The influence of collecting patient-reported outcome measures on visit satisfaction in rheumatology clinics

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Abstract

Objectives: Patient-reported outcome measures (PROMs) can direct patient-centered care and increase patient satisfaction with the visit. The objective of this study was to assess the relationship between the collection of PROMs and visit satisfaction, as measured by the Clinician and Group Practice Consumer Assessment of Healthcare Providers and Systems (CG-CAHPS) survey.

Methods: An electronic platform for collection of patient-reported information was implemented in Rheumatology clinics between August-September 2016. Adult patients were included in the study if they completed CG-CAHPS after an ambulatory visit. The pre-implementation cohort consisted of patients seen between January-June 2016; the post-implementation cohort consisted of patients seen January-June 2017. CG-CAHPS scores were compared between cohorts. Mixed effect models were constructed to identify predictors of visit satisfaction.

Results: Characteristics were similar between the 2,117 pre- and 2,380 post-implementation patients. Visit satisfaction was high in both cohorts but did not differ (OR = 0.97 (95% CI: 0.79, 1.19)). Predictors of improved satisfaction included being an established patient, male, older age, and reporting higher quality-of-life. However, sensitivity analyses in the post-implementation cohort suggested that implementing PROMs may convey benefits for new patients, in particular.

Conclusion: PROMs collection had no effect on visit satisfaction in Rheumatology clinics, though there may be benefits for new patients. These largely null findings may be due to high satisfaction levels in our cohorts or lack of provider review of PROM data with patients. Further research is indicated to determine the impact of provider communication of PROM results to patients on different domains of visit satisfaction.
**Key Words**: Patient-Reported Outcomes, Patient Satisfaction, Rheumatology

**Key messages:**

- Patient-reported outcome measures (PROMs) may influence office visit satisfaction for patients seen in Rheumatology clinics.
- Predictors included being an established patient, male, older age, and better quality of life.
- PROMs may lead to improved provider ratings through enhancing communication, particularly in new patients.

**INTRODUCTION**

Patient-reported outcome measures (PROMs) are progressively becoming a standard tool in research and clinical practice, taking an increasingly important role in clinical management and evaluation of patient outcomes (1–3). Among the potential benefits of PROMs are improved symptom monitoring and management (4,5), detection of undiagnosed psychological or functional issues (6), and greater patient engagement and satisfaction (7). To maximize the effectiveness of PROMs, feedback from the physician is an important component (8), however merely completing measures may convey some benefits (9).

Previous research suggests that clinical practice in rheumatology may be well suited to benefit from the use of PROMs. PROMs may be especially applicable for patients with conditions that are more subjective in nature, such as rheumatologic conditions. Clinical outcomes, such as laboratory values, are not always suitable, whereas patients’ perceptions of
symptoms and the illness’s effect on their lives should be assessed (10) as rheumatology patients have been shown to differ with their physician in assessment of disease severity (11). Furthermore, completing PROMs and discussing them with their physician may contribute to patients’ thinking more broadly about their condition and how it affects their life (12). When incorporated into an office visit, PROMs have the potential to aid clinicians in better understanding health from the patient’s viewpoint, leading to enhanced communication and shared decision-making, and empowering the patient to self-manage their symptoms (13,14). Given this, incorporation of the patient’s perspective during treatment is paramount to increase patient engagement and enhance patient-provider communication (15).

A recent analysis by our group demonstrated neurological patients completing PROMs as part of routine clinical care found the measures useful and reported improved communication with their provider (16). In another study by our group, we found that patients reporting a more positive PROMs experience also reported higher overall visit satisfaction, as measured by the Clinician and Group Consumer Assessment of Healthcare Providers and Systems (CG-CAHPS) survey (17,18). The Center for Medicare & Medicaid Services ties Medicare reimbursements with patient satisfaction, as measured by the CG-CAHPS, which has implications for national rankings and quality metrics. Given the potential benefits of using PROMs in the rheumatology population, exploring the effect of completing PROMs on overall patient satisfaction with their office visit is of interest. While our prior study and other correlational studies have examined the relationship between experience with PROMs and visit satisfaction, few studies have compared satisfaction between cohorts who did versus did not complete PROMs. Rheumatology centers at Cleveland Clinic were in a unique position to facilitate this comparison, as an electronic platform for the systematic collection of PROMs was implemented starting in August 2016. The objective
of our study was to assess the influence of the collection of PROMs on overall patient satisfaction ratings through a comparison of CG-CAHPS scores pre- versus post-implementation of PROMs collection.

**METHODS**

This was a retrospective pre-post cohort study conducted within 13 ambulatory clinics in the Rheumatology Department at Cleveland Clinic. Inclusion criteria for participation was all adult (18+) patients who completed CG-CAHPS surveys following their office visit. Electronic collection of PROMs was implemented within the Rheumatology Department between August-September 2016. Data were compared between a pre-implementation cohort of patients seen between January-June 2016 and a post-implementation cohort seen between January-June 2017. These windows were selected to account for effects of workflow transition due to implementing PROMs and to eliminate any seasonality effects. The study was approved by the Cleveland Clinic Institutional Review Board. Because the study consisted of analyses of pre-existing data, the requirement for patient informed consent was waived.

**Patient-Reported Outcomes:** During routine care following implementation of PROMs, rheumatology patients completed the Patient Health Questionnaire 9 (PHQ-9) (19), the Patient-Reported Outcomes Measurement Information System (PROMIS) Global Health, Fatigue, Pain Interference, and Physical Function scales (20), as well as the condition-specific RAPID 3 (21). All PROMs were administered through Cleveland Clinic’s Knowledge Program (KP) (22). The KP is a flexible healthcare information technology platform that is currently used to collect patient-entered data in ~115,000 patients each month within the Cleveland Clinic Health System. All patients completed measures on an electronic tablet just prior to their visit or at home before the visit via a patient portal (MyChart, Epic Systems). PROMs data are integrated within the
electronic health record and are available to the provider at the point of care. Providers acknowledge review of the PROM data by clicking a “Review/Approve” button. Although the majority of providers indicate review of the PROM scores, the extent to which they digest the data or discuss with their patients is unknown. As such, our study does not have documentation of whether such a review and/or discussion took place during the visit.

**Patient satisfaction:** The CG-CAHPS survey (23) is a standardized measure used to assess patients’ outpatient medical appointment experience. It is sent to a randomly selected sample of patients following medical practice visits through paper and email distribution methodologies. For the present study, primary outcomes included the overall provider rating on a 10-point scale (0 = worst doctor possible; 10 = best doctor possible), the patient’s report of willingness to recommend the caregiver to family and friends (response options: Yes, definitely; Yes, somewhat; No), and a composite measure of overall satisfaction with care. This composite measure consisted of provider rating of 9 or 10 and a top box response to each of the following items: provider listened, showed respect, and spent enough time (18). Secondary outcomes included six items related to the Communication with Caregiver domain.

**Demographics and Clinical Characteristics:** Patient demographics were collected, including age, race, marital status, household income estimated from 2010 census data by zip code, and patient history of comorbidities. Additionally, a Charlson comorbidity index (CCI) was also available. The CCI reflects 19 conditions related to the potential for mortality and morbidity (24). Finally, a variable was also included to indicate whether the patient was new to the Rheumatology Department at the time of the study visit, or whether they were an established patient.
**Statistical Analysis:** Descriptive statistics were used to summarize and compare demographics and clinical characteristics between the pre-implementation and post-implementation cohorts. Frequency count with percentage was used to present categorical data and mean with standard deviation or median with interquartile range was used to present continuous data. Chi-square tests were used to compare categorical variables and t-tests (parametric) or Mann-Whitney U tests (nonparametric) were used to compare continuous variables across cohorts, as appropriate. Unadjusted odds ratios were calculated from univariate mixed effects logistic regression models, to account for possible repeated measures from patients seen in both cohorts, for top box responses to each of the six communication domain items, the probability of a score of 9 or 10 on the provider rating scale, a recommendation of the provider’s office to family/friends, and the composite measure of satisfaction with care. The models examined the effect of cohort (post- vs pre-implementation of PROMs).

Subsequently, multivariable models adjusted for demographic and clinical covariates identified a priori: whether the patient was new to Rheumatology, age, gender, marital status, race, income, education level, Charlson score, and a single item on quality of life (QOL) from the CG-CAHPS. For QOL, a low score indicator was calculated for patients that did not respond with “Excellent” or “Very Good”. Healthcare provider was also included as a random effect. All possible two-way interaction terms with cohort were introduced to these models, to determine if there was a differential effect of completing PROMs on outcomes. Statistical significance was established throughout at p < 0.05. As the results of this data analysis are exploratory and hypothesis-generating, no formal adjustment for multiple comparisons was made. Missing data were minimal, therefore no imputation was conducted. All analyses were completed in R, version 3.6.0 (R Core Team, 2019).
Two sensitivity analyses were conducted. The first evaluated the effect of PROMs implementation in the subset of patients who were seen in both cohorts and completed CG-CAHPS in both time periods. Outcomes were compared across time using McNemar’s test. The second sensitivity analysis further explored whether experience with PROMs impacted visit satisfaction in the post-implementation cohort only, comparing patients who actually completed PROMs to those that did not. Multivariable mixed effects logistic models were constructed as described above, but the cohort predictor was replaced with an indicator of whether the patient completed PROMs. Interaction effects were similarly evaluated as described above.

RESULTS

Between January and June, 15,911 and 16,608 patients were seen in the Rheumatology department, in the pre-implementation (2016) and post-implementation (2017) periods, respectively (Figure 1). Of these patients, 2,117 completed CG-CAHPS in the pre-implementation cohort and 2,380 in the post-implementation cohort. Of those in the post-implementation cohort, 2,008 (84%) had PROMs data. There were 486 patients with data in both cohort periods. Table 1 presents demographics and clinical characteristics for both groups. While statistically different, age and BMI were similar between the pre-implementation and post-implementation cohort (62.76 (SD = 13.29) vs. 61.62 (13.41); median BMI 27.97 vs. 28.70, respectively). The pre-implementation patients were more likely to have a history of cancer (49.6% vs 45.7%), as compared to post-implementation patients. The post-implementation cohort had a slightly greater percentage of new patients (19.3 % vs. 22.6%) as compared to the pre-implementation cohort.
The outcomes and unadjusted odds ratios by cohort are presented in Table 2. Top box responses ranged from 88.2 - 95.1% in the pre-implantation cohort and from 88.6 - 96.0% in the post-implementation cohort. The only statistically significant difference between cohorts was on the communication domain question of whether the patient’s “concerns [were] answered with easy to understand information” (91.51% in pre- versus 93.75% in post-implementation cohort; Odds Ratio = 1.68 (95% CI 1.14, 2.48) for the post-implementation cohort). There were no significant or meaningful differences between the pre- and post-implementation cohorts on the other communication items. Likewise, none of the three primary outcome measures (provider rating, provider recommendation, and composite satisfaction with care) were significantly different between cohorts. Composite satisfaction was 85.77% and 85.62% for the pre- and post-implementation cohorts, respectively.

Multivariable mixed effects logistic regression models were constructed for the three primary outcomes of provider rating, provider recommendation, and composite satisfaction (Table 3). For all three outcomes, there were no main effects for post- versus pre-implementation cohort. However, being a new patient was related to lower provider rating (OR = 0.56 (95% CI 0.43, 0.73)), lower provider recommendations (OR = 0.70 (95% CI 0.50, 0.98)), and lower overall satisfaction with care (OR = 0.60 (95% CI 0.47, 0.77). Older patients were more likely to give a top box provider rating (OR = 1.29 (95% CI 1.15, 1.44)), top box provider recommendations (OR = 1.56 (95% CI 1.34, 1.81)), and higher satisfaction with care (OR = 1.19 (95% CI 1.07, 1.32)). Female patients were less likely to give a top box provider rating (OR = 0.70 (95% CI 0.53, 0.92)), to recommend the provider (OR = 0.43 (95% CI 0.29, 0.64), and report satisfaction with care (OR = 0.68 (95% CI 0.53, 0.87)). Married patients were more likely to report higher overall satisfaction with care (OR = 1.26 (95% CI 1.01, 1.56)). Finally, patients
with low QOL were less likely to give a top box provider rating (OR = 0.49 (95% CI 0.37, 0.65)), less likely to give a top box provider recommendation (OR = 0.43 (95% CI 0.30, 0.61)) and less likely to report overall satisfaction with care (OR = 0.48 (95% CI 0.37, 0.61)). There were no interactions between cohort and any of the covariates on the three outcome measures.

A sensitivity analysis was conducted in the 486 patients that had outcome data in both cohorts. Patients had increased top box responses for recommending the provider from pre-(95%) to post-implementation (97%) (p = 0.09). Responses were similar across the other outcomes (data not shown).

A second sensitivity analysis assessed differences in patients who did versus did not complete PROMs in the post-implementation cohort (Table 4). Of the 2,380 patients in the post-implementation cohort, 2,008 (84.4%) completed PROMs whereas 372 did not complete PROMs. In multivariable mixed effects logistic regression models, there was no effect for completing PROMs on the global outcomes. Predictors for the three primary global outcomes in the post-implementation cohort were similar to those from both cohorts, with older age positively predicting greater satisfaction for all outcomes and low QOL negatively predicting satisfaction. Additionally, new patients negatively predicted top box scores in provider rating and overall satisfaction with care, as compared to established patients. However, there were significant interaction effects between PROMs by new patient status for both provider rating and overall satisfaction (Figures 2a and 2b). For both interactions, completing PROMs was related to a significant increase in top box scores in new patients, while established patients had high scores, independent of completing PROMs.
DISCUSSION

Our study found limited evidence of the effect of PROMs on visit satisfaction, as measured by three global outcomes: overall provider rating on a 10-point scale, the patient’s report of willingness to recommend the caregiver to family, and a composite measure of overall satisfaction with care, indicated by a high provider rating, and a high response to items *provider listened, showed respect, and spent enough time*. Responses on these three global measures were extremely high in both cohorts (88-94%). Responses to communication items on the CG-CAHPS were also high in our study (90-96%). However, other studies of patient experience have found CG-CAHPS ratings of communication questions tend to be high. A study of 21,318 patients across 450 practice sites demonstrated communication top box scores ranging from 90-95%, with provider ratings from 82-90% (23). In rheumatology patients, responses have been shown to be similarly high with a study of over 2,800 rheumatology patients having communication and provider ratings ranging from 92-95% (25). The implementation of PROMs into an office visit has the potential to be burdensome for patients and cause disruption to the clinical workflow for providers and office staff. Our study found visit satisfaction remained high among established patients in an ambulatory setting, and new patients demonstrated higher levels of satisfaction following PROMs implementation.

Though PROMs implementation did not predict higher responses in any of the three primary outcome measures in our study, other predictors were shown to have an effect on visit satisfaction. Sensitivity analyses showed that for patients new to the Rheumatology Center, completing PROMs was a significant predictor of higher top box scores in provider rating and overall satisfaction with care. However, this comparison is somewhat limited, due to a very low percentage of patients who did not complete PROMs. Overall, being a new patient was related to
less satisfaction, as was having a low quality of life and being female. However, older age was related to better scores on all three outcomes. Established patients, higher quality of life, and older age have been demonstrated in the literature to predict increased satisfaction with medical visits (26–28). The relationship between sex and visit satisfaction has been largely contradictory (28), with female sex and increased visit satisfaction being shown in some studies (29), but not others (26,27,30). In rheumatology patients specifically, older age and follow-up visits have also been associated with higher visit satisfaction (31). A cohort study of 573 rheumatology patients determined predictors of high and low satisfaction based on quartiles and, in contrast to our study, found female sex was associated with higher visit satisfaction. Another study in patients with rheumatoid arthritis found women were more likely to rate certain visit aspects significantly better than males, but sex was largely unrelated to patients view on care (32).

As health care in the United States transitions from a fee-for-service to an outcomes-based environment, enhancing the patient experience has become a priority for both policy makers and clinical leaders. When incorporated into the clinic visit, PROMs could theoretically direct patient-centered care and increase patient satisfaction with their visit and care. PROMs allow clinicians to capture patient views, feelings, and subjective experiences. When clinicians are better able to understand a patient’s health from their perspective, it can enhance provider-patient communication, enable shared decision-making, and impact how the patient thinks about his condition (33). Our study suggests that the act of completing PROMs alone may not impact overall communication with the provider or satisfaction with care. The review process is critical to the effectiveness of PROMs. A mixed methods study found that both patients and providers felt that reviewing PROMs results contributed to increased insight into the patient’s condition and led to shared decision making (12). The results of our study may provide an innovative
approach to increase patient satisfaction and positively impact patient-centered care if the provider reviews the PROMs with the patient.

For rheumatology patients, including PROMs as part of the office visit may provide important information beyond their physician-led care. As evidence of this, a meta-analyses of 109 clinical trials found that use of PROMs were useful when used in a treat-to-target strategy, as compared usual care (34). Also, PROMs may better discriminate active from placebo treatment than physician-reported measures in randomized controlled trials (RCTs). Strand and colleagues found that in two RCTs with over 800 patients with active rheumatoid arthritis, PROMs of disease activity, pain and physical function showed no improvement for patients in the placebo condition. In contrast, physician-reported measures showed improvement for patients with rheumatoid arthritis (35).

Our study has a number of strengths. We included a large study of representative patients seen in Rheumatology clinics within a large integrated health system. As PROMs were rolled out within a two month window to all Rheumatology centers, we were uniquely positioned to answer our research question of whether PROMs impacted overall visit satisfaction. Our study also has a number of limitations. First, the pre-post study design is correlational and therefore we are unable to assess causality. The act of completing PROMs alone did not show any effect on CG-CAHPS scores, but it is unknown if providers reviewed PROMs and communicated them to the patient. Future longitudinal studies should assess how to present PROMs to the patient and provider and how to facilitate PROMs communication in order to optimize engagement. Second, there was high satisfaction across CG-CAHPS items and summary scores. The dearth of unsatisfied patients limits the ability to detect change over time. Third, not all patients in the post-implementation cohort completed PROMs, however the majority (84%) completed at least
some PROMs. We do not know if the patients who did not complete PROMs were offered PROMs, reviewed them without completing, and/or declined participation. Lastly, our study is limited to the proportion of patients who completed CG-CAHPS. The surveys are sent to a random selection of patients, and we controlled for demographics in multivariable models in an attempt to account for possible selection bias. Though our response rate is low (14%), this is a universal issue of concern with CAHPS surveys, as noted in a 2017 review from the Agency for Healthcare Research and Quality (AHRQ)(36). Despite the potential for response bias, Centers for Medicare and Medicaid Services and private insurers still use CAHPS as the primary measure of patient experience in the United States, and have found the results to be a valid source of data from which to base many policy and reimbursement practices.

In conclusion, we found high levels of satisfaction with care in patients seen in rheumatology clinics. Implementation of systematic patient-reported outcomes collection within the rheumatology clinics had little demonstrable effect on patient satisfaction with ambulatory care. Further evaluation of the impact of PROMs collection within clinical care should incorporate review of results with patients into the study design.
References

1. Black N. Patient reported outcome measures could help transform healthcare. BMJ. 2013 Jan 28;346(jan28 1):f167–f167.

2. Lavallee DC, Chenok KE, Love RM, Petersen C, Holve E, Segal CD, et al. Incorporating Patient-Reported Outcomes Into Health Care To Engage Patients And Enhance Care. Health Aff (Millwood). 2016 Apr;35(4):575–82.

3. Reeve BB, Wyrwich KW, Wu AW, Velikova G, Terwee CB, Snyder CF, et al. ISOQOL recommends minimum standards for patient-reported outcome measures used in patient-centered outcomes and comparative effectiveness research. Qual Life Res. 2013 Oct;22(8):1889–905.

4. Basch E, Deal AM, Kris MG, Scher HI, Hudis CA, Sabbatini P, et al. Symptom Monitoring With Patient-Reported Outcomes During Routine Cancer Treatment: A Randomized Controlled Trial. J Clin Oncol. 2016 Feb 20;34(6):557–65.

5. Basch E, Iasonos A, Barz A, Culkin A, Kris MG, Artz D, et al. Long-Term Toxicity Monitoring via Electronic Patient-Reported Outcomes in Patients Receiving Chemotherapy. J Clin Oncol. 2007 Dec;25(34):5374–80.

6. Greenhalgh J, Meadows K. The effectiveness of the use of patient-based measures of health in routine practice in improving the process and outcomes of patient care: a literature review. J Eval Clin Pract. 1999 Dec;5(4):401–16.

7. Freel J, Bellon J. Better Physician Ratings from Discussing PROs with Patients. :11.

8. Detmar SB, Muller MJ, Schornagel JH, Wever LDV, Aaronson NK. Health-Related Quality-of-Life Assessments and Patient-Physician Communication: A Randomized Controlled Trial. JAMA. 2002 Dec 18;288(23):3027.

9. Velikova G, Booth L, Smith AB, Brown PM, Lynch P, Brown JM, et al. Measuring Quality of Life in Routine Oncology Practice Improves Communication and Patient Well-Being: A Randomized Controlled Trial. J Clin Oncol. 2004 Feb 15;22(4):714–24.

10. Mecoli CA, Park JK, Alexanderson H, Regardt M, Needham M, de Groot I, et al. Perceptions of Patients, Caregivers, and Healthcare Providers of Idiopathic Inflammatory Myopathies: An International OMERACT Study. J Rheumatol. 2019 Jan;46(1):106–11.

11. Barton JL, Imboden J, Graf J, Glidden D, Yelin EH, Schillinger D. Patient-physician discordance in assessments of global disease severity in rheumatoid arthritis. Arthritis Care Res. 2010 Jun;62(6):857–64.

12. Bartlett SJ, De Leon E, Orbai A-M, Haque UJ, Manno RL, Ruffing V, et al. Patient-reported outcomes in RA care improve patient communication, decision-making, satisfaction and confidence: qualitative results. Rheumatology. 2019 Oct 30;kez506.
13. Noonan VK, Lyddiatt A, Ware P, Jaglal SB, Riopelle RJ, Bingham CO, et al. Montreal Accord on Patient-Reported Outcomes (PROs) use series – Paper 3: patient-reported outcomes can facilitate shared decision-making and guide self-management. J Clin Epidemiol. 2017 Sep;89:125–35.

14. Castro EM, Van Regenmortel T, Vanhaecht K, Sermeus W, Van Hecke A. Patient empowerment, patient participation and patient-centeredness in hospital care: A concept analysis based on a literature review. Patient Educ Couns. 2016 Dec;99(12):1923–39.

15. Santana M-J, Feeny D. Framework to assess the effects of using patient-reported outcome measures in chronic care management. Qual Life Res. 2014 Jun;23(5):1505–13.

16. Lapin B, Udeh B, Bautista JF, Katzan IL. Patient experience with patient-reported outcome measures in neurologic practice. Neurology. 2018 Sep 18;91(12):e1135–51.

17. Agency for Healthcare Research and Quality. CAHPS Clinician & Group Survey [Internet]. [cited 2019 Nov 2]. Available from: https://www.ahrq.gov/cahps/surveys-guidance/cg/index.html

18. Lapin BR, Honomich RD, Thompson NR, Rose S, Sugano D, Udeh B, et al. Association Between Patient Experience With Patient-Reported Outcome Measurements and Overall Satisfaction With Care in Neurology. Value Health. 2019 May;22(5):555–63.

19. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med. 2001 Sep;16(9):606–13.

20. Cella D, Riley W, Stone A, Rothrock N, Reeve B, Yount S, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. J Clin Epidemiol. 2010 Nov;63(11):1179–94.

21. Pincus T, Swearingen CJ, Bergman M, Yazici Y. RAPID3 (Routine Assessment of Patient Index Data 3), a Rheumatoid Arthritis Index Without Formal Joint Counts for Routine Care: Proposed Severity Categories Compared to Disease Activity Score and Clinical Disease Activity Index Categories. J Rheumatol. 2008 Nov;35(11):2136–47.

22. Katzan I, Speck M, Dopler C, Urchek J, Bielawski K, Dunphy C, et al. The Knowledge Program: an Innovative, Comprehensive Electronic Data Capture System and Warehouse. In: AMIA Annual Symposium Proceedings. American Medical Informatics Association.; 2011. p. 683–91.

23. Dyer N, Sorra JS, Smith SA, Cleary P, Hays R. Psychometric Properties of the Consumer Assessment of Healthcare Providers and Systems (CAHPS®) Clinician and Group Adult Visit Survey. Med Care. 2012 Nov;50(Suppl):S28–34.

24. Aslam F, Khan NA. Tools for the Assessment of Comorbidity Burden in Rheumatoid Arthritis. Front Med. 2018 Feb 16;5:39.
25. Quigley DD, Elliott MN, Farley DO, Burkhart Q, Skootsky SA, Hays RD. Specialties Differ in Which Aspects of Doctor Communication Predict Overall Physician Ratings. J Gen Intern Med. 2014 Mar;29(3):447–54.

26. Jackson JL, Chamberlin J, Kroenke K. Predictors of patient satisfaction. Soc Sci Med. 2001 Feb 1;52(4):609–20.

27. Rahmqvist M, Bara A-C. Patient characteristics and quality dimensions related to patient satisfaction. Int J Qual Health Care. 2010 Apr 1;22(2):86–92.

28. Batbaatar E, Dorjdagva J, Luvsannyam A, Savino MM, Amenta P. Determinants of patient satisfaction: a systematic review. Perspect Public Health. 2017 Mar 1;137(2):89–101.

29. Fenton JJ, Jerant AF, Bertakis KD, Franks P. The Cost of Satisfaction: A National Study of Patient Satisfaction, Health Care Utilization, Expenditures, and Mortality. Arch Intern Med. 2012 Mar 12;172(5):405–11.

30. Hall JA, Dornan MC. Patient sociodemographic characteristics as predictors of satisfaction with medical care: A meta-analysis. Soc Sci Med. 1990 Jan 1;30(7):811–8.

31. Ku JH, Danve A, Pang H, Choi D, Rosenbaum JT. Determinants of Patient Satisfaction in an Academic Rheumatology Practice: JCR J Clin Rheumatol. 2015 Aug;21(5):256–62.

32. Jacobi CE, Boshuizen HC, Rupp I, Dinant HJ, Van Den Bos GAM. Quality of rheumatoid arthritis care: the patient’s perspective. Int J Qual Health Care. 2004 Feb 1;16(1):73–81.

33. Greenhalgh J, Gooding K, Gibbons E, Dalkin S, Wright J, Valderas J, et al. How do patient reported outcome measures (PROMs) support clinician-patient communication and patient care? A realist synthesis. J Patient-Rep Outcomes. 2018 Dec;2(1):42.

34. Castrejón I, Pincus T. Patient self-report outcomes to guide a treat-to-target strategy in clinical trials and usual clinical care of rheumatoid arthritis. Clin Experimental Rheumatol. 2012;30(4):S50-55.

35. Strand V, Cohen S, Crawford B, Smolen JS, Scott DL. Patient-reported outcomes better discriminate active treatment from placebo in randomized controlled trials in rheumatoid arthritis. Rheumatology. 2004 May;43(5):640–7.

36. Tesler R, Sorra J. CAHPS Survey Administration: What We Know and Potential Research Questions. AHRQ; 2017.
Figure legends

Figure 1. Flow Chart of Study Cohorts. CAHPS: Consumer Assessment of Healthcare Providers and Systems. PROMS: Patient-reported outcome measures

Figure 2. Predicted probability of satisfaction measures for PROMs completion status by new versus established patient. Predicted probabilities from multivariable mixed effects models (Table 4) for A) top box provider rating and B) overall satisfaction with care for established and new patients completing versus not completing PROMs. PROMS: patient-reported outcome measures.
# Table 1. Characteristics of Study Cohorts Pre- and Post- PROMs Implementation

| Characteristics                                    | Pre-Implementation Cohort | Post-Implementation Cohort | P-Value |
|----------------------------------------------------|---------------------------|----------------------------|---------|
| **N=2117**                                         |                           | **N=2380**                 |         |
| Female Sex, N (%)                                  | 1562 (73.8)               | 1778 (74.7)               | 0.502   |
| New Patients (vs Established Patients), N (%)      | 408 (19.3)                | 537 (22.6)                | 0.008   |
| Non-White, N (%)                                   | 210 (10.0)                | 277 (11.7)                | 0.074   |
| Age (years), Mean (SD)                             | 62.76 (13.29)             | 61.62 (13.41)             | 0.004   |
| Median [Q1, Q3]                                    | 64.11 [55.06, 71.71]      | 63.22 [53.86, 70.87]      | 0.004   |
| Married, N (%)                                     | 1469 (70.5)               | 1610 (68.8)               | 0.245   |
| College Degree or Higher*, N (%)                   | 900 (43.0)                | 1021 (43.3)               | 0.863   |
| Household Income (per $10k), Median [Q1, Q3]       | 5.76 (1.80)               | 5.80 (1.89)               | 0.483   |
| Body Mass Index (BMI), Median [Q1, Q3]             | 27.97 [24.37, 33.16]      | 28.70 [24.70, 33.75]      | 0.013   |
| Charlson Score, Mean (SD)                          | 2.11 (2.11)               | 2.04 (2.16)               | 0.276   |
| Married, N (%)                                     | 1469 (70.5)               | 1610 (68.8)               | 0.245   |
| Diabetes, N (%)                                    | 282 (13.3)                | 291 (12.2)                | 0.292   |
| Cancer, N (%)                                       | 1049 (49.6)               | 1088 (45.7)               | 0.011   |
| Depression, N (%)                                  | 527 (24.9)                | 597 (25.1)                | 0.910   |
| Hypertension, N (%)                                 | 983 (46.4)                | 1059 (44.5)               | 0.203   |
| Low Quality of Life (QOL) ‡, N (%)                 | 1437 (68.3)               | 1659 (70.0)               | 0.230   |
| Patient-Reported Outcomes Measurement Information System (PROMIS) Global Health (GH) Physical, Mean (SD) |                          |                           | 43.89 (8.91) |
| PROMIS GH Mental, Mean (SD)                        |                           |                           | 48.56 (9.20) |
| PROMIS Fatigue, Mean (SD)                          |                           |                           | 54.39 (10.18) |
| PROMIS Pain Interference, Mean (SD)                |                           |                           | 56.42 (8.66) |
| PROMIS Physical Function, Mean (SD)                |                           |                           | 42.76 (8.46) |
| Routine Assessment of Patient Index Data (RAPID) 3, Mean ± SD |                           |                           | 9.74 (6.24) |

SD = standard deviation; Q = quartile; GH = Global health; *Based on CG-CAHPS; ‡Single item rating of overall health from CG-CAHPS, categorized as low if response = “Good”, “Fair”, or “Poor”
Table 2. Frequency of topbox responses by item and global measures with unadjusted odds ratios

| Outcomes | Pre-Implementation Cohort N (%) | Post-Implementation Cohort N (%) | Unadjusted Odds Ratio (95% CI) | P-Value |
|----------|---------------------------------|---------------------------------|-------------------------------|---------|
| **Communication Domain Questions** | | | | |
| Explained things in a way that was easy to understand | 1853 (94.01) | 2097 (94.37) | 1.08 (0.75, 1.56) | 0.681 |
| Listened carefully | 1860 (94.37) | 2100 (94.59) | 1.11 (0.72, 1.71) | 0.646 |
| Concerns answered with easy to understand information | 1736 (91.51) | 2009 (93.75) | 1.68 (1.14, 2.48) | 0.009 |
| Knew important information about medical history | 1778 (90.48) | 1997 (90.12) | 1.30 (0.6, 2.81) | 0.506 |
| Showed respect for what you had to say | 1878 (95.09) | 2134 (95.95) | 1.43 (0.89, 2.29) | 0.137 |
| Spent enough time | 1864 (94.57) | 2099 (94.51) | 0.99 (0.72, 1.36) | 0.950 |
| **Global Measures** | | | | |
| Provider Rating 9 or 10 | 1729 (88.21) | 1963 (88.62) | 1.11 (0.82, 1.5) | 0.494 |
| Recommend provider's office to family/friends | 1813 (92.36) | 2081 (93.53) | 1.44 (0.94, 2.19) | 0.094 |
| Overall Satisfaction with Care | 1675 (85.77) | 1881 (85.62) | 1.02 (0.76, 1.37) | 0.912 |

Odds Ratios presented for Post-Implementation Cohort (with Pre-Implementation Cohort as the referent)

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.

1. Sample size varied between items, due to missingness.

CI: confidence interval.
Table 3. Multivariable models for predicting provider rating, provider recommendation, and satisfaction with care

| Characteristics                  | Model 1. Provider Rating N= 4029 | Model 2. Provider Recommendation N= 4040 | Model 3. Overall Satisfaction with Care N= 4007 |
|----------------------------------|----------------------------------|------------------------------------------|-----------------------------------------------|
|                                  | Odds Ratio (95% CI) | P-Value | Odds Ratio (95% CI) | P-Value | Odds Ratio (95% CI) | P-Value |
| Cohort                           | 1.05 (0.84, 1.31)  | 0.668   | 1.20 (0.91, 1.60)  | 0.204   | 0.97 (0.79, 1.19)  | 0.765   |
| New Patient (vs Established Patient) | 0.56 (0.43, 0.73)  | <0.001  | 0.70 (0.50, 0.98)  | 0.039   | 0.60 (0.47, 0.77)  | <0.001  |
| Age (per year)                   | 1.29 (1.15, 1.44)  | <0.001  | 1.56 (1.34, 1.81)  | <0.001  | 1.19 (1.07, 1.32)  | <0.001  |
| Female (vs Male)                 | 0.70 (0.53, 0.92)  | 0.009   | 0.43 (0.29, 0.64)  | <0.001  | 0.68 (0.53, 0.87)  | <0.001  |
| Married (vs Non-Married)         | 1.25 (0.98, 1.58)  | 0.068   | 0.89 (0.66, 1.21)  | 0.458   | 1.26 (1.01, 1.56)  | 0.039   |
| Non-White (vs White)             | 0.89 (0.64, 1.24)  | 0.495   | 1.13 (0.72, 1.75)  | 0.600   | 1.00 (0.73, 1.38)  | 0.997   |
| Income (per $10k)                | 1.00 (0.94, 1.06)  | 0.941   | 0.95 (0.88, 1.03)  | 0.191   | 1.00 (0.95, 1.06)  | 0.928   |
| College Degree or Higher (vs <College)* | 0.99 (0.78, 1.24)  | 0.897   | 1.08 (0.81, 1.44)  | 0.606   | 0.99 (0.8, 1.22)   | 0.939   |
| Charlson Score                   | 1.01 (0.95, 1.06)  | 0.832   | 1.01 (0.94, 1.09)  | 0.696   | 1.01 (0.96, 1.07)  | 0.618   |
| Low QOL†                         | 0.49 (0.37, 0.65)  | <0.001  | 0.43 (0.30, 0.61)  | <0.001  | 0.48 (0.37, 0.61)  | <0.001  |

Cohort Odds Ratios presented for Post-Implementation Cohort (with Pre-Implementation Cohort as the referent); 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.

* Based on CG-CAHPS; † Single item rating of overall health from CG-CAHPS, categorized as low if response = “Good”, “Fair”, or “Poor”

CI: confidence interval, QOL: quality of life
Table 4. Multivariable models for predicting provider ratings, provider recommendation, and overall satisfaction post-implementation cohort

| Characteristics                  | Model 1. Provider Rating N= 2145 | Model 2. Provider Recommendation N= 2153 | Model 3. Overall Satisfaction with Care N= 2130 |
|----------------------------------|----------------------------------|------------------------------------------|-----------------------------------------------|
| Completed PROMs                  | 0.83 (0.52, 1.34)                | 1.18 (0.70, 1.98)                        | 0.71 (0.46, 1.10)                             |
| New Patient (vs Established Patient) | 0.33 (0.13, 0.81)               | 0.98 (0.64, 1.52)                        | 0.34 (0.14, 0.78)                             |
| Age (year)                       | 1.35 (1.17, 1.56)               | 1.61 (1.34, 1.94)                        | 1.19 (1.05, 1.36)                             |
| Female (vs Male)                 | 0.85 (0.60, 1.19)               | 0.63 (0.39, 1.00)                        | 0.80 (0.59, 1.09)                             |
| Married (vs Non-Married)         | 0.98 (0.72, 1.33)               | 0.79 (0.53, 1.17)                        | 1.07 (0.81, 1.41)                             |
| Non-White (vs White)             | 0.90 (0.59, 1.37)               | 1.14 (0.65, 2.01)                        | 0.99 (0.66, 1.47)                             |
| Income (per $10k)                | 0.95 (0.88, 1.03)               | 0.93 (0.84, 1.03)                        | 0.97 (0.90, 1.04)                             |
| College Degree or Higher (vs <College)* | 0.87 (0.65, 1.17)               | 0.95 (0.65, 1.38)                        | 0.94 (0.72, 1.22)                             |
| Charlson Score                   | 1.03 (0.96, 1.10)               | 1.08 (0.97, 1.19)                        | 1.04 (0.97, 1.11)                             |
| Low QOL†                         | 0.52 (0.37, 0.74)               | 0.49 (0.31, 0.77)                        | 0.53 (0.39, 0.72)                             |
| Interaction: Completed PROMs X New Patient | 2.4 (0.93, 6.19)               | -                                         | 2.46 (1.01, 6.00)                             |

* Based on CG-CAHPS; † Single item rating of overall health from CG-CAHPS, categorized as low if response = “Good”, “Fair”, or “Poor”

CI: confidence interval, PROMS: patient-reported outcome measures, QOL: quality of life

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Figure 1. Flow Chart of Study Cohorts. CAHPS: Consumer Assessment of Healthcare Providers and Systems. PROMS: Patient-reported outcome measures.
Figure 2. Predicted probability of satisfaction measures for PROMs completion status by new versus established patient. Predicted probabilities from multivariable mixed effects models (Table 4) for A) top box provider rating and B) overall satisfaction with care for established and new patients completing versus not completing PROMs. PROMS: patient reported outcome measures.
Figure 2. Predicted probability of satisfaction measures for PROMs completion status by new versus established patient. Predicted probabilities from multivariable mixed effects models (Table 4) for A) top box provider rating and B) overall satisfaction with care for established and new patients completing versus not completing PROMs. PROMs: patient reported outcome measures.