



Contents lists available at ScienceDirect

Technical Innovations & Patient Support in Radiation Oncology

journal homepage: www.sciencedirect.com/journal/technical-innovations-and-patient-support-in-radiation-oncology



Research Article

Socioeconomic disadvantage and its impact on patient satisfaction at a multi-site radiation oncology center

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ARTICLE INFO

Keywords:

Socioeconomic status
Patient satisfaction
Radiation Oncology
Area Deprivation Index
Healthcare disparities
Provider recommendations

ABSTRACT

Purpose: Despite the importance of patient satisfaction (PS) on healthcare outcomes, the factors that influence PS in radiation oncology remain unexplored. This study assesses the influence of socioeconomic status (SES) on PS in radiation oncology, using the Area Deprivation Index (ADI) as a measure of SES.

Methods: This single-institution cross-sectional study used the National Research Council (NRC) PS survey at four radiation oncology sites from 2021 to 2023. SES was measured using ADI data from the Neighborhood Atlas. Univariate (UVA) and multivariable (MVA) logistic regression analyses were conducted on recommendation scores (0–10 scale, with 9 or higher indicating a likelihood to recommend).

Results: In our analysis of 7,501 survey responses, most patients were female (55.3%), had curative treatment intent (81.5%), and were diagnosed with breast cancer (30.4%), with most being follow-up visits (69.0%). Average scores for state and national ADI were 3.94 and 50.75, respectively. UVA identified factors such as curative intent (OR 1.68, $p < 0.001$), follow-up visits (OR 1.69, $p < 0.001$), and breast cancer diagnosis (OR 1.42, $p = 0.018$) as enhancing the likelihood of recommending the facility or provider. Those with a national ADI above the mean showed lower propensity to recommend the facility (OR 0.81, $p = 0.050$) or provider (OR 0.71, $p = 0.002$). MVA confirmed the significance of national ADI on provider recommendations (OR 0.730, $p = 0.005$) but not facility recommendations (OR 0.832, $p = 0.089$).

Conclusion: Patients facing higher SES disadvantages are less inclined to recommend their healthcare provider. These results highlight the role of SES in PS assessments and advocate for further investigation into how SES impacts PS and patient-provider relationships.

Introduction

Patient satisfaction

Patient satisfaction (PS) is a paramount metric in the evaluation of healthcare quality, influencing both the utilization of medical resources and patient adherence to treatment plans[1–4]. Its importance transcends mere metrics, directly correlating with improved health outcomes, including lower readmission rates and enhanced patient safety [5,6]. PS has been directly associated with clinical effectiveness and quality of care, impacting organizational performance, augmenting reimbursement rates, mitigating claims, and strengthening provider reputation[5,7–10].

The measurement of PS varies widely, from qualitative interviews to standardized surveys like the National Research Corporation (NRC) PS

Survey, which is aligned with the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) and developed in collaboration with the American Nurses Credentialing Center (ANCC) Magnet Recognition Program[11,12]. Typically, HCAHPS surveys include questions about hospital stays and interactions that may not apply to radiation oncology. Therefore, we adapted the NRC PS survey by removing questions that did not pertain to radiation oncology patients, such as those specific to inpatient hospital care. Our adaptation of the NRC PS survey included 14 questions focused on seven key categories including Patient Education, Safety, and Patient-Centered Care, capturing the diverse experiences specific to radiation oncology. The adapted survey was reviewed and modified based on expert input from radiation oncologists to ensure relevance and clarity for our patient population.

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<https://doi.org/10.1016/j.tipsro.2024.100276>

Received 3 June 2024; Received in revised form 8 August 2024; Accepted 3 September 2024

Available online 6 September 2024

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Socioeconomic status

Socioeconomic status (SES) has a recognized impact on PS, affecting patient perceptions and care experiences. Studies indicate a positive correlation between higher SES and improved PS, particularly in contexts like breast cancer and psychological well-being post-treatment [13–15]. Moreover, several studies have highlighted an association with SES deprivation and worse overall survival [16–18]. This body of research underlines the importance of examining SES indicators like Area Deprivation Index (ADI) in the context of PS in radiation oncology.

The ADI, initially introduced by Singh in 2003 as an innovative tool for assessing neighborhood socioeconomic status, has since evolved into a more refined and nuanced measure thanks to the efforts of Kind et al. in 2018 [19,20]. This index amalgamates a wide array of socioeconomic indicators, including income, employment, education, and housing quality, to generate a comprehensive snapshot of the socioeconomic environment surrounding patients [19,20]. The primary aim of this study is to assess how SES, as measured by the ADI, influences patient satisfaction with radiation oncology services. We hypothesize that lower SES will correlate with lower patient satisfaction scores. This hypothesis is based on the premise that SES may exert a significant influence on how patients perceive and evaluate their care [13,21,22]. By understanding these dynamics, we aim to identify specific SES-related disparities in patient satisfaction and devise targeted strategies to enhance patient-centered care and satisfaction in radiation oncology. This investigation is pivotal for devising strategies to address SES-related disparities, ultimately enhancing patient-centered care and satisfaction in radiation oncology.

Methods

Study design and participants

This single-institution cross-sectional study was conducted at four outpatient academic radiation oncology centers, from May 2021 to November 2023. The centers are located in Royal Oak, Dearborn, Troy, and Lenox, Michigan, and serve a diverse patient population across a broad socioeconomic spectrum. We prospectively collected data via NRC PS survey questionnaires, which were sent to all patients receiving care at these locations every 90 days. Each encounter was identified by a unique hospital account number. Patient survey responses were not anonymous, as patient information associated with their responses was required for this study. When analyzing the data, each response was assigned a unique identifier to maintain confidentiality. All data was stored securely in password-protected databases with access restricted to authorized research personnel only. The study was approved by the Institutional Review Board (IRB).

The data entry process was managed through the NRC website, which was designed to minimize human error and ensure data accuracy. For web-based surveys, the NRC implemented robust measures to prevent multiple participation by the same participants. These measures included unique survey links and tracking mechanisms that ensured each participant could only submit one survey per encounter. This approach maintained the integrity of the data and prevented duplication.

PS was measured using the NRC PS survey detailed in Supplemental Table 2, encompassing 14 questions on interactions with healthcare staff, communication, patient involvement in decisions, and the propensity to recommend services. The surveys were distributed via email, Interactive Voice Response (IVR), or text message (SMS). Participation was strongly encouraged but not mandatory. Responses for most questions used a 1–4 Likert scale, with 1 representing 'No' and 4 'Yes, definitely'. Question 9 on seeing a nurse allowed binary responses. Recommendations for facilities or providers were scored on a 0–10 scale; scores of 9–10 were categorized as favorable, suggesting a high likelihood of recommendation, while 0–8 were less favorable. This scoring

system supported logistic regression analyses to identify drivers of patient satisfaction.

Socioeconomic status measurement

The SES of participants was gauged through the ADI, sourced from the Neighborhood Atlas [19,20]. This index was aligned with each patient's 9-digit zip code, facilitating a precise assessment of SES based on their residential location. The ADI scores, reflective of both national percentiles and state deciles, were used to classify patients into different levels of SES disadvantage, with higher scores indicating greater disadvantage.

Statistical analysis

We employed the Mann Whitney *U* test to evaluate the propensity for favorable facility and provider scores based on both national and state ADI levels, segmented above and below the mean. For a more detailed analysis, the state ADI was binned into quartiles, whereas the national ADI was compressed into deciles before being similarly binned into quartiles. Additionally, the Mann Whitney *U* test was also used to facilitate the comparison of favorable scores between the first and fourth quartile of ADI, allowing us to assess how extreme ends of the socioeconomic spectrum impact PS survey scores within our study population.

Univariate (UVA) logistic regression analyses identified independent predictors of favorable facility and provider scores. Analyzed variables included gender, age at encounter, encounter type, ADI, hospital site, treatment intent, cancer type, and individual PS survey questions, treated as binary variables. Dummy variables were created for categorical predictors, and questionnaire items were recoded as binary variables in two ways: "Yes, definitely/mostly" vs. "Else," and "Yes, definitely" vs. "Else".

Each survey response was treated as an independent entry, regardless of whether it was from the same patient at different encounters. To address non-response error, we documented non-response patterns and compared demographic and clinical characteristics between respondents and non-respondents to identify any significant differences. This helped us understand the potential impact of non-response on our findings. These initial findings suggest some differences, which will be detailed in a forthcoming analysis. Missing data were treated as missing at random (MAR). For the subsequent analyses, survey responses with missing data on the recommend provider or recommend facility questions were excluded from the analysis.

Subsequently, multivariable (MVA) logistic regression analyses were conducted using a backward stepwise regression model to determine the effect of SES (as measured by ADI), treatment intent, survey purpose, and cancer type on PS. Statistical analyses were conducted using IBM SPSS version 29.0.

Results

Overall, there were 14,243 encounters and 7,501 survey responses, constituting a 52.7 % response rate to the PS survey. The demographic composition of the survey respondents, as outlined in Table 1, primarily included females (55.3 %), patients with curative intent (81.5 %), and individuals diagnosed with breast cancer (30.4 %), with a predominant number of responses originating from follow-up visits (69.0 %). The mean state and national ADI scores were 3.94 (95 % CI: 3.89 to 3.98, $p < 0.001$) and 50.75 (95 % CI: 50.18 to 51.33, $p < 0.001$), respectively. The raw NRC questionnaire survey responses are outlined in Table 2.

Raw comparison of ADI

As indicated in Table 3, patients from regions with lower national socioeconomic disadvantage (national ADI below 50.75) reported

Table 1
Characteristics of Survey Respondents.

Characteristic	All Respondents (N=7501)
Age at Encounter (years)	69 (2–100)
National ADI	50.75, (1–100)
< 50.75 (mean)	3808 (50.9 %)
≥ 50.75 (mean)	3666 (49.1 %)
State ADI	3.94 (1–10)
< 3.94 (mean)	4030 (53.9 %)
≥ 3.94 (mean)	3444 (46.1 %)
Gender	
Female	4145 (55.3 %)
Male	3354 (44.7 %)
Non-Binary	2 (0 %)
Diagnosis Type	
Benign	275 (3.7 %)
Breast	2242 (30.4 %)
CNS	106 (1.4 %)
GI	358 (4.9 %)
GU	1782 (24.2 %)
GYN	514 (7 %)
HN	600 (8.1 %)
Lung	753 (10.2 %)
Lymphoma	90 (1.2 %)
Skin	142 (1.9 %)
Sarcoma	60 (0.8 %)
Miscellaneous	451 (6.1 %)
Treatment Intent	
Curative	6012 (81.5 %)
Treatable	107 (1.5 %)
Palliative	329 (4.5 %)
Evaluation in Progress	529 (7.2 %)
Other	113 (1.5 %)
Not Applicable	283 (3.8 %)
Survey Visit Purpose	
Consult	2258 (30.6 %)
Follow Up	5090 (69.0 %)
Procedure	17 (0.2 %)
OTV/Treatment	7 (0.1 %)
Missing	1 (0 %)

Data presented as mean (range) or n (%).

Abbreviations: ADI=area deprivation index; CNS=central nervous system; GI=gastrointestinal; GU=genitourinary; GYN=gynecologic; HN=head and neck.

significantly higher favorable scores for both facilities (95.1 %) and providers (95.9 %) compared to those from areas with higher ADI scores (facility: 94.1 %, provider: 94.3 %), with p-values of 0.049 and 0.002, respectively. When combining facility and provider satisfaction scores, lower ADI areas showed higher approval (96.9 % vs. 95.8 %; p = 0.018).

For state ADI, patients from areas below the mean of 3.94 were more likely to report favorable provider scores (95.7 % vs. 94.3 %; p = 0.007). However, facility satisfaction was similar regardless of state ADI (94.9 % vs. 94.2 %; p = 0.190).

For combined facility and provider scores, patients with a state ADI of below mean showed higher favorable scores (96.8 % vs. 95.8 %; p = 0.021). Quartile binning of ADI did not reveal significant disparities in facility recommendation scores. However, a trend toward significance was observed in provider recommendation scores, with the first quartile for both state and national ADI being marginally higher than the fourth quartile. Specifically, state ADI provider recommendation scores were 9.85 compared to 9.80 (p = 0.082), and national ADI showed a similar trend (p = 0.091). Conversely, facility recommendation scores showed no significant variation between the first and fourth quartiles for either state or national ADI, indicating that ADI has a more pronounced impact on perceptions of provider quality than on facilities.

Logistic regression analysis

In our UVA, depicted as forest plots in Figs. 1 and 2, we examined factors affecting the likelihood of reporting favorable scores for facilities

Table 2
National Research Council patient satisfaction survey responses.

Survey Responses	All Respondents (N=7501)
Clerk/Receptionist: Courtesy & Respect	
No response/Not applicable	901 (12 %)
No	108 (1.4 %)
Yes, somewhat	231 (3.1 %)
Yes, mostly	365 (4.9 %)
Yes, definitely	5896 (78.6 %)
Nurse: Adequate Explanation	
No response/Not applicable	1799 (24 %)
No	38 (0.5 %)
Yes, somewhat	104 (1.4 %)
Yes, mostly	266 (3.5 %)
Yes, definitely	5294 (70.6 %)
Nurse: Listened	
No response/Not applicable	1782 (23.7 %)
No	35 (0.5 %)
Yes, somewhat	109 (1.5 %)
Yes, mostly	207 (2.8 %)
Yes, definitely	5368 (71.6 %)
Nurse: Courtesy & Respect	
No response/Not applicable	1763 (23.5 %)
No	50 (0.7 %)
Yes, somewhat	115 (1.5 %)
Yes, mostly	176 (2.3 %)
Yes, definitely	5397 (72 %)
Team Member: Listened	
No response	59 (0.8 %)
No	118 (1.6 %)
Yes, somewhat	263 (3.5 %)
Yes, mostly	362 (4.8 %)
Yes, definitely	6699 (89.3 %)
Doctor: Adequate Explanation	
No response	121 (1.6 %)
No	65 (0.9 %)
Yes, somewhat	220 (2.9 %)
Yes, mostly	519 (6.9 %)
Yes, definitely	6576 (87.7 %)
Nurse: Confidence & Trust	
No response/Not applicable	1917 (25.5 %)
No	24 (0.3 %)
Yes, somewhat	98 (1.3 %)
Yes, mostly	262 (3.5 %)
Yes, definitely	5200 (69.3 %)
Doctor: Enough Input in Care	
No response	1823 (24.3 %)
No	46 (0.6 %)
Yes, somewhat	123 (1.6 %)
Yes, mostly	339 (4.5 %)
Yes, definitely	5170 (68.9 %)
Nurse Present	
No Response	154 (2.1 %)
No	1597 (21.3 %)
Yes	5750 (76.7 %)
Family or Friend Involved	
No response/Not applicable	3255 (44.2 %)
No	255 (3.5 %)
Yes, somewhat	218 (3 %)
Yes, mostly	254 (3.5 %)
Yes, definitely	3371 (44.9 %)
Nurse/Doctor: Interprofessional Communication	
No response/Not applicable	1897 (25.3 %)
No	75 (1 %)
Yes, somewhat	130 (1.7 %)
Yes, mostly	360 (4.8 %)
Yes, definitely	5039 (67.2 %)
Nurse: Comfortable Talking	
No response/Not applicable	1854 (24.7 %)
No	60 (0.8 %)
Yes, somewhat	114 (1.5 %)
Yes, mostly	322 (4.3 %)
Yes, definitely	5151 (68.7 %)
Overall: Recommend Facility	
0–8	374 (5.0 %)
9–10	6550 (87.3 %)
No Response	577 (7.7 %)

(continued on next page)

Table 2 (continued)

Survey Responses	All Respondents (N=7501)
Overall: Recommend Provider	
0-8	343 (4.9 %)
9-10	6643 (88.6 %)
No Response	515 (6.9 %)
Data presented as n (%)	

or providers, respectively.

In assessing favorable facility scores, patients from higher national ADI regions demonstrated a decreased likelihood of positive evaluations (OR=0.810, p = 0.050). Similarly, for provider scores, those from higher

national ADI areas showed significantly less favorable ratings (OR=0.711, p = 0.002). Patients with a state ADI above mean were also less likely to provide positive provider scores (OR=0.740, p = 0.007), however, patients with a state ADI above mean did not have a statistically significant difference in positive facility ratings (OR=0.190, p = 0.870).

Treatment intent significantly influenced patient satisfaction, with those receiving curative intent more likely to rate both facilities (OR=1.561, p < 0.001) and providers (OR=1.558, p < 0.001) favorably. Breast cancer diagnosis further impacted assessments, enhancing likelihood of positive facility (OR=1.515, p = 0.001) and provider scores (OR=1.455, p = 0.004). Follow-up visits also correlated with higher

Table 3

Comparison of Recommendation Scores by Area Deprivation Index.

Recommendation Score	National			State		
	ADI Below Mean	ADI Above Mean	p	ADI Below Mean	ADI Above Mean	p
Unfavorable Facility Score	172 (4.9 %)	199 (5.9 %)	0.049	189 (5.1 %)	182 (5.8 %)	0.190
Favorable Facility Score	3369 (95.1 %)	3179 (94.1 %)		3553 (94.9 %)	2975 (94.2 %)	
Unfavorable Provider Score	147 (4.1 %)	194 (5.7 %)	0.002	160 (4.3 %)	181 (5.7 %)	0.007
Favorable Provider Score	3416 (95.9 %)	3204 (94.3 %)		3604 (95.7 %)	3016 (94.3 %)	
Unfavorable Facility or Provider Score	112 (3.1 %)	143 (4.2 %)	0.018	120 (3.2 %)	135 (4.2 %)	0.021
Favorable Facility or Provider Score	3448 (96.9 %)	3248 (95.8 %)		3640 (96.8 %)	3055 (95.8 %)	

Data presented as n (%).

Abbreviations.

ADI=area deprivation index.

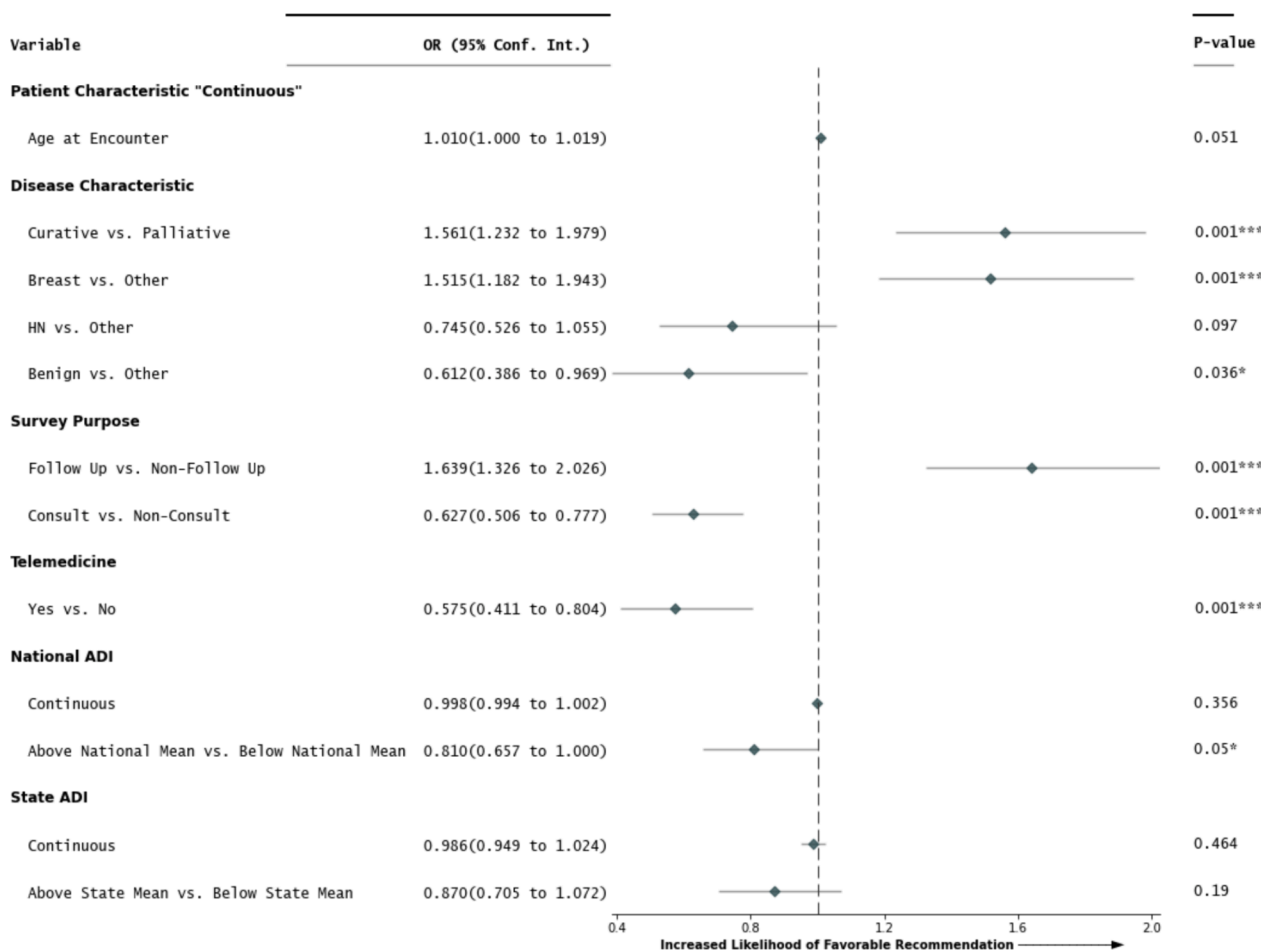


Fig. 1. Univariate Analysis of Factors Affecting Favorable Facility Patient Recommendations. Fig. 1 presents a forest plot summarizing the univariate analysis (UVA) of various factors that influence patients' likelihood of providing favorable facility recommendations. It details odds ratios (OR) and their corresponding 95% confidence intervals (95% Conf. Int.) for each factor, with associated p-values displayed on the right side of the figure.

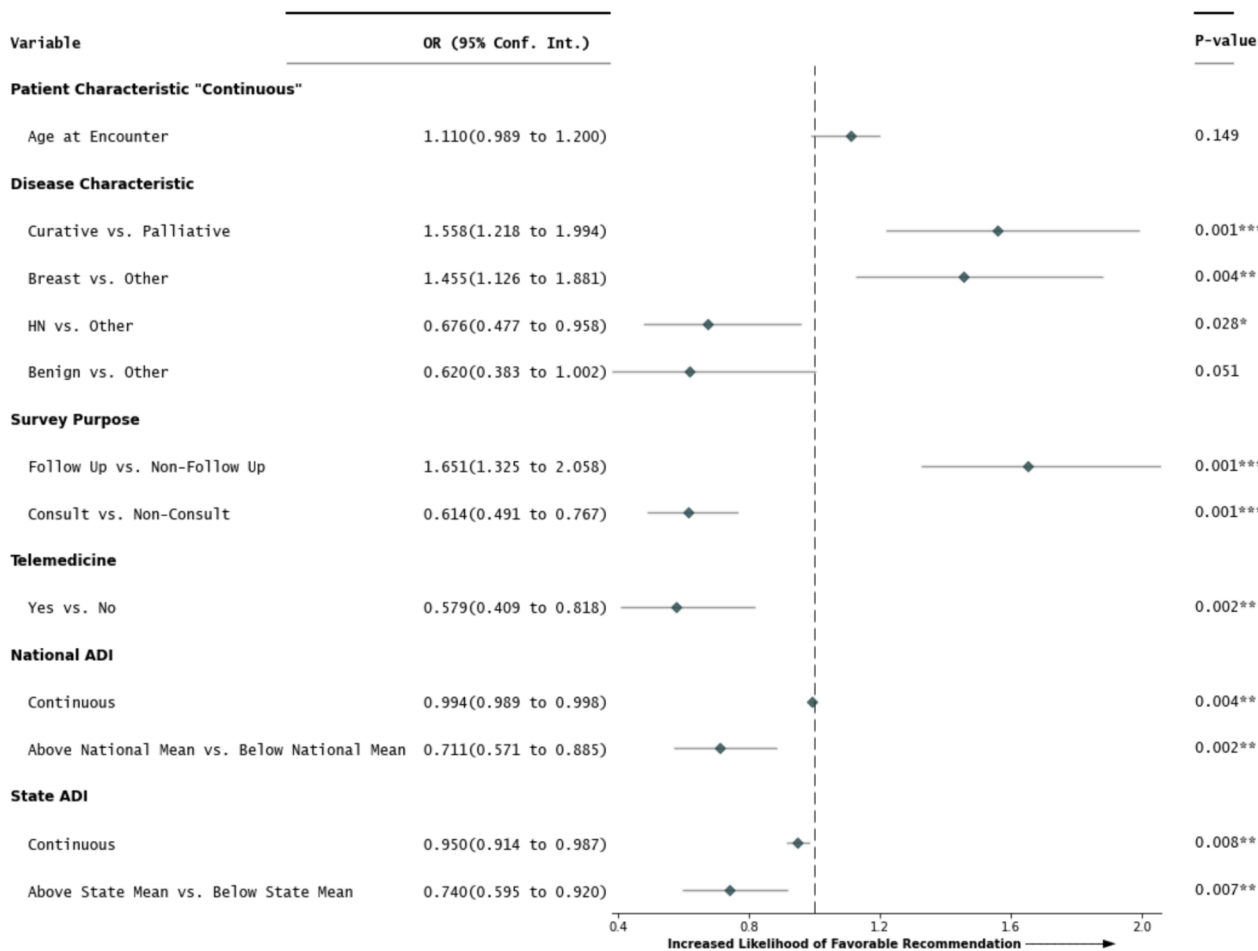


Fig. 2. Univariate Analysis of Factors Affecting Favorable Provider Patient Recommendations. Fig. 2 presents a forest plot summarizing the univariate analysis (UVA) of various factors that influence patients' likelihood of providing favorable provider recommendations. It details odds ratios (OR) and their corresponding 95% confidence intervals (95% Conf. Int.) for each factor, with associated p-values displayed on the right side of the figure.

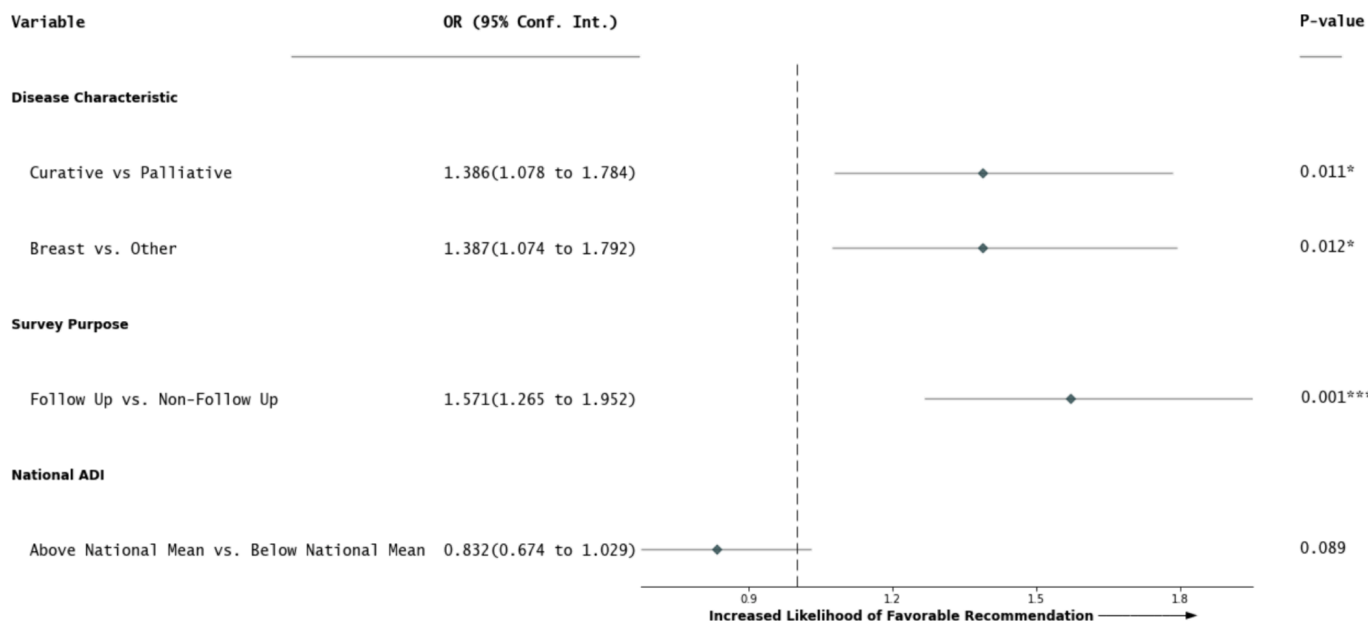


Fig. 3. Multivariable Analysis of Factors Affecting Favorable Provider Patient Recommendations. Fig. 3 presents a forest plot summarizing the multivariable analysis (MVA) of various factors that influence patients' likelihood of providing favorable provider recommendations. It details odds ratios (OR) and their corresponding 95% confidence intervals (95% Conf. Int.) for each factor, with associated p-values displayed on the right side of the figure.

favorable ratings for both facility (OR=1.639, $p < 0.001$) and provider (OR=1.651, $p < 0.001$).

In refining our MVA, we identified potential confounders using Mann Whitney U tests to see if ADI varied with treatment intent and cancer diagnoses. There were small but significant differences in mean national and state ADI scores between curative and non-curative groups (national: 50.32 vs. 52.50, $p = 0.003$; state: 3.90 vs. 4.11, $p = 0.010$), suggesting more non-curative patients had higher SES disadvantages. This was adjusted for in the MVA. No significant ADI differences were found across cancer diagnoses, ensuring the integrity of our final model.

To address multicollinearity between national and state ADI scores, we used two separate backward stepwise MVA models, each incorporating either national or state ADI, alongside treatment intent, visit type, and cancer diagnosis. The Akaike Information Criterion (AIC) was similar for both models, indicating comparable explanatory power. Given this, we included only the national ADI model for clarity. This model showed a significant increase in provider recommendations, Fig. 3, for patients with ADI scores below the mean (OR=1.360, $p = 0.005$), but a non-significant trend for facility recommendations, Fig. 4, (OR=1.202, $p = 0.089$).

Curative treatment intent significantly increased the likelihood of recommending both the provider (OR=1.428, $p = 0.007$) and facility (OR=1.386, $p = 0.011$) compared to palliative intent. Follow-up visits were also strongly associated with higher recommendations (facility: OR=1.571, $p < 0.001$; provider: OR=1.602, $p < 0.001$). Additionally, having a breast cancer diagnosis positively influenced recommendations for both the facility (OR=1.387, $p = 0.012$) and provider (OR=1.332, $p = 0.034$).

Discussion

Our study establishes a direct link between PS within radiation oncology and SES, highlighting the crucial role SES plays in shaping patients' healthcare experiences and perceptions of care quality. Given the connection between PS and improved healthcare outcomes, including better adherence to treatment plans and enhanced patient safety, our findings suggest that SES, as indicated by ADI, should be considered at the initial consultation[1-4]. This can guide research to identify interventions aimed at improving PS among socioeconomically

disadvantaged patients. The study's use of a large, diverse patient population across multiple outpatient centers enhances the external validity of our results, suggesting that the findings may be generalizable to similar healthcare settings and broader populations.

We observed that individuals from less socioeconomically disadvantaged backgrounds, indicated by lower ADI scores, reported higher levels of satisfaction with healthcare providers and, to a lesser extent, with the facility. These results align with broader literature linking higher SES to improved PS, especially concerning specific healthcare interventions[13,23-25]. The lower satisfaction among disadvantaged patients may be due to their perception that SES negatively influences their healthcare interactions, affecting delivery and decision-making. Aprey et al. (2017) found that lower SES patients believe their status adversely impacts their care, particularly regarding treatment options, accessibility, and interactions with healthcare providers[21].

Clinician biases may also contribute to reduced satisfaction among lower SES patients. Ryn et al. (2000) showed that physicians often view lower to middle SES patients more negatively than those of higher SES, affecting care quality and satisfaction[14]. This bias extends to medical students in their early training years[15]. These biases, combined with patients' perceptions of how their SES influences their treatment, significantly shape healthcare experiences and satisfaction.

Clinician bias is further elucidated by Ennis et al. (2021), who argue that physicians' inherent heuristics subtly guide medical decision-making, potentially compromising the efficacy of consultations and informed consent processes[26]. Several studies suggest that interventions aimed at increasing provider compassion and empathy can alleviate patient anxiety and improve decision-making outcomes [22,27-29]. Thus, exploring strategies to mitigate the impact of provider biases on patient satisfaction, particularly among low SES populations, warrants further research.

Lower SES is linked to poorer health outcomes and overall survival, potentially leading to perceptions that SES adversely affects healthcare treatment and interactions[16-18,30]. Despite efforts to provide equitable treatment, such as free transportation, social work referrals, and peer review to ensure standard of care treatment, studies show that lower SES patients still exhibit higher levels of distrust towards physicians[31]. Future research could employ validated healthcare system distrust scales to explore the relationships between ADI, PS, and

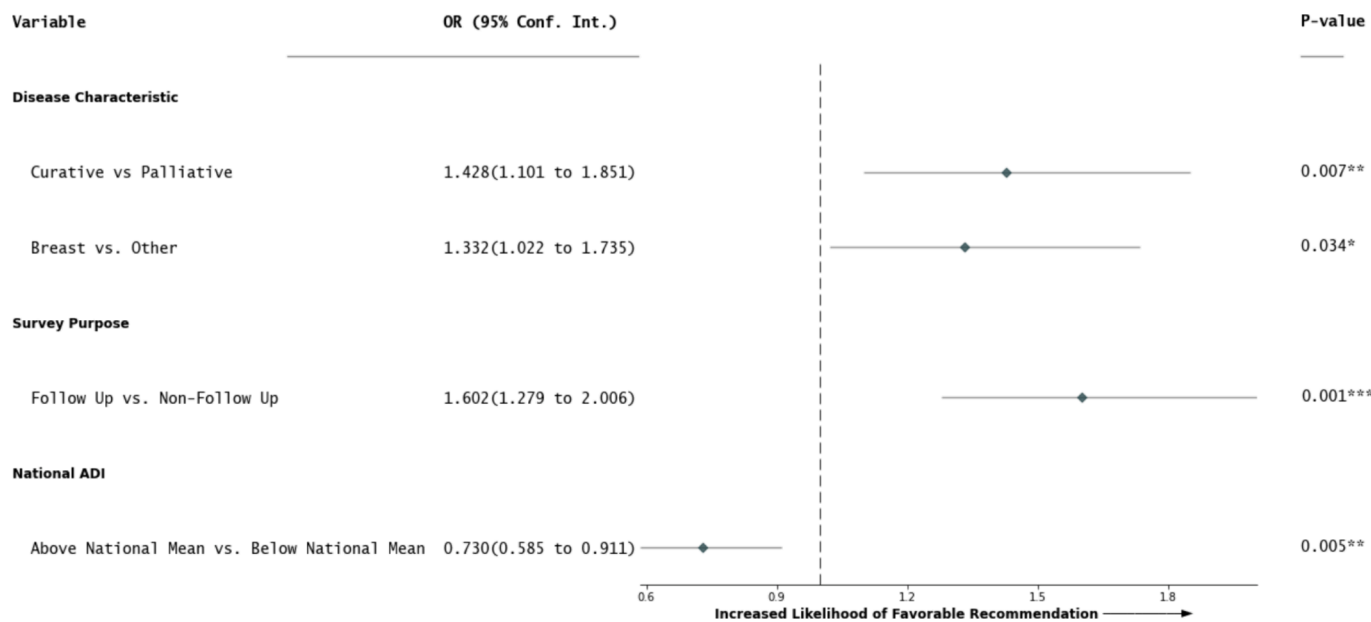


Fig. 4. Multivariable Analysis of Factors Affecting Favorable Facility Patient Recommendations. Fig. 4 presents a forest plot summarizing the multivariable analysis (MVA) of various factors that influence patients' likelihood of providing favorable facility recommendations. It details odds ratios (OR) and their corresponding 95% confidence intervals (95% Conf. Int.) for each factor, with associated p-values displayed on the right side of the figure.

physician trust[32,33]. These scales distinguish between distrust based on physician competence or physician values, with findings indicating more significant racial and SES disparities in values distrust[34]. This aligns with studies suggesting that medical mistrust among racial/ethnic minorities may stem from past discrimination experiences[35].

Future studies should target health promotion efforts specifically at lower SES patients to promote equity. Health initiatives not aimed at supporting lower SES patients may inadvertently increase disparities, echoing Adler et al. (2002)'s stance on targeted health promotion efforts [36].

Our findings differ from a UK study on early-stage non-small cell lung cancer patients receiving stereotactic body radiotherapy (SBRT) or video-assisted thoracoscopic surgery (VATS), where those from more deprived areas or with complications reported higher satisfaction, emphasizing medical decision-making and age as key factors[37]. In contrast, age did not significantly affect combined favorable scores for providers and facilities in our study. This discrepancy may be due to cultural contexts, healthcare system support, specific patient subsets, survey collection methods, or attention given to lower SES patients in the UK study[38]. Further research is needed to understand why low SES patients sometimes report higher satisfaction and to develop broader interventions to enhance satisfaction across diverse populations.

Our decision to conduct analyses using both state and national ADI scores was driven by the goal of enhancing the generalizability of our findings while uncovering specific nuances within our population. The national ADI mean was around 50.75, suggesting a broader SES perspective, while the state ADI mean was lower at 3.94, indicating relatively higher SES patients locally. This distinction was important in our analysis, as patients with a national ADI below mean were more likely to provide positive recommendations for both the provider and the facility, as shown by direct comparisons and the UVA.

Conversely, for the state ADI, patients with scores at mean were more likely to recommend their healthcare providers, a correlation consistent in both direct comparisons and the UVA. However, this correlation did not extend to facility recommendations. This divergence between national and state ADI findings underscores the importance of considering both macro- and micro-level SES indicators in healthcare satisfaction studies. The state ADI may pinpoint more specific regional socioeconomic differences that influence patients' perceptions, especially in their assessments of healthcare providers compared to facilities. Such insights could reflect local disparities in healthcare service delivery, more significant at the state level than through the national SES lens. The findings advocate for including both national and state ADI measures in future studies to ensure a nuanced evaluation of the interplay between SES and healthcare experiences.

Our study provides valuable insights into the relationship between SES, as measured by the ADI, and PS within radiation oncology. However, several limitations warrant careful consideration. The reliability of our satisfaction measures could be impacted by the survey design, potential sampling biases, and variable response rates. These factors might skew results towards certain demographics or socioeconomic groups and limit the generalizability of our findings. Additionally, our survey approach, which involved surveying patients once every 90 days as recommended by the NRC, led to an undersampling of patients currently undergoing treatment, as most treatments are completed within this timeframe. This limitation could affect the overall representation of patient satisfaction during the treatment phase. Future studies should aim to survey patients at multiple points throughout their treatment journey to provide a more comprehensive assessment of patient satisfaction.

While the NRC PS Survey aims to comprehensively measure patient satisfaction, it may not fully capture all aspects of patient experience, particularly in critical areas such as patient-provider dynamics, emotional support, care accessibility, and coordination. Previous research highlights the importance of these domains: Samant et al. (2022) emphasized that attributes like provider knowledge, kindness,

honesty, effective communication, and a positive demeanor significantly influence patient trust and satisfaction[39]. Similarly, Bourque et al. (2022) identified access to care and coordination as major factors in patient satisfaction, with emotional support frequently noted as an unmet need[40].

Hong et al. (2021) found that only a third of patients reported having in-depth discussions about their emotional and social needs, which significantly affected their well-being[41]. Having these discussions was linked to a reduction in depressive symptoms and an increase in perceived benefits from healthcare interactions, suggesting the profound impact of emotional and social support on patient well-being[41]. Our survey did not fully encompass these aspects of the patient experience, suggesting a path for future studies to integrate a broader range of satisfaction determinants. This will enrich our understanding of PS, ensuring a holistic approach that considers the emotional and logistical facets of patient care.

Our survey focused on interactions with the primary staff members involved during patient visits, specifically the clerk/receptionist, nurse, and doctor. While we acknowledge the important roles of other multidisciplinary team members, such as therapists, our survey aimed to capture satisfaction with the main points of contact during these visits. Future research could expand to include a broader range of staff interactions to provide a more focused assessment of patient satisfaction throughout the treatment experience.

An additional consideration is the high rate of non-responses for certain survey questions, particularly the question 'Did you have enough input or say in your care?', which had a 24.3 % non-response rate. Although this question was intended to relate to doctor interactions, we hypothesize that participants may have mistaken it for a nurse-related question, given the similar non-response/non-applicable rates for nurse-related questions. While these particular responses were not the primary focus of our study and do not significantly impact the overall findings, future research should aim to refine survey wording to reduce potential ambiguities.

Conclusions

Our investigation reveals a compelling association between SES, as measured by ADI, and PS within radiation oncology, particularly highlighting that patients from lower SES backgrounds are less likely to recommend their healthcare providers. This finding emphasizes the profound impact of SES on healthcare experiences and satisfaction levels, reinforcing the necessity for healthcare systems to consider and address SES disparities comprehensively. Future research should prioritize the development and implementation of targeted interventions aimed at mitigating the effects of SES on PS, thereby promoting higher satisfaction levels across all patient groups. Future studies should utilize both national and state ADI metrics to capture the full spectrum of SES influences on patient satisfaction, facilitating targeted and effective improvements in healthcare delivery and patient-centered care.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors gratefully acknowledge the support of the department of Radiation Oncology at our institution for fully funding this research; all individuals who contributed to the study are recognized as co-authors.

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