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Notions of “Value” in Healthcare

Association Between Patient Experience With Patient-Reported Outcome Measurements and Overall Satisfaction With Care in Neurology

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ABSTRACT

Background: There has been increasing focus on both patient-reported outcome measurement (PROM) collection and patient satisfaction ratings; nevertheless, little is known about their relationship.

Objectives: To determine the association between patient experience with PROM collection and visit satisfaction and to identify characteristics of better ratings for each.

Methods: This cross-sectional observational study included all patients seen in 15 neurological clinics who completed PROMs as well as 6 questions on the patient experience with PROMs at least once from October 1, 2015 to December 31, 2016. Visit satisfaction was evaluated using a composite measure of physician communication, overall physician rating, and the likelihood of recommending that physician as indicated on the Clinician and Group Consumer Assessment of Healthcare Providers and Systems survey. Predictors of PROM experience and satisfaction were identified using proportional odds and logistic regression models, respectively.

Results: There were 6454 patients (average age 58 ± 15 years, 59% women) who completed PROMs and responded to the Clinician and Group Consumer Assessment of Healthcare Providers and Systems survey. There were significant positive associations between each PROM experience question and visit satisfaction ($r = 0.11$ – 0.19 ; $P < .010$), although factors predicting visit satisfaction differed from those predicting PROM experience. A differential effect of PROMs on visit satisfaction was identified for patients who were nonwhite, had lower income, and had more comorbidities.

Conclusions: Although there was a significant association between better PROM experience and higher visit satisfaction, relationships with clinical characteristics differed, providing insights into how PROMs may be associated with patients' visit satisfaction. Further research is necessary to confirm whether PROMs can be used to improve visit satisfaction, particularly in patients who historically have reported lower quality of care.

Keywords: patient-provider communication, patient satisfaction.

VALUE HEALTH. 2019; 22(5):555–563

Introduction

Over the past 2 decades, patient-centered care has been at the forefront of discussions of healthcare quality, with patient-reported outcome measurements (PROMs) being increasingly used in the clinical management and evaluation of patient outcomes.^{1–4} PROMs include measures related to symptoms, functional status, and health-related quality of life. These are used to monitor patient progress and treatment response, investigate effects of medical and surgical interventions, and provide patient-based data for quality improvement initiatives.^{5–8} Although systematic appraisal of PROMs is increasingly included in

neurology quality measurement sets, few studies examine the efficacy of PROMs in this population.⁹ In a previous study by our group, we found that most neurological patients who completed PROMs before their clinic visit felt the experience was useful and improved communication with their provider and control over their own care.¹⁰ When implemented successfully into a clinic visit, PROMs should aid clinicians in understanding health from the patient perspective, leading to more effective communication, improved shared decision making, and greater patient empowerment to manage their symptoms.^{11–13}

Since the 1990s, patient satisfaction with care has also been a key dimension of patient-centered care, and patient satisfaction

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1098-3015/\$36.00 - see front matter Copyright © 2019, ISPOR–The Professional Society for Health Economics and Outcomes Research. Published by Elsevier Inc. <https://doi.org/10.1016/j.jval.2019.02.007>

measures continue to be incentivized and their results publicly reported.^{2–4,14} With healthcare in the United States transitioning from a fee-for-service to an outcomes-based environment, enhancing the patient experience has become a priority for both policymakers and clinical leaders.¹⁵ Healthcare institutions rely on patient ratings of care, which have implications for national rankings, quality metrics, reimbursements, and provider raises.^{4,16} Beginning in 2012, the Center for Medicare & Medicaid Services tied Medicare reimbursements with patient satisfaction, as measured by the Clinician and Group Consumer Assessment of Healthcare Providers and Systems (CG-CAHPS) survey.¹⁷

Although much has been written about the benefits of PROMs,¹⁸ less is known about its association with visit satisfaction. A recent case study in orthopedic patients found preliminary evidence that PROMs may have an impact on satisfaction.¹⁹ They found that patients who discussed PROMs with their provider reported greater scores for physician communication and shared decision making from the CG-CAHPS survey as compared with patients who did not discuss PROMs with their provider or patients who did not complete PROMs. Because patient-provider communication is an essential component of quality care and is heavily weighted on the CG-CAHPS, PROMs have the potential to play a vital role in improving patient satisfaction with care through enhancing patient-provider communication.²⁰

In addition, PROMs may have the potential to improve satisfaction in patients who have historically reported lower value of care. Predictors of satisfaction with care have been shown to vary according to demographic and clinical characteristics, with younger age and poor health status consistently predicting lower satisfaction.^{21–25} Nonwhite patients and those with low socioeconomic status have also indicated a perception of low quality of care.^{26–28} Nevertheless, a recent study by our group found that the experience of completing PROMs was especially favorable within more vulnerable neurological populations, including younger, black, depressed, and lower income patients.¹⁰ These patients felt that PROMs improved communication and control of care significantly more than their counterparts. This is especially salient in the neurological setting where patients are undergoing complex treatment and ongoing office visits. Determining ways to increase patient satisfaction within neurological populations, especially within subgroups that have historically reported lower satisfaction with care, has the potential for a significant positive impact on value-based care.

With the increasing adoption of PROMs as part of clinical care and the importance of visit satisfaction as a quality metric, assessing their relationship is critical. Our primary objective was to better understand the association between patient experience with PROMs and satisfaction with care in a general neurological population. Our secondary objective was to examine whether PROMs were differentially associated with improved satisfaction in patient subgroups that historically have reported lower quality of care.

Methods

This cross-sectional observational study included data from 15 condition-based centers within the Cleveland Clinic Neurological Institute (NI). Inclusion criteria for participation were broad and inclusive of all adult (older than 18 years) patients seen in NI clinics who completed PROMs and patient experience questions at least once between October 2015 and December 2016. The study was approved by the Cleveland Clinic Institutional Review Board. The use of preexisting data waived the requirement for patient consent.

Patient-Reported Outcome Measurements

Cleveland Clinic's Knowledge Program (KP) is a flexible health information technology platform used to collect patient-entered data in about 115 000 patients each month within the Cleveland Clinic Health System.²⁹ Through this platform, all patients seen in NI ambulatory clinics complete PROM questionnaires in English on an electronic tablet before their clinical visit, or at home before their appointment via the patient portal (MyChart, Epic Systems, Verona, WI). The KP system has been successful, with patient questionnaire completion rates exceeding 80% in the NI since 2010. Each PROM questionnaire set is composed of 2 generic scales as well as condition-specific measures that vary by center. Importantly, the information is immediately available for the provider to review during the patient visit through a link in the electronic health record (Epic Systems). The 2 generic scales include the 10-item Patient-Reported Outcome Measurement Information System Global Health short form (PROMIS-GH)³⁰ and the Patient Health Questionnaire-9 (PHQ-9).³¹ The PROMIS-GH produces 2 summary scores: physical health and mental health.

PROM Experience Questions

Six questions on the patient experience with PROMs were constructed from literature review and have been used in previous evaluations of PROM collection systems^{10,32,33} (see [Appendix Table 1](https://dx.doi.org/10.1016/j.jval.2019.02.007) in Supplemental Materials found at <https://dx.doi.org/10.1016/j.jval.2019.02.007>). Since October 2015, these questions have been administered routinely through the KP at the end of the questionnaire set. Two questions on whether the PROM system improved communication with their provider and control over their own care were asked only within established patients who had completed PROMs at a previous visit. The assumption was that these patients had experience with how the KP affects office visits.

Demographic and Clinical Characteristics

Patient demographic characteristics included age, race, sex, marital status, and household income estimated from 2010 census data using zip code. Clinical characteristics included whether the patient had help completing the survey, and comorbid conditions from their electronic health record. Education level and patient's perception of current health were included from the CG-CAHPS survey.

Patient Satisfaction With Care

The CG-CAHPS survey is a standardized survey instrument developed by the Agency for Healthcare Research and Quality to assess the patients' experience and perception of care in ambulatory office settings.¹⁷ Completed clinical visit details are sent to an external survey vendor, who randomly applies a survey sampling rate. All patients with a valid email address on record, who had not been selected for a survey in the previous 90 days, received a link via email to complete the survey online. If no email address was on record but a mailing address was available, the patient received a paper survey to complete and mail back. The CG-CAHPS survey was administered in English and evaluated patient satisfaction across many dimensions ranging from physician communication to test result follow-up. Our study included the measures assessing physician communication (6 items), and 2 global satisfaction items evaluating overall physician rating and likelihood of recommending physician to family and friends (see [Appendix Table 1](https://dx.doi.org/10.1016/j.jval.2019.02.007) in Supplemental Materials). The overall physician rating was conducted on a scale from 0 (worst provider possible) to 10 (best provider possible). All other questions were

on a 3-category Likert scale ("Yes, definitely," "Yes, sometimes," and "No"). Top-box responses to all questions were tabulated as the most positive answer ("Yes, definitely") or an overall provider rating of 9 or 10.

Statistical Methods

Descriptive statistics summarized patient responses to the PROM experience and CG-CAHPS questions (see [Appendix Table 1](#) in Supplemental Materials). Clinical and demographic characteristics of patients who did versus those who did not complete the CG-CAHPS survey were compared to assess potential response bias. Categorical characteristics were compared using χ^2 test, and continuous variables were compared using t test or the Mann-Whitney U test, as appropriate.

The association between PROM experience questions and CG-CAHPS questions on a Likert scale was assessed using polychoric correlation coefficients. In addition, top-box responses to CG-CAHPS questions were tabulated and compared across PROM experience response using the Cochran-Armitage trend test. All CG-CAHPS questions were highly correlated with one another ($r > 0.73$ for all). Therefore, a composite measure of *patient satisfaction with care* was constructed as described previously in the literature.^{34–36} Patients were considered "satisfied" if they chose the most positive or top-box answer ("Yes, definitely") on communication domain questions of provider listened carefully, showed respect, spent enough time, and a provider rating of 9 or 10.³⁷

Clinical and patient characteristics associated with more positive responses to each of the 6 PROM experience questions were determined using proportional odds models. The assumption of proportionality of the odds was evaluated graphically and by a score test, and was met for all models. Independent factors associated with increasing agreement with each of the 6 questions were ascertained using multivariable proportional odds regression models on the basis of covariates determined a priori and covariates that differed between patients who did versus those who did not complete the CG-CAHPS survey. Age, sex, marital status, income, and established patient were included in all models. Race was dichotomized as white versus nonwhite. Patient history of coronary artery disease, cancer, chronic renal failure, diabetes, hypertension, and stroke was summed as a measure of overall comorbidity status. Depression was classified according to the established PHQ-9 cutoff of 10+, indicating major depression.³¹ Because of multicollinearity between measures of global quality of life, the PROMIS-GH Physical T-Score was included in adjusted models. For ease of interpretation, a dichotomous variable was created to indicate poor physical global health, defined as scores less than 40, representing 1 standard deviation less than the population average.

Univariate logistic regression models were constructed to determine predictors of the primary outcome: the composite measure of satisfaction with care. Covariates included all demographic and clinical characteristics, PROMs, and the 6 PROM experience questions. Because of multicollinearity between PROM experience questions, multivariable regression models were constructed separately to include each of the 6 questions. Models were adjusted for variables that were significant from the univariate models at P less than .050, as well as variables that differed between patients who did versus those who did not complete the CG-CAHPS survey. To determine whether the effect of PROM experience on visit satisfaction was differentially impacted by patient characteristics, 2-way interaction terms were introduced to the multivariable models between all characteristics and the PROM experience questions. Significant interaction terms at P less than .050 were graphed for visual interpretation.

Statistical significance was established throughout at P less than .050. All statistical analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC).

Results

There were 6454 patients who completed questions about their experience with PROMs before their clinic visit and responded to the CG-CAHPS survey after the visit. The average age of the study cohort was 57.7 ± 14.6 years. Most of the patients were women (59.2%), white (91.5%), married (70.5%), and attended college (80.3%) ([Table 1](#)). As compared with patients who did not complete the CG-CAHPS survey, patients who completed it were more likely to be older, married, and white, and had lower depression scores and better PROMIS mental and physical T-scores. PROM experience responses were similar between the 2 groups (data not shown).

There were small yet significant correlations between PROM experience questions and CG-CAHPS communication domain questions and global satisfaction items ($P < .050$ for all but 1; [Table 2](#)). The PROM experience question on improving communication with the provider was the most highly correlated with all CG-CAHPS questions except for the question that the provider explained things in a way that was easy to understand. The highest correlation was found between the global satisfaction item of "Would you recommend this provider's office to your family/friends" and the PROM experience questions of improving communication and control of care ($r = 0.26$ and 0.23 , respectively).

The percentage of patients indicating the top-box responses to CG-CAHPS communication domain questions ranged from 85.8% for the provider knowing important information about their medical history to 94.6% for the provider showing respect for what they had to say (see [Appendix Table 2](#) in Supplemental Materials found at <https://dx.doi.org/10.1016/j.jval.2019.02.007>). Similarly, the global satisfaction items were highly ranked, with 85.4% indicating provider scores of 9 or 10, and 91.2% signifying they would definitely recommend the provider's office to family and friends. The composite measure of satisfaction with care demonstrated that 82.2% of patients had a top-box response to 3 communication domain questions of provider listened, showed respect, spent enough time, as well as a provider rating of 9 or 10. Furthermore, a dose-response relationship was present between PROM experience questions and CG-CAHPS questions, with a greater proportion of patients having top-box responses on CG-CAHPS questions with increasing levels of agreement to PROM experience questions (see [Appendix Table 2](#) in Supplemental Materials). For example, the composite measure of satisfaction with care increased from 81.2% in patients who "strongly disagreed" that completing PROMs improved communication with their provider to 94.2% who "strongly agreed" that it improved communication ([Figure 1](#); $P < .001$).

[Table 3](#) presents the multivariable proportional odds regression models for predicting response to each PROM experience question. Characteristics consistently associated with more favorable PROM experience responses included male sex, nonwhite, younger age, lower income, and depression.

Univariate predictors of the composite measure of satisfaction with care included older age, being married, and higher self-rated health (see [Appendix Table 3](#) in Supplemental Materials found at <https://dx.doi.org/10.1016/j.jval.2019.02.007>). Being nonwhite, depressed, and having lower mental and physical health scores were significantly associated with worse satisfaction. PROM experience questions were significantly associated with satisfaction. [Table 4](#) presents the multivariable logistic regression models for

Table 1. Characteristics of patients who completed vs those who did not complete the CG-CAHPS survey from October 1, 2015 to December 31, 2016.

Characteristics	Completed CG-CAHPS	Did not complete CG-CAHPS	P value
Total number of patients, n (%)	6454 (12.6)	44 884 (87.4)	
Demographic characteristics			
Sex, female, n (%)	3823 (59.2)	26 425 (58.9)	.580
Nonwhite, n (%)	549 (8.5)	5631 (13.4)	<.001
Age (y), mean $\pm$ SD	57.7 $\pm$ 14.6	53.7 $\pm$ 16.6	<.001
Married, n (%)	4275 (70.5)	24 854 (59.1)	<.001
Education,* n (%)		NA	NA
<High school	93 (1.4)		
High school graduate	1170 (18.3)		
Some college	2116 (33.0)		
College graduate	3030 (47.3)		
Household income (per \$10 000), median (q1, q3)	5.42 (4.40, 6.70)	5.27 (4.31, 6.52)	<.001
Clinical characteristics			
Comorbidities, n (%)			
Coronary artery disease	891 (13.8)	6782 (15.1)	.006
Cancer	1677 (26.0)	11 796 (26.3)	.610
Chronic renal failure	597 (9.2)	4909 (10.9)	<.001
Diabetes	1458 (22.6)	11 138 (24.8)	<.001
Hypertension	2497 (38.7)	17 856 (39.8)	.093
Stroke	948 (14.7)	6990 (15.6)	.066
Total number of comorbidities, mean $\pm$ SD	1.25 $\pm$ 1.71	1.32 $\pm$ 1.79	.095
Established patient, n (%)	2291 (35.5)	14 464 (32.3)	<.001
PROMs			
Rating of overall health,* n (%)		NA	NA
Excellent	1352 (21.0)		
Very good	2107 (32.8)		
Good	1889 (29.4)		
Fair	878 (13.7)		
Poor	203 (3.2)		
PHQ-9 score, median (q1, q3)	5 (2, 10)	6 (2, 11)	<.001
Depressed (PHQ-9 score 10+), n (%)	1568 (25.4)	13 064 (32.1)	<.001
PROMIS Mental T-Score, mean $\pm$ SD	46.1 $\pm$ 9.6	44.5 $\pm$ 9.7	<.001
Poor mental health (T-Score <40), n (%)	1 475 (24.2)	12 630 (30.0)	<.001
PROMIS Physical T-Score, mean $\pm$ SD	42.8 $\pm$ 8.9	41.4 $\pm$ 9.1	<.001
Poor physical health (T-score <40), n (%)	2531 (41.6)	20 167 (47.8)	<.001
Received help completing the KP, n (%)	513 (8.0)	4983 (11.3)	<.001
Received help completing the CG-CAHPS,* n (%)	386 (6.0)	NA	NA

CG-CAHPS indicates Clinician and Group Consumer Assessment of Healthcare Providers and Systems; KP, Knowledge Program system for completing PROMs and patient experience questions; NA, not applicable; PHQ-9, Patient Health Questionnaire-9; PROM, patient-reported outcome measurement; PROMIS, Patient-Reported Outcome Measurement Information System; SD, standard deviation.

*Completed on CG-CAHPS survey.

predicting the composite measure of satisfaction with care, including each PROM experience question separately. After adjustment, all PROM experience questions remained significant independent predictors of satisfaction (odds ratios ranged from 1.27 [95% confidence interval 1.19-1.36] to 1.53 [95% confidence interval 1.33-1.76]). Older age remained a significant predictor after adjustment in all models, whereas patients who were depressed and had poor self-rated physical health remained characteristics of lower satisfaction with care.

Despite the different patient characteristics predicting PROM experience and the composite measure of satisfaction with care, there were few statistically significant interaction effects between characteristics and PROM experience questions. A significant interaction was found between PROM experience being useful and income (Appendix Figure 1a in Supplemental Materials found at <https://dx.doi.org/10.1016/j.jval.2019.02.007>), where more patients at the top 3 quartiles of income had high satisfaction, as measured by the composite variable, but patients in the lowest quartile of income showed a strong dose-response relationship

between PROM experience and satisfaction. Interactions with race were found in the models including PROM experience questions on communication and control of care (see Appendix Figures 1b and 1c in Supplemental Materials). White patients had high satisfaction with care across all responses to these 2 PROM experience questions. In contrast, nonwhite patients had increased satisfaction with increasing levels of agreement that PROMs improve communication with the provider and control of care. Finally, an interaction was found between the number of comorbidities and PROMs helping the physician understand current health (see Appendix Figure 1d in Supplemental Materials). Patients with fewer than 2 comorbidities had significantly higher satisfaction as compared with patients with more than 2 comorbidities if they did not think PROMs helped their physician understand their current state of health ($P=.020$). For patients with more than 2 comorbidities who did think the questions helped their physician "a lot," their satisfaction was significantly higher than that of patients with fewer than 2 comorbidities ($P=.040$). Similar relationships were demonstrated between race, income,

Table 2. Polychoric correlation coefficients between PROM experience questions and CG-CAHPS communication and global satisfaction questions.

CG-CAHPS questions	PROM experience questions					
	Easy to understand	Useful	Improve communication*	Improve control of care*	Help provider understand health	Continue to use
CG-CAHPS communication questions						
Explained things in a way that was easy to understand	0.097 [†]	0.104 [†]	0.083 [†]	0.140 [†]	0.112 [†]	0.079 [†]
Listened carefully	0.104 [†]	0.075 [†]	0.180 [†]	0.133 [†]	0.120 [†]	0.068 [†]
Concerns answered with easy-to-understand information	0.111 [†]	0.109 [†]	0.209 [†]	0.166 [†]	0.117 [†]	0.098 [†]
Knew important information about medical history	0.080 [†]	0.082 [†]	0.191 [†]	0.147 [†]	0.091 [†]	0.070 [†]
Showed respect for what you had to say	0.086 [†]	0.047	0.148 [†]	0.111 [†]	0.081 [†]	0.057 [†]
Spent enough time with you	0.114 [†]	0.071 [†]	0.142 [†]	0.114 [†]	0.091 [†]	0.079 [†]
CG-CAHPS global satisfaction items						
Provider rating	0.140 [†]	0.124 [†]	0.185 [†]	0.151 [†]	0.130 [†]	0.117 [†]
Would you recommend this provider's office to your family/friends?	0.070 [†]	0.120 [†]	0.259 [†]	0.232 [†]	0.120 [†]	0.108 [†]
Composite measure of satisfaction with care [§]	0.158 [†]	0.113 [†]	0.187 [†]	0.151 [†]	0.116 [†]	0.106 [†]

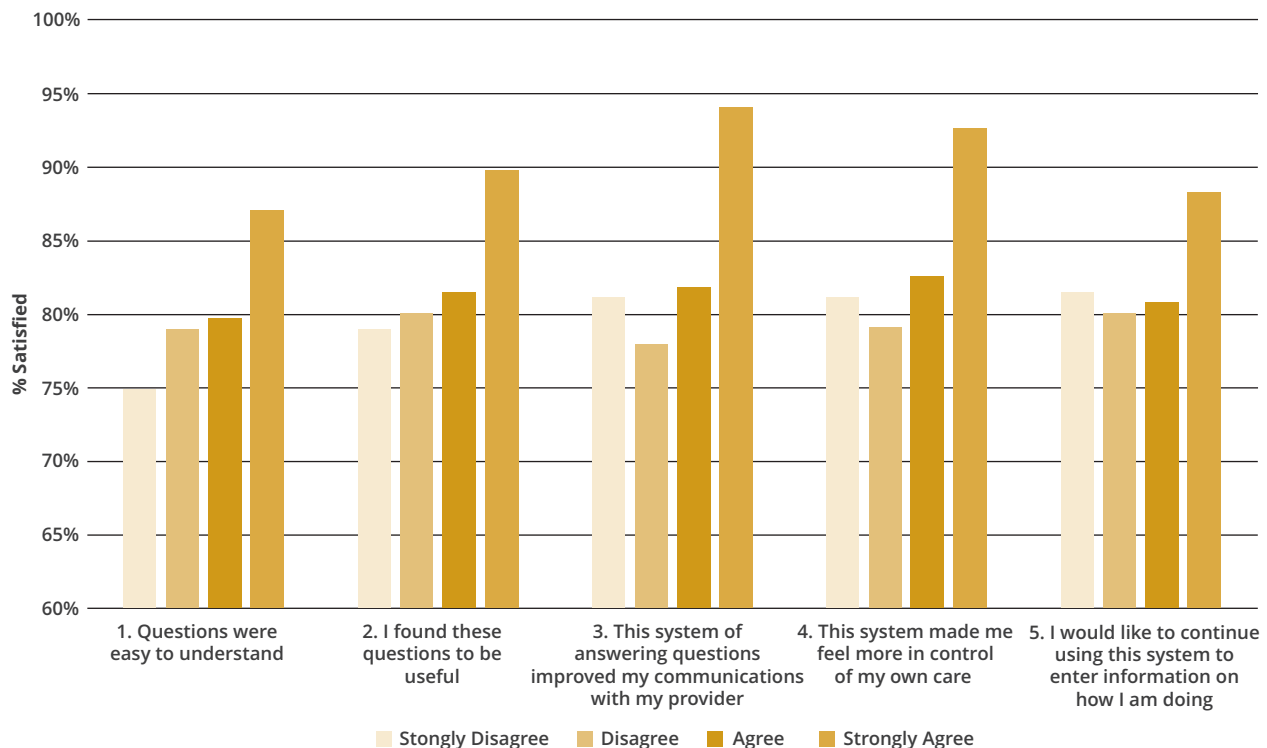
CG-CAHPS indicates Clinician and Group Consumer Assessment of Healthcare Providers and Systems; PROM, patient-reported outcome measurement.

*Answered in established patients only who completed PROMs at a previous visit, with the assumption that they had the opportunity to see how PROMs affected experience at a previous visit.

[†]Correlation significant at $P < .010$.

[‡]Correlation significant at $P < .050$.

[§]Composite measure of satisfaction with care is defined as a top-box response to CG-CAHPS communication domain questions of provider listened, showed respect, spent enough time, and a provider rating of 9 or 10.

Figure 1. Association between PROM experience questions and satisfaction with care. Cochran-Armitage trend test $P < .001$ for all. Satisfaction with care is a composite measure defined as a top-box response to CG-CAHPS communication domain questions of provider listened, showed respect, spent enough time, and a provider rating of 9 or 10.

CG-CAHPS indicates Clinician and Group Consumer Assessment of Healthcare Providers and Systems; PROM, patient-reported outcome measurement.

Table 3. Multivariable proportional odds models for predicting 6 PROM questions.

Characteristics	Model 1: Questions easy to understand		Model 2: Questions useful		Model 3: Improve communication*	
	Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
Sex, female	1.04 (0.93-1.17)	.500	0.74 (0.66-0.83)	<.001	0.70 (0.58-0.85)	<.001
Nonwhite	0.88 (0.72-1.09)	.240	1.26 (1.02-1.55)	.032	1.44 (1.03-2.02)	.033
Age (per decade)	0.90 (0.86-0.94)	<.001	0.92 (0.89-0.96)	<.001	0.90 (0.83-0.96)	.002
Married	0.99 (0.88-1.13)	.980	1.05 (0.92-1.19)	.470	1.20 (0.97-1.48)	.094
Income (per \$10 000)	1.05 (1.01-1.08)	.004	0.96 (0.93-0.99)	.014	0.96 (0.91-1.02)	.170
Total no. of comorbidities	0.98 (0.94-1.01)	.140	0.98 (0.95-1.02)	.340	1.00 (0.95-1.05)	.930
Established patient	1.01 (0.90-1.14)	.850	1.02 (0.91-1.15)	.710	NA	–
Depressed	0.96 (0.83-1.11)	.610	1.45 (1.26-1.68)	<.001	1.19 (0.94-1.51)	.150
Poor physical health	0.61 (0.54-0.69)	<.001	0.92 (0.81-1.05)	.220	0.97 (0.78-1.19)	.750

Note. PROM experience questions in columns indicate the dependent variable.

CI indicates confidence interval; NA, not applicable; PROM, patient-reported outcome measurement.

*Answered in established patients only who completed PROMs at a previous visit, with the assumption that they had the opportunity to see how PROMs affected experience at a previous visit (n = 2291).

comorbidities, and the other PROM experience questions, but the interaction effects did not reach conventional statistical significance in all models.

Discussion

The present study of 6454 neurological patients demonstrated a significant association between experience with PROMs and

satisfaction with care. Although our study demonstrated low positive correlations, patients with positive responses on PROM experience questions had 30% to 50% increased odds of satisfaction with care, on the basis of a composite of CG-CAHPS questions. This finding is consistent with several studies demonstrating that clearer communication from doctors is related to greater patient satisfaction with care.^{16,21,38} In addition to improving the patient's communication with the provider, patients in our study indicated

Table 4. Multivariable logistic regression models for predicting satisfaction with care by PROM experience question.

Characteristics	Model 1: Questions easy to understand		Model 2: Questions useful	
	Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
Sex, female	1.03 (0.89-1.20)	.700	1.07 (0.92-1.24)	.390
Nonwhite	0.83 (0.65-1.06)	.130	0.79 (0.62-1.01)	.059
Age (per decade)	1.11 (1.06-1.17)	<.001	1.11 (1.06-1.17)	<.001
Married	1.21 (1.04-1.42)	.016	1.20 (1.03-1.41)	.023
Income (per \$10 000)	0.97 (0.93-1.01)	.200	1.00 (0.96-1.05)	.079
Total no. of comorbidities	1.03 (0.98-1.08)	.210	1.03 (0.98-1.08)	.220
Established patient	1.14 (0.97-1.33)	.100	1.14 (0.98-1.33)	.094
Depressed	0.79 (0.66-0.94)	.006	0.75 (0.63-0.89)	.001
Poor physical health	0.59 (0.51-0.70)	<.001	0.57 (0.48-0.66)	<.001
PROM experience question	Questions easy to understand		Questions useful	
	1.53 (1.33-1.76)	<.001	1.42 (1.28-1.59)	<.001
Interactions [†]	None		Income	

Note. Dependent variable is a satisfaction with care, a composite measure defined as a top-box response to CG-CAHPS communication domain questions of provider listened, showed respect, spent enough time, and a provider rating of 9 or 10.

CG-CAHPS indicates Clinician and Group Consumer Assessment of Healthcare Providers and Systems; CI, confidence interval; NA, not applicable; PROM, patient-reported outcome measurement.

*Answered in established patients only who completed PROMs at a previous visit, with the assumption that they had the opportunity to see how PROMs affected experience at a previous visit.

[†]Interactions between PROM experience question and indicated covariates at $P < .050$ are included in the models and presented in Figure 1. Estimates are presented for mean level of PROM experience question.

Table 3.

Continued

Model 4: Improve control of care*		Model 5: Help physician understand		Model 6: Continue to use	
Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
0.75 (0.62-0.90)	.002	0.83 (0.76-0.92)	<.001	0.79 (0.71-0.88)	<.001
1.35 (0.97-1.87)	.072	1.28 (1.08-1.53)	.006	1.21 (0.99-1.48)	.051
0.89 (0.83-0.95)	<.001	0.98 (0.94-1.01)	.170	0.88 (0.84-0.91)	<.001
1.18 (0.96-1.45)	.100	1.07 (0.96-1.19)	.250	1.16 (1.03-1.31)	.014
0.96 (0.91-1.02)	.180	0.95 (0.92-0.98)	<.001	0.96 (0.93-0.98)	.003
1.01 (0.96-1.06)	.780	0.97 (0.95-1.00)	.094	0.98 (0.95-1.01)	.200
NA	–	0.90 (0.81-0.99)	.036	1.07 (0.95-1.19)	.260
1.20 (0.95-1.52)	.120	1.42 (1.25-1.61)	<.001	1.29 (1.13-1.48)	<.001
0.87 (0.71-1.06)	.170	1.02 (0.92-1.14)	.660	0.91 (0.80-1.02)	.110

that through completing PROMs, they had an increase in sense of control over their care and that the provider better understood their health. A recent randomized controlled trial demonstrated that for patients with cancer undergoing chemotherapy, providing self-reported symptoms to a nursing team resulted in fewer visits to emergency departments, longer bouts of chemotherapy, and greater survival rates than patients receiving standard of care who did not complete PROMs.³⁹ These results suggest that as patients

were able to relay new or troubling symptoms with providers, they were better able to manage symptoms and remain in therapy longer. PROMs identify areas of importance to patients, allowing physicians to better address patient concerns, which has been shown to improve satisfaction with care.⁴⁰

Importantly, our study demonstrated that different patient characteristics predicted positive PROM experience compared with satisfaction with care. Higher satisfaction with care was associated

Table 4.

Continued

Model 3: Improve communication*		Model 4: Improve control of care*		Model 5: Help physician understand		Model 6: Continue to use	
Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
1.10 (0.87-1.39)	.320	1.10 (0.88-1.39)	.310	1.06 (0.91-1.23)	.440	1.06 (0.91-1.23)	.440
0.55 (0.35-0.88)	.009	0.64 (0.41-0.98)	.019	0.78 (0.61-0.99)	.041	0.80 (0.63-1.02)	.070
1.07 (0.98-1.16)	.027	1.12 (1.01-1.23)	.023	1.11 (1.05-1.17)	<.001	1.12 (1.06-1.18)	<.001
1.03 (0.80-1.32)	.980	1.05 (0.82-1.35)	.890	1.20 (1.03-1.41)	.022	1.20 (1.02-1.40)	.024
0.99 (0.92-1.05)	.800	0.99 (0.76-1.27)	.930	0.99 (0.95-1.03)	.490	0.98 (0.94-1.02)	.430
1.01 (0.95-1.07)	.810	1.01 (0.95-1.07)	.790	1.06 (0.99-1.10)	.200	1.03 (0.98-1.07)	.240
NA	–	NA	–	1.16 (0.99-1.36)	.066	1.14 (0.98-1.33)	.100
0.68 (0.52-0.89)	.021	0.69 (0.53-0.90)	.024	0.75 (0.63-0.89)	<.001	0.76 (0.64-0.90)	.002
0.66 (0.51-0.85)	<.001	0.65 (0.51-0.83)	<.001	0.56 (0.48-0.66)	<.001	0.57 (0.49-0.67)	<.001
Improve communication*		Improve control of care*		Help physician understand		Continue to use	
1.52 (1.28-1.81)	<.001	1.37 (1.16-1.63)	<.001	1.27 (1.19-1.36)	<.001	1.31 (1.19-1.44)	<.001
Nonwhite		Nonwhite		Comorbidities		None	

with older age, white race, being married, absence of depression, and higher self-rated health, whereas better PROM experience was seen in those who were younger, nonwhite, male, depressed, and with lower income. These disparate relationships between clinical characteristics, patient experience with PROMs, and visit satisfaction provide insight into how leveraging a patient's PROM experience may affect satisfaction with the office visit.

Studies have consistently demonstrated that older patients report higher patient satisfaction.^{21,22,36} It is hypothesized that older patients have greater familiarity with the processes and shortcomings of care, and their expectations are more aligned with the reality of their office visit.^{25,41} Contrarily, younger patients indicated greater experience with PROMs in our study. Younger patients may be more apt to use health information technology and may be more comfortable providing personal information electronically. Whether age-related discrepancies in satisfaction reflect differences in patient perceptions of care, expectations of care, or true differences in care provided should be investigated further.²⁵

Our study did not show a significant interaction effect between depression and PROM experience questions on satisfaction with care. Depression, however, was significantly associated with better PROM experience but worse satisfaction with care. As surveys include depression screenings, patients with depression may find the surveys particularly relevant and may be interested in having their symptoms evaluated by a provider. Our study also did not demonstrate a differential effect between quality of life and PROM experience on satisfaction with care, with quality of life unrelated to response on PROM experience questions but significantly associated with CG-CAHPS responses. Specifically, lower functional status was associated with significantly worse satisfaction with care. This is aligned with previous research that has consistently demonstrated a correlation between ratings of lower physical, mental, and general health and worse patient satisfaction.^{16,21,22,25,36,42} Along with age, reports of health status could act as proxies for patient expectations about healthcare.²⁴ Patients who perceive themselves as healthier may be more satisfied with life generally, including the healthcare they receive, and have a general positive attitude. In contrast, patients with a general negative outlook may be more likely to view their health as poor and be dissatisfied with their healthcare.²⁵ In the present study, the lack of association between self-reported health status and patient experience with PROMs suggests that the relationship between health status and perceptions of healthcare is nuanced and does not extend to all aspects of the healthcare experience.

Nonwhite race and low socioeconomic status were both independently associated with higher ratings on several PROM experience questions. Of particular note, within the 9% of nonwhite patients who completed the CG-CAHPS survey in our study, there were significantly increased odds of feeling that PROMs aided in communication and, along with patients with lower household income, had higher odds of feeling that PROMs helped their provider understand their health. In contrast, nonwhite race was associated with lower satisfaction with care, but income was not associated with satisfaction in our study. Although a meta-analysis showed higher satisfaction with higher social status, including income, and white race, research has been generally inconclusive on a relationship between socioeconomic status and patient satisfaction.²³ It is of special note that minorities were more likely to feel that PROMs aided in communication with their provider given previous reports that minorities view communication with providers less favorably than do whites.^{43–46} Our study provides preliminary support for the potential of using PROMs as a mechanism to improve provider communication and potentially patient satisfaction in

minorities and those socioeconomically disadvantaged by removing barriers to communication.

Finally, our study showed a significant interaction effect between the number of comorbidities and PROM experience on satisfaction. Patients with more comorbidities had greater satisfaction with care if they felt PROMs helped their physician understand their current health. PROMs could help patients feel they are sharing important information with their providers in cases where patients have complex histories or symptoms, thereby improving satisfaction. Patient-centered communication requires longer visits; nevertheless, the brevity of office visits requires novel methods for optimizing face-to-face patient-provider interactions.³⁶ Through implementing the appropriate PROMs targeted to specific populations, patients can provide real-time access to information about their health and concerns to prioritize topics for discussion during the clinical visit and promote shared decision making.^{1,11} Further exploration of these differences may elucidate mechanisms for how to potentially use PROMs to improve satisfaction.

Our study has several strengths. It evaluated the association between the patient experience with PROMs and increased satisfaction with care within a diverse population of patients with differing neurological conditions, severities, and characteristics. It used PROM data as part of routine care processes, increasing the generalizability of our findings to other neurological populations. There are, however, several limitations to our study that deserve consideration. First, this being a retrospective observational study, causality cannot be assessed between experience with PROMs and visit satisfaction. Future longitudinal studies are needed to examine the relationship between PROMs and satisfaction with care. Second, we did not have information on patients who did not complete the KP, nor did we have information on why a patient would decline to complete the KP or the CG-CAHPS survey. Patients who completed both are likely to be a unique sample. To account for nonresponse bias on the CG-CAHPS, analyses were adjusted for factors that differed between responders and nonresponders. We are limited, however, by the characteristics measured, and some of the factors, such as race and income, may be confounded by unmeasured or uncaptured variables. Because the proportion of nonwhite participants is low in our study, results regarding race should be interpreted with caution. Third, disease-specific measures differed by center, and patient experience based on the PROMs may vary by questionnaire length and the specific questions they complete. Because there were 15 centers included in this study, assessing experience by center was outside the scope of this study; nevertheless, this should be explored in future research studies. Fourth, there was a high level of visit satisfaction overall, with top-box scores exceeding 90% across many domains. This makes it difficult to assess the variability in responses with such high responses. In addition, patients who are generally positive responders may respond to all survey questions positively. Finally, we do not know whether the provider reviewed the PROMs with the patient. Quality improvement projects within our centers have demonstrated that providers generally review patient responses before the office visit, and best practice alerts are triggered on the basis of patient response to PROMs, which providers must address in the electronic health record. Given these practices, patients using our PROM system may solicit different responses to other PROM systems. Despite these limitations, the differing relationship between clinical and demographic factors that are associated with PROM experience versus visit satisfaction lend support to the potential explanation that experience with PROM collection may contribute to visit satisfaction.

Conclusions

Given the importance of visit satisfaction in operational aspects of healthcare delivery and increased adoption of PROMs within routine care over the past 20 years, there remains a dearth of information on their relationship. This study provides preliminary information on the association between increased visit satisfaction and a positive PROM experience, and suggests that the influence of PROM collection on visit satisfaction may be a consideration when defining the value of their collection. Further research that allows direct comparisons of visit satisfaction in patients who are not exposed to PROM collection will be necessary to elucidate causality and determine the potential of PROMs to improve visit satisfaction, particularly in patients who historically have reported lower satisfaction with care.

Acknowledgments

We thank Daniel Bokar, Sabahat Hizlan, and Robert Johnson for their help with data collection.

Source of Financial Support

The authors have no other financial relationships to disclose.

Supplemental Materials

Supplementary data associated with this article can be found in the online version at <https://dx.doi.org/10.1016/j.jval.2019.02.007>.

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