Distance, Quality, or Relationship?

Interhospital Transfer of Heart Attack Patients

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Abstract

Patients with acute myocardial infarction (AMI), commonly known as heart attack, are frequently transferred from the emergency department (ED) of one acute care hospital to another. According to the ED visit statistics provided by the Agency for Healthcare Research and Quality, 12.4% of all ED encounters of heart attack patients in the United States were transferred to other acute care hospitals in 2009 (Kindermann et al. 2013). One reason explaining the high rate of interhospital transfer is the fact that many acute care hospitals, e.g., the community hospitals, lack the resources to provide revascularization procedures for heart attack patients. Revascularization is to mechanically open the clogged artery in the heart and reestablish vascular connection and blood perfusion by either percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). Compared to medical therapy using clot-busting drugs, revascularization procedures have been consistently shown to reduce mortality for patients with ST-elevation myocardial infarction (STEMI), a severe form of heart attack caused by the complete blockage of a heart artery (Henry et al. 2010). However, to perform PCI or CABG, a hospital needs a cardiac catheterization laboratory and interventional cardiologists or cardiac surgeons. In the United States, many hospitals lack such resources—for example, PCI is only available at 36.2% of the hospitals (Concannon et al. 2012). Extensive clinical evidence suggests that a timely transfer of STEMI patients from non-PCI hospitals to PCI-capable hospitals yields superior outcomes compared to administering clot-busting medicine at non-PCI hospitals (Henry et al. 2010). As a result, both American College of Cardiology Foundation and American Heart Association recommend first medical contact to device time of \( \leq 120 \) minutes for transferred STEMI patients (Dauerman et al. 2015).

Much of the medical literature has focused on the timeliness of transferring AMI patients and its impact on healthcare outcomes (Dalby et al. 2003). However, timeliness does not seem to be the only factor determining where AMI patients get transferred. Some studies find that hospitals do not always
choose the closest revascularization hospitals as transfer destinations (Iwashyna et al. 2010). Anecdotal
evidence also suggests that community hospitals in the United States tend to rely on a key hospital with
longstanding referral relationship to transfer AMI patients (Veinot et al. 2012). These observations raise
the question of what factors influence hospitals’ choice of transfer destinations for their AMI patients? How
do these factors compare in terms of their relative importance? Furthermore, how do hospitals’ choice of
transfer destinations impact the healthcare outcomes of transferred patients? To our surprise, there exists
very few evidence-based studies on interhospital transfer of AMI patients as well as patient transfer in
general. As a result, the current literature does not offer a clear answer to the aforementioned questions. In
this paper, we aim to bridge these knowledge gaps by investigating three decision factors influencing the
routing of AMI patients between hospitals: (1) the distance between sending and receiving hospitals; (2)
publicly reported quality measures of receiving hospitals; and (3) the relationship between sending and
receiving hospitals as indicated by whether they are affiliated with the same multihospital system.

We use a conditional (fixed effect) logit model to incorporate the aforementioned factors and
explore their relative importance in influencing hospitals’ choice of transfer destinations by analyzing 2011
Florida State Emergency Department and Inpatient Databases. We find that affiliation with a multihospital
system plays a much more important role than distance or quality in the selection of transfer destinations.
Specifically, our analysis shows that belonging to the same multihospital system as the sending hospital
increases a receiving hospital’s odds of being selected as the transfer destination by over 20 times. By
contrast, being the closest revascularization hospital or being the best-quality revascularization hospital in
terms of AMI 30-day readmission rate, only increases a receiving hospital’s odds of being selected by about
two times. These results are robust to three different approaches of choice set specifications (see Section
4.2 for details) and are also robust to alternative definitions of distance and quality measures, e.g., using a
continuous measure for the distance between sending and receiving hospitals or using AMI 30-day
mortality rate to measure the quality of receiving hospitals.

To evaluate how hospitals’ choice of transfer destinations impact patient outcomes, we classify all
transferred patients in our data into three categories based on the rules that best describe the choice of the
transfer destination among the alternatives within a sending hospital’s choice set: distance-based, quality-
based, or relationship-based.¹ Using this categorization, we find that relationship-based transfers are
prevalent, accounting for 45.7% of all transfers, while distance-based and quality-based transfers contribute
to 18.3% and 43.5% of all transfers, respectively. There exist cases where more than one rules explain the
choice of a transfer destination, for example, a selected receiving hospital could be both the closest to the
sending hospital and also affiliated with the same multihospital system as the sending hospital. By

¹ There is a fourth category of transfer cases where none of the three transfer rules apply.
excluding these “overlapping” cases, we obtain a mutually exclusive sample which contains 67.8% of all transfer cases in our data. In this mutually exclusive sample, 22.8% are relationship-based transfers, 7.96% are distance-based transfers, and 29.2% are quality-based transfers. Using 30-day all-cause readmission rate to measure the healthcare outcome of transferred patients, we find that relationship-based transfers are associated with worse outcome than distance-based and quality-based transfers. Specifically, compared within the mutually exclusive sample, relationship-based transfers are associated with a 10.6 percentage point higher readmission rate than distance-based transfers, and a 22.1 percentage point higher readmission rate than quality-based transfers.

To further understand the role of hospital relationship in interhospital transfer, we investigate whether the use of the relationship-based transfer rule is influenced by sending hospitals’ ownership type, which is either for-profit, nonprofit, or government-owned in the United States. To do so, we use the three aforementioned transfer rules as a choice set and conduct a multinomial logit analysis on the mutually exclusive sample. We find that nonprofit hospitals have a higher likelihood of conducting quality-based transfers and a lower likelihood of conducting relationship-based transfers than their for-profit counterparts.

Our work makes contribution along three dimensions. First, we contribute to the growing research stream on patient routing in the healthcare operations literature. We empirically investigate an important hospital process, namely, interhospital transfer of heart attack patients, and identify key factors influencing hospitals’ choice of transfer destinations. Our results highlight the important role played by hospital relationship in the selection of transfer destinations as well as its negative impact on patient outcomes. Second, our work is valuable to clinicians and hospital administrators by associating patient outcomes with the selection rules of transfer destinations (i.e., relationship-based vs. distance-based vs. quality-based). Our finding calls for reevaluation of current hospital practice of relationship-driven patient transfers. Last but not least, our work is highly relevant to the ongoing nationwide effort to improve care for heart disease, which is the leading cause of death in the United States, accounting for 1 in 4 deaths currently. An essential part of the improvement effort is to create regionalized care networks, which is still much of a work in progress (Henry et al. 2010). For regionalization of care to succeed, it is critical to transfer patients from hospitals lacking treatment capabilities to higher-level or specialized hospitals with appropriate capabilities. Our study provides valuable empirical evidence that can inform policy makers in developing guidelines to standardize and optimize the process of interhospital transfer of heart attack patients.