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## Brief Communications

# Communication through the electronic health record: frequency and implications of free text orders

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### ABSTRACT

Communication for non-medication order (CNMO) is a type of free text communication order providers use for asynchronous communication about patient care. The objective of this study was to understand the extent to which non-medication orders are being used for medication-related communication. We analyzed a sample of 26 524 CNMOs placed in 6 hospitals. A total of 42% of non-medication orders contained medication information. There was large variation in the usage of CNMOs across hospitals, provider settings, and provider types. The use of CNMOs for communicating medication-related information may result in delayed or missed medications, receiving medications that should have been discontinued, or important clinical decision being made based on inaccurate information. Future studies should quantify the implications of these data entry patterns on actual medication error rates and resultant safety issues.

**Key words:** electronic health record, communication, safety, workaround

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### LAY SUMMARY

Communication for non-medication order (CNMO) is a type of free text communication order providers use for asynchronous communication about patient care. We conducted a study analyzing a large sample of CNMOs placed in 6 hospitals to understand the extent to which these non-medication orders are being used for *medication-related* communication. We identified that over 42% of CNMOs contain medication information. We identified large variation in the usage of CNMOs across hospitals, provider settings, and provider types. We also discuss the implications of these usage patterns.

### INTRODUCTION

Communication is critical for safe and effective healthcare delivery, yet communication failures contribute to the majority of sentinel events that occur in hospitals<sup>1</sup> and 38% of malpractice incidents involve miscommunication between providers.<sup>2</sup> The Joint Commission has identified *improving provider communication* as a priority and included it in their 2019 National Patient Safety Goals.<sup>3</sup>

Electronic health records (EHRs) are now ubiquitous, with 99% of large hospitals using a certified EHR.<sup>4</sup> With the increasing use of EHRs in place of face to face communication,<sup>5</sup> it is essential that these technologies support effective communication. EHRs allow

communication via structured (eg, computerized provider order entry [CPOE]) and unstructured pathways (eg, clinician notes). Structured information is highly specified and frequently used to convey information such as allergies, medications, and diagnostic testing. Unstructured information may have a general format, such as a physician's progress note with specific sections each containing free text, or may have very few restrictions on what can be entered, such as free text orders. Communication order is a text field of limited characters that allows the physician to place a computerized order with verbatim text for the nurse to follow. This is not a specific document type like a physician progress note or a nurse triage note. They are stand-alone orders like medication or procedure orders that support asynchronous communication. A *communication for non-medication orders* (CNMOs) is one type of free text communication order used for communication of information not appropriate for structured medication orders. However, anecdotal evidence suggests medication-related information is often included in CNMOs, which can represent a communication workaround and potential EHR usability concerns.

The purpose of this study is to understand the types of information contained in CNMOs, particularly the extent to which CNMOs are being used for *medication-related* communication. This study also seeks to identify whether this prevalence in using CNMOs to communicate medication-related information varies across hospitals, provider settings, and provider types.

## METHODS

We conducted a retrospective analysis of free text CNMOs placed at 6 hospitals on the east coast comprised of 5 clinical settings (ie, Emergency, Inpatient, Outpatient, Ambulatory Service, and Observation). The 6 hospitals are a part of a single health system and have implemented the same large EHR vendor system, with some hospital-level customizations to the EHR. The health system has mix of academic and community hospitals. This study was approved by the health system IRB. We extracted 667 429 free text CNMOs written during 2017, representing 437 128 unique patients. We randomly sampled 26 524 orders for analysis, representing 21 333 unique patients (Rao-soft calculator with error  $\leq 0.99\%$  and confidence level of 99.9%).<sup>6</sup>

Some of the 26 524 CNMOs contained identical text, so we analyzed the contents of the 5574 unique free text strings. We then extrapolated the findings to the full set of 26 524 CNMOs.

We coded each CNMO based on the information categories contained in the text, and each CNMO could contain information related to multiple information categories. Information categories were developed iteratively by 2 coders (DJH and SK) on 50 orders randomly sampled from the entire corpus. Differences in coding of information categories were reconciled through consensus by changing definitions or by merging, deleting, or adding information categories. Disagreements between the 2 coders were resolved by the third coder (AZH). Information categories were finalized after 5 rounds when (1) the coders did not make any changes to categories and (2) when there was an Inter rater reliability of at least 0.8 on a sample of 50 CNMOs. The final codebook included sixteen CNMO information categories. Table 1 details the definitions, inclusion, and exclusion criteria, and example text for each information category.

## RESULTS

Figure 1 shows the prevalence of each information category within the CNMOs. Forty-two percent of the CNMOs contained informa-

tion about medications, despite their intention to be used for *non-medication-related* communication. ADT (admissions/discharges/transfers), protocol, and documentation information were also in the top 4 categories included in CNMOs.

Figure 2 shows the variation in the prevalence of CNMOs containing medication information across hospitals. There was a large range in the total number of CNMOs (1010–9894) and proportion of CNMOs containing medication information (26%–62%) across hospitals. The largest number of CNMOs containing medication information was written at hospital 2 (2942 orders). When normalizing the number of CNMOs containing medication information by the total number of CNMOs written at each hospital, hospital 4 had the highest proportion of overall CNMOs containing medication information (62%), but the lowest total number of CNMOs (1010 orders). Hospital 6 had the lowest proportion of CNMOs containing medication information (26%), but the highest total number of CNMOs (9894).

Figure 3 shows the variation in the prevalence of CNMOs containing medication information across patient settings. Like hospitals, there was a large range in the total number of CNMOs (728–14 994) and proportion of CNMOs containing medication information (15%–62%) across patient settings. The largest number of CNMOs containing medication information was written by providers caring for inpatients (5664). When normalizing the number of CNMOs containing medication information by the total number of CNMOs written in each patient setting, the ambulatory surgery setting had the highest proportion of overall CNMOs containing medication information (62%). The inpatient setting had the lowest proportion of CNMOs containing medication information (15%), but the highest total number of CNMOs (14 994).

The prevalence of medication information in the CNMOs also varied across provider types. Fifty-six percent of CNMOs written by nurses contained medication-related information, compared to 37% for nurse practitioners, 27% for resident physicians, and 21% for attending physicians.

## DISCUSSION

The presence of medication information in free text CNMOs may pose patient safety risks. For example, if “increase argatroban now by 0.1 mcg/kg/min” is entered in a CNMO but not entered as a medication order, a nurse may not see this information or there may be conflicting rates based on the original order. This may either over or under anticoagulate the patient's blood if the nurse or ordering provider is working from different information. Safety risks may also arise when CNMOs are used for other standard CPOE order types, such as diet orders. A CNMO requesting a patient to not eat after midnight for a procedure may leave a diet order in place that triggers delivery of breakfast to the patient, potentially resulting in a delay to a procedure or aspiration risk for the patient.

Our findings point to several avenues of future work. Our method of extracting free text EHR orders, and coding and analyzing those data for patterns proved feasible and useful. We anticipate this methodology could be extended to other scenarios where anecdotal evidence suggests there may be potentially unsafe or inefficient EHR data entry patterns.

While we assessed variation across hospitals, patient settings, and provider types, we do not know if differences in data entry patterns exist across different EHR vendor systems. A comparative analysis of a similar health system using a different EHR could provide insight into the impact of interface design on these patterns.

**Table 1.** Code book

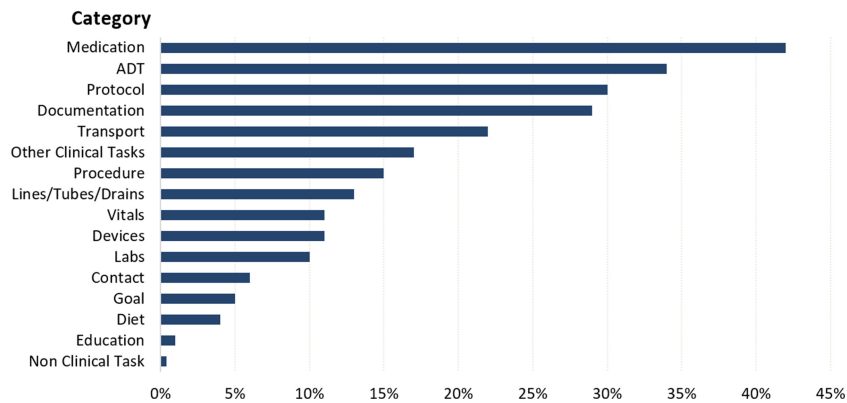
Category	Description	Examples
Medication	Information related to medication(s) INCLUSION: Medication name, modifying medication attribute, confirming/documenting medication administration or intake EXCLUSION: None	<ul style="list-style-type: none"> <li>• “hold heparin”</li> <li>• “give ceFAZolin”</li> <li>• “Confirm if pt took meds”</li> </ul>
ADT	Instructions or information related to admitting, transferring, or discharging patients INCLUSION: Terms such as “discharge,” “d/c,” “transfer,” “go back to floor,” or “leave ICU” EXCLUSION: Phrases referring to movement to or from scans, procedures, etc.	<ul style="list-style-type: none"> <li>• “Patient can be discharge home after PT/OT.”</li> <li>• “Please give patient 1 time dose IV morphine 2 mg an hour prior to d/c or when doing PT, and then regular scheduled dose 8 mg dilaudid prior to leaving so comfortable when traveling. Thank you.”</li> <li>• “Pt to be discharged with indwelling foley catheter”</li> <li>• “The patient can go back to the floor once he meet the PACU discharge criteria”</li> <li>• “Initiate hypoglycemia protocol”</li> </ul>
Protocol	Information about a protocol to be followed INCLUSION: Phrases such as “as per XYZ protocol,” “follow XYZ procedure,” or “as per XYZ rule” EXCLUSION: None	<ul style="list-style-type: none"> <li>• “Initiate hypoglycemia protocol”</li> </ul>
Documentation	Request for information or documentation, recording/changing information in the patient’s chart/EHR, or note instructions INCLUSION: Phrases referring to asking or informing about status post-procedure/therapy, requesting information from the patient, or requesting documentation or confirmation EXCLUSION: None	<ul style="list-style-type: none"> <li>• “Pls get records from xxx hospital”</li> <li>• “pls confirm allergy”</li> <li>• “pls document all episodes of hemostasis”</li> <li>• “Confirm if pt took meds”</li> </ul>
Transport	Introductions, clarification, and requests for patient transportation INCLUSION: Phrases referring to actual patient movement such as “pt to xray,” “pt to OR,” “pt can go off floor,” “pt to be discharged/meets d/c criteria” EXCLUSION: None	<ul style="list-style-type: none"> <li>• “Move pt to xray”</li> <li>• “pt can go off the floor without tele”</li> </ul>
Other clinical tasks	Permission or instructions for clinical procedures (not covered by L/T/D; Labs; Imaging; Medication; Transportation; Medical Device) INCLUSION: Phrases referring to activities such as dressing wounds, neuro checks, observations, or terms related to patient care activities such as “walking pt,” “cleaning pt,” etc. EXCLUSION: None	<ul style="list-style-type: none"> <li>• “Please clean forehead”</li> <li>• “Pls walk patient”</li> <li>• “Bladder scan”</li> <li>• “pt to wear mask out of room</li> <li>• “transfer 1 uprbc”</li> <li>• “read chart”</li> <li>• “no q1hr neuro checks”</li> <li>• “going for colonoscopy”</li> <li>• “pt ok for PT/OT eval”</li> </ul>
Procedure	Information about procedures or instruction before a procedure INCLUSION: Phrases referring to blood transfusions, PT/OT evals, colonoscopies, surgeries, or therapies (OT, speech, etc.) EXCLUSION: None	<ul style="list-style-type: none"> <li>• “going for colonoscopy”</li> <li>• “pt ok for PT/OT eval”</li> </ul>
Lines/tubes/drains	Information about lines, tubes, or drains INCLUSION: Phrases such as “IV,” “IV Meds,” “NG tubes,” other tubes, “Foley,” “drains,” “drips,” “arterial/central/peripheral lines,” etc. EXCLUSION: None	<ul style="list-style-type: none"> <li>• “Ok to use central line”</li> <li>• “D/C arterial”</li> <li>• “Restart insulin drip”</li> <li>• “NG tube to suction prior to starting CPAP”</li> </ul>
Vitals	Information about patient vitals, instructions to skip taking vitals, or discontinue monitoring INCLUSION: Phrases referring to taking or skipping vital sign(s), including terms such as “weight,” “blood pressure,” or “height” EXCLUSION: None	<ul style="list-style-type: none"> <li>• “rectal temp”</li> <li>• “daily wt”</li> <li>• “pt can go off the floor without tele”</li> </ul>
Devices	Information about medical devices, patient aides that are internal/external to the patient INCLUSION: Phrases referring to tele-monitoring, pacemakers, pumps, pulse-ox, walkers, or wheelchairs EXCLUSION: None	<ul style="list-style-type: none"> <li>• “LVAD speed changed from 9200 to 9400 RPM at the bedside by Dr XXXX at XXXX”</li> <li>• “OK to go to dialysis, off tele”</li> <li>• “Platform walker”</li> </ul>
Labs	Clarification or instructions related to lab tests or imaging INCLUSION: Phrases such as “Xray,” “radiology,” “CT/MRI,” “Echo/EKG,” “BNP,” “CBC,” “blood draws,” “blood sugar (accu check),” or just labs EXCLUSION: None	<ul style="list-style-type: none"> <li>• “Please clean forehead and do accu check”</li> <li>• “Move pt to xray”</li> </ul>
Contact	Information about contacting or calling another provider, or asking for information from patient INCLUSION: Phrases such as “page,” “phone,” “call,” “contact,” or any other terms implying a communication from 1 person to another. Includes phone number, email, etc. EXCLUSION: Terms such as “as per Dr X said this. . .”	<ul style="list-style-type: none"> <li>• “page DR XXX XXX”</li> <li>• “call MD”</li> </ul>

(continued)

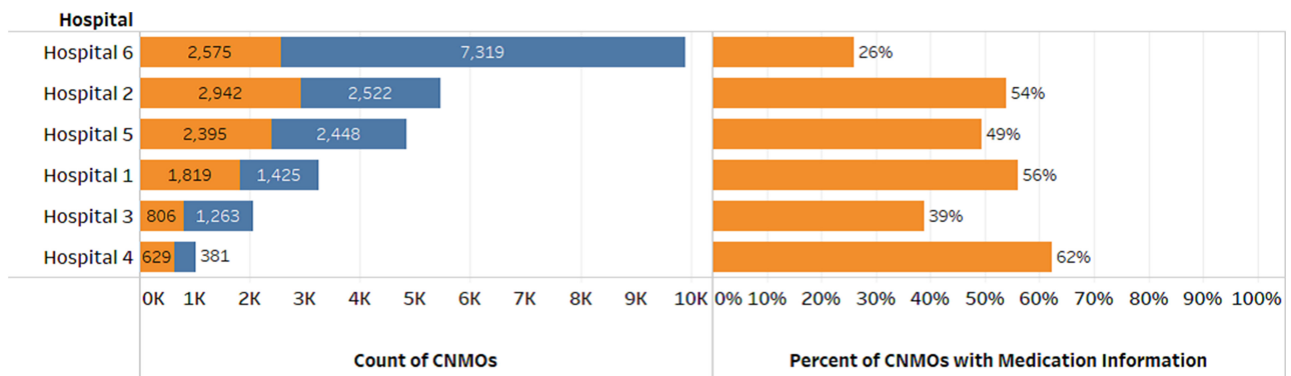
**Table 1.** continued

Category	Description	Examples
Goal	Phrases referring to clinical goals for the patient INCLUSION: Explicitly states a numerical value or patient status to be achieved and/or includes the terms “goal,” “target,” etc. EXCLUSION: Reference to abnormal values (eg, hypertension)	<ul style="list-style-type: none"> <li>• “Goal oxygen sat &gt;88%”</li> </ul>
Diet	Phrases referring to patient food, fluid, diet INCLUSION: Phrases referring to “PO,” “NPO” or “Diet” or items surrounding food, fluid intake. Or, “diet related” activities such as an “order snacks” EXCLUSION: Information about lines/tubes/drains pertaining to diet but does not explicitly mention diet; code only as “Lines/Tubes/Drains.” Example: “NG tube to suction prior to starting CPAP”	<ul style="list-style-type: none"> <li>• “small sips of liquid”</li> <li>• “PO challenge”</li> </ul>
Education	Information about patient education or requesting patient education INCLUSION: Phrases such as “educate,” “inform patient,” “teach,” etc. in reference to the patient EXCLUSION: Terms above but directed toward clinical staff	<ul style="list-style-type: none"> <li>• “pls teach pt about diabetics”</li> </ul>
Non-clinical task	Permission or instruction about issues outside of direct patient care INCLUSION: confirmation/ permission for tasks outside patient care EXCLUSION: None	<ul style="list-style-type: none"> <li>• “Spouse can meet pt outside visiting hours”</li> <li>• “pt can use own shoes”</li> <li>• “Ok to wear sweater”</li> </ul>

*Abbreviations:* ADT, admission/discharge/transfer; BNP: Brain natriuretic peptide; CBC: Complete blood count; CPAP: Continuous positive airway pressure; CT: computed tomography; EHR: electronic health record; ICU: intensive care unit; LVAD: left ventricular assist device; MRI: Magnetic resonance imaging; NG: nasogastric; NPO: nil per os (nothing by mouth); OR: Operating Room; OT: Occupational therapy; PACU: Post-Anesthesia Care Unit; PO: per os (by mouth); PT: patient or physical therapy; IV: Intravenous.

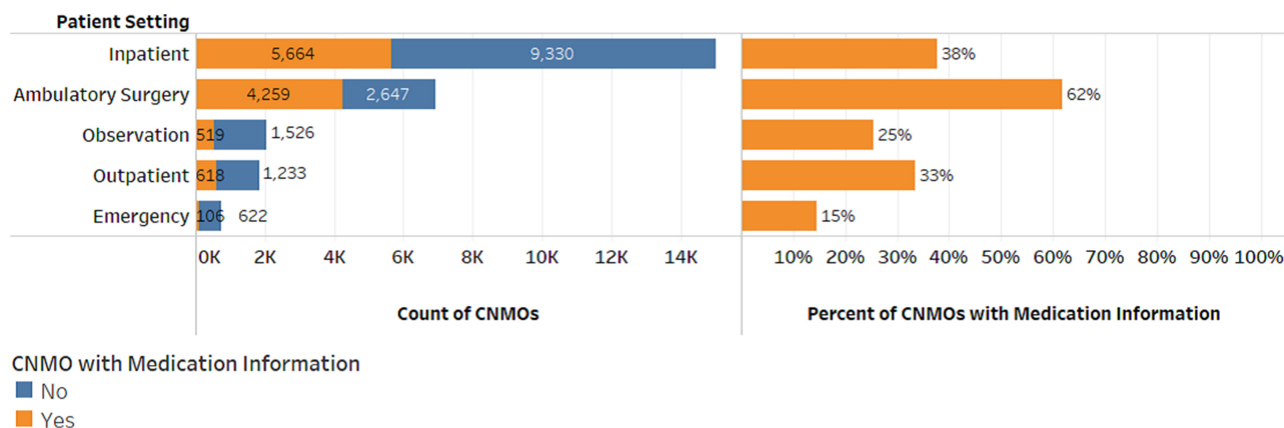


**Figure 1.** Prevalence of information categories included in free text communication for non-medication orders. *Abbreviation:* ADT: admission/discharge/transfer.



**CNMO with Medication Information**  
■ No  
■ Yes

**Figure 2.** Variation in the use of CNMOs for medication information across hospitals. *Abbreviation:* CNMO: communication for non-medication order.



**Figure 3.** Variation in the use of CNMOs for medication information across patient settings. *Abbreviation:* CNMO: communication for non-medication order.

Our findings suggest a need for a robust qualitative analysis to better understand why standard EHR medication orders do not appear to be adequate for communicating medication information. Our initial hypotheses from the note contents are that standard EHR medication orders may be cumbersome or lack some necessary functionalities. For example, 1 free text CNMO asked nurses to cancel the third and fourth runs of potassium as they had an updated lab result for potassium. Canceling part of an order is not supported well in the EHR standard medication orders, so the ordering provider may have used the CNMO as a necessary workaround. The example above creates a potential risk for a commission error, with the patient receiving unnecessary medications. This qualitative analysis must also account for the varied impact of hospitals, patient settings, and provider types on these note entry patterns. The variability in our data may be a reflection complex socio-technical issues and differences in factors such as organizational policies and procedures, patient loads, workflows, communication needs, and local EHR customizations. For example, some CNMOs are used to provide explicit instruction about medication administration, such as, “give medication on call to MRI/operating room” or “give medication A then medication B to prevent side effects”. Another example included holding continuous drip medications instead of discontinuing the order. If the order was canceled, then the remaining medication would have to be thrown out or returned to pharmacy per policy which could result in a delay of restarting the medication if the patient’s condition changed acutely.

The large number of CNMO orders written by nurses may reflect standing nursing protocols and physician initiated verbal orders. Because of these differences, interventions that address the appropriate use of CNMOs will likely need to be tailored to organizations, settings, and providers.

Many studies have identified unintended consequences due to the use of EHRs<sup>7,8</sup> and clinicians may not be aware of the unintended consequences or errors associated with using the EHR in ways it was not designed for.<sup>9</sup> The use of CNMOs for communicating medication-related information has potential patient safety implications, but future studies should attempt to quantify the implications of these data entry patterns on actual medication error rates and resultant safety issues. We hypothesize that this unintended use of CNMOs may result in delayed or missed medications, receiving medications that should have been discontinued, or important clinical decision being made based on inaccurate information. Additionally, EHR features such as decision support, allergy alerts, and medication

interactions typically do not review free text content, creating a significant safety hazard. It would be useful to know the scale and types of the consequences associated with this use of CNMOs.

This study is limited in its analysis of 1 year of data from 1 EHR in a single healthcare system and lack of individual chart review for each CNMO containing medication information. However, this work details a valuable method for understanding EHR data entry practices and brings to light an EHR data entry patterns with potential patient safety implications.

## FUNDING

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## AUTHOR CONTRIBUTIONS

All authors conceived of and designed the study. SK and DJH extracted the data. SK, DJH, and AZH developed codebook. SK analyzed the data and drafted the manuscript. All authors made critical manuscript revisions and approved the final version for submission.

## CONFLICT OF INTEREST STATEMENT

None declared.

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