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Variation of follow-up rate after psychiatric hospitalization of Medicare beneficiaries by hospital characteristics and social determinants of health

Ivy Benjenk, RN, MPH and
University of Maryland School of Public Health

Jie Chen, PhD
University of Maryland School of Public Health

Abstract

Objectives: Early follow-up after inpatient psychiatric hospitalization is a key part of the care transition process and has been found to reduce the risk of readmission and emergency department utilization. Our objective was to determine the extent to which hospital performance on measures of 7-day (FUH-7) and 30-day (FUH-30) mental health follow-up among Medicare beneficiaries varies by hospital characteristics and hospital neighborhood socioeconomic characteristics.

Design: We linked 2015 hospital-level follow-up rates from the CMS Hospital Compare website to hospital characteristics obtained from the American Hospital Association Annual Survey and characteristics of the community within a 5-mile radius of the hospital from the American Community Survey.

Setting: Inpatient psychiatric facilities in the United States.

Participants: Our sample included 1,275 inpatient psychiatric facilities in 2015.

Measurements: State fixed effects multivariate linear regression was used.

Results: Hospital 30-day follow-up rates ranged from 16.00% to 95.00% with an average of 55.80%. After controlling for hospital-level, and community-level factors, and applying state-level fixed effects, we found that psychiatric specialty hospitals, public hospitals, and minority-serving hospitals were associated with lower rates of mental health follow-up.

Conclusions: Hospitals have considerable opportunity to improve the quality of their transitional care processes and increase the percentage of their Medicare patients that receive timely mental health follow-up after discharge. Policymakers should consider strengthening the incentives for hospital performance on these quality measures, while working to improve the behavioral health infrastructure of minority communities.

Corresponding Author: Jie Chen PhD, fax 301-405-2542, phone (301) 405-9053, jichen@umd.edu.

Objectives

The period following discharge from an inpatient psychiatric unit is a critical time in a patient's recovery. During this time, patients are at high risk for suicide and readmission.[1,2] Timely follow-up with an outpatient mental health provider after discharge has been shown to decrease the likelihood of readmission and emergency department utilization and increase the likelihood of medication adherence and extended participation in outpatient treatment.[3]

Timely follow-up after psychiatric hospitalization (FUH) has been used as a measure of health plan quality in the National Committee on Quality Assurance's (NCQA) Health Plan Employer Data and Information Set (HEDIS) program since 1999.[4] In July 2013, this measure was adopted by the Centers for Medicare and Medicaid Services (CMS) Inpatient Psychiatric Facility Quality Reporting (IPFQR) program as a measure of hospital quality. The IPFQR is a pay-for-reporting program for inpatient psychiatric facilities that participate in the CMS Inpatient Psychiatric Facilities Prospective Payment System (IPF PPS). The IPFQR FUH-7 and FUH-30 measures assess the percentage of traditional Medicare beneficiaries discharged from a hospital's inpatient psychiatric units that follow-up with mental health providers within seven and thirty-days of discharge respectively.[5] Hospital performance on these measures is publicly reported on the CMS Hospital Compare website.[6]

Discharge planning and care coordination are integral components of inpatient psychiatric treatment. Hospitals are expected to establish patient-centered discharge plans and eliminate barriers to participation in follow-up care. Since its inception, the IPFQR program has used structure and process measures to evaluate the quality of hospital-based care coordination. The FUH measures are the program's first attempt at evaluating the intermittent outcomes of these care coordination efforts.

As 82.7% of Medicare enrollees are age 65 and older, the FUH measures primarily evaluate the quality of care coordination for older adult patients.[7] Due to the increased risk for falls and other adverse events related to psychotropic medications, older adults require close medication monitoring as they return to their regular routine after discharge.[8,9] Conversely, older adults experience unique barriers to following-up after discharge, including high out-of-pocket costs, negative personal beliefs about mental health treatment, and concerns about stigma and embarrassment.[10,11] Racial and ethnic minority older adults may experience even greater barriers to following up due to poorer social determinants of health among minority populations. Black adults have been found to be significantly less likely to receive outpatient mental health services within thirty days of discharge than their white counterparts.[12,13]

The Donabedian model is a framework for healthcare quality improvement that posits that improvements in healthcare structures and processes will lead to improvements in outcomes. [14] There are also many patient states or intermittent outcomes between process and outcome that can be used as measures of quality; mental health follow-up can be viewed as an intermittent outcome between hospital discharge planning processes and readmissions.[15] The social ecological model is a framework for health behavior that posits that individuals exist within larger social situations and their behaviors are driven by the interaction of intrapersonal, interpersonal, community, and policy factors.[16] Building off of these

frameworks, the objective of this study was to determine the extent to which hospital performance on the FUH-7 and FUH-30 measures varies by hospital organizational and community socioeconomic characteristics.

Based on the Donabedian model,[14] we hypothesized that hospital performance on the structure and process measures of care coordination in the IPFQR program would be positively associated with hospital performance on the FUH intermittent outcome measures. As public hospitals have previously been found to have lower average performance scores on the IPFQR care coordination process measures, we hypothesized that public hospitals would have lower FUH scores.[17] We also hypothesized that hospitals with a high volume of Medicare beneficiaries discharged from their psychiatric units would have higher FUH scores due to the extensive literature surrounding the positive association between volume and quality,[18] including evidence linking health plans with high numbers of mental health claims to superior performance scores on the HEDIS FUH measures.[19] Based on the social ecological model[16] and previous studies that explored individual, hospital, and community-level characteristics associated with mental health follow-up,[12,13,20] we hypothesized that teaching hospitals, psychiatric hospitals, and smaller hospitals would have higher FUH scores, while hospitals located in rural communities and communities with high rates of poverty and minority residents would have lower scores.

Methods

Study Design and Data Sources

We used a cross-sectional design to examine associations between a hospital's organizational and community characteristics and the percentage of older adults discharged from the hospital's psychiatric unit that received timely follow-up care. We linked 2015 data from the CMS Hospital Compare website,[21] the American Hospital Association Annual (AHA) Survey[22] and the American Community Survey (ACS) using the hospital ID and zip-code.[23] We defined the hospital's community as a collection of zip codes located within a 5-mile radius of the hospital. We geocoded the hospital's geographical coordinates as points and defined a buffer size of 5 miles for each hospital. We used ArcGIS 10.3 software to determine the geographic area and associated zip codes. Zip-codes were then aggregated to create hospital communities.

IPFQR FUH-7and FUH-30

We obtained 2015 hospital-level FUH-7 and FUH-30 performance scores from the Hospital Compare website. The 2015 data set includes discharges from July 1, 2014 to June 30, 2015. The FUH-7 and FUH-30 measures are percentages. Percentages reflect the number of inpatient psychiatric discharges with claims for partial hospitalization, intensive outpatient treatment, or outpatient mental health visits within seven days and thirty days of discharge divided by the total number of eligible psychiatric discharges. A score of 50% on the FUH-30 measure should be interpreted as 50% of psychiatric discharges attended a mental health follow-up appointment within thirty days of discharge.

All hospitals that participate in the CMS IPF PPS must participate in the FUH measure. Discharges eligible for inclusion in the measure must be enrolled in both traditional Medicare Part A and B and cannot be dually eligible for Medicaid. Eligible discharges must also have a principal diagnosis of schizophrenic disorders, mood disorders, paranoid state, psychosis, autistic disorder, or anxiety. Eligible mental health practitioners are limited to psychiatrists, neurologists, psychiatric nurse practitioners, psychiatric physician assistant, psychologists, clinical social workers, and psychiatric occupational therapists. Patients who are readmitted to a psychiatric unit or die during the follow-up period are excluded from the measures. CMS only reported data from hospitals with twelve or more discharges eligible for the measure.

Predictors for IPFQR FUH-7and FUH-30

We used the Hospital Compare website to obtain hospital-level performance scores for care coordination structure and process measures from the 2015 CMS IPFQR program: utilization of certified or non-certified electronic health records (EHRs), participation in a health information exchange (HIE), and transmission of continuing care plans (Hospital Based Inpatient Psychiatric Services-7; HBIPS-7). The HBIPS-7 measure assesses the percentage of patients that had a continuing care plan (i.e., discharge instructions) developed and faxed or securely emailed to the patient's outpatient provider within five days of discharge. The HBIPS-7 is also a percentage and a score of 100% can be interpreted as the hospital transmitted discharge instructions for one-hundred percent of discharges. We categorized hospital performance on the HBIPS-7 measure into low (<77%), medium (77%-97%), and high (>97%) score categories. We also included FUH denominator size (FUH-7: low, <71; moderate, 71–193; high, >193; FUH-30: low, <55; medium, 55–175; high >175) as an indicator of volume.

We used the AHA annual survey to obtain information about hospital organizational structure, including hospital size (small, <100 beds; medium, 100–399 beds; large, >399 beds), ownership (public, nonprofit, for profit), academic hospital, system-affiliation, and psychiatric specialty hospital, and rural location of the hospital.

We used the ACS to measure the social determinants of health of the communities served by hospitals. These variables were percentage of the community living in poverty (low, <8%; moderate, 8–22.5%; high, >22.5%), the percentage of the community reporting ethnicity as Hispanic (low, <2.5%; moderate, 2.5–14%; high, >14%), and the percentage of the community reporting race as African American, Asian or other, hereto forth referred to as nonwhite (low, <5.5%; moderate, 5.5–29.5%; high >29.5%). State fixed effects were included to capture various state policies that may influence hospital performance on the FUH measures.

Statistical Analysis

We first calculated descriptive statistics for each of the hospital-level and community-level characteristics. We used unequal variance t-tests to compare average FUH scores for hospitals with and without those characteristics. We used multivariate linear regression with

state-level fixed effects to evaluate the relationship between hospital FUH scores and hospital and community-level characteristics.

We found that hospital performance on the FUH measures varied significantly. For example, hospitals located in communities with a high percentage of nonwhite residents (>29.5%) had an average FUH-30 score of 50.16%, while hospitals located in communities without a high percentage of nonwhite residents (29.5%) had an average score of 57.76%. Hence, to better understand the characteristics of hospitals and communities associated with high FUH scores, we created a dichotomous outcome variable which equaled 1 if the hospital's FUH score was ranked among the top 25% and 0 if otherwise and used multivariate logistic regression to explore the predictors of high FUH performance.

For both linear and logistic regression models, we used bootstrap standard errors to account for the large number of hospitals in our population and issues of variance related to using a proportion as an outcome measure. In our descriptive statistics, we considered variables to be statistically significant at p<0.05 (two-tailed). In our regression models, we used a Bonferroni adjustment[24] to account for the multiple hypotheses being tested by our models; we considered variables to be statistically significant at p<0.0038. All analyses were performed using STATA 15. We tested the robustness of our finding using various sensitivity analyses, including step-wise model specifications, robust standard errors, and alternate reference groups. Results were all similar and are available upon request.

Results

Our population included 1,082 hospitals for the FUH-7 measure and 1,275 hospitals for the FUH-30 measure. Table 1 presents findings on the average characteristics of hospitals in the population. FUH-7 measure ranged from 0% to 88.24% with a mean of 32.84% (SD=12.12%), and FUH-30 ranged from 16.00% to 95.00% with a mean of 55.80% (SD=13.07%). Approximately 154 (SD=124.83) patients and 137 (SD=122.27) patients were eligible for the FUH-7 and FUH-30 per hospital per year respectively.

The majority of hospitals with publicly reported FUH-30 performance were medium-sized, nonacademic, nonprofit general hospitals that are affiliated with healthcare systems. On average, hospitals were located in communities where 12.23% (SD=17.72%) of residents were Hispanic, 20.29% (SD=20.85%) of residents were nonwhite, and 16.96% (SD=11.48%) of residents lived in poverty. Only 5% of participating hospitals were located in rural communities. The average hospital HBIPS-7 score was 83.36% (SD=21.24%). Less than half of the hospitals reported using EHRs and participating in HIEs.

In Table 2, we demonstrated significant variation in FUH-30 scores by hospital- and community-level characteristics. We found that psychiatric specialty hospitals had lower average FUH-30 scores than general hospitals, system-affiliated hospitals had lower average scores than unaffiliated hospitals,. and nonprofit hospitals had significantly higher average scores than public and for-profit hospitals. Hospitals with high volumes of traditional Medicare psychiatric discharges (>175 discharges) had lower average scores than hospitals with fewer discharges. Hospitals with top quartile HBIPS-7 scores had lower average

FUH-30 scores than hospitals with lower HBIPS-7 scores. Hospitals located in communities with a high percentage of Hispanic residents, a high percentage of nonwhite residents, and a high percentage of residents living in poverty had lower FUH-30 scores than their counterparts respectively.

In Table 3, we used multivariate regression analysis and found significant negative associations between FUH-30 scores and psychiatric specialty, public, and large hospitals. Public hospitals were also negatively associated with hospital FUH-7 scores. We also found significant negative associations between FUH-30 score and the percentage of nonwhite residents in the community.

Table 4 shows the results of the multivariate logistic regression comparing the top quartile of hospitals (FUH-7 >41%; FUH-30 >65%) to the lower three quartiles of hospitals (FUH-7 41%; FUH-30 65%). Top quartile FUH-30 performers were significantly less likely to be system-affiliated hospitals, public hospitals, and for-profit hospitals. Top quartile FUH-30 performers also were less likely to be located in communities with high percentages of nonwhite residents. Top quartile FUH-7 performers were also significantly less likely to be public and for-profit hospitals. They were also found to be significantly less likely to be located in communities with high percentages of residents living in poverty.

Discussion

To our knowledge, this is one of the first published studies using FUH data from the IPFQR program and the first study to explore variation in FUH performance by characteristics of hospitals and the social determinants of health of the communities that those hospitals serve. Our results showed that U.S. hospitals have unacceptably low rates of follow-up for their traditional Medicare patients. Although an average FUH-7 score of 32.84% and an average FUH-30 score of 55.80% closely resembles that mean 2015 Medicare Advantage HMO (FUH-7, 33.8%; FUH-30, 52.1%) and PPO plan HEDIS FUH scores (FUH-7, 33.4%; FUH-30, 53.6%), these scores are far below the mean HEDIS FUH scores for managed Medicaid (FUH-7, 43.6%; FUH-30, 61.2%), commercial HMO (FUH-7, 52.2%; FUH-30, 70.7%), and commercial PPO (FUH-7, 48.6%%; FUH-30, 68.7%) plans scores.[4] Furthermore, there were 33 hospitals that had FUH-30 scores of 80% or greater. There is ample opportunity for hospitals to improve on these measures.

In order for hospitals to improve their performance, they must first improve their structures and processes.[14] We found no association between the structure (EHR, HIE) and process (HBIPS-7) measures of care coordination in the IPFQR program and the FUH intermittent outcome measures. The process measures in the IPFQR program are based on evidence from clinical trials where the processes of interest were found to have significant positive effects on patient outcomes, however these linkages can weaken when evidence-based practices are translated into quality measures.[25] This is not the first time that good performance on care coordination process measures in public reporting programs has not been associated with good performance on outcome measures.[26] Jha and colleagues found no association between hospital performance on the congestive heart failure (CHF) discharge instructions process

measure in the Inpatient Quality Reporting (IQR) program and 30-day CHF readmission rates.[27]

Health behavior is shaped by multiple factors. In this study, we mainly focused on the organizational and community factors contributing to mental health follow-up after discharge. We found that public hospitals and hospitals that serve minority communities had significantly lower mental health follow-up rates across all of our statistical tests. These findings are similar to those found in studies exploring variation in hospital performance on the Hospital Readmission Reduction Program (HRRP) measures, a program that financially penalizes hospitals for excess medical and surgical readmissions.[28,29] It is unclear from our findings whether (1) hospitals that cater to lower income and minority communities deliver lower quality care, (2) such hospitals are located in communities with poor behavioral health services infrastructure, or (3) social determinants of health prohibit follow-up after discharge. Additional research is needed to determine the cause of this profound disparity.

Policy Implications

Public reporting of quality measures is a powerful way to change behavior. Hospitals are likely to adopt processes that are publicly reported, often at the expense of other processes and quality improvement activities. It is important that CMS ensure that the structure and process measures in their pay-for-reporting are nuanced enough to improve outcomes. In 2017, CMS replaced the HBIPS care coordination measures with the new Transition Record measure set.[30] The Transition Record measures require hospitals to include significantly more information on the continuing care plan and to transmit the plan within one day of discharge instead of five. Once performance data is available, CMS should evaluate whether hospital performance on this measure set has stronger association with FUH performance as well as medication fill and readmission rates. CMS should also work to identify meaningful mental health outcome measures for inclusion in the program, like quality of life, housing, and employment.[31]

CMS may want to consider using stronger incentives to motivate hospitals to improve their performance on the measures in the IPFQR program. The IPFQR program is a pay-for-reporting program, but hospital performance on these measures is not readily accessible on the Hospital Compare website. The "Find a Hospital" lookup mechanism on the welcome page leads to an interactive scorecard that contains information on a hospital's performance on quality measures in the IQR and Outpatient Quality Reporting (OQR) programs.[6] Consumers can compare up to three hospitals based on their performance on these metrics. Hospital performance on the IPFQR measures is available under a hyperlink and metrics can only be accessed through spreadsheets. Hospitals may be more motivated to improve their performance on these measures if consumers could readily access this data and in the case of general hospitals, if it is displayed alongside their performance on non-psychiatric quality measures.

CMS may also want to consider including IPFQR measures into the Hospital Compare overall rating (star rating) methodology and establishing financial penalties for poor performance. CMS started publishing overall star ratings for hospitals on the Hospital Compare website in July 2016 based on performance metrics from the IQR and OQR

programs.[32] Regardless of potential flaws in its current methodology, the star ratings are likely excellent motivators of improvement as no hospital wants to have a one or two-star rating. Financial penalties are potentially even stronger motivators. Wasfy and colleagues found that after the HRRP was passed into law, hospitals reduced their readmission scores at a greater rate than when readmission scores were only being publicly reported.[33]

Unfortunately, pay-for-performance programs have been found to disproportionately affect hospitals that have fewer resources. Since the HRRP was passed into law, the gap in readmission rates between minority-serving and non-minority serving hospitals has narrowed, but minority-serving hospitals have been considerably more likely to receive financial penalties during each year of the program's existence.[29] This would likely be the case if hospital performance on FUH measures was linked to financial penalties.

In order to truly reduce disparities, policymakers must work to improve the mental health infrastructure of minority communities. Racial and ethnic minorities continue to have poorer quality and access to behavioral health care even when they have adequate insurance.[34] Policymakers must work to increase the number of community mental health centers and the number of specialty mental health providers located in minority communities.[35] They may want to encourage managed Medicare care penetration in minority communities as managed care has previously been found to reduce disparities in access to behavioral health, although it is unclear if there has been any difference in mental health follow-up rates between managed Medicare and traditional Medicare beneficiaries.[35,36] Policymakers should also support the growth of behavioral health integration and collaborative care models in minority communities. These models have been found to improve access to behavioral health services and reduce symptoms of depression among older Latinos and African Americans.[37] Accountable care organizations (ACOs) may also have the potential to reduce disparities in behavioral health as Medicare's ACO contracts include mental health care in their total cost of care calculations. However, ACOs that serve high proportions of minority patients have thus far been performing poorly on quality metrics and ACOs have not yet been shown to improve behavioral health outcomes.[38,39]

Limitations

We used a cross-sectional study design; hence our results cannot infer causality. Instead, our results explore associations. We were also limited to data from the CMS IPFQR program. This program only uses data from Medicare Part A and B fee-for-service claims. Our results cannot be generalized to hospital performance on these measures for patients with commercial insurance, managed Medicare or Medicaid, or traditional Medicaid. Additionally, this data set does not include follow-up mental health care that is not billed through Medicare, which may include self-payment and services delivered at public health agencies. The IPFQR data set contains data from all hospitals that participate in the IPF PPS program. As a result, our study included over 1,200 hospitals in the analysis. Although we applied bootstrapping technique and a Bonferroni adjustment to produce robust standard errors and adjust significance levels, the relatively large sample size may still cause significant p-values for subtle effect. We focused our analysis on the characteristics of the

communities where hospitals are located, but recognize that there is significant variation in the size of the geographic regions that inpatient psychiatric units serve.

Conclusion

Quality measurement in psychiatry is lagging behind other sectors of healthcare. Moving from process to outcomes measures is the step in the right direction. In December 2018, the IPFQR will publicly report its first toutcome measure, Thirty-Day All-Cause Unplanned Readmission Following Psychiatric Hospitalization in an Inpatient Psychiatric Facility.[40] As CMS adds additional measures to the IPFQR program, policymakers should ensure that all measures included in the program are meaningful and should consider additional ways to incentivize hospitals to improve their performance on these measures. However, these incentives must not disproportionately affect minority-serving hospitals. Policymakers must prioritize the identification and adoption of interventions that can effectively reduce disparities in behavioral health care.

Acknowledgments

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Highlights section:

What is the primary question addressed by this study?

Do hospital level follow-up rates of Medicare beneficiaries differ by hospital characteristics and hospital neighborhood socioeconomic characteristics?

What is the main finding of this study?

We found marked variation in performance on these measures across U.S. hospitals. We found that system-affiliated hospitals, psychiatric specialty hospitals, public hospitals, and for-profit hospitals, and hospitals located in communities with high rates of minority residents and residents living in poverty were inversely associated with follow-up rates.

What is the meaning of the finding?

Both hospital organizational factors and social determinants of health influence follow-up after psychiatric hospitalization of the aging population. Hospitals must evaluate and improve their current care transitional practices to maximize the likelihood that patients will remain engaged in treatment following discharge.

Table 1.

Characteristics of Hospitals Participating in the FUH-7 and FUH-30 Measures

		FUH-7 Participants		FUH-30 Participants	
		N=1,082		N=1,275	
		Mean	**SD**	**Mean**	**SD**
Hospital-Level	FUH-7 or FUH-30 Performance Score [1]	32.84%	12.12%	55.80%	13.10%
	Electronic Health Records, N (%) [2]	43.47%	49.59%	43.32%	49.57%
	Health Information Exchanges, N (%)	40.50%	49.11%	40.33%	49.08%
	HBIPS-7 Performance Score	82.99%	21.22%	83.36%	21.14%
	FUH-7 or FUH-30 Denominator Volume	154.27	124.83	137.10	122.27
	Academic Medical Center, N (%)	42.98%	49.52%	40.94%	49.19%
	System-Affiliated, N (%)	69.32%	46.14%	68.71%	46.39%
	Psychiatric Specialty Hospital, N (%)	29.21%	45.49%	28.31%	45.07%
	Bed size				
	Small (Less than 100 Beds), N (%)	25.05%	43.35%	26.51%	44.16%
	Medium (100–399 Beds), N (%)	52.68%	49.95%	52.78%	49.94%
	Large (More than 399 Beds), N (%)	22.27%	41.63%	20.71%	40.53%
	Ownership				
	Public, N (%)	15.90%	36.58%	18.12%	38.53%
	Non-profit, N (%)	54.71%	49.80%	52.47%	49.96%
	For-profit, N (%)	29.39%	45.57%	29.41%	45.58%
Community-Level	Percent of Community that is Hispanic [3]	12.53%	17.67%	12.23%	17.72%
	Percent of Community that is Nonwhite	20.83%	20.66%	20.79%	20.85%
	Percent of Community that is Below FPL	16.39%	11.19%	16.96%	11.48%
	Rural, N (%)	3.97%	19.54%	4.47%	20.67%

Data source: Linked data sets of 2015 AHA Annual Survey, CMS Hospital Compare, and American Community Survey were used for the analysis.

Note 1: "FUH-7 or FUH-30 Performance Score" refers to the average hospital performance scores on the FUH measures. Hospitals had an average performance score of 32.84% on the FUH-7 measure and an average performance score of 55.8% on the FUH-30 measure.

Note 2: "Electronic Health Records" (EHRs) refers to the percentage of hospitals that had EHRs. 43.47% of hospitals with publicly reported FUH-7 data had EHRs.

Note 3: "Percent of Community that is Hispanic" refers to the average percentage of Hispanic residents that live in the community in which the hospital is located. On average, hospitals with publicly reported FUH-7 data were located in communities were 12.53% of the population is Hispanic.

Table 2.

Comparison of mean hospital performance scores on the FUH-7 and FUH-30 measures by hospital and community characteristic

	FUH-7 Measure			FUH-30 Measure		
	Mean	p-value	t/Welch (df)	Mean	p-value	t/Welch (df)
Hospital-Level Characteristics						
Electronic Health Records[1]						
Yes	33.33%	0.294	−1.05 (1029)	56.60%	0.066	−1.84 (1098)
No	32.55%			55.23%		
Health Information Exchanges						
Yes	33.29%	0.374	−0.89 (948)	56.03%	0.651	−0.45 (1060)
No	32.62%			55.69%		
High HBIPS-7 Performance Score (>97%)						
Yes	32.27%	0.397	0.85 (419)	54.18%	**<0.05**	2.57 (551)
No	33.03%			56.36%		
High FUH Volume (FUH-7, >193; FUH-30, >175)						
Yes	30.82%	**<0.001**	3.43 (535)	53.41%	**<0.0001**	4.09 (627)
No	33.51%			56.57%		
Academic Medical Center						
Yes	33.31%	0.267	−1.10 (1040)	56.40%	0.176	−1.35 (1098)
No	32.49%			55.39%		
System-Affiliated						
Yes	32.20%	**<0.05**	2.53 (576)	54.83%	**<0.001**	3.81 (701)
No	34.30%			57.94%		
Psychiatric Specialty Hospital						
Yes	30.97%	**<0.001**	3.34 (611)	52.86%	**<0.0001**	5.24 (701)
No	33.62%			56.96%		
Bed Size[3]						
Small (Less than 100 Beds)	33.39%	0.427	−0.80 (417)	56.86%	0.084	−1.73 (594)
Medium (100–399 Beds)	32.66%	0.602	0.52 (1050)	55.61%	0.587	0.54 (1262)
Large (More than 399 Beds)	32.66%	0.790	0.27 (410)	54.92%	0.215	1.24 (421)
Ownership[4]						
Public	29.62%	**<0.0001**	4.30 (272)	52.68%	**<0.001**	4.11 (347)
Non-profit	35.32%	**<0.0001**	−7.67 (1076)	59.15%	**<0.0001**	−9.99 (1271)
For-profit	29.97%	**<0.0001**	5.23 (632)	51.75%	**<0.0001**	7.54 (759)
Community-Level Characteristics						

	FUH-7 Measure			FUH-30 Measure		
	Mean	**p-value**	**t/Welch (df)**	**Mean**	**p-value**	**t/Welch (df)**
High Percent Hispanic Residents (>14%)[2]						
Yes	30.96%	**<0.01**	3.07 (497)	52.83%	**<0.0001**	5.47 (543)
No	33.47%			56.89%		
High Percent Nonwhite Residents (>29.5%)						
Yes	28.95%	**<0.0001**	6.71 (539)	50.16%	**<0.0001**	9.73 (612)
No	34.18%			57.76%		
High Percent Residents in Poverty (>22.5%)						
Yes	29.96%	**<0.0001**		51.46%	**<0.0001**	7.65 (666)
No	33.84%			57.41%		
Rural						
Yes	31.83%	0.684	0.41	56.95%	0.537	−0.62
No	32.89%		(43.88)	55.75%		(61)

Note 1: Unequal variances t-test was used to compare hospital characteristics; values of less than 0.05 are interpreted to be significant (two-tailed).

Note 2: Interpretation of the mean: Hospitals with electronic health records had an average performance score of 56.60% on the FUH-30 measure, while hospitals without electronic health records had an average performance score of 55.23%.

Note 3: Interpretation of the mean: Hospitals that are located in communities with a high percentage of Hispanic residents have an average performance score of 30.96% on the FUH-7 measure, while hospitals that reside in communities without a high percentage of Hispanic residents have an average performance score of 33.47%.

Note 4: For each of the bed size t-tests, each of the three bed size categories was compared to the other two bed size categories. Small-sized hospitals were compared to medium and large-sized hospitals combined. Medium-sized hospitals were compared to small and large-sized hospitals. Large-sized hospitals were compared to small and medium-sized hospitals.

Note 4: For each of the ownership status t-tests, each of the three ownership statuses was compared to the other two ownership statuses. Public hospitals were compared to nonprofit and for-profit hospitals. Nonprofit hospitals were compared to public and for-profit hospitals. For-profit hospitals were compared to non-profit and public hospitals.

Table 3.

Multivariate linear regression results indicating association between hospital- and community-characteristics with FUH-7 and FUH-30 performance scores

	FUH-7 Performance[1]			FUH-30 Performance[2]		
	Coef.	SE	z (p-value)	Coef.	SE	p-value
Hospital-Level Characteristics						
Electronic Health Records	0.002	0.008	0.18 (0.858)	0.008	0.009	0.91(0.365)
Health Information Exchanges	0.006	0.010	0.64 (0.521)	−0.005	0.008	−0.55(0.583)
HBIPS-7 Performance Rate	−0.008	0.015	−0.51 (0.610)	−0.030	0.018	−1.76(0.078)
Patients Eligible for FUH per 1,000	−0.014	0.029	−0.44 (0.657)	−0.020	0.031	−0.71(0.476)
Academic Medical Center	0.010	0.007	1.29 (0.198)	0.010	0.008	1.28 (0.201)
System-Affiliated	−0.010	0.007	−1.24 (0.214)	−0.017	0.008	−2.08 (0.038)
Psychiatric Specialty Hospital	−0.010	0.009	−1.02 (0.307)	−0.029	0.009	**−3.02 (0.002)**
Bed Size						
Small (Less than 100 Beds)	Reference			Reference		
Medium (100–399 Beds)	−0.015	0.009	−1.56 (0.119)	−0.029	0.010	−2.96 (0.003)
Large (More than 399 Beds)	−0.017	0.009	−1.34 (0.180)	−0.044	0.015	**−3.30 (0.001)**
Type						
Non-profit	Reference			Reference		
Public	−0.038	0.011	**−3.71 (<0.001)**	−0.040	0.010	**−3.95 (<0.001)**
For-profit	−0.014	0.010	−1.37 (0.169)	−0.018	0.010	−1.85 (0.064)
Community-Level Characteristics						
Percent Hispanic Residents[1]	−0.063	0.025	−2.55 (0.011)	−0.048	0.028	−1.75 (0.080)
Percent Nonwhite Residents[2]	−0.059	0.025	−2.64 (0.008)	−0.075	0.018	**−3.75 (<0.001)**
Percent Below FPL Residents	−0.004	0.045	−0.09 (0.930)	−0.047	0.037	−1.32 (0.187)
Rural	−0.001	0.029	0 (0.996)	−0.0005	0.021	0 (0.998)
State fixed effect	Controlled			Controlled		

Note 1: Number of observations = 1,053; number of replications = 392; Wald chi2(64) = 2438.68; Rsquared = 0.2865; Adj R-squared = 0.2402

Note 2: Number of observations = 1,244; number of replications = 526; Wald chi2 (64) = 1495.03; Rsquared = 0.3400; Adj R-squared = 0.3041

Note 3: The z test and p values were calculated from the linear regression coefficients and bootstrap standard errors.

Note 4: P Values of less than 0.0038 are determined to be significant based on Bonferroni adjustment Note 5: Different model specifications have been tested. Results are available upon request.

Table 4.

Multivariate logistic regression comparing the highest quartile performers to the bottom three quartile performers

	FUH-7 Performance			FUH-30 Performance		
	AOR	z (p-value)	95% CI	AOR	z (p-value)	95% CI
Hospital-Level Characteristics						
Electronic Health Records	0.72	−1.41 (0.158)	0.45–1.37	1.26	1.08 (0.280)	0.83–1.93
Health Information Exchanges	1.31	1.33 (0.185)	0.88–1.96	0.89	−0.56 (0.574)	0.61–1.32
HBIPS-7 Measure Performance						
Low (<77%)	Reference			Reference		
Moderate (77%-97%)	0.93	−0.36 (0.716)	0.63–1.37	0.91	−0.56 (0.575)	0.65–1.27
High (>97%)	1.24	0.82 (0.419)	0.75–2.05	0.83	−0.96 (0.338)	0.57–1.21
Number of Patients Eligible for FUH						
Low (FUH-7, <71; FUH-30, <55)	Reference			Reference		
Mod (FUH-7, 71–193; FUH-30, 55–175)	0.76	−1.57 (0.117)	0.53–1.07	1.00	0.02 (0.983)	0.69–1.46
High (FUH-7, >193; FUH-30, >175)	0.63	−1.95 (0.051)	0.39–1.00	0.69	−1.46 (0.143)	0.44–1.10
Academic Medical Center	1.15	0.86 (0.389)	0.84–1.56	1.47	2.12 (0.034)	1.03–2.10
System-Affiliated	0.63	−2.47 (0.014)	0.44–0.91	0.58	**−3.86 (<0.001)**	0.44–0.77
Psychiatric Specialty Hospital	0.80	−0.96 (0.339)	0.50–1.27	0.60	−2.06 (0.039)	0.37–0.98
Bed Size						
Small (Less than 100 Beds)	Reference			Reference		
Medium (100–399 Beds)	0.82	−1.05 (0.295)	0.57–1.19	0.67	−2.02 (0.043)	0.46–0.99
Large (More than 399 Beds)	0.78	−0.86 (0.392)	0.44–1.38	0.51	−2.18 (0.030)	0.27–0.93
Ownership						
Non-profit	Reference			Reference		
Public	0.36	−3.60 (**0.001**)	0.21–0.63	0.38	**−4.12 (<0.001)**	0.24–0.60
For-profit	0.56	−2.78 (**0.005**)	0.37–0.84	0.47	**−3.51 (<0.001)**	0.31–0.72
Community-Level Characteristics						
Percent Hispanic Residents [1]						
Low (<2.5%)	Reference			Reference		
Moderate (2.5–14%)	1.05	0.26 (0.795)	0.71–1.57	1.14	0.75 (0.451)	0.81–1.62
High (>14%)	0.83	−0.73 (0.468)	0.50–1.38	0.85	−0.68 (0.495)	0.54–1.35
Percent Nonwhite Residents [2]						
Low (<5.5%)	Reference			Reference		
Moderate (5.5–29.5%)	1.31	1.23 (0.219)	0.85–2.01	0.84	−0.98 (0.326)	0.60–1.18
High (>29.5%)	0.85	−0.72 (0.474)	0.54–1.34	0.42	−3.82 (**<0.001**)	0.27–0.66
Percent Below FPL Residents						
Low (<8%)	Reference			Reference		
Moderate (8–22.5%)	0.69	−1.94 (0.052)	0.48–1.00	0.94	−0.33 (0.743)	0.67–1.33

	FUH-7 Performance			FUH-30 Performance		
	AOR	z (p-value)	95% CI	AOR	z (p-value)	95% CI
High (>22.5%)	0.36	−3.87 (**<0.001**)	0.21–0.60	0.58	−2.52 (0.012)	0.38–0.89
Rural	1.03	0.06 (0.953)	0.43–2.43	1.60	1.33 (0.183)	0.80–3.20

Note 1: Top quartile hospitals had FUH-7 >41%; FUH-30 >65%

Note 2: Number of observations = 1,079; Number of replications = 100; Wald chi2(20) = 66.49; Pseudo R2 = 0.0811

Note 3: Number of observations = 1,272; Number of replications = 100; Wald chi2(20) = 149.56; Pseudo R2 = 0.1136

Note 4: The z test and p values were calculated from the logistic regression coefficients and bootstrap standard errors.

Note 5: P Values of less than 0.0038 are determined to be significant based on Bonferroni adjustment