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Comparison of Hospital Resource Use and Outcomes Among Hospitalists, Primary Care Physicians, and Other Generalists

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IMPORTANCE A physician's prior experience caring for a patient may be associated with patient outcomes and care patterns during and after hospitalization.

OBJECTIVE To examine differences in the use of health care resources and outcomes among hospitalized patients cared for by hospitalists, their own primary care physicians (PCPs), or other generalists.

DESIGN, SETTING, AND PARTICIPANTS This retrospective study analyzed admissions for the 20 most common medical diagnoses among elderly fee-for-service Medicare patients from January 1 through December 31, 2013. Patients had at least 1 previous encounter with an outpatient clinician within the 365 days before admission, and diagnoses were restricted to the 20 most common diagnosis related groups. Data were collected from Medicare Parts A and B claims data, and outcomes were analyzed from January 1, 2013, through January 31, 2014.

EXPOSURES Physician types included hospitalists, PCPs (ie, the physicians who provided a plurality of ambulatory visits in the year preceding admission), or generalists (not the patients' PCPs).

MAIN OUTCOMES AND MEASURES Number of in-hospital specialist consultations, length of stay, discharge site, all-cause 7- and 30-day readmission rates, and 30-day mortality.

RESULTS A total of 560 651 admissions were analyzed (41.9% men and 59.1% women; mean [SD] age, 80 [8] years). Patients' physicians were hospitalists in 59.7% of admissions; PCPs, in 14.2%; and other generalists, in 26.1%. Primary care physicians used consultations 3% more (relative risk, 1.03; 95% CI, 1.02-1.05) and other generalists used consultations 6% more (relative risk, 1.06; 95% CI, 1.05-1.07) than hospitalists. Lengths of stay were 12% longer among patients cared for by PCPs (adjusted incidence rate ratio, 1.12; 95% CI, 1.11-1.13) and 6% longer among those cared for by other generalists (adjusted incidence rate ratio, 1.06; 95% CI, 1.05-1.07) compared with patients cared for by hospitalists. However, PCPs were more likely to discharge patients home (adjusted odds ratio [AOR], 1.14; 95% CI, 1.11-1.17), whereas other generalists were less likely to do so (AOR, 0.94; 95% CI, 0.92-0.96). Relative to hospitalists, patients cared for by PCPs had similar readmission rates at 7 days (AOR, 0.98; 95% CI, 0.96-1.01) and 30 days (AOR, 1.02; 95% CI, 0.99-1.04), whereas other generalists' readmission rates were greater than hospitalists' rates at 7 (AOR, 1.05; 95% CI, 1.02-1.07) and 30 (AOR, 1.04; 95% CI, 1.03-1.06) days. Patients cared for by PCPs had lower 30-day mortality than patients of hospitalists (AOR, 0.94; 95% CI, 0.91-0.97), whereas the mortality rate of patients of other generalists was higher (AOR, 1.09; 95% CI, 1.07-1.12).

CONCLUSIONS AND RELEVANCE A PCP's prior experience with a patient may be associated with inpatient use of resources and patient outcomes. Patients cared for by their own PCP had slightly longer lengths of stay and were more likely to be discharged home but also were less likely to die within 30 days compared with those cared for by hospitalists or other generalists.

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Invited Commentary
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Supplemental content

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Three dominant models of generalist care exist for adults hospitalized for medical diagnoses in the United States. For some patients, their primary care physician (PCP) serves as the attending physician during a hospitalization. For others, a hospitalist (a generalist physician who focuses primarily on hospitalized patients) serves as the attending physician. Finally, some patients are cared for by a cross-covering generalist who is neither the patient's PCP nor a hospitalist (eg, physicians in group practices may cover inpatient admissions for the practice for a few weeks per year). These practice patterns reflect trade-offs between familiarity with the patient and expertise in hospital care. The association between these trade-offs and patient outcomes has not been extensively investigated.

Hospitalists now outnumber any other specialty of internal medicine, care for an increasing number of patients,[1] and care for patients in approximately 75% of US hospitals.[2] The hospitalist model has been studied extensively, but whether hospitalists increase the overall value of care has been a matter of some debate. Prior research[3-6] has demonstrated few differences between hospitalists and other internists in inpatient mortality and readmissions, although some studies[3-6] have noted decreased lengths of stay among patients cared for by hospitalists. Those studies, however, do not distinguish between patients cared for by their own PCPs and other covering physicians who may have little prior knowledge of the patient, thereby potentially masking the benefits of familiarity with the patient. Moreover, most prior research focusing on costs of care has been limited to care in the hospital and excludes the rest of the episode of care.[4,6-8]

In this context, we aimed to estimate differences in care and outcomes of hospitalized patients cared for by different types of generalists. We used a nationally representative sample of Medicare beneficiaries hospitalized for the most common medical diagnoses in the United States and hypothesized that familiarity with the patient would be associated with less use of specialty consultation and shorter length of stay. We were also interested in differences in the likelihood of discharge to home (vs postacute care), readmissions, and 30-day mortality.

Key Points

Question Does the type of generalist physician caring for a hospitalized patient—the patient's primary care physician, a hospitalist, or another covering outpatient generalist—affect patient outcomes in and out of the hospital?

Findings In this cohort study of 560 651 admissions of Medicare beneficiaries in 2013, patients cared for during a hospitalization by their own primary care physicians had slightly longer lengths of stay, were more likely to be discharged to home, and were less likely to die within 30 days compared with those cared for by hospitalists. Patients cared for by hospitalists had fewer specialty consultations, all of which represented significant differences.

Meaning A physician's prior experience with a patient may be associated with resource use and patient outcomes in the hospital and during the postdischarge period.

Methods

Study Population

We studied medical admissions to acute care hospitals from January 1 through December 31, 2013, in the 50 states and Washington, DC, among a random 20% sample of continuously enrolled fee-for-service Medicare beneficiaries 66 years or older. To identify a relatively homogeneous population, we restricted our population to patients admitted for the 20 most common medical diagnosis related groups (DRGs) (including related DRGs for conditions without complications, with complications, or with major complications). We also restricted the population to beneficiaries with at least 1 encounter with an outpatient clinician in the 365 days before admission. Admissions to federal hospitals and hospitals with fewer than 10 medical admissions in 2013 were excluded.[9] Our study was approved by the institutional review board at the Beth Israel Deaconess Medical Center, Boston, Massachusetts, which waived the requirements of informed consent and authorization for disclosure of protected health information.

Types of Generalist Physician

Our primary exposure of interest was the type of generalist physician who cared for the patient in the hospital, including the patient's PCP, a hospitalist, or other covering generalist physician. We required that the physician of record (from Part A claims) bill for care in the Carrier (Part B) claims at least once during the hospital stay. The physician was identified as a generalist and a candidate for inclusion in the study if the most frequently identified specialty on claims submitted by that physician during 2013 was general practice, internal medicine, family medicine, or geriatrician. Patients cared for by a physician of record who was not a generalist were excluded from the study.

We identified hospitalists by using previously established methods based on the volume of inpatient claims per year.[1] We categorized claims billed by all generalist physicians according to *Current Procedural Terminology* (*CPT*) codes for care setting: ambulatory (*CPT* codes 99201-99205, 99211-99215, and 99241-99245) or inpatient (*CPT* codes 99221-99223, 99231-99233, and 99251-99255). We then defined a hospitalist as a generalist physician who billed at least 20 claims per year (equivalent to 100 per year given our 20% sample), of which 90% or more were inpatient claims.

For each admission with a nonhospitalist generalist, the physician was defined as the patient's PCP if that physician billed for the plurality (the largest share) of the patient's generalist ambulatory evaluation and management visits during the 12 months preceding the admission. Any physician who was neither a hospitalist nor a PCP was considered to be another generalist. The same physician could be a PCP in one patient's admission and other generalist for a different patient's admission, but hospitalists were always identified as hospitalists.

Outcomes

Inpatient Resource Use

We defined the number of consultations per admission as the number of unique specialties billing during the hospitalization minus 1 to account for the attending physician.[10] Ser-

vices delivered by emergency medicine physicians, diagnostic radiologists, and pathologists were excluded from the count of consultations because these services do not represent an inpatient consultation.

Length of stay was defined as the date of discharge minus the date of admission plus 1 so that each admission had a length of stay of at least 1 day. Roughly 2% of admissions were transfer admissions. Transfer admissions were excluded from consultation and length-of-stay analyses.

Discharge Destination, Readmissions, and Mortality

Discharge destination was identified from the inpatient file. We categorized discharge to home vs other destinations, which include postacute skilled nursing facilities and rehabilitation hospitals. Readmissions were identified as admission to any hospital for any cause within 7 days or 30 days after discharge. Both outcomes were restricted to the population who survived the index admission. Transfers in this population were considered part of the index admission, with the 7- or 30-day readmission window starting from the discharge date of the transfer hospitalization. All-cause mortality, as identified from the Medicare Beneficiary Summary File, included death during the hospitalization and within 30 days after admission, excluding transfers.

Patient and Hospital Characteristics

Demographic information, including age (categorized in 5-year increments), race/ethnicity (defined as black, Hispanic, non-Hispanic white, Asian, and other), and sex were obtained from the Medicare Beneficiary Summary File. We also identified whether the beneficiary was dually eligible for Medicare and Medicaid. We measured clinical comorbidities in the calendar year before admission using the Center for Medicare & Medicaid Services hierarchical condition categories (HCCs)[11] and estimated the severity of the current admission using the DRG family (of varying complexities) weight as without complications, with complications, or with major complications. We also measured the month of admission and whether it occurred on a weekend or weekday.[12,13] We identified patients admitted from a skilled nursing facility as an additional indicator of severity of illness.

Hospital characteristics obtained from the 2013 American Hospital Association survey included critical access hospital status, ownership (for-profit, not-for-profit, or government-owned nonfederal), number of beds (fewer than 100, 100-249, or ≥250), teaching status (major teaching [Council of Teaching Hospitals members], minor teaching [any hospital with residents or medical students], or nonteaching), major geographic region (East, West, South, or Midwest), and urban or rural location.[14] We also measured the tendency of a hospital to use resources (the mean number of intensive care unit admissions in the previous year, coded as quartiles[10]) and the hospital's patient illness burden (measured as mean Medicare patient HCC scores).

Statistical Analysis

Data were analyzed from January 1, 2013, through January 31, 2014. The reference group for the analyses was the hospitalist group. We compared patient characteristics across the 3 types of generalists using χ^2 tests for categorical variables and unpaired *t* tests for continuous variables, with $P < .05$ (2 sided) indicating statistical significance. In multivariable models, we used fixed effects for each DRG family and omitted variables that were endogenous to the hospital stay. For the number of inpatient consultations, we fit a Poisson regression model with a log link, using generalized estimating equations to account for correlation of patients within hospital (SAS code available in eTable 1 in the Supplement). For length of stay, we fit a negative binominal regression model with a log link and the same generalized estimating equation structure for clustering. To analyze the binary outcomes (7- and 30-day readmission rates, 30-day mortality, and discharge destination), we used generalized estimating equation models with logit link and binomial distributions.

We conducted several sensitivity analyses. First, because hospitalists might have more experience with sicker patients, we separately estimated the association between type of generalist and outcomes stratified by the complexity of the admission, defined by DRG complexity, and stratified by the overall disease burden of the patient, defined by HCC score calculated during the prior year. Second, to understand the contribution of prior patient knowledge to our results, we examined whether the same outpatient physicians behaved differently with patients they knew and patients they did not know by analyzing a subgroup of physicians who were PCPs for some patients and other generalists for other patients and who cared for at least 5 patients in each role. Third, because hospitals with different care models might vary in other ways, we examined the association between generalist physician type and outcomes of interest after stratifying hospitals into quartiles based on the proportion of admissions cared for by PCPs. Fourth, because hospitalists may be more skilled at billing for patient care than PCPs or other generalists, we performed a robustness check of our results by comparing our final model, including DRG family and DRG severity, with a model with DRG family alone. Fifth, because we restricted our population to the most common medical admissions that distinguished among different levels of severity of the same condition (eg, with or without comorbidities or complications), we repeated our unadjusted analyses using all medical admissions.

Results

We studied a total of 560 651 medicine admissions (59.1% women and 41.9% men; mean [SD] age, 80 [8] years; 14.4% nonwhite) to 4535 hospitals from January 1 to December 31, 2013. Patients were admitted by 80 727 different generalist physicians. Physicians were hospitalists in 59.7% of admissions, PCPs in 14.2%, and other outpatient generalists in 26.1%. Of physicians assigned as PCPs, 76.4% were other generalists for separate admissions at some point in 2013. The median length of stay was 5 days (interquartile range [IQR], 3-7 days); 28.5% of admissions included an intensive care unit stay; and 10.6% of patients died by 30 days after admission. Most admissions were to hospitals with more than 250 beds, to nongovernment and not-for-profit hospitals, and to hospitals in urban areas. Patients cared for by each of the 3 physician types were similar in demographic characteristics but differed by the clinical characteristics of the admission, Medicaid dual-eligible sta-

Table 1. Patient and Hospital Characteristics by Type of Admission

Characteristic	Admitting Physician[a]		
	Hospitalists (n = 334 692)	Patients' PCPs (n = 79 824)	Other Generalists (n = 146 135)
Patient demographics			
Age, mean (SD), y	80.3 (8.4)	81.0 (8.2)	80.3 (8.3)
Female	58.6	61.7	58.8
White	86.3	85.9	83.6
Hispanic	1.6	2.1	2.2
Black	9.1	9.5	10.9
Medicaid dual eligibility	27.1	25.0	30.4
Admissions			
With ICU stay	29.2	25.6	28.7
Admitted on weekend	24.8	21.7	24.5
Admitted from SNF	7.4	5.5	9.4
HCC score, mean (SD)[b]	2.3 (2.1)	2.4 (2.0)	2.6 (2.2)
Hospital size, No. of beds			
<100	14.5	19.5	17.6
100-249	31.3	35.1	31.6
≥250	54.2	45.4	50.8
Hospital case mix, HCC score, mean (SD)[b]	2.3 (0.8)	2.3 (1.0)	2.4 (0.9)
Hospital ownership			
Government, nonfederal	10.2	13.1	11.9
Not-for-profit	75.7	67.7	70.3
For-profit	13.1	19.2	17.8
Other			
Major teaching hospital, %	13.4	7.0	12.3
Minor teaching hospital, %	38.3	36.6	36.4
No. of ICU admissions per 100 admissions per year, mean (SD)	25.6 (25.3)	22.8 (27.1)	23.2 (25.6)
Critical access hospital, %	3.9	6.3	6.4
Region			
Northeast	19.3	16.5	19.5
Midwest	21.9	30.6	28.2
South	42.6	43.8	39.4
West	16.1	9.2	12.9
Urban	80.0	71.1	78.2

Abbreviations: HCC, hierarchical condition category; ICU, intensive care unit; PCPs, primary care providers; SNF, skilled nursing facility.

[a] Unless otherwise indicated, data are expressed as percentage of admissions. For test of differences, $P < .001$ for all comparisons.

[b] Scores range from 0 to 6, with higher scores indicating greater predicted health care spending.

tus of the patient, and the features of the hospital (**Table 1**). For example, patients cared for by hospitalists and other generalists were more likely to have intensive care unit admissions (29.2% of all admissions for hospitalists, 25.6% for admissions of PCPs, and 28.7% for admissions of other generalists; $P < .001$) and to be admitted to large hospitals (54.2% of hospitalists' admissions, 45.4% of PCPs' admissions, and 50.8% of other generalists' admissions; $P < .001$).

Inpatient Resource Use

After controlling for patient factors and clinical features of the admissions, PCPs used specialty consultation at a slightly higher rate than hospitalists (relative risk, 1.03; 95% CI, 1.02-1.05; $P < .001$). Other generalists consulted with specialists 6% more often than hospitalists (relative risk, 1.06; 95% CI, 1.05-1.07; $P < .001$) (**Table 2** and **Figure**; full model available in eTable 2 in the Supplement).

Median length of stay in the hospital was slightly longer for patients treated by PCPs (5 days; IQR, 4-7 days) compared with hospitalists (5 days; IQR, 3-7 days) and other generalists (5 days; IQR, 3-7 days). The result was similar in magnitude in multivariable analyses for PCPs (adjusted incidence rate ratio for an additional day of hospitalization, 1.12; 95% CI, 1.11-1.13; $P < .001$) and other generalists (adjusted incidence rate ratio for an additional day of hospitalization, 1.06; 95% CI, 1.05-1.07; $P < .001$) compared with the hospitalists (Figure and eTable 3 in the Supplement).

Discharge Destination, Readmissions, and Mortality

Primary care physicians were more likely to discharge patients home (68.5%) compared with hospitalists (64.0%) and other generalists (62.1%; test of difference, $P < .001$). The adjusted odds ratios (AORs) were calculated for discharge destination at 1.14 (95% CI, 1.11-1.17; $P < .001$) for PCPs and 0.94 (95% CI, 0.92-0.96; $P < .001$) for other generalists, with hospitalists as the reference group. At 7 days, 11.1% of patients cared for by PCPs were readmitted compared with 11.6% for hospitalists and 12.0% for other generalists. In adjusted analyses, patients cared for initially by PCPs or hospitalists were read-

Table 2. Unadjusted and Adjusted Care Patterns and Patient Outcomes by Physician Type[a]

	Summary Statistics by Physician Type[b]			Regression Result by Physician Type (95% CI)		
Pattern or Outcome	Hospitalists	Patients' PCPs	Other Generalists	Hospitalists	Patients' PCPs	Other Generalists
No. of inpatient consultations per admission, median (IQR)	1 (1-2)	1 (1-2)	1 (1-2)	1 [Reference]	RR, 1.03 (1.02-1.05)	RR, 1.06 (1.05-1.07)
P value	NA	NA	NA	NA	<.001	<.001
Length of stay, median (IQR), d	5 (3-7)	5 (4-7)	5 (3-7)	1 [Reference]	IRR, 1.12 (1.11-1.13)	IRR, 1.06 (1.05-1.07)
P value	NA	NA	NA	NA	<.001	<.001
Discharge home vs to nursing home or other long-term care facility, %	64.0	68.5	62.1	1 [Reference]	AOR, 1.14 (1.11-1.17)	AOR, 0.94 (0.92-0.96)
P value	NA	NA	NA	NA	<.001	<.001
Readmission at 7 d, %	11.6	11.1	12.0	1 [Reference]	AOR, 0.98 (0.96-1.01)	AOR, 1.05 (1.02-1.07)
P value	NA	NA	NA	NA	.31	<.001
Readmission at 30 d, %	23.0	23.0	24.3	1 [Reference]	AOR, 1.02 (0.99-1.04)	AOR, 1.04 (1.03-1.06)
P value	NA	NA	NA	NA	.17	<.001
Mortality at 30 d, %	10.8	8.6	11.0	1 [Reference]	AOR, 0.94 (0.91-0.97)	AOR, 1.09 (1.07-1.12)
P value	NA	NA	NA	NA	<.001	<.001

Abbreviations: AOR, adjusted odds ratio; IQR, interquartile range; IRR, incidence rate ratio; NA, not applicable; PCPs, primary care physicians; RR, relative risk.

[a] Full models for adjusted analyses are available in eTables 2 to 7 in the Supplement.

[b] For test of differences, $P < .001$ for all comparisons.

mitted at the same rates at 7 days (AOR, 0.98; 95% CI, 0.96-1.01; $P = .31$) and 30 days (AOR, 1.02; 95% CI, 0.99-1.04; $P = .17$) but were more likely to be readmitted if cared for by other generalists at 7 days (AOR, 1.05; 95% CI, 1.02-1.07; $P < .001$) and 30 days (AOR, 1.04; 95% CI, 1.03-1.06; $P < .001$), with hospitalists as the reference group. Full models are available in eTables 4 through 6 in the Supplement.

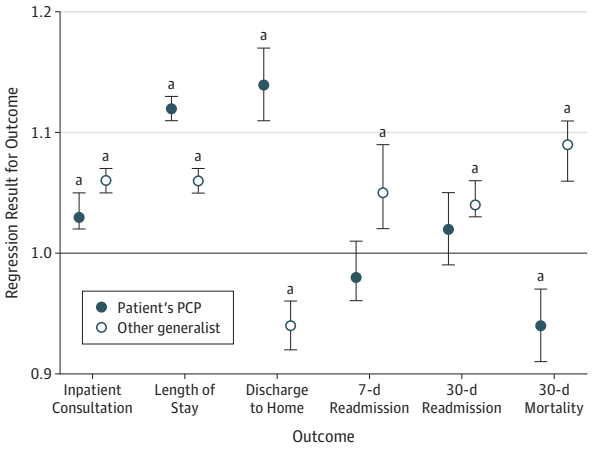
Patients cared for by PCPs had the lowest unadjusted 30-day mortality among the 3 groups (PCPs, 8.6%; hospitalists, 10.8%; and other generalists, 11.0%; test of difference, $P < .001$). These findings persisted in adjusted analyses for PCPs (AOR, 0.94; 95% CI, 0.91-0.97; $P < .001$) and other generalists (AOR, 1.09; 95% CI, 1.07-1.12; $P < .001$), with hospitalists as the reference group. Full models are available in eTable 7 in the Supplement.

Sensitivity Analyses

In sensitivity analyses, the complexity of the admission (acuity of the DRG) and patient disease burden (HCC scores) largely did not modify the association of generalist type and resource use, the likelihood of discharging patients home, readmission, or mortality (eTables 8 and 9 in the Supplement). For example, patients cared for by PCPs had the lowest 30-day mortality across all 3 physician groups at all quantiles of DRG complexity and patient comorbidities. We repeated our analyses after stratifying hospitals into quartiles of PCP use to distinguish whether the care delivery model of the hospital or the type of physician may lead to differences in patient outcomes. Our findings were consistent with our overall findings.

In analyses restricted to nonhospitalist physicians who were classified as the PCPs of some patients but not of others, physicians treating their own patients ordered fewer consultations, more frequently discharged patients home, and had lower 30-day mortality than when they were caring for patients with whom they were less familiar (eTables 10 and 11 in the Supplement). In analyses of an expanded population of all medical admissions, results also remained unchanged.

Figure. Rates of Care Patterns by Physician Type Adjusted for Patient and Hospital Characteristics



Consultations are compared using relative risks. Length of stay is compared using incidence rate ratios. Mortality, readmissions at 7 and 30 days, and discharge home are compared with the use of adjusted odds ratios. Hospitalists represent the reference group. Error bars signify 95% CIs. PCP indicates primary care physician.

[a] Pairwise comparison with hospitalists significant at $P < .05$.

Discussion

Our results suggest that longitudinal contact with a patient may translate into meaningful differences in care patterns and patient outcomes.[15,16] Prior research comparing hospitalists with

other generalists has not distinguished between physicians who were previously familiar with the patient and other covering generalists who might have less experience caring for hospitalized patients (compared with hospitalists) and little knowledge of the specific patient (compared with the patients' PCPs). We found that, although patients cared for in the hospital by their own PCPs had slightly longer lengths of stay, they also were more likely to be discharged home and had improved survival, even after controlling for differences in patient and hospital characteristics. In contrast, patients cared for by physicians with the least knowledge of the hospital and the patient had more frequent specialty consultations and the highest rates of readmission at 7 and 30 days, were the least likely to be discharged home, and had the highest mortality at 30 days.

Since the hospitalist model was first introduced in the early 1990s, it has spread broadly in the United States. Hospitalists develop expertise in complex, hospital-level care and are more available at the patient's bedside.[17-19] Thus, many believed that hospitalist care would be more efficient and lead to better outcomes, which influenced growth of the care model.[20] This model also reduced the need for office-based PCPs, who themselves had growing patient panels and increasing complexity of care in the outpatient setting, to devote time to caring for their patients who were hospitalized.[21] Until now, the literature about hospitalist models has demonstrated that expertise about hospital-level care has translated into slightly decreased length of stay and raised the possibility of improved outcomes. Each of those studies, however, faced substantial limitations. For instance, although some studies were able to randomize patients to different models of care, they were single-institution studies that were also limited by a small number of hospitalists providing care in the hospitalist arm of the study.[3,5] Similarly, although Lindenauer et al[4] compared hospitalists with patients cared for by family physicians or internal medicine physicians across a much larger sample of hospitals, they did not differentiate among nonhospitalist physicians based on prior knowledge of the patient. Finally, Jungerwirth et al[22] looked solely at the association of presence of hospitalists at institutions with risk-adjusted outcomes, risking ecological bias.

Although our primary outcome was not mortality, we did find that physician characteristics were associated with 30-day mortality, which, to the best of our knowledge, differs from prior research in this area. Of the 3 groups of generalists, patients cared for by PCPs had the lowest mortality rates, whereas patients cared for by other generalists had the highest rates. Our study is the first to distinguish between these 2 different types of outpatient physicians compared with hospitalists. Although this finding persisted in multiple sensitivity analyses, including stratified analyses that explored variation in patient severity of illness and in hospital care models, nonetheless, given the observational design of our study, unmeasured confounding might have contributed to these results. Further research is needed to identify the mechanisms by which PCPs achieve better outcomes, such as whether some populations of patients with clinically complex conditions may benefit from a new type of physician who can incorporate familiarity with the patient and the hospital.[15]

Our findings also suggest that engaging a patient's PCP in his or her hospital care may be an approach to increasing the rates of discharge home, an outcome important to the patient and the hospital system, without increasing the risk for readmissions at 7 days. When elderly patients are discharged to postacute care facilities, their likelihood of returning home decreases, which has substantial implications for quality of life and spending in ensuing years.[23,24]

Our findings also show that patients cared for by other generalists—physicians who neither work primarily in a hospital setting nor likely have longitudinal knowledge of the patient—had the worst outcomes. Conceptually, this third group of physicians has less outpatient continuity with patients than PCPs and less specialization in hospital-based care than hospitalists.[4,25] Our results show that patients cared for by these physicians had worse readmission and mortality outcomes relative to those cared for by hospitalists. We found that most of the PCPs who cared for their own patients in the hospital also cared for other patients, suggesting that at least some of these physicians practice in group arrangements that involve cross-coverage. Furthermore, our sensitivity analysis of this group found that care patterns differed according to whether the physician was that patient's assigned PCP, suggesting that familiarity with a patient over time is responsible for some of the findings we observed. Our study suggests that opportunities exist to clarify which types of outpatient practice coverage arrangements yield the highest benefits for inpatient care and meaningful gains in patient outcomes.[26,27]

Limitations

Our study has several limitations. First, we studied older adults enrolled in fee-for-service Medicare, and our findings may not generalize to younger patients, other payers, or beneficiaries enrolled in Medicare Advantage. We note, however, that Medicare patients are responsible for 39% of hospitalizations nationally.[28] Second, we used administrative data. These data lack the nuance and granularity of clinical data, which could contain information, for example, about patient functional status. Third, we relied on specialty designations on claims and certain procedural codes to further differentiate specialists from nonhospitalists, which may misclassify some physicians. This type of misclassification would bias our results toward the null if specialists use fewer hospital resources. Fourth, some aspects of admissions attended by PCPs, hospitalists, and other generalists were different in meaningful ways at the admission and hospital levels. We attempted to control for these differences in our regression models, but unmeasured confounding may have contributed to our results. Furthermore, our assignment of physician type ignores care provided by resident physicians or advanced practice clinicians (eg, nurse practitioners and physician assistants). Fifth, we used the discharge destination field from billing claims to identify patients discharged home, but this variable may not always be accurate.[29] Finally, from our models examining inpatient subspecialty use and length of stay, we excluded a small number of admissions in which patients were transferred between hospitals. These hospitalizations were included in the models for discharge destination and readmission rates, but because these patients were unlikely to have access to their PCPs at their transfer hospital, including these cases likely biased our results toward the null.

Conclusions

Our results suggest that longitudinal contact with a patient may translate into meaningful differences in care patterns and patient outcomes. Novel models of care that integrate PCPs who care for patients in the ambulatory setting with their patients' hospital care may yield substantial benefits in outcomes that are meaningful to patients.

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