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Quality of Physician Care Coordination During Inter-Facility Transfer for Cardiac Arrest Patients

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Abstract

Aim—We sought to evaluate whether the quality of coordination between physicians transferring comatose cardiac arrest survivors to a high-volume cardiac arrest center for targeted temperature management (TTM) was associated with timeliness of care.

Methods—We conducted a retrospective analysis of inter-facility transfers to Vanderbilt University Medical Center for TTM between October 2016 and October 2018. We examined the relationship between Relational Coordination (RC) – a measure of communication and relationship quality – during phone conversations between transferring physicians and time-to-acceptance.

Results—We identified 18 patients meeting criteria. TTM was initiated or continued in 72%, and in-hospital mortality was 75%. Median time-to-acceptance was 2.77 (interquartile range [IQR] 2.0, 4.1) minutes, and duration of calls was 3.95 (IQR 2.7, 5.2) minutes. Interrater reliability for

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overall RC was high ($\rho=0.87$). The correlation between RC and the time-to-acceptance was significant in univariate analyses (adjusted relative risk=0.96, 95%CI 0.93, 1.0, $p=0.05$). Secondary analyses did not find a significant relationship between RC and timeliness measures.

Conclusion—In this sample of patients transferred for TTM, we found that RC as a measure of care coordination, was reliable. Higher quality care coordination for cardiac arrest survivors was associated with faster physician acceptance. Future work using a larger cohort should explore if higher RC among a broader set of stakeholders (physicians, EMS, families, etc.) is associated with timeliness measures after adjusting for other factors, to better understand how the quality of care coordination impacts timeliness of care and patient outcomes.

INTRODUCTION

Despite advances in regional systems of care, out of hospital cardiac arrest (CA) remains associated with high mortality.¹ Targeted temperature management (TTM) improves survival in comatose CA survivors² and the 2015 American Heart Association (AHA) guidelines recommend TTM in comatose adult patients with return of spontaneous circulation (ROSC) after CA.³ While the optimal timing remains unclear, target temperature was achieved within 4–8 hours post-ROSC in clinical trials demonstrating benefit with TTM.⁴ Studies have also linked delayed TTM with increased mortality and less favorable neurologic outcomes.^{5–7} In light of evidence that high-volume centers have better outcomes for CA survivors, the AHA recommends regionalization, with patients transferred to high-volume, regional cardiac resuscitation centers via established clinical pathways, and there is support for use of a quality metric measuring door-to-TTM.^{8,9}

High quality care coordination is often recognized as essential to regionalization efforts, yet research is needed to characterize and measure the quality of the coordination, especially in real-time during high-risk events. More specifically, how the quality of patient handoffs between transferring and receiving physicians influences timeliness and clinical outcome measures remains understudied. Instead, prior studies have examined involvement in a hospital network as a proxy for more relationship quality, without examining the content and quality at an individual case level.^{10,11}

Relational Coordination (RC) is a validated measure that provides a framework for measuring the quality of care coordination across settings. The Agency for Healthcare Research and Quality recognizes RC to guide development, implementation, and evaluation of care coordination interventions.¹² RC is comprised of 7 measures assessing communication (frequency, timeliness, accuracy, problem solving) and relationships (respect, knowledge sharing, shared goals). More broadly applied to healthcare, higher RC is associated with improved patient outcomes, higher quality of care, and reduced medical intensive care unit length of stay.^{13–16} In this study, our objective was to use RC to evaluate the quality of coordination between physicians transferring comatose CA survivors to a cardiac arrest center for TTM at the time of transfer and its relationship with timeliness. We hypothesized that higher quality coordination would be associated with shorter time-to-acceptance durations.

METHODS

Setting

This study was conducted at Vanderbilt University Medical Center (VUMC), a quaternary academic medical center in Nashville, TN that provides comprehensive cardiovascular care for middle Tennessee including 24/7 interventional cardiac catheterization services and TTM to patients with CA using a standardized TTM protocol.¹⁷ A “CODE ICE” protocol was initiated following a phone conversation between transferring and receiving providers. To our knowledge, no additional regional TTM centers were in existence during the study period. Further, no pre-existing auto-accept policy was in place for these patients.

Data Collection

We conducted a retrospective analysis of inter-facility transfers to VUMC for the “CODE ICE” protocol for patients transferred from non-VUMC emergency departments (EDs). We included transfers between October 2016 and October 2018 that had a complete phone call between the outside transferring and VUMC accepting physician, capturing the entirety of dialogue between the two clinicians. Calls were audio recorded with participant knowledge as part of existing operational practices and stored using Encore® Recording Software (DVSAnalytics, Scottsdale, AZ), a cloud-based web application that timestamps conversations. We obtained patient demographic, clinical (e.g., downtime, comorbidities, ROSC), and operational (e.g., length of stay) data retrospectively through the electronic health record, which also contains transferring center medical records. Patients with missing or incomplete physician calls were excluded, as were CA patients going to the cardiac catheterization laboratory for primary percutaneous coronary intervention (PCI) as these were identified separately as part of the STEMI pathway rather than the CODE ICE pathway. The CODE ICE pathway specifies that patients without ST-elevation be transported distinct from the STEMI pathway. The STEMI pathway differs from CODE ICE in that it involves auto-acceptance of patients, whereas transfer of CODE ICE patients is dependent upon a physician conversation and subsequent acceptance prior to transfer. Of note, patients who subsequently underwent PCI later in their hospitalization were not excluded. We also excluded patients who were transferred from non-ED settings (e.g., hospital ward) in order to standardize the pre-VUMC care setting. While potential transfers for emergency medical conditions were accepted, these accepted transfers may not be completed if the patient was too unstable or there was no bed capacity. We only included complete transfers so that we could obtain outcome data for this population. Data were stored in a REDCap database,¹⁸ and this study was approved by the VUMC IRB.

Two abstractors independently scored each call using a standardized scoring guide (Supplemental Figure), which was piloted prior to use, and a total of three abstractors (KM, TJV, MJW) participated in the study.¹⁶ The RC instrument was adapted for use in these calls. Abstractors piloted five calls outside of the study inclusion dates prior to use of included studies. Scores for each dimension ranged from 1 to 100 with 1 being a poor score and 100 being an excellent score. Consistency in scores across the raters was assessed with Spearman correlations. Scores from each rater were summed and then averaged for each

dimension and to calculate an overall score. There were 7 overall dimensions with a possible maximum score of 700.

Descriptive statistics were computed for demographic, transferring facility, and phone call RC characteristics. The primary outcome of interest was duration from initiation of the conversation between physicians until transfer acceptance, defined as the time at which the accepting physician clearly verbalized willingness to accept the patient. This outcome was chosen over broader timeliness measures because it is more directly influenced by the content of the call. Secondary outcomes included total transferring ED length of stay (LOS); time from initiation of phone call to goal temperature (36°Celsius); initiation or continuation of TTM; and in-hospital mortality. 36°Celsius was used based on studies showing that lower goal temperatures do not confer benefit.¹⁹ The association of the time-to-acceptance interval with RC was modeled using univariate quasi-Poisson models with a log-link. Additional univariate analyses included subject presentation to the transferring ED during weekday hours, whether the transferring ED was a part of the existing VUMC STEMI network, and the number of CODE ICE transfers from the transferring ED in the year prior to arrival.

RESULTS

We identified 18 patients that met inclusion criteria. Patient characteristics and time intervals are summarized in Table 1. Four of the patients included presented from facilities in pre-existing STEMI network, and five patients arrived from rural facilities. TTM was initiated or continued in 72%, and in-hospital mortality was 75%. Median time-to-acceptance was 2.77 (interquartile range [IQR] 2.0, 4.1) minutes, and the duration of calls was 3.95 (IQR 2.7, 5.2) minutes. On a scale of 0 to 700, mean overall RC was 492 (IQR 408,525). Interrater reliability for overall RC was high ($\rho=0.87$, Table 2). The correlation between overall RC and the time-to-acceptance was significant in univariate analyses (adjusted relative risk=0.96, 95% CI 0.93, 1.0, $p=0.05$) but not significant ($\rho=-0.098$, $p=0.7$) after adjustment. In other words, for every 10-point increase in RC, the time to acceptance decreased by 4%. Other dimensions of RC significantly associated with time-to-acceptance included Timely Communication, Accurate Communication, and Problem Solving (Table 3). Secondary analyses did not find a significant relationship between RC (overall and individual dimensions) and other time intervals (Conversation Complete-to-ED Exit, ED length of stay, ED Arrival-to-VUMC Arrival).

DISCUSSION

High quality care transitions of CA survivors to high-volume centers is recognized as an essential characteristic of timely and safe transfers, yet little is known about physician handoffs for these cases. Prior research has examined inter-facility relationships at the facility-level, but not at the level of individual events.^{10,11} Our data show that even with regionalization and a well-developed TTM pathway, there is still significant case-by-case variation that is at least partially explained by the quality of transfer communication. This study takes a novel approach to measure physician coordination during these transfers by using the content of the transfer call. In doing so, we show how existing data (e.g., recorded calls) may help reveal a more nuanced understanding of in situ coordination. Specifically,

we found transfer calls can be used to construct a reliable measure of care coordination. Such measures are necessary to understand the relationship between care coordination and patient outcomes, particularly for vulnerable populations, and provide opportunities for quality improvement.²⁰

We also found that there was a significant association between higher overall RC and faster acceptance of CA survivors transferred for TTM. This is a somewhat counterintuitive finding given the commonly held belief that higher quality care coordination is more time consuming. At the same time, it is noteworthy that the more relationally oriented elements of RC (e.g., mutual respect, shared goals, shared knowledge) do not relate to faster acceptance. This suggests the communication elements of RC are most important for highly time sensitive coordination and merits further investigation. Improving the quality of coordination is a potentially modifiable and low-cost approach to realizing the benefits of regionalized post-arrest care pathways. Other factors we examined such as the number of transfers, presence in the STEMI transfer network, and timing of the transfer did not relate to timely acceptance.

Our results should be considered in light of potential limitations. The physician conversation is brief relative to the time necessary to reach target temperature goals. Further, the physician conversation represents one of several forms of coordination that must occur during such a transfer (e.g., family, hospital staff, and EMS communications), all crucial to decision-making and quality care transitions during a transfer. This may explain the lack of a broader relationship with measures of timeliness. To address this concern, future research should explore RC overall as well as its components among the broader set of relevant roles and stakeholders to further assess its relationship with timeliness. While our primary outcome variable, time-to-acceptance, is helpful in understanding the coordination relationship, future work in larger samples should consider outcomes reflecting the broader transfer performance and patient-oriented outcomes. Finally, the retrospective nature of the study limits data availability and quality (e.g., timestamps), and our small sample size due to the relative rarity of CA transfers for TTM impacted our ability to adjust for other confounders and may limit the generalizability of these findings.

CONCLUSIONS

We found that RC was reliably measured and that higher quality RC (more timely, accurate, and problem-solving communication) for patients surviving CA is associated with faster physician acceptance. Further work should build on our findings to explore how the quality of care coordination between a broader set of stakeholders affects the timeliness and quality of inter-facility transfers, and best practices for enhancing quality of coordination, particularly during transfers.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Descriptive statistics for the cohort.

Variable	Total N	Overall N=18
Age, median (IQR)	18	61 (53,65)
Female Sex		0.33 (6)
Race		
Caucasian		0.56 (10)
African American		0.28 (5)
Unknown		0.17 (3)
Insurance (Primary)	18	
Medicare		0.50 (9)
Private		0.28 (5)
Unknown		0.11 (2)
Medicaid		0.06 (1)
Self-Pay (Uninsured)		0.06 (1)
Mode of arrival to Outside ED	17	
Ground EMS		0.65 (11)
Personal Vehicle		0.06 (1)
Unknown		0.24 (4)
Other		0.06 (1)
Estimated Downtime Prior to ROSC, Median (IQR)	12	27.8 (17.5,42.5)
Initial Cardiac Rhythm	18	
Ventricular Fibrillation		0.61 (11)
Unknown		0.11 (2)
Asystole		0.11 (2)
Pulseless Electrical Activity (PEA)		0.11 (2)
Ventricular Tachycardia		0.06 (1)
Transport to PCI center	16	
Helicopter EMS		0.62 (10)
Ground EMS		0.31 (5)
Unknown		0.06 (1)
FACILITIES		
Facility Travel Distance in miles, median (IQR)	18	47 (36, 74)
Transfer During Business Hours	15	0.47 (7)
STEMI Network Status	18	0.22 (4)
Transfers in Past Year	18	2 (1, 3)
Rural Hospital Status	18	0.28 (5)
TTM Continued/Initiated at VUMC	18	0.72 (13)
In-Hospital Mortality	16	0.75 (12)
TIME INTERVALS, Median min. (IQR)		
Physician Conversations		
ED arrival to time Physicians start speaking	15	29.1 (23.4,54.7)

Variable	Total N	Overall N=18
Duration to Acceptance	18	2.77 (1.96,4.06)
Total Call Duration	18	3.95 (2.68,5.20)
ED Length of Stay	15	102 (81,132)
EMS Arrival at ED to VUMC	14	27.5 (20.3,65.8)
Physician Conversation to Goal Temperature	13	97.8 (47.5, 260.1)
Outside ED arrival to PCI center arrival	14	144.0 (111.2,170.2)

Table 2.

Descriptive statistics of Relational Coordination between the two abstractors who reviewed each call and Spearman correlation coefficient with time-to-acceptance by the physician.

Dimension	Median Score (IQR)	Correlation
Frequent Communication	69.50 (59.38,78.12)	0.79
Timely Communication	68.00 (57.38,75.12)	0.61
Accurate Communication	63.25 (54.75,68.38)	0.49
Problem Solving	69.75 (63.25,77.00)	0.61
Shared Goals	71.75 (62.50,79.38)	0.88
Shared Knowledge	73.25 (66.75,80.75)	0.73
Mutual Respect	71.25 (54.88,75.25)	0.71
Overall Score	492.0 (407.8,525.0)	0.87

Table 3.

Results from the univariate quasi-Poisson models with log-link evaluating the association of a priori selected covariates with time-to-acceptance.

Covariate	aRR	95% CI	P Value
Overall RC Score (per 10 points)	0.96	(0.93, 1.00)	0.05
Frequent Communication	0.71	(0.42, 1.20)	0.17
Timely Communication	0.64	(0.41, 0.99)	0.03
Accurate Communication	0.55	(0.39, 0.77)	<0.001
Problem Solving	0.67	(0.46, 0.98)	0.03
Shared Goals	0.72	(0.42, 1.23)	0.20
Shared Knowledge	0.78	(0.54, 1.14)	0.16
Mutual Respect	0.76	(0.49, 1.17)	0.17
Transfers in Past Year (per 1 transfer)	1.04	(0.70, 1.56)	0.83
Business hours status			
Weekday hours	(ref)		
Evening, Weekend Hours	0.78	(0.22, 2.80)	0.68
Network Status			
STEMI Network	(ref)		
Non-STEMI Network	2.24	(0.52, 9.68)	0.38