




## Research and Applications

# Examining perspectives on the adoption and use of computer-based patient-reported outcomes among clinicians and health professionals: a Q methodology study

Shirley V. Burton <sup>1</sup>, Annette L. Valenta<sup>1</sup>, Justin Starren <sup>2</sup>, Joanna Abraham <sup>3</sup>,  
Therese Nelson<sup>2</sup>, Karl Kochendorfer<sup>4</sup>, Ashley Hughes<sup>1</sup>, Bhrandon Harris<sup>5</sup>, and  
Andrew Boyd<sup>1</sup>

<sup>1</sup>Department of Biomedical and Health Information Sciences, University of Illinois Chicago, Chicago, Illinois, USA, <sup>2</sup>Department of Preventive Medicine, Northwestern University, Chicago, Illinois, USA, <sup>3</sup>Department of Anesthesiology and Institute for Informatics, Washington University in St. Louis, St. Louis, Missouri, USA, <sup>4</sup>Department of Clinical Family Medicine, University of Illinois Chicago, Chicago, Illinois, USA, and <sup>5</sup>Department of Family Medicine, University of Illinois Chicago, Chicago, Illinois, USA

Corresponding Author: Shirley V. Burton, PhD, MPH, Department of Biomedical and Health Information Sciences, College of Applied Health Sciences, University of Illinois Chicago, 1919 W. Taylor Street, Chicago, IL 60612, USA (burtonsv23@gmail.com)

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### ABSTRACT

**Objective:** To determine factors that influence the adoption and use of patient-reported outcomes (PROs) in the electronic health record (EHR) among users.

**Materials and Methods:** Q methodology, supported by focus groups, semistructured interviews, and a review of the literature was used for data collection about opinions on PROs in the EHR. An iterative thematic analysis resulted in 49 statements that study participants sorted, from most unimportant to most important, under the following condition of instruction: “What issues are most important or most unimportant to you when you think about the adoption and use of patient-reported outcomes within the electronic health record in routine clinical care?” Using purposive sampling, 50 participants were recruited to rank and sort the 49 statements online, using HTMLQ software. Principal component analysis and Varimax rotation were used for data analysis using the PQMethod software.

**Results:** Participants were mostly physicians (24%) or physician/researchers (20%). Eight factors were identified. Factors included the ability of PROs in the EHR to enable: efficient and reliable use; care process improvement and accountability; effective and better symptom assessment; patient involvement for care quality; actionable and practical clinical decisions; graphical review and interpretation of results; use for holistic care planning to reflect patients’ needs; and seamless use for all users.

**Discussion:** The success of PROs in the EHR in clinical settings is not dependent on a “one size fits all” strategy, demonstrated by the diversity of viewpoints identified in this study. A sociotechnical approach for implementing PROs in the EHR may help improve its success and sustainability.

**Conclusions:** PROs in the EHR are most important to users when the technology is used to improve patient outcomes. Future research must focus on the impact of embedding this EHR functionality on care processes.

**Key words:** patient-reported outcomes, Q methodology, socio-technical, patient-centered

## INTRODUCTION

In the United States, rapidly rising healthcare costs and shortfalls in care delivery have resulted in an urgent need to prioritize care quality and patient outcomes.<sup>1,2</sup> Patient-reported outcomes (PROs) in electronic health records (EHRs) have been proposed to support patient-centered care.<sup>3–5</sup> PROs refer to health information reported directly by patients about their symptoms, quality of life, functional status, and satisfaction with treatment, without interpretation by anyone.<sup>6–8</sup>

PROs offer patients the opportunity to be more engaged in their care, participate in decision-making about their care, and improve communication with their providers; however, integrating PROs in the EHR presents its own set of challenges including workflow issues that have been linked to care efficiency, lack of user-friendly interfaces, administrative issues and time related to the burden incurred on patients and healthcare staff when patients complete PROs in the clinical setting.<sup>9,10</sup> Moreover, concerns have been raised about the perceived benefits of PRO measures by both patients and clinicians, access to PRO data at the point of care, patients' inability to access and complete PROs, and a lack of standardized PROs for clinical care.<sup>9,11</sup>

The growing interest in the use of PROs in direct patient care signifies the need to collect and assess the perspectives of users for embedding PROs in the EHR.<sup>10</sup> Prior research has suggested considerations for the successful use of PROs; more specifically, research has suggested input from users in all aspects of the development of PRO measures<sup>12–15</sup> such as their design, the language used for the measures, and the reliability and validity of the measures.<sup>16</sup> Training for users, including improving their ability to interpret and observe changes in PRO measure scores, has also been suggested.<sup>13,17</sup>

Consideration of clinicians' perspectives regarding what is most important to them about this integration, how PROs fit into treatment plans, and how clinicians can maximize the use of PRO data are critical concerns. Such information will help add to the limited research on understanding factors that affect the use of this EHR functionality by clinicians. Moreover, the information can be used for a more comprehensive assessment of patients, thus helping to improve patient outcomes and care quality.

Previous research has used qualitative and quantitative methods to study the effects of barriers and facilitators associated with adopting PROs in the EHR and the difficulties associated with the routine use and interpretation of PRO measures by clinicians.<sup>18–20</sup> These studies have identified barriers to the adoption of PROs in the EHR that include the need for training and education of users, organizational policies, technical support, a clear benefit of PROs in clinical assessment, and describe the burden incurred by clinicians and patients when collecting PROs. Limitations in the development of PROs include convenience sampling of study participants, conflicting researcher perspectives, and the use of only one institution or a specific medical specialty. Other studies have identified several gaps in knowledge related to best practices for informing clinicians and patients about the value of PRO data, for identifying what is most important to users of PROs, for collecting PRO data, and for interpreting PRO data for optimal use and population health purposes.<sup>10,19,21,22</sup> For success in both integration of PROs in the EHR

and its role in decision-making in the clinical setting and the consistent use of the technology by clinicians, gaps must be addressed. Moreover, clinician buy-in, a factor that is important for the use and optimization of the EHR, must also be considered.<sup>23–26</sup>

The objective of this study was to determine the factors that influence clinicians' and other health professionals' decisions to adopt and use PROs within the EHR as a tool for assessing patient care. Insights gained from this study can help in the development of strategies to improve the successful adoption and use of PROs within the EHR, to mitigate barriers that impede adoption and use of the technology, and to establish guidelines for care delivery, quality, and patient-centered services.

## MATERIALS AND METHODS

### Study setting and participants

Two groups of participants with experience working with PROs within the EHR were recruited for this study. Purposive sampling was used to recruit participants for both groups. The first group of participants was recruited for data input to build the study instrument called the Q set. These participants were recruited from teaching hospitals where PROs were implemented and used within the EHR. These participants ( $N=18$ ) worked as physicians ( $n=7$ ); physician/researcher ( $n=1$ ); data manager ( $n=1$ ); informatician ( $n=1$ ); information technology manager ( $n=1$ ); marketing manager ( $n=1$ ); physical therapist ( $n=1$ ); nurse manager ( $n=1$ ); research scientist lead on PRO governance ( $n=1$ ); clinical psychologist/researcher ( $n=1$ ); Quality manager ( $n=1$ ); and PRO researcher ( $n=1$ ).

The second group of participants was recruited from national listservs of organizations and workgroups. This group participated in the online Q sorting of the Q set. Consent for participation in the study was implied once participants submitted their responses for the Q sort. The study was approved by the Human Subjects Research Institutional Review Board of the University of Illinois Chicago.

### Building the study instrument

Q methodology was the methodological approach used for this study because it supports a unique process for studying human subjectivity and for revealing perspectives and attitudes.<sup>27,28</sup> Q methodology is a systematic approach used to study subjectivity whereby similarities and differences in opinions on a specific topic are determined.<sup>27–29</sup> The methodology combines both qualitative and quantitative techniques and was developed in 1935 by William Stephenson.<sup>30–33</sup> A full explanation is in.<sup>29</sup> The methodology's application has been described in health informatics<sup>34</sup> and in research to study subjectivity in healthcare.<sup>33,35–39</sup> Table 1 provides the stages and definition of terms used in Q methodology. Figure 1 illustrates the methodology, highlighting its six stages—the identification of a topic; the Q set; the P set; Q sorting; data analysis and data interpretation of factors from the resulting analysis.

To build the concourse, data were collected using focus group and interview discussions and a review of literature specific to clinicians' and other health professionals' perspectives on PROs in the EHR.<sup>6,18,21,24,40–47</sup> Data were collected face-to-face for focus group and interview sessions by the principal investigator and an assistant,

**Table 1.** Stages of Q methodology and a definition of terms

Stages of Q methodology	Description
Concourse	Comprehensive list of statements that represent the discourse about the topic of interest as related to the research question
Q set	The final set of statements that will be sorted and ranked by study participants
P set	Participants who are knowledgeable about the topic of interest and will rank and sort the statements in the Q set
Q sort	The process where participants rank and sort statements from the Q set and arrange them in the Q grid based on their individual opinions
Q grid	A quasi-normal distribution grid that participants use to rank statement from the Q set based on what is most important and most unimportant to them when they considered the adoption and use of PROs in the EHR

EHR: electronic health record; PROs: patient-reported outcomes.

and by a review of the literature by the principal investigator. Some interviews were conducted face-to-face or over the telephone by the principal investigator. Once the data were collected, all statements that identified perspectives about PROs in the EHR were gathered for building a comprehensive list of statements called the concourse. Once the concourse was finalized, an iterative thematic process was undertaken by the principal investigator and 2 other researchers. The process categorized statements that conveyed the same or similar opinions about PROs in the EHR, using the dimensions of the 8-dimensional model<sup>48</sup> as a guide. Once categorization was finalized and agreed upon by all 3 researchers, the statements within each category that encompassed the meaning of the other statements within the category were first discussed, agreed upon, and selected for inclusion in the Q set. Demographic questions were added to the Q set to provide context to study results.

The questionnaire for focus group and semi-structured interviews was informed by the 8-dimensional socio-technical model of safe and effective EHR use.<sup>48</sup> This 8-dimensional model was developed to study the design, development, use, implementation, and evaluation of new technology in dynamic environments such as in healthcare settings.<sup>48</sup> The dimensions of the model can address many of the factors within sociotechnical systems that either facilitate or hinder effective functioning. The multidimensional characteristic of the model highlights the interdependence of each of its dimensions which include: hardware and software; content; user interface; personnel; workflow and communication; organizational policies, procedures and culture, external rules and regulations, and system measurement and monitoring (Figure 2).<sup>48</sup>

To maintain rigor for the qualitative data collected, triangulation, member checking, and saturation were used.<sup>50</sup> As we approached the interviews, we evaluated for data saturation of concept. If saturation was not evident from this analysis, additional interviews would have been pursued. Data saturation was complete when no further new concepts were being introduced within the interviews. Triangulation entailed the collection of data from multiple focus group and interview discussions and the literature. Member checking entailed the review of responses after data collection from focus group and interview sessions. To conduct member checking, the assistant or principal investigator read the responses provided for each question after the focus group and interview sessions allowing respondents to either clarify or elaborate on their responses.

### Data collection

Each study participant in the P set sorted and ranked the statements in the Q set (Q sorting) on a continuum ranging from -4 (most unimportant) to +4 (most important) using HTMLQ software for electronic and anonymous sorting.<sup>51</sup> The sorted statements were

placed in a Q sort grid.<sup>38</sup> All completed Q sorts were electronically captured, fed into PQMethod, and were subjected to factor analysis using PQMethod software program for Windows (Version 2.35).<sup>52</sup>

### Data analysis and interpretation

The input data were the digital sorting of the 49 statements in the Q set on a continuum from most unimportant (-4) to most important (+4). Using factor analysis, the Q sorts were analyzed to identify shared viewpoints (factors) about PROs in the EHR among participants. The analysis entailed the application of principal component analysis and factor rotation using varimax.<sup>29</sup> Results included the calculation of a correlation matrix, and factors that were identified using Eigenvalues of two or more. Participants who shared similar opinions on a particular statement were aligned mathematically on one factor.

## RESULTS

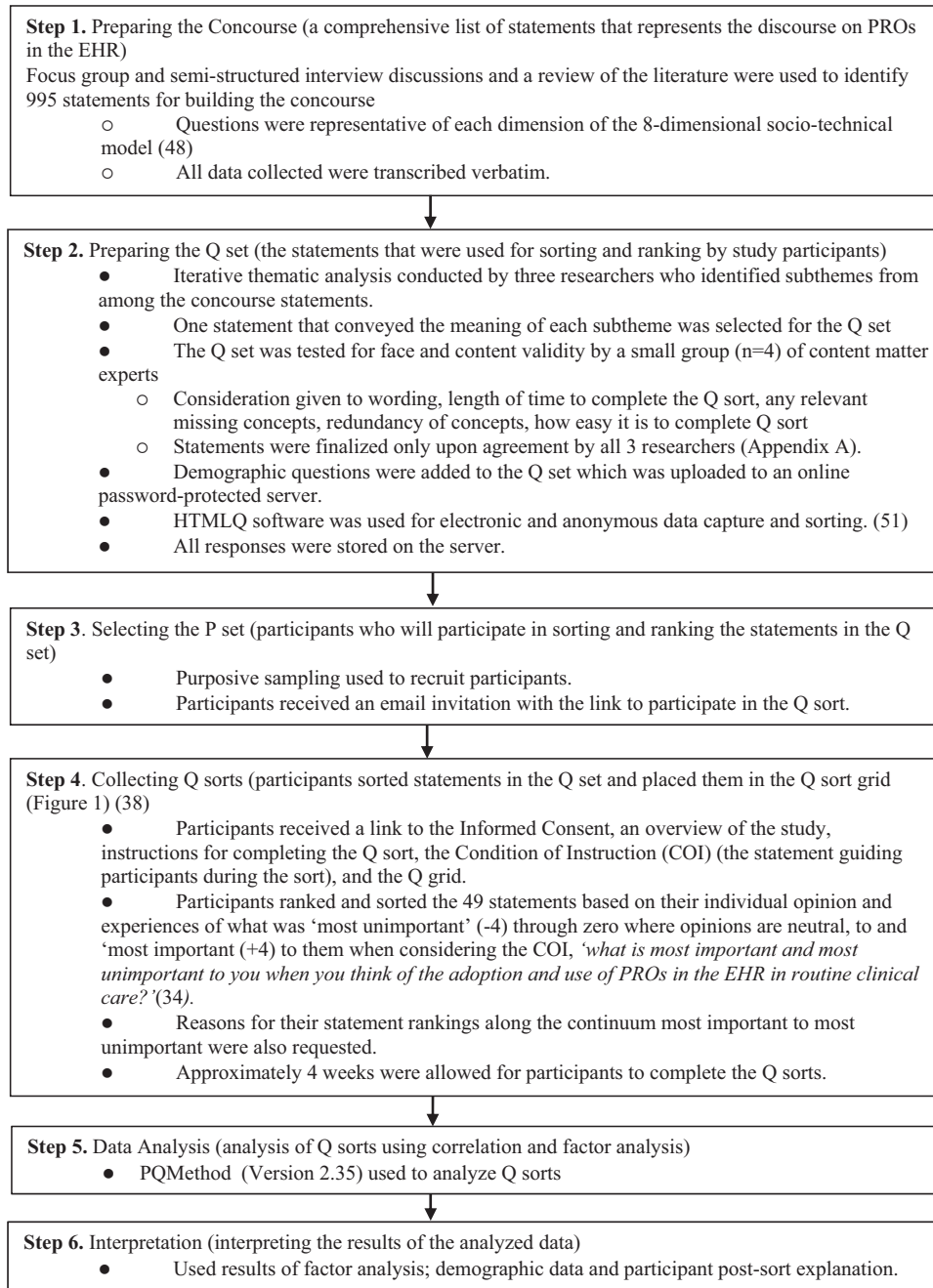
### Demographics

Fifty participants who received an email invitation to participate in the study completed a Q sort of 49 statements in the Q set. Figure 3 shows an idealized example of a Q sort. Table 2 shows the demographics of participants who completed the Q sorts.

### Factor analysis

Factor analysis and varimax rotation resulted in eight factors with eigenvalues of at least two. The factors, which represented similar groupings of statements were defined by 27 of the 50 Q sorts (54%) and explained 61% of the study variance. The variance explained by each factor indicates the similarity among the individuals who aligned on it. The amount of variance is attributed to the similarity on the factor and not the number of individuals. For instance, factor 1 only explains 8% of the variance because the three individuals who aligned on it are very similar. Factors emerge when there is a sufficient number of people to define a factor. It is about shared opinion sets that are identified to address an issue. Although all participants had an opinion about each statement, it may not have been shared by others. It is not uncommon for a factor to emerge only from the shared opinions of a few individuals.<sup>29</sup> The overall 61% variance that resulted from this study is higher than the variance reported by other Q methodology studies where overall study variance ranged from 21% to 53%.<sup>53-56</sup> The remaining 23 Q sorts did not load significantly on any of the eight factors. None of the Q sorts loaded significantly on more than one factor (no confounding Q sorts).

Supplementary Appendix SA presents the ranking, by level of importance, of each statement within the eight factors. The most im-



**Figure 1.** Stages of Q methodology used in this study.

portant statements were ranked as +4 and those most unimportant were ranked as -4. Results suggest that statement # 25, The ability to review PRO item results and cumulative scores in a way meaningful to clinicians, was deemed most important (score +4) on six of the eight factors. Statement #49, the ability of clinicians to receive payment for use of PROs, was deemed most unimportant (score -4) on all, but factor 2.

### Description of factors

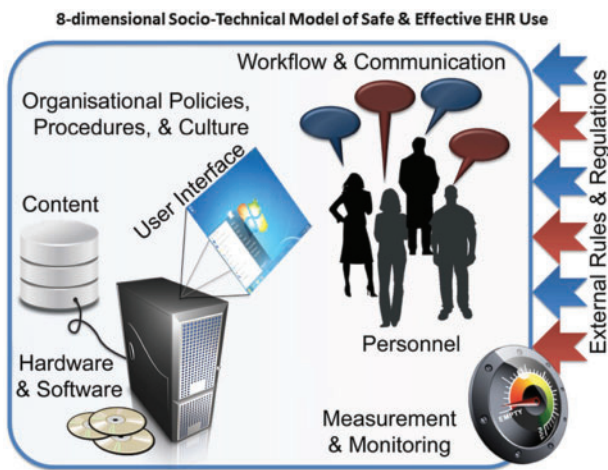
The eight factors that emerged from the analysis were described using results of the defining Q sorts, distinguishing statements, and postsort descriptions provided by participants. The overall senti-

ments suggested by participants supported patient care as shown in the following quotations:

patients need and deserve to have the greatest say in their health (researcher);

[PROs could] save time and be efficient in health tracking for both clinicians and patients (researcher), and the point of healthcare...is to increase the quality of care [and] this should always be top priority (nurse).

More specifically, the viewpoints of the eight factors are depicted in Figure 4. Each factor is subsequently described, followed by quotations from participants and their roles.



**Figure 2.** Eight-dimensional socio-technical model of safe and effective electronic health record use (used with permission<sup>49</sup>).

#### Factor 1: enable efficient and reliable use

Factor 1 highlighted the priority health professionals place on their ability to use PROs in the EHR efficiently to enrich and inform their care decisions. This factor was defined by five participants (Q sorts that were highly significant on the factor [ $P < .01$ ]) and accounted for 11% of the total study variance. The viewpoints expressed on Factor 1 suggest how important the value of PRO data is to patient care. As stated by participants:

It is critical to ensure PRO measures provide data that can advance care (Researcher/clinical manager)  
change detection is a critical issue (Researcher).

#### Factor 2: enable care process improvement and accountability

Factor 2 highlighted the importance of quality improvement and the use of PROs in a manner that is useful for clinical care. Two participants defined factor 2, accounting for 5% of the study variance. According to participants, PROs in the EHR:

can be used in quality improvement. . . will improve patient outcomes over time (Physician/researcher)  
are critical and beneficial if used effectively. . . must unburden providers and staff and make it easy to do the right thing (Physician)  
[can] be used as one benchmark of care (Researcher).

#### Factor 3: enable effective and better symptom assessment

Factor 3 highlighted the value placed on PROs by clinicians as a tool for improving patient assessment. The factor was defined by two participants, accounting for 6% of the total variance. Comments provided by participants highlighted PROs in the EHR as a tool to identify critical PROs result through flagging and:

the patient as an important source of data . . . adding PRO data to the clinical assessment (Physician/researcher).

#### Factor 4: enable patient involvement for care quality

Factor 4 highlighted the importance of patients engaging in their care for improving care quality. The factor accounted for 9% of the study variance and was defined by six participants. Participants'

comments included the ability of PROs to improve quality of care measurement and surveillance and should be:

top priority [and] patients need and deserve to have the greatest say in their health (Researcher).

#### Factor 5: enable actionable and practical clinical decisions

The need to access and use PROs to inform clinical decisions at the point of care was highlighted by factor 5. Factor 5 accounted for 7% of the study variance and was defined by three participants. The factor suggests the importance of PROs for improving patient care and outcome and, as stated by a participant, PROs are most important:

given the need for patient-centered care (Researcher).

#### Factor 6: enable graphical review and interpretation of results

Factor 6 highlighted the importance of presenting PROs data in a manner that is easily understood for use in clinical decision-making. Two participants defined factor 6, which accounted for 8% of the study variance. The viewpoints expressed in factor 6 suggest the need for easy access and comprehension of PRO results. One participant remarked:

I want to know when someone may be deteriorating; maybe even before they realize it themselves (Physician).

#### Factor 7: enable use for holistic care planning to reflect patients' needs

The importance of patients' needs was suggested by factor 7 whereby care planning and patient outcome were prioritized. Factor 7 accounted for 8% of the study variance and was defined by three participants. As indicated by study participants, PROs are most important:

when it is accessible and understood by patients (Clinical manager) [and]  
if it is in the EHR (Informatician).

#### Factor 8: enable seamless use for all users

Factor 8 suggested the need for the efficient use of PROs so that their benefits could be maximized for all users. This factor accounted for 7% of the study variance and was defined by three participants. Participants suggested that the integration of PROs in the EHR would improve care efficiency through data collection for all users and access to reliable data at the point of care for clinicians. As explained by a participant, PROs in the EHR must be:

mandatory and data collection must be seamless (Physician).

Additionally, results of this study suggest the need for PRO data to determine the delivery of care, provide better patient care, and promote better patient outcomes. Results from the focus group and interview discussions identified the need for a standardized "language" among users for communicating when using PROs. Also, the focus group and interview discussions further suggested there is no common language among study participants to describe their opinions about PROs in the EHR.



Most Unimportant			Neutral			Most Important		
-4	-3	-2	-1	0	1	2	3	4
24	1	9	4	8	2	3	14	4
36	22	18	6	10	7	17	16	11
49	38	32	13	15	12	26	19	25
	43	35	27	28	21	40	20	
		37	31	33	23	41		
			42	39	29			
			47	44	30			
			48	45	34			
				46				

**Figure 3.** Representation of an idealized example of a Q sort as ranked by a participant. The numbers in the top row reflect the opinions of participants along the continuum, most unimportant (−4) through zero where opinions are neutral, to most important (+4). The rows represent the number of statements allowed for each column's value.

## DISCUSSION

Opinions regarding the value and use of PROs in the EHR are diverse, even among users within the same institution. The diversity of the eight factors identified demonstrates the complexity associated with adopting and using PROs in the EHR. The factors focused on issues that benefit patients and clinicians at the point of care and on the ability of the embedded functionality to support care processes. This diversity of opinions further suggests the need for comprehensive consideration for successful implementation of PROs within the EHR.

Study results can be interpreted within the context of a socio-technical model. Five of the eight dimensions of the socio-technical model of safe and effective EHR use<sup>48</sup> aligned with the factors including people; workflow and communication; human user interface; hardware and software; and system measurement and monitoring. The three dimensions of the sociotechnical model that were not well represented within the factors included organizational policies and procedures; external rules, regulations, and pressures; and clinical content. Though these dimensions are equally important to the success of technology in healthcare systems, our findings suggest that study participants may be more concerned with the actual use of PROs in the EHR to affect patient care and less concerned with EHR issues that are outside of their personal control. The importance of these underreported dimensions in this study should not be discounted as other studies have identified them as an important influence; for example, clinical content is especially important for adopting PROs and has been identified as a barrier to the success of the technology.<sup>18,44</sup> Further research that could provide more insight on this finding is needed.

Prioritizing PROs for use at the point of care and more specifically, the need to access and interpret PRO-based data were considered important among study participants as seen in factors 1 and 2. The factors suggest the importance of communication in healthcare between management and users and between software designers and users to ensure that resource needs and requirements of users are met. Factor 3 was characterized by statements that emphasized the importance of using PROs to their full potential and integrating

PRO-based metrics into the EHR. In factor 4, the potential use of PROs within the EHR to improve care quality was highlighted. This finding is consistent with the literature that emphasizes the use of PROs in the EHR to support quality improvement.<sup>21,57</sup>

Three of the eight factors suggest prioritizing a functioning, technical infrastructure that is user-friendly and meets the needs of users. Factor 5 described the importance of PROs in the EHR to enable actionable and practical clinical decisions; factor 6 focused on using PROs in the EHR to enable graphical review and interpretation of results; and factor 8 called for infrastructure to enable seamless use by all users. To address these factors, technology that is well designed, intuitive, accessible, and easy to use is required. Factor 7 described respondents' viewpoints that PROs are important for optimizing patient care. Well-designed PROs that are easy to use best support patient-centered care by providing a holistic view of patients' health for improving and planning their care needs. Health organizations should, therefore, consider investing in efforts that use PROs for improving care coordination, workflows, and for using PRO scores across disease specialties and population norms.

An underlying gap in knowledge of PROs was also apparent, highlighting the need for better education and training of users. It is, therefore, important to plan effective implementation strategies that include comprehensive education and training for all users. Moreover, clinicians will not be motivated to use the technology if they do not see benefit to their work such as improving workflow, communication, interoperability, use of their time, and PROs as an effective tool for patient assessment. According to the literature, individual attitude toward the use of technological systems is influenced by the users' perceived ease of use and personal opinion about the likelihood of the technology to improve their performance.<sup>58</sup>

Results of this study support some elements in previously published guidelines for implementing PROs in the EHR; however, while participants in our study were interested in how best PROs in the EHR can be used to improve clinical care, they did not feel important other elements that have been highlighted in previous research as important when adopting PROs in the EHR, such as:

**Table 2.** Participant demographics (N = 50)

Demographic	n (%)
Gender (N = 45)	
Male	23 (46)
Female	21 (42)
Other	1 (2)
Did not respond	5
Age (N = 32)	
0–25	0
25–34	7 (14)
35–44	7 (14)
45–54	10 (20)
55–64	3 (6)
≥65 years	5 (10)
Did not respond	18
Occupation (N = 46) <sup>a</sup>	
Clinical manager	5 (10)
Informatician	9 (18)
IT Professional	3 (6)
Nurse	3 (6)
Physician	12 (24)
Physician/researcher	10 (20)
Researcher	11 (22)
Other: (clinical analyst, clinical support, and psychologist)	5 (10)
Work location (N = 44) <sup>b</sup>	
Hospital	28 (56)
University	29 (58)
Research Institute	9 (18)
Other (ambulatory care)	2 (4)
Mean number of years working with PROs (N = 39)	5.03 ± 3.5

PROs: patient-reported outcomes.

<sup>a</sup>Some participants reported dual roles such as physician/researcher.

<sup>b</sup>Some participants worked in multiple settings such as hospitals and universities.

- Compensation for clinicians who use PRO in the EHR<sup>24</sup>;
- The use of “champions” to promote and support the adoption of the technology<sup>24,26</sup>;
- The value of PROs in terms of clinician performance<sup>59</sup>; and
- Education and training for users.<sup>21,60</sup>

The findings of this study have significant implications for nationwide deployment strategies of PROs in the EHR, particularly in clinical settings. Despite the importance of champions when adapting new technology,<sup>24</sup> the *level* of importance of champions to facilitate PRO/EHR technology adoption remains unknown. Similarly, the *level* of the importance of financial compensation for use of the PROs in the EHR, among other considerations expressed by study participants, indicates the need for future research objectives that focus on resolving these differences, perhaps by utilizing different approaches to query user perspectives or by probing different populations of users. We would expect variation in viewpoints in the factors deemed most important/most unimportant among users who either have different roles or different work settings from those in this study. Other key areas for advancing the research on PROs in the EHR are: (1) How to improve the quality of PRO measures and surveillance; (2) What is the impact of patient involvement in health and treatment decision-making through PROs; and (3) What are methods for presenting PRO item results and cumulative scores in a way that is meaningful to clinicians? These results may inform organizational leaders of strategies that are necessary for the success of the technology in clinical settings for all users.

## Study strengths

Strengths of this study include subjective insights from persons directly connected to the topic of interest, the assurance of participant anonymity, and the personal accounts that allow us to gain insight into the decision-making process of participants. Despite the limitations of online sorting in Q methodology, the method presents a level of efficiency compared with manual sorting. The geographical diversity of participants also reflects the strength of the results.

## Study limitations

The data collection process presented some limitations. Additionally, although study participants varied in professional roles and location, purposive sampling limits generalizing study results to the general population.<sup>29</sup> A majority of the participants who completed the Q sort were physicians or physician/researchers, making the results physician-centric. Other limitations, as explained by Jurczyk<sup>61</sup> included the online Q sorting which may result in challenges like a lack of direct communication between the study participants and principal investigator, limited technical skills among study participants, and the availability of visual space needed for sorting a large number of statements. Our findings do not represent the entire population of the United States, but rather is a reflection of a studied example of the population. Future work will expand the findings to other populations to determine how the opinion sets differ and new opinions emerge.

## CONCLUSION

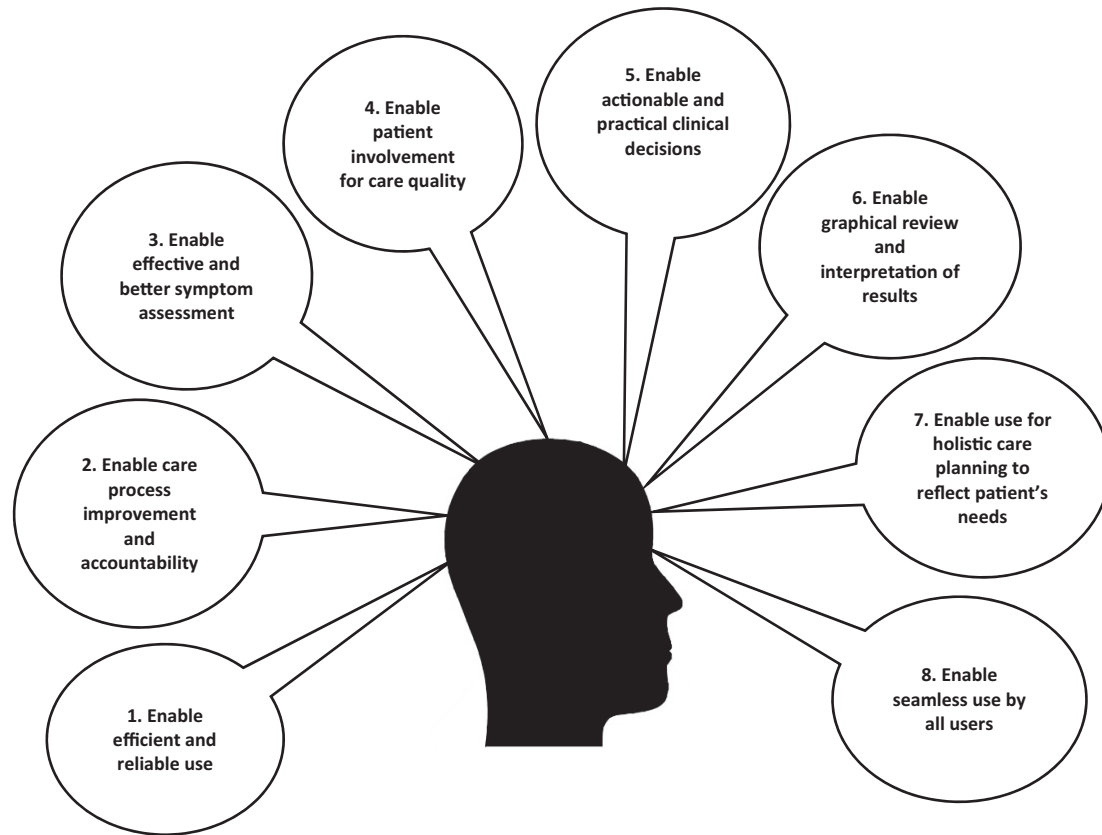
The diversity of viewpoints identified in this study suggests that there is no “one size fits all” strategy for ensuring the success of PROs in the EHR in clinical settings. Successful strategies will need to be tailored to specific organizational and practice characteristics. Such strategies may entail effective communication and collaboration among stakeholders such as leadership, users, patients, and technical staff. The preferences of clinical users are especially critical to the success of PROs in the EHR. Results from this study may serve as a catalyst for developing strategies that can bridge the gap between the limited use of PROs in the EHR, knowledge gaps in the literature, and the benefits of PROs to patients and clinicians alike. Additional research must focus on strategies that improve the standardization of PRO use among users, the use of PRO results in clinical settings, and how PROs impact health outcomes.

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## AUTHOR CONTRIBUTIONS

SVB, PhD, MPH: Study conceptualization; data collection for building the Q set; iterative thematic analysis for building the Q set; assistant with building the P set; data analysis and interpretation of factor analysis; article writing, edit, and review. ALV, DrPH: study conceptualization; assistance with Q methodology; iterative thematic analysis for building the Q set; assistant with building the P set; interpretation of factor data analysis; article writing, edit and review. JS, MD, PhD: Content validity expert; assistant with building the P set; advise for data analysis; article review. JA, PhD: article edit and review and guidance on qualitative data analysis. TN, AM,



**Figure 4.** Factors that emerged from the Q sort analysis.

LSW: Technical advise on implementation of PROs in the EHR. KK, MD: Content validity expert; assistant with building the P set; advise on data analysis and article review. AH, PhD: article review and advise on qualitative data analysis. BH, MD: Content advise on PROs in the EHR. AB, MD: Data collection for building the study concourse; iterative thematic analysis for building the Q set; assistance with building the P set; factor analysis using PQMethod; data interpretation of output from factor analysis; article writing, edit, and review.

## SUPPLEMENTARY MATERIAL

Supplementary material is available at *Journal of the American Medical Informatics Association* online.

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## CONFLICT OF INTEREST STATEMENT

None declared.

## DATA AVAILABILITY STATEMENT

Data will be made available upon request for the factor analysis. The statements for the Q set will be shared for future Q sorts as well.

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