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Interorganizational Collaboration in Emergency Cardiovascular Care

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Background: Interorganizational collaboration management theory contends that cooperation between distinct but related organizations can yield innovation and competitive advantage to the participating organization. Yet, it is unclear if a multi-institutional collaborative can improve quality outcomes across communities. Methods: We developed a large regional collaborative network of 15 hospitals and 24 emergency medical service agencies surrounding Dallas, Texas, and collected patient-level data on treatment times for acute myocardial infarctions. Using a pre-/posttest research design, we applied median tests of differences to explore outcome changes between groups and over the 6-year period, using data extracted from participating hospital electronic health records. Results: We analyzed temporal trends and changes in treatment times for 2302 patients with ST-elevation myocardial infarction between the pre- and posttest groups. We found a statistically significant 19-minute median reduction in the key outcome metric (total ischemic time, the time difference between the patient’s first reported symptoms and the definitive opening of the artery). This represents a 10.8% community-wide improvement over time. Conclusions: Interorganizational collaboration focused on quality improvement can impact population health across a community. This study provides a basis for broader understanding and participation by health care organizations in multi-institutional community change efforts.

Key words: interorganizational collaboration, population health, quality improvement, system of care

Interorganizational collaboration between organizations has been widely discussed between for-profit organizations that seek to work together toward common goals. Often termed “strategic alliances,” these interorganizational relationships are sought to improve competitive advantage for the respective collaborating organizations. However, in hospitals and health care systems, very little is known about the extent of interorganizational collaborations and their effect on community-wide performance or patient outcomes. In this research, we examine one specific community-wide collaboration around emergency cardiovascular care and the impact of that collaboration on cardiovascular outcomes in the community.

Cardiovascular emergencies, such as myocardial infarction (ie, heart attack), represent the leading cause of death in the United States. Nearly 750,000 people will suffer a myocardial infarction this year alone, more than all forms of cancer combined. Treatment of cardiovascular emergencies are largely based on opening occluded arteries in as short of a time as possible following symptom onset, restoring blood flow, and reducing long-term damage to the heart muscle. Time to treatment is a key determinant of a patient’s likelihood for survival as well as full rehabilitation.

Yet, delays in care are inevitable. Sometimes patients are not aware of signs and symptoms, and they delay calling 911 or presenting to a hospital. However, other major sources of delay are organizational. For example, patients may wait for accurate confirmatory diagnosis from paramedics or physicians, they may wait to be transferred from the emergency department to an interventional cardiology laboratory, and/or they wait on ambulance transport from a community hospital to a more advanced hospital with a cardiac catheterization laboratory. In fact, transfers between hospitals occur nearly one-third of the time in urban areas and 65% of the time in rural areas. Improving the collaboration and coordination between providers is essential to improving the overall treatment times in a community.

To improve community outcomes for patients, there has been a significant increase in the growth of regional cardiovascular systems. Termed “systems of care,” these networks of collaborative partners are formed to improve the care to patients in a geographic region. Systems of care represent organized, collaborative working agreements between entities in the continuum of care for myocardial infarctions, including 911, emergency medical services (EMS), community hospitals, and receiving hospitals that provide definitive care.
The impact of these collaborative arrangements is relatively understudied in health care management. First, interorganizational relationships in health care tend to be based around nonprofit organizations, rather than for-profit, and these are less studied. Second, as the relationships are less formalized and span multiple organizational boundaries, they fall outside traditional management research that focuses on individual firm performance. Finally, the impermanence of these collaborations results in greater research around motives and behaviors driving the relationship than systematic research around the performance impact of the organizations themselves.

In this article, we intend to build upon the research in interorganizational collaboration by focusing on the relationship between interorganizational collaboration and community health outcomes. We chose to focus on cardiovascular systems of care because of the disease significance, the breadth of the relationships between community providers, and the complexity of these collaborative networks.

BACKGROUND

In this study, we explore the program effects of interorganizational collaboration between health care organizations that cooperate to improve the diagnosis and treatment of cardiovascular emergencies. Interorganizational collaboration theory helps describe why certain organizations—which compete for patients and resources and are traditionally competitive—choose to collaborate around specific long-term initiatives.

In metropolitan regions, hospitals and other health care facilities deploy competitive strategies to increase patient volumes, quality, and margins. Hospital competition, even for nonprofit organizations, is so intense that managerial tactics emphasize identifying and targeting certain payer groups, specific service lines, and even marketing for EMS patients. This rivalry is often seen as contradictory to collaboration, yet some researchers have found “collaboration competition” or “co-operation” to explain the coexistence of both collaboration and competition and describe why competitors coordinate their activities.

Organized health care delivery systems resulted from a search for improved efficiency between competitors that serve the same markets, provide similar services, and compete for similar funding. Yet, these organized systems tend to take the structure of strategic alliances, joint ventures, or wholly integrated networks that share revenue expectations around key service lines. Cooperation between rival organizations is often used as a strategy to improve efficiency or reduce administrative costs, through sharing space, funding, or personnel and in a much lesser extent cooperation around community-based initiatives. Bunger offers evidence of administrative cooperation between human service agencies and finds that trust is essential to forming and maintaining such partnerships but concludes that little evidence exists on the impact or outcomes of such relationships.

Theories around motivations, dynamics, and drivers for interorganizational relationships between traditionally competitive firms have a rich history. Management literature has applied these theories to explain competitive rationale, formation, operations, performance, and organizational complexities of managing these relationships. They conclude that interorganization collaboration research is challenged to find an integrative theory.

Different perspectives on interorganizational collaboration from management theory have emerged and offer a variety of explanations for the motivations and outcomes of interorganizational collaboration. Institutional theory proposes that collaboration could be a search for legitimacy, as organizations attempt to improve their prestige or credibility through association with another. Resource dependence theory contends that resource scarcity and the search for greater resources motivate interfirm relations. Social exchange theory concerns reciprocity, whereby each collaborator is receiving commensurate value from the other. Economic theories have focused on cost savings and efficiency gains by reducing transaction costs and gaining synergies from cooperation. Resource-based theory has been applied to health care organizations and stresses the importance of identifying unique programmatic strengths to achieve a competitive advantage within a market. Corporate strategic management theory recognizes the desire to improve differentiation or focus through cooperation as well as strategic compatibility between organizations. Innovation theories argue that interorganizational relationships are solely designed to produce some form of innovation.

From the management perspective, collaboration can be defined as a cooperative relationship between multiple organizations, adapted through ongoing communications. Interorganizational collaboration theory contends that cooperation can yield competitive advantage and innovation for all parties, if executed successfully. Austin describes that the strength and alignment of a collaboration grow over time. The collaboration may become transactional in nature, focusing on creating synergies, and eventually may become integrative in nature, focusing on an issue (or issues) that is complex and strategically important to both organizations. Integrative collaborations will involve a high level of engagement and resource commitments from all organizations involved in the collaboration. Research points to collaboration longevity as being a key to advancing to integrative collaboration where “mutual mission” among organizations is achievable. In health care, there have been several articles describing collaboration as a means of strategy.

Given the variety of theories offering explanations for interorganizational collaboration, few offer explanations as to the actual outcomes or effectiveness of the collaboration, especially in the health care environment. Therefore, it is unclear whether disparate community and academic hospitals (which are outside of an integrated delivery network), EMS agencies, and the
community at large can effectively achieve interorganizational collaboration for the community’s benefit with regard to treatment of acute myocardial infarctions. On the basis of this theoretical framework, we propose a positive relationship between interorganizational collaboration and specific time-based, community health outcomes.

**METHODS**

**Sample and study setting**
This study relied on data collected from a large geographic cardiovascular collaboration network implemented in the Dallas, Texas, metropolitan statistical area. This area represents the major population city centers in north Texas, including Dallas, Fort Worth, and Arlington. The population for this area is just over 5.5 million within 5500 square miles.

Sponsored by the American Heart Association, this initiative brought together representatives from the interventional cardiovascular-capable hospitals in this geographic region. The network comprised 15 hospitals and 24 EMS agencies. Of the hospitals, 9 are major academic teaching hospitals and the total network capacity was more than 9070 licensed beds. Approximately 73% of all the hospitals and 100% of the participating EMS agencies were nonprofit entities. The project was funded through $8.5 million in donations, with a substantial portion of this coming from the W.W. Caruth Foundation.

**Quality improvement intervention**
Dozens of volunteer leaders were selected for physicians, nurses, and paramedics across the region. Hospital and EMS volunteers worked in multiple stakeholder teams, and teams came together to focus on 4 structural components:
1. **Ongoing clinical training for personnel.** This consisted of online training for myocardial infarction identification and recognition, with 5352 personnel completing the training.
2. **Development of a community-wide standardized treatment and transfer protocol.** These protocols were developed and refined by teams of physicians, nurses, and paramedics.
3. **Quarterly review and analysis of performance outcome data.** All participating volunteers from each agency and hospital came together in quarterly meetings to review the data outcomes and discuss progress and performance changes.
4. **Acquisition and deployment of technology.** This technology for transmitting prehospital electrocardiogram (ECG) data from the ambulance to the hospital was provided to all EMS agencies to ensure that 100% of ambulances were able to transmit ECG data to the receiving hospital, to reduce patient delays in transfers.
5. All of these interactions and collaborations resulted in an enhanced culture of trust and cooperation.

Figure 1 shows the collaboration framework.

**Data collection and variable measurement**
De-identified data were collected at the patient level from each of the participating hospital organizations, through an export from the standardized cardiovascular registry—the National Cardiovascular Data Registry. The data received were in a standardized format for all patients treated with myocardial infarction for the preceding quarter and were collected retrospectively following each quarter during the program. The data included the interventions provided, disposition, treatment times, and outcomes for all patients.

We focused our analyses on a subset of all myocardial infarctions in the system: those patients who experienced a specific type of myocardial infarction (ST-elevation myocardial infarction; the most severe form and most time-sensitive) were transferred by EMS. This ensures that every patient had collaboration between agencies (EMS and hospital) under very time-sensitive conditions and controls for differences in severity and time due to self-arrival versus ambulance. The primary aim of the collaborative network is that “time matters” and the more coordinated the response to a patient’s call to 911, the better the health outcome of that individual and for the region. The dependent variable is total ischemic time, measured as the difference in minutes between the time the patient reports his or her first symptom from myocardial infarction and the resulting reperfusion (or restoring of oxygenated blood at the hospital’s cardiology laboratory). This metric is considered the most important metric for a patient’s long-term survival and recovery.

We examined data only from patients who survived, had reported symptom onset within the last 24 hours, and had complete time records. We grouped the data over time into 2 groups for a pre-/posttest analyses. The years from 2009 to 2010 were defined as the baseline period prior to formal collaboration and full integration of the quality interventions; 2011 was the year of
intervention, including training and protocol standardization. The posttest period was from 2012 to 2014.

Statistical analyses
To test our hypothesis, we relied on nonparametric statistical analyses to assess trends and changes between groups and over time to determine if time-to-treat outcome (ie, total ischemic time) statistically changed over time. Time-based outcome data are known to be highly skewed, so we first tested for normality and confirmed that both skewness and kurtosis were outside of reference ranges. We therefore report medians and compared differences in treatment times using nonparametric independent-samples t tests of median and distribution differences. These tests included the k samples and Kolmogorov-Smirnov tests. All analyses were conducted in IBM SPSS Statistics software (version 24).

RESULTS
There were 15 hospitals and 24 EMS agencies providing data. Table 1 shows the summary of the organizations providing data in the study.

In total, there were 2302 surviving ST-elevation myocardial infarction (STEMI), EMS-transferred patients, with complete records used in the analyses. Table 2 summarizes the patient and outcome variables for the study.

As can be seen, there was no significant difference in either age or gender of the patient populations between the groups (ie, most were male and approximately 60 years of age). Across all time periods, the median total ischemic time was 162 minutes from the time the patient first experienced symptoms until the time he or she was treated at one of the hospitals and the artery was opened (or reperfused) through placement of a stent.

There was a statistically significant reduction in the total ischemic time between the pre- and posttest periods, from 176 to 157 minutes (k samples = 6.995, P < .01). The distribution between the groups was also significantly different (Kolmogorov-Smirnov test = 1.662, P < .01). The 19-minute median reduction represents a 10.8% improvement. Figure 2 shows the consistent improvement trend over time during the project.

DISCUSSION
Interorganizational collaboration has primarily focused on the performance impact that collaboration has on the organizational participants. Most of the research has been outside of health care, and none has focused on community-wide performance outcomes incorporating programmatic longevity. This longitudinal program effect of the pre-/posttest study involved 39 total organizations and provides significantly greater insight into the collaboration-performance relationship in health care.

Collaborative strategies between distinct organizations are often proposed for short-term projects or initiatives. Rarely are these lasting, unless there are lasting mutual benefits for each organization. The types of program assessed here are more long-term in nature and impact community outcomes far more than...
individual organizations. Working together, hospitals and EMS agencies can develop and refine standardized processes of care for treating patients, which ultimately can reduce treatment times and improve outcomes across a community.

We proposed in this research that cooperation between competitive health care organizations is possible and effective under certain conditions. Previous research has suggested that trust, a neutral convening body, and community impact are all determinants and motivators for strategic collaboration. Although we did not test the determinants here, we focused on the effect of the collaboration over a long-term basis. We found that a multiyear collaboration led to nearly an 11% reduction in overall treatment times, providing evidence that as organizations work together collaboratively over time, they perform better.

CONCLUSIONS

This study shows that collaboration between health care organizations can produce positive changes in specific population health outcomes. We hope these findings will encourage other health care management practitioners and researchers to focus on community collaboratives. There is an abundance of strategy-performance relationship research conducted in the field, but very few that focus on the performance outcomes resulting from interorganizational relationships. Since health care management domain is so heavily influenced by networks and collaboration, understanding the dynamics and determinants of these relationships will substantially improve our understanding of health care organizations behaviors and strategies.

From a practical perspective, these results are interesting in that they help provide evidence that cooperation and coordination strategies can work outside of for-profit industries and specifically in health care. While an individual organization must improve its own organization’s financial and quality performance outcomes, there needs to be a balance with those of the community. Interorganizational collaboration strategy can produce positive impact on performance between organizations, as each organization brings a unique strength to the table while the collaborative allows for the leveraging of multiple unique strengths.

There are limitations to this study, of course. First, we do presume that improvements would not have been made without this program. We are not able to control for other changes or factors that might contribute toward performance gains; we simply measure the effect of this network over time. Second, we explored a very direct relationship between a single network’s performance in a strong collaborative network over time. Even with the large number of participants in this program, it remains, however, an analysis of only a single collaborative network. Findings are not necessarily generalizable outside of emergency cardiovascular care or even this one network. It will be important for future research to focus on multiple programs and incorporate other outcomes to more richly understand interorganizational collaboration. Finally, we operationalized only a few constructs in our statistical analyses. Future research could expand on this significantly, and in fact our ongoing research involves modeling of key aspects of the initiative to identify individual factors influencing these outcomes.

In summary, this research finds that interorganizational collaboration is an important strategy for improving population health outcomes. We suggest that future research should be devoted to understanding what drives successful, long-term interorganizational relationships in health care.

REFERENCES


