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Travel patterns of cancer surgery patients in a regionalized system

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ABSTRACT

Background: Regionalization of complex surgeries has increased patient travel distances possibly leaving a substantial burden on those at risk for poorer surgical outcomes. To date, little is known about travel patterns of cancer surgery patients in regionalized settings. To inform this issue, we sought to assess travel patterns of those undergoing a major cancer surgery within a regionalized system.

Materials and methods: We identified 4733 patients who underwent lung, esophageal, gastric, liver, pancreatic, and colorectal resections from 2002–2014 within a multihospital system in the Mid-Atlantic region of the United States. Patient age, race and/or ethnicity, and insurance status were extracted from electronic health records. We used Geographical Information System capabilities in R software to estimate travel distance and map patient addresses based on cancer surgery type and these characteristics. We used visual inspection, analysis of variance, and interaction analyses to assess the distribution of travel distances between patient populations.

Results: A total of 48.2% of patients were non-white, 49.9% were aged >65 y, and 54.9% had private insurance. Increased travel distance was associated with decreasing age and those undergoing pancreatic and esophageal resections. Also, black patients tend to travel shorter distances than other racial and/or ethnic groups.

Conclusions: These maps offer a preliminary understanding into variations of geospatial travel patterns among patients receiving major cancer surgery in a Mid-Atlantic region-alized setting. Future research should focus on the impact of regionalization on timely delivery of surgical care and other quality metrics.

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1. Introduction

Procedures performed at high-volume hospitals (HVHs) have been associated with lower operative mortality and complication rates [1—4]. Insurers and employers have responded to this inverse volume—outcome relationship by encouraging referrals to HVHs to reduce health costs of complications and to ensure delivery of quality care [5—8]. As a result of this trend, several studies observed the regionalization of specific surgical procedures to HVHs including surgeries for brain, esophageal, gastric, liver, bladder, and colorectal cancers [9—11].

Despite this encouraging trend, some worry that regionalization may create barriers of access to care for certain populations and have pointed out disparities observed in or even exacerbated by regionalizing surgical care [2,12]. Such studies suggest that during the transition to regionalized care, the use of HVHs by minority patients grew more slowly or even declined compared with that of whites [9—11]. Further studies revealed that minority patients are more likely to go to low-volume hospitals for surgical care than whites [10,13—15]. The contributing factors underlying these disparities tend to be multifactorial. Specifically, regionalization to HVHs significantly increased the distance some patients must travel to receive their surgical care [10,16—18]. Stitzenberg et al. [10] showed that mean travel distance for patients undergoing esophagectomies and pancreatectomies increased from 1996—2006 in response to regionalization. Increased travel for surgical care may enhance the burden of those who often lack the means to receive their surgical cancer care in an efficient and satisfactory manner [19]. Certain patients may be willing to accept suboptimal care rather than travel longer distances to regionalized centers [20].

To date, little is known about how travel patterns to major cancer surgeries vary with patient sociodemographic factors in a regionalized care setting. To inform this important issue, we sought to map travel patterns of patients receiving major cancer surgery in a large multihospital system serving a diverse population within the Mid-Atlantic region of the United States using geographic information systems. Geographic information system has emerged as a tool to integrate and visualize data and run mathematical models to find relationships between various variables. Thus, it has become an important tool in epidemiologic studies regarding cancer research including evaluating travel patterns to cancer screenings and therapies [21—26]. Leveraging this technology, this study generates preliminary data about varying travel distances of cancer surgery patients in a regionalized system and contributes to efforts to disentangle disparities seen in regionalized care. We hypothesize that travel distances to receive major cancer surgery within a regionalized health care system vary by sociodemographic factors.

2. Materials and methods

2.1. Data source

Retrospective data were queried from MedStar's medical records. Patients with specific documented differentiated cancer types evaluated at MedStar-affiliated hospitals, namely MedStar Georgetown University Hospital (MGUH), MedStar Washington Hospital Center (MWHC), MedStar Union Memorial Hospital (MUMH), and MedStar Franklin Square Medical Center (MFSMC) were selected. Explorys platform was used to extract data of 6107 patients who met the inclusion criteria for this study.

2.2. Cohort ascertainment

Using the International Classification of Diseases, Ninth Revision (ICD-9), procedure codes, we included a total of 6107 patients: 3674 (60.1%) with a diagnosis of colon cancer (ICD-9, 153.0—153.9), 78 (1.3%) with a diagnosis of esophageal cancer (ICD-9, 150.0—150.9), 252 (4.1%) with a diagnosis of gastric cancer (ICD-9, 151.9), 547 (9.0%) with a diagnosis of pancreatic cancer (ICD-9, 157.9), 286 (4.7%) with a diagnosis of liver cancer (ICD-9, 155.0), and 1269 (20.8%) with a diagnosis of lung cancer (ICD-9, 162.9). All patients underwent a major surgical procedure as related to their type of cancer between 2002 and 2014. Six cohorts were created stratifying patients by type and location of cancer. Our definition of major oncologic cancer surgery is in line with our previous work of older adults undergoing major cancer surgery [14,27,28]. Patients underwent cancer resection at one of the four MedStar hospitals either in the Greater Washington, District of Columbia or Baltimore, Maryland area: MGUH, MWHC, MFSMC, or MUMH. MedStar's Institutional Review Board approved the study.

We identified 6107 patients using Explorys, and we excluded 962 patients (15.7%) who visited a hospital other than those considered for this study, 373 duplicate records (6.1%), 32 patients (0.52%) with unknown race, and 7 patients (0.11%) aged <18 y. A final data set of 4733 patients was available for this study.

2.3. Variable selection

Variables included in the analysis were age, geographic location, admission year, race and/or ethnicity, insurance type, cancer surgery type, and treating hospital.

2.4. Geospatial mapping

Maps were generated in R, version 3.1.0 (R Core Team, Vienna, Austria), using the ggplot2 and ggmap packages. Patients' addresses and the location of the four MedStar hospitals were deidentified and geocoded (converted into geographic coordinates, latitude, and longitude) to form the data points plotted on the maps. Google satellite maps were used as the basis for generating the maps. Several maps were generated and the points were colored based on age, race, or cancer surgery type (Figs. 1—3). Because of the allotted space in this article, we displayed maps from one of our hospitals (Figs. 2 and 3).

2.5. Statistical methods

Using R packages, travel distances were calculated between the patient's home address and the destination (hospital). Travel distances were log transformed. Comparisons between