications or embedded CPOE functionality for timely resolution of questions and feedback.	Effective communication between clinicians is essential for safe and effective care. Lack of two-way communication can result in poor feedback, misinformation, and treatment delays.	Yes	Long term

Abbreviations: CPOE, computerized physician order entry; EHR, electronic health record; NG, nasogastric.

interpreted from a human factors and informatics lens. The feasibility and unintended consequences of these recommendations have not been tested. Future studies should investigate the feasibility of these recommendations as well as the quantity of actual error resulting from the use of free-text order to communicate medication information.

Conclusion

In this study, we identified several risks associated with the use of free-text order for communicating medication information. Ordering clinicians use free-text orders due to various usability and functional deficiencies in current structured medication order systems. Clinicians noted that

the use of free-text orders to communicate medication information as a workaround could create unintended risks to patient safety. Thoughtful solutions designed to address why clinicians use free-text orders as a workaround can improve the medication ordering process and the subsequent medication administration process.

Clinical Relevance Statement

This study fills a gap in current literature and throws light on clinicians' rationales for using free-text orders to communicate medication information. The study also identified several risks associated with the use of free-text order for communicating medication information. Our findings align

with previous research highlighting how EHR usability issues disrupt clinicians' work and can contribute to patient harm. Lack of insight into reasons and risks associated with the use of free-text orders would prohibit our efforts to improve communication and reduce medical errors. The proposed solutions are summarized in ▶Table 4 and seek to balance implementation time, effectiveness, and sustainability.

Multiple Choice Questions

1. Which of the following is intended to be used most frequently for communicating medication information?
 - a. Structured CPOE orders
 - b. Free-text orders
 - c. Verbal orders
 - d. Other

Correct Answer: The correct answer is option a. Though verbal orders still exist, EHRs are now ubiquitous and CPOE ordering is common. Free-text orders are used as workarounds to structured CPOE orders, with these workarounds largely due to insufficient functionality or usability of structured CPOE ordering systems. Ideally, well-designed structured CPOE ordering systems would be used almost universally.

2. Based on the findings of this study, which of the following is not a common reason for clinicians to use of free-text orders, as opposed to structured CPOE orders, for communicating medication information in the EHR?
 - a. The EHR lacks the functionality to order some medications.
 - b. Clinicians need to document additional information for future reference.
 - c. Creating free-text orders can be more efficient than creating structured CPOE orders.
 - d. Clinicians do not know whether some medications are available.

Correct Answer: The correct answer is option d. In this study, clinicians used free-text orders as a workaround because the EHR currently does not allow all medication tasks (e.g., holding medications, sequential administration of medications) to be executed through structured CPOE orders. Clinicians may also want communication about medications and care plans to be recorded in the EHR for future reference. Additionally, structured orders can be time consuming to complete, update, or modify. However, this study did not show any evidence that free-text orders arise from a lack of knowledge about the availability of specific medications.

Author Contributions

S.K. (1), J.M., A.Z.H., and R.R. conceived and designed the study. S.K. (1), D.H., S.K. (2), and Z.P. collected the data. S.K. (1), Z.P., and S.O. analyzed the data. S.K. (1), S.K. (2), and Z.P. drafted the manuscript. All authors made critical manuscript revisions and approved the final version for submission.

Protection of Human and Animal Subjects

This study was approved by the health system's institutional review board.

Funding

This study received its financial support from U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality (grant numbers: R01 HS025136 to R.R. and R21 HS024755 to A.Z.H.).

Conflict of Interest

None declared.

Acknowledgments

A.Z.H., and R.R. report grants from Agency for Healthcare Research and Quality during the conduct of the study.

References

- 1 Schmidt IK, Svarstad BL. Nurse-physician communication and quality of drug use in Swedish nursing homes. *Soc Sci Med* 2002;54(12):1767-1777
- 2 Boev C, Xia Y. Nurse-physician collaboration and hospital-acquired infections in critical care. *Crit Care Nurse* 2015;35(02):66-72
- 3 Joint Commission on Health Care Quality and Safety. Sentinel Event Statistics Data - Root Causes by Event Type. (2004 - 2015). Accessed 2016 at: <http://info.jcrinc.com/rs/494-MTZ-066/images/Sentinel39.pdf>
- 4 National patient safety goals effective July 2020 for the hospital program. [Internet] [cited 2020 July 21]. Accessed 2020 at: https://www.jointcommission.org/-/media/tjc/documents/standards/national-patient-safety-goals/2020/npsg_chapter_hap_jul2020.pdf
- 5 Taylor SP, Ledford R, Palmer V, Abel E. We need to talk: an observational study of the impact of electronic medical record implementation on hospital communication. *BMJ Qual Saf* 2014; 23(07):584-588
- 6 Kuperman GJ, Gibson RF. Computer physician order entry: benefits, costs, and issues. *Ann Intern Med* 2003;139(01):31-39
- 7 Singh H, Mani S, Espadas D, Petersen N, Franklin V, Petersen LA. Prescription errors and outcomes related to inconsistent information transmitted through computerized order entry: a prospective study. *Arch Intern Med* 2009;169(10):982-989
- 8 Palchuk MB, Fang EA, Cygielnic JM, et al. An unintended consequence of electronic prescriptions: prevalence and impact of internal discrepancies. *J Am Med Inform Assoc* 2010;17(04):472-476
- 9 Zhou L, Mahoney LM, Shakurova A, et al. How many medication orders are entered through free-text in EHRs?—a study on hypoglycemic agents AMIA Annu Symp Proc 2012;2012:1079-1088
- 10 Kandaswamy S, Hettinger AZ, Hoffman DJ, Ratwani RM, Marquard J. Communication through the electronic health record: frequency and implications of free text orders. *JAMIA Open* 2020;3(02):154-159
- 11 Hajihashemi Z, Pancoast P. Reducing free-text communication orders placed by providers using association rule mining. AMIA Annu Symp Proc 2012;2012:1254-1259
- 12 Smith CNC, Quan SD, Morra D, et al. Understanding interprofessional communication: a content analysis of email communications between doctors and nurses. *Appl Clin Inform* 2012;3(01):38-51
- 13 Cheng DR, South M. Electronic task management system: a pediatric institution's experience. *Appl Clin Inform* 2020;11(05):839-845

- 14 Dingley C, Daugherty K, Derieg MK, Persing R. Improving patient safety through provider communication strategy enhancements. *Advances in Patient Safety* 2008
- 15 Pitts SI, Barasch N, Maslen AT, et al. Understanding CancelRx: results of end-to-end functional testing, proactive risk assessment, and pilot implementation. *Appl Clin Inform* 2019;10(02):336–347
- 16 Tschannen D, Kalisch BJ. The impact of nurse/physician collaboration on patient length of stay. *J Nurs Manag* 2009;17(07):796–803
- 17 Renz SM, Carrington JM. Nurse–physician communication in long-term care: literature review. *J Gerontol Nurs* 2016;42(09):1–8
- 18 Nguyen C, McElroy LM, Abecassis MM, Holl JL, Ladner DP. The use of technology for urgent clinician to clinician communications: a systematic review of the literature. *Int J Med Inform* 2015;84(02):101–110
- 19 von Gaudecker JR. Interprovider communication using a scheduled provider alert-response communication system in 3 inpatient neurology units. *J Neurosci Nurs* 2017;49(05):272–273
- 20 Walsh C, Siegler EL, Cheston E, et al; Informatics Intervention Research Collaboration (I2RC) Provider-to-provider electronic communication in the era of meaningful use: a review of the evidence. *J Hosp Med* 2013;8(10):589–597
- 21 Hospital & Health Systems | Cerner. [Internet]. [cited 2020 July 29]. Accessed 2020 at: <https://www.cerner.com/solutions/health-systems>
- 22 Campbell EM, Sittig DF, Ash JS, Guappone KP, Dykstra RH. Types of unintended consequences related to computerized provider order entry. *J Am Med Inform Assoc* 2006;13(05):547–556
- 23 McDonald CJ, Callaghan FM, Weissman A, Goodwin RM, Mundkur M, Kuhn T. Use of internist's free time by ambulatory care electronic medical record systems. *JAMA Intern Med* 2014;174(11):1860–1863
- 24 Baron JM, Dighe AS. Computerized provider order entry in the clinical laboratory. *J Pathol Inform* 2011;2(01):35
- 25 Sittig DF, Ash JS, Guappone KP, Campbell EM, Dykstra RH. Assessing the anticipated consequences of Computer-based Provider Order Entry at three community hospitals using an open-ended, semi-structured survey instrument. *Int J Med Inform* 2008;77(07):440–447
- 26 Johnson CM, Khan A, Stark S, Samee M. A nurse shadowing program for physicians: bridging the gap in understanding nursing roles. *J Nurs Adm* 2020;50(06):310–313
- 27 Howe JL, Adams KT, Hettinger AZ, Ratwani RM. Electronic health record usability issues and potential contribution to patient harm. *JAMA* 2018;319(12):1276–1278
- 28 Zahabi M, Kaber DB, Swangnetr M. Usability and safety in electronic medical records interface design: a review of recent literature and guideline formulation. *Hum Factors* 2015;57(05):805–834
- 29 Ratwani RM, Reider J, Singh H. A decade of health information technology usability challenges and the path forward. *JAMA* 2019;321(08):743–744
- 30 Hettinger AZ, Fairbanks RJ, Hegde S, et al. An evidence-based toolkit for the development of effective and sustainable root cause analysis system safety solutions. *J Healthc Risk Manag* 2013;33(02):11–20
- 31 Walsh KE, Secor JL, Matsumura JS, et al. Promoting secure provider-to-provider communication with electronic health record messaging: an educational outreach study. *J Healthc Qual* 2018;40(05):283–291
- 32 Brown N, Eghdam A, Koch S. Usability evaluation of visual representation formats for emergency department records. *Appl Clin Inform* 2019;10(03):454–470
- 33 Orenstein EW, Boudreaux J, Rollins M, et al. Formative usability testing reduces severe blood product ordering errors. *Appl Clin Inform* 2019;10(05):981–990