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Mislabeled out-of-hospital patient care records during transitions of care: a quality improvement intervention using root cause analysis (RCA) in an EMS system

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ABSTRACT

INTRODUCTION: Out-of-hospital emergency care has developed dramatically and grown more complex in the last decade. Transfer of care between out-of-hospital clinicians and the emergency department (ED) staff drives the connection to the healthcare system. Across the US, this process is highly variable and not standardized, which may lead to adverse events. The purpose of this quality study is to identify the cause of mislabeled EMS patient care reports in an EMS agency and develop an intervention to reduce the rate of mislabeled patient care reports.

MATERIALS AND METHODS: This quality improvement study follows the model for improvement process, using PDCA cycles and root cause analysis, and used the two-sample unmatched Wilcoxon rank-sum to test for differences in the number of mislabeled records after intervention implementation.

RESULTS: Before the intervention, the receiving facilities identified a total of 75 mislabeled ePCR. After implementation of the facility code changes, the receiving facilities identified a reduction in the number of mislabeled ePCRs received from Agency E, from 37 in January to 14 in April. This change represents a 37.83% (z=-10.583, p=0.000) reduction in the number of mislabeled ePCRs, although the EMS Agency E still accounts for the largest proportion of mislabeled records with more than 70%, even after the intervention.

CONCLUSIONS: A considerable number of mislabeled records (65%) remain unexplained by the technological factors identified in the PDCA Root Cause Analysis approach. Other factors, including human factors and other technological factors not addressed in this study, which may require validation rules, may still be contributing to mislabeled EMS records.

KEY WORDS: Patient safety, emergency medical services, clinical protocols, documentation.

INTRODUCTION

Problem description

A jurisdictional emergency medical service (EMS) agency regularly transports patients to a hospital that has both a pediatric and an adult emergency department and mislabels the patients' electronic patient care record which results in this record not being available to medical staff at the receiving facility after transfer of care is completed and the EMS unit has left the facility.

Available knowledge

Out-of-hospital emergency care has developed dramatically in the last decades, grown increasingly complex, and requires a significant amount of interconnected resources to respond to medical and trauma emergencies [1-5]. Access to these services requires a designated emergency number (e.g., 112 or 911), and connects people with community care, care in route to a destination and care upon arrival to the destination, including continuity of care during the patient's hospital stay. Transfer of care between out-of-hospital clinicians and the emergency department (ED) staff drives the connection to the healthcare system. Across the US, this process is highly variable and not standardized, which may lead to adverse events [6-8]. A key component of this transfer of care process involves a written patient care report (PCR). The PCR provides all the minimum key information needed for patient care and should be available to clinical personnel taking over patient care [9]. In many health systems, the PCR is a paper-based report shared with ED staff, while in others it is an electronic patient care (ePCR) report shared electronically with clinical and administrative staff at the ED [7,10,11]. During this transition process, any documentation errors in out-of-hospital emergency care can have a significant impact on healthcare quality, can impede efficient continuity of care, and can delay critical patient information [12-13]. Most of our attention to documentation errors gravitates around clinical processes (e.g., medication errors, patients' vital signs), but not making the PCR/ePCR itself available to ED staff at the destination can be considered a form of documentation error [9,14].

The availability, accuracy, and timeliness of patient information can make the difference between appropriate and timely care and care delays associated with adverse health outcomes [15,16]. Improvements in patient safety are well documented in the hospital setting. In contrast, research on patient safety in the out-of-hospital field is limited [11,17-20]. Out-of-hospital emergency care is a complex field where a mix of high-risk activities are routine. Given the level of complexity and high risk involved, there are important implications for patient safety and associated adverse events [17]. The prevalence of adverse events in the out-of-hospital setting among patients suffering from life-threatening conditions is higher, compared with lower-acuity patients, and are associated with deviations from clinical protocols and missing, incomplete out-of-hospital documentation, data mapping problems, or documentation delays [14,17,18,21]. Verbal reports without a substantiating written report are not conducive to appropriate and safe transitions of care between out-of-hospital and hospital clinicians [22-24].

The transformation of out-of-hospital care from an emergency-only service perspective into an integrated function of not only emergency care, but critical and primary care as well, highlights the need for greater scrutiny on patient safety issues [25]. Accurate and timely documentation of patient care in the out-of-hospital setting enhances continuity of care, promotes quality care practices and is useful in identifying potentially inappropriate field interventions [26,27].

Rationale

Hospital staff have access to the ePCR reports completed and submitted by EMS agencies that transport patients to their ED. The hospital has a unique code that identifies them in the EMS ePCR system. As EMS clinicians complete their ePCR, they add the hospital's code receiving to their report, submit, and send it to the hospital portal. Hospital ED staff can then use the ePCR for decision-making as they continue medical care and integrate the report into the patients' hospital medical record. The hospital assigned the ED charge nurse to manage this workflow in both the adult and pediatric EDs, completed a review of mislabeled ePCR records and identified one EMS agency accounted for most of these records. The charge nurse noted that many ED patients transported by EMS did not have their corresponding ePCR in the hospital portal. After reviewing both hospital ED portals, the charge nurse identified ePRC reports for patients in one ED (e.g., pediatric) labeled as being transported to the other ED (e.g., adult). For the ePCR to reflect the correct receiving facility code, the charge nurse reached out to the EMS system that transported the patient and requested them to change the hospital code on the ePCR. Individual charts had to be corrected, a very time-consuming process necessary to review reports to identify and correct any errors.

The hospital worked with the EMS agency to identify the cause(s) of mislabeled ePCRs and realized the problem was not specific to individual clinicians or EMS. The EMS agency had also reinforced messaging to their personnel on correct destination coding, without any significant improvement. Furthermore, both receiving adult and pediatric hospitals had placed signage with hospital numbers displayed at the EMS entrance to their corresponding ED in the past without noticeable improvement either.

Specific aim

The aim of this quality improvement study is to identify the cause for the mislabeled EMS patient care reports in the target jurisdiction (Agency_E) and develop an intervention to reduce the rate of mislabeled patient care reports.

MATERIALS AND METHODS

Context

This quality improvement study follows the model for improvement process, using PDCA cycles and root cause analysis, using mislabeled EMS patient care reports between February through December of 2020. The setting is an urban EMS system that transports patients to a level 1 trauma hospital in the US, with both a pediatric and an adult emergency department.

The study followed the Squire 2.0 guidelines for quality improvement reporting [28]. The study used the two-sample unmatched Wilcoxon rank-sum to test for differences in the number of mislabeled records after the intervention, where Agency_E received the intervention compared with all other “Agencies”, which did not receive the intervention.

Interventions

The study group reviewed a random sample of five (5) incorrectly coded ePCRs from Agency_E between February through December 2020 to review the processes associated with ePCR submission to hospital portals and identify the cause of the mislabeled ePRCs. The final sample included the following variables from each selected PCR:

1) Date/Time Unit Notified by Computer-Aided Dispatch (CAD)
2) Incident number
3) ePCR number
4) EMS Agency Name (Agency)
5) Unit Call Sign (Unit number)
6) Destination Transferred to, Name (hospital name)
7) Destination Transferred to, Code (hospital code)

Using a quality improvement approach based on Root Cause Analysis (RCA), the study mapped the process followed to capture call information and integrate it into the PCR (Figure 1). The study group also created a fishbone diagram to consider all the potential causes of mislabeled ePRCs, including those already addressed by the hospital and EMS agencies (Figure 2).

Based on the mapped process and using PDCA cycles, the study group focused first on step number nine (#9, EMS unit completes and submits ePCR), addressing human and physical/site factors potentially associated with mislabeled records (Figure 2). The team reviewed the layout associated with different devices potentially being used to complete and submit PCRs (e.g., computer vs. tablet) that may affect the visual appearance of the drop-down menu clinicians click to select the destination. The team confirmed the drop-down menu offers clinicians a full few of the hospital names along with their corresponding codes. The team continued to Step eight (#8) and determined that previous attempts at educating ED and EMS clinicians had addressed this factor. The team then proceeded to steps five-seven (5-7) and three-four (3-4), addressing technological and human factors potentially associated with mislabeled ePCRs, respectively. The team reviewed information collected at the time of dispatch (steps 3 and 4) and manually explore the background coding that is fed from the initial call information from dispatch automatically into the PCR (steps 5-7). The team confirmed that the EMS clinicians notified dispatch of the destination facilities accurately in the selected calls, which eliminated steps three and four from our list of potential causes of mislabeled records.

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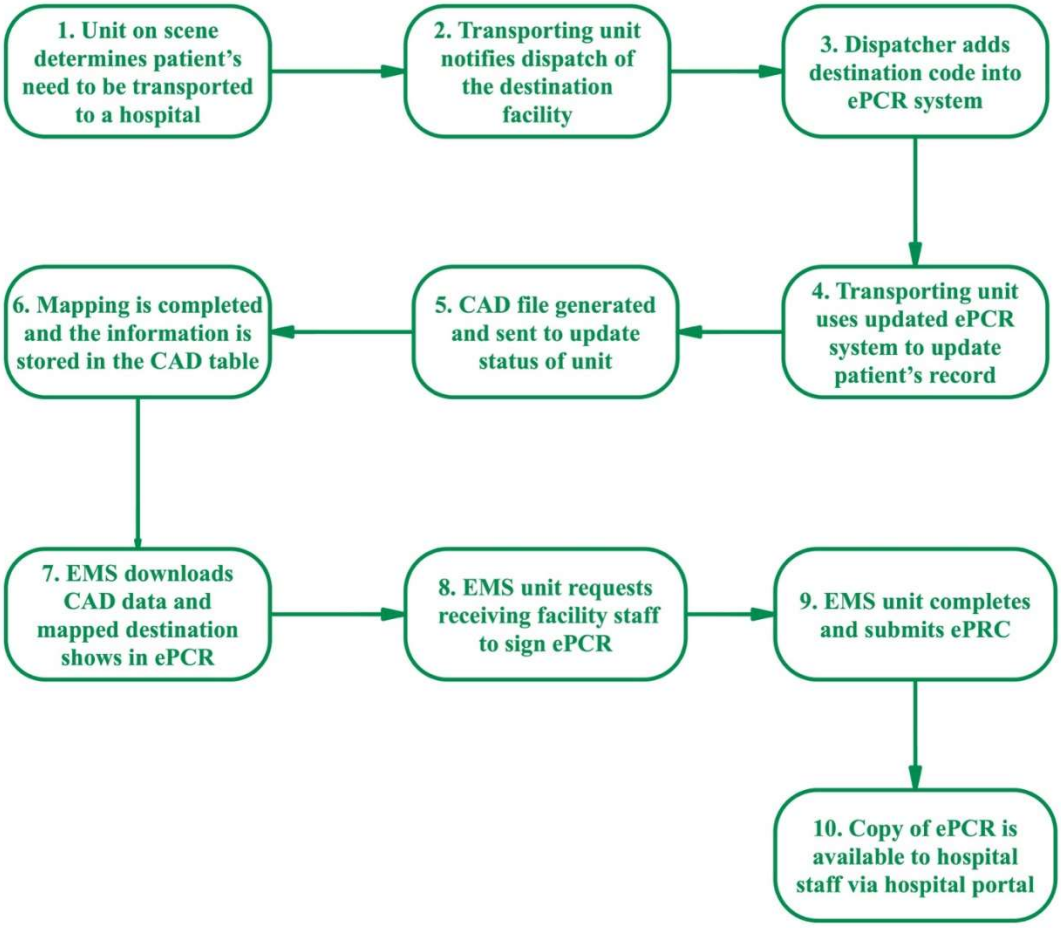

Figure 1. Process mapping for Patient Care Reports (PCR).

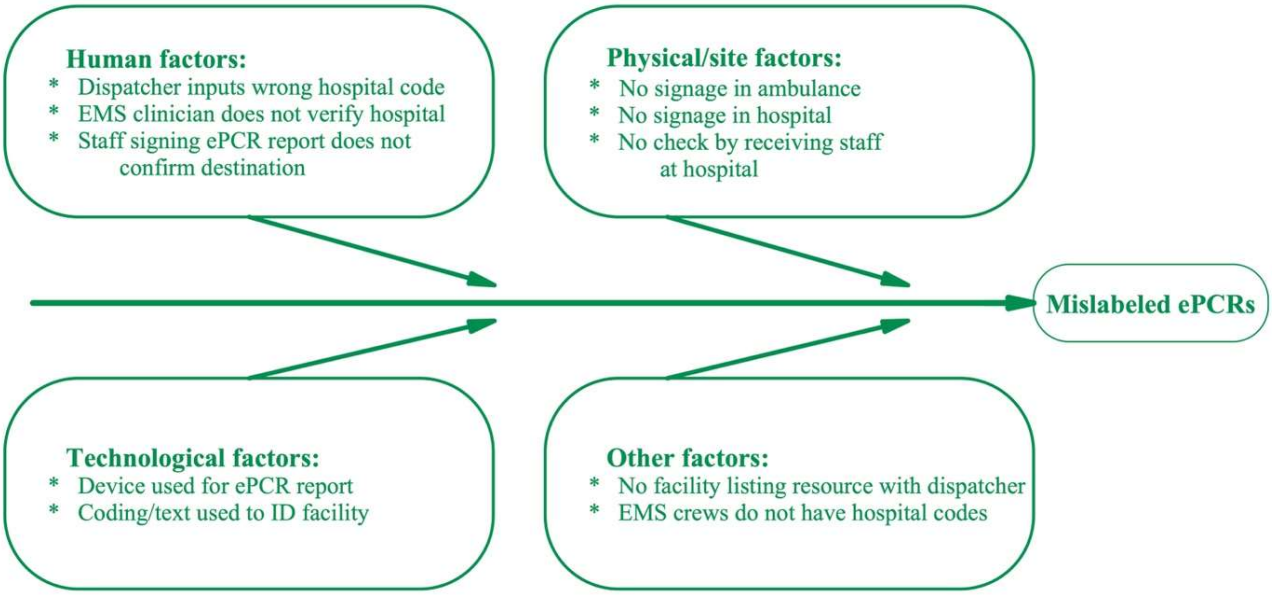

Figure 2. Cause-and-effect diagram for miscoded PCRs.

The next step included a detailed review of the background coding used to link dispatch information and the ePCR system (Figure 3). This coding procedure documents information captured by dispatch, from the call itself (911 call) and from the EMS clinician on scene. In step #5, a computer-aided dispatch (CAD) file with all the dispatch information, including agency, unit number and identifier, response times, and destination facility, is prepared and sent to a third party, who manages the ePCR system. This third party matches the dispatch information, including destination facility, with a list provided by the EMS agency's regulatory body, to ensure the data are consistent and accurate. Once matched, the third party sends the information back to be uploaded directly into the ePCR (steps 7 and 8).

Upon review of the sampled records, the team found that all ePCRs had the correct facility code. This facility code is shared with an electronic health record (EHR) vendor that helps the agency map the code on file with the code provided by the regulatory agency. The team then compared the facility code records from the vendor and the regulatory agency to ensure both lists matched and found that hospitals had facility codes switched and, therefore, did not match.

This potentially explained why the completed and uploaded ePCR had the incorrect facility code and why these ePCRs went to the wrong hospital portal. When the EMS unit notified dispatch which facility should be marked as the destination facility, dispatch correctly included this facility code in their CAD file (step 5). But when the vendor matched the file (step 6), it assigned a different facility code and then returned that CAD file back for it to be uploaded into the unit's ePCR (step 7). The team corrected the vendor destination facility code file and made it consistent with the agency's destination facility code file. Once this step was completed, information was collected for two months and check for changes in the number of mislabeled ePCRs.

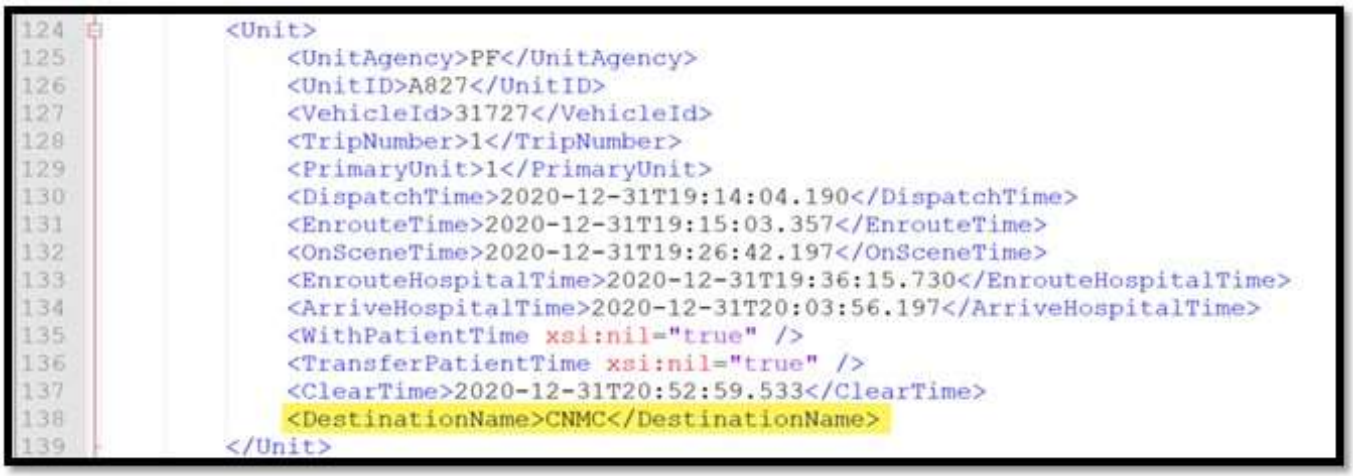

Figure 3. 911 call information-coding structure.

RESULTS

The change to the facility code lists were completed in February. After identifying and correcting the facility code data on the lists, the team followed up EMS transports to both hospitals for a period of two months. The results are included in Table 1.

	Month				
	January	**February**	**March**	**April**	
Agency	No (%)	No (%)	No (%)	No (%)	**Total**
E ±	37 (38%)	33 (34%)	13 (13%)	14 (14%)	97
X †	4 (27%)	1 (7%)	6 (40%)	4 (27%)	15
Total	41	34	19	18	112

± Test † Control

Table 1. Number of EMS transports with mislabeled ePCRs, by EMS agency and month.

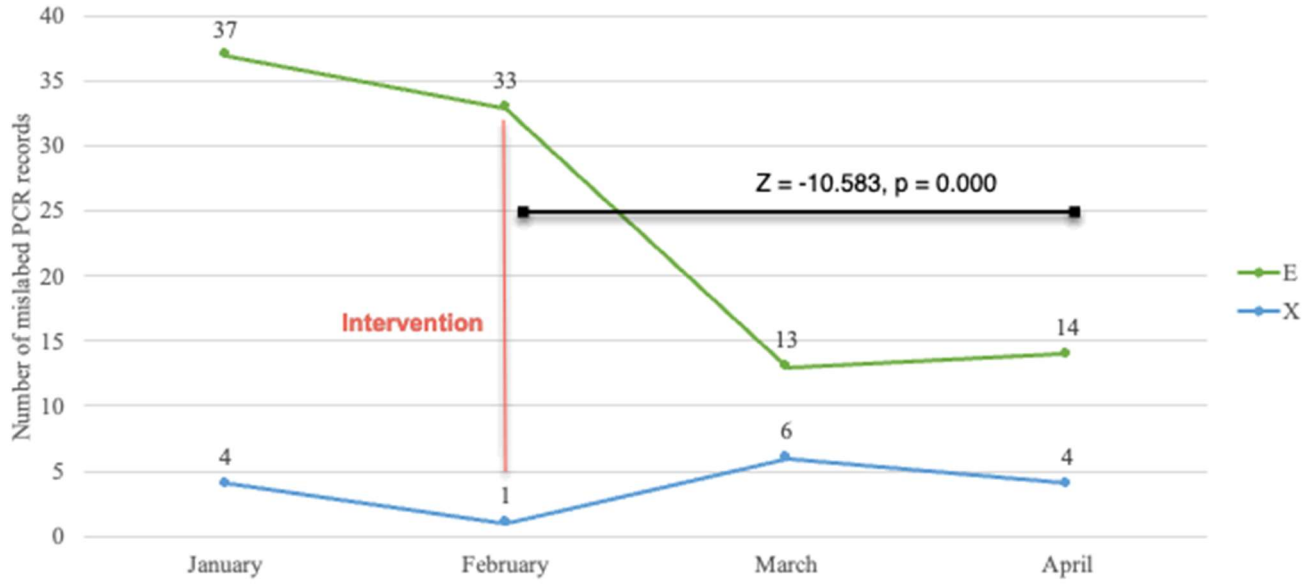

Figure 4. Number of miscoded patient care records, by Agency and month.

In January and February there were a total of 75 mislabeled ePCR. After implementing the intervention, the team identified a total of 37 mislabeled ePCRs, 27 (73%) of which were tracked to agency E and 10 (27%) to agency X. Agency E showed a reduction in the number of mislabeled ePCRs, from 37 in January to 14 in April, representing a 37.83 % reduction in the number of mislabeled ePCRs in agency E, after the facility code change (z=-10.583, p=0.000). Mislabeled reports from agency X remained virtually unchanged at the end of the study period, with an average of 3.7 mislabeled reports per month, compared with 24.5 from agency E (Figure 4).

DISCUSSION

Even though the reduction in the number and rate of mislabeled PCR records documented by the hospital resulted from the updates on the facility code mapping, in both April and March, agency E accounted for 65% and 78% of all mislabeled ePCRs. This means that there causes of mislabeled records that are not explained by the technological factors identified in the PDCA-RCA approach. EMS Agency E still accounts for the largest proportion of mislabeled records, more than twice compared with agency X.

One potential area that the was not addressed by our study is related to what are called validation rules, which are specific rules and criteria programmed within the ePCR system itself that ensure ePCR data are entered accurately and in compliance with local, state, and federal guidelines and requirements. These rules can require specific values or disallow certain values to be entered or recorded, provide visual indicators that specific fields are missing or incorrectly entered, or require clinicians to review data before it is submitted and finalized. This is one technological aspect the RCA did not consider as a potential cause and should be explored in the future.

Both the hospital and EMS agency staff had already attempted solutions prior to this study, with no effect on mislabeled ePCRs, including signs at both hospitals indicating which facility code corresponded to each hospital, as well as EMS clinician education. This lack of success underscores the importance of selecting interventions that have shown to be effective, and contexts that support the intervention(s) implementation and are connect theoretical mechanisms and the implementation outcomes.

Lastly, the study's PDCA cycles relied on assumptions of root causes potentially associated with the outcome, which were a direct result of brainstorming sessions between hospital staff, EMS agency staff, and the research team. These potential root causes may not have captured other causes relevant to field operations and clinical care. This process could have benefited by seeking active, full-time EMS clinicians who understand current field practices.

Limitation

This quality improvement study has several important limitations. First, our sample of mislabeled PCRs is small, particularly from Agency X, which represented several EMS Agencies. This also limits our ability to identify other factors associated with mislabeled PCR records.

Secondly, the intervention implementation timeframe was small and prevented us from trending the data. In addition, our data collection included only a limited number of PCR variables and did not allow us to identify other operational or clinical trends that may be contributing to mislabeled PCRs. Given that we limited PDCA cycles to those associated with process mapping of PCRs, we were not able to explore cause-and-effect factors in other areas of EMS clinical field operations.

CONCLUSIONS

Despite the success of the intervention in reducing the overall number of mislabeled ePCRs, a considerable number of mislabeled records remain unexplained by the technological factors identified in the PDCA-RCA approach. Other factors, including human factors and other technological factors not addressed in this study, including validation rules, may still be contributing to mislabeled EMS records.

SUPPLEMENTARY INFORMATION

Funding: *No fund was received related to this study.*
Institutional Review Statement: *The study was conducted according to the guidelines of the Declaration of Helsinki.*
Informed Consent Statement: *Informed consent was obtained from all subjects involved in the study.*
Data Availability Statement: *The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.*
Conflicts of Interest: *The authors declare no conflicts of interest.*

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