Surgeon-Perceived Requirements for a Platform to Integrate Patient-Reported Outcome Measures into Clinical Practice

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Abstract

Background Patient-reported outcome measures (PROMs) are standardized, validated tools that translate subjective patient-reported concerns about their health status into quantitative data. PROMs were initially developed as research instruments; however, they have more recently been recognized as important clinical tools. PROMs have not been widely adopted into surgical practices and this study sought to uncover the system requirements of a platform to integrate PROMs into surgical practice, as perceived by surgeons.

Methods Semi-structured interviews were performed from November 2019 until August of 2020. Interviews continued until thematic saturation was achieved. All interviews were recorded and transcribed verbatim. Qualitative interview data were thematically analyzed using an inductive approach.

Results Analysis revealed 12 system features desired by surgeons for a platform to integrate PROMs into clinical use. These were further grouped into four unique overarching themes. Surgeons asserted that the platform must (1) be user-friendly, (2) promote information transparency, (3) incorporate validated questionnaires while still allowing for some degree of customizability, and (4) support the collection and display of longitudinal data.

Conclusions Health care systems planning to develop a platform to integrate PROMs into their clinical practices should investigate the feasibility of the system features identified as essential by this study. While surgeons represent an important stakeholder group when designing a new platform for use in surgical practice, it will also be crucial to explore the features desired by patients before designing or adopting a platform for clinical use.

Keywords

► patient-reported outcome

► patient-reported outcome measures

► informatics

► system requirements

► electronic health record

► surgery

Introduction

Patient-reported outcome (PRO) measures are standardized, validated tools that collect subjective patient-reported concerns including symptoms, functional well-being, and mental health into quantitative outcome data.[1] PRO measures (PROMs) were initially developed as research instruments; however, they have more recently been recognized as important clinical tools.[2–5] Routinely capturing PROMs facilitates the longitudinal measurement of outcomes from the patient's perspective and has been shown to improve patient engagement with shared- decision making, symptom management, and the patient experience.[4,6–12] Therefore, integrating PROMs into standard clinical practice is an essential step toward patient-centered health care.[6]

PROMs are especially important in the field of surgery where the impact of a specific surgical procedure can be evaluated both before and after the intervention using measurements most meaningful for patients themselves.[3,10,13–15] Surgeons have already harnessed the power of PROM collection for research.[16] Retrospectively analyzing PROMs aggregated from groups of patients has informed surgical decision making and continues to inform patient-centered care and precision medicine.[17] Additionally, PROMs can inform appropriate patient selection for select surgeries.[9,18]

Despite the increased recognition of the value of integrating PROMs into clinical practice, PROMs have not been routinely integrated into standard surgical workflows in most health systems.[1,2,19–23] Integrating large amounts of novel data into clinical workflows introduces new challenges and remains a primary barrier to the adoption of PROMs into standard clinical practices.[17,24,25] Additionally, while numerous platforms have been developed to support the collection of PROMs, few have been specifically designed for surgical practice.[1,17,26–29] There is a paucity of literature focused on understanding the essential features of PROM platforms for diverse surgical practices.[4,5,30,31] Therefore, we applied qualitative methodology to assess what surgeons perceive are the principal system requirements of a platform to integrate PROMs into surgical practice.

Methods

Interview Protocol
After reviewing existing literature, a semi-structured interview guide was developed to explore current experience with PROMs, opinions on the advantages and disadvantages of implementing PROMs into clinical practice, and the essential features of a platform for integration of PROMs into surgical workflows. This guide was then iteratively refined through review by surgical faculty and investigators. This study was reviewed and approved by the institutional review board.

Data Collection
The research team conducted in person or phone interviews with surgeons from a quaternary care academic medical center between November 2019 and August 2020. After obtaining consent, all interviews were audio-recorded, transcribed verbatim, and ultimately deidentified. An interview guide was used by the research team to conduct the interviews (►Supplementary Fig. S1, available in the online version). All transcripts were independently reviewed by a secondary investigator for completeness and accuracy.

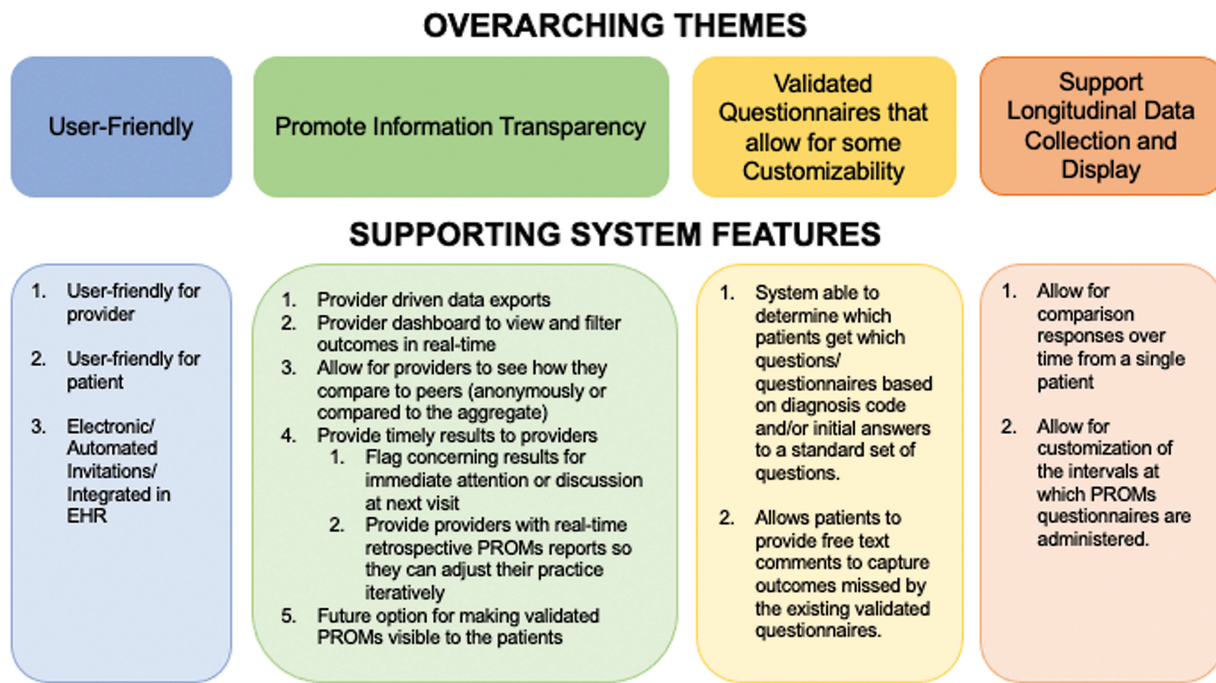### Determination of Thematic Saturation
In order to recruit participants from a variety of surgical specialties, and with variable prior experience with PROMs, a purposeful sampling strategy was utilized. Surgeons who were identified as potential participants were recruited and scheduled for interviews via email. Following the transcription of the first three interviews, the interviews were coded, and a preliminary coding manual was created. As subsequent interviews were performed, each transcription was analyzed using the preliminary coding manual and new codes were added as needed. The number of new codes added with each interview was recorded and plotted on a saturation chart. Interviews were continued until thematic saturation was reached, which was defined as three consecutive interviews without any new additional codes (►Supplementary Fig. S2, available in the online version).

Data Analysis
Inductive content analysis was then used to analyze the interview data. Transcripts were coded by two independent reviewers using Atlas.TI qualitative software. After independently analyzing a subset of transcripts ($N = 3$), investigators met to discuss the coding manual. Each subsequent interview was analyzed for new codes until thematic saturation was achieved. An iterative coding process was used to evaluate whether new codes were present in previously coded transcripts. All coding discrepancies were discussed with a third investigator for resolution. Consensus-based review was then conducted to produce an understanding of the general themes (or subcategories) with respect to surgeon's perceptions of the essential system requirements necessary to integrate PROMs into clinical practice. These general themes were then grouped into overarching themes (or content categories) (►Fig. 1).

Results

Nine surgeons representing eight different surgical specialties (Urology, Burn, Endocrine, Trauma, Plastic, Breast, Cardiothoracic, and Vascular) were interviewed as a result of our purposeful sampling strategy. The number of unique codes was graphed for each interview until thematic saturation was reached (►Supplementary Fig. S2, available in the online version). Overall, 47 unique codes were identified. Following a consensus-based review of these codes, 12 general themes were identified representing system features desired by surgeons for a platform to integrate PROMs into clinical use. These were further grouped into four unique organizing themes (►Table 1). Surgeons asserted that the platform must (1) be user-friendly, (2) promote information transparency,

OVERARCHING THEMES

User-Friendly	Promote Information Transparency	Validated Questionnaires that allow for some Customizability	Support Longitudinal Data Collection and Display

SUPPORTING SYSTEM FEATURES

1. User-friendly for provider
 	
2. User-friendly for patient
 	
3. Electronic/ Automated Invitations/ Integrated in EHR
	1. Provider driven data exports
	2. Provider dashboard to view and filter outcomes in real-time
	3. Allow for providers to see how they compare to peers (anonymously or compared to the aggregate)
	4. Provide timely results to providers
	   1. Flag concerning results for immediate attention or discussion at next visit
	   2. Provide providers with real-time retrospective PROMs reports so they can adjust their practice iteratively
	5. Future option for making validated PROMs visible to the patients
		1. System able to determine which patients get which questions/ questionnaires based on diagnosis code and/or initial answers to a standard set of questions.
		
		2. Allows patients to provide free text comments to capture outcomes missed by the existing validated questionnaires.
			1. Allow for comparison responses over time from a single patient
			
			2. Allow for customization of the intervals at which PROMs questionnaires are administered.

Fig. 1 Overarching themes and supporting system features.

(3) incorporate validated questionnaires while still allowing for some degree of customizability, and (4) support the collection and display of longitudinal data. Results are organized by theme (►Tables 1–4).

PRO Platforms Must Be User-Friendly

Surgeons emphasized that in order for PROs to be adopted into surgical practice, the PROM platform must be user-friendly for *both* clinicians and patients, and should be seamlessly integrated into the electronic health record (EHR; ►Table 1). *"Not encumbering the provider, not encumbering the patient, and incorporating them into regular practice."* Surgeons voiced that automation was necessary given that *"there are so many competing factors on patient and clinician time."* Automating the delivery of PROM question-

naires to patients was viewed as a way to incorporate PROMs into clinical workflows without greatly increasing the burden of work for clinicians. *"It would be nice to have some kind of automated system so, you don't have people gathering this [these] data all the time."* Additionally, surgeons voiced that a successful PROM platform would be patient-friendly and would therefore result in higher survey response rates. *"[PROMs] should be more real-time and probably should be delivered in a digital format. I think the way the survey is actually sent out matters."*

A Clinical PRO Platform Must Promote Information Transparency

Participants conveyed that for a PROM platform to be successfully adopted into a surgical practice, the system must

Table 1 Overarching theme 1: PRO platforms must be user-friendly

Theme: surgeons desire user-friendly PRO platforms	
Supporting system features	Representative quote
User friendly for provider	"It would be nice to have some kind of automated system so, you don't have people gathering this data all the time."
User friendly for patient	"The second barrier is the way they are currently collected, which is via snail mail 4 to 6 weeks out. A lot of patients aren't going to remember everything about their stay 4–6 weeks out so probably should be more real time and probably should be delivered in a digital format. I think the way the survey is actually sent out matters."
Electronic/automated invitations/integrated in EHR	"I think we should be routinely collecting a standardized battery of patient-reported outcome measures that we can incorporate seamlessly into the EHR so that we can utilize them on a rapid and regular basis seamlessly in clinic. Not encumbering the provider, not encumbering the patient, and incorporating them into regular practice."

Abbreviations: EHR, electronic health record; PRO, patient reported outcome.

Table 2 Overarching theme 2: a clinical PRO platform must promote information transparency

Theme: a clinical PRO platform must promote information transparency	
Supporting system features	**Representative quote**
Provider-driven data exports	"There needs to be an interface that allow[s] the end user to access their data in a user-friendly way without having to go through an (EHR) report building intermediary."
Provider dashboard to view and filter outcomes in real-time	"[PROs] should be provided as a quality dashboard to provide more real-time feedback so you can adjust the way you practice."
Allow for providers to see how they compare to peers (anonymously or compared to the aggregate)	"It is important for individual surgeons to see their results and to be able to compare to an aggregate to know if they need to make adjustments."

Provide timely results to providers
  I. Flag concerning results for immediate attention or discussion at next visit
  II. Provide clinicians with real-time retrospective PRO reports so they can adjust their practice iteratively
	"Based on validated systems, one can say this patient is not back to their baseline standard at 6 weeks after their surgery, what do we need to do? Are they having problems with physical recovery? Do they need to have a physical therapy evaluation? Are they having problems with psych-social adjustment? Do they need to see a psychologist? Are they having persistent pain that we haven't accounted for in our peri-operative management scheme and therefore need to engage a pain specialist to put in a referral? I believe the utility of these [PROs] are getting real-time feedback for how the patient is feeling and recovering that we may not be addressing or are aware of in our routine and current climate of patient assessment."

Future option for making validated PROs visible to the patients	"[Patients] should have access to [PROs]. But the problem is it has to be standardized, validated questionnaires, and everybody should be doing them"

Abbreviations: EHR, electronic health record; PRO, patient reported outcome.

promote information transparency (►**Table 2**). *"If you give us information, we are apt to use it, but it's got to be timely, appropriate, and useful."* Surgeons expressed that the current systems for requesting EHR data were cumbersome and desired *"an interface that allow[s] the end user to access their data in a user-friendly way without having to go through an (EHR) report building intermediary."* Dashboards were commonly referenced as effective ways for clinicians to view data in a timely manner and compare their PROMs to aggregate data or to anonymous peers. *"[PROMs] should be provided as a quality dashboard to provide more real-time feedback so you can adjust the way you practice."* The ability to periodically review retrospective PROMs at the level of populations of patients undergoing similar operations to improve care for future patients was viewed as fundamental to the surgeons interviewed. *"I also see the value of long-term tracking of patient outcomes and cohort analysis so that we can do a better job as a provider not just at an individual level but at the patient population level."*

Surgeons also wanted a system that can flag concerning results. *"I believe the utility of these [PROMs] are getting real-time feedback for how the patient is feeling and recovering that we may not be addressing or are aware of in our routine and current climate of patient assessment."* The recognized advantages of a system to flag abnormal results included earlier detection of symptoms or complications requiring immediate intervention as well as identification of patients who would benefit from additional resources. Conversely, participants raised concerns about the additional responsibility this might place on surgeons to identify a need for intervention and to appropriately intervene. *"I think it is very over-*

whelming for a provider to be like oh now I am not just responsible for making a decision about cancer care but also responsible for these patient-reported things? I think that kind of information fatigue is real."

Lastly, some participants voiced a desire to be able to share individual PROMs with each patient over time. However, the idea of giving patients unrestricted access to each provider's PROMs was controversial. Similarly, a system that allows clinicians to see how they compare to their anonymous, aggregate peers was viewed as valuable. *"It is important for individual surgeons to see their results and to be able to compare to an aggregate to know if they need to make adjustments."* Nevertheless, surgeons expressed concerns about having their identifiable PROM data visible to their peers and about institutions using PROMs for professional evaluation. *"It may create an environment that is unhealthy if everyone saw everyone's data"* and *"it could be dangerous if it was used as a metric to generate competition between users."*

The System Must Include Validated Questionnaires While Allowing for Some Customizability

Surgeons recognized the value of validated PROM questionnaires. *"Validated measures are important because they help you standardize across other hospitals." "…it has to be standardized, validated questionnaires, and everybody should be doing them"* (►**Table 3**). However, given that there are many diverse surgical practices, participants wanted a system that allowed for customization. One surgeon said, *"individual providers or clinics or service lines [should have] specific PROMs geared at their outcomes that they desire to track as well as generalized ones."* Providing patients the opportunity

Table 3 Overarching theme 3: the system must include validated questionnaires while allowing for some customizability

Theme: the system must include validated questionnaires while allowing for some customizability	
Supporting system features	**Representative quote**
System able to determine which patients get which questions/questionnaires based on diagnosis code and/or initial answers to a standard set of questions.	"An ideal system would know which questions to send to which patients and abbreviate or expand the questions based on [the patient's] responses."
Allows patients to provide free-text comments to capture outcomes missed by the existing validated questionnaires.	"There should be a blank for them to complain because I think we can use that as a platform to see if it is a common complaint and for our processes to improve so patients don't have those complaints after surgery."

to expand on specific concerns using free text was also viewed as useful. Lastly, an ideal system would incorporate branching logic and *"know which questions to send to which patients and abbreviate or expand the questions based on [the patient's] responses."*

The Platform Must Support Longitudinal Data Collection and Display

The ability of a PROM platform to collect and display longitudinal data was considered paramount (►Table 4). Surgeons identified the need to *"look at the temporal trends for an individual patient to track recovery of functionality after surgery, pain scores, social integration, general health, quality of life."* Additionally, participants recognized a need to collect PROMs at frequent, standardized time intervals. *"I would like to find out when is that (complaint) most common, what is the period of time, and when does it start to get better. Because right now it is hard to tell."* They expressed that limiting the collection of PROMs to clinical encounters may limit the ability to capture the true timeline for recovery after surgery which could improve preoperative counseling for future patients.

Discussion

Building on previous work examining clinician perceptions of the utility of PROMs in clinical practice, our study is the first to explore surgeons' perceptions of the essential system requirements of a platform to integrate PROMs into standard clinical workflow.[32,33] Overall, surgeons emphasized the need

for a user-friendly, integrated platform that seamlessly allows longitudinal PROM data collection and intuitively displays outcome measures in a way that is easy to process. While many electronic patient engagement platforms have been developed to aid in the implementation of PROMs into clinical practice, lack of integration of these platforms with EHRs remains a significant barrier to adoption. For example, in a review of available electronic PROM systems in oncology, Jensen et al found that only 44% were directly integrated into the EHR.[34] Multiple surgeons cited frustrations with complex, centralized systems for requesting data exports from the EHRs. Consistent with prior literature, participants expressed interest in either provider-controlled data exports and/or a clinician dashboard that allowed for real-time review of pooled, retrospective PROM data.[17,35–37] Currently surgeons often rely on prior anecdotal experiences to help counsel patients about the quality-of-life differences between treatment options; however, access to a user-friendly retrospective display of PROM data would better allow surgeons to help patients make treatment-related decisions.[38]

Additionally, surgeons underscored the importance of limiting the potential burden of implementing PROMs into clinical practice on patients. Electronic collection of PROMs is generally preferred due to the lower rates of missing data when compared to paper forms and ability to automatically integrate with the EHR.[25,31,39] However, with the increasing ease of assigning surveys through electronic platforms, patients may experience survey fatigue. Additionally, electronic PROMs may exacerbate health care disparities.[7,40] A

Table 4 Overarching theme 4: the platform must support longitudinal data collection and display

Theme: the platform must support longitudinal data collection and display	
Supporting system features	**Representative quote**
Allow for comparison of responses over time from a single patient	"The provider should be able to actually look at the temporal trends for an individual patient to track recovery of functionality after surgery, pain scores, social integration, general health, quality of life."
Allow for customization of the intervals at which PROM questionnaires are administered.	"I would like to find out when is that (complaint) most common, what is the period of time, and when does it start to get better. Because right now it is hard to tell. Not necessarily for intervention but more than anything to be able to tell the other patients that it is a common complaint at this given time."

Abbreviation: PROM, patient reported outcome measure.

recent study of the incorporation of the BREAST-Q PROM into routine clinical practice demonstrated significantly higher response rates for patients who were younger, white, and privately ensured.[41]

A novel feature of a clinical PROM platform desired by surgeons was the ability of the system to flag concerning PROMs for immediate attention or discussion at the next visit. This sentiment is supported by previous literature emphasizing that the widespread adoption of EHRs and patient portals permits real-time assessment and analysis of patient data which should be harnessed to advance precision medicine.[17,27,42,43] However, in order to identify at-risk patients, the normal postoperative trajectory must be well-defined.[7,23] Perhaps the best existing example of using PROMs as a real-time needs assessment is the administration of a depression screen in primary care in order to identify the necessity for a formal evaluation or therapeutic evaluation.[25,44] However, for such a feature to be appropriately adopted, the institution must have the resources to act in real-time on abnormal PROM responses—such as expedited follow-up appointments with the surgeon, referrals to psychiatry, social services, rehabilitation, etc. Previous work has raised similar concerns regarding information overload, provider liability, and the importance of having designated, qualified personnel reviewing PROM data.[17,24,29,36] Therefore, health care systems implementing this desired system feature will need to examine the possible impact such a feature would have on existing clinical workflows and ensure that appropriate resources and procedures are in place to address flagged results in a safe and timely manner.[21,25]

Surgeons perceived different levels of importance for each desired feature of a PROM system. Ultimately, the surgeons interviewed agreed that the system should primarily utilize validated and standardized questionnaires. Perhaps the best-known example of such a system is the Patient Reported Outcome Measurement Information System (PROMIS) which is a collection of PROMs designed to be used across medical specialties and conditions.[30,45] However, all surgeons agreed that some level of customization would be necessary to allow different patient groups to receive disease-specific questionnaires. This is consistent with previous literature which has recommended that both general and condition-specific PROMs be applied concurrently but at different levels of the health system.[17,23,46–48] Moreover, some surgeons felt that patient-level customizability was critical, stating that patients need opportunities *"to express the outcomes that we might not have even taken into consideration."* This is supported by prior research which demonstrated that clinician-based evaluations have varied significantly from patient-reported assessments.[50] Additionally, because many validated PROM measures were developed in relatively homogenous populations, they may not adequately capture the outcomes of interest in more diverse patient populations.[50] Furthermore, in order to adequately integrate PROMs into routine care, validated questionnaires must be able to be altered to assess non-English-proficient patients and patients with differing levels of health literacy.[51]

Despite the universal desire for information transparency, surgeons found the idea of patients or other stakeholders using PROM data to compare providers to one another controversial and problematic. The majority of surgeons perceived value in allowing the platform to display their individual outcomes compared to either the individual outcomes of anonymous peers or the average outcomes for a specialty or practice. However, many of the surgeons interviewed voiced concerns about patients having the ability to compare surgeons to one another and/or institutions using the PROM data for professional evaluation. This result is consistent with previous studies that raised concerns about using PROM data for peer benchmarking, including the validity of the data and the potential for misinterpretation of the data by patients or other consumers.[52–55]

The limitations of this work include data collection from a relatively small number of surgeons. However, standard and prespecified methodology was used to determine number of interviews required to reach thematic saturation. Additionally, interviews were conducted with surgeons within a single, large health care system, which may limit the generalizability of results. Lastly, while the qualitative methodology employed for this study allows us to explore surgeon preferences, it did not quantitatively assess the proportion of surgeons favoring each system feature. Despite the limitations of this work, we believe this study represents a valuable addition to the existing literature by exploring the features desired by surgeons in a platform to integrate PROMs into routine surgical practices. Future work will include taking a user-centered approach to piloting existing PROM platforms and examining the experience of the user including both clinicians and patients.

Conclusion

We performed semi-structured interviews with surgeons representing diverse surgical specialties to better understand surgeons' perceptions of integrating PROMs into clinical practice. Qualitative analysis of the interview transcripts revealed four overarching themes. Surgeons felt the successful integration of PROMs into clinical practice was dependent on the system (1) being user-friendly, (2) promoting information transparency, (3) incorporating existing validated questionnaires while allowing for some degree of customizability, and (4) supporting longitudinal data collection and display. Our interviews revealed interest in a novel capability of a PROM platform to flag outlier results for real-time interventions. Health care systems planning to develop or adopt a platform to integrate PROMs into their clinical practices should investigate the feasibility of the system features identified as essential by this study and seek input from stakeholders ranging from clinicians to the patients themselves.

Clinical Relevance Statement

PROMs were initially developed as research instruments but are now recognized as important clinical tools. Despite this, PROMs have not been widely adopted into surgical practices.

This study identified the surgeon-perceived system requirements of a platform to integrate PROMs into surgical practice.

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Conflict of Interest
None declared.

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