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Patient Satisfaction in Outpatient Radiology: Effects of Modality and Patient Demographic Characteristics

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Abstract

Objective: To characterize predictors of patient satisfaction in outpatient radiology, we examined whether patient satisfaction differs across radiology modalities and demographic groups. **Methods:** A random sampling of Press-Ganey outpatient services surveys for radiology and non-radiology visits from September 2008 to September 2017 were retrospectively analyzed. Composite scores averaged across all Likert items were analyzed as both a continuous variable and a dichotomous variable of dissatisfaction (defined as ≤ 3 on the 5-point scale). **Results:** Among 9983 radiology surveys, mammography had higher composite scores than MRI, CT, radiography, US, and NM/PET ($p < 0.001$) and lower dissatisfaction (3.9%) than CT (6.7%), MRI (7.3%), and radiography (8.2%). Low-scoring responses were most common in the Facilities domain (7.8%) and least common in Overall Assessment (3.8%). Satisfaction metrics were lowest for ages 20–29 and highest for ages 70–79. Lower dissatisfaction rates were seen among Hispanics (3%) and whites (6%), compared to blacks (10%) and Asians (18%). **Conclusion:** Significant differences in patient satisfaction were found across imaging modalities and demographic variables. Further investigations to identify contributing factors may help improve patient experiences.

Keywords

radiology, patient satisfaction, press-ganey, imaging modalities, health equity.

Introduction

In an era of growing emphasis on patient-centric medicine and value-based care, patients' perceptions of imaging experiences are increasingly important to radiology practices. Patient experiences, in addition to contributing to patient retention or practice reputation, may impact reimbursements in value-based payment models that incentivize patient-centered care (1). While patient satisfaction in healthcare in general has been studied, radiology imaging visits may differ from other outpatient clinical encounters in that radiology patients typically neither choose nor meet a physician provider in person, and many situations in radiologic imaging can be viewed by patients as unfamiliar, uncomfortable, or anxiety-provoking (2). Therefore, patient experiences and expectations in radiology may differ from other clinical encounters and warrants dedicated investigation.

Existing studies on radiology patient satisfaction include custom-designed radiology-specific surveys (3–6), proprietary surveys not specific to radiology (1), physician rating websites (7), and complaint/feedback assessment (8–10). Few studies, however, have examined potentially generalizable differences in patient satisfaction across modalities or demographic variables in radiology. Given that radiology practices and patients are inherently heterogeneous, attempts to gauge quality through benchmarking may need to take into consideration such factors as patient age composition or modality mix if systematic differences exist across these variables. Awareness of differences in satisfaction metrics among radiology modalities, between radiology and non-radiology encounters, or across patient demographics may help identify differing patient expectations, reveal biases related to how survey instruments capture patients'

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subjective assessments, or suggest targeted quality improvement efforts for specific modalities or patient populations.

While transient fluctuations in satisfaction metrics may reflect specific local events or idiosyncratic factors, analysis of satisfaction over long time periods may reveal patterns that persist over time and thus could represent systematic or potentially generalizable differences in patient perceptions and experiences. In this study, we examine and characterize patient satisfaction at our institution over a 9-year period and test the hypothesis that patient satisfaction differs across radiology modalities and demographic variables.

Methods

Satisfaction Source Data

Informed consent was waived for this IRB-approved study. 69,319 completed Press Ganey outpatient services surveys over a 9-year period (September 2008 - September 2017) at an academic institution were retrospectively reviewed. Surveys were mailed to patients who underwent outpatient imaging in mammography, radiography, CT, MRI, ultrasound, or nuclear medicine, instructing respondents to answer questions related to the specific visit and location referenced in the survey. Similar surveys were sent to patients undergoing non-radiology visits, which included various outpatient visits outside the radiology department, the most common of which were sports/rehabilitation medicine visits, endoscopy appointments, and physical therapy sessions. In addition to background questions and space for free-text comments, the survey includes 21 Likert items soliciting responses on a scale from 1 (Very Poor) to 5 (Very Good). These questions cover a wide range of topics grouped into 5 domains (Registration, Facilities, Test/Treatment, Personal Issues, or Overall Assessment). Demographic information associated with each visit was also recorded, including age, gender, and race/ethnicity (white, black, Hispanic, Asian, and Unknown/Other). To simplify reporting, ages were binned into groups by decade.

Statistical Analysis

Inferential statistics were performed using SAS 9.4 and JMP Pro. Numerical responses for the 21 Likert items from each survey were averaged to obtain a composite score for that survey. In addition, survey responses were dichotomized in a "dissatisfaction" variable describing whether responses fall in the low-scoring range (≤ 3), corresponding to descriptors of Fair, Poor, or Very Poor. This dichotomization is similar to how transaction-level customer satisfaction data are dichotomized in the 5-point Customer Satisfaction (CSAT) survey scale used in the business marketing literature, as the 2 highest satisfaction categories in the 5-point CSAT scale have been found to correlate with indicators of a firm's future business performance (11). Given the potential for large sample sizes to magnify biases or detect statistically significant but inconsequential findings (i.e., small effect sizes) (12), stratified random sampling of the source data was performed based on a power analysis targeted to 80% power for detecting a 3% difference in proportions, resulting in approximately 27% of the original dataset sampled for descriptive and inferential statistical analysis ($N = 18{,}088$ surveys). Variables used for stratification were modality, race/ethnicity, gender, and age category (<18 years, 18–64 years, $\geq$ 65 years). The differences in composite score distributions were assessed by the nonparametric Kruskal-Wallis test, followed by pairwise comparisons of composite scores across radiology modalities and demographic variables using the Dwass, Steel, Critchlow-Flingner method to control the family-wise error rate. The rank-sum test was used to compare composite scores between radiology and non-radiology surveys. Differences in proportions of the binary dissatisfaction variable were assessed by pairwise chi square analysis, with Bonferroni adjustment. To facilitate interpretation, dissatisfaction rates for each survey domain are also presented. In addition, multivariable regression modeling was performed on the radiology survey population to assess relative contributions of each examined independent variable (age, gender, race/ethnicity, modality, and visit year) to patient satisfaction. Nominal logistic regression was applied to model dissatisfaction, and least squares linear regression was performed for composite scores. A p value (adjusted for multiple comparisons where applicable) of < 0.05 was considered statistically significant.

Results

Survey Respondent Population

Of the 18088 completed surveys included in our analysis, 9983 were based on radiology visits. The number of survey respondents increased over the study period, with 73% of responses derived from the final 4 years of the study. Basic demographic characteristics for the radiology cohort and for each radiologic modality are shown in Table 1. Median age of radiology survey respondents was 61, with slightly higher median ages of 65 and 66 associated with CT and NM/PET visits, respectively. Almost all were adult patients, with 0.1% of patients <18 years of age. Among respondents, most were female (72%), and a large majority were white (87%). Approximately 8% were black, with the remaining three racial/ethnic categories of Hispanic, Asian, or Other/Unknown each constituting 1−2%. The demographic distribution varies across modalities (Figure 1).

Modality Effects on Satisfaction Scores

Among completed surveys for radiology, the most common modality was mammography, followed by CT. Significant effects of modality were identified when analyzing both the composite score continuous variable (Figure 1a) and the dissatisfaction binary variable (Figure 1b). Pairwise two-tailed multiple-comparison analyses showed higher composite

Table 1. Demographic Characteristics of the Respondent Sample for Radiology Visits (Separated by Modality).

Variable	CT	MRI	Mammography	NM/PET	Radiography	US	All Modalities
N	2213	1626	3000	317	2126	701	9983
Age (Years)							
Median	65	60	60	66	61	59	61
Q1 - Q3	57–73	49–69	51–67	58–73	51–70	47–67	52–69
Age Category							
<18 years			1 (0.03%)		8 (0.4%)	1 (0.1%)	10 (0.1%)
18–64 years	1042 (47%)	1046 (64%)	2045 (68%)	141 (44%)	1264 (59%)	467 (67%)	6005 (60%)
≥ 65 years	1171 (53%)	580 (36%)	954 (32%)	176 (56%)	854 (40%)	233 (33%)	3968 (40%)
Gender							
Female	1120 (51%)	1004 (62%)	2989 (99.6%)	152 (48%)	1441 (68%)	457 (65%)	7163 (72%)
Male	1093 (49%)	622 (38%)	11 (0.4%)	165 (52%)	685 (32%)	244 (35%)	2820 (28%)
Race/ethnicity							
White	2001 (90%)	1448 (89%)	2623 (87%)	280 (88%)	1795 (84%)	544 (78%)	8691 (87%)
Black	137 (6%)	112 (7%)	233 (8%)	19 (6%)	234 (11%)	95 (14%)	830 (8%)
Hispanic	22 (1%)	18 (1%)	34 (1%)	5 (2%)	26 (1%)	17 (2%)	122 (1%)
Asian	25 (1%)	19 (1%)	54 (2%)	3 (1%)	30 (1%)	23 (3%)	154 (2%)
Other/Unknown	28 (1%)	29 (2%)	56 (2%)	10 (3%)	41 (2%)	22 (3%)	186 (2%)

Numbers in parentheses represent column percentages. Q1 and Q3 denote the 25th and 75th percentiles, respectively.

scores for mammography than MRI, CT, radiography, US, and NM/PET ($p < 0.001$). No other significant pairwise modality comparisons for composite score were observed. Surveys meeting dissatisfaction criteria were uncommon and represented approximately 6% of all surveys. Mammography showed lower dissatisfaction (3.9%) compared to CT (6.7%), MRI (7.3%), and radiography (8.2%) ($p < 0.0001$ after Bonferroni correction). Dissatisfaction proportions for US (6.4%) and NM/PET (5.4%) were slightly but not significantly higher than for mammography. There was no statistical significance between radiology and non-radiology visits for composite scores ($p = 0.54$) or for proportion of dissatisfaction ($p = 0.27$).

To facilitate future investigations into factors contributing to observed differences in dissatisfaction rates across modalities, the dissatisfaction rates for each of the 5 domains of the survey are presented in Table 2. Low-scoring responses were most common in the Facilities domain (7.8%) and least common in the Overall Assessment domain (3.8%). For mammography, all survey domains had significantly fewer low-scoring responses than the group average, and for MRI and radiography, all survey domains had higher dissatisfaction rates than the group average, with the greatest differences seen in the Facilities domain, with dissatisfaction rates of 9.8% and 9.4%, respectively. MRI and radiography also had above-average dissatisfaction rates in the Test/Treatment domain (6.4% and 7.1%, respectively). Registration issues also contribute to dissatisfaction in radiography, with 6.8% of respondents reporting dissatisfaction in this domain.

Demographic Determinants of Satisfaction in Radiology

Age had a significant effect on median composite scores, with satisfaction highest in the 70–79 age group and lowest in patients 20−40 years old (Figure 2a). Scores for individuals < 20 years or ≥ 90 years of age were below the group average but were not statistically significant (possibly related to the relatively small size of these groups). Proportions of dissatisfaction showed a similar age dependence, with peak dissatisfaction of 17% in the 20−29 year age group, in contrast to 4.3% for the 70−79 year group (Figure 2b).

Composite scores also vary by race/ethnicity (Figure 2c). Highest median scores were seen among Hispanics (4.95) and non-Hispanic whites (4.90), with blacks, Asians, and individuals with Other/Unknown race all demonstrating a significantly lower median of 4.81 ($p < 0.01$ for each pairwise comparison). The rates of dissatisfaction were highest for Asians (18%), followed by the Other/Unknown group (11%) and blacks (10%) (Figure 2d). This metric was lowest for Hispanics (3%) and whites (6%). Pairwise comparisons show that dissatisfaction rates are significantly higher among Asians and blacks compared to white respondents ($p < 0.0001$) and higher in the Other/Unknown race group compared to whites ($p = 0.03$). Although the Hispanic and Asian groups are relatively small in our study population, the difference in dissatisfaction rates between Asians and Hispanics was significant ($p = 0.002$). Median composite scores were higher for females ($p < 0.0001$). The binary dissatisfaction variable was slightly higher among males (6.7% vs. 6.0%), but this difference was not statistically significant ($p = 0.19$).

The data on individual domain dissatisfaction rates (Table 2) show that the various domains contribute differently to the observed dissatisfaction rates derived from the composite satisfaction scores. When assessing dissatisfaction in individuals under 20 years of age, the deviation from the group average was greatest in the Registration domain, whereas in the 20−29 year age group, interpersonal interactions had a greater impact. Racial/ethnic minority groups, except for the

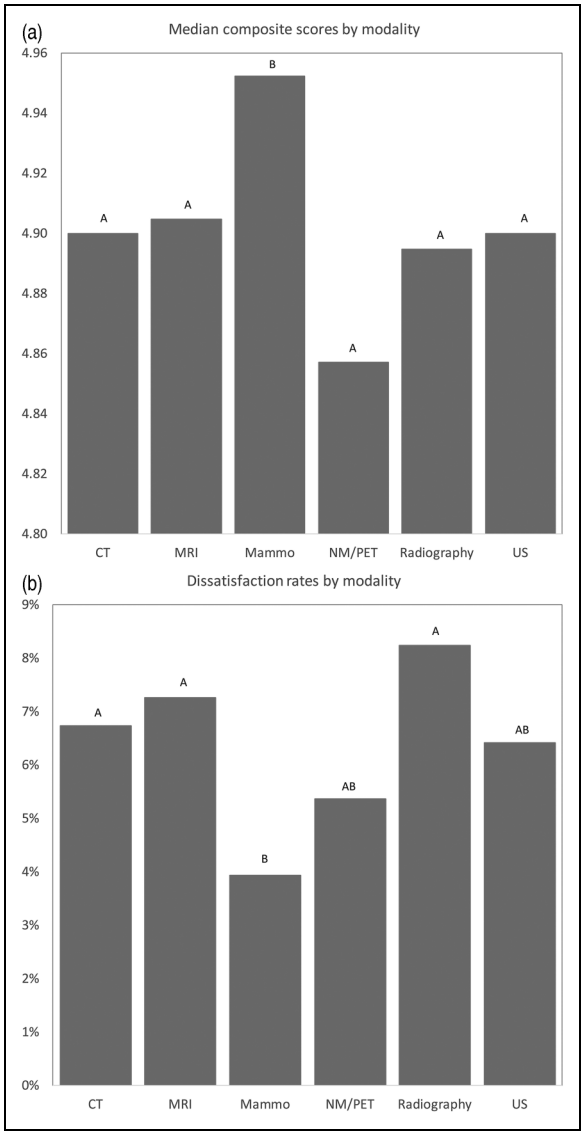

Figure 1. Satisfaction metrics as a function of imaging modality. Median composite scores (a) and dissatisfaction rates (b) are shown for each modality. The data points are annotated with a connected letters representation, such that pairs sharing a common letter are not statistically significant.

Hispanic group, showed greater dissatisfaction in multiple domains. The domains with the highest difference between whites and Asians was the Test/Treatment and Registration domains, with 16.7% and 14.4% of Asian respondents reporting dissatisfaction in these domains compared to 5.1% and 4.3% in whites, respectively. The highest differences in dissatisfaction rates between blacks and whites were found in the Registration domain, with 8.4% of blacks showing dissatisfaction in this domain, in contrast to 4.3% among whites. The greatest difference between male and female respondents was seen in the Facilities domain, with 10.8% of males dissatisfied compared to 6.6% of females.

There was a mild upward trend in composite scores for radiology visits across years, with yearly means ranging from 4.45 to 4.75. Dissatisfaction rates in radiology showed a more apparent downward trend across years, with 8.8% dissatisfied during the first half of the study period compared to 6.1% in the second half. Linear regression analysis of composite scores and logistic regression of dissatisfaction, incorporating all the examined variables as multivariable predictors (modality, age, race, gender, and study year) found significant independent effects of all variables ($p < 0.0005$) except gender in our radiology respondent population.

Discussion

In this multi-year study spanning almost a decade, significant differences in patient satisfaction were found across imaging modalities and among different patient demographic groups. Among modalities, patients were more satisfied with mammography and relatively less satisfied with MRI, CT, or radiography, with dissatisfaction rates for these modalities highest for items pertaining to the Facilities domain. Dissatisfaction was also higher for some racial minority groups and for patients in the young adult to early middle age groups.

There are several potential explanations for the observed differences in satisfaction across modalities, which may reflect inherent challenges related to modality-specific patient interactions or workflow issues. For instance, the duration of an outpatient visit or extent of interaction with staff could influence patient satisfaction (13,14). In addition, some differences in satisfaction among modalities may be due to varying expectations among patients or biases related to varying patient composition among some modalities (e.g., screening of asymptomatic patients in mammography vs. evaluation of acute or chronic disease or known abnormalities in MRI). Furthermore, patients' experiences could also be affected by the type of modality encountered. Many patients undergoing MRI, for instance, may have adverse experiences due to anxiety, claustrophobia, physical discomfort related to remaining still and supine for a relatively lengthy period of time, poor tolerance of scanner noise, or delays related to scheduling or safety screening for MRI, which are undesirable both for the patient experience and from a cost perspective (2,15,16). Even if high-quality care is delivered, these factors have the potential to influence patient's perception of quality.

Modality differences in satisfaction have been discussed in only a few of the existing patient satisfaction studies in radiology. One study using a custom radiology-specific survey reported a higher frequency of negative comments in MRI than mammography (5), but this modality difference was not observed in a study that analyzed written complaints in radiology (8). There is limited existing literature on effects of demographic variables on patient satisfaction in radiology. One small study of 359 surveys on satisfaction with radiologist assistants reported no gender or age effects on satisfaction scores (17). Most of the existing data on effects of age, sex, and race on patient satisfaction are found in the non-

Table 2. Differences in Dissatisfaction Rates for Radiology Across the Five Domains of the Survey. Results for Radiology Visits are Provided, Separated by Modality, age, Race/Ethnicity, and Gender.

	Registration	Test/Treatment	Facilities	Personal Issues	Overall Assessment
CT	4.5%	5.7%	8.6%	5.7%	3.9%
MRI	5.9%	6.4%	9.8%	5.8%	5.0%
Mammo	3.1%	4.1%	4.7%	3.4%	2.6%
NM/PET	4.7%	5.1%	8.8%	4.5%	3.2%
Radiography	6.8%	7.1%	9.4%	6.0%	4.5%
US	5.7%	5.8%	8.0%	5.5%	3.5%
<20 years	9.1%	7.1%	11.6%	0.0%	0.0%
20–29	8.1%	13.7%	13.2%	14.7%	10.7%
30–39	10.9%	11.5%	11.1%	8.0%	8.1%
40–49	6.3%	7.5%	8.3%	6.6%	5.1%
50–59	5.2%	5.3%	8.2%	4.9%	3.7%
60–69	3.8%	5.1%	6.8%	4.7%	3.2%
70–79	3.8%	4.1%	7.0%	3.7%	2.4%
80–89	3.6%	2.4%	6.5%	2.3%	2.4%
90 + years	5.0%	5.0%	5.1%	5.1%	0.0%
Asian	14.4%	16.7%	15.0%	12.8%	9.9%
Black, non-Hispanic	8.4%	8.4%	7.6%	7.1%	4.5%
Hispanic	4.9%	3.3%	2.5%	4.2%	1.6%
Other/Unknown	9.1%	10.8%	8.6%	9.8%	5.5%
White, non-Hispanic	4.3%	5.1%	7.7%	4.6%	3.6%
Male	5.1%	5.6%	10.8%	5.5%	3.5%
Female	4.8%	5.7%	6.6%	4.9%	3.9%
All	4.9%	5.6%	7.8%	5.0%	3.8%

radiology clinical literature, some of which corroborate the observations in the current study. Regarding the dependence of age on patient satisfaction in healthcare, one study on medical and surgical inpatients found older age to be one of the two strongest predictors of satisfaction (18). Younger patients also reported less satisfaction in different studies on orthopedic outpatients (19,20), surgery outpatients in general (21), and hospital emergency department patients (22). Our study found a similar relationship with age and satisfaction, except for minor deviations from this trend at the low and high extremes of age, similar to a Swedish inpatient study that found highest satisfaction scores in those aged 75 −84 and lowest in those aged 15−24 (23). Gender effects in the existing patient satisfaction literature are minimal, with one meta-analysis 2 decades ago finding no effects of gender on satisfaction with medical care (24) and another study reporting no significant gender correlation with inpatient satisfaction (23). One study on satisfaction with hospital care that reported significant effects of race and age found no significant gender effects (25).

Our finding of worse satisfaction scores among blacks and Asians is analogous to several other reports in the non-radiology clinical literature. Lower satisfaction among non-white patients was reported in a study using Veteran Health Administration data (25). A study on hospital emergency departments found that black race predicted less patient satisfaction (22). A large national survey with > 120,000 respondents found consistently lower patient satisfaction among Asian/Pacific Islanders and patients listed as other/multiracial but not among blacks (26). Similarly low satisfaction scores were reported by Asian patients but not blacks in a study examining > 160,000 responses to the Consumer Assessment of Health Plans Surveys (CAHPS)(27). However, these racial disparities in satisfaction were not found in some studies (24,28). The relationships between satisfaction and race/ethnicity in radiology found in our study may be due to a variety of reasons and warrant further evaluation.

Although our results reflect data at a single institution, they were obtained from multiple outpatient sites and across multiple years to capture patterns that tend to persist, such as intrinsic differences in patient expectations or inherent difficulties that are not readily addressed from a short-term quality improvement perspective. As such, there is potential for generalizability, particularly since some of our observations are corroborated by published satisfaction studies in other radiology or non-radiology populations. Of note, satisfaction metrics showed mild overall improvement over time, likely due to ongoing quality improvement efforts, but observed modality, racial, and age effects persist in a multivariable regression analysis, confirming that these variables independently contribute to differences in patient satisfaction. Follow-up investigations using structural equation modeling approaches may be helpful to further analyze relationships among contributing variables. The observed disparities in satisfaction across such factors as age and race/ethnicity represent opportunities for more focused investigations regarding potential variations in quality of care or more targeted quality improvement efforts to reduce barriers to health care

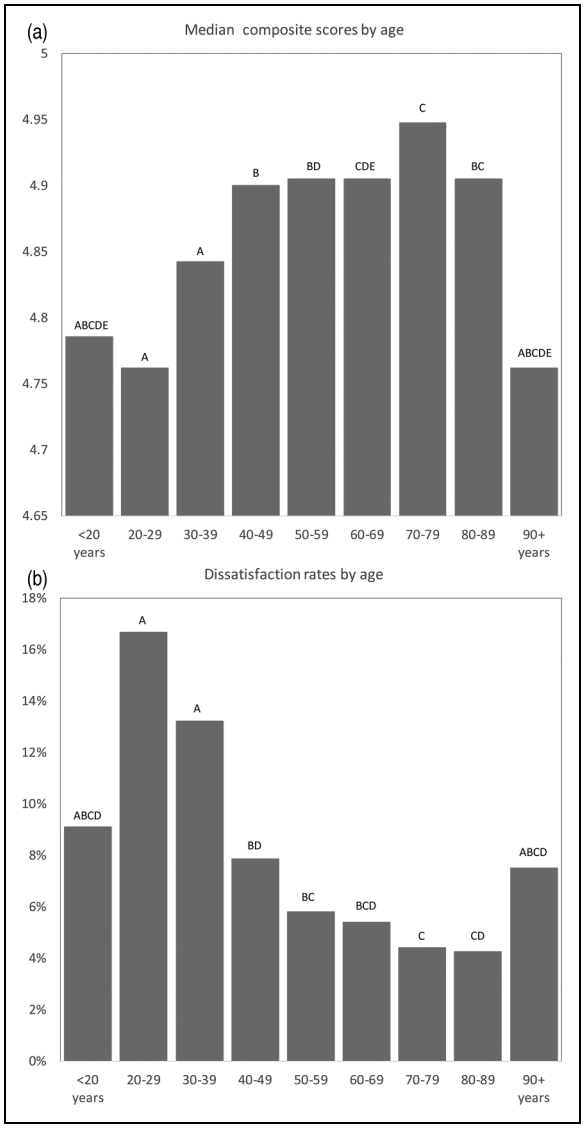

Figure 2. Satisfaction metrics as a function of patient demographics. Median composite scores (a) and dissatisfaction rates (b) are shown for each age group. Median composite scores (c) and dissatisfaction rates (d) are shown for each racial group. The data points are annotated with a connected letters representation, such that pairs sharing a common letter are not statistically significant.

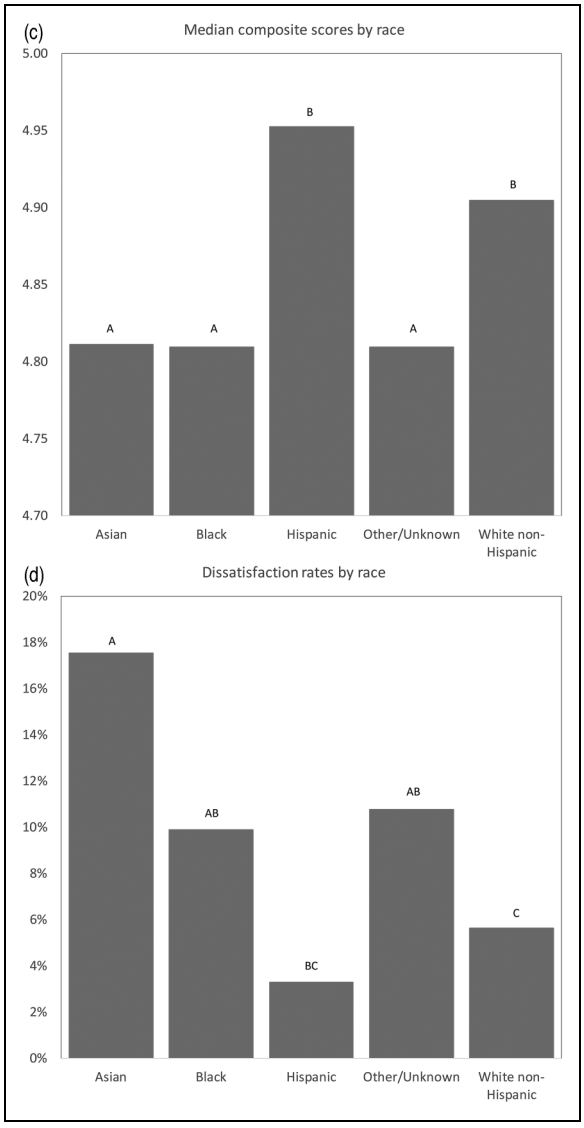

Figure 2. (Continued).

access, such as tailored patient-friendly educational resources (29), staff training in interpersonal skills and face-to-face interaction (30), or exit interviews and follow-up telephone contact to address patients' questions, offer additional explanations of the procedure, or find out what could have enhanced the imaging experience. Differences in satisfaction across modalities can similarly be examined and mitigated where possible, but it is plausible that some effects of modality on satisfaction may be difficult to correct (e.g., an MRI will inevitably be longer, louder, and more uncomfortable than shorter diagnostic tests). If modality effects such as low satisfaction for MRI are observed across institutions, issues may be raised regarding whether institutions with a higher mix of MRI could be unfairly penalized when global satisfaction benchmarks are used as quality metrics without adjusting for modality mix and/or population differences (25).

This study has several limitations. Given use of single-institution data, some observations may be attributable to institution-specific factors that may not apply to other institutions or settings. Second, we limited the independent variables in our analysis to modality, time, and a small number of readily available demographic variables to focus on these variables of interest rather than attempt a comprehensive predictive model using more granular data such as insurance/employment status, educational attainment, socioeconomic status, general health status, and other variables that conceivably could affect satisfaction. Concordance of demographic characteristics between patients and staff, which could potentially affect patient satisfaction (31), was

not examined in this study. Another limitation is response bias, which has been previously reported for Press Ganey surveys (32), but because reimbursements or published quality metrics ultimately depend on the subset of patients who actually respond, the group of respondents is nonetheless a relevant population to study for practical purposes, even if it represents a biased sampling of all imaged patients. Of note, racial minorities are underrepresented in our survey respondents compared to the general population. However, the demographic profile of our study population is similar to our institution's imaging patient population, suggesting that the racial composition may reflect differences in health care access or utilization rather than response bias.

In summary, we examined outpatient satisfaction survey responses across a relatively long time period to identify determinants of satisfaction in radiology that tend to persist over time. Patients' satisfaction or perception of quality in radiology vary across demographic factors and imaging modalities; identifying factors responsible for these differences may assist targeted efforts toward improving patient experiences.

Declaration of Conflicting Interests

The authors declare no conflict of interest.

Ethical Approval

This study was approved by the Biomedical Sciences Institutional Review Board of the Ohio State University, Columbus, OH.

Statement of Human and Animal Rights

All procedures involving human subjects were conducted in accordance with all applicable guidelines and approved by the Biomedical Sciences Institutional Review Board of the Ohio State University, Columbus, OH.

Statement of Informed Consent

Full waivers of informed consent and HIPAA authorization were granted upon IRB approval for this retrospective study by the Biomedical Sciences Institutional Review Board of the Ohio State University, Columbus, OH.

Declaration of Conflicting Interests

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