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Hospital Collaboration with Emergency Medical Services in the Care of Patients with Acute Myocardial Infarction: Perspectives from Key Hospital Staff

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Abstract

Objective—Evidence suggests that active collaboration between hospitals and emergency medical services (EMS) is significantly associated with lower acute myocardial infarction (AMI) mortality rates; however, the nature of such collaborations is not well understood. We sought to characterize views of key hospital staff regarding collaboration with EMS in the care of patients hospitalized with AMI.

Methods—We performed an exploratory analysis of qualitative data previously collected from site visits and in-depth interviews with 11 US hospitals that ranked in the top or bottom 5% of performance on 30-day risk-standardized AMI mortality rates (RSMRs) using Centers for Medicare and Medicaid Services data from 2005–2007. We selected all codes from the first analysis in which EMS was most likely to have been discussed. A multidisciplinary team analyzed the data using the constant comparative method to generate recurrent themes.

Results—Both higher and lower performing hospitals reported that EMS is critical to the provision of timely care for patients with AMI. However, close, collaborative relationships with EMS were more apparent in the higher performing hospitals. Higher performing hospitals demonstrated specific investment in and attention to EMS through: 1) respect for EMS as valued professionals and colleagues; 2) strong communication and coordination with EMS; and 3) active engagement of EMS in hospital AMI quality improvement efforts.

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Conclusion—Hospital staff from higher performing hospitals described broad, multifaceted strategies to support collaboration with EMS in providing AMI care. The association of these strategies with hospital performance should be tested quantitatively in a larger, representative study.

Introduction

Background

Emergency medical services (EMS) is a key component of the emergency cardiovascular care chain of survival.[1] Hospitals are increasingly working with EMS agencies to form regional systems to provide timely access to percutaneous coronary intervention (PCI) to patients with ST-segment-elevation myocardial infarction (STEMI).[2] The initial focus of hospital-EMS collaboration has been on operational logistics, such as EMS performance of 12-lead electrocardiograms and EMS selection and notification of the appropriate receiving center. Recent evidence indicates that more active collaboration between hospitals and their EMS systems is associated with better performance in acute myocardial infarction (AMI) care.[3, 4] However, the nature of such collaboration is not well understood and hence there is little guidance for hospitals seeking to improve AMI performance by developing strong working relationships with EMS agencies.

Importance

Cardiovascular disease is the most common cause of death in the United States. Variability in risk-standardized mortality rates (RSMRs) for patients hospitalized with AMI between US hospitals has been well established, even after adjusting for severity of illness.[5] Studies have identified hospital characteristics associated with RSMRs, including hospital AMI volume, geographic location, teaching status, and safety net status; [6, 7] however, these features are not amenable to change. Recent evidence that active collaboration between EMS and clinicians caring for patients with AMI is significantly associated with lower RSMRs is an actionable opportunity for hospitals to improve their care for patients hospitalized with AMI.[3]

Goals of this Investigation

We employed a qualitative approach, well suited for characterizing complex work processes and organizational dynamics [8, 9] to explore hospital staff views on the nature of collaboration between hospitals and EMS in the care of patients hospitalized with AMI and to generate hypotheses for further study.

Methods

Study Design

The present study reports findings from a secondary analysis drawing on data from the qualitative component of the Survival after Acute Myocardial Infarction (SAMI) project – a mixed methods, positive deviance[10, 11] study to identify hospital factors associated with lower 30-day RSMRs.[11] The project used a sequential exploratory design;[12] the first component was a qualitative study employing site visits and in-depth interviews with 11 hospitals at the extreme ends of the range in RSMR (higher and lower performing hospitals) in order to generate hypotheses regarding hospital factors potentially associated with better performance.[4] In the second component a quantitative survey was administered to a large sample of US hospitals (n=537, 91% response rate) to test those hypotheses and identify strategies statistically associated with lower RSMR.[3]

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During the analysis of qualitative data, the role of EMS emerged as a substantive theme and informed the development of several hypotheses to be tested in the survey. While the quantitative survey component was underway, we undertook a focused analysis of the qualitative data to further understand the hospitals' perspectives on collaboration with EMS in the care of patients hospitalized with AMI. The quantitative data demonstrated a statistically significant association between monthly meetings to review the care of patients with AMI cases between the hospital clinicians and EMS providers.[3] This article provides further insights into the nature of this important relationship between hospitals and EMS.

Selection of Participants

As described in a previous article,[4] we selected hospitals for participation based on their 30-day RSMRs.[13] RSMR is calculated by dividing the hospital's predicted number of deaths by the expected number of deaths within 30 days of admission. The predicted number of deaths is determined on the basis of the hospital's observed case mix; the expected number of deaths is determined on the basis of the nation's performance with that hospital's case mix. This ratio is then multiplied by the overall, national unadjusted 30-day AMI mortality rate.[13, 14] This model for calculating the RSMR outcome has been endorsed by the National Quality Forum and is used by the Centers for Medicare and Medicaid Services (CMS) for public reporting.[13, 14] Hospitals were sorted by their 2005–2007 30-day RSMRs using data from the CMS Hospital Compare website (http://www.hospitalcompare.hhs.gov) for the most recent data available (January 1, 2005 – December 31, 2007). The Hospital Compare website was created through the efforts of CMS, the Department of Health and Human Services, and the Hospital Quality Alliance to make hospital measures (e.g., care and outcome measures) more accessible to healthcare professionals and consumers.[15]

Hospitals were eligible for inclusion if their RSMR was in the top 5% or bottom 5% of performance for two consecutive years. We excluded hospitals without ability to perform emergency primary percutaneous coronary intervention (PCI), given the importance of PCI for acute ST-elevation myocardial infarction.[16] Higher and lower performing hospitals were then purposefully sampled[17] with attention to teaching status, geographic location, socioeconomic status, and hospital size, factors previously shown to be important correlates with AMI mortality rates.[6, 7] Socioeconomic status was determined by the percentage of patients with AMI in that hospital who were from ZIP codes rated in the lowest quintile of socioeconomic status, as measured by the Socioeconomic Status scale.[18] We continued hospital selection until thematic saturation was achieved, or no new concepts surfaced in additional interviews,[19, 20] which occurred after 14 hospital site visits. We retained 11 of the hospitals in the sample for analysis because these hospitals' RSMR performance remained in the top 5% or bottom 16% during 2007–2008 (the performance data most proximal to the data collection period), as we were focusing on the hospitals at the most extreme ends of the range in order to maximize the opportunity to learn from their experiences, known as extreme or deviant case sampling.[17]

Methods and Measurements

Site visits were conducted during December 2008 to December 2009 by a team of 3–4 researchers from our multidisciplinary research team with backgrounds in cardiology, nursing, emergency medicine, emergency medical services, health services research, organizational psychology, and social work. We requested hospital participation from hospital leadership; typically the Director of Quality or Performance Improvement was the initial point of contact. After agreeing to participate in the study, hospital leadership was asked to provide a list of key staff involved in the care of patients with AMI. Of note, we did not explicitly inquire about EMS involvement. We created an environment for the hospitals

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to discuss the role of EMS by asking participants specifically to describe the entire AMI care process, including important care transitions. One site allowed an interviewer to observe their EMS Medical Director during an EMS training session; however, the EMS providers attending the training were not interviewed. Because the sample does not include representatives from EMS agencies, findings reflect the perspectives of hospital staff only.

Multiple in-depth interviews were conducted at each site (n=158, a total of 85 of which discussed content related to EMS), each lasting approximately one hour. We developed a standard interview guide with five broad questions[21] to facilitate the interviews [Table 1]. The interview questions were developed by the study team based on relevant existing literature and members' experience with hospital and AMI care; the guide was pilot tested with eight individuals involved in hospital AMI care and refined accordingly. Interviews focused on the prior year's care and were audio recorded and professionally transcribed. An organizational psychologist conducted formal debriefing sessions with each site visit team to inform subsequent data analyses.[17]

Data Analysis

We applied the constant comparative method [19, 22] for qualitative data analysis of all transcripts. Data were analyzed in two stages. As reported previously [4], the first stage identified overarching factors associated with better performance in the care of AMI patients. A six-member multidisciplinary team applied the constant comparison method[19, 22], coding essential concepts from interview data and comparing over successive interviews to extract recurrent themes across the data. Additional team members reviewed coded transcripts for the site visits they had conducted. This process of negotiating consensus on differing interpretations, refining codes and describing properties of each continued until no new concepts emerged..[17] The resulting primary code structure is provided in Table 2.

The second stage of analysis focused on understanding hospital staff perspectives on the nature of collaboration between hospitals and EMS in the care of patients hospitalized with AMI. We selected all codes from the first analysis in which EMS was most likely to have been discussed: interaction between hospital and external groups; EMS protocols; and catheterization lab activation systems. These three code reports were then analyzed by a three-member multidisciplinary coding team with experience and training in emergency medicine, emergency medical services, cardiology, and health services research (AL, ES, and EC) under the guidance of the senior author, an expert in qualitative methods (LC). Each code report was read by all members of the analysis team to develop new codes focused on the role of EMS in the care of patients with AMI. We discussed each report, line-by-line, until consensus was reached on each code. Codes were revised, added, and deleted as we progressed through the code reports. We then developed key themes, or recurrent and unifying ideas that characterized participant views about the role of EMS in the care of patients with AMI.

During this transcript coding, the investigators were blinded to the performance status of the hospitals. After key themes emerged, we removed the blinding to perform targeted analyses to identify prominent differences in themes between higher and lower performing hospitals as part of the positive deviance approach. Data from lower performing hospitals were limited in scope and depth. Importantly, the minimal commentary on EMS among the lower performers cannot be interpreted as a signal that these hospitals did not partially or fully implement communication and collaboration strategies with EMS.

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Atlas Ti software (v5.6.3, Scientific Software Development, Berlin, Germany) facilitated data organization and retrieval. All research procedures were approved by the Human Investigation Committee at the Yale University School of Medicine.

Results

Characteristics of Study Participants

The sample consisted of hospitals diverse with regard to RSMR, geographic location, hospital size, patient socioeconomic status, and teaching status (Table 3). Interview participants (n=85) who discussed the role of EMS in AMI care included representatives from cardiology, emergency medicine, and hospital leadership (Table 4).

Main Results

Four themes characterized hospital views on EMS-hospital collaborations in the care of patients with AMI. The first theme, the importance of EMS in providing timely care of patients with AMI, was shared by both higher and lower performing hospitals. However, close, collaborative relationships with EMS were more apparent in the higher performing hospitals. Higher performing hospitals demonstrated specific investment in and attention to EMS through: 1) respect for EMS as valued professionals and colleagues, 2) strong communication and coordination with EMS, and 3) active engagement of EMS in AMI quality improvement efforts. These domains and the strategies associated with each are described below and summarized in Table 5.

Importance of EMS in providing timely care of patients with AMI—Participants from both the higher and the lower performing hospitals reported that EMS is critical to the provision of timely care of patients with AMI. One nurse manager from a higher performing hospital (ID#7) observed the central role of EMS in optimizing processes to deliver rapid treatment in the hospital:

> "I'm glad that the EMS people [EMS Medical Director] got to speak to you because that is certainly a huge piece of getting the patients the best care in the shortest amount of time."

Lower performing hospitals also indicated that EMS was an important part of the system of care for patients with AMI, particularly in terms of rapid transport. An ED Medical Director from a lower performing hospital (ID#9) noted improved efficiency when patients with AMI arrive via EMS:

> "the ideal, the best ones [patients with STEMI] are the ones that come in by ambulance … we'll get everybody together and prepare a room for them."

Respect for EMS as valued professionals and colleagues—Participants at higher performing hospitals conveyed respect for EMS, viewing them as important members of the care team for patients with AMI. This respect was manifest in several ways, as participants described the ways in which hospital staff: 1) value EMS clinical skills and judgment; 2) tolerate false activations of the cardiac catheterization lab; and 3) invest in relationships with EMS.

Value EMS clinical skills and judgment: Higher performing hospitals regarded EMS as valued health care professionals, rather than technicians responsible solely for rapid transport of the patient to the hospital. Participants in higher performing hospitals provided examples of how hospital staff actively involved EMS in clinical decisions. For instance, this ED staff member from a higher performing hospital (ID#5) observed that EMS crews

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are invaluable to determining whether or not to activate the cardiac catheterization laboratory:

> "the [EMS] services that are enrolled in our STEMI activation program will call forward and talk to the attending physician. … describe the patient, the patient's EKG changes, and then there's a checklist … that they walk through just to ensure there's no contraindications for after in the lab."

Tolerate false activations of the cardiac catheterization laboratory: False activation of the catheterization laboratory by EMS crews was not met with a punitive or negative response from hospital staff in the higher performing hospitals. A cardiology fellow at a higher performing hospital (ID#1) noted that tolerance for false activation was a necessary aspect of transferring responsibility for activation to EMS, and that EMS should not to be blamed for false activations:

"I don't think you can necessarily fault the paramedics for doing that [false positive cardiac catheterization laboratory activation] … I would rather come in and be able to call off the Code then to delay that care further."

Invest in relationships with EMS: Higher performing hospitals perceived the relationships among staff throughout the hospital staff and EMS as essential to the system-wide care of AMI patients. One Director of a Mobile ICU at a higher performing hospital (ID#6) observed the "tight" connections between EMS, the emergency department team, the catheterization lab and cardiologists that keep everybody involved in patient care:

> "…the patients come here, because our relationship with the pre-hospital team, the ER team, and the cath team or the cardiologists, kind of really tighten it up, and everybody stays involved."

Participants in higher performing hospitals emphasized that maintaining good working relationships between ED and EMS providers requires a persistent commitment and investment of time and resources from both groups. As one EMS director noted: "We are constantly trying to make relationships better …" (EMS Director, Higher Performing Hospital, ID#4). And an ED staff member from a higher performing hospital (ID#5) described the excitement and pride that the ED feels in their strong connection with EMS:

> "… for us as a hospital, to have such a strong connection with EMS is actually a huge effort on our parts, and one I think collectively we're quite excited about and quite proud of."

Strong Communication and Coordination with EMS—Higher performing hospitals invested in multifaceted strategies to foster and support strong communication and coordination with EMS: 1) ensure timely, bi-directional communication between the hospital and EMS; 2) ensure EMS providers have up-to-date, evidence-based clinical knowledge base; and 3) cultivate a shared, patient-focused mission to improve AMI care and outcomes.

Ensure timely, bi-directional communication between hospital and EMS agencies: Higher performing hospital participants described the importance of bi-directional and timely communication between the hospital and EMS to address clinical, interpersonal and system issues.

Higher performing hospitals helped ensure smooth and timely flow of information between the hospital and EMS agencies by employing EMS liaisons or coordinators, typically a paramedic or nurse with prehospital experience. An EMS Director from a higher performing

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hospital (ID#4) explained how EMS liaisons facilitate communication between the EMS agencies and her hospital:

> "It's all in the communication. Building relationships…having a coordinator at the service [EMS agency] who can be your eyes and ears and mouth at that place because there's no way that I can go to every service."

In addition to communicating with EMS agencies via EMS liaisons, several higher performing hospital participants described hospital-based physicians meeting directly with EMS to obtain feedback on cardiac care programs (e.g., paramedic performance of 12-lead ECG and paramedic activation of the cardiac catheterization laboratory):

> "The doctors meet with them [EMS] on a regular basis. Our service chief meets with the EMS representatives and they go over any problems or anything we can report it at the time… and get feedback." Catheterization Lab Nurse, Higher Performing Hospital (ID#3)

Ensure EMS providers have up-to-date, evidence-based clinical knowledge base: Higher performing hospitals recognized the need to keep prehospital providers informed on the latest evidence-based care for patients with AMI and devoted hospital resources to formal training of EMS providers.

Although EMS continuing education classes are commonly taught by EMS medical directors, emergency physicians, or emergency nurses, several higher performing hospital participants described broader engagement in EMS training by other medical staff, such as cardiologists. One catheterization laboratory medical director from a higher performing hospital (ID#7) reported: "There's a lot of [prehospital] education. I give talks to paramedics, trying to get them involved."

Other higher performing hospitals engaged EMS staff in their hospital-based educational forums with an explicit goal of integrating EMS in learning activities. One mobile ICU director from a higher performing hospital (ID#6) described inviting paramedics to weekly cardiology teaching conferences where paramedics have the opportunity to learn about and discuss outcomes of patients, many of whom they initially cared for:

> "… every Wednesday they have the cardiac conference, and all the paramedics are invited. … they're talking about interesting cases, and a lot of these cases [the paramedics] were involved in, It's an opportunity [for the paramedics] to see how the patient was cared for after being dropped off at the ER. They got a PCI done; they did well; they didn't do well; they arrested upstairs on the floor. And it's interesting, and it enhanced learning."

Cultivate shared, patient-focused mission: Participants from higher performing hospitals also reported embracing opportunities to cultivate a shared, patient-focused mission with EMS providers to improve AMI care and outcomes by reviewing and discussing patients' electrocardiogram findings, allowing EMS providers to observe the angiogram for patients they transported, and sharing information on previously transported patients' clinical course in the hospital. An ED medical director from a higher performing hospital (ID#3), described how he provides patient follow-up and teaching to EMS providers in the ED:

> "The EMS guys who bring someone who has a STEMI, somehow or other they… try to find out … 'Hey, what did that guy have,' and we give them feedback. … we'll tell them and we'll go over the EKGs, their EKGs and the EKG that we get in the ED, and we'll show what kinds of changes, things that we're concerned about, reasons why we might not be concerned if they were concerned."

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Some higher performing hospitals allowed prehospital teams to observe the angiogram for patients they brought directly to the catheterization laboratory. Interventional cardiologists explained the procedure and EMS teams were able to see firsthand how their actions directly impacted patient care and outcomes:

> "… we've actually taken some of the EMS guys right into the cath lab and let them observe cases, and Dr. [person's name] goes out with angiograms and shows them, 'Here's your patient and here's the lesion, and this is what we did to get it open.' It's very dramatic for them to see that kind of stuff." Medical Director of Cardiac Catheterization Laboratory, Higher Performing Hospital (ID#7)

Higher performing hospitals recognized that EMS providers were interested in feedback and follow-up on their patients. While time consuming, higher performing hospitals recognized that providing feedback was a key component for EMS provider learning and reinforced the value of the care EMS is delivering:

> "I think that feedback … is really essential for them [EMS] and making sure that folks know that what they're doing matters, and what they do counts. And that it does affect mortality, and that you can see that by the trend of our mortality. … And they follow through. The EMS services follow through with us to find out what happened to the patients, and how did their patient do, and stuff like that. That is key for them." ED Staff at Higher Performing Hospital (ID#5)

Active Engagement of EMS in AMI Quality Improvement Efforts—Higher performing hospitals employed multiple strategies to engage EMS providers in AMI quality improvement efforts: 1) Include EMS representation on AMI care quality improvement committees; 2) Share AMI performance data with EMS; and 3) Encourage EMS participation in creative problem solving.

Include EMS representation on AMI quality improvement committees: Higher performing hospitals integrated EMS into multidisciplinary AMI quality improvement committees alongside representatives from key hospital departments (cardiology, catheterization laboratory, cardiac intensive care unit, emergency department).

> "We needed a multidisciplinary team. And so, we contacted people and we got together and we said, "Okay, who else do we need at the table?" And that's how the team developed. We got Pharmacy involved, and we ultimately got [person's name] involved with EMS." Group discussion including hospital, ED, and cardiology leaders, Higher Performing Hospital (ID#7)

Another hospital gradually extended its committee membership and found greater engagement and exchange with EMS about STEMI efforts after joining the quality improvement committee:

> "First it was just the cath lab folks based on reports from quality management and then we started including the ED folks and then we expanded it even more and now we have the paramedic team come in and sit in with us. It's very interesting to see how much more they feel involved now and when the door-to-balloon time feedback reports go out you get this blitz of feedback from them and, and they want to know how the patient did." Cardiology Program Quality Manager, Higher Performing Hospital (ID#6)

Nursing staff at a higher performing hospital (ID#5) described a typical AMI care quality improvement meeting in which EMS participated, where a broad range of issues was discussed, from individual case presentations to new evidence, to performance on particular metrics:

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> "EMS comes and the cath lab comes, the research nurse that's in charge of coordinating all the information, the ED comes, the medical telemetry floor can come, the interventional telemetry floor can send representatives. We do case presentations there. We talk about what are the issues going on, what are the questions, what are the new findings, what does our database show, how are we taking care of our patients, are we meeting door-to-balloon times. That's another indicator that we are looking at. Do we have any complications that we're surprised about? And then in the case study's kind of a nice bonus for everybody to sit down and say what do you think is going on here? "

Share AMI performance data with EMS: Higher performing hospitals produced and shared reports on AMI performance with EMS. Data were often shared during AMI quality improvement committee meetings (as described above) and included overall performance and sometimes EMS specific metrics. ED staff at a higher performing hospital (ID#5) shared how the data galvanized EMS providers on the importance of their care for patients with AMI:

> "EMS colleagues … were really blown away by the larger data that we're collecting right now … it's really invigorated them … I think that feedback is really essential for them and making sure that folks know that what they're doing matters, and what they do counts. And that it does affect mortality, and that you can see that by the trend of our mortality. … And they follow through."

AMI performance data were also shared with EMS agencies through EMS liaisons. One EMS director at a higher performing hospital (ID#4) reflected on the value of gathering and analyzing feedback in efforts to improve quality of care:

> "They [EMS liaisons] understand the importance of having QI [quality improvement] and getting the feedback …. It's an attempt to try to improve your care so that you can be better for the next patient."

Encourage EMS participation in creative problem solving: Higher performing hospitals also described how EMS representatives on quality improvement committees were encouraged to problem solve. In one case where the quality improvement committee was discussing ways to reduce door-to-balloon time for STEMI patients, an EMS committee representative proposed EMS activation of the cardiac catheterization laboratory without ED confirmation. The committee piloted this approach, and after finding that it did not increase false positives cardiac catheterization laboratory (CCL) activations, changed their practice. In this case, EMS representatives were engaged and supported in generating and trialing possible solutions, leading to a new strategy that decreased door to CCL time and helped improve the care of AMI patients by the entire system:

> "That suggestion came from the paramedics themselves because when they started getting included in the meetings, then they would come up with suggestions and they were saying well, would it help if we gave you the heads up while we were still out in the field? …. So initially we thought, wait a minute. We don't want to be calling the on call team right away because now we might end up with on-call hours that we have to pay when in fact they weren't real cases. But we said let's try and see what happens. So we changed the policy of how they activate the call team and whether it was confirmed or not we would activate the call team. And we wanted to see how many false activations there were because if there were too many false activations, then we had to abandon that effort. And we realized that there really weren't that many false activations." Cardiology Program Quality Manager, Higher Performing Hospital (ID#6)

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Limitations

We used established approaches to enhance the rigor of our findings [8, 17, 23, 24]; however, the study has several limitations. First, our findings cannot be generalized to all hospitals and EMS agencies. Findings from qualitative studies are not intended to be generalized, but rather to provide insights into areas which have been previously unexplored and to generate hypotheses for future quantitative evaluation.[8] The specific strategies we identified to improve hospital-EMS communication and coordination and to actively engage EMS in AMI care quality improvement activities should be evaluated quantitatively to determine their relationship with RSMR. Second, because the primary sample included hospital staff and did not systematically include EMS providers, we cannot discuss the perspective of EMS providers. Third, we may not have reached saturation on this specific focal area (EMS) as the study was not designed with this as a central research question. Fourth, lower performing hospitals had minimal commentary on EMS, limiting our ability to make direct comparisons between higher and lower performing hospitals. Data came predominantly from a single site that focused on 12-lead ECG transmission, and did not convey a clear, coherent and consistent message within the site. One interpretation is that lower performing hospitals have less developed relationships with EMS and therefore could not provide examples or illustrations. Nevertheless, despite the paucity of data from lower performing hospitals, it cannot be concluded that lower performing hospitals did not partially or fully implement communication and collaboration strategies with EMS. Fifth, social desirability response bias, in which participants may have misrepresented their improvement efforts in order to provide desirable answers, may have occurred.[25] We interviewed multiple staff in each hospital, used scripted probes to elicit details that would be difficult to misrepresent, and instructed respondents to share both positive and negative experiences. Interviewers were unable to be “blinded” as to the reason for hospital selection. We used three techniques to minimize the impact of researchers’ preconceived biases from impacting the results[26]: a) attention to researcher reflexivity through systematic debriefings with an organizational psychologist; b) a multidisciplinary team to critically analyze transcripts with explicit focus on identifying negative (disconfirming) cases; and c) trained qualitative interviewers and data collection strategies to encourage respondents to provide both positive and negative comments during interviews, without interviewer judgment. Finally, hospitals were visited at a single point in time and their performance could have been changing (improving or declining); these changes were not represented in our data.

Discussion

Hospital-EMS active collaboration is a key strategy in achieving lower risk-standardized mortality rates for patients with AMI.[3] In this exploratory study, we sought to characterize key hospital staff perspectives on such collaboration and found that higher performing hospitals maintained a high level of respect for EMS as valued professionals and colleagues in the overall care of patients with AMI, invested in strong communication and coordination between hospitals and EMS agencies, and actively engaged EMS in AMI quality improvement activities. Although the impact of these hospital-EMS strategies should be tested using a quantitative approach in a larger, representative sample of US hospitals, these findings may provide useful insights into the nature of this collaborative relationship among top performing hospitals and EMS. These strategies may form a conceptual framework for hospitals interested in improving their relationships with EMS.

Collaborative teams have been shown to be important in delivering high quality and safe care.[27–29] Multidisciplinary membership of these teams has been shown to improve core measure performance for AMI[30] and the importance of high functioning teams and close collaboration in the provision of acute care is increasingly being recognized.[4, 31–33] Our

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study suggests interdisciplinary teams caring for patients with AMI should also include EMS, a group which is often independent from the hospital. While research has not yet examined the influence of hospital-EMS teams on overall hospital performance, our study indicates that at least for AMI care, higher performing hospitals effectively integrated EMS as a critical part of the care delivery team.

Our findings provide broad strategies for hospitals seeking to improve communication and coordination with EMS agencies. These are complex interventions that could be implemented well in a variety of ways to meet local hospital and EMS needs; our findings also suggest several approaches used by hospitals who have achieved lower RSMRs. These include hiring an EMS liaison or coordinator to build relationships and facilitate communications between the hospital and EMS agencies[34], and using existing expert staff to train EMS providers in conferences or courses. Hospital staff, particularly in the ED and cardiac catheterization laboratory, can engage prehospital providers in impromptu teaching and share patient follow-up information in the course of usual patient care. Automatically sharing clinical information between hospitals and EMS agencies has proven difficult since they are often distinct health care entities with separate clinical information systems. Data registries, such as the Cardiac Arrest Registry to Enhance Survival (CARES) and National Cardiovascular Data Registry ACTION registry-Get with the Guidelines (GWTG), may facilitate linkage of prehospital, and hospital data to participating entities for quality improvement and research.[35, 36] As more prehospital and hospital data become electronic, hospital and EMS agencies can work together to directly exchange electronic patient data to ensure timely follow-up and communication.[37–39]

In addition to collaborating with EMS in the delivery of clinical care, higher performing hospitals in this study also integrated prehospital providers into their AMI quality improvement committees. Interdisciplinary QI committee membership, with representation from each clinical discipline involved, is increasingly recognized as essential for quality improvement and patient safety activities.[40, 41] Even though many EMS agencies are external to the hospital, the higher performing hospitals in our study recognized prehospital providers as key stakeholders in AMI care and involved them in quality improvement efforts. EMS representatives were treated equally to other committee members and encouraged to actively collaborate on problem solving. These EMS representatives became additional liaisons, communicating with their EMS agency and facilitating any necessary EMS system changes.

Prior research indicates that collaboration between hospitals and EMS agencies in the care of patients with AMI is associated with better outcomes as measured by RSMR.[3] We sought to characterize the nature of such collaboration from the perspective of hospital staff, and to generate hypotheses for further investigation. Our findings suggest that, as hospitals incorporate new protocols and technologies to improve the care and outcomes of patients with AMI, attention should also be directed to fostering strong collaborative working relationships between hospitals and EMS agencies through respect for EMS as professionals, strong communication and coordination with EMS, and engagement of EMS in quality improvement activities.

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Table 1

Interview Guide

1. Let's start by having you describe what you do here.
Provide comfortable, non-threatening a way into the interview; begin to establish a relationship; locate the person in the organization from his/her own perspective; and gain a sense of his or her role in the larger process of AMI care
2. What happens to a patient with AMI who comes here? Can you walk me through the process?
Elicit descriptions of hospital processes for AMI care, and to give the interviewer the opportunity to explore a broad range of factors that the interviewee considers relevant to AMI patient care in this setting
3. Have there been efforts to improve the care of patients with AMI here?
Explore hospital QI efforts broadly conceived, both formal and informal. What got it started? How does the organization recognize problems or opportunities? How do you deal with setbacks? Can you describe things that needed to get ironed out along the way?
4. Now let's hear about what happens to the patient after they leave the hospital. For the next month, what happens? Who do they see and how does that work?
Encourage respondents to talk about all aspects of discharge for AMI patients, things that occur within the hospital and in various post-discharge settings.
5. Has the process always worked this way? If it has changed, can you tell me about when that happened, and how it went?

AMI=acute myocardial infarction

QI=quality improvement

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Table 2

Stage One Code Structure (*codes in italics indicates codes used for EMS analysis*)

1 Mission/goals
2 Interaction among groups within the hospital
2a Coordination/communication
2b Emotional aspects of relationships
2c Roles of nurses
2d Roles of pharmacists
2e Roles of social workers
3 Interaction between hospital and external groups (community, EMS, outer physicians)
4 Work design, protocols, and innovations
4a. EMS protocols
4b. Checklists
4c. Standing orders
4d. Hypothermia program
4e. STEMI boxes for medications
4f. Catheterization laboratory activation systems (Code STEMI, etc., single call, etc.)
4g. Rapid response teams
4h. Hospitalist coverage or other physician coverage systems
4i. Discharge planning process/medication reconciliation
4j. Follow up appointment systems, including cardiac rehab program
4k Patient education
4l. Information Technology applications
4z Work design not otherwise specified
5 Audit and feedback
Data or feedback of any kind used and problem solving (including external and internal data)
6 Patient mix
SES, severity, geographical location, other
7 Quality of (non-champion) staff as individuals; attribution to individuals
8 Individuals in clinical championship roles
9 Individuals named as administrators or management people who are in championship roles
10 Organizational support, including the “administrative support” as norm (not as individuals)

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Table 3

Description of Study Sample (Hospitals)

30-Day RSMR Performance, July 2005-June 2007	Hospital ID	Region	No. of Beds	RSMR, % 2005–2006	RSMR, % 2006–2007	Teaching	% Patients with Low SES
Higher Performing	1	Pacific	855	13.4	13.4	Yes	8.13
	2	East North Central	491	13.8	12.8	Yes	30.7
	3	Middle Atlantic	703	13.4	13.3	Yes	14
	4	New England	632	13.1	13.3	Yes	19.4
	5	New England	557	13.3	13.4	Yes	5.56
	6	Middle Atlantic	317	14.0	13.2	Yes	1.46
	7	East North Central	398	11.4	14.0	No	4.85
Lower Performing	8	South Atlantic	454	18.6	19.1	Yes	44.2
	9	South Atlantic	190	17.9	18.7	No	25.3
	10	West South Central	324	20.9	19.6	No	20.8
	11	East North Central	481	20.6	19.9	No	0

RSMR=risk-standardized mortality rate

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Table 4

Type of Staff Interviewed at Study Hospitals (N=85)

Participants	Number
Physicians	
Cardiac Fellow	2
Emergency Physician	6
Hospitalist	2
Interventional Cardiologist	7
Nurses	
Cardiac Nursing Director	1
Cardiac Research Coordinator	1
Cardiovascular Manager	2
Cardiac Rehabilitation Nurse	1
Case Manager	2
Catheterization Laboratory Nurse	2
Clinical Coordinator Emergency Dept	1
Clinical Nurse Specialist	1
Critical Care Nurse	3
Emergency Department Nurse	6
Nurse Manager (Cardiology)	5
Nurse Manager (Emergency Department)	3
Nursing Educator (Cardiology)	1
Administration	
Administrative Director of Cardiac Services	2
Chair of Emergency Medicine	4
Chief Medical Officer	3
Chief Nursing Officer	1
Chief Quality Officer	1
Chief of Cardiology	2
Director of Cardiology	1
Director of Catheterization Laboratory	3
Director of Critical Care	1
Director of Emergency Medical Services	7
Director of Quality Management	4
Vice Presidents (Medical Affairs, Health Care Quality, and Nursing Services)	3
Clinical Staff	
Catheterization Technician	2
Quality Management Staff	4
Social Worker	1
Total	**85**

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Table 5

Domains and key strategies used by higher performing hospitals to engage EMS in the care of patients with AMI

Domain	Key strategy(s)
Respect for EMS as valued professionals and colleagues	• Value EMS clinical skills and judgment; treat EMS providers as health care professionals, rather than technicians solely responsible for rapid transport • Tolerate false activations of the cardiac catheterization laboratory by EMS providers • Invest in relationships with EMS by building tight connections with EMS and making EMS part of the care team
Strong communication and coordination with EMS	• Ensure timely, bi-directional communication between the hospital and EMS (e.g., hospitals employ EMS liaisons and meet regularly with EMS agencies) • Ensure EMS providers have up-to-date, evidence-based clinical knowledge base (e.g., hospital staff teach EMS continuing education classes and integrate EMS staff into hospital-based educational forums) • Cultivate shared, patient-focused mission with EMS providers to improve AMI care and outcomes (e.g., review findings on current patients' electrocardiogram, allow the EMS providers to observe the angiogram for patients they transported, and share information on previously transported patients' clinical course in the hospital)
Active engagement of EMS in quality improvement	• Include EMS representation on hospital AMI quality improvement committees • Share AMI performance data with EMS regularly through EMS liaisons and AMI quality improvement committees • Encourage EMS participation in creative problem solving and consider piloting EMS process improvement proposals (e.g., pilot EMS activation of the cardiac catheterization laboratory without ED confirmation)