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Geographic variation in the demand for emergency care: A local population-level analysis

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ABSTRACT

Background: Geographic variation in healthcare has been traditionally studied in large areas such as hospital referral regions or service areas. These analyses are limited by variation that exists within local communities.

Materials and methods: Using a New York claims database, we analyzed variation in emergency department use using 35 million visits from 2008 to 2012 among 4797 Census tracts, a smaller unit than usually studied. Using multivariate analysis, we studied associations between population characteristics and proximity to healthcare with rates of emergency department use. We analyzed how factors associated with emergency department utilization differed among urban, suburban, and rural regions.

Results: We found significant geographic variation in emergency department use among Census tracts. Public insurance and uninsurance were correlated with high emergency department utilization across all types of regions. We found that race, ethnicity, and poverty were only associated with high emergency department use in urban regions. In suburban and rural regions, a lower proportion of elderly residents and shorter distances to the nearest ED were correlated with high emergency department use.

Conclusions: Significant variation in emergency department use exists locally when studied within small geographic areas. Insurance type is significantly associated with variation in emergency department use across urban, suburban, and rural regions, whereas the significance of other factors depended on urbanicity.

Implications: Studying geographic variation at a more granular level can lead to better understanding of local population health, drivers of healthcare utilization, and inform targeted interventions. Given heterogeneity in emergency department use by Census tract, policies directed at shaping acute care utilization must consider these local geographic differences.

1. Introduction

Emergency department (ED) care has been targeted as a substantial driver of increased healthcare costs, and decreasing ED use has become a primary endpoint for new healthcare delivery models [1–4]. However, understanding geographic variation in ED use is a critical first step in reducing avoidable emergency department visits without unintentionally creating barriers to the healthcare safety net [5]. To date, geographic variation has largely been studied from the perspective of hospitals by focusing on hospital referral regions (HRRs) and hospital service areas (HSAs) [6]. As the Institute of Medicine concluded in its recent report, HRRs and HSAs are large and significant variation in healthcare utilization and spending exists in progressively smaller geographic units of analysis [6]. They suggested that if healthcare payment systems wanted to use geographic variation to promote value, then variation would have to be targeted at a local level.

Shifting the frame of reference from HRRs and HSAs to a more granular unit of analysis, i.e. Census tracts, not only improves identification of local hotspots with high healthcare use, but it shifts from focusing on variation at the regional level to variation among local populations and communities [7,8]. Patient choice is a large driver of variation in healthcare use, and nowhere is this

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more evident in patterns of emergency department use,[9] where specific patient characteristics have been linked to a higher probability of using the ED for care [10]. Prior patient-level studies have demonstrated several demographic and socioeconomic factors are associated with high ED utilization, such as race, poverty, and insurance status [10–12]. However, these studies have not considered that these characteristics may have varying effects in different geographic regions [13]. In addition, many of these factors cluster in small communities, thus studying ED use at a local level can provide insight on how to geographically target interventions to improve the delivery of healthcare [14–17].

Understanding how healthcare utilization patterns vary at a local population or community level is essential to ensure that broad policies outlined to reduce ED use do not have adverse effects if ED utilization is heterogeneous depending on the region considered. Thus, the objective of this study was to analyze geographic variation in ED use at the level of the Census tract and to determine which factors were associated with variation in ED use. We compared rates of ED use by controlling for the influence of demographic and socioeconomic factors in addition to geographic variables such as proximity to primary and emergency care. We then performed stratified analyses of urban, suburban, and rural regions to identify how the influence of these factors may vary depending on geographic region.

2. Materials and methods

2.1. Study setting

We studied ED use in New York State using the Statewide Planning and Research Cooperative System (SPARCS), an all-payer, administrative claims database created by the New York State Department of Health. New York contains varied population types as well as geographic diversity (urban, suburban and rural areas). We studied ED use from 2008 to 2012 to match recently released data from the American Community Survey (ACS). For our geographic analyses, we used data and shapefiles provided by the National Historical Geographic Information System (NHGIS) at the University of Minnesota [18].

2.2. Subjects

We included all patients visiting an ED at a New York State general acute care hospital who had a geocodable home address in New York State. Patient addresses were located to specific Census tracts using ArcGIS Desktop: Version 10.1 (ESRI: Redlands, CA: 2011). We excluded patients that visited the few specialty hospitals with EDs, but that provide care only for specific patient populations (i.e. cancer, surgical specialty or Veterans hospitals). These exclusions only accounted for approximately 1% of all ED visits in New York State.

2.3. Measures

Our primary outcome measure was the total number of ED visits per 1000 New York State residents for each Census tract. To calculate this outcome, the number of ED visits for the five-year study period that geocoded to each Census tract was divided by population estimates from the ACS. This number was then divided by five to obtain an annual number of ED visits per population for each Census tract. To account for sampling error in Census data, we excluded Census tracts where the 95% confidence interval radius was greater than one-half of the total population estimate [19]. These exclusions reduced the influence of tracts where the Census did not survey enough residents to provide confident estimates [20]. We also performed a sensitivity analysis to evaluate whether increasing the strictness of this error cutoff to one-third or one-fourth of the population estimate had any material effect on our results.

Of the 4854 New York State Census tracts with non-zero population counts, 32 tracts (0.7%) were excluded due to significant error in population estimates. An additional 25 tracts (0.5%) were excluded because they had missing or erroneous data for one of the population covariates described below. In addition, approximately 8% of addresses geocoded only to the zip code level and thus were excluded from the analysis.

2.4. Population characteristics

We examined Census tract-level variables including the proportion of the population categorized as elderly (age 65 or above), female, black or African–American, Hispanic, in poverty (defined as below 100% of the federal poverty level), with public health insurance (includes both Medicaid and Medicare), uninsured, and level of education (defined as without a high school degree). We selected these covariates a priori based on prior studies of ED use and a conceptual model of population health [21–24]. This conceptual model by Kindig considers that disparities in population health are driven not only by gender, race/ethnicity, and socioeconomic factors, but identifies geography as playing a key role in population health.

2.5. Access to primary care

To include proximity to primary care in our analysis [15,25,26], we determined primary care density by Census tract using data from The Primary Care Physician Mapper available from the Robert Graham Center at the American Academy of Family Physicians [27], which created estimates from National Provider Identifiers for allopathic and osteopathic physicians in family medicine, general practice, internal medicine and pediatrics. Since this source uses 2010 Census tracts, we adjusted the counts based on proportion of geographic overlap with 2012 Census tracts in order to match the geographic frame of reference for all other data sources. The primary care density was calculated as providers per 10,000 New York State residents.

2.6. Distance to nearest ED

To include proximity to an ED in our analysis [14,15,28], we used ArcGIS Network Analyst and New York State Streets Files to determine the driving distance from the center of Census tracts to the nearest ED [29]. To account for hospital closures and new hospital openings identified from SPARCS audit reports, we calculated distances on an annual basis and included an ED if it was open during a given year of analysis. We then averaged distances from 2008 to 2012 to create a metric reflective of average ED accessibility over the study period.

2.7. Stratification by locale

To test whether findings were related to differences in geographic region,[13] we decided a priori to stratify Census tracts by urban, suburban and rural regions. These regions were developed based on the Census definition of Urbanized Areas [20]. Census tracts located in urban regions were defined as those found within the boundaries of Urbanized Areas as delineated by the Census. Suburban regions were defined as tracts that intersected Urbanized Areas but were not contained by them. Rural regions were defined as those remaining tracts that did not otherwise intersect with Urbanized Areas (see Supplemental figure).