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ORIGINAL RESEARCH

Association of Hospitalist Presence and Hospital-Level Outcome Measures Among Medicare Patients

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BACKGROUND: Hospitalists have been shown to lower patient costs through better resource utilization and decreased length of stay, but it is unclear whether hospitalists are associated with quality of care. We examined the association between the presence of hospitalists and 30-day predicted excess all-cause hospital mortality and readmissions among Medicare patients admitted to a hospital with any of 3 conditions: heart failure, acute myocardial infarction, and pneumonia.

METHODS: Using national hospital-level, case mix-adjusted, risk-standardized, 30-day all-cause excess mortality and readmission data from the Centers for Medicare and Medicaid Services, we used descriptive and bivariate statistics to illustrate trends across hospitals. Using multivariable ordinary least squares regression to control for hospital-level characteristics, we then estimated the association between the presence of hospitalists and predicted hospital mortality and readmission.

RESULTS: After multivariable adjustment, the presence of hospitalists was associated with lower probability of readmission for all 3 target conditions. No significant associations for any of the target conditions were found in all-cause mortality models.

CONCLUSIONS: Hospitalists are already integral to the delivery of inpatient care at most institutions. This study, however, showed an association at the national level of the presence of hospitalists with an important and timely quality measure: reduction of readmission rates. Future research is indicated to explore specific causation pathways for the impact of hospitalists on quality of care. *Journal of Hospital Medicine* 2014;9:1–6. © 2013 Society of Hospital Medicine

Since Wachter and Goldman coined the term *hospitalist* in 1996,[1] the number of hospitalists in the United States has grown rapidly, to more than 30,000 in recent estimates, with at least 80% of hospitals with 200 beds or more having hospital medicine programs.[2] A number of factors have led to the growth of such programs. First, hospital-level incentives to use hospitalists exist to improve patient flow and maximize bed use, thereby reducing length of stay (LOS) and improving efficiency. Hospitals also employ hospitalists to address limitations on the number of hours that medical residents can work. Second, the use of hospitalists allows primary care physicians (PCPs) to focus their practices on outpatient care, thus avoiding the complexity of hospital-based medicine, which requires both hospital-focused clinical skills as well as institutional knowledge. Supporters of the hospitalist movement claim that hospitalists can improve efficiency and quality of care because hospitalists (1) have more experience managing inpatient care, (2) are more available to patients, and (3) have greater commitment to hospital quality improvements than (nonemployed) community PCPs.[3–5] On the other hand, criticisms of hospitalists include concerns related to (1) discontinuity in care and patient handoffs, (2) patient dissatisfaction at being treated by someone other than their PCP, (3) loss of acute care skills by PCPs, and (4) hospitalist burnout due to large workloads and poor institutional support.[3–5]

Hospitalists have been shown to have an effect on lowering total patient costs through better resource utilization and reduced LOS.[6–9] There is no clear agreement, however, that hospitalists more often implement guideline-recommended care.[10–12] In fact, most evaluations have found no significant differences between mortality and readmission rates among hospitalist and nonhospitalist groups.[12–16] The majority of these studies, however, were conducted in individual institutions or with small sample sizes, thus limiting their generalizability.

As 1 of the fastest-growing medical specialties, hospitalists have assumed a significant role in inpatient care. The Centers for Medicare and Medicaid Services (CMS) have identified heart failure (HF), acute myocardial infarction (AMI), and pneumonia (PN) as important inpatient conditions associated with substantial morbidity and mortality among the Medicare population. Further, Jencks et al.[17] found that nearly one-fifth of Medicare beneficiaries discharged from a

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hospital were readmitted within 30 days, which incurred an estimated cost to Medicare of $17.4 billion in 2004. Hospital readmission is of particular importance under healthcare reform because CMS introduced financial penalties in 2013 for hospitals with excessive readmission rates. The reimbursement penalty related to readmissions is included in the Patient Protection and Affordable Care Act and will be gradually expanded across many other outcomes.[18]

METHODS

Data Sources

Using hierarchical, generalized, linear modeling with hospital-specific random effects, CMS has developed and made publicly available national, hospital-level data reporting case mix-adjusted, risk-standardized, 30-day all-cause predicted excess mortality and readmission rates, as measured from the first day of the index inpatient admission. The models produce aggregate hospital-level predictions of excess mortality and readmissions, as compared to other hospitals with the same case mix.[19,20] Outcome measures in this study reflect these hospital-specific, adjusted measures of mortality and readmission. Each of these measures is expressed as a continuous variable of the adjusted number of events within a 30-day period, analogous to a ratio of observed-to-expected outcomes, multiplied by the national rate. Specifically, the numerator is the number of observed events in a 30-day period based on the hospital's case mix-adjusted performance, and the denominator is the number of expected events in a 30-day period based on average national hospital performance with that hospital's case mix. CMS adjusts the measures for case mix to account for important patient-level, clinically relevant variables such as age, sex, and comorbidities. However, the data do not allow the measures to be further adjusted for admission source, discharge destination, or patient socioeconomic status.[19] CMS also does not report rates for hospitals with fewer than 25 cases for a condition, which could limit the generalizability of our findings with regard to small hospitals or hospitals with only occasional patients discharged with a target condition. Details on specific inclusion/exclusion criteria, model adjustment, and statistical approach used by CMS can be found in their methodology reports.[21,22]

The 2008 CMS risk-standardized mortality and readmission measures described above were linked with the 2008 American Hospital Association (AHA) Annual Survey Database, using each hospital's 6-digit Medicare provider identification number. The AHA Annual Survey Database provides comprehensive hospital-level data for approximately 6500 US hospitals, including demographics, organizational structure, facilities and services, utilization data, community indicators, physician arrangements, managed care relationships, expenses, and staffing, including employment of hospitalists.[23]

Variables

We used the CMS case mix-adjusted, risk-standardized, 30-day all-cause predicted excess mortality and readmission measures for HF, AMI, and PN as dependent variables. The primary independent variable was a dichotomous measure of whether or not hospitalists provided care within the hospital. Covariates identified from the literature[11,23–28] included hospital and community characteristics, organizational perspective, size, and resources. Models were adjusted for hospital ownership (government, nongovernment nonprofit, investor-owned for profit), region (Northeast, South, Midwest, West), teaching status, bed size, number of nurses per hospital bed, intensive care unit (ICU) presence (medical–surgical, cardiac), managed care contracts (health maintenance organization, preferred provider organization), urban/rural setting, and median household income in the hospital county.

Statistical Analysis

Descriptive statistics of the dependent and independent variables illustrated trends across hospitals with and without hospitalists, and bivariate statistics identified differences between the 2 groups. We employed multivariable ordinary least squares (OLS) regression to assess the association between the independent variables and risk-standardized, 30-day all-cause excess mortality and readmission rates at the hospital level. OLS was used because the dependent variables were measured continuously; count models were not appropriate for our analyses, because we did not have access to patient-level data that could provide person-days at risk for mortality or readmission. This limitation is mitigated, however, because CMS had already used hierarchical, multivariate, patient-level models to produce hospital-specific predictions, which formed the basis of our outcome measures. Six OLS models were run reflecting each of the 6 outcomes of interest: AMI mortality, HF mortality, and PN mortality, and AMI readmission, HF readmission, and PN readmission. All statistical analyses were conducted using Stata version 11 (StataCorp, College Station, TX).

RESULTS

Hospital Characteristics and Descriptive Measures

There were 3029 US hospitals in the final analysis dataset. Of these, 59.3% reported employing hospitalists on staff. Descriptive statistics are shown in Table 1.

Table 2 presents bivariate analyses. Mortality for all 3 conditions and readmissions for AMI and HF were all significantly lower among hospitals employing hospitalists. Of the 3029 hospitals in the sample (both with and without hospitalist programs), over 93% had 25 or more cases per category for 4 of the 6

TABLE 1. Hospital and Community Characteristics by Hospitalist Presence

	Hospitalist Presence, n = 1,796, % or Mean (SD)	No Hospitalist Presence, n = 1,233, % or Mean (SD)	P Value
Hospital control			<0.001
Government	14.8%	33.3%	
Nongovernment, nonprofit	72.9%	56.8%	
Investor owned, for profit	12.4%	10.0%	
Bed size	257 (224)	94 (106)	<0.001
Nurses per inpatient bed	1.5 (0.6)	1.1 (0.7)	<0.001
Urban	75.3%	32.7%	<0.001
Rural	24.7%	67.3%	
Region			<0.001
Northeast	18.2%	8.3%	
South	40.1%	33.1%	
Midwest	24.4%	46.3%	
West	17.3%	12.3%	
ICU presence			
Medical–surgical	94.0%	64.0%	<0.001
Cardiac	58.7%	26.9%	<0.001
Managed care contracts			
HMO	81.2%	59.4%	<0.001
PPO	88.7%	79.9%	<0.001
Teaching hospital	12.6%	1.7%	<0.001
Median household income in hospital county	$51,851 ($13,566)	$44,448 ($10,058)	<0.001

NOTE: *P* values represent χ^2 or *t* tests as appropriate, testing differences in proportions, or means between hospitals with and without hospitalists. **Abbreviations:** ICU, intensive care unit; HMO, health maintenance organization; PPO, preferred provider organization; SD, standard deviation.

TABLE 2. Bivariate Comparison of Hospitalist Presence by Disease Mortality and Readmission Outcome Measures

Outcome Variable	Hospitalist Presence, Mean (SD)	No Hospitalist Presence, Mean (SD)	P Value	n
AMI mortality	16.3 (1.8)	16.7 (1.7)	<0.001	2,007
HF mortality	11.1 (1.6)	11.4 (1.5)	<0.001	2,625
PN mortality	11.4 (1.9)	11.8 (1.8)	<0.001	2,746
AMI readmission	19.8 (1.4)	20.1 (1.3)	0.003	1,707
HF readmission	24.2 (2.1)	24.8 (2.0)	<0.001	2,620
PN readmission	18.1 (1.7)	18.1 (1.6)	0.896	2,709

NOTE: Outcome measures are expressed per 100 admissions. **Abbreviations:** AMI, acute myocardial infarction; HF, heart failure; PN, pneumonia; SD, standard deviation.

outcome variables, indicating only a minor risk of hospital selection bias due to small size or infrequent admissions for target conditions.

Multivariate Analyses: Mortality Outcomes

Multivariate analyses showed no significant relationship between hospitalist care and risk-standardized mortality measures for any of the 3 target conditions (Table 3). Stated more precisely, the presence or absence of hospitalists was not associated with an increase or decrease in the case mix-adjusted, risk-standardized, 30-day all-cause predicted excess mortality rates for these conditions. Covariates in the models generally performed as might be hypothesized.

TABLE 3. Results of Multivariable Ordinary Least Squares Regression Using Hospitalist Presence to Predict Disease Mortality and Readmission Outcome Measures

	Acute Myocardial Infarction (95% CI)	Heart Failure (95% CI)	Pneumonia (95% CI)
Mortality			
Hospitalist presence	0.058 (−0.132 to 0.247)	0.104 (−0.041 to 0.249)	0.042 (−0.132, 0.217)
Readmission			
Hospitalist presence	−0.182 (−0.343 to 0.022)*	−0.575 (−0.763 to 0.387)‡	−0.228 (−0.380 to 0.075)†

NOTE: **Abbreviations:** CI, confidence interval.

*Significant at $P = 0.05$.

†Significant at $P = 0.01$.

‡Significant at $P = 0.001$.

When stratified by ICU presence, urban/rural setting, and bed size, none of the hospitalist presence coefficients reached significance.

Multivariate Analyses: Readmission Outcomes

In contrast to the mortality measures, risk-standardized readmission rates were significantly lower for all 3 conditions for hospitals employing hospitalists (Table 3). Specifically, hospitalist services within a hospital were associated with a decrease in case mix-adjusted, risk-standardized, 30-day predicted excess readmissions for each of the 3 target conditions, as follows: 0.182 fewer predicted AMI readmissions per 100 people at risk ($P < 0.05$), 0.575 fewer predicted HF readmissions per 100 people at risk ($P < 0.001$), and 0.228 fewer predicted PN readmissions per 100 people at risk ($P < 0.01$). Covariates in the models again generally performed as might be expected. When stratified, the presence of hospitalists tended to have a stronger negative association with medical–surgical ICU presence, cardiac ICU presence, urban setting, and larger bed size.

Full results from the OLS regressions for mortality and readmission outcome variables, including significance levels and 95% confidence intervals, are available (see Supporting Information, Appendix Tables 1 and 2, in the online version of this article).

DISCUSSION

Most previous studies have used patient-level data from single institutions, and have shown inconsistent association between hospitalist care and clinical outcomes. Only a few studies have been conducted at the national level, and we know of only 1 that uses the same types of clinical outcomes as in our approach. In particular, Goodrich et al. conducted an in-depth survey of hospitalist programs, and found that hospitalist presence had a significant association with HF readmissions.[29] Our results, similar to those of Goodrich et al., showed that the presence of hospitalists was not associated with risk-standardized, 30-day, all-cause predicted excess mortality rates for Medicare patients hospitalized for any of these 3 conditions. The presence of hospitalists was, however, associated with lower-risk standardized, 30-day, all-cause predicted excess readmission rates in our study. Our analyses resulted in somewhat different coefficients than Goodrich et al., but that is most likely due to: (1) different sample sizes, (2) use of similar yet not identical control variables, and (3) reporting error, as we used different sets of self-reported data to indicate hospitalist services. The presence of a hospital-level association with inconclusive patient-level evidence suggests that there may be a more nuanced relationship between hospitalists and quality of care than has been previously explored.

This result may be explained by a number of reasons, the first of which is that hospitalists generally have more experience in the increasingly specialized practice of hospital-based medicine than PCPs or nonhospitalists. For example, Meltzer et al.[30] found that hospitalists have more experience than nonhospitalists in treating acute manifestations of cardiovascular and respiratory diseases. Even though we might expect that greater experience with hospital-based medicine would be associated with lower mortality rates, this outcome may not be captured because mortality is a rare event in the reported 30-day postdischarge period and may be less preventable than readmission. There are a number of other factors possibly affecting hospital readmission, such as inadequate information transfer by discharge planners, poor patient compliance, inadequate follow-up, insufficient use of family caregivers, deterioration of a patient's clinical condition, and medical errors.[31]

Studies have found that hospitalists have had positive effects related to managing case complexity and navigating the discharge process, perhaps due to their increased availability to patients and commitment to hospital quality improvements.[16,32] Some determinants of patient outcomes may be difficult for hospitalists to influence, however, such as poor patient compliance or lack of support by family caregivers. Hospitalists who have extensive discharge experience may understand key challenges and adopt strategies to ameliorate these negative effects, for instance by using appropriate motivational strategies to encourage compliance and capitalizing on family caregivers.[33] Being located in the hospital, hospitalists are more available to deal with emergencies that occur during the hospitalization, and may be more available and active in discharge planning. Benbassat and Taragin[34] found that between 9% and 48% of all readmissions were preventable because they were associated with indicators of substandard care during the index hospitalization. They further estimated between 12% and 75% more readmissions could have been prevented by implementing patient education, predischarge assessment, and at-home aftercare programs. Hospitalists are in a unique position to use their specialized training to improve transitions from hospital to home, communicate needs with the family and caregivers during the index hospitalization, and ensure that adequate postdischarge care is received. Although the use of hospitalists creates another handoff in the transition between inpatient and outpatient settings, hospitalist care may have a positive effect on many of the determinants of readmission sufficient to overcome that discontinuity.

Quality of care may also be affected by tertiary factors such as hospital administration or organizational culture. Lower AMI mortality has been associated with factors beyond cardiologist care, including organizational behavior and the appointment of physician and nurse champions.[35] Although the exact mechanism is unclear, better patient outcomes may be a result of this combination of direct clinical care, care transition management, and administrative or organizational factors. The models showed several hospital and community characteristics having coefficients larger in magnitude than the hospitalist variable, including classification as a teaching hospital, region, and hospital county median income. Teaching hospitals have been shown to have varying effects on quality of care depending on the type of care being provided, and teaching status may also be a proxy for factors related to organizational culture or mission.[36] Community-level contextual factors including poverty and income have been shown previously to be related to readmission rates, possibly due to lack of social support and financial resources in the community to help discharged patients manage their healthcare needs in community settings.

Research Limitations

Two important limitations of this study are assumptions made necessary using aggregated, hospital-level data. These assumptions include: (1) that hospitalists regularly treat Medicare patients with HF, AMI, and PN, and (2) that patient exposure to hospitalists is consistent in amount and quality across all patients treated in the hospital. Due to the frequency of the 3 study conditions in the Medicare population, it is reasonable to assume that hospitalists treat these patients, but it is unlikely that all patients admitted to each hospital employing hospitalists are indeed treated by hospitalists or that they are all treated in a consistent manner. There is also significant variation among hospitalist services nationwide, from different types of hospitalists to varying responsibilities across settings. Differences in physician practice structure and hospital staffing could affect hospitalist care on individual patient outcomes between hospitals that employ hospitalists. Models also did not control for the extent to which hospitals have implemented specific interventions to prevent hospital readmissions; hospitals with hospitalists may more often implement other interventions potentially influencing readmissions. We further could not distinguish between effective and ineffective hospitalist programs. The inability to account for these factors would effectively weaken the indicator, most likely underestimating the association between hospitalist presence and the outcome variables. Finally, the AHA database is subject to some variability, as it utilizes self-reported data from the hospitals, but the database is generally considered the industry standard.

Using OLS regression, this study reflects correlation, but cannot demonstrate causation between the presence of hospitalists and an increase or decrease in risk-standardized predicted mortality or readmission rates. There is also controversy regarding the appropriateness of using risk-standardized predicted mortality and readmission rates as measures of quality of care, because these rates represent outcomes that may be influenced by other factors beyond the care received during the inpatient stay. These rates will, however, be of increasing importance given emerging pay-for-performance initiatives.[35,37,38]

CONCLUSION

Reducing medical errors and improving patient outcomes are becoming more important in light of increased reporting of hospital performance and outcome measures. Post-discharge 30-day mortality and hospital readmission represent 2 major undesirable patient outcomes, and Medicare's new pay-for-performance initiatives only provide further incentives for hospitals to take action in reducing these rates. Because the likelihood of receiving inpatient care provided by a hospitalist has significantly increased among Medicare patients since the 1990s,[39] hospitalists have become important players in potentially reducing mortality and readmission for patients discharged from inpatient settings. This study has shown that use of hospitalists may be associated with lower hospital readmissions, a clear quality measure, but are not associated with any changes in 30-day mortality.

Further studies are needed, however, to better characterize and validate the observed associations, as well as to determine how hospitalist programs can be enhanced to improve inpatient care quality. Case studies could be carried out within hospitals with high- and low-performing hospitalist services to help identify key aspects of hospitalist care most closely associated with desirable outcomes. Discharge and transitional care processes could also be standardized according to best practices, with their implementation tailored to individual hospital settings. Finally, as patient-level data become increasingly available, researchers should merge these data with hospital-level data to assess more robustly the multilevel effect of hospitalists on inpatient quality of care and individual patient outcomes. Such information will be valuable to policymakers and health administrators alike in the ongoing and volatile economic and political environment surrounding healthcare.

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