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Effect of hospital referral networks on patient readmissions

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ABSTRACT

Previous studies have shown that referral networks encompass important mechanisms of coordination and integration among hospitals, which enhance numerous organizational-level benefits, such as productivity, efficiency, and quality of care. The present study advances previous research by demonstrating how hospital referral networks influence patient readmissions. Data include 360,697 hospitalization events within a regional community of hospitals in the Italian National Health Service. Multilevel hierarchical regression analysis tests the impacts of referral networks' structural characteristics on patient hospital readmissions. The results demonstrate that organizational centrality in the overall referral network and ego-network density have opposing effects on the likelihood of readmission events within hospitals; greater centrality is negatively associated with readmissions, whereas greater ego-network density increases the likelihood of readmission events. Our findings support the (re)organization of healthcare systems and provide important indications for policymakers and practitioners.

1. Introduction

In the past two decades, considerable scholarly attention has been devoted to the organization of healthcare networks (Bazzoli et al., 1999; Shortell et al., 2000; Alexander et al., 2003; Dubbs et al., 2004; Wells and Weiner, 2007). In the market-driven US healthcare system, hospitals have long relied on interorganizational agreements as a viable strategy to attain greater market power over suppliers and customers, achieve operational efficiency, and, ultimately, improve strategic positioning vis-à-vis competitors (Shortell et al., 2000; Alexander et al., 2003; Dubbs et al., 2004). Collaboration networks improve hospitals' innovative capability (Goes and Park, 1997) and mitigate the downside of intense competition, thereby contributing to the development of a more sustainable market-based healthcare system (Peng and Bourne, 2009). In the US, recent reforms brought about by the Affordable Care Act have been intended to create a more unified, less fragmented healthcare system in which different actors (hospitals, specialty outpatient clinics, long-term care facilities, community services) further coordinate their activities to provide a comprehensive service for prevention and acute and chronic care. The roles and impacts of alliances and other interorganizational arrangements in healthcare have been of interest outside the US as well, and their exploration is a research priority in many European countries (e.g., Van Raak et al., 2005).

Whether and to what extent networks benefit healthcare organizations and patients have become increasingly compelling issues in healthcare management research (Bazzoli et al., 1999). Researchers have explored the impacts of such interorganizational models on several types of organizational outcome, including productivity, efficiency, and quality of care (Kaluzny et al., 1998). Other studies have investigated the ways in which interhospital collaboration enhances patient-centered goals, rather than organizational outcomes (Cuellar and Gertler, 2005; Chukmaitov et al., 2009). Vertical and horizontal collaboration have been associated with organizational advantages. Vertical collaboration comprises cooperation among actors along the care value chain and has been argued to reduce hospitals' opportunistic behavior and enhance continuity of care; horizontal collaboration involves cooperative agreements among competitors (Zuckerman et al., 1995; Buchner et al., 2015). In the healthcare domain, hospital cooperation reportedly spurs efficiency gains and cost reduction because of the

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advantages associated with shared resources, medical infrastructure, and care provision (Dranove and Shanley, 1995; Olden et al., 2002; Buchner et al., 2015). In some industries, horizontal collaboration has also been associated with detrimental price fixing and anti-competitive behaviors (e.g., Teece, 1994). However, price-fixing behaviors of networking hospitals have received little support in the US context (Burgess et al., 2005) and are even less likely to arise in European healthcare markets, which are mostly non-price competitive (e.g., Cooper et al., 2011; Mascia et al., 2012).

Although abundant, previous research on this topic carries several limitations. First, most previous studies have examined formal collaborative agreements among hospitals, which may not reflect actual systems of care (Wells and Weiner, 2007). Moreover, such forms of health networks are largely confined to the US healthcare domain (Bazzoli et al., 1999), rendering the generalization of findings difficult. Lastly, even as collaborative healthcare networks diffuse and grow in importance in modern health systems around the world, little is known about their effects on one important indicator of care effectiveness: patient readmissions.

The present study addresses these limitations by investigating the extent to which hospital collaboration mechanisms are beneficial by reducing the likelihood of patient readmission events. Recent healthcare research has shown that hospital collaboration can often be examined through patient sharing or referral in US (Lee et al., 2011) and European (Lomi et al., 2014) settings. The literature on patient sharing highlights the strong and heterogeneous interconnectedness of hospitals through patient flows, suggesting that, "in many ways, hospitals are analogous to individual people within a social network. Just as people are connected by social ties and interactions, hospitals are often connected to each other through sharing patients, because patients discharged from one hospital may be admitted to other hospitals" (Lee et al., 2011; 707). Patient sharing involves the exchange of highly complex information and thus requires high levels of communication and coordination between receiving and sending hospitals (Gittell and Weiss, 2004). Hence, the practice of patient sharing embeds hospitals in collaborative networks in which not only patients, but also information and behavioral practices are exchanged (Iwashyna et al., 2009; Veinot et al., 2012). The investigation of patient-sharing dynamics allows researchers to move beyond a static and purely formal view of interhospital collaboration by taking into account actual clinical information sharing and relational coordination associated with care provision (Gittell and Weiss, 2004; Veinot et al., 2012).

In this study, we apply social network analysis techniques to investigate inter-hospital patient referrals, considered as relations constituting an interorganizational network amenable to direct empirical investigation. This social network perspective allows us to evaluate the relationship between healthcare networks and patient readmissions in a twofold manner. First, to conceptualize healthcare network variables, we identify networks as emerging from actual patient flows. Classifications and taxonomies routinely reported in the extant literature are based on formal agreements that simplify the actual patterns of collaboration between hospitals. Social network analysis of patient sharing instead captures and describes the complex characteristics of collaborative network structure as emerging from actual exchanges. In addition, this approach can be replicated across domains and geographic areas, overcoming the problematic use of formal classifications of healthcare networks (e.g., centralized vs decentralized networks) that may be highly context-specific. We thus propose a model that explores how hospitals' positions within referral networks influence the effectiveness of care delivered at the patient level, measured as patient readmissions.

2. Theoretical background

A hospital's patient referral – or sharing – network represents an important form of collaboration in the healthcare sector (Iwashyna et al., 2009; Lee et al., 2011). Patient referrals occur *via* direct interhospital transfers, whereby (in)patients discharged from one hospital are admitted to another hospital (Lee et al., 2011). For elective patients, initial admission is scheduled in advance and does not involve a medical emergency. Transferred patients are dispatched from a sender to a receiver hospital *via* ambulance service within 24 h of admission to the sender hospital, in line with Lee et al.'s (2011) classification of "uninterrupted patient sharing." Patient transfer requires deliberate adjustment between partnering hospitals because it takes place after the receiving organization has agreed to receive the patient. Thus, this type of patient sharing relies entirely on hospitals' decisions and is not influenced by patients' preferences (Lomi et al., 2014). In settings characterized by universal coverage and general access to services, such as European health systems or the US Medicare system, insurance schemes are also unlikely to influence transfer decisions.

Patient referrals may be driven by "asymmetries" in providers' clinical resources or competences (e.g., lack of necessary medical equipment, expertise, staffing, or supplies). For example, hospitals that provide only basic services may send patients with more complex clinical conditions to providers that offer comprehensive specialty care. Hospitals with medical school affiliations or advanced surgical capacity are more likely than other institutions to receive transferred patients (Iwashyna et al., 2009). Hospitals refer patients to more capable hospitals (Lomi et al., 2014).

Patient referral requires a high level of information sharing between hospitals, facilitated by close interorganizational coordination and shared routines. A transferred patient is accompanied by preliminary diagnostic analyses, clinical documentation, and reports, which the receiving hospital may use (Bosk et al., 2011). Veinot et al. (2012) documented wide reliance on a collective, repeated, and stable set of activities established by partner hospitals for patient sharing in the context of the US Medicare system. These interorganizational routines provide important learning opportunities, especially regarding patient care and appropriate ways of addressing clinical problems (Hilligoss and Cohen, 2011; Cohen et al., 2012).

Referral networks can thus provide opportunities for hospitals to improve the quality of care delivery. According to the relational view advanced by Lavie (2006), network resources can add to intrafirm knowledge and capabilities, enhancing financial and reputational returns. The complementarity of resources present in the network with respect to those possessed by the focal organization is crucial. In a patient referral event, the referring hospital confronts a shortage of knowledge, equipment, and/or capacity to treat the patient and requires a partner with complementary, non-shared resources. The provider partner with the best possible combination of capabilities, capacity, and reputation is identified and the patient is dispatched. This mechanism results in better, more specialized treatment for the patient, with important returns in terms of quality of care for the receiving and referring hospitals (Lomi et al., 2014). A patient referral event also enables the referring hospital to increase focus on its specialization(s) by avoiding resource investment for a patient requiring a different type of care (Dudley et al., 2000). At the same time, it allows the receiving hospital to refine its knowledge and capabilities related to selected treatments by increasing the number of patients treated.

3. Hypothesis development

The social network perspective focuses on how an