ORIGINAL RESEARCH

Demographic Factors and Hospital Size Predict Patient Satisfaction Variance—Implications for Hospital Value-Based Purchasing

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BACKGROUND: Hospital Value-Based Purchasing (HVBP) incentivizes quality performance-based healthcare by linking payments directly to patient satisfaction scores obtained from Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) surveys. Lower HCAHPS scores appear to cluster in heterogeneous population-dense areas and could bias Centers for Medicare & Medicaid Services (CMS) reimbursement.

OBJECTIVE: Assess nonrandom variation in patient satisfaction as determined by HCAHPS.

DESIGN: Multivariate regression modeling was performed for individual dimensions of HCAHPS and aggregate scores. Standardized partial regression coefficients assessed strengths of predictors. Weighted Individual (hospital) Patient Satisfaction Adjusted Score (WIPSAS) utilized 4 highly predictive variables, and hospitals were reranked accordingly.

SETTING: A total of 3907 HVBP-participating hospitals.

PATIENTS: There were 934,800 patient surveys by the most conservative estimate.

MEASUREMENTS: A total of 3144 county demographics (US Census) and HCAHPS surveys.

RESULTS: Hospital size and primary language (non–English speaking) most strongly predicted unfavorable HCAHPS scores, whereas education and white ethnicity most strongly predicted favorable HCAHPS scores. The average adjusted patient satisfaction scores calculated by WIPSAS approximated the national average of HCAHPS scores. However, WIPSAS changed hospital rankings by variable amounts depending on the strength of the predictive variables in the hospitals' locations. Structural and demographic characteristics that predict lower scores were accounted for by WIPSAS that also improved rankings of many safety-net hospitals and academic medical centers in diverse areas.

CONCLUSIONS: Demographic and structural factors (eg, hospital beds) predict patient satisfaction scores even after CMS adjustments. CMS should consider WIPSAS or a similar adjustment to account for the severity of patient satisfaction inequities that hospitals could strive to correct. *Journal of Hospital Medicine* 2015;10:503–509. © 2015 Society of Hospital Medicine

The Affordable Care Act of 2010 mandates that government payments to hospitals and physicians must depend, in part, on metrics that assess the quality and efficiency of healthcare being provided to encourage value-based healthcare.[1] Value in healthcare is defined by the delivery of high-quality care at low cost.[2,3] To this end, Hospital Value-Based Purchasing (HVBP) and Physician Value-Based Payment Modifier programs have been developed by the Centers for Medicare & Medicaid Services (CMS). HVBP is currently being phased in and affects CMS payments for fiscal year (FY) 2013 for over 3000 hospitals across the United States to incentivize healthcare delivery value. The final phase of implementation will be in FY 2017 and will then affect 2% of all CMS hospital reimbursement. HVBP is based on objective measures of hospital performance as well as a subjective measure of performance captured under the Patient Experience of Care domain. This subjective measure will remain at 30% of the aggregate score until FY 2016, when it will then be 25% the aggregate score moving forward.[4] The program rewards hospitals for both overall achievement and improvement in any domain, so that hospitals have multiple ways to receive financial incentives for providing quality care.[5] Even still, there appears to be a nonrandom pattern of patient satisfaction scores across the country with less favorable scores clustering in densely populated areas.[6]

Value-Based Purchasing and other incentive-based programs have been criticized for increasing disparities in healthcare by penalizing larger hospitals (including academic medical centers, safety-net hospitals, and others that disproportionately serve lower socioeconomic communities) and favoring physician-based specialty hospitals.[7–9] Therefore, hospitals that serve indigent and elderly populations may be at a disadvantage.[9,10] HVBP portends significant economic consequences for the majority of hospitals that rely heavily on Medicare and Medicaid reimbursement, as most hospitals have large revenues but low profit margins.[11] Higher HVBP scores are associated with for profit status, smaller size, and location in certain areas
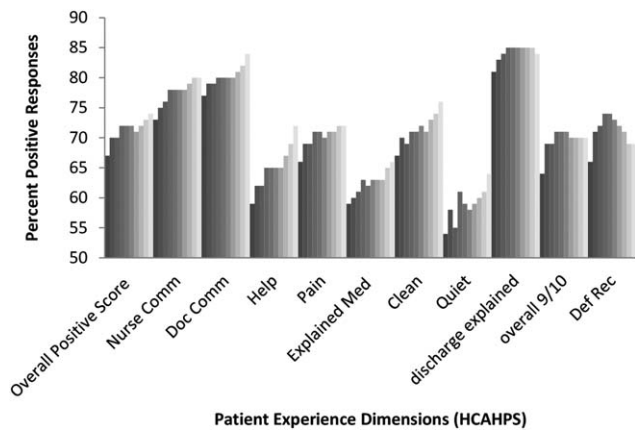
FIG. 1. Overall patient satisfaction by population density decile. Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores are segregated by population density deciles (representing 33 million people each). Population density increases along the grey scale. The composite score and 9 out of 10 HCAHPS dimensions demonstrate lower patient satisfaction as population density increases (darker shade). Abbreviations: Doc, doctor; Def Rec, definitely recommend.

of the United States.[12] Jha et al.[6] described Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores' regional geographic variability, but concluded that poor satisfaction was due to poor quality.

The Patient Experience of Care domain quantifies patient satisfaction using the validated HCAHPS survey, which is provided to a random sample of patients continuously throughout the year at 48 hours to 6 weeks after discharge. It is a publically available standardized survey instrument used to measure patients' perspectives on hospital care. It assesses the following 8 dimensions: nurse communication, doctor communication, hospital staff responsiveness, pain management, medicine communication, discharge information, hospital cleanliness and quietness, and overall hospital rating, of which the last 2 dimensions each have 2 measures (cleanliness and quietness) and (rating 9 or 10 and definitely recommend) to give a total of 10 distinct measures.

The United States is a complex network of urban, suburban, and rural demographic areas. Hospitals exist within a unique contextual and compositional meshwork that determines its caseload. The top population density decile of the United States lives within 37 counties, whereas half of the most populous parts of the United States occupy a total of 250 counties out of a total of 3143 counties in the United States. If the 10 measures of patient satisfaction (HCAHPS) scores were abstracted from hospitals and viewed according to county-level population density (separated into deciles across the United States), a trend would be apparent (Figure 1). Greater population density is associated with lower patient satisfaction in 9 of 10 categories. On the state level, composite scores of overall patient satisfaction (amount of positive scores) of hospitals show a 12% variability and a sig-

nificant correlation with population density ($r = -0.479$; Figure 2). The lowest overall satisfaction scores are obtained from hospitals located in the population-dense regions of Washington, DC, New York State, California, Maryland, and New Jersey (ie, 63%–65%), and the best scores are from Louisiana, South Dakota, Iowa, Maine, and Vermont (ie, 74%–75%). The average patient satisfaction score is 71% ± 2.9%. Lower patient satisfaction scores appear to cluster in population-dense areas and may be associated with greater heterogeneous patient demographics and economic variability in addition to population density.

These observations are surprising considering that CMS already adjusts HCAHPS scores based on patient-mix coefficients and mode of collection.[13–18] Adjustments are updated multiple times per year and account for survey collection either by telephone, email, or paper survey, because the populations that select survey forms will differ. Previous studies have shown that demographic features influence the patient evaluation process. For example, younger and more educated patients were found to provide less positive evaluations of healthcare.[19]

This study examined whether patients' perceptions of healthcare (pattern of patient satisfaction) as quantified under the patient experience domain of HVBP were affected and predicted by population density and other demographic factors that are outside the control of individual hospitals. In addition, hospital-level data (eg, number of hospital beds) and county-level data
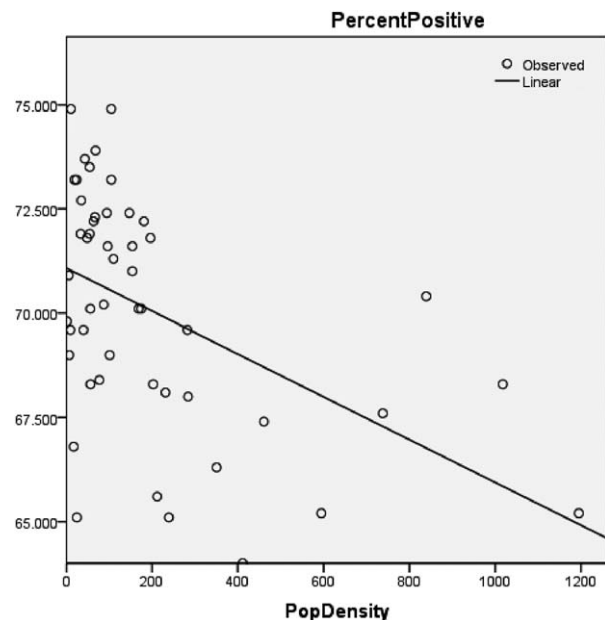
FIG. 2. Averaged Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores by state correlated with state population (Pop) density. Bivariate correlation of composite HCAHPS scores predicted by state population density without District of Columbia, $r = -0.479$, $P < 0.001$ (2-tailed). This observed correlation informed the hypothesis that population density could predict for lower patient satisfaction via HCAHPS scores.

such as race, age, gender, overall population, income, time spent commuting to work, primary language, and place of birth were analyzed for correlation with patient satisfaction scores. Our study demonstrates that demographic and hospital-level data can predict patient satisfaction scores and suggests that CMS may need to modify its adjustment formulas to eliminate bias in HVBP-based reimbursement.

METHODS

Data Collection

Publically available data were obtained from Hospital Compare,[20] American Hospital Directory,[21] and the US Census Bureau[22] websites. Twenty relevant US Census data categories were selected by their relevance for this study out of the 50 publically reported US Census categories, and included the following: county population, county population density, percent of population change over 1 year, poverty level (percent), income level per capita, median household income, average household size, travel time to work, percentage of high school or college graduates, non-English primary language spoken at home, percentage of residents born outside of the United States, population percent in same residence for over 1 year, gender, race (white alone, white alone (not Hispanic or Latino), black or African American alone), population over 65 years old, and population under 18 years old.

HCAHPS Development

The HCAHPS survey is 32 questions in length, comprised of 10 evaluative dimensions. All short-term, acute care, nonspecialty hospitals are invited to participate in the HCAHPS survey.

Data Analysis

Statistical analyses used the Statistical Package for Social Sciences version 16.0 for Windows (SPSS Inc., Chicago, IL). Data were checked for statistical assumptions, including normality, linearity of relationships, and full range of scores. Categories in both the Hospital Compare (HCAHPS) and US Census datasets were analyzed to assess their distribution curves. The category of population densities (per county) was converted to a logarithmic scale to account for a skewed distribution and long tail in the area of low population density. Data were subsequently merged into an Excel (Microsoft, Redmond, WA) spreadsheet using the VLookup function such that relevant 2010 census county data were added to each hospital's Hospital Compare data. Linear regression modeling was performed. Bivariate analysis was conducted (ENTER method) to determine the significant US Census data predictors for each of the 10 Hospital Compare dimensions including the composite overall satisfaction score. Significant predictors were then analyzed in a multivariate model (BACKWORDS method) for each Hospital Compare dimension and the composite

average positive score. Models were assessed by determinates of correlation (adjusted R^2) to assess for goodness of fit. Statistically significant predictor variables for overall patient satisfaction scores were then ranked according to their partial regression coefficients (standardized β).

A patient satisfaction predictive model was sought based upon significant predictors of aggregate percent positive HCAHPS scores. Various predictor combinations were formed based on their partial coefficients (ie, standardized β coefficients); combinations were assessed based on their R^2 values and assessed for colinearity. Combinations of partial coefficients included the 2, 4, and 8 most predictive variables as well the 2 most positive and negative predictors. They were then incorporated into a multivariate analysis model (FORWARD method) and assessed based on their adjusted R^2 values. A 4-variable combination (the 2 most predictive positive partial coefficients plus the 2 most predictive negative partial coefficients) was selected as a predictive model, and a formula predictive of the composite overall satisfaction score was generated. This formula (predicted patient satisfaction formula [PPSF]) predicts hospital patient satisfaction HCAHPS scores based on the 4 predictive variables for particular county and hospital characteristics.

$$PPSF = K_{MV} + B_{HB}(HB) + B_{NE}(NE) + B_E(E) + B_W(W)$$

where K_{MV} = coefficient constant (70.9), B = unstandardized β coefficient (see Table 1 for values), HB = number of hospital beds, NE = proportion of non-English speakers, E = education (proportion with bachelor's degree), and W = proportion identified as white race only.

The PPSF was then modified by weighting with the partial coefficient (β) to remove the bias in patient satisfaction generated by demographic and structural factors over which individual hospitals have limited or no control. This formula generated a Weighted Individual (hospital) Predicted Patient Satisfaction Score (WIPPSS). Application of this formula narrowed the predicted distribution of patient satisfaction for all hospitals across the country.

$$WIPPSS = K_{MV} + B_{HB}(HB)(1-\beta_{HB}) + B_{NE}(NE)(1-\beta_{NE}) + B_E(E)(1-\beta_E) + B_W(W)(1-\beta_W)$$

where β = standardized β coefficient (see Table 1 for values).

To create an adjusted score with direct relevance to the reported patient satisfaction scores, the reported scores were multiplied by an adjustment factor that defines the difference between individual hospital-weighted scores and the national mean HCAHPS score across the United States. This formula, the Weighted Individual (hospital) Patient Satisfaction Adjustment Score (WIPSAS), represents a patient

TABLE 1. Multivariate Regression of Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Average Positive Score by County and Hospital Demographics

	B	SE	β	t	P
Educational attainment–bachelor's degree	0.157	0.018	0.27	8.612	<0.001
White alone percent 2012	0.09	0.012	0.235	7.587	<0.001
Resident population percent under 18 years	0.404	0.0444	0.209	9.085	<0.001
Black or African American alone percent 2012	0.083	0.014	0.191	5.936	<0.001
Median household income 2007–2011	−0.00003	0.00	−0.062	−2.027	0.043
Population density (log) 2010	−0.277	0.083	−0.087	−3.3333	0.001
Average travel time to work	−0.107	0.024	−0.088	−4.366	<0.001
Educational attainment–high school	−0.082	0.026	−0.088	−3.147	0.002
Average household size	−2.58	0.727	−0.107	−3.55	<0.001
Total females percent 2012	−0.423	0.067	−0.107	−6.296	<0.001
Percent non–English speaking at home 2007–2011	−0.052	0.018	−0.14	−2.929	0.003
No. of hospital beds	−0.006	0.00	−0.213	−12.901	<0.001
Adjusted R^2	0.222				

NOTE: A multivariate linear regression model of statistically significant dimensions of patient satisfaction as determined by Hospital Consumer Assessment of Healthcare Providers and Systems scores is provided. The dependent variable is the composite of average patient satisfaction scores by hospital (3192 hospitals). Predictors (independent variables) were collected from US Census data for counties or county equivalents. All of the listed predictors (first column) are statistically significant. They are placed in order of partial regression coefficient contribution to the model from most positive to most negative contribution. Adjusted R^2 (last row) is used to signify the goodness of fit. Abbreviations: β, standardized β (partial coefficient); B, unstandardized β coefficient; P, statistical significance; SE, standard error; t, t statistic.

satisfaction score adjusted for demographic and structural factors that can be utilized for interhospital comparisons across all areas of the country.

$$WIPSAS = PS_{rep}[1 + (PS_{USA} - WIPPSS_X)/100]$$

where PS_{rep} = patient satisfaction reported score, PS_{USA} = mean reported score for United States (71.84), and $WIPPSS_X$ = WIPPSS for individual hospital.

Application of Data Analysis
PPSF, WIPPSS, and WIPSAS were calculated for all HCAHPS-participating hospitals and compared with averaged raw HCAHPS scores across the United States. WIPSAS and raw scores were specifically analyzed for New York State to demonstrate exactly how adjustments would change state-level rankings.

RESULTS
Complete HCAHPS scores were obtained from 3907 hospitals out of a total 4621 hospitals listed by the Hospital Compare website (85%). The majority of hospitals (2884) collected over 300 surveys, fewer hospitals (696) collected 100 to 299 surveys, and fewer still (333) collected <100 surveys. In total, results were available from at least 934,800 individual surveys, by the most conservative estimate. Missing HCAHPS hospital data averaged 13.4 (standard deviation [SD] 12.2) hospitals per state. County-level data were obtained from all 3144 county or county equivalents across the United States (100%). Multivariate regression modeling across all HCAHPS dimensions found that between 10 and 16 of the 20 predictors (US Census categories) were statistically significant and predictive of individual HCAHPS dimension

scores and the aggregate percent positive score as demonstrated in Table 2. For example, county percentage of bachelors' degrees positively predicts for positive doctor communication scores, and hospital beds negatively predicts for quiet dimension. The strongest positive and negative predictive variables by model regression coefficients for each HCAHPS dimension are also listed in Table 2.

Table 1 highlights multivariate regression modeling of the composite average positive score, which produced an adjusted R^2 of 0.222 ($P < 0.001$). All variables were significant and predicted change of the composite HCAHPS except for place of birth–foreign born (not listed in the table). Table 1 ranks variables from most positive to most negative predictors.

Other HCAHPS domains demonstrated statistically significant models ($P < 0.001$) and are listed by their coefficients of determination (ie, adjusted R^2) (Table 2). The best-fit dimensions were help (adjusted $R^2 = 0.304$), quiet (adjusted $R^2 = 0.299$), doctor communication (adjusted $R^2 = 0.298$), nurse communication (adjusted $R^2 = 0.245$), and clean (adjusted $R^2 = 0.232$). Models that were not as strongly predictive as the composite score included pain (adjusted $R^2 = 0.124$), overall 9/10 (adjusted $R^2 = 0.136$), definitely recommend (adjusted $R^2 = 0.150$), and explained meds (adjusted $R^2 = 0.169$).

A predictive formula for average positive scores was created by determination of the most predictive partial coefficients and the best-fit model. Bachelor's degree and white only were the 2 greatest positive predictors, and number of hospital beds and non–English speaking were the 2 greatest negative predictors. The PPSF (predictive formula) was chosen out of various combinations of predictors (Table 1), because its coefficient of determination (adjusted $R^2 = 0.155$) was closest to

TABLE 2. Multivariate Regression of Hospital Consumer Assessment of Healthcare Providers and Systems by County and Hospital Demographics

	Average Positive Scores	Nurse Communication	Doctor Communication	Help	Pain	Explain Meds	Clean	Quiet	Discharge Explain	Recommend 9/10	Definitely Recommend
Educational–bachelor's	0.27	0.19	0.45	0.10	0.10	0.05	0.08	0.33	0.15	0.27	0.416
Hospital beds	−0.21	−0.16	−0.19	−0.26	−0.16	−0.17	−0.27	−0.26	−0.06	−0.11	—
Population density 2010	−0.09	−0.07	−0.28	−0.20	−0.08	−0.23	−0.14	−0.19	0.22	0.07	*
White alone percent	0.24	0.25	0.09	0.16	0.23	0.07	0.16	—	0.17	0.31	0.317
Total females percent	−0.11	−0.05	−0.06	−0.07	−0.06	−0.03	−0.05	−0.09	−0.12	−0.09	—
African American alone	0.19	0.19	—	0.09	0.23	0.09	0.07	0.34	*	0.09	0.084
Average travel time to work	−0.09	−0.10	*	−0.09	−0.06	−0.04	−0.08	*	−0.12	−0.17	−0.16
Foreign-born percent	*	−0.16	0.14	−0.06	−0.12	−0.08	0.06	−0.13	−0.18	*	*
Average household size	−0.11	−0.05	−0.15	−0.07	*	−0.07	*	−0.01	*	−0.07	0.076
Non–English speaking	−0.14	−0.12	−0.50	−0.07	*	*	*	*	*	−0.34	−0.28
Education–high school	−0.09	−0.09	−0.40	*	—	—	—	−0.27	0.06	−0.08	*
Household income	−0.06	*	−0.35	−0.08	*	*	−0.16	−0.41	—	—	−0.265
Population 65 years and over	*	−0.14	−0.14	−0.12	*	−0.11	−0.15	—	—	*	−0.10
White, not Hispanic/Latino	*	*	−0.20	*	*	*	0.09	0.13	0.09	−0.22	−0.25
Population under 18	0.21	—	0.15	—	0.08	—	—	—	0.11	0.20	—
Population (county)	*	−0.06	−0.08	*	−0.03	−0.05	*	*	−0.06	*	*
All ages in poverty	—	—	−0.24	—	—	—	−0.10	−0.22	−0.08	*	−0.281
1 year at same residence	*	0.13	0.12	0.11	—	—	0.10	*	−0.04	*	*
Per capita income	*	−0.07	*	*	*	*	*	0.09	—	—	*
Population percent change	*	*	*	*	*	*	−0.05	—	—	*	*
Adjusted R^2	0.22	0.25	0.30	0.30	0.12	0.17	0.23	0.30	0.19	0.14	0.15

NOTE: Linear regression modeling results of 10 dimensions of patient satisfaction (ie, Hospital Consumer Assessment of Healthcare Providers and Systems [HCAHPS]) and Average Positive Scores (top row) by county demographics and hospital size (left column) are shown. Adjusted R^2 (last row) is used to signify the goodness of fit. All models are statistically significant with $P = <0.001$. Partial regression coefficients (β) are used to positively or negatively assess contribution to the individual models (ie, each column). The dash (—) indicates nonsignificance and the asterisk (*) indicates a value that was statistically significant in univariate analysis but not in multivariate analysis. Independent variables (first column) are ordered from top to bottom by the number of HCAHPS dimensions that each contributes to HCAHPS predictive scoring.

the overall model's coefficient of determination (adjusted $R^2 = 0.222$) without demonstrating colinearity. Possible predictive formulas were based on the predictors' standardized β and included the following combinations: the 2 greatest overall predictors (adjusted $R^2 = 0.051$), the 2 greatest negative and positive predictors (adjusted $R^2 = 0.098$), the 4 greatest overall predictors (adjusted $R^2 = 0.117$), and the 8 greatest overall predictors (adjusted $R^2 = 0.201$), which suffered from colinearity (household size plus non–English speaking [Pearson = 0.624] and under 18 years old [Pearson = 0.708]). None of the correlated independent variables (eg, poverty and median income) were placed in the final model.

The mean WIPSAS scores closely corresponded with the national average of HCAHPS scores (71.6 vs 71.84) but compressed scores into a narrower distribution (SD 5.52 vs 5.92). The greatest positive and negative changes were by 8.51% and 2.25%, respectively. Essentially, a smaller number of hospitals in demographically challenged areas were more significantly impacted by the WIPSAS adjustment than the larger number of hospitals in demographically favorable areas. Large hospitals in demographically diverse counties saw the greatest positive change (e.g., Texas, California, and New York), whereas smaller hospitals in demographically nondiverse areas saw comparatively smaller decrements in the overall WIPSAS scores. The WIPSAS had the most beneficial effect on urban and rural safety-net hospitals that serve diverse populations including many academic medical centers. This is illustrated by the reranking of the top 10 and bottom 10 hospitals in New York State by the WIPSAS (Table 3). For example, 3 academic medical

TABLE 3. Top Ten Highest-Ranked Hospitals in New York State by HCAHPS Scores Compared to WIPSAS

Ten Highest Ranked New York State Hospitals by HCAHPS	Ten Highest Ranked New York State Hospitals After WIPSAS
1. River Hospital, Inc.	1. River Hospital, Inc.
2. Westfield Memorial Hospital, Inc.	2. Westfield Memorial Hospital, Inc.
3. Clifton Fine Hospital	3. Clifton Fine Hospital
4. Hospital For Special Surgery	4. Hospital For Special Surgery
5. Delaware Valley Hospital, Inc.	5. New York–Presbyterian Hospital
6. Putnam Hospital Center	6. Delaware Valley Hospital, Inc.
7. Margaretville Memorial Hospital	7. Montefiore Medical Center
8. Community Memorial Hospital, Inc.	8. St. Francis Hospital, Roslyn
9. Lewis County General Hospital	9. Putnam Hospital Center
10. St. Francis Hospital, Roslyn	10. Mount Sinai Hospital

NOTE: Top 10 highest-ranked hospitals in New York State by overall patient satisfaction out of 167 evaluable hospitals are shown. The left column represents the current top 10 hospitals in 2013 by HCAHPS overall patient satisfaction scores, and the right column represents the top 10 hospitals after the WIPSAS adjustment. The 4 factors used to create the WIPSAS adjustment were the 2 most positive partial regression coefficients (education–bachelor's degree, white alone percent 2012) and the 2 most negative partial regression coefficients (number of hospital beds, non–English speaking at home). Three urban academic medical centers, Montefiore Medical Center, New York Presbyterian Hospital, and Mount Sinai Hospital, were reranked from the 46th, 43rd, and 42nd respectively into the top 10. Abbreviations: HCAHPS, Hospital Consumer Assessment of Healthcare Providers and Systems; WIPSAS, Weighted Individual (hospital) Patient Satisfaction Adjustment Score.

centers in New York State, Montefiore Medical Center, New York Presbyterian Hospital, and Mount Sinai Hospital, were moved from the 46th, 43rd, and 42nd (out of 167 hospitals) respectively into the top 10 in patient satisfaction utilizing the WIPSAS methodology. Reported patient satisfaction scores, PPSF, WIPPSS, and WIPSAS scores for each hospital in the United States are available online (see Supporting Table S1 in the online version of this article).

DISCUSSION

The HVBP program is an incentive program that is meant to enhance the quality of care. This study illustrates healthcare inequalities in patient satisfaction that are not accounted for by the current CMS adjustments, and shows that education, ethnicity, primary language, and number of hospital beds are predictive of how patients evaluate their care via patient satisfaction scores. Hospitals that treat a disproportionate percentage of non–English speaking, nonwhite, noneducated patients in large facilities are not meeting patient satisfaction standards. This inequity is not ameliorated by the adjustments currently performed by CMS, and has financial consequences for those hospitals that are not meeting national standards in patient satisfaction. These hospitals, which often include academic medical centers in urban areas, may therefore be penalized under the existing HVBP reimbursement models.

Using only 4 demographic and hospital-specific predictors (ie, hospital beds, percent non–English speaking, percent bachelors' degrees, percent white), it is possible to utilize a simple formula to predict patient satisfaction with a significant degree of correlation to the reported scores available through Hospital Compare.

Our initial hypothesis that population density predicted lower patient satisfaction scores was confirmed, but these aforementioned demographic and hospital-based factors were stronger independent predictors of HCAHPS scores. The WIPSAS is a representation of patient satisfaction and quality-of-care delivery across the country that accounts for nonrandom variation in patient satisfaction scores.

For hospitals in New York State, WIPSAS resulted in the placement of 3 urban-based academic medical centers in the top 10 in patient satisfaction, when previously, based on the raw scores, their rankings were between 42nd and 46th statewide. Prior studies have suggested that large, urban, teaching, and not-for-profit hospitals were disadvantaged based on their hospital characteristics and patient features.[10–12] Under the current CMS reimbursement methodologies, these institutions are more likely to receive financial penalties.[8] The WIPSAS is a simple method to assess hospitals' performance in the area of patient satisfaction that accounts for the demographic and hospital-based factors (eg, number of beds) of the hospital. Its incorporation into CMS reimbursement calculations, or incorporation of a similar adjustment formula, should be strongly considered to account for predictive factors in patient satisfaction that could be addressed to enhance their scores.

Limitations for this study are the approximation of county-level data for actual individual hospital demographic information and the exclusion of specialty hospitals, such as cancer centers and children's hospitals, in HCAHPS surveys. Repeated multivariate analyses at different time points would also serve to identify how CMS-specific adjustments are recalibrated over time. Although we have primarily reported on the composite percent positive score as a surrogate for all HCAHPS dimensions, an individual adjustment formula could be generated for each dimension of the patient experience of care domain.

Although patient satisfaction is a component of how quality should be measured, further emphasis needs to be placed on nonrandom patient satisfaction variance so that HVBP can serve as an incentivizing program for at-risk hospitals. Regional variation in scoring is not altogether accounted for by the current CMS adjustment system. Because patient satisfaction scores are now directly linked to reimbursement, further evaluation is needed to enhance patient satisfaction scoring paradigms to account for demographic and hospital-specific factors.

Disclosure

Nothing to report.

References

1. Florence CS, Atherly A, Thorpe KE. Will choice-based reform work for Medicare? Evidence from the Federal Employees Health Benefits Program. *Health Serv Res.* 2006;41:1741–1761.
2. H.R. 3590. Patient Protection and Affordable Care Act 2010 (2010).
3. Donabedian A. The quality of care. How can it be assessed? *JAMA.* 1988;260(12):1743–1748.
4. Lake Superior Quality Innovation Network. FY 2017 Value-Based Purchasing domain weighting. Available at: http://www.stratishealth.org/documents/VBP-FY2017.pdf. Accessed March 13, 2015.
5. Hospital Value-Based Purchasing Program. Available at: http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Hospital-Value-Based-Purchasing. Accessed December 1st, 2013.
6. Jha AK, Orav EJ, Zheng J, Epstein AM. Patients' perception of hospital care in the United States. *N Engl J Med.* 2008;359(18):1921–1931.
7. Porter ME, Lee TH. Providers must lead the way in making value the overarching goal *Harvard Bus Rev.* October 2013:3–19.
8. Jha AK, Orav EJ, Epstein AM. The effect of financial incentives on hospitals that serve poor patients. *Ann Intern Med.* 2010;153(5):299–306.
9. Joynt KE, Jha AK. Characteristics of hospitals receiving penalties under the Hospital Readmissions Reduction Program. *JAMA.* 2013;309(4):342–343.
10. Ryan AM. Will value-based purchasing increase disparities in care? *N Engl J Med.* 2013;369(26):2472–2474.
11. Thorpe KE, Florence CS, Seiber EE. Hospital conversions, margins, and the provision of uncompensated care. *Health Aff (Millwood).* 2000;19(6):187–194.
12. Borah BJ, Rock MG, Wood DL, Roellinger DL, Johnson MG, Naessens JM. Association between value-based purchasing score and hospital characteristics. *BMC Health Serv Res.* 2012;12:464.
13. Elliott MN, Zaslavsky AM, Goldstein E, et al. Effects of survey mode, patient mix, and nonresponse on CAHPS hospital survey scores. *Health Serv Res.* 2009;44(2 pt 1):501–518.
14. Burroughs TE, Waterman BM, Cira JC, Desikan R, Claiborne Dunagan W. Patient satisfaction measurement strategies: a comparison of phone and mail methods. *Jt Comm J Qual Improv.* 2001;27(7):349–361.
15. Fowler FJ Jr, Gallagher PM, Nederend S. Comparing telephone and mail responses to the CAHPS survey instrument. Consumer Assessment of Health Plans Study. *Med Care.* 1999;37(3 suppl):MS41–MS49.

16. Rodriguez HP, von Glahn T, Rogers WH, Chang H, Fanjiang G, Safran DG. Evaluating patients' experiences with individual physicians: a randomized trial of mail, internet, and interactive voice response telephone administration of surveys. *Med Care*. 2006;44(2): 167–174.
17. O'Malley AJ, Zaslavsky AM, Elliott MN, Zaborski L, Cleary PD. Case-mix adjustment of the CAHPS Hospital Survey. *Health Serv Res*. 2005;40(6 pt 2):2162–2181.
18. Mode and patient-mix adjustments of CAHPS hospital survey (HCAHPS). Available at: http://www.hcahpsonline.org/modeadjustment.aspx. Accessed December 1, 2013.
19. Zaslavsky AM, Zaborski LB, Ding L, Shaul JA, Cioffi MJ, Clear PD. Adjusting performance measures to ensure equitable plan comparisons. *Health Care Financ Rev*. 2001;22(3):109–126.
20. Official Hospital Compare Data. Displaying datasets in Patient Survey Results category. Available at: https://data.medicare.gov/data/hospital-compare/Patient%20Survey%20Results. Accessed December 1, 2013.
21. Hospital statistics by state. American Hospital Directory, Inc. website. Available at: http://www.ahd.com/state_statistics.html. Accessed December 1, 2013.
22. U.S. Census Download Center. Available at: http://factfinder.census.gov/faces/nav/jsf/pages/download_center.xhtml. Accessed December 1, 2013.