RESEARCH LETTER

Hospital and Regional Variation in Medicare Payment for Inpatient Episodes of Care

Health care spending varies widely between geographic regions, but there is disagreement regarding the appropriate policy response. Regional policies include reducing Medicare payment rates in high-spending regions, limiting the supply of health care facilities using certificate-of-need criteria, and implementing care-improvement collaboratives. The Institute of Medicine opposed regional policies in favor of hospital- and health care professional-focused policies, such as bundled payments, accountable-care organizations, and value-based payments. Their concern was that substantial variation in Medicare spending occurs within geographic regions and high-performing hospitals and health care professionals in low-performing regions would be unfairly penalized by regional policies. To further inform this debate, we compared the amount of spending variation that occurs between regions vs between hospitals.

Methods | Using claims for all Medicare fee-for-service beneficiaries from January 1, 2008, through December 31, 2008, we summed Medicare payments for hospital and post–acute care services (skilled nursing facilities, home health, and inpatient rehabilitation) for episodes spanning from inpatient admission to 30 days after discharge. Physician payments—a small proportion of both the total episode payments and the variation in episode payments—were not included. Payments were standardized to remove Medicare’s geographic adjustments. Ten common conditions were included in the analysis (Figure 1), identified using 27 Medicare Severity Diagnosis Related Groups (MS-DRGs). We normalized episode payments within each MS-DRG to a mean (SD) of 0 (1) to facilitate comparisons across MS-DRGs. Each episode was linked to the hospital with the initial admission and the hospital referral region (HRR). We then estimated the average normalized episode payment across all episodes for each originating hospital. Our sample included 3086 hospitals that provided at least 50 episodes across the 10 conditions in 2008; the median value for a hospital was 515 episodes. We excluded HRRs with fewer than 3 hospitals and hospitals with fewer than 20 episodes of a particular condition. Using hospitals as the unit of analysis, we estimated a hierarchical regression model with HRR random intercepts to estimate episode-spending variance components at the hospital and HRR levels. Institutional review board approval was obtained from RAND Corporation.

Results | There were between 3 and 72 hospitals per HRR. Hospital referral regions were associated with between 7.3% (gastrointestinal tract bleeding) and 29.4% (joint replacement of lower extremity) variation in spending, with considerable differences across conditions (Figure 1). Conditions that more frequently involved post–acute care had a greater proportion of HRR-level spending variation.

Figure 2 shows the range of hospital episode spending in each HRR. Hospital episode spending was calculated as the average of normalized Medicare spending across episodes for the 27 MS-DRGs in the sample. Hospital referral regions are

---

Figure 1. Proportion of Variance in Medicare Spending at the Hospital and Area Levels

<table>
<thead>
<tr>
<th>Condition</th>
<th>Hospital</th>
<th>HRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint replacement of lower extremity (85%)</td>
<td>29.4</td>
<td>70.6</td>
</tr>
<tr>
<td>Sepsis (56%)</td>
<td>25.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Hip fracture (94%)</td>
<td>22.2</td>
<td>77.8</td>
</tr>
<tr>
<td>Urinary tract infection (53%)</td>
<td>21.8</td>
<td>78.2</td>
</tr>
<tr>
<td>Pneumonia (44%)</td>
<td>19.7</td>
<td>80.3</td>
</tr>
<tr>
<td>COPD (36%)</td>
<td>17.9</td>
<td>82.1</td>
</tr>
<tr>
<td>Congestive heart failure (46%)</td>
<td>17.5</td>
<td>82.5</td>
</tr>
<tr>
<td>Acute myocardial infarction (47%)</td>
<td>8.9</td>
<td>91.1</td>
</tr>
<tr>
<td>Gastrointestinal tract bleeding (31%)</td>
<td>7.3</td>
<td>92.7</td>
</tr>
</tbody>
</table>

Data were obtained using 2008 Medicare claims. The unit of analysis was hospitals. COPD indicates chronic obstructive pulmonary disease; HRR, hospital referral region.
ranked from lowest to highest median spending along the x-axis. Each bar represents the range between the lowest- and highest-spending hospital in an HRR, with the median denoted by an orange line. There is a great deal of overlap between HRRs in the range of hospital spending. For example, the lowest-spending HRR contains a hospital with higher spending than the lowest-spending hospital in the highest-spending HRR.

Discussion | Variation in Medicare spending for episodes of acute and post-acute care was driven by both hospital-based and regional factors. Total Medicare spending was also affected by the volume of episodes. While hospital-level factors accounted for most of the variation in episode spending, region also played an important role, particularly for episodes that commonly involve post-acute care. Post-acute care is particularly important given that it accounts for the largest share of variation in per capita Medicare payments.3

These results are consistent with a prior study4 of per capita spending in areas within HRRs and inform the continuing debate regarding provider- vs region-level policies to address variation in spending.7 Because higher- and lower-spending hospitals are located within regions, region-level policies, such as global reductions in payments, would be expected to penalize lower-spending hospitals. However, our results suggest that there is an important regional component driving cost variation for conditions with more post-acute care spending that should be considered in any payment reform.

Peter S. Hussey, PhD
Peter Huckfeldt, PhD
Samuel Hirshman, BA
Ateev Mehrotra, MD, MPH

Author Affiliations: RAND Corporation, Boston, Massachusetts (Hussey, Huckfeldt); Division of Health Policy and Management, University of Minnesota School of Public Health, Minneapolis (Huckfeldt); Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts (Mehrotra).

Corresponding Author: Peter S. Hussey, PhD, RAND Corporation, 20 Park Plaza, Ste 920, Boston, MA 02116 (hussey@rand.org).

Author Contributions: Dr Hussey had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Hussey, Mehrotra.
Acquisition, analysis, or interpretation of data: Hussey, Huckfeldt, Hirshman.
Drafting of the manuscript: Hussey, Hirshman.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Hussey, Huckfeldt, Hirshman.
Obtained funding: Hussey, Mehrotra.
Study supervision: Hussey, Mehrotra.

Conflict of Interest Disclosures: None reported.

Funding/Support: This study was supported by the Institute of Medicine.

Role of the Funder/Sponsor: The Institute of Medicine provided input on the design and conduct of the study, but was not involved in the collection, analysis, and interpretation of the data, and in the preparation, review, or approval of the manuscript.

Additional Contributions: Mark Totten, MS, RAND Corporation, provided assistance with data preparation. He was not compensated.

Data were obtained using 2008 Medicare claims. The unit of analysis is hospitals. HRR indicates hospital referral region; orange line, median value.

Figure 2. Ranges of Hospital Spending in HRRs by Median HRR Spending
Editor’s Note

The Role of Post–Acute Care in Variation in the Medicare Program

Variation is frequently cited as evidence of unnecessary or wasteful health care, because we would expect a patient’s medical condition, not geography or health care professional, to dictate who receives a particular procedure or service. Understanding how much variation is owing to regions vs providers within regions can help in devising strategies to reduce variation.

A 2013 Institute of Medicine report found that differences in individual provider and hospital practices explained variation more than did regional patterns. Hussey, a member of that Institute of Medicine committee, and colleagues analyze in depth some of the Medicare data on variation in their article. They find that conditions that more frequently involved post–acute care explained much of the variation by region. Post–acute care refers to a wide range of services, which include skilled nursing facilities, inpatient rehabilitation facilities, home health aides, outpatient physical and occupational therapy, and long-term care facilities. For example, joint replacement of a lower extremity had more than 4 times as much regional variation as conditions that do not generally involve post–acute care, such as gastrointestinal bleeding. The association of post–acute care with the variation seen by Hussey et al is consistent with a 2011 report from the Medicare Payment Advisory Commission that found that use of post–acute care services explained the largest portion of Medicare variation at the metropolitan statistical-area level.

Medicare spends more than $59 billion on post–acute care, which has more than doubled since 2001. Discharges to post–acute care facilities have increased nearly 50% during the past 15 years. Post–acute care is a major contributor to the costs of a hospitalization episode, because 42% of Medicare beneficiaries are discharged from hospitals to post–acute care. The Medicare Payment Advisory Commission’s recommendations to Congress, which promote site-neutral payments for acute care facilities have increased nearly 50% during the past 15 years.

Association Between Opioid Use and Atrial Fibrillation: The Reasons for Geographic and Racial Differences in Stroke (REGARDS) Study

It has been estimated that more than 4.3 million adults in the United States are taking opioids regularly in any given week. Opioid receptors are downregulated in animal models of atrial fibrillation (AF). However, to our knowledge, the association between opioid use and AF has not been examined in population-based studies. We examined the cross-sectional association between prescription opioid use and AF using data from the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study.

Methods | Details of the REGARDS study and its design have been published. Briefly, between January 25, 2003, and October 30, 2007, a total of 30,239 participants were recruited using postal mailings and telephone calls from across the United States. Demographic information, medical histories, blood tests, and electrocardiograms were obtained using a computer-assisted telephone interview system and in-home study visits by trained staff. The study was approved by the institutional review boards at all participating centers. Oral informed consent was obtained; the participants received financial compensation. Atrial fibrillation was identified by electrocardiogram and self-reported history of a previous physician-determined diagnosis. Opioid use was ascertained by pill-bottle review during the in-home visit. The association between opioid use and AF was examined in multivariable adjusted logistic regression models using SAS, version 9.3 (SAS Institute Inc). Subgroup analyses were performed.

Results | A total of 24,632 participants (mean [SD] age, 65 [9.4] years; 54.0% women; 40.2% black) were included in the analysis. A total of 1887 participants (7.7%) reported opioid use, and 2086 individuals (8.5%) had AF. The most commonly used opioid was hydrocodone (779 [41.3%] of opioid users), followed by propoxyphene (470 [24.9%] of opioid users) and tramadol (378 [20.0%] of opioid users). Several differences were observed between opioid users and nonusers. Opioid users were slightly younger and more likely to be female, black, and have cardiovascular comorbidities (Table 1). The prevalence of AF was higher in opioid users than nonusers (12.5% vs 7.6%; P < .001). As reported in Table 2, opioid use was associated with increased odds of AF (odds ratio [OR], 1.35 [95% CI, 1.16-1.57]) after adjustment for potential confounders, and the results were consistent in several subgroups of the REGARDS study participants. Since it is possible that this association could be confounded by substance abuse, we further adjusted for benzodiazepine and alcohol use. The association remained statistically significant (OR, 1.29 [95% CI, 1.11-1.51]). In addition, given the known cardiotoxic effects of propoxyphene, we excluded 434 participants receiving this drug in a sensitivity analysis, and the association remained statistically significant (OR, 1.33 [95% CI, 1.11-1.58]).

Discussion | In this analysis of data from the REGARDS study, opioid use was independently associated with increased...