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Collecting and Using Patient-Reported Outcomes (PRO) for Comparative Effectiveness Research (CER) and Patient-Centered Outcomes Research (PCOR): Challenges and Opportunities

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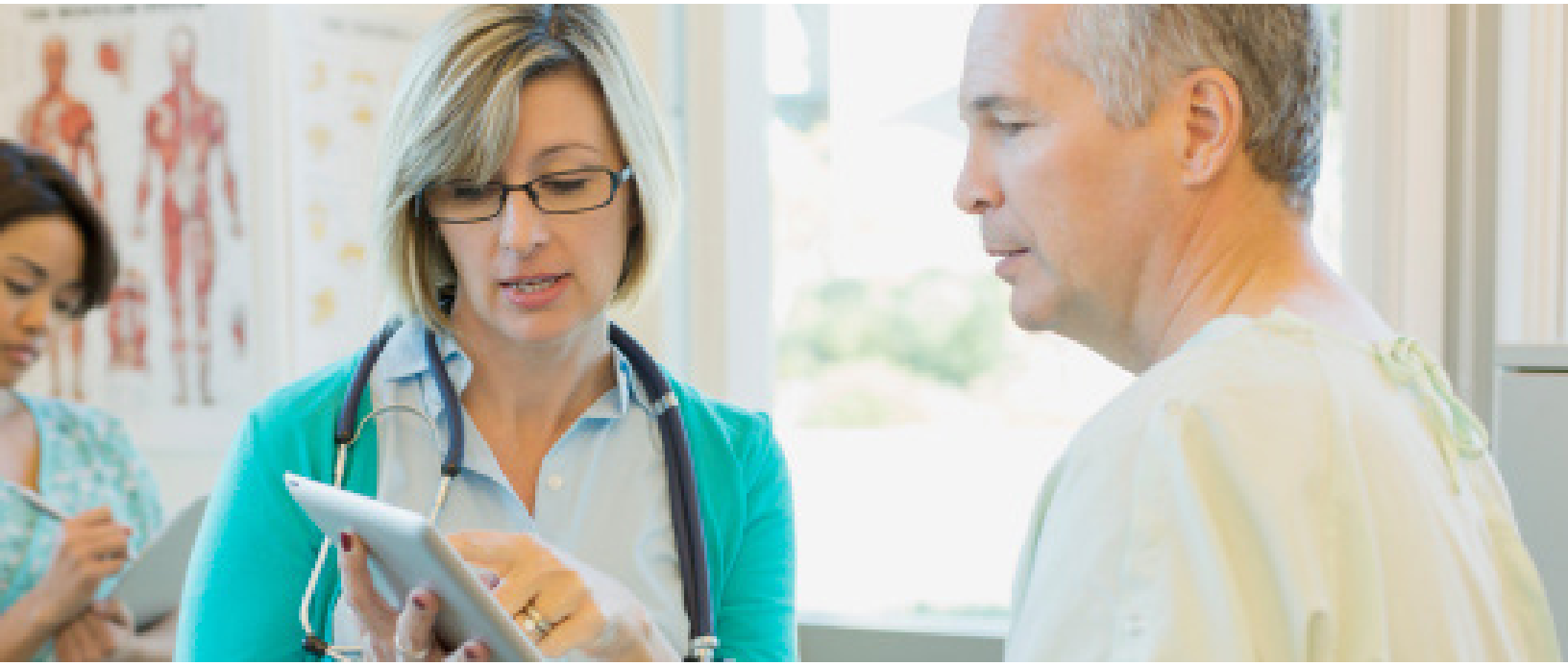
EDM Forum



Issue Brief

Collecting and Using Patient-Reported Outcomes (PRO) for Comparative Effectiveness Research (CER) and Patient-Centered Outcomes Research (PCOR): Challenges and Opportunities

About the EDM Forum

The Electronic Data Methods (EDM) Forum is a three-year grant from the Agency for Healthcare Research and Quality (AHRQ) to advance the national dialogue on the use of electronic clinical data for the conduct of comparative effectiveness research (CER), patient-centered outcomes research (PCOR), and quality improvement (QI). The EDM Forum facilitates exchange and collaboration between eleven AHRQ-funded projects, including: the Prospective Outcome Systems using Patient-specific Electronic data to Compare Tests and therapies (PROSPECT) studies; the Scalable Distributed Research Networks for CER, the Enhanced Registries for QI and CER, as well as other relevant health information technology (healthIT) initiatives. The EDM Forum and the research projects connected to the Forum are funded through the American Recovery and Reinvestment Act of 2009 (ARRA).

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Executive Summary

Patient-reported outcomes (PRO), or data reported directly by patients on outcomes, provides insights on patients' experience and perspectives on treatment and outcomes. PROs can be very useful for assessing outcomes that are important to patients as part of comparative effectiveness research (CER) and patient-centered outcomes research (PCOR). In particular, the growing use of electronic PRO (ePRO) in these types of research has the potential to improve the efficiency of data collection and analysis, and to also provide new opportunities to bring meaningful evidence back to decision makers and patients in innovative ways.

In March 2012 the AcademyHealth Electronic Data Methods (EDM) Forum convened a symposium focused on the collection and use of PRO, especially ePRO, for CER and PCOR. A framework of challenges and opportunities for collecting and using PRO in CER and PCOR emerged based on the presentations and discussions. The framework identifies more than 50 challenges, organized by issues when collecting or using PRO around governance, informatics and technology, analytic methods, and the implementation of PRO in learning health systems. Each of these sets of issues are explored and a series of examples are provided that illustrate the possibilities and challenges of using PROs with electronic health data to improve patient outcomes.

Background

A primary objective of the AcademyHealth Electronic Data Methods (EDM) Forum is to advance the national dialogue on the use of electronic clinical data (ECD) for comparative effectiveness research (CER), patient-centered outcomes research (PCOR), and quality improvement (QI) to improve patient outcomes. Understanding how best to engage patients, consumers, providers, payers, and researchers who have input on the infrastructure and conduct of CER, PCOR, and QI is an equal-

The EDM Forum is supported by the Agency for Healthcare Research and Quality (AHRQ) through the American Recovery & Reinvestment Act of 2009, Grant U13 HS19564-01.

ly important objective. Increasingly, researchers and advocates have called for better ways of incorporating patients' perspectives on which outcomes matter most to health and quality of life; the anticipated or unintended consequences of specific treatments; and/or, other personal factors that may be important predictors of outcomes. Patient-reported outcomes (PRO) are one mechanism to incorporate this desired "patient's voice" into research and QI efforts. PROs are defined as health data reported directly by patients about their experience of treatment and care, and are distinct from other outcomes commonly used in research in that they uniquely provide the patient perspective (1-2).

Implementing PRO in CER and PCOR can help to achieve a more patient-centered research agenda by collecting and using PROs to understand the experience of patients while they are receiving care, as well as addressing their desired treatment outcomes. Additionally, including PRO in research studies can bridge information gaps in health records and other data sources by providing reliable, validated, and standardized measures of patient-level health status that address health conditions and outcomes that are meaningful to patients and caregivers (3). Doing so can help ensure that the evidence base aligns with outcomes of interest for both patients and clinicians.

Electronic data capture modes of administration of PROs (e.g., via computers)—sometimes referred to as 'ePRO'(4)—and/or incorporating PROs into the patient's electronic clinical record offers a host of exciting opportunities to learn from patients' experiences during the process of care and outside of the care setting. Mobile health (mHealth) technologies are platforms for collecting and processing patient perspectives and outcomes outside of the traditional health care delivery setting (5-6) that offer additional, new opportunities for learning.

To better understand the practical opportunities and challenges of implementing PRO strategies using electronic data, the EDM Forum convened a Stakeholder Symposium in Washington, DC on March 15-16, 2012.[1] Meeting participants represented clinical, health system, employer, payer, policy, patient, consumer, scientific, and technical (informatics) perspectives. Based on the presentations and discussions at the PRO Symposium, this brief explores the opportunities and challenges for PRO in research and QI. Case examples are provided to explore the key dimensions of the PRO challenge framework (governance, informatics, analytic methods, and implementation), including the implications for collecting or using the data electronically. By clarifying the landscape of current opportunities and challenges, the brief aims to stimulate further discussion among researchers, administrators, policymakers, and other interested parties about ways to further integrate PRO in future health research and QI efforts.

Key Challenges for the Collection and Use of PRO

Presentations and discussion at the March 2012 PRO Symposium identified a set of technical, practical, and ethical issues related to governing the use of PRO; implementing informatics strategies to collect, exchange, and access PRO; and, methods to analyze PRO data. Specific issues that arise through application and implementation in real-world settings were also considered.

Participants identified a framework of challenges related to both the *collection of PRO data*, and the *use of PROs in practice* (see Box 1). These dimensions are addressed in the columns. Within each of these dimensions, participants identified challenges and promising examples (or need for more research) in each of the major domains within the EDM Forum:

- governance;
- clinical informatics;
- analytic methods; and,
- how the systems are implemented in a learning health system.

Each of these dimensions is reflected in the rows of the framework, and represent the major elements of infrastructure development and integration addressed by the EDM Forum.

The sections that follow provide a description of key challenges identified in the framework. The discussion is organized first by the challenges of *collecting* PRO, and second by the challenges of *using* PRO. Case examples of issues and strategies to resolve existing challenges are highlighted from projects participating in the EDM Forum.

Box 1: A Framework of Challenges for Collecting and Using Patient-Reported Outcomes for CER, PCOR, and QI

		Collection Challenges	Use Challenges
Infrastructure	Governance	• **Further guidance is needed on successful strategies to facilitate interpretation of HIPAA regulations, including key messages or guidance for IT personnel and IRBs.** Specific concerns include: – The variation in legal counsel's interpretation of the HIPAA privacy rule at the organizational level – Novel PRO collecting methods (e.g., via sensing/ remote monitoring) may require additional governance policies – **Few mechanisms to establish and test PRO data security exist, especially for mobile collection** – **May be various interpretations of HIPAA regulations surrounding settings (e.g., health care delivery) and modes (e.g., mobile devices) of PRO collection** • Approaches and mechanisms for patient consent to use PRO for QI and research are still emerging • Some patients may not wish to participate at all; requirements for patients to "opt-in" versus "opt-out" at the healthcare system level are evolving; need to think through the implications of allowing "opt out" in perpetuity • Need to decide who "owns" the data, especially if patients are actively providing their own data, if multiple sites are involved, and if external entities want to access PRO data	• **Limited guidance on data governance exists for the transfer, access and use of PRO in research and QI** • Systems to jointly analyze PRO & EHR data are emerging. Governance, user roles, and access to these systems need to be addressed • Potential disconnect for the reason PRO was collected and how researchers can analyze the data • **De-identifying data (i.e., removing PHI) is required for many studies (particularly multi-site), which may limit the ability to match individual PRO data across sites, settings, and time** • Some types of analysis (or use of PRO data in care) may be limited if data are not available at the patient level • Generally believed that researchers are held to a higher standard for ensuring security, which may limit opportunities for new research • Provider conflict of interest could impact PRO, especially if outcomes are used in pay for performance (P4P)
	Informatics & Technology	• **Criteria for selecting valid and reliable PRO tools are needed** • Time/cost to develop, validate, and license software, platforms, and tools to collect PRO can be high • The logic and methods underlying automated tools to collect PRO may not be sufficiently transparent • Effectiveness of "mixed-mode" data collection (e.g. paper and tablet) needs to be understood and standards need to be developed and validated • Other models of data collection that may provide insight into the patient experience outside of traditional clinical settings (bio- monitoring, sensing, etc.) needs to be explored • Need to consider advances in IT user interface that can reduce respondent burden and increase content validity (e.g., user-centered design) when collecting PRO	• Tools to access PRO from EHR, CDS system, and/or other systems for QI and research may not adequately reflect: – Principles of user-centered design – How the questionnaire was completed (not just content/ items) – Innovations from other sectors and disciplines • **Systems/decision rules for transfer/access/use of PRO data across IT platforms for QI and research are emerging and require guidance on best practice to improve interoperability**. • **Data silos may be exacerbated by IT platforms and can limit the ability to integrate PRO in a rapid learning system** • **Need to develop and record appropriate (standardized) metadata in research and QI systems and determine meaningful ways to leverage metadata to interpret and use PROs.**

Box 1: A Framework of Challenges for Collecting and Using Patient-Reported Outcomes for CER, PCOR, and QI *(continued)*

		Collection Challenges	Use Challenges
Infrastructure	Analysis	• **Need to validate/compare data collected in different settings, modes, or time series (e.g., at different disease stages)** • Need to develop analytic strategies to identify and manage surrogate-reported data • **Patient's perception may contribute to bias (e.g., patients may 'game' responses in light of social desirability bias, etc.)** • Based on characteristics of the patient and history of the disease, analytic guidance is needed on selecting PRO tools to administer (and at what frequency).	• At present, it can be very difficult to standardize, harmonize, or integrate PRO data with other electronic data for analysis • If the results of PRO data do not align with traditional claims or EHR analysis, guidance is needed on best practices for analyzing and interpreting data • Need to identify and quantify systematic differences in response to variation and potential bias, and provide guidance on how to analyze these differences • **Approaches to assess the generalizability of PRO for health research and QI are needed** • **Need to better understand the added analytic value of using PRO for health research and QI** • **Best practices are needed to determine whether general or condition-specific PRO measures are most useful and appropriate to answer specific health research and QI questions** • Need to assess reproducibility of PRO results across settings and/or modes of collection for the same population, especially for CER • **Guidance on best practices to adjust for potential response bias in PROs is needed**
-- requires adequate feedback loops across all elements --			
Application and Outcomes Measurement	Implementation	• **Need to ensure that the PRO tools and measures selected for QI and research networks have demonstrated utility for clinical or operational purposes, as well as research.** • Based on the population of interest, there is little guidance available to select among the varying approaches for: – incorporating PRO tools into the patient experience – handling privacy issues at point of care (POC) survey completion – incorporating PRO into clinical workflow to act on information in real-time and developing tools that are practical in the workplace (and perhaps even improve or maintain current processes) • **Need to develop incentives, and reduce burden of time and effort, to encourage patients to complete PRO questionnaires; and for clinicians and healthcare systems to administer PRO (burden at POC needs to be assessed)** • **Need to ensure that the design and structure of PROs are compatible with patients' needs and minimize response burden** • Important to understand or anticipate literacy issues/challenges for written questions • Level of comfort with collecting and acting on PRO needs to be considered for both patients and clinicians • Need to understand whether there is a difference in the clinical or research utility of PRO that is collected passively or actively • Need to understand potential limitations to scale successful PRO implementation in specialty clinics or certain population groups • **Need to develop strategies to include patients in the design of PRO tools and collection methods**	• Need to evaluate the ethical and practical/feasibility considerations of including (or excluding) patient perspectives and PRO in QI and research • **Need to explore which types of PRO measures/data are useful and relevant for QI and research (ideal to have utility for both)** • Important to understand how rapid or 'real-time' PRO must be to improve patient outcomes, and consider how this will impact mode of collection (and analysis) • "Use cases" are needed to distinguish value of PROs from clinical endpoints, or "hard" endpoints • Development and evaluation of user interface approaches/tools is needed that help patients, providers, and caregivers understand how to act based on PRO data, and take action to improve outcomes • Need to create guidance for secure communities/portals where patients can receive meaningful feedback/guidance • Can be difficult to sustain participation in longitudinal studies • **Processes are needed to ensure appropriate use of CDS in patient care, and CDS measurement that will lead to improvements in patient experiences and outcomes.** – **Need to develop new, rapid-cycle evaluation strategies to maximize the utility of new CDS tools using PRO**

IV. Collecting PRO for CER and PCOR

Governance and PRO Data Collection

Governance refers to the policies and procedures that oversee data stewardship and management of the linkage, aggregation, storage, acquisition, and use of data (7). Traditionally, PROs have been collected in research studies and clinical trials, which are controlled settings with established consent procedures connected to an overall research protocol. The collection of PRO in clinical settings that can also be used for research is an emerging practice, and there is little precedent or guidance to follow concerning the stewardship and management of PRO data. Existing regulations are often interpreted in different ways at the local level, particularly among institutional review boards (IRBs).

As an example, DARTNet, a collaborative of primary care practices participating in a federated ambulatory care network to share QI information, conducted a project to implement PRO collection into clinical care. DARTNet's project measured depression severity and suicidality by collecting PHQ-9 data in physician offices (8). The participating practices collected the PHQ-9 data in a number of settings and modes (i.e., paper forms completed in the waiting room by the patient or nurse, or online systems used by nurses or clinicians). However, the investigators experienced difficulties getting some practices to use the PRO tool at the point of care because of different interpretations of the Health Insurance Portability and Accountability Act (HIPAA) privacy rule regarding which settings provide an appropriate level of privacy when data are being collected from patients. The project had to overcome substantial governance and challenges in order to successfully integrate the additional data collection of PHQ-9 as part of routine care, or "measurement-driven care". Ultimately, the project was able to overcome these issues and most participating site practices elected to implement the PRO collection tool. Symposium participants identified this as one area where *guidance is needed for interpreting HIPAA regulations surrounding the collection of PRO in health delivery settings.*

Governance challenges also arise when seeking approval to use novel informatics strategies to collect PRO. A lack of understanding of the technology, including security or implementation protocols, can create questions and cause delays for institutional approval to use new PRO collection tools for QI and research.

Within the EDM Forum, several projects are employing novel methods for PRO collection, including the use of iPads to administer surveys (WICER) (9), and mHealth tools to measure patient disease management (Cincinnati Enhanced Registry). There are emerging technologies and governance strategies to address security and privacy concerns; however, IRBs and Privacy Boards may not necessarily be familiar with the technical aspects used to establish protection of privacy and security (10). Some researchers and administrators have invested substantial amounts of time to get approval to use new data collection strategies or data storage (e.g., using the cloud for data storage). As a result of these efforts, promising strategies are emerging that are financially feasible and have demonstrated their acceptability to IRBs as appropriately protecting protected health information (PHI).

These projects' experience suggest there is a need for guidance oriented towards IRBs that will address technological considerations that are important to maintaining privacy when collecting PRO. Investigators have commented that there may be a lengthy process of 'one-on-one" education of key IT and IRB staff to increase familiarity and comfort with new ePRO technology. This effort takes additional time and must be built in when developing the infrastructure for such ePRO projects. In response to these experiences, PRO Symposium participants called for *guidance on successful strategies to facilitate technical assistance on governance, including key messages or guidance for IT personnel and IRBs.*

Informatics & Technology to Collect PRO

Selecting the appropriate informatics tools or technology for collecting valid and reliable PRO may pose additional challenges. In CER and PCOR, the focus and aims of the study must be kept in mind during the phase in which the research design and infrastructure are developed. Investigators must consider how informatics tools used to collect PRO will inform the primary research questions; and, how the design and interface with these tools may impact response rates or the validity and generalizability of PRO data. As the number of technologies for collecting PRO and interacting with PRO rapidly expands (e.g., mHealth and participatory sensing (11-12)), the strengths and limitations of tools and technologies may not initially be clear or easy to assess.

Lessons from current research efforts may offer guidelines and strategies for selecting the appropriate PRO tools and technologies. For example, the SAFTINet project used a set of criteria for selecting the appropriate PRO instrument for asthma patients, which also takes into account the workflow and technology needs of the clinicians administering the tool. SAFTINet researchers and stakeholders prioritized that the tool should seek to have high clinical value (e.g., improving the quality and efficiency of care) while improving the quality of data for research. In the SAFTINet example, selecting informatics strategies to collect PROs that work best for the end-users of the research (in the case of SAFTINet, the clinicians providing care to the asthma patients), is given high importance in ultimately selecting PROs for the project and network.

PRO Collection Analytics and Methodology

Differences in the way PRO tools are administered (such as setting and mode) are not currently well understood, which may impact the analysis and interpretation of PRO data. This issue suggests the need for additional validation studies. Two EDM Forum affiliated projects are assessing PRO administration in different *settings* (e.g., at a clinical visit versus at home) to see if the setting in which PRO is collected impacts outcomes. For example, WICER is administering a community level survey about hypertension in three different environments: 1) community care clinics, 2) ambulatory care clinics, and 3) data collection in residents' homes. Different *modes of data collection* (e.g. online survey versus phone interview) are also being studied to see if mode impacts response bias. The project SCOAP CERTAIN is collecting PRO to compare different treatment strategies and outcomes of peripheral arterial disease (PAD) as one of their CER studies. The project is comparing different modes of data collection (i.e., SMS, email, snail mail, interactive voice response, live call) in administering PRO tools to test validity and bias of the tools. For each item being measured (e.g., leg pain), the study is assessing the content validity of the outcomes generated within each collection method. These and other validation efforts will provide important lessons for designing and selecting methods for future studies collecting PRO.

Another analytic challenge to take into account with PRO collection, as with all self-reporting efforts, is the *potential for perception bias from both the patient providing the information as well as the clinician or staff collecting the information.* Perception bias may contribute to missing or inaccurate data. One example discussed during the PRO symposium was that patients may not provide information on their satisfaction during an office visit if they believe that the provider will be able see the results. Likewise, physicians may not be comfortable talking with a patient who has reported on the PHQ-9 that s/he is at risk of self-harm. *Social desirability bias, such as a patient responding to questions in a manner to be perceived favorably by others, may lead patients to "game" their responses* (13). As collection approaches for PRO evolve, studies must be undertaken to assess these potential sources of response bias.

Implementation of PRO Collection

Particularly for research and QI purposes, *the burden of time and effort for both the clinician or staff administering PRO tools, as well as the patient providing the information, should be considered.* Participants at the PRO Symposium emphasized that PRO should focus on collecting "need to know" versus "nice to know" information in order to minimize response burden. Participants also encouraged investigators to *ensure that the PRO tools and measures selected for QI and research networks have demonstrated utility for clinical or operational purposes, as well as for research.* As some of the Symposium participants commented, PRO has potential to be a "triple threat" for all major stakeholders, however achieving this goal will require serving the key needs within health systems providing information 1) at the point of care (for patients and providers); 2) for operations; and, 3) to researchers. Symposium participants with experience implementing PRO caution that *there may be limited uptake of PRO tools in practice if they are not of optimal benefit to the clinician or staff administering the tool.*

An essential component of successful PRO implementation is ensuring that the design and structure of the PRO tool are compatible with patients' needs and minimize response burden. To support the implementation of patient-centered PRO collection, *best practices are needed that demonstrate ways to minimize response burden and guide decisions about where and when PRO tools should be administered.* As an example, certain populations may be more amenable to providing information during their visit at the point of care and others may be less likely to complete a survey as pre-visit prep. Others may prefer SMS text messages and questionnaires between visits. It is likely that offering a range of options to complete PRO questionnaires will be most effective at encouraging participation, but more information is needed to guide implementation of PRO.

The recent AcademyHealth Framework for Engagement suggests that engaging patients and consumers in the infrastructure and research development process is one approach to PRO implementation. Two elements where patients could provide input on the collection of PRO include the selection of software and hardware, and determining data elements (14). *Patients are the key players in PRO collection, and including them in the design of PRO tools and collection methods has potential to help to ensure a patient-centered design and increase participation.*

V. Using PRO to Improve Patient Outcomes

Governance and Use of PRO for Research and QI

Beyond the governance challenges related to collecting PRO, participants commented that guidance is needed to address the access and stewardship of PRO when *using* the data for research. Enabling the flow of health data (e.g. PHI) across institutions requires data use agreements (DUAs) and security measures built into the infrastructure (15). However, *limited guidance exists for the transfer, access and use of PRO within and across institutions* and it can be very confusing for security and privacy experts to determine whether to construe PRO as "QI" or "research" for the purposes of acceptable data transfer among partners.

Due to interpretations of HIPAA requirements to protect the privacy and confidentiality of identifiable information, PHI is often stripped from datasets to "de-identify" health records. In this process there is potential to lose important information. In particular, longitudinal information needed to assess changes over time, geographic identifiers, and dates of services are key elements of health records that researchers often need to produce useful CER and PCOR (16). *Removing PHI from PRO in CER*

studies can be a major issue because PHI may be needed to link PRO data back to a patient for follow-up or longitudinal analysis. Finding a balance between the need to maintain patient privacy and how best to link PRO data to ensure the most effective use of these data to benefit the patient was mentioned as a key consideration by many of the PRO Symposium participants.

Employing Informatics & Technology to Use PRO

Several participants at the PRO symposium mentioned a *desire to improve interoperability—or the technical ability of different systems to exchange information (17)—between PRO and EHRs, but noted that there are many hurdles to overcome to achieve this goal.* There is often a need to coordinate with a range of organizations, vendors, and researchers to capture patient experience outside of traditional clinical settings and link data across the patient's experiences of care. Participants also mentioned the *need for formal standardization of PRO data elements to facilitate linkages between PRO and other ECD, including electronic health records (EHRs).*

For example, some of the PROSPECT, DRN, and Enhanced Registry projects (including, WICER and the Cincinnati Enhanced Registry) are collecting PRO in surveys and linking the data to EHRs. This effort requires researchers to work closely with EHR vendors. To enhance PRO and strengthen data linkages across settings and institutions, metadata (the data that describes information about the data) is a potential resource to facilitate standardization and interoperability with other data sources and types, including PRO (18). Many participants identified the *need for more innovation and research on metadata, especially with respect to PRO* as an important area for future consideration.

Methods to Use and Analyze PRO

PRO can be integrated into traditional research study designs to incorporate the patient perspective. However, the added value of using PRO to supplement other health information that is collected in a CER or PCOR study - or the use of PRO as a key outcome measure – should always be assessed as a best practice. Expressed in another way, it is important to ensure researchers understand where PRO can add unique value for answering different CER and PCOR questions. For example, there are specific considerations when using PRO measures for particular study designs such as integrating PROs into clinical trials (e.g., for drug-safety), which may bring a richer perspective to the trial regarding the impact of the treatment on patient experience, including preference and satisfaction. However, because of concerns of content validity, the added value of using PRO in different types of study designs and topics for CER and PCOR (e.g., observational studies using electronic clinical data) needs to be more comprehensively assessed. *A better understanding of the added value of PRO for CER and PCOR will help to develop best practices and define more formally when PRO has demonstrated utility.*

The value of including more targeted, disease specific PRO measures in clinical trials versus generic PCOR measures (e.g. SF-36) was discussed at length. Using disease-specific attribution in questions (e.g., specifying hip pain) can increase responsiveness in data collection because the questions may be more relatable to the patient's concerns or experiences, which satisfies issues raised in the collection process. However, health related quality of life (HRQoL) measures, which can be combined with both generic measures (e.g., functional, well-being, etc.,) and disease specific measures, have been shown to be highly significant predictors of expenditures, productivity, response to treatment, and other impacts on patient outcomes (19). Thus, there can be a trade-off to using condition-specific measures or generic measures resulting in challenges for analyses, including missingness. *Whether general or condition-specific PRO measures are most useful and appropriate for specific CER, PCOR, and QI questions needs to be explored to establish best practices for different populations and settings.*

Finally, *The subjective nature of patient-reported data* is also important to consider. For example, patients who participate in social network sites or associations may be more active in their health care, and thus are more likely to participate and contribute their data to PRO collection efforts. Symposium participants noted that the evolving methods developed to analyze PRO in CER and PCOR, especially in large observational studies, should take these issues of representativeness and bias into account in order to ensure that the data are patient-centered yet are generalizable to the population(s) of focus.

Implementing PRO in Practice

Participants in the PRO Symposium highlighted the importance of *ensuring that PRO collection provides value and utility for clinical, operational, and research purposes, and acknowledged the need to develop innovative user-interface tools for clinical decision support (CDS).* CDS tools can bring meaningful information back to clinicians, but there is a need to understand how clinicians and patients then interpret and act upon the data emerging from the PRO instruments to improve patient care and outcomes. ePRO tools are potentially powerful since the collection, aggregation, and presentation of these data in new ways can provide clinicians with the opportunity to intervene based on data collected in real-time, which presents a unique tool for public health not previously available.

For example, at the Duke Cancer Care Research Program, new rapid learning techniques structure ePRO data into pattern recognition models and alert systems so that clinicians can see patterns in data quickly, rather than analyzing individual quantitative data (20). As a pilot project, PRO data were collected to monitor cancer-related symptoms and psychosocial well-being and then used to generate patient care monitor (PCM) reports. The PCM reports provided clinicians with pattern recognition models that highlighted areas of concern (e.g., pain, fatigue) and presented recent history/trend data in a user-friendly format, as

Box 2: Where do we go next? Supporting the Infrastructure for Collecting and Using PRO for CER and PCOR

PRO for CER and PCOR

Governance

- Develop training manuals for support staff administering ePRO tools at the point of care. These should establish clear policies regarding the confidential treatment and secure storage of PRO data at participating sites.
- Disseminate established protocols and case examples to illustrate specific governance approaches to using ePRO, including guidance for investigators, IRBs, delivery systems, and patients.

Informatics & Technology

- Establish a common pool, or central repository, of PRO measures in order to support data collection and capture patient experience outside of traditional clinical or research settings. The repository should clarify settings and modes of administration in which each have been validated. The Patient Reported Outcomes Measurement Information System (PROMIS), and the Health Services and Sciences Research Resource (HSRR) are examples of this type of repository.

Analytic Methods

- Develop further guidance on the analytic methods for incorporating PRO measures and tools into broader research studies, particularly in terms of addressing bias and generalizability.

Implementation

- Disseminate case examples that demonstrate effective use of PRO tools to improve patient outcomes.
- Improve the CDS, patient portals, or mHealth tools used to support decision making (i.e., implement tools to utilize evidence in a timely fashion) for clinicians and patients in order to enable real-time action on new information

a CDS tool. When a distressed patient was identified (e.g., the patient responds that she would feel "better off dead") the clinician, as well as a trained counselor, was automatically alerted to provide immediate intervention or referrals to additional services as needed. New technologies and CDS tools, like the ePRO tools implemented at the Duke Cancer Care Research Program, provide promising examples for further development of user-interface tools that can use PRO to increase the efficiency of care and improve patient outcomes in real-time. A key next step in these efforts noted by many of the PRO symposium participants is to *develop new, rapid-cycle evaluation strategies to maximize the utility of these tools.*

VI. Next Steps

The experiences of the EDM Forum project teams and other participants in the Forum provide a unique viewpoint of the challenges and solutions of implementing PRO into research and QI. These efforts also emphasize the need for more active discussion and collaboration with stakeholders to develop guidance and best practices. The timing for these efforts is good, and there are many collaborators eager to provide emerging guidance on best practices in PRO. For example, a report about PRO measures released after the Symposium, developed on behalf of the Patient-Centered Outcomes Research Institute (PCORI) by Oxford Outcomes (21), provides initial guidance on a subset of the challenges included in the framework. Specifically, the PCORI report provides suggestions for ways to address the lack of IRB guidance, or protocols to collect PRO at the point of care; the challenges of interoperability and the ability to link valid PRO measures with tools used to collect electronic data; the need for guidance and development of analytic methods for incorporating PRO in research; and ways to improve clinical decision support with PRO implementation.

Some preliminary next steps to support the PRO infrastructure based on discussion at the PRO Symposium are identified in Box 2. These research agenda priorities correspond with the domains for collecting and using PRO (governance, informatics, analytic methods, and implementation). However, as the many challenges enumerated in this brief demonstrate, there is a substantial need for more research on the methods to collect and use PRO. The suggestions in Box 2 do not address the spectrum of research needs, but focus instead on resources that could promote transparency and exchange of information across activities and projects currently integrating PROs with ECD.

Many of the case examples discussed in this brief are innovative and promising solutions to implement PRO in the process of care. Further efforts to link these PRO efforts with ECD will ideally provide a more comprehensive view of patients in order to conduct CER and PCOR and improve patient outcomes. Ultimately, there is great potential that PRO will be a useful tool to drive improvement in clinical practice. Many potential uses for PRO are currently being discussed, including:

- facilitating pre-visit planning,
- developing patient-centered care plans based on outcomes of interest to individual patients in addition to traditional clinical endpoints (e.g., morbidity and mortality), and
- improving the quality of data for care as well as research by reducing omissions in data collection.

The good news is that there is a general consensus that best practices and solutions will emerge as the community develops more experience collecting and using PRO, as well as ePRO with new electronic clinical data infrastructure.

The PRO Challenge Framework and examples included in this brief provide a set of considerations to facilitate discussion about the important strategies to integrate PRO in research and practice. The result is an initial roadmap of innovation and articulation of current gaps in understanding. Arguably, the result is an emerging research agenda that can help to build a body of patient-centered outcomes evidence. However, as the framework

also demonstrates, this is a tall order. Fully integrating PROs into the healthcare system and overall patient experience requires an openness to address the many technical and non-technical hurdles identified.

The EDM Forum's open access e-publication *eGEMs* (Generating Evidence and Methods to improve patient outcomes) and eRepository could be a potential home for disseminating lessons learned about PRO collection and use. The EDM Forum welcomes submissions to *eGEMs* about emerging approaches and methods that address challenges articulated in the PRO Challenge Framework, as well as other strategies and issues to consider when using PRO for CER, QI, and patient-centered care. The EDM Forum will continue to play an active role in this discussion and engage stakeholders through our events and activities, highlighting PRO as an important research tool. We hope you will join the discussion and contribute your thoughts and experiences using PROs in learning health systems to improve patient outcomes.

About AcademyHealth

AcademyHealth is the leading national organization serving the fields of health services and policy research and the professionals who produce and use this important work. Together with our members, we offer programs and services that support the development and use of rigorous, relevant and timely evidence to increase the quality, accessibility, and value of health care, to reduce disparities, and to improve health. A trusted broker of information, AcademyHealth brings stakeholders together to address the current and future needs of an evolving health system, inform health policy, and translate evidence into action.

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Endnotes

1 The objectives of the March 2012 EDM Forum Symposium on the Collection and Use of Patient-Reported Outcomes were: 1) to discuss the development, validation, and analysis of generic and disease-specific PROs in CER; 2) to propose and refine a framework for addressing the challenges and opportunities for incorporating PROs into CER and PCOR; and, 3) building from the framework, explore opportunities for a multi-platform collaborative test project. For more information on the symposium, including an agenda and archived presentations, please visit www.edm-forum.org.