

Geographic Variation in Use of Ambulance Transport to the Emergency Department

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Study objective: Evidence on variability in emergency medical services use is limited. We obtain national evidence on geographic variation in the use of ambulance transport to the emergency department (ED) among Medicare enrollees and assess the role of health status, socioeconomic status, and provider availability.

Methods: We used 2010 Medicare claims data for a random sample of 999,999 enrollees aged 66 years and older, and identified ambulance transport and ED use. The main outcome measures were number of ambulance transports to the ED per 100 person-years (ambulance transport rate) and proportion (percentage) of ED visits by ambulance transport by hospital referral regions.

Results: The national ambulance transport rate was 22.2 and the overall proportion of ED visits by ambulance was 36.7%. Relative to hospital referral regions in the lowest rate quartile, those in the highest quartile had a 75% higher ambulance transport rate (incidence rate ratio [IRR] 1.75; 95% confidence interval [CI] 1.69 to 1.81) and a 15.5% higher proportion of ED visits by ambulance (IRR 1.155; 95% CI 1.146 to 1.164). Adjusting for health status, socioeconomic status, and provider availability reduced quartile 1 versus quartile 4 difference in ambulance transport rate by 43% (IRR 1.43; 95% CI 1.38 to 1.48) and proportion of ED visits by ambulance by 7% (IRR 1.145; 95% CI 1.135 to 1.155). Among the 3 covariate domains, health status was associated with the largest variability in ambulance transport rate (30.1%), followed by socioeconomic status (12.8%) and provider availability (2.9%).

Conclusion: Geographic variability in ambulance use is large and associated with variation in patient health status and socioeconomic status. [Ann Emerg Med. 2017;■:1-11.]

Please see page XX for the Editor's Capsule Summary of this article.

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INTRODUCTION

Emergency medical services (EMS), ranging from 911 calls and medical dispatch to emergency and trauma care that take place before a patient's arrival to the hospital, are a vital component of the out-of-hospital health care system, which covers virtually all ill and injured Americans. Despite its recent growth—most of the current infrastructure was developed in the last 60 years—there is “enormous variability in the design of EMS systems among states and local areas,” with half the systems relying on the local fire department.^{1,2}

To date, there is little evidence on geographic variation in EMS use.¹ Data from the National Hospital Ambulatory Medical Care Survey (NHAMCS), an annual survey of ED patients, indicate that the number of ambulance transports to the ED was 20.4 million in 2012, amounting to 6.5 transports per 100 population.³ NHAMCS data are the basis for much of the current national evidence on

ambulance transport to the ED⁴⁻⁶; however, because of limited sample size, geographic variation cannot be measured.⁷ Other cohort studies of hospitalized patients with acute conditions have examined use of ambulance transport in evaluating patient outcomes, but provide little information on geographic variability.⁸⁻¹¹ Also, because much of the current evidence is based on data about ED patients and because propensity to seek ED care varies by geography, rates of use of ambulance transport at the community level may differ from that among ED patients.¹²

Our aim in this study was to evaluate geographic variability in the use of ambulance transport to the ED at the community level and among ED patients. Combining individual data on patient health status for a national sample of Medicare enrollees with area-level socioeconomic and provider data, we also evaluated the relative role of 3 factor domains—health status, socioeconomic status, and

Editor's Capsule Summary*What is already known on this topic*

National database assessments suggest 6.5 transports per 100 persons per year, but little is known about geographic variability at the community level.

What question this study addressed

The geographic variability in ambulance use among Medicare enrollees and the relative contributions of health status, socioeconomic status, and provider availability to this variability.

What this study adds to our knowledge

Medicare enrollees use ambulance transport frequently, with significant geographic variability (range 9.3 to 37.8/100 person-years). Health status accounted for the largest proportion of variability (30.1%), followed by socioeconomic status (12.8%) and provider availability (2.9%).

How this is relevant to clinical practice

This does not affect practice but may assist in improving access to services in the Medicare population.

provider availability—in accounting for the geographic variation in ambulance use.

MATERIALS AND METHODS**Study Design**

We performed a retrospective cohort study of a random sample of Medicare enrollees aged 66 years and older and their use of ambulance transport to the ED.

Our primary data source was administrative claims data covering all inpatient and outpatient care received by Medicare enrollees. Among all Medicare enrollees, we identified 22.1 million aged 66 years or older on January 1, 2010, and who were continuously enrolled in the Fee-for-Service plan (Parts A and B) during 2009 to 2012. Treating these enrollees as the sampling universe, we obtained a random sample of 999,999 enrollees stratified by region, race/ethnicity, and (zip code–level) household income. We included individuals aged 66 years and older to ensure availability of data on at least 1 year of previous health care use in Medicare. We used Dartmouth Institute's partitioning of the country into 306 hospital referral regions, derived from identification of contiguous areas wherein a majority of acute inpatient care of residents is provided¹³; our sample had 1,140 to 11,470 enrollees from

each hospital referral region. We obtained person-level sampling weights to provide estimates for the universe of 22.1 million enrollees. We examined the use of ambulance transport and emergency department (ED) care during 2010 or until death for enrollees who died during 2010.

As factors that potentially mediate geographic variation in ambulance and ED use, we identified several area-level and hospital-level data from previous literature on geographic variation in health care use.^{12,14,15} We used US Census Bureau data on zip code–level socioeconomic status measures, including median household income, English-language proficiency, and foreign birth.¹⁶ We characterized provider availability according to proximity to hospitals, using data from the American Hospital Association survey (2010),¹⁷ area-level availability of physicians from the Dartmouth Institute,¹⁴ and urban designation of enrollee county residence.¹⁸

In the Medicare data, we identified individual ED visits not resulting in admission according to outpatient claims (revenue center codes 0450 to 0459 or 0981) and ED visits resulting in inpatient admission, using inpatient claims (a positive value of ED charge amount).¹⁹ We identified emergency ambulance transport to a hospital ED from a nonhospital setting, using claims arising from ambulance transport and ED visit. First, we identified ambulance service claims for emergency ground transport (Healthcare Common Procedure Coding System [HCPCS] code A0427, A0429, or A0433 and a positive value in the mileage indicator field A0425) from any location other than a hospital (based on the origin field) to a hospital (based on the destination field).^{20,21} Second, to ascertain transport to an ED, we included ambulance transport claims for which the date of service was the same day or the day before the date of the ED visit.

Outcome Measures

Our main outcomes were ambulance transport rate, defined as the number of ambulance transports to the ED per 100 person-years and an indicator of community-level ambulance use, and proportion of ED visits by ambulance, defined as the proportion (%) of ED visits using ambulance transport, an indicator of ambulance use among ED patients. As a secondary outcome, we also examined the number of ED visits per 100 person-years, the ED rate.

We identified enrollee age at baseline, sex, and race/ethnicity (grouped as Hispanic, non-Hispanic black, non-Hispanic white, non-Hispanic Asian, and other); "other" included 0.02% of enrollees with no race/ethnicity information. In identifying Hispanics, we used the imputed Hispanic indicator field (included in the Medicare enrollee data), developed with name and location data.²²⁻²⁴

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