

CASE STUDY

The Benefits of Capturing PROMs in the EMR

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Patient-reported outcome measures (PROMs) quantify patient-perceived health across numerous domains, such as physical function, pain, and mental health. These measures are critical components of numerous aspects of health care delivery, including shared decision-making, post-intervention monitoring, research, quality, and value-based health care. However, despite its importance, routine PROM measurement in the ambulatory setting — especially in high-volume practices such as orthopedic surgery — presents technological, financial, logistical, and administrative burdens. This case study highlights how integrating a PROM platform into a native electronic medical record and clinical workflow can result in successful data collection in the ambulatory orthopedic setting. Moreover, the authors identify foundational elements for large-scale PROM collection.

KEY TAKEAWAYS

- » Patient-reported outcome measures (PROMs) play critical roles in clinical care, quality, research, and value-based health care.
- » PROMs can be challenging to measure in a routine fashion in busy ambulatory clinics.
- » To be successful, PROM collection needs a clinician champion and active support from system leadership, with integration into existing clinical workflows and results available in real time for clinicians.

The Challenge

As health care moves toward value-based reimbursement, it will be essential to measure outcomes that matter most to patients.¹⁻³ Health care leaders must ensure that these measures are collected and reported upon across their organization to demonstrate the practice of high-value care. Within orthopedics, patient-reported outcome measures (PROMs) have become invaluable tools in assessing patient health across a variety of health domains (pain, function, mental health, and quality of life).

Despite the obvious importance of administering and measuring PROMs as part of routine clinical care, most health care organizations struggle in executing upon this practice.^{4,5} Numerous logistical, financial, technological, and managerial constraints hinder successful PROM collection. In 2019, the Department of Orthopedic Surgery at the Henry Ford Health System (HFHS) conducted five PROM collection initiatives with variable efficacy (Table 1). Only a minority of patients (and clinicians) participated in PROM collection, and patients did not have access to or awareness of the data captured in this process.

From a systemwide perspective, leadership understood that PROMs represent a critical component for value-based, patient-centric care. At baseline, PROMs were collected in various capacities in different clinical settings, but there was no unified approach or mechanism for PROM collection. Moreover, departments that were interested in bolstering PROM collection were independently negotiating potential contracts with PROM vendors. Engagement with multiple vendors would result in significant burden to IT staff with regards to implementation and integration, along with unsustainable costs with multiple department contracts. Therefore, there was a pressing need to adopt a foundational platform for PROM collection that could easily be expanded throughout the health system in numerous capacities.

The Goal

To improve the quality of patient-centered care, the Department of Orthopedic Surgery at the HFHS undertook an initiative to create a PROM platform housed within the native electronic medical record (EMR) and integrated into the current clinical workflow. This capability would

Table 1. Prior Division-Led Patient-Reported Outcome Measure Collection Initiatives

Division	Method of Collection	Patient Population	Who Collected	Efficacy
Arthroplasty	REDCap (tablet), paper, phone	BCBS value patients (surgical)	Perioperative RN, MA	Variable
Trauma	EMR (Epic)	Ambulatory patients	MA	Variable
Spine	REDCap (tablet)	BCBS value patients (surgical)	MA	High
Sports	REDCap (tablet)	Two of five surgeons, ambulatory patients	RA	High
Shoulder	REDCap (tablet)	One surgeon, ambulatory and research patients	RA	High

REDCap = Research Electronic Data Capture, BCBS = Blue Cross Blue Shield, RN = registered nurse, MA = medical assistant, EMR = electronic medical record, RA = research assistant. Source: Eric C. Makhni.

allow the collection of PROMs for all ambulatory orthopedic patients, not just select groups. The data would be available at the time of the clinical encounter, to be used for assessment and shared decision-making. If successful, the platform could be expanded to other departments within the health system.

The Team

The HFHS is an integrated health system in metro Detroit and Southeast Michigan, employing nearly 4,000 staff and affiliate physicians across 40 different clinical specialties. In 2019, HFHS created an Orthopedic Service Line to unite orthopedic clinicians across five different HFHS hospitals and to increase the clinical footprint in the region. The Orthopedic Service Line employs over 50 surgeons and 20 non-operative clinicians across the five main hospital settings with approximately 187,000 office visits and 21,000 surgeries performed annually.

“ *Despite the obvious importance of administering and measuring PROMs as part of routine clinical care, most health care organizations struggle in executing upon this practice.* ”

Integrating PROMs into the EMR required coordinated efforts between the Orthopedic Service Line and the IT team of HFHS, with support from departmental and health system leadership. The leadership team consisted of an orthopedic surgeon “Clinician Champion,” who designed the platform in collaboration with an IT senior leader and the Chief Medical Information Officer. A project manager from IT who had a clinical background as well as expertise with the EMR coordinated the work of the many IT team members involved in platform construction.

The Execution

In mid-2019, orthopedic and health system leadership decided to create a PROM platform that would be fully integrated within the Epic EMR and existing clinical workflows. This platform had to satisfy five requirements:

- Be electronically and automatically administered to every orthopedic patient at each ambulatory visit
- Integrate into existing clinical workflow and personnel
- Make data accessible to clinicians for review in real time during the ambulatory visit
- Achieve 80% questionnaire completion rate
- Enable quality-driven health care.

Design Phase (September to November 2019)

Through the PROM platform (Figure 1), all patient questionnaires were transitioned from paper versions to electronic versions. We created an intake form that could be used for all new patients. We used the National Institutes of Health Patient-Reported Outcomes Measurement Information System (PROMIS) Computer Adaptive Test (CAT) measures, which are valid and efficient assessment tools with standardized scoring parameters. Numerous studies have demonstrated favorable correlation between PROMIS assessments and traditional PROMs for musculoskeletal conditions. Whenever possible, PROMs were standardized across the Orthopedic Service Line (Table 2). An orthopedic task force consisting of representation from each subspecialty ensured that the questionnaires (and assignment algorithm) and proposed workflow were satisfactory.

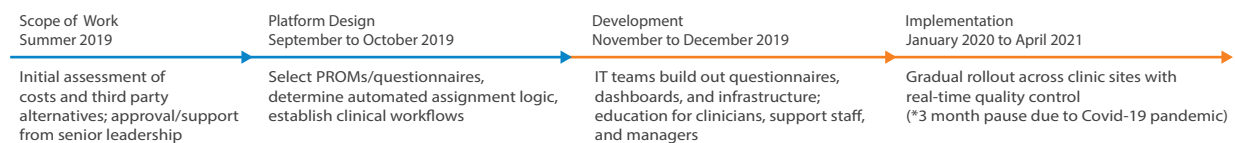
Because PROMIS is domain based (e.g., upper-extremity function) as opposed to diagnosis based (e.g., PROM for rotator cuff tear), the forms could be assigned automatically, according to the reason for the visit (e.g., shoulder) and other discrete data from the appointment recorded.^{6,7} In comparison, if assigning PROMs according to diagnosis, the provider must first make a diagnosis and then manually assign questionnaires. Patients would then have to complete questionnaires (after the evaluation), which can be disruptive when attempting to perform an examination on all ambulatory patients. Moreover, PROM data would not be available for the clinician at the time of the evaluation for shared decision-making purposes.

“*There was a pressing need to adopt a foundational platform for PROM collection that could easily be expanded throughout the health system in numerous capacities.*”

FIGURE 1

Timeline of the Development of the Patient-Reported Outcome Measure (PROM) Platform

The process began with the scope of alt-textwork definition in the summer of 2019, followed by the platform's design and development from September through December of 2019. The implementation began in January of 2020 with a gradual rollout across all clinic sites.



Source: Eric C. Makhni

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Table 2. Patient-Reported Outcome Measure Questionnaire Assignment

Questionnaire	Purpose	Patients	Lookback
Intake	Standardized history for all clinicians	New patients	25 days
PROMIS Physical Function CAT v2.0	Functional assessment	Lower extremity, spine	25 days
PROMIS Upper Extremity CAT v2.0	Functional assessment	Upper extremity	25 days
PROMIS Pain Interference CAT v1.1	Impact of pain on quality of life	All patients, visits	25 days
PROMIS Depression CAT v1.0	Depression symptoms	All patients, visits	12 months
Patient Acceptable Symptomatic State (“PASS”)	Satisfaction with current symptoms	All patients, visits	25 days
Anchor question	Perceived benefit of treatment/surgery	Patients with prior treatment/surgery	25 days

PROMIS = Patient-Reported Outcomes Measurement Information System, CAT = Computer Adaptive Test. Source: Eric C. Makhni.

For this initiative to be successful, patients would need to complete PROMs prior to their clinical evaluation (Figure 2). The proposed workflow gave them two opportunities to do this. First, questionnaires were sent to patients a week before their appointment through the Epic MyChart portal. Second, patients who had not yet completed the surveys by the time they arrived for their appointment could do so while they were waiting, using a tablet computer and Epic’s Welcome Mobile application.

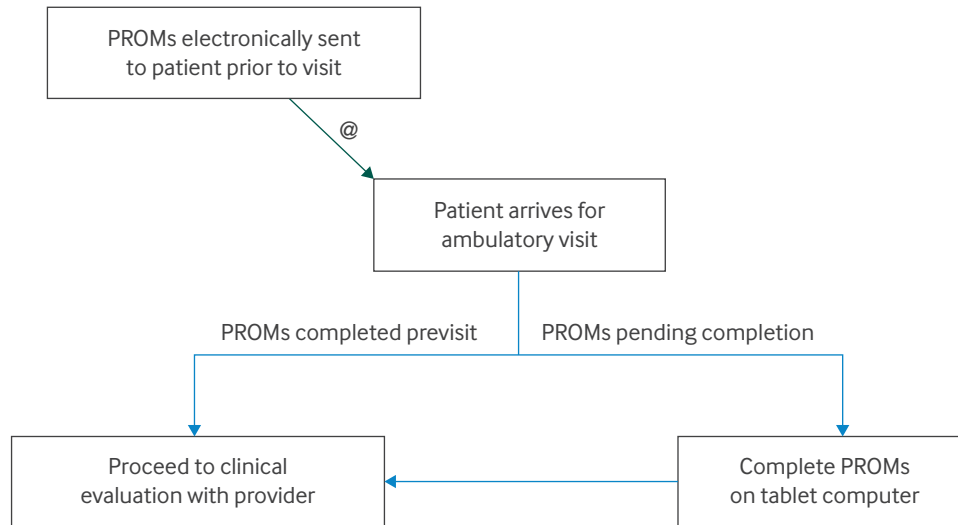
Development Phase (November to December 2019)

The IT team first created all of the questionnaires and PROMIS CAT form modifications to be used in the PROM platform. These surveys were then linked to the patient encounter through an automatic assignment logic based on discrete scheduling parameters (visit type, visit reason, and clinician name). The dashboards of the front desk staff were modified to identify patients who had pending questionnaires, which could be retrieved using a Quick Response code.

FIGURE 2

Patient-Reported Outcome Measure (PROM) Workflow for Questionnaire Completion

Patients are assigned and able to complete questionnaires prior to their visit using MyChart. Surveys not completed at home are given during ambulatory check-in for patients to complete.



Source: Eric C. Makhni

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Clinician tools maximized the incorporation of PROMs into daily clinical routine. They included a patient response dashboard that displayed intake information, PROM scores, and graphs, along with responses to each PROM question (Figure 3). These visualizations were accessible through the EMR and available in real time for the patient and the clinician. Additionally, “smartphrases” allowed clinicians to incorporate information from the intake form, along with PROMIS scores/interpretations, directly into the note (Figure 4).

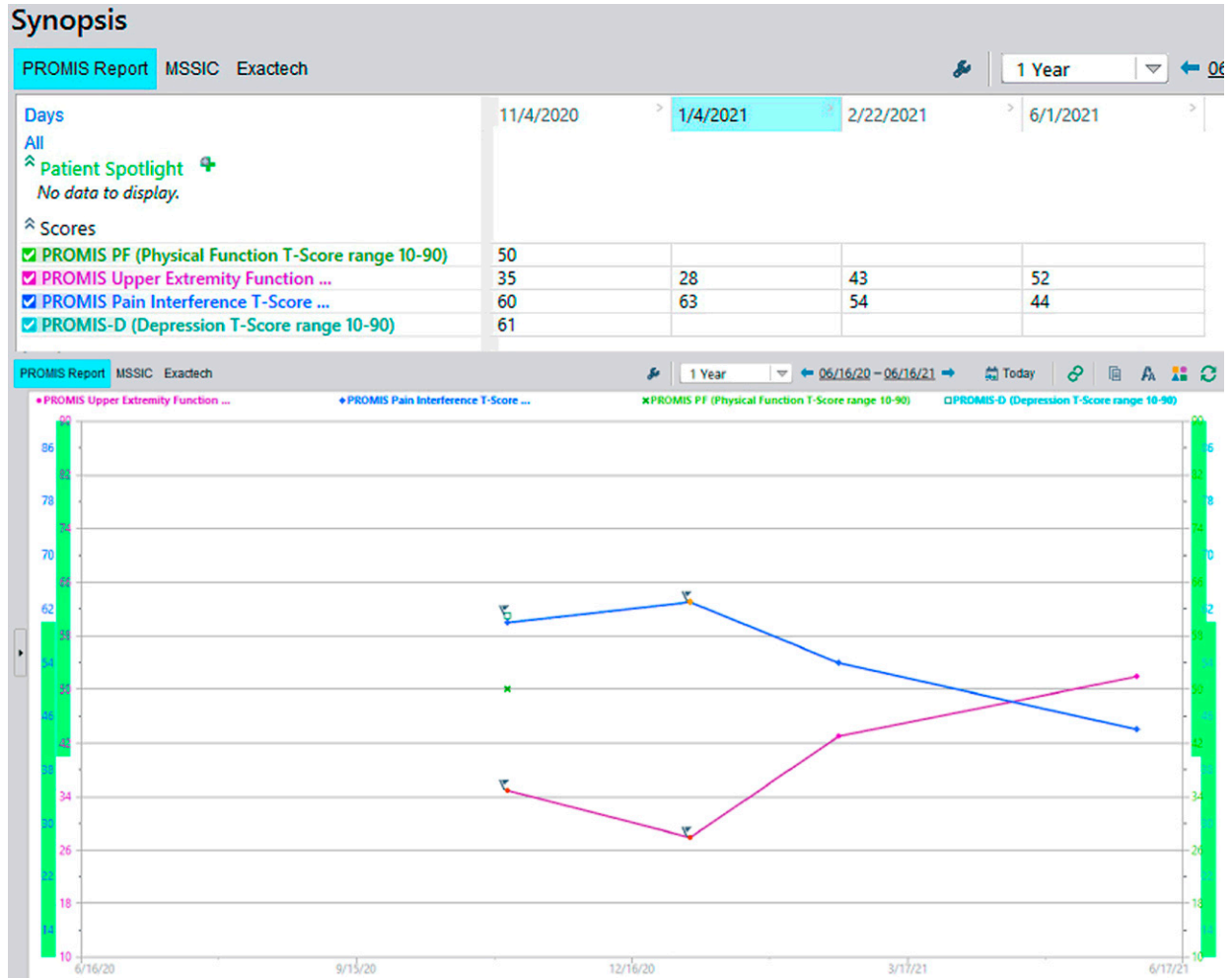
Implementation Phase (January 2020 to April 2021)

The platform was introduced in a stepwise approach over 12 months (with a 4-month pause because of the Covid-19 pandemic). Prior to launch, the clinician champion led educational sessions for clinicians and front desk and support staff, with IT staff on site and on call during the week of the launch. To gain momentum and early success, we first rolled out at smaller satellite clinics with fewer staff and patients. The larger, complex clinical sites (e.g., main hospital clinic) launched later. We allowed for 1 or 2 weeks between clinic launches, depending on the size of the clinic. A

FIGURE 3

Patient Response Data Visualization Dashboard

The dashboard provides the clinician with an initial summary output, detailed responses for each questionnaire, and a graph to track patient patient-reported outcome measures in real time. PROMIS = Patient-Reported Outcomes Measurement Information System.



Source: Eric C. Makhni

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FIGURE 4

“Smartphrase” Output into Clinician Note

A “smartphrase” inserted snippet providing intake questionnaire responses and the most up-to-date patient-reported outcome measure scores, along with the questionnaire score range and an interpretation of the patient’s scores. HFH = Henry Ford Health, Ortho = Orthopedics, PF = Physical Function, PROMIS = Patient-Reported Outcomes Measurement Information System, RN = registered nurse.

A	Ortho Intake Form	1/20/2021
	Who referred you for this appointment?	Allied appointment line at HFH
	What is the main reason for your visit today?	Left knee
	What are your symptoms?	Pain, instability, stiffness
	How did this pain/injury begin?	Ski accident
	When did your pain/injury start?	1/17/21
	Does any other area/part of your body hurt?	No
	What is the level of your pain at rest? (0 indicates no pain, 10 indicates maximum pain)	0
	What is the level of your pain with activity? (0 indicates no pain, 10 indicates maximum pain)	2
	What makes your pain worse?	Lateral movement of my leg, bending leg
	What treatments have you tried so far? Check all that apply	Rest/activity modification, over-the-counter pain medicine
	Are you currently employed?	Yes
	What is your occupation?	RN
	Describe your living situation	Live home/apartment
	Do you currently smoke?	No
	Do you currently drink alcohol?	No
	Within the last 30 days, have you used any drugs (prescription or recreational) other than those required for medical reasons?	Yes
	PROMIS	
B	ORTHO PROMIS SCORES	1/20/2021
	PROMIS PF T-score (range 10–90)	59 (within normal limits)
	PROMIS Pain Interference T-score (range: 10–90)	70 (moderate)
	PROMIS Depression T-score (range 10–90)	34 (within normal limits)

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questionnaire completion dashboard (Figure 5) allowed for compliance tracking by clinical site and clinician. Monthly reports were distributed to the entire service line, including providers, nurse/clinic managers, and leadership, with targeted improvement efforts when applicable.

Metrics

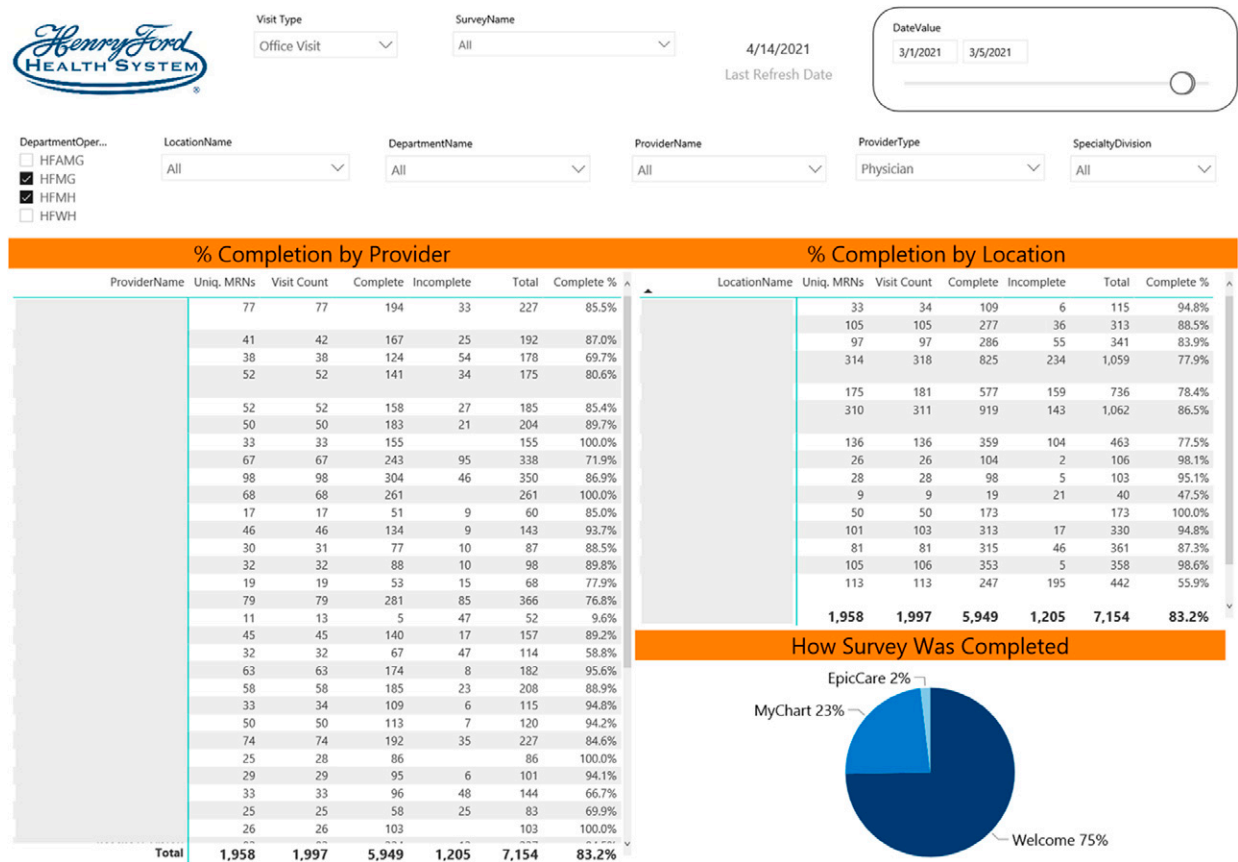
We set a target questionnaire completion rate of 80%.⁸ We anticipated some loss of completion due to numerous factors, such as language barriers (questionnaires were only available in English), patient preference, and any workflow or technological constraints. Questionnaire completion rates were monitored by the clinic on a monthly basis. The platform was slowly reintroduced starting in

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FIGURE 5

Patient-Reported Outcome Measure Questionnaire Completion Dashboard

Questionnaire completion dashboard showing completion rates broken down by provider, location, and method of completion for March 1 to March 5, 2021. Rates may also be filtered by visit type, provider type, and department. HFAMG = Henry Ford Allegiance Medical Group, HFMG = Henry Ford Medical Group, HFMH = Henry Ford Macomb Hospital, HFWH = Henry Ford Wyandotte Hospital, MRN = medical record number.



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June 2020, and we began tracking patient questionnaire completion rates, broken down by clinic and provider, in August 2020. These results can be seen in Figure 6.

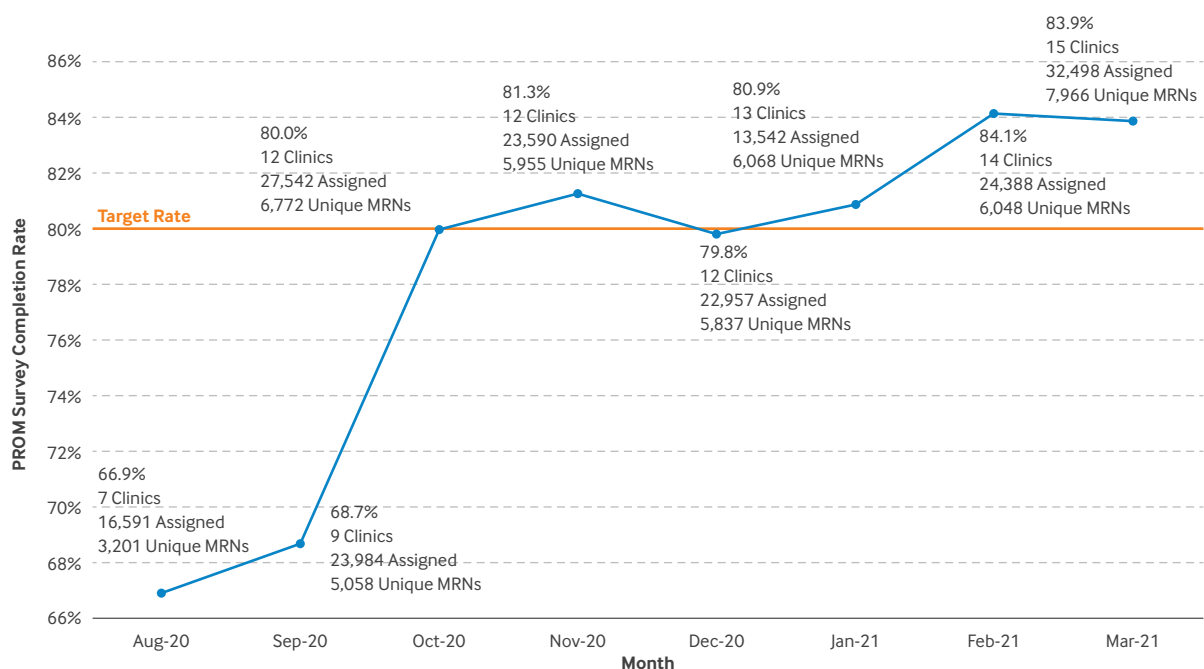
At that time, the platform was live in seven clinics, with a 66.9% completion rate from 16,591 total administered questionnaires. The completion rate and number of clinics increased steadily. By March, the platform had expanded to 15 clinics, with a completion rate of 83.9% (27,262 of 32,501 questionnaires). When sampling January through March 2021, we found the mean completion rate to be 86% ± 7% across all 15 clinic sites (Table 3), with 12 of 15 clinics surpassing the 80% target completion rate.

Successful questionnaire completion varied by age group, which we had anticipated, given our dependence on electronic tools. The highest completion rates were in patients younger than 45 years (89%) compared with patients 45–64 years (84%) and patients 65 years and older (76%).

FIGURE 6

Monthly and Cumulative Patient-Reported Outcome Measure (PROM) Questionnaire Completion Rates

Monthly completion rates for the PROM platform from August 2020 through March 2021 are shown. The number of clinics using the platform, the number of unique medical record numbers (MRNs; patients), and the number of assigned PROMs for each month are shown alongside each monthly rate. Monthly completion rates remained above the target completion rate of 80% in 5 of the last 6 months of this study.



Source: Eric C. Makhni

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Table 3. Completion Rate by Clinic Location January 1, 2021, to March 31, 2021

Location	Unique MRNs	Visit Count	Total Surveys Given	Percent Complete
1	337	473	1,596	98
2	770	1,081	3,655	97
3	526	688	2,143	96
4	218	265	963	95
5	216	259	1,000	90
6	747	1,122	3,448	85
7	1,062	1,492	4,771	85
8	1,884	2,385	8,903	85
9	2,799	3,678	13,671	83
10	1,195	1,669	5,447	82
11	2,579	3,410	12,336	81
12	1,143	1,593	5,938	80
13	2,594	3,785	12,448	78
14	431	484	1,880	76
15	676	787	3,232	74

MRN = medical record number. Source: Eric C. Makhni.

Hurdles

There are numerous hurdles when attempting routine PROM collection in the busy ambulatory setting. Upon securing departmental, service line, and system leadership when building a PROM platform, leadership must facilitate dedicated time for a clinician champion to lead the platform. This clinician must then get buy-in from and consensus by clinicians. To be most effective, patients should be administered a set of PROMs that is standardized by division or department. Even though there are hundreds of validated PROMs in orthopedics, our department chose three core PROMIS CAT measures for most of our patients. It can be expected that clinicians may have different preferences regarding which PROMs should be collected compared with others. To overcome this hurdle, the taskforce came to a consensus on a “core” set of PROMIS forms, with additional forms allowable, provided they were standard for all clinicians within a given division and would not lead to survey fatigue. Getting such cooperation from clinicians can be challenging.

“ *The data would be available at the time of the clinical encounter, to be used for assessment and shared decision-making.* ”

Second, such an initiative must be prioritized by the IT team. There must be dedicated personnel and support teams that can focus on platform development, troubleshooting, and evolution.

Availability of such support has become more challenging because of the Covid-19 pandemic. However, health care practices can use third-party PROM vendors to provide the technical platform for collection, if needed. Regardless of technical team, PROM administration should be integrated into existing clinical workflows, with results available in real time for clinicians to use during clinic visits.⁹ Moreover, because our platform is housed within Epic, it is not uncommon to encounter errors or changes corresponding to Epic upgrades. Therefore, there must be continuous monitoring of questionnaire assignment accuracy by the clinical and IT teams.

Finally, there was apprehension from clinical support teams, typically clinic managers and front desk managers, that incorporating questionnaires could lead to workflow delays and patient dissatisfaction. This concern is precisely why we began platform rollout at small clinics, with workflows that were streamlined. As an increasing number of clinics went live, our data in support of efficient operations without patient delays helped appease clinical managers from larger clinics. We also worked with clinicians and staff to minimize survey burden in “low-value” scenarios, such as patients coming for initial post-operative checks or wound checks or as part of a serial injection treatment series. In these scenarios, PROM scores were of low utility, and we programmed our algorithm to eliminate questionnaire assignment for these patients. Finally, given the heterogeneity of our many orthopedic clinics with regards to patient volumes and workflows, we made sure to incorporate feedback and input operational leadership and nurse managers in our PROM workflow for each clinic.

Where to Start

PROMs should be collected from all patients and not just for surgical or research purposes.^{6,7} Therefore, health care practices and systems should consider development of PROM platforms, to effectively collect these data. Our EMR was able to incorporate such collection into existing processes; health systems that use incompatible EMRs may need to consider third-party providers. PROM platform development involves numerous stakeholders, ranging from hospital leadership and managers to individual providers, IT, and clinical support staff. Although there are clearly costs associated with the development of a PROM platform, the marginal cost for additional departments and service lines is significantly lower. Moreover, incorporation of PROM data into research grants and alternative payment models (e.g., condition-based bundles) may increase revenue streams.¹⁰

Next Steps

As the PROM platform became integrated into routine practice, we identified numerous clinical applications (Table 4).

Our next step is to improve our analytics applications of PROMs, including clinical registries for specific patient cohorts and streamlined PROM reporting for research and quality applications. Additionally, we plan to incorporate pre- and post-operative data into predictive models that can aid in shared decision-making prior to surgery, as had been done previously by our group for meniscus surgery.^{11,12} We will also expand the PROM platform to other departments and service

Table 4. Meaningful Applications of the PROM Platform

Application	Description
Documentation	PROM scores and interpretations are available for automated import into clinical documentation. Intake data for new patient encounters can also be automatically imported.
Operations	Integration of new patient intake questionnaires into PROM platform eliminates need for similar paperwork to be completed upon registration. By using a 25-day lookback, survey burden can be reduced for patients who are seeing multiple orthopedic physicians within the department (e.g., patient seen for knee arthritis in the sports medicine clinic who requires referral to joint replacement service for surgical consultation).
Patient monitoring	PROM scores are used for post-operative and post-intervention patient monitoring (e.g., determining response to treatment).
Shared decision-making	Baseline PROM scores are incorporated into shared decision-making conversations during surgical evaluation. Patients with high functional or low pain scores may have lower likelihood of improving from surgery. ¹¹
Virtual care	PROM scores are collected as part of virtual care visits, enhancing the data available for these encounters.
Clinical quality and reporting	Automation of PROM collection for patients in statewide quality initiatives improves participation in registries. Creation of clinical registries can allow for quality efforts within the department.
Clinical research	Integration of PROM collection into ambulatory care for all orthopedic physicians increases the amount of data available for use in clinical research studies. Moreover, the platform can be used to seamlessly assign questionnaires to patients currently participating in prospective clinical trials.

PROM = patient-reported outcome measure. Source: Eric C. Makhni.

lines within the organization, with initial focus on neurosurgery and oncology. These departments were chosen not only because of the potential impact of integrating PROMs into clinical and research activities, but also because they have numerous clinical champions and the requisite organizational infrastructure to facilitate a successful implementation.

We are also leveraging the PROM platform to deliver innovative, high-value, and high-quality patient care. One example of this is the introduction of Integrated Practice Units focused on chronic back and joint pain. Patients in these clinics receive not only multidisciplinary, team-based care, but also tailored specialty care (i.e., behavioral health, physical therapy, and nutrition services) on the basis of responses to PROMs.

Significant efforts will be made toward improving patient education about PROMs, including how to interpret their PROM scores, and in improving the rates of previsit remote collection, which will help improve workflow by minimizing the need for in-person collection during the ambulatory encounter. We will commence clinical studies to examine the impact of the PROM platform on patient and physician satisfaction, as well as patient perceptions of physician communication.¹³ Finally, we are working to better integrate our PROM collection into our virtual care encounters.

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