

PROgress Evidence Review and Summary: Impact of Administering Patient-Reported Measures and Outcomes (PROs) Within HIV Routine Care

Authored by:

Rob J. Fredericksen, PhD, MPH

University of Washington, Medicine, USA

Heidi M. Crane, MD, MPH

University of Washington, Medicine, USA

William Lober, MD

University of Washington, Health Informatics, USA

Emma Fitzsimmons, BA

University of Washington, Medicine, USA

Duncan Short, PhD

ViiV Healthcare, Global Implementation Science, UK

On Behalf of the PROgress Study Team:

Improving HIV care through the implementation of PROs
within routine patient management' – PROgress study



TABLE OF CONTENTS

FOREWORD	4
EXECUTIVE SUMMARY	6
1. INTRODUCTION	9
1.1. What are PROs?	9
1.2. PROs in the context of modern HIV care	9
1.3. Types and uses of PROs	11
1.4. Potential impact of PROs	11
1.5. Opportunities for use of PROs in routine care.....	12
1.6. About the evidence review and summary	13
2. IMPACT ON PROVIDER AWARENESS AND MONITORING OF SYMPTOMS, BEHAVIORS, AND OTHER PRO DOMAINS	15
2.1. Evidence from HIV care	15
2.2. Evidence from other disease areas.....	17
3. IMPACT ON PATIENT-PROVIDER COMMUNICATION	21
3.1. Evidence from HIV care	21
3.2. Evidence from other disease areas.....	22
4. PROVIDER ACCEPTANCE AND PERCEPTIONS OF THE VALUE OF PROS	24
4.1. Evidence from HIV care	24
4.2. Evidence from other disease areas.....	25
5. PATIENT USABILITY, ACCEPTABILITY, AND VALUE OF PROS	27
5.1. Evidence from HIV care	27
5.2. Evidence from other disease areas.....	29
6. IMPACT OF PROS ON DELIVERY OF CARE	32
6.1. Evidence from HIV care	32
6.2. Evidence from other disease areas.....	33
7. IMPACT ON PATIENT OUTCOMES	35
7.1. Evidence from HIV care	35
7.2. Evidence from other disease areas.....	36
8. SUMMARY AND DISCUSSION	39
8.1. Summary.....	39
8.2. Gaps in the HIV literature around PRO use	40
8.3. Conclusions.....	41

APPENDIX 1. IMPACT ON UNDERSTANDING PATIENT OUTCOMES (RESEARCH).....	42
APPENDIX 2. METHODS	43
ABBREVIATIONS.....	44
ACKNOWLEDGMENTS AND FUNDING	45
REFERENCES.....	47

FOREWORD

This Evidence Review and Summary was assembled by members of the PROgress Study Team from the University of Washington and ViV Healthcare, and reviewed by the PROgress Study Steering Group.

PROgress is a research workstream entitled '*Improving HIV care through the implementation of PROs within routine patient management*'. This includes three interrelated components, designed to support the implementation of patient-reported measures and outcomes (PROs) within routine HIV care:

1. An implementation science research study (the **PROgress study**), integrating PROs into two HIV clinical care settings. This served two purposes: first, to identify the essential program elements that can support the sustainable implementation of PROs into routine HIV care in community settings; second, to examine the added value of implementing PROs into routine HIV care for the salient stakeholders, including the patient, the providers, and other clinic staff. Further details can be found at <https://progresshivcare.org/#study>.
2. A **PROgress Implementation Toolkit**, which is a resource for those considering implementing PROs in clinical HIV care. This is designed to provide practical advice to support the introduction of clinical PRO assessments into routine HIV care. These insights draw from a range of sources, including: practical experience integrating PROs into HIV clinical care at multiple sites, including the PROgress sites; published literature; and additional primary interviews with stakeholders that have experience integrating PROs into HIV clinical care. This Toolkit was designed to provide resources, tips, and learning to help implement PROs adapted as needed for individual clinics and is available at <https://progresshivcare.org/#toolkit>.
3. This **Evidence Review and Summary**, which is designed to raise awareness of the evidence relating to PROs in the care of people living with HIV (PLHIV) and to outline the potential for well implemented instruments within routine care. It draws on evidence from published literature characterizing the impact of PROs in routine clinical care for patients with chronic comorbidities including HIV-related literature as well as other fields, particularly oncology.

The Evidence Summary and PROgress Implementation Toolkit serve as complimentary resources, with the Evidence Summary designed to summarize available real-world evidence supporting the integration of PROs within routine HIV clinical care settings, and the Toolkit designed to provide practical hands-on approaches. The PROgress study has informed both documents and this Evidence Summary will continue to be updated as PROgress outcomes are published.

The target audience for the Evidence Summary includes stakeholders considering PRO implementation such as providers, clinic managers, and clinic leadership. We draw upon a targeted literature review which identified primary data sources in the published, peer-reviewed literature that reported findings of the usability, impact and utility of PROs in routine clinical care.

The Evidence Summary does not include every study regarding PRO implementation (see [Appendix 2](#) for **Methods**), instead it highlights those from both HIV clinical care and other clinic settings, categorizing impacts of PRO implementation into 6 broad categories:

1. Provider awareness
2. Patient-provider communication
3. Provider acceptance
4. Patient usability, acceptability, and value of PROs
5. Delivery of care
6. Patient outcomes.

While we present studies in these 6 categories, there is clearly a great deal of overlap.

EXECUTIVE SUMMARY

Key takeaways

PRO assessments have the potential to:

- Improve providers' awareness and monitoring of patient needs, behaviors, and health issues
 - Unearthing otherwise hidden patient needs and increase the number of complex health and behavioral issues identified
- Improve patient-provider communication
 - Helping both providers and patients to initiate, structure, and prioritize discussion topics, including sensitive issues

PROs have demonstrated:

- High acceptability and value to both patients and providers
- Ability to be integrated into routine care with minimal disruption to clinic flow

Progress continues to be made towards achieving the UNAIDS 90-90-90 HIV targets: 90% of PLHIV diagnosed, 90% of those diagnosed on treatment, and 90% of those on treatment virally suppressed (the 90-90-90 targets were set for 2020; a 95-95-95 target has been set for 2030).^{1,2} The concept of the fourth 90 is the addition of health-related quality of life (HRQoL) as an equally important goal to the other 90-90-90 targets that healthcare systems should be trying to achieve.^{3,4} The ability to expand targets to consider the fourth 90 is a result of the dramatic alteration antiretroviral therapy (ART) has had on the progression of HIV disease, including reducing HIV-related mortality and increasing life expectancy.⁵⁻⁷ As a result, there has increasingly been a shift in focus from mortality to morbidity among PLHIV including symptom burden and HRQoL.

In parallel with these changes has been an increasing emphasis on a fourth 90: HRQoL. Focusing on person-centered healthcare, which addresses the wide array of determinants of poor health among PLHIV beyond just viral suppression, will enable PLHIV to enjoy healthy aging with ongoing viral suppression.³ Eliciting patient reported measures and outcomes (PROs) to inform patient-provider consultations is an efficient way to ensure that HIV care reflects the needs and priorities of PLHIV³ and moves towards more person-centered healthcare.

A patient-reported measure or outcome (PRO) is defined as “any report on the status of a patient’s health condition that comes directly from the patient without interpretation of the patient’s response by a clinician or anyone else”.⁸ PROs may include one or more dimensions of care, including physical symptoms, mental health (e.g. depression, anxiety), health behaviors (e.g. medication adherence, substance use, sexual risk behavior), functioning (e.g. cognitive, physical), life circumstances (e.g. current housing, intimate partner violence), identity (e.g. sexual orientation, gender identity), social well-being (e.g. social support, HIV stigma), HRQoL, and/or satisfaction with treatment/care or other factors. Many PRO measures assess patients’





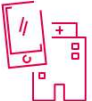

perceptions of their health that cannot otherwise be observed or measured (e.g. depression, HRQoL, pain, fatigue, anxiety), or are not easily directly observable (e.g. adherence, substance use, sexual risk behavior, ability to perform daily activities).³ While PROs have long been used in research, the use of PROs in HIV clinical care is less common, yet its expansion can provide a complement to laboratory testing or physical examinations with standardized PRO assessments. Routine administration of PROs in clinical care has the potential to: improve systematic detection of clinically relevant issues such as inadequate medication adherence, substance use, or unrecognized depression; enrich the visit by shifting the focus of provider discussions to areas of need rather than information gathering; improve health outcomes; and increase patient satisfaction with care.

There are many ways that implementing PROs in HIV care can potentially have benefits. Among PLHIV, rates of substance use, depression, intimate partner violence, homelessness, and other factors are higher than among the general population.⁹⁻¹³ Sexual risk behavior has important implications, both for an individual's risk of acquiring sexually transmitted infections as well as public health consequences in terms of possible HIV transmission or transmission of other sexually transmitted diseases. Not assessing sexual risk behavior allows missed opportunities in terms of offering partners pre-exposure prophylaxis (PrEP) to prevent HIV transmission and other potential support for individuals and their partners. Among those who are not virally suppressed, important contributors may include inadequate adherence to ART, substance use, and depression symptoms. Many of the symptoms, health and risk behaviors, and life circumstances described above are not directly observable and are best measured by direct patient report. Yet, many are not well measured in most clinical care settings and therefore poorly addressed.

We present in this document, a body of evidence regarding the potential value and impact of implementing PROs in routine clinical care for PLHIV, based on evidence from HIV care when available and supplemented by evidence from other chronic conditions (**Figure 1**. Possible improvements in HIV care due to PROs

Figure 1. Possible improvements in HIV care due to PROs

We highlight that PROs have the potential to improve HIV care in the following ways:

<p>Improve provider awareness and monitoring</p> <ul style="list-style-type: none"> Improves provider awareness of highly personal or stigmatizing symptoms or behaviors including depression, suicidal ideation, and substance use Improves detection of QoL issues Improves detection and management of symptoms 	<p>Improve patient-provider communication</p> <ul style="list-style-type: none"> Yields information previously unknown to the provider Facilitates more honest discussion on sensitive issues Focuses clinical visits; helps both patient and provider identify or prioritize needs/concerns 	<p>Useful to providers</p> <ul style="list-style-type: none"> Improves detection of issues including less observable or infrequently discussed symptoms and behaviors Useful for monitoring including tracking changes 
<p>Acceptable and useful to patients</p> <ul style="list-style-type: none"> Easy to use (tablet-based assessments) Acceptable Helps promote discussion Encourages honest responses to sensitive topics 	<p>Impact on health services delivery</p> <ul style="list-style-type: none"> Does not increase visit length or have a large negative impact on clinic flow when done well Increases referrals Leads to more closely monitored treatment 	<p>Impact on health outcomes</p> <ul style="list-style-type: none"> Improves symptom control Improves outcomes for mental conditions including depression 

QoL, quality-of-life

Not all of the above areas of evidence apply to all PLHIV, clinical care settings, or all approaches to PRO implementation, and several areas would be strengthened by additional evidence specifically among PLHIV rather than patients with other chronic conditions such as cancer. However, overall this is a very compelling body of collective evidence that supports well-done PRO implementation despite noted barriers.

Key recommendations include the selection of instruments measuring domains that are clinically-relevant or actionable for providers. Other recommendations include implementation of PROs in such a way that avoids long delays between PRO completion and clinic visits, and that minimizes disruption of clinic flow. For example, a well-done PRO implementation approach might include brief tablet-based assessments done in clinic on the same day as provider visits, with easily interpretable results immediately available to the provider focused on clinically-important domains.

For more information on implementation considerations, please see the PROgress Implementation Toolkit available at <https://progresshivcare.org/#toolkit>. Overall, while implementation requires careful consideration, the evidence suggests it can be an important tool to improve clinical care for PLHIV, facilitating person-centered approaches; improving patient-provider communication, incorporating patients' viewpoints on their health status, and identifying missed symptoms, health and risk behaviors, as well as life circumstances.

1. INTRODUCTION

1.1. What are PROs?

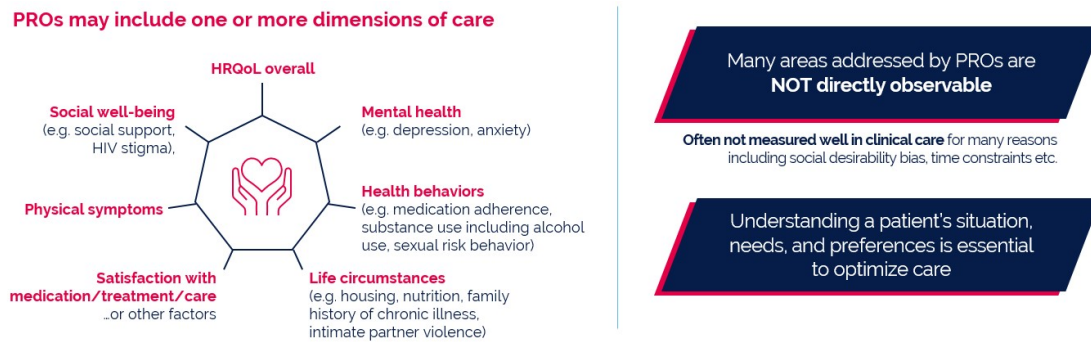
Patient-reported measures and outcomes (PROs) are defined as “*any report on the status of a patient’s health condition that comes directly from the patient without interpretation of the patient’s response by a clinician or anyone else*”.⁸ In the context of this evidence review, we focus on brief PRO assessments useful for clinical care, typically but not always collected on touch-screen tablets at the start of clinic appointments to improve care with summary results made available to providers for the clinic visit. Other approaches are also possible such as interviewer-based collection or electronic health record patient portals; however, we emphasize these much less due to the high costs, staff burden, and under-reporting of risk behaviors with interviewer-based approaches, and the exclusion of so many potentially high-risk patients with patient portals that require a level of technological sophistication and access that is not inclusive of entire HIV clinic populations.

1.2. PROs in the context of modern HIV care

Advances in ART over the past decades has increased the life expectancy of PLHIV and transformed it from a fatal disease to a chronic manageable condition.⁵⁻⁷ The associated decline in mortality since ART has been introduced has led to increased emphasis on managing comorbidities, including those associated with HIV and its treatment. Many of the symptoms, health behaviors, and life circumstances associated with living with HIV and these comorbidities cannot be measured by laboratory values or other directly observable approaches, they are best measured by direct patient report and are under-addressed in clinical care. In HIV care, examples include antiretroviral (ARV) medication adherence, substance use, sexual risk behavior, and depression.¹⁴ Reasons for this have included social desirability bias, time constraints, limited communication skills to convey symptoms or feelings, or linguistic and/or cultural barriers.¹⁵⁻¹⁸

Assessments of PROs implemented in HIV care settings, if done well, present an opportunity to measure several dimensions of care including physical symptoms, mental health (e.g. depression, anxiety), functioning (e.g. cognitive function, physical function), health behaviors (e.g. medication adherence, substance use, sexual risk behavior, physical activity), life circumstances (e.g. current housing, intimate partner violence), identity (e.g. sexual orientation, gender identity), social well-being (e.g. social support, HIV stigma), HRQoL, and/or satisfaction with care (**Figure 2**). The information can inform and direct dialogue between clinician and PLHIV and uncover otherwise hidden patient needs. In particular, brief, validated instruments that result in interpretable results and inform action-oriented decision-making (e.g. depression screening) may be of particular value. While these are just some of the domains of potential interest, in most clinical settings a targeted subset could be selected to integrate into clinical flow (see <https://progresshivcare.org> for information on successful implementation approaches).

Figure 2. Dimensions of care measured by PROs



In addition to improving HIV care, there are other reasons PROs have increased in relevance. These include demands from regulators, payers, professional organizations, and providers and increased reporting requirements in areas such as depression or substance use screening, which can be systematically assessed with PROs.¹⁹ Common reasons cited for implementing PROs in clinical care among stakeholders who have already implemented them include screening, monitoring, treatment evaluation and treatment planning, and quality improvement including that mandated by external agencies.²⁰ PROs have increasingly been identified as measures needed for demonstrating high-quality patient-centered care.¹⁹ Goals include making the most meaningful use of visit time, managing costs, and ensuring patient-driven care. Technological infrastructure has advanced rapidly, leading to expanded incorporation of touch-screen tablets and internet-based applications, as well as electronic medical records in clinical settings,¹⁹ which has increased the feasibility and decreased the burden of PRO assessment.

1.3. Types and uses of PROs

Table 1 below describes several different types of PROs and how they might be applied, using examples from both HIV and other clinical settings.

Table 1. Examples of types and uses of PROs

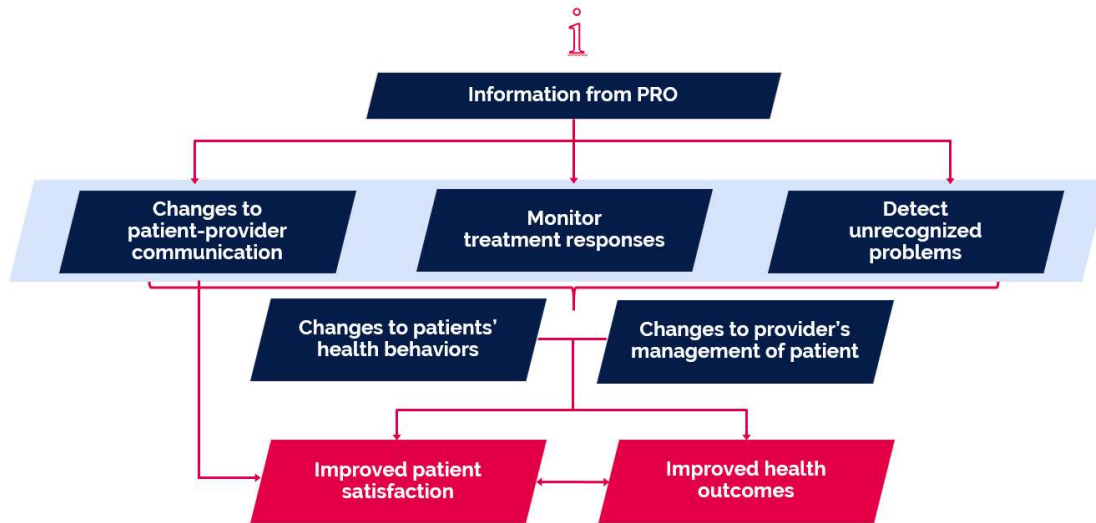
	Type	Example of potential use	Examples of PRO instruments
1	Needs assessment/screening	Depression screening to identify the need for a therapeutic intervention ²¹ At-risk alcohol use screening ²²	Patient Health Questionnaire – 9 items for depression (PHQ-9) ²³ Alcohol Use Disorders Identification Test (AUDIT/AUDIT-C) ^{24,25}
2	Adherence	Assessment of adherence to HIV medications ^{26,27}	Visual analogue scale, self-rating scale ^{28,29}
3	Symptom management	Outpatient symptom monitoring in patients with HIV ³⁰ Outpatient symptom monitoring in patients with cancer receiving chemotherapy. ³¹ Tracks intended and unintended treatment effects, and identifies symptom-management opportunities	HIV Symptom Index ³² MD Anderson Symptom Inventory (MDASI) ³³
4	Quality improvement	Assessment of symptom prevalence across all patients in clinic or hospital-setting Provides population-level scores to evaluate clinical practice	Symptom Distress Scale (SDS) ³⁴ HIV/AIDS Targeted Quality of Life (HAT-QoL) measure ³⁵

Adapted and expanded from Jensen et al.¹⁹

1.4. Potential impact of PROs

Figure 3 describes the potential impact of PROs in clinical care.³⁶ Results from PROs are reviewed by providers, which prompts discussion of health issues with patients. This information enables clinicians to identify previously unrecognized problems or monitor the impact of treatment and the patients' health status, allowing for more tailored, individualized care. The resulting information and response may lead to improvement in the patients' health status and/or satisfaction with care.³⁶

Figure 3. Theory of PRO impact on patient health outcomes

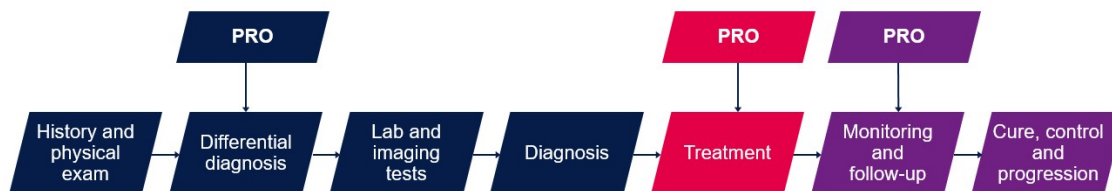


Adapted from Greenhalgh et al.³⁶

1.5. Opportunities for use of PROs in routine care

Figure 4 outlines points at which PRO data might be used in care settings, from initial history and physical examination, during treatment, and during follow-up.³⁷ PROs may be administered pre-consultation to enhance the identification of health issues before a provider sees the patient.

Figure 4. PRO use in routine clinical care



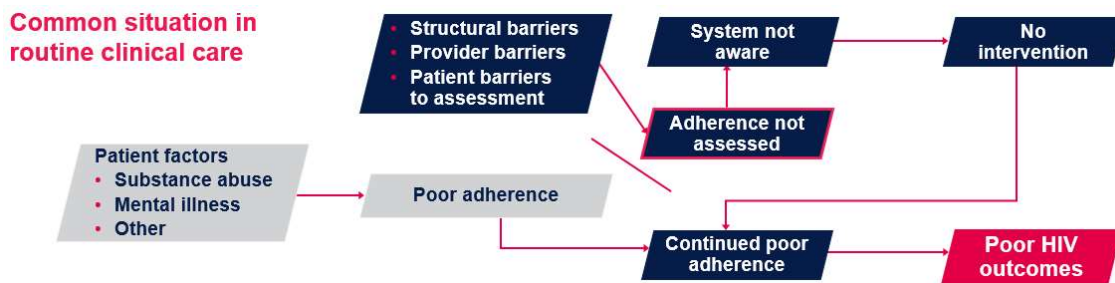
Adapted from Osoba, 2007.³⁷

Figure 5 provides an example of HIV care using the goal of improving adherence to ART to demonstrate the comparison between HIV clinics without PRO implementation versus those with PRO implementation. Adherence to ART is one of the most important determinants of obtaining and maintaining HIV viral suppression and is critical to prevent drug resistance, disease progression and death, and to minimize HIV transmission.³⁸⁻⁴³ Detecting and addressing sub-optimal adherence therefore is a crucial aspect of HIV clinical care. However, suboptimal adherence is under-detected by providers,^{39,44,45} and often not recognized until after virologic failure (**Figure 5a**). In

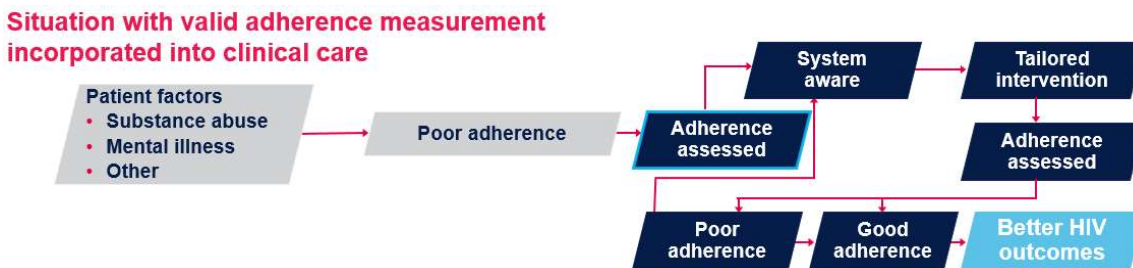
contrast, when PROs are implemented in clinical care including clinically-relevant domains such as adherence, depression, and substance use, the clinic is then in the improved situation of **Figure 5b**.

Figure 5. Comparison of HIV clinical care in two clinics: one without PROs including adherence assessment, and one with PROs using adherence as an example

a. Clinic situation without a PRO assessment using adherence as an example



b. Clinic situation with a PRO assessment using adherence as an example



1.6. About the evidence review and summary

The studies discussed in this evidence review and summary put forth a variety of approaches and contexts to PRO implementation that render comparisons between the studies and their findings difficult; in general, however, they provide PRO data to the provider prior to or at the beginning of an appointment. More recent studies mostly (but not exclusively) used tablet-based PRO collection while more of the older studies used paper-based PRO assessment approaches.

Furthermore, several methodological approaches are reported, including randomized controlled trials (RCTs), as well as observational or pre-test/post-test comparisons. Numerous PROs and outcome measurements are also used, thereby rendering it difficult to directly compare results.

Evidence is organized within each chapter, separating HIV care studies from studies of other types of care. Within HIV and non-HIV care sections, strongest evidence is presented first based on data and outcome quality, relevance to HIV clinical care implementation, timeliness of the study, as well as study type (e.g. systematic reviews

and meta-analyses vs intervention trials, mixed method qualitative/quantitative studies, quantitative surveys, and qualitative interviews).

2. IMPACT ON PROVIDER AWARENESS AND MONITORING OF SYMPTOMS, BEHAVIORS, AND OTHER PRO DOMAINS

Summary

The use of PROs:

- Improves provider ability to identify highly personal or stigmatizing symptoms or behaviors, including depression,^{14,46,47} substance use,¹⁴ inadequate ART adherence,¹⁴ and sexual risk behavior³¹
- Results in information that providers did not know about their patients such as suicidal ideation, depression, and substance use. Furthermore, this occurred for patients with established relationships which was unexpected by providers⁴⁸
- Improves detection of a broad range of symptoms in several clinical populations^{47,49-55}
- Improves symptom management^{14,49-52,54-56}
- Increases provider actions in response to domains such as depression and inadequate adherence¹⁴
- Domains that have clear provider actions resulted in more impact
- Impact is larger with more addressable domains such as depression in contrast to general health status⁴⁷
- Improves detection of HRQoL issues including social functioning^{31,57-59}

Strong evidence suggests the use of PROs in HIV care improves providers' ability to detect and monitor symptoms and health behaviors. These studies indicate that PROs are successful in increasing provider awareness of a variety of often unrecognized problems (e.g. symptoms or risk behaviors) that patients may be experiencing. They demonstrate that for HIV care this is particularly valuable for domains that providers consider actionable, such as depression/suicidal ideation and substance use. It demonstrates that the impact of PRO implementation on provider awareness may differ by approach with providers preferring easily interpretable, concise, and directly-actionable information in a timely manner. It further demonstrates that the impact differs by domain therefore suggesting much more research is needed on benefits for less directly-actionable domains to either demonstrate their benefits or provide resources or education for providers as to how to use that information.

2.1. Evidence from HIV care

Kjaer et al:⁴⁹ This study evaluated the clinical implementation and use of a web-based PRO symptom collection tool in a cohort of PLHIV (n=262) in outpatient HIV care. PLHIV completed the assessment on-line from home. Medical records were evaluated to determine whether the results from PLHIV indicating high levels of symptom severity provided new information. In many cases, ***PROs appeared to provide new information on cognitive (76%) symptoms, and on other severe symptoms (42%).***

Crane et al:¹⁴ In an outpatient HIV clinic, PROs were implemented as part of clinic visits using touch-screen tablets. A comparison was made of provider documentation in a period after PROs were implemented but before providers started receiving the PRO results versus a period after they started receiving the PRO results. Chart documentation was reviewed in both time periods to determine if PRO feedback to providers resulted in greater awareness or actions as measured by chart documentation of depression, suicidal ideation, adherence to ART, sexual risk behavior, and substance use. PRO assessments (n=2,289) were completed at the beginning of clinic visits. Results indicated that **providers were significantly more likely to document depression** (74% before vs 87% after feedback, p=0.02), **as well as at-risk alcohol use** (41% before vs 64% after feedback, p=0.04), **substance use** (60% before vs 80% after, p=0.004), **and less likely to incorrectly document good adherence among PLHIV with inadequate adherence** (42% vs 24%, p=0.02). **Provider awareness increased** (as measured by chart documentation) **for all domains assessed**, significantly so for all domains except one (sexual risk behavior) however **impact on actions was smaller (impact was in the positive direction for all domains but only statistically significant for depression and adherence)**.

Lawrence et al:⁶⁰ Among 1,216 PLHIV in clinical care who completed a PRO assessment at two clinics, 170 reported some degree of suicidal ideation including 33 (~3% overall) who reported the highest degree of suicidal ideation (thinking “nearly every day” that they would be “better off dead or hurting themselves in some way”). An automated notification system allowed additional self-harm assessments to be done in clinic for those who reported the highest degree of suicidal ideation including contracts for safety when needed. The investigators concluded that **the implementation of PROs in routine HIV care represented “potentially transformative technology to screen for suicidal ideation and other PROs, which would significantly enhance detection, referral, and ultimately, the overall cost-effectiveness of care** through timely intervention.”

Fredericksen et al:¹⁵ A needs assessment of PRO data was conducted in an HIV clinic. PLHIV completed the PROs in the waiting room before their appointments. Providers did not receive the PRO results. Chart documentation from the visit from the same day that PLHIV completed the PROs was reviewed and **notable discrepancies between PRO results and provider documentation were observed**. Among the 300 patients completing the assessment, chart review of 20 patients reporting severe depression symptoms on the assessment revealed no provider mention of depression for 9 (45%). Only 7 of these 20 (35%) had depression addressed in any way (medication initiated, dose increased, psychiatry, or case worker referral etc). Among the 68 PLHIV who reported current use of illicit drugs other than marijuana, providers either failed to document the issue at all or documented the absence of substance use for 31 (46%) patients. Among 62 PLHIV who reported missing multiple doses of ARV medications in the prior 4 days, providers documented inadequate adherence for only 17 (27%), did not comment on adherence for 25 (40%), and reported good adherence (“missed no doses”, “>95% adherence”, and “perfect adherence”) for 20 (32%). **This demonstrates the value of PROs to evaluate outcomes such as adherence and mental health/substance use issues that otherwise may be overlooked by providers.**

Fredericksen et al:⁴⁸ A qualitative study to elicit the views of 27 providers was conducted to understand views and experiences of PRO implementation from HIV and community health clinics. One benefit cited was that **PROs help to identify less-observable and difficult-to-discuss behaviors and conditions**. Two-thirds of providers described PROs as **a useful tool to identify problems “that might have otherwise been minimized or omitted by the patient”**. Almost all providers mentioned the **identification of depression and suicidal ideation** as a valued benefit of PROs. It was suggested that PROs helped patients to raise issues that may not be easily offered due to social desirability issues. One provider described how PROs are **“triangulating the communication dynamic, allowing for reprieve from direct eye contact as both parties review the PRO results on a computer screen or on paper, creating a sense of objectivity and teamwork in discussion of the content”**.

Several providers described being surprised by the PRO results:

“ Getting a printout that said “Your patient is feeling suicidal” essentially was like “Whoa! I didn’t expect this!” 🙄

HIV Provider, Seattle

“ Today, the patient sat down [and] said, “Yeah, things are okay, I’m just not sleeping good.” But when I looked at the PROs that he had just answered, he was suicidal a couple of times last week. 🙄

HIV Provider, San Diego

Several providers interviewed described how they believed **PROs had provided an efficient inventory of recent substance use**, identifying nature and frequency of use, and acting as a conversation starter:

“ Who has the time to ask about all of the types of drugs that people use? [The PROs] right away give you the spectrum of what people are using...from there you can structure the conversation. 🙄

HIV Provider, San Diego

2.2. Evidence from other disease areas

Chen et al:⁵⁵ In this systematic review of 27 oncology studies, 16 studies reported results related to detection of unrecognized problems. Of these 16 studies, 15 reported either **a strong or moderate positive impact on detecting unrecognized problems**. There was evidence that it **improved the monitoring of treatment response** with all 11 relevant studies reporting strong or modest effects. Of 17 studies, 13 reported **modest or strong positive changes to patient management**, 4 found none. Several of the involved studies suggested that the success of PROs may be dependent on the availability of PRO feedback in a simple clear manner, the involvement of multiple stakeholders, and health professional training.

Barr et al:⁶¹ In this study of older adults in primary care in 14 clinics in the United States (US), patients (n=505) completed a 46-item health risk assessment including falls risk and urinary incontinence. Physicians in the intervention clinics received notification in the scheduling program that there were PRO results to review, physicians in control clinics did not (approach varied slightly by clinic). Information on falls risk or urinary incontinence was only documented by physicians between 3–14% of the time. Interviews with providers (n=16) identified several reasons for this. Providers noted the poor interface with the electronic health record such that while they received “pop-up alerts”, they had to do a lot of clicking and scrolling to find the result, making it time-consuming and frustrating. Providers commented that one of the barriers in this study was that there was way too much data in the PRO feedback and that much of it was unnecessary. ***The barriers highlighted the importance of streamlined easy-to-use approaches to provider feedback.***

Berry et al:³¹ In a randomized trial of oncology patients, Electronic Self-Report Assessment – Cancer (ESRA-C) was evaluated for impact on outpatient visit patient-provider discussions of symptoms and HRQoL. Patients (n=660) were randomized to either an intervention group for whom providers received ESRA-C results in the form of a 2-page graphical summary, and a control group where providers did not receive feedback. Effectiveness was measured by whether the patient-reported issues identified in ESRA-C were mentioned during an audio-recorded visit. ***HRQoL and symptoms were more likely to be discussed in the intervention group (p=0.03).*** In particular, ***there was a greater likelihood of discussions regarding impact of cancer on sexual activities and social functioning in the intervention group.***

Cleeland et al:⁵¹ In an outpatient thoracic surgery clinic, patients were monitored for symptom experiences: pain, distress, disturbed sleep, shortness of breath, and constipation via automated phone assessments. In one arm, email alerts were sent to providers when a certain symptom severity level was reached, while in the control arm no alerts were sent. Both groups completed the MDASI via interactive voice response (IVR). ***The intervention group demonstrated fewer symptom severity events (19% vs 8%) and faster improvement in symptoms than the control group;*** difference in average reduction of symptoms between intervention and control was –0.36 (standard error, 0.078; p=0.02). The results suggest that monitored post-operative symptoms with clinician alerts can improve symptom management and lead to a reduction in symptom severity during the post-operative period.

Ruland et al:⁵⁰ Patients (n=145) with leukemia or lymphoma completed an interactive tailored patient assessment (ITPA) tool that included questions on patient care, symptom distress, and need for symptom management support during treatment and rehabilitation. Patients were randomly assigned to two groups; an intervention group where the provider received ITPA data and a control group where the providers did not receive the data. ***Significantly more symptoms and problems were addressed by providers in the intervention group (p<0.001).*** ***Over time, patients assigned to the intervention group demonstrated less symptom distress than those randomized to the control group.*** Systematic elicitation and appraisal of symptoms/concerns appeared to increase provider awareness/monitoring and improve patient symptoms.

Velikova et al:⁵⁴ In a prospective RCT, oncology patients (n=286) were randomly assigned to one of three arms; an intervention arm, who completed touch-screen PROs and whose providers received the results; an attention-control arm, who did the same but with no results delivered to providers; and a control arm that received usual care (no PRO). PROs included the European Organization Research and Treatment of Cancer Quality of Life Cancer – 30 (EORTC-QLQ-C30) and the Hospital Anxiety and Depression Screening (HADS) measures. The first two groups were administered PROs over a 6-month period. **When compared to the two control groups, the number of symptoms identified and discussed during the provider-patient interaction was significantly higher (p=0.03).**

Detmar et al:⁵⁹ In a 2-year prospective randomized cross-over trial, investigators examined the usefulness of increasing providers' awareness of patient HRQoL. Patients whose providers were in the intervention arm completed the EORTC-QLQ-C-30. Patients also completed a functional assessment questionnaire and following their first and fourth study visit, completed a patient satisfaction questionnaire. Based on content analysis of audio-taped consultations, **HRQoL concerns were discussed significantly more often by providers in the intervention arm and moderate-to-severe HRQoL concerns were more likely to be identified.**

Dobscha et al:⁴⁶ In this study of US veterans in primary care, patients with an affirmative response to a single depression item were asked to complete a self-administered paper-based questionnaire (PHQ-9), which they turned in to their provider. A mental health nurse subsequently reviewed the records and contacted providers when depression was present as measured by the PHQ-9 but not mentioned by the provider in the visit note. As a result of this brief assessment combined with a mental health nurse contact with the provider when depression was not addressed, this study found **a significant improvement in documentation of depression symptoms** (72% vs 48%; p<0.001) **and suicidal ideation** (36% vs 14%; p<0.001).

Taenzer et al:⁵⁷ In this study of patients being seen at a lung cancer outpatient clinic, patients (n=53) were randomized to complete a computerized HRQoL questionnaire (EORTC QLQ-C30) before their clinic visit with feedback of results to clinic team members, or to complete a paper-based version after their appointment without feedback. **Significantly more HRQoL items were addressed** during the clinic appointments among those who completed the assessment before the appointment with PRO feedback to clinic staff compared with patients in the control group who completed it after the appointment without feedback (49% vs 24%, p<0.05).

Espallargues et al:⁴⁷ This systematic review of RCTs (n=21) from community health and outpatient clinics assessed the impact of PROs with provider feedback. Seven of 11 studies that evaluated this **found a positive impact on diagnoses**. Of note, **this was stronger among those that provided feedback on more targeted and actionable domains such as mental health symptoms rather than general health status feedback**. For example, the meta-analysis of mental health feedback showed a higher diagnosis rate in the intervention group (odds ratio [OR], 1.91; 95% confidence interval [CI]: 1.28, 2.83). In contrast, the impacts on treatment were not significant.

Mazonson et al:⁵³ A 5-month prospective trial studied the impact on primary care provider decision-making of giving PRO information on anxiety and other mental health symptoms and disorders to providers (n=75) in primary care. Randomization was to either a control group that received no PRO feedback, or to an intervention group that did. Patients (n=573) received the Symptom Checklist-90 (SCL-90) and the 36-item Standard Health Form (SF-36). **Providers receiving PRO feedback on patients with previously unrecognized anxiety were more likely to identify anxiety** (32% vs 19% control; adjusted OR [aOR], 2.51; 95% CI: 1.6, 3.9), **and conducted more frequent follow-up appointments with patients** (aOR, 1.7; 95% CI: 1.1, 2.7).

Mark et al:^{52,62} Quantitative and qualitative approaches were used to evaluate providers' impressions of the Patient Assessment, Care and Education (PACE) system™ which administered a symptom severity screening scale. **Over 60% of the providers rated the system as high value with regards to patient problem identification, focusing patient interviews, tracking changes in patient symptoms and providing documentation.**

3. IMPACT ON PATIENT-PROVIDER COMMUNICATION

Summary

The use of PROs:

- Improves detection of previously unrecognized problems^{14,48} (see [Chapter 2](#))
- Facilitates honest discussion on sensitive issues (i.e. reduces social desirability bias)^{48,58,63} (see [Chapter 4](#) and [Chapter 5](#))
- Empowers patients as partners in care^{64,65} and helps prioritize needs/concerns^{63,65-67}
- Helps providers and patients prioritize discussion of patient concerns^{48,52,58,62}
- Increases frequency of discussions on a broad range of outcomes including HRQoL domains, suicidal ideation, substance use, and others^{31,52,54,55,59,65,67-73}
- Increases time spent addressing symptoms^{52,62} and helps patients remember their symptoms⁶⁵

Evidence suggests PROs improve, and do not impede, patient-provider communication. Both patients and providers have found PROs useful for prioritizing concerns, as well as reducing social desirability bias experienced when discussing highly personal or potentially stigmatizing topics face-to-face. In addition to improved detection of issues that may have otherwise gone unaddressed, the discussion of PROs appears to add a depth of communication that legitimizes discussion of difficult topics, focuses the visit, and empowers the patient.

3.1. Evidence from HIV care

Crane et al:¹⁴ As described in [Chapter 2](#), touch-screen-based PRO implementation occurred in an outpatient HIV clinic and a comparison was made between provider documentation in a) a period after PROs were implemented but before providers started receiving the PRO results, and b) a period after they started receiving the PRO results. **Providers increased both their documentation of discussions and their actions such as referrals in response to depression and inadequate adherence, after they received the PROs**, suggesting improved patient-provider communication.

Fredericksen et al:⁴⁸ As described in [Chapter 2](#), 27 providers were interviewed regarding the benefits and consequences of having had PROs integrated into routine HIV care at their clinics. **PROs helped providers set the agenda for the interaction.** Value was also reported in the **use of PROs to promote patient-provider collaboration** and to **improve patient involvement**. A key benefit reported by providers included **the identification of less observable behaviors that could be problematic, including suicidal ideation and previously unknown at-risk alcohol use** that would have not been discussed without the PROs.

Crane et al:⁵⁸ Stakeholder interviews with providers and patient usability interviews were conducted as part of an evaluation of PRO implementation using touch-screen tablets into routine HIV clinical care. Results indicated that both providers and patients viewed the PROs as extremely relevant to the clinical consultation. **Providers found that the PRO reports served as “conversational ice-breakers”. Patients noted PROs increased awareness of their own needs, focused the visit, and allowed them to be more honest.**

3.2. Evidence from other disease areas

Kotronoulas et al:⁶⁸ This systematic review of PROs in cancer care included 26 articles that reported on 24 unique studies. Though effect sizes were small, **use of PROs increased frequency of discussions with providers on relevant patient outcomes during visits.** For example, among those receiving palliative chemotherapy, PROs improved overall communication regarding dyspnea, social functioning, fatigue, sleep problems, constipation, diarrhea, and cognitive functioning.

Chen et al:⁵⁵ This systematic review of 27 studies in cancer care showed strong evidence that **well-implemented PROs improved patient-provider communication.** Among 23 studies, 21 (91%) reported a positive impact on patient-provider communication, the studies included well-designed and conducted large RCTs. There was also evidence that PROs **improved the monitoring of treatment response and the detection of unrecognized problems.**

Greenhalgh et al:⁶³ This realist synthesis (a review of 39 studies) sought to understand the impact of PROs on patient-provider communication and subsequent care processes. It explored two theories: whether **PROs generate patient “self-reflection” and improve ability to communicate with providers, and whether PROs raise provider awareness of patient issues** and prompts discussion and action. The synthesis concluded that both hypotheses were true.

Berry et al:³¹ As described in [Chapter 2](#), in a randomized trial of oncology patients, the ESRA-C reporting system was developed to assess symptoms and HRQoL in ambulatory oncology care settings. Among 660 patients, audio-recorded **patient-clinician discussions of symptoms and HRQoL were significantly increased in the intervention group** ($p=0.03$) as were the odds of specific symptoms being discussed in the intervention group compared with the control group.

Takeuchi et al:⁶⁹ The goal of this study was to evaluate whether regularly collecting PROs with feedback to oncologists impacts patient-provider communication over four consecutive visits. Patients ($n=198$) were randomly assigned to intervention (PRO completion with feedback to providers), attention-control (PRO completion, no feedback to providers), and control (usual care) groups. Symptoms discussed were noted on a checklist based on a recording of the visit. **In the intervention group, more physical symptoms were discussed relative to the attention-control ($p=0.008$) or the control ($p=0.04$) groups.** Severity of symptoms, particularly for symptoms such as dyspnoea, pain, fatigue, nausea, anorexia, and insomnia also impacted likelihood of discussion.

Detmar et al:⁵⁹ In a 2-year prospective randomized cross-over trial, investigators examined the usefulness of increasing providers' awareness of patient HRQoL. Patients whose providers were in the intervention arm completed the EORTC-QLQ-C30. Patients also completed a functional assessment questionnaire – and following their first and fourth study visit, completed a patient satisfaction questionnaire. Based on content analysis of audio-taped consultations, **10 of 12 HRQoL concerns were more likely discussed by providers in the intervention arm than the control arm, and moderate-to-severe concerns were more likely to be identified. PRO results increased discussion of less observable concerns such as social function and more long-term concerns such as fatigue.**

Mark et al:^{52,62} Quantitative and qualitative approaches were used to evaluate providers' impressions of the PACE system™, which administered a symptom severity screening scale. Over 60% of the providers rated the system as high value with regards to **patient problem identification, focusing patient interviews, tracking changes in patient symptoms, and providing documentation. Providers noted that the time they spent discussing symptoms was increased while the time spent on unimportant symptoms was decreased.**

Basch et al:⁶⁵ Symptom Tracking and Reporting (STAR) is a web-based PRO platform that allows patients with gynaecologic cancer initiating a new chemotherapy regimen to enter and track their own symptoms as well as HRQoL, and generates longitudinal reports for clinicians. As part of a larger assessment, patients completed a questionnaire assessing the system and patient satisfaction after 4–6 weeks of use. **Most patients found the PRO system useful for helping them remember their symptoms (94%) and improved discussions with their provider (90%).** Clinicians involved in the study believed that a primary benefit of STAR was the increased sense of empowerment in patients. Patients noted it helped them **feel more in control of their own care.**

Santana et al:⁷³ In a RCT of 213 patients with lung disease studying usefulness of HRQoL assessment in routine care, patients completed a tablet-based PRO assessment and were randomized to whether or not the providers received the feedback. The arm with provider feedback **discussed a greater mean number of issues per encounter related to health domains in the PRO assessment.** Over the study period, the intervention had a small but **significantly greater improvement in patient-provider communication** than the control arm.

Mejdahl et al:⁶⁴ This Danish qualitative study (n=23) of patients living with epilepsy and their providers, found that **PRO use promoted patient involvement in terms of improved communication and increased “patient activation”.** Patients experienced communication with their provider as more personalized when based on PRO responses. Patients also reported feeling more comfortable discussing psychosocial issues. **Providers found PROs enabled them to more easily raise sensitive and more personal issues.**

4. PROVIDER ACCEPTANCE AND PERCEPTIONS OF THE VALUE OF PROS

Summary

Providers find PROs:

- Help identify less observable or infrequently discussed symptoms or behaviors,^{48,54,59,62,70,74} including psychosocial issues
- Help focus the agenda of the appointment and allow the provider to focus upon issues of most importance to both parties,^{48,58,62,74} or identify problems for discussion⁵⁴
- Useful for monitoring including tracking changes^{52,54,62,72} and toxicity monitoring⁷², useful to better understand patient symptoms, function, and psychosocial areas⁵⁹
- Less acceptable or useful if high patient response burden, if impedes clinic flow, or difficult to access or interpret results^{54,61}
- Help address sensitive topics⁷⁴
- Provide an overall assessment of patients,⁵⁴ adds information⁵⁴
- Provides reports worth discussing with patients⁷²

Providers generally reported PROs as useful to their practice, particularly in identifying symptoms and behaviors that might otherwise have been undetected, especially mental health and suicidal ideation. However, providers noted that adoption of PROs in practice was dependent on minimal disruption to clinic flow, ease of provider access to data, quantity and presentation of data, technological capacity, manageable patient response burden, and a focus on directly actionable domains such as depression.^{15,48,55,61}

4.1. Evidence from HIV care

PROgress study (2020):⁷⁴

PROs were implemented for PLHIV in care at two North American clinics with PRO feedback to providers as part of clinic visits. To evaluate provider perceptions, (N=11) 1:1 semi-structured interviews and post-interview anonymous surveys were conducted in which they were asked level of agreement with value statements pertaining to PROs. Survey data demonstrated that providers agreed or strongly agreed (82%) with each statement shown in **Figure 6**.

Figure 6. Survey data demonstrating level of agreement with value statements pertaining to PROs

Strong agreement (82% for each category below) that PROs helped:



In contrast, providers disagreed on whether PROs saved them time (50% agreed, 27% disagreed, 23% neither agreed nor disagreed).

In interviews, providers reported PROs **facilitated identifying sensitive topics that would likely have been missed such as suicidal ideation, sexual risk behavior, and intimate partner violence**. Providers also reported PROs allowed for a **more comprehensive identification of issues** and had an additional but manageable impact on workflow but the comprehensiveness of care was a valuable trade-off.

Fredericksen et al:⁴⁸ As described in [Chapter 2](#), 27 providers were interviewed from four geographically diverse HIV and community health clinics that have integrated PROs into routine care to better understand provider views on PRO implementation at their clinic. **Perceived benefits included the ability of PROs to identify less-observable behaviors and conditions, especially suicidal ideation, depression, and substance use; usefulness in agenda setting at the beginning of a visit; and reduction of social desirability bias in patient-provider communication.**

4.2. Evidence from other disease areas

Mark et al:^{52,62} As described in [Chapter 2](#), quantitative and qualitative approaches were used to evaluate providers' impressions of the PACE system. **Over 60% of the providers rated the system as high value with regards to patient problem identification, focusing patient interviews, tracking changes in patient symptoms, and providing documentation.**

Barr et al:⁶¹ As described in [Chapter 2](#), older adults (n=505) in primary care in 14 clinics completed a 46-item health risk assessment including falls risk and urinary incontinence. Documentation rates of International Classification of Diseases (ICD) diagnosis codes for falls and urinary incontinence were low. Providers noted that reviewing the PRO results was time-consuming and frustrating due to a poor interface with the electronic health record. They also noted that the PRO feedback included way too much data to be able to easily find what was useful. This study demonstrated that **PRO feedback that is difficult to use or interpret is much less acceptable and less likely to be used by providers.**

Basch et al:⁷² Providers receiving results of the PRO version of Common Terminology Criteria for Adverse Events (CTCAE) were asked about its usefulness in clinical decision making. ***The majority of providers (89%) discussed reports with their patients and felt the system was useful for toxicity monitoring while 78% felt reports accurately represented the true clinical status of the patient.*** These findings suggest that acceptance was high.

Velikova et al:⁵⁴ As part of the study described in [Chapter 2](#), oncology providers (n=28) were asked to respond to a survey assessing the clinical usefulness of PROs completed by patients prior to their appointment. ***Providers reported finding the PRO information clinically very useful/quite useful in 43% of encounters, somewhat useful in 28%, a little useful in 21%, and not useful (or missing response) in 9%. Providers appreciated that PRO data provided an overall assessment of patients (69%), additional information (33%), or identified problems for discussion (27%); PRO data contributed to patient management in 11% of encounters.*** During qualitative interviews providers expanded on these findings. ***Providers reported PROs identified symptoms that might have been missed, and alerted them about symptoms prone to social desirability bias such as sexual side effects and mental health status. Providers also noted that receiving results from the PACE system™ helped them focus the appointment and saved time.*** Providers indicated drawbacks including patient burden and technological difficulties.

Stover et al:⁶⁷ This qualitative study among outpatient cancer care clinicians in the US (n=12), found a web-based PRO assessing symptoms and functional status and described in [Chapter 3](#) to be ***easy to interpret (83%), and helpful for documenting symptoms (92%)***. Over 90% reported consultation time did not increase.

Detmar et al:⁵⁹ A large-scale, randomized study in palliative care examined impact of PRO feedback delivery which included graphical display, with feedback delivery to an intervention but not the control group. Providers (n=10) participated in semi-structured interviews about the study afterward and ***found it useful for better understanding patient symptoms, function, and psychosocial topics***. All the providers indicated that they would like to continue use of the HRQoL summary profile in their daily practice.

Kotronoulas et al:⁶⁸ As described in [Chapter 3](#), this was a systematic review of PROs in cancer care that demonstrated benefits including improved symptom control. ***Providers felt that overall assessments of patients were helpful for identifying issues of concern and guiding discussions with patients.***

5. PATIENT USABILITY, ACCEPTABILITY, AND VALUE OF PROS

Summary

Patients find PROs:

- Easy to use (electronic/computer-based)^{52,62,65,70-72,75}
- Acceptable across a broad range of populations and care modalities^{30,71,76,77}
- Help to recall and promote discussion of symptoms^{52,62,65,77}
- Enhance their provider's awareness of their needs^{59,65,72,78}
- A positive, useful, and valuable experience promoting self-awareness and challenging them to be honest with themselves and others about health-related behaviors and symptoms^{58,79}
- Encourage honest responses to sensitive topics⁷⁹
- Help them feel more in control of their own care⁶⁵

Furthermore, accuracy of reporting may be higher as patients are more likely to report sensitive information when completing a PRO assessment on a computer compared with an interviewer-based assessment,⁷⁵ and patients report a willingness to repeat completion of PROs at future visits⁷⁶

Despite the breadth of content of PRO assessments found in the studies listed here, most patients found tablet-based or other electronic PRO collection to be easy-to-use and highly acceptable, with many reporting its value in taking inventory of their health and in enhancing their provider's awareness of their needs.

5.1. Evidence from HIV care

PROgress study (2020):⁷⁹ (manuscript in preparation).

PROs were implemented for PLHIV in care at two North American clinics with PRO feedback to providers as part of clinic visits. To evaluate patient perceptions, a post-appointment survey was administered to 200 PLHIV to evaluate PRO utility during the visit, and 30 semi-structured interviews were conducted to assess use and perceived impact. In post-visit survey data, 82% of PLHIV reported **PROs made the visit better overall**. In addition, that PROs helped them:



In interviews, PLHIV reported feeling “cared about” by being asked about mental health and QoL needs. Most patients reported not minding the sensitive nature of the questions although two had concerns about the confidentiality of drug use data. PLHIV reported PROs added value to their care by “**encouraging honest responses to sensitive questions, improving patient-provider communication, and promoting self-evaluation**”.

Sinha et al:⁷⁵ In this PRO usability study of PLHIV in care in India, participants (n=50) completed a laptop-based PRO assessment with audio cues including adherence and psychosocial measures followed by an interview to assess acceptability and usability of the PROs. Almost all PLHIV (96%) found the PRO assessment **was easy to complete and understand**. All participants reported the PROs were **suitable for answering sensitive questions** and that they **would be willing to use PROs in the future**. Discrepancies were noted among those who completed both the PRO assessment and the same instruments using the traditional interviewer approach with discrepancies in alcohol use and sexual behaviors. In addition, all participants who completed the counselor-administered questionnaire reported no emotional stress and the highest levels of satisfaction with family support, and almost all reported “excellent” or “very good” physical health. In contrast, the laptop-based PROs resulted in a more believable distribution of responses suggesting an impact of social desirability bias on the interviewer-based assessments and greater accuracy with the PROs. **This study found that a PRO assessment was not only acceptable and well-tolerated among PLHIV with a range of literacy levels, but likely also increased accuracy compared with a counselor-administered questionnaire.**

Crane et al:⁵⁸ Patient interviews were conducted as part of an evaluation of a tablet-based PRO assessment implemented in HIV care with assessments completed at the beginning of HIV clinic visits. The PRO assessment included instruments assessing symptoms and behaviors such as depressive symptoms, drug and alcohol use, and medication adherence. **The system was reported by patients to elicit information that was useful, relevant, and important.**

“ It’s all relevant to me, even though I had to swallow a few times before answering some of them. 🙄🙄🙄”

“ The doctors don’t ask all these things in person – and some people might be more honest with the computer than the doctor. 🙄🙄🙄”

Completing a tablet-based PRO assessment was reported by patients as an inherently positive, useful, and valuable experience by heightening/promoting self-awareness, and challenging them to be honest with themselves and with others about health-related behaviors and symptoms

“ Oh I like these questions! It’s like this thing knows me! 🙄🙄🙄”

“ This keeps me aware and keeps me focused and keeps me honest. 🙄🙄🙄”

Crane et al:³⁰ The acceptability of a touch-screen tablet-based PRO assessment (62–111 items) was evaluated among 136 patients presenting for routine care in an HIV clinic. Patients were invited to participate before their clinic appointment. Patients were given brief instructions on the use of touch-screens and asked to complete the assessment which included instruments measuring depressive symptoms, symptom burden, medication adherence, drug/alcohol/tobacco use, and HRQoL. **The authors found that collection of PROs using touch-screen technology was feasible and “highly acceptable” by patients.** Outcome measures included refusal rates, patient completion times, completion rates, missing data rates, and the number of patients requiring assistance.

Of the 136 patients approached to participate in the study, 106 patients (78%) completed the assessment, 6 (4%) started but did not complete it, and 24 (18%) refused to participate, most often due to time constraints. Most of the 24 patients who refused, stated a willingness to be approached to participate on a different day. Of the 106 patients who completed the assessment, 3 required assistance (1 due to vision issues, 2 due to literacy). Median completion time was 11 minutes and 40 seconds, with a mean completion time of 12 minutes and 21 seconds. Missing data was minimal. Older patients did not take longer to complete the PROs. The authors note that with the prevalence of computers (and now smart phones and tablets) in the US, patients are likely more comfortable with technology than just a few years ago. Use of touchscreens has made PRO completion easier for the patient.

Fredericksen et al:⁸⁰ Acceptability/usability of tablet-based PRO assessments among PLHIV in care was assessed including relationships with health outcomes using a modified version of the 6-item Acceptability E-Scale (AES) within a self-administered PRO assessment. Among 768 PLHIV, overall mean score was 26/30 points (SD: 4.4). Mean scores per dimension (max 5, 1=lowest acceptability, 5=highest): ease of use 4.7, understandability 4.7, time burden 4.3, overall satisfaction 4.3, helpfulness describing symptoms/behaviors 4.2, and enjoyability 3.8. Higher acceptability was associated with better HRQoL (0.3 points [95% CI: 0.2, 0.5]) and adherence (0.4 points [95% CI: 0.2, 0.6]). Lower acceptability was associated with: higher depression symptoms (–0.9 points [95% CI: –1.4, –0.4]), and recent illicit opioid use (–2.0 points [95% CI: –3.9, –0.2]). Overall, PLHIV found self-administered, tablet-based PRO assessments to be highly acceptable and easy to use although there was some variation across patients.

5.2. Evidence from other disease areas

Howell et al:⁷⁶ In this review of PROs used in cancer clinical practice, three studies evaluated patient acceptability of computer-based PROs. **PRO assessments were found to be highly acceptable to patients with a high level of willingness for repeat use in their cancer care.**

Detmar et al:⁵⁹ As in [Chapter 2](#), a large-scale, randomized study was conducted in palliative care to evaluate the effectiveness of giving providers and patients PRO feedback using graphical displays. **Patients in the intervention group reported a significantly higher degree of emotional support received from the provider.** The majority (79%) of patients believed that the summary enhanced their provider’s

awareness of their health problems, and 87% believed that it would be useful to introduce the intervention as a standard part of the outpatient clinic procedure.

Sharma et al:⁷⁰ Male patients with prostate cancer (n=50) were administered the computerized Expanded Prostate Cancer Index Composite (EPIC), a QoL PRO, as well as a 6-item acceptability scale to evaluate satisfaction with the electronic format. ***The majority (>90%) of respondents found the computerized PRO format easy to use.***

Sarabia et al:⁷⁷ Patients being treated for cancer completed PRO assessments measuring pain symptoms and acceptability using touch-screen tablets. Patients receiving both palliative and curative cancer treatments (n=202) found touchscreen-based PROs acceptable. ***93% of palliative patients and 92% of curative patients reported being happy to complete the surveys on a touch-screen tablet at the time of the visit, and 62% of patients were willing to complete surveys at every visit.***

Thewes et al:⁷⁸ This study evaluated the acceptability and usability of psychological screening PROs in rural cancer clinics in Australia among 83 newly-diagnosed patients. Ninety-six percent of patients were in agreement that the PROs were ***easy to understand***, not too personal (86%), and not upsetting (92%). While this small study was unable to demonstrate significant beneficial outcomes in terms of increased referrals for psychosocial services, referrals appear to have been made earlier and 84% of patients 'agreed' or 'strongly agreed' that the PROs should continue to be asked and would encourage discussion of psychological issues. ***Ninety-three percent appreciated questions about their emotional well-being.***

Mark et al:⁶² 100 oncology patients were surveyed about satisfaction with their use of the PACE (PRO) system. Fifty-five percent reported feeling satisfied or very satisfied with the system, 19% reported being very or somewhat unsatisfied, and the remaining 26% were neither satisfied nor unsatisfied. Forty-four percent reported that it encouraged them to discuss their symptoms with their provider while 43% said it did not promote additional discussion. Fifty-three percent of patients reported that it helped them remember their symptoms. ***Almost all (91%) said the system was easy to use including readability of the PROs and 79% of patients said that they would recommend the PACE system to other patients.***

Wolpin et al:⁷¹ Oncology patients (n=342) utilized a computer-based symptom and QoL PRO (ESRA-C) without difficulty and were satisfied with it. The study found the computer-based PRO assessment to be ***easy to use and acceptable to a broad range of users.***

Basch et al:⁶⁵ As described in [Chapter 3](#), oncology patients initiating a new chemotherapy regimen completed a questionnaire assessing a web-based PRO system (STAR) after 4–6 weeks of use. ***Most patients found the PRO system easy to use (96%), useful for helping them remember their symptoms (94%), improved discussions with their provider (90%), and would recommend it to others (98%).*** In addition, 77% of patients stated that STAR made them ***feel more in control of their own care.***

Stover et al:⁶⁷ This qualitative study of patients receiving outpatient cancer care evaluated the acceptability of a web-based PRO assessment including measures of symptoms and functional status. ***Patients found PROs helpful in discussing health issues with providers (92%), wanted to review their results with providers during future visits (82%), and would recommend it to other patients (87%).***

6. IMPACT OF PROS ON DELIVERY OF CARE

Summary

Use of PROs:

- Increases number of referrals^{14,46}
- Reduces emergency department utilization and hospitalizations⁵⁶
- Leads to more closely-monitored treatment⁵⁶
- Leads to greater likelihood of treatment or provider actions (e.g. antidepressant medication prescriptions)^{14,46}
- Reduces nursing workload who otherwise would ask questions regarding domains such as tobacco use and medication adherence³⁰
- Does not increase visit length or consultation time,^{31,67,73} and helps focus appointments⁵⁴
- Succeeds if goals for use are clear, well-integrated into clinic flow, clinically-relevant, easy to interpret, with minimal patient and data burden^{48,54,61,81-83}

Note: not all findings will apply to all clinical settings. Findings of impact on care delivery vary greatly based on existing care, for example reducing nursing staff workload applies to clinical care settings where nursing staff are already collecting relevant information such as tobacco use or medication adherence that would be replaced by the PRO assessment thereby saving nursing staff time

Use of PROs has helped identify the need for and increase number of specialty referrals, led to more closely-monitored treatment, and reduced emergency department utilization and hospitalizations among particularly high-risk patients. Evidence suggests that PROs do not necessarily add length to the provider visit time and may focus the content of the visit. However, providers and investigators across several studies note that the success of PROs appear dependent on several factors: clinical relevance of measures to provider and population needs, ease of interpretation, and, above all, minimal disruption to clinic flow.

6.1. Evidence from HIV care

Crane et al:¹⁴ As described in [Chapter 2](#), providers responded to receiving feedback from a tablet-based PRO assessment completed by PLHIV as part of routine HIV care visits by **significantly increasing referrals to adherence counseling or case management services** (from 23% of PLHIV with inadequate adherence prior to feedback to 38% after feedback). **Providers also significantly increased actions to address depression after feedback (e.g. treatment referral).**

Crane et al:³⁰ The acceptability of a touchscreen-based PRO assessment was evaluated among 136 patients presenting for routine care in a busy HIV clinic. Patients were approached in the waiting room before their clinic appointment and invited to participate. As part of the study, **the authors reported that collection of PROs using touch-screen technology reduced nursing workload**, who would otherwise ask questions about tobacco use, HRQoL, and medication adherence at each visit.

Fredericksen et al:⁴⁸ As described in [Chapter 2](#), 27 providers were interviewed from four geographically diverse HIV and community health clinics that have integrated PROs into routine HIV care. While the use of PROs was **highly valued for detecting adverse health behaviors and symptoms**, the providers agreed **its usefulness depended on the quality of integration into clinic flow, inclusion of only the most clinically-relevant content, and ease of interpretation**. See the PROgress Implementation Toolkit (<https://progresshivcare.org/#toolkit>) for more discussion on these potential barriers.

6.2. Evidence from other disease areas

Boyce et al:⁸² In a systematic review of 16 qualitative studies, providers from diverse settings identified PROs as a **valuable tool in the clinical decision-making process when measuring clinically-relevant domains**. However, authors also identified a number of barriers unless there is sufficient infrastructure in place and the use of PROs does not disrupt normal workflow. They noted the benefits that advances in technology can play in processing the information efficiently, the need for improvements in the interpretability of PROs which would increase their use, and that including stakeholders in the planning stages may improve attitudes toward the use of PROs. Note additional discussions regarding barriers and engaging stakeholders can be found in the PROgress Implementation Toolkit (<https://progresshivcare.org/#toolkit>).

Turner et al:⁸¹ This study evaluated provider perspectives on challenges and benefits of PROs. One hundred English primary care general practitioners participated in a survey, with 77% reporting using at least one PRO. Most common reasons for use were **to aid clinical management** (n=66) or as **screening/diagnostic tools** (n=62). **Providers also valued PROs for shared decision making and helping to direct patient discussions**. Among 25 providers who participated in semi-structured qualitative interviews, barriers were identified including time constraints, lack of integration into clinical systems, and PROs that were mandated without stakeholder involvement. This is another study demonstrating both the value of PROs in clinical care settings but also the importance of implementing PROs well to ensure success. As described above, more discussion regarding addressing barriers can be found in the PROgress Implementation Toolkit (<https://progresshivcare.org/#toolkit>).

Basch et al:⁵⁶ A web-based PRO assessing chemotherapy side effects and symptoms as part of a longitudinal trial embedded into oncology care was evaluated. Patients (n=766) were randomized to usual care or to receive the PROs. In the intervention (PRO) arm, automated email alerts were sent to nurses of worsening symptoms and symptom result summaries were provided to nurses and providers at each visit. In addition, to better outcomes such as HRQoL and quality-adjusted survival (as described in [Chapter 7](#)), patients randomized to the PRO intervention were less likely to visit the emergency department or to be hospitalized **suggesting better outcomes and a decline in resource utilization** compared to usual care patients.

Berry et al:³¹ As described in [Chapter 2](#), the ESRA-C was developed to assess symptoms and HRQoL of oncology patients. In an RCT, **no significant difference was found between PRO intervention and control groups for the average length**

of clinic visits. Despite additional discussion regarding symptoms due to the PRO assessment, overall visit length was unchanged.

Santana et al:⁷³ As described in [Chapter 3](#), a RCT of 213 patients with lung disease examined the usefulness of HRQoL assessment in routine care. Patients completed tablet-based PRO assessments and were randomized to whether or not the providers received the feedback. The arm with provider feedback had a **greater mean management composite score** (i.e. a summation of the medication changes, number of referrals, and tests ordered). **No statistically significant differences in mean clinic visit duration was found** between the two arms.

Cleeland et al:⁵¹ As described in [Chapter 2](#), a post-operative symptoms monitoring study with provider alerts demonstrated **fewer symptom severity events** (19% vs 8%) and a **more rapid improvement in symptoms** in the intervention arm. However, the alerts generated 35 provider phone calls to the patient to provide education, confirm prescribed symptom management, or provide new medication prescriptions suggesting this home-based PRO assessment **impacted care delivery** including provider time.

Stover et al:⁶⁷ This qualitative study assessed consultation time impact among outpatient cancer care clinicians whose patients were using web-based PROs of symptoms and functional status in the US (n=12): **90% reported no increase in consultation time.**

Mazonson et al:⁵³ As described in [Chapter 2](#), a trial of anxiety and mental health symptom feedback to providers demonstrated that **providers receiving PRO feedback from patients with no previous anxiety were more likely to make referrals to mental health specialists** (aOR, 3.86; 95% CI: 1.63, 9.16), and see **patients for more frequent visits** (aOR, 1.73; 95% CI: 1.11, 2.70). No difference was found in the use of psychotropic drugs or hospitalization rate.

Kotronoulas et al:⁶⁸ As described in [Chapter 3](#), this was a systematic review of PROs in cancer care. The impact on care delivery varied based in part on the PRO domains of interest with some studies showing no effect but others, for example, a study that included a PRO to increase provider's awareness of patient's level of pain, showed an **impact on analgesic prescription patterns.**

Dobscha et al:⁴⁶ As described briefly in [Chapter 2](#), US veterans in primary care were screened with a single depression item, and if they affirmed symptoms, asked to complete the paper-based PHQ-9 depression instrument which was then given to their provider. A mental health nurse reviewed patient records, notifying providers when depression existed per the PHQ-9 but was not mentioned in the visit note. **Documentation of depression symptoms was higher** among patients reporting depression after adding the PHQ-9 intervention, as was the **likelihood of being prescribed antidepressants** (23% vs 12%; p<0.05) or **being referred to mental health services** (28% vs 9%; p<0.001).

7. IMPACT ON PATIENT OUTCOMES

Summary

Use of PROs:

- Increased survival rates among patients with cancer due to closer monitoring^{56,84}
- Fewer emergency department visits and hospitalizations among patients with cancer^{56,84}
- Improved symptom control^{55,68}
- Improved outcomes for mental health conditions,⁸⁵ including depression scores among PLHIV²¹
- Lowered symptom distress^{50,51,86}
- Improved HRQoL⁵⁴

While much of the evidence regarding outcomes is from systematic reviews and other studies particularly from oncology, studies in HIV care have shown that when PROs are implemented with provider feedback, it increases the awareness and actions of providers to address domains such as depression and substance use,¹⁴ and this leads to better depression outcomes.²¹ It may be hypothesized that increased understanding of a patient's needs and a greater propensity to act leads to improved outcomes relating to other domains measured

7.1. Evidence from HIV care

As described in [Chapter 2](#) and above, evidence from HIV care includes studies demonstrating that providers are more likely to identify depression, substance use, and inadequate adherence¹⁴ when patients complete a clinical PRO assessment at the start of clinic visits with PRO results to the provider in real time as part of the visit; and furthermore that providers are more likely to address depression and inadequate adherence in some way (e.g. referral, antidepressant prescription etc.)¹⁴ and this can lead to better depression scores.²¹ While it is reasonable to assume that care is better when providers are aware of and addressing issues such as substance use, adherence etc., and better outcomes for specific domains such as depression has been demonstrated,²¹ additional data is needed on long-term outcomes demonstrating that increased awareness and actions by providers to address PRO domains improves clinical outcomes. Additional indirect supportive evidence from HIV care is domain-specific, demonstrating better outcomes for PLHIV when domains such as depression, adherence, and drug and alcohol use improve. For example, when drug use frequency decreases, the likelihood of viral suppression increases.⁸⁷ While this is compelling, particularly as drug use and many of the other PRO domains are typically not assessed well in HIV care in any other way, the field would be strengthened by more evidence directly showing the impact of long-term PRO implementation on HIV outcomes, particularly as better interventions are needed to address many domains (e.g. methamphetamine use).

Schumacher et al:²¹ Among 1,570 PLHIV who completed clinic-based PROs in a 21-month period, 25% (399) reported depressive symptoms (i.e. PHQ-9 score ≥ 10). Depression treatment was offered for all 399, 46% of whom received the treatment. PHQ-9 scores improved by a mean of 0.63 points for each depression treatment visit attended during follow-up. This study demonstrated the benefits of screening and acting on PRO results but also that not all screening and intervention approaches work for all PLHIV.

Examples of indirect evidence from HIV care using substance use as an example

Nance et al:⁸⁷ PRO data from 7 HIV clinics was used to examine changes in frequency of drug use by drug class and associated changes with viral suppression. The number of PLHIV who were using each drug at baseline (BL) ranged from n=568 (illicit opioids) to n=4,272 (marijuana). Among PLHIV using drugs at BL, abstinence at follow-up was associated with a higher odds of viral suppression (OR, 1.4–2.2) for all four drug categories. ***Reducing frequency of illicit opioid or methamphetamine/crystal use even without achieving abstinence was associated with viral suppression*** (OR, 2.2–1.6, respectively).

Delaney et al:⁸⁸ Among 9,905 PLHIV who completed a PRO assessment as part of clinical care at BL, 728 used cocaine/crack, 1,016 used methamphetamines, 290 used illicit opioids, and 3,277 used marijuana at BL. Stopping methamphetamine use led to a mean 2.2 point decrease in depressive symptom score while decreasing methamphetamine use led to a mean decrease of 1.7 points. Stopping or reducing marijuana and stopping cocaine/crack use were also associated with improvement in depressive symptoms. This study demonstrated that among PLHIV in care using drugs, reductions in frequency of drug use, even without achieving abstinence resulted in improvements in depressive symptoms.

This section does not attempt to be comprehensive as it only provides indirect supportive evidence regarding the impact of PRO implementation in HIV clinical care. However, it does provide relevant examples demonstrating that **when key domains that are difficult to assess by any other approach except PROs such as substance use improves, other HIV outcomes also improve.**

7.2. Evidence from other disease areas

Kotronoulas et al:⁶⁸ As described in [Chapter 3](#), this systematic review of trials investigated impacts of PRO assessments in oncology. Though effect sizes were sometimes small, ***the use of PROs was associated with significantly improved symptom control*** (prevalence and severity) in some (not all) studies. Examples included greater reductions in severity of menopausal symptoms, sexual dysfunction, frequency of constipation and vomiting, and incidence of pain or fatigue in the intervention versus control arms. In contrast, impacts on HRQoL were inconsistent or small with several studies showing no benefit.

Chen et al:⁵⁵ Systematic review of 27 studies (see also [Chapter 2](#)) in oncology settings showed improvements in patient-provider communication, ongoing symptom monitoring, detection of unrecognized problems, and treatment response. Results regarding health outcomes were mixed however 13 of 15 studies reported **some positive improvement with symptoms, with side effects and toxicity most likely to be improved followed by emotional well-being**. There was little evidence of improvement in HRQoL or social well-being.

Valderas et al:⁸⁹ This systematic review of RCTs examined the impact of PRO information to providers, included 34 studies most of which were from primary care settings. Although the impact of using PROs appeared modest, 15 of the 23 studies (65%) assessing process of care demonstrated at least one significant benefit, and **8 of 17 studies measuring care outcomes demonstrated at least one significant benefit**. Studies varied on types of feedback, timing of PRO administration to provider feedback (from immediate to up to 6 months), and on mode of administration with most paper or interviewer based: only one used a touch-screen assessment. These differences and limitations likely contributed to the heterogeneity of impact.

Marshall et al:⁸⁵ This review of 38 primarily RCT studies from a mix of primary and specialty care practices (particularly mental health and oncology), found that the health status of patients with mental health conditions appears to be most responsive to the improved care associated with feedback from a PRO assessment. For example, in a trial by Lewis et al,⁹⁰ **patients who completed a computerized depression screen had improved depressive symptoms at 6 weeks compared with control patients**.

Espallargues et al:⁴⁷ This systematic review of heterogeneous RCTs (n=21) from community health and outpatient clinics assessed the impact of PROs on the process and the outcomes of care to providers in clinical practice. As described in [Chapter 2](#), this study demonstrated a significant impact on diagnoses particularly for mental health symptoms. In addition to 54% of the studies demonstrating a positive impact on diagnoses, positive impacts were also found on health services use (46% of studies) and on treatment (31% of studies). In addition, while the greatest impacts were on processes of care including diagnoses, of the 11 trials that assessed patient outcomes, **4 (36%) detected significant improvements in the intervention arm with provider feedback**.

Basch et al:⁸⁴ This study assessed overall survival (OS) associated with electronic PRO symptom monitoring versus usual care during routine cancer treatment, comparing patients whose providers received PRO feedback versus usual care. **Median OS was 31.2 months (95% CI: 24.5, 39.6) in the PRO intervention group, and 26.0 months (95% CI: 22.1, 30.9) in the usual care group (difference, 5 months; p= 0.03)**.

Boyce et al:⁹¹ This systematic literature review of controlled intervention trials examined the impact of providing providers with feedback on PROs. **One study found an overall significant difference in the PRO score. An additional six studies found significant results favoring the intervention group for a particular subgroup or domain**. The studies demonstrating the greatest impact primarily used PROs as a management tool in an outpatient setting on a specialized patient

population. Implementation and feedback varied across the studies although were predominantly older paper-based PRO implementation approaches somewhat limiting relevance to the current era.

Basch et al:⁵⁶ A web-based PRO assessing chemotherapy side effects and symptoms as part of a longitudinal trial embedded into care was evaluated (described in [Chapter 6](#)). Patients (N=766) were randomized to usual care or to complete the PROs with nurse and provider feedback. Patients randomized to the PRO arm demonstrated **significantly improved HRQoL, reduced emergency department visits, fewer hospitalizations, a longer duration of palliative chemotherapy, and longer quality-adjusted survival**. Authors attributed these benefits to email alerts regarding side-effect and symptom changes and suggest close monitoring may have led to improved outcomes.

Berry et al:⁸⁶ Cancer patients randomized to an intervention arm of a trial which included an intervention that monitored depression, symptoms, and QoL issues via a computer-based PRO assessment, and had a component to help patients communicate with providers, demonstrated **significantly lower depression (p=0.04) at the study end** compared to controls.

Ruland et al:⁵⁰ As described in [Chapter 2](#), 145 patients with leukemia or lymphoma completed a PRO assessment that included questions on patient care, symptom distress, and need for symptom management support during treatment and rehabilitation. **Significantly more symptoms and problems were addressed by providers in the intervention group (p<0.001) who received the assessment results than in the control group where they did not. Over time, patients assigned to the intervention group demonstrated less symptom distress than those in the control group.**

Velikova et al:⁵⁴ As described in [Chapter 2](#), a prospective RCT, randomly assigned oncology patients (n=286) to one of three groups: intervention, who completed touch-screen PROs and whose providers received the results; attention-control, who completed the PROs but with no results delivered to providers; and a control group that received usual care (no PRO). Patients in the intervention and attention-control groups had better HRQoL than the control group (p=0.006 and p=0.01, respectively), but the intervention and attention-control groups were not significantly different. **PROs were associated with a positive impact on emotional well-being (p=0.008), as well as significant improvements in reports of physical and functional well-being.**

Cleeland et al:⁵¹ As in [Chapter 2](#), patients from an outpatient thoracic surgery clinic with home-based symptom monitoring with provider notification, demonstrated **fewer symptom severity events and a faster improvement in symptoms** than the control group. The control group completed the same assessment but without alerts to providers, suggesting the opportunity for home-based symptom PRO assessments to lead to better outcomes during the post-operative period.

8. SUMMARY AND DISCUSSION

8.1. Summary

Advances in ARV treatment in the past two decades have led to dramatically improved survival rates, affording PLHIV longevity similar to individuals without HIV, albeit with increased morbidity for aging-related chronic conditions. As a result, healthcare for PLHIV has shifted to focus on addressing co-morbidities, promoting healthy behaviors, and elevating HRQoL. Many of the domains within this scope rely heavily on patient report in order to meaningfully address in care: examples include mental health and other symptoms, functioning, substance use, social well-being, sexual functioning, sexual risk behavior, treatment satisfaction, and HRQoL. Routine PRO collection in primary HIV care offers the unique opportunity for comprehensive yet targeted inquiry into patient health status, helping prioritize issues important to both patients and providers. In doing so, PRO collection amplifies and articulates the patient's voice in their ability to advocate for their own health.

The evidence provided here supports integration of PROs into HIV care. While it is difficult to link the use of PROs in care directly to long-term patient outcomes for PLHIV, PROs have been shown to lead to increased provider awareness and action for domains important for care of PLHIV. PROs have clearly led to their increased documentation, and to improved and more frequent patient-provider communication, improved monitoring, treatment, and referral. The improved outcomes summarized in this review, such as lower symptom distress, less emergency department utilization, and better cancer survival rates are likely due, at least in part, to these actions and may allow generalizable insights to be gleaned despite being from non-HIV care settings.

From the patient perspective, PROs allow for an inventory of their current health and health behaviors, an opportunity to organize their agenda for the appointment, and provide a preview of possibilities for discussion. Patients find PROs easy to use in several computerized contexts, and report that PROs open an avenue to discuss highly personal or potentially embarrassing behaviors or issues with their providers that they might not have done otherwise.

Providers value insight into less observable symptoms or behaviors that might have gone unreported in an in-person interaction, particularly depression, suicidal ideation, and substance use. Its impact on visit time appeared minimal, and those that adopted PROs in their practice found it helped structure the appointment agenda. However, providers and authors in this review urge caution based on implementation experience: PROs require a specific context in order to ensure success. Specifically, this context requires inclusive clinic leadership that actively considers the needs of stakeholders; selection of PROs that are clinically relevant, brief, and easy for providers to interpret; minimal disruption to clinic flow; low overall patient burden; and ease of access to PRO results.

This evidence review has focused primarily on individual patient outcomes, that is, improving the clinical management of individual patients. One area not discussed here but of importance nonetheless is the use of PROs to measure quality of care in larger

settings such as within hospitals, across hospitals, or within regions such as states. Changes in clinical care and even in healthcare policy could be supported by PRO evidence. In the US, outcome measures have been used to evaluate the clinical and cost-effectiveness of interventions, to monitor population health, or to audit healthcare systems and guide quality improvement plans.⁹²⁻⁹⁶ In the aggregate, PRO data could be used to assess variations in patient care across hospitals or regions. In addition, costs could be compared across institutions to help with a better understanding of staffing needs. In the United Kingdom (UK), PRO use has focused on comparing the performance of providers in the hopes of avoiding unnecessary treatments and using the data to assist with service redesign.⁹⁷ PRO use has been mandatory since 2009 in patients undergoing selected elective surgeries (hernia repair, varicose vein surgery, and hip or knee replacement). More work is needed to understand how to best use PROs in the larger arena of clinical and policy decision making, but there appears to be consensus across therapeutic areas on the added benefit of using of PRO data in individual patient care.

8.2. Gaps in the HIV literature around PRO use

Overall evidence regarding the value of PROs within routine HIV care is still emerging and there is a limited breadth of information across the areas of focus reported in this document. The primary published data relates to the screening and monitoring of health problems, the value in improving patient-provider communication, and acceptability by patients and providers. Additional evidence to complement this data in a variety of settings would build further strength to the case for widespread implementation, including evidence generated from sites with limited prior exposure and limited resources. The HIV data identified and presented in this evidence review is primarily taken from studies conducted within the Centers for AIDS Research (CFAR) Network of Integrated Clinical Systems (CNICS).

Other disease areas, notably oncology, provide supplementary insights to this document and they add further indications of the value of PROs. This includes evidence regarding improved symptom management and treatment outcomes. There is some positive evidence of a minimal logistical impact upon a clinic's operation, however, further research is needed to ensure that any value of PROs to patient care can be successfully integrated within workflows in a range of settings.

Potential smaller scale studies that could be designed to supplement information in this Evidence Review and Summary

- Little is known about how HIV providers use PRO information. For example:
 - Where PROs highlight unmet need, what actions does this initiate for different PROs?
 - Where PROs highlight unmet need, to what extent is this information viewed by providers as indicative of fact, and to what extent is it further probed in detail? Is there an acceptance of the result or is it viewed as a discussion guide only?
 - Where PROs do not highlight an unmet need, to what extent are these issues still explored by providers?

- While some domains clearly impact providers, do other domains? If not, what are the reasons? Lack of intervention, wrong care team members, other reasons?
- Do PRO-led consultations lead to changes in patient behaviors?
 - Adherence
 - Sexual risk behavior
 - Alcohol use
 - Substance misuse
 - Entry into drug treatment
 - Attendance at referral appointments
- Do patients who complete PROs report higher levels of care satisfaction than those patients who do not complete PROs?
- What information do providers want to see in PRO feedback summaries? How would they like it presented? What format and how would they want the information organized? How much detail? How much interpretation/scoring is wanted? Do patients want the same information? Can patient feedback facilitate health behavior change by the patient?
- How has the introduction of PROs changed the way in which a patient-provider appointment is managed by the provider?
- How has the introduction of PROs changed the way in which a patient engages the provider in their appointment? To what extent does PRO completion help patient to focus their agenda and/or raise issues?
- Are there domains where PROs are necessary but not sufficient without a focus on next steps including potential interventions?

8.3. Conclusions

PRO implementation into HIV clinical care is feasible and useful, particularly for improving provider ability to detect and monitor symptoms and health behaviors, many of which are key drivers of outcomes among PLHIV and cannot be assessed another way. However, the success of PRO implementation depends on inclusion of clinically-relevant and actionable PRO domains, ease of provider access to data, quantity and presentation of data, and a minimal impact on clinic workflow, highlighting the importance of careful consideration of implementation approaches (see the PROgress Implementation Toolkit for additional discussion of practical implementation approaches [<https://progresshivcare.org/#toolkit>]). More research is needed, particularly on the impact of PROs on long-term outcomes among PLHIV. More research is also needed on additional clinic-based interventions that can improve outcomes for PLHIV once unmet needs or issues are identified by the PRO assessment. Overall, while PRO implementation in HIV care would benefit from additional research and requires careful consideration, the evidence suggests it is an important tool to improve HIV care, by improving patient-provider communication; voicing and clarifying patients' perspective on their health status; and identifying missed symptoms, health and risk behaviors, as well as life circumstances.

APPENDIX 1. IMPACT ON UNDERSTANDING PATIENT OUTCOMES (RESEARCH)

While the purpose of this Evidence Summary is to summarize data regarding PRO implementation to improve HIV care, by focusing on domains valuable for care, PRO implementation provides important information that can also be used to answer important research questions. In fact, domains that are most beneficial for care are arguably also the most important domains to consider for key research questions. This ensures that research questions are relevant to improving HIV care and outcomes. There are many examples of PROs collected as part of clinical care being used to address research questions. Here we provide examples by domain from the CNICS clinical assessment of PROs implemented into HIV care which is also serving as a rich resource to better understand HIV outcomes.

Depression: Implementing PROs, specifically a depression instrument (PHQ-9) in HIV clinical care, provided the opportunity to better understand the associations between depression and increased all-cause mortality;⁹⁸ differences in depression scoring approaches among PLHIV;⁹⁹ and gaps in antidepressant treatment including lack of timely dose adjustment to address persistently high depressive symptoms.¹⁰⁰

Alcohol: Implementing alcohol screening (AUDIT-C) in HIV clinical care has provided the opportunity to better understand predictors of hazardous alcohol use among PLHIV;¹⁰¹ trajectories of alcohol use over time and the factors that influence them which is important to better develop alcohol interventions;¹⁰² predictors and differences between PLHIV who never drank alcohol versus those with a prior history of hazardous alcohol use who became non-drinkers;¹⁰³ the impact of hazardous alcohol use on viral suppression;¹⁰⁴ and the association between heavy alcohol use and retention in HIV care.¹⁰⁵

Drug use: Implementing PROs including a measure of illicit drug use (modified Alcohol, Smoking and Substance Involvement Screening Test [ASSIST]) in HIV clinical care has enabled studies focused on the prevalence and predictors of substance use disorders among PLHIV¹⁰⁶, impact of drug use on retention in care,¹⁰⁷ benefits of reducing drug use even when unable to abstain on depression⁸⁸ and on viral suppression,⁸⁷ and the impact of marijuana use on chronic pain.¹⁰⁸

Cigarette use: Including smoking measures has enabled an evaluation of the associations between smoking and increased risk of a detectable viral load.¹⁰⁹

Sexual risk behavior: Including sexual risk behavior in the CNICS PRO assessment has enabled studies examining how hazardous alcohol use impacts sexual risk behavior differently among different groups of PLHIV¹¹⁰ and how unprotected anal sex is associated with higher odds of marijuana, methamphetamine, and polydrug use.¹¹¹

These are examples from one group of HIV clinics of just a few of the relevant research questions that can be examined when PROs are implemented into HIV care. While the primary reason for PRO implementation in most settings is to improve HIV care, it still results in rich resource of relevant data.

APPENDIX 2. METHODS

Overview

The targeted literature review conducted for this document identified primary data and systematic reviews in peer-reviewed literature that report on the use of PROs in routine clinical care. Studies in multiple disease conditions including HIV/AIDS were identified and reviewed for inclusion. The studies of interest were identified by the methods and inclusion criteria described below.

Search strategy

A referral sampling technique was used for this literature whereby relevant references were identified from reference lists of sampled articles.

- A list of evidence topics and sources was generated from an initial targeted ViiV literature review¹¹² and consultation with several PRO stakeholders, including CNICS colleagues.
- References were re-examined for relevance and to identify further source articles of value compared to the inclusion/exclusion criteria below.
- A non-time limited PubMed/Medline search was conducted to identify primary source articles that might support the review. Keywords/phrases used: *patient reported outcomes, patient reported outcome measures, patient reported outcome assessment, outcome assessment healthcare, patient based measures.*

Inclusion criteria:

- Outpatient clinical care settings
- PRO outcomes reported
- Primary data or systematic reviews
- HIV adult patient population or other adult clinical outpatient population
- Topic area specific to Evidence and Review Summary.

Exclusion criteria:

- Non-clinical care settings
- PROs not specified
- PRO data not reported.

ABBREVIATIONS

aOR	adjusted OR
ART	antiretroviral therapy
ARV	antiretroviral
ASSIST	Alcohol, Smoking and Substance Involvement Screening Test
AUDIT	Alcohol Use Disorders Identification Test
AUDIT-C	Alcohol Use Disorders Identification Test Consumption Questions
BL	baseline
CFAR	Centers for AIDS Research
CI	confidence interval
CNICS	CFAR Network of Integrated Clinical Systems
CTCAE	Common Terminology Criteria for Adverse Events
EORTC-QLQ-C30	European Organization Research and Treatment of Cancer Quality of Life Cancer – 30
EPIC	Expanded Prostate Cancer Index Composite
ESRA-C	Electronic Self-Report Assessment – Cancer
HADS	Hospital Anxiety and Depression Screening
HAT-QoL	HIV/AIDS Targeted Quality of Life
HRQoL	health-related quality of life
ICD	International Classification of Diseases
ITPA	interactive tailored patient assessment
IVR	interactive voice response
MDASI	MD Anderson Symptom Inventory
OR	odds ratio
OS	overall survival
PACE	Patient Assessment, Care and Education
PLHIV	people living with HIV
PHQ-9	Patient Health Questionnaire – 9 items for depression
PrEP	pre-exposure prophylaxis
PRO	patient-reported outcome
QoL	quality-of-life
RCT	randomized controlled trial
SCL-90	Symptom Checklist-90
SDS	Symptom Distress Scale
SF-36	36-item Standard Health Form
STAR	Symptom Tracking and Reporting
UK	United Kingdom
UNAIDS	Joint United Nations Programme on HIV/AIDS
US	United States

ACKNOWLEDGMENTS AND FUNDING

This Evidence Summary was made possible by funding from ViiV Healthcare Limited, a subsidiary of GlaxoSmithKline Limited. This was created as part of the PROgress Study, which evaluated the process of implementing tablet-based collection of PROs in routine outpatient HIV care, as well as their utility, usability, acceptability, and impact. We are grateful to Leah Kleinman, DrPH and Anne Skalicky, MPH, both of Evidera, Seattle, USA for their valued contribution in an earlier iteration of this document.

We thank the patients, providers, and research staff from the two PROgress Study clinics, Midway Specialty Care in Ft. Pierce, Florida, USA, and St. Michael's Hospital in Toronto, Ontario, Canada for their rich insights and commitment to this work. We thank the staff of the Ontario HIV Treatment Network and affiliated clinics for their continued collaborative partnership in advancing the role of PROs in HIV care. We also thank the Centers for AIDS Research Network of Integrated Clinical Systems (CNICS), and the University of Washington Clinical Informatics Research Group (CIRG), for provision of resources and expertise.

Finally, we thank the PROgress Study Steering Committee, an expert panel of individuals listed below which includes patients living with HIV, HIV care providers, clinic directors, and healthcare researchers, for their oversight and guidance.

In alphabetical order:

Jean Bacon, Executive Director, Ontario HIV Treatment Network, Toronto, Canada

Jeff Berry, patient advocate, USA

Heidi Crane, MD, PROgress co-Principal Investigator, HIV care provider, University of Washington, Seattle, WA, USA

Emma Fitzsimmons, PROgress Study Coordinator, University of Washington, Seattle, WA, USA

Rob Fredericksen, PhD, PROgress co-investigator, University of Washington, Seattle, WA, USA

Kevin Gough, MD, Medical Director, HIV Service Head, St. Michael's Hospital, Toronto, Canada

Sean Hosein, patient advocate, Canada

Abigail Kroch, PhD, Director, Data and Applied Science Impact, Ontario HIV Treatment Network, Toronto, Canada

William Lober, MD, PROgress co-Principal Investigator, University of Washington, Seattle, WA, USA

Justin McReynolds, MS, Technical Program Manager, University of Washington, Seattle, WA, USA

Alex Musten, Senior Lead, Testing and Clinical Care Initiatives, Ontario HIV Treatment Network, Toronto, Canada

Edgar Overton, MD, HIV care provider, University of Alabama Hospital, Birmingham, AL, USA

Moti Ramgopal, MD, Director, Midway Specialty Care Center, Ft. Pierce, FL, USA

Duncan Short, PhD, Director, Global Implementation Science, ViiV Healthcare, Brentford, UK

Guido van den Berk, MD, HIV care provider, OLVG Hospital, Amsterdam, The Netherlands

REFERENCES

1. Joint United Nations Programme on HIV/AIDS (UNAIDS). 90-90-90 An ambitious treatment target to help end the AIDS epidemic. Available at: https://www.unaids.org/sites/default/files/media_asset/90-90-90_en.pdf. Accessed October 2020.
2. Joint United Nations Programme on HIV/AIDS (UNAIDS). World AIDS Day 2014 Report. Available at: https://www.unaids.org/sites/default/files/media_asset/JC2686_WAD2014report_en.pdf. Accessed October 2020.
3. Kall M, Marcellin F, Harding R, et al. Patient-reported outcomes to enhance person-centred HIV care. *Lancet HIV* 2020;7:e59-68.
4. Lazarus JV, Safreed-Harmon K, Barton SE, et al. Beyond viral suppression of HIV: the new quality of life frontier. *BMC Med* 2016;14:94.
5. Palella FJ, Jr., Delaney KM, Moorman AC, et al. Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. HIV Outpatient Study Investigators. *N Engl J Med* 1998;338:853-60.
6. Murphy EL, Collier AC, Kalish LA, et al. Highly active antiretroviral therapy decreases mortality and morbidity in patients with advanced HIV disease. *Ann Intern Med* 2001;135:17-26.
7. Hogg RS, Heath KV, Yip B, et al. Improved survival among HIV-infected individuals following initiation of antiretroviral therapy. *JAMA : the journal of the American Medical Association* 1998;279:450-4.
8. US Food and Drug Administration. Guidance for industry patient-reported outcome measures: use in medical product development to support labeling claims. Available at: <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/patient-reported-outcome-measures-use-medical-product-development-support-labeling-claims>. Accessed October 2020.
9. Duko B, Ayalew M & Ayano G. The prevalence of alcohol use disorders among people living with HIV/AIDS: a systematic review and meta-analysis. *Subst Abuse Treat Prev Policy* 2019;14:52.
10. Edelman EJ, Tetrault JM & Fiellin DA. Substance use in older HIV-infected patients. *Curr Opin HIV AIDS* 2014;9:317-24.
11. Green TC, Kershaw T, Lin H, et al. Patterns of drug use and abuse among aging adults with and without HIV: a latent class analysis of a US Veteran cohort. *Drug Alcohol Depend* 2010;110:208-20.
12. Machtinger EL, Wilson TC, Haberer JE, et al. Psychological trauma and PTSD in HIV-positive women: a meta-analysis. *AIDS Behav* 2012;16:2091-100.
13. Bing EG, Burnam MA, Longshore D, et al. Psychiatric disorders and drug use among human immunodeficiency virus-infected adults in the United States. *Arch Gen Psychiatry* 2001;58:721-8.
14. Crane HM, Crane PK, Tufano JT, et al. HIV provider documentation and actions following patient reports of at-risk behaviors and conditions when identified by a web-based point-of-care assessment. *AIDS Behav* 2017;21:3111-21.
15. Fredericksen RJ, Crane P, Tufano J, et al. Integrating a web-based patient assessment into primary care for HIV-infected adults. *J AIDS HIV Res* 2012;4:47-55.
16. Williams MV, Davis T, Parker RM, et al. The role of health literacy in patient-physician communication. *Family Medicine* 2002;34:383-9.
17. Narayan MC. Culture's effects on pain assessment and management. *Am J Nurs* 2010;110:38-47. Quiz 48-9.

18. Kissinger P, Rice J, Farley T, et al. Application of computer-assisted interviews to sexual behavior research. *Am J Epidemiol* 1999;149:950-4.
19. Jensen RE, Rothrock NE, DeWitt EM, et al. The role of technical advances in the adoption and integration of patient-reported outcomes in clinical care. *Medical care* 2015;53:153-9.
20. International Society for Quality of Life Research (prepared by Chan E ET HK, Mikles S, Newton L),. Companion guide to implementing patient reported outcomes assessment in clinical practice. Available at: <https://www.isogol.org/wp-content/uploads/2019/09/ISOQOL-Companion-Guide-FINAL.pdf>. Accessed October 2020.
21. Schumacher JE, McCullumsmith C, Mugavero MJ, et al. Routine depression screening in an HIV clinic cohort identifies patients with complex psychiatric co-morbidities who show significant response to treatment. *AIDS Behav* 2013;17:2781-91.
22. Yang C, Crane HM, Cropsey K, et al. Implementation of computer-delivered brief alcohol intervention in HIV clinical settings: who agrees to participate? *J Addict Res Ther* 2016;7:276.
23. Kroenke K, Spitzer RL & Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16:606-13.
24. Bush K, Kivlahan DR, McDonnell MB, et al. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. *Arch Intern Med* 1998;158:1789-95.
25. Bradley KA, Bush KR, Epler AJ, et al. Two brief alcohol-screening tests from the Alcohol Use Disorders Identification Test (AUDIT): validation in a female Veterans Affairs patient population. *Arch Intern Med* 2003;163:821-9.
26. Crane HM, Fredericksen RJ, Church A, et al. A randomized controlled trial protocol to evaluate the effectiveness of an integrated care management approach to improve adherence among HIV-infected patients in routine clinical care: rationale and design. *JMIR Res Protoc* 2016;5:e156.
27. Stirratt MJ, Dunbar-Jacob J, Crane HM, et al. Self-report measures of medication adherence behavior: recommendations on optimal use. *Transl Behav Med* 2015;5:470-82.
28. Lu M, Safren SA, Skolnik PR, et al. Optimal recall period and response task for self-reported HIV medication adherence. *AIDS Behav* 2008;12:86-94.
29. Feldman BJ, Fredericksen RJ, Crane PK, et al. Evaluation of the single-item self-rating adherence scale for use in routine clinical care of people living with HIV. *AIDS Behav* 2013;17:307-18.
30. Crane HM, Lober W, Webster E, et al. Routine collection of patient-reported outcomes in an HIV clinic setting: the first 100 patients. *Curr HIV Res* 2007;5:109-18.
31. Berry DL, Blumenstein BA, Halpenny B, et al. Enhancing patient-provider communication with the electronic self-report assessment for cancer: a randomized trial. *J Clin Oncol* 2011;29:1029-35.
32. Justice AC, Holmes W, Gifford AL, et al. Development and validation of a self-completed HIV symptom index. *J Clin Epidemiol* 2001;54 Suppl 1:S77-90.
33. Cleeland CS, Mendoza TR, Wang XS, et al. Assessing symptom distress in cancer patients: the M.D. Anderson Symptom Inventory. *Cancer* 2000;89:1634-46.
34. McCorkle R & Young K. Development of a symptom distress scale. *Cancer Nurs* 1978;1:373-8.
35. Holmes WC & Shea JA. A new HIV/AIDS-targeted quality of life (HAT-QoL) instrument: development, reliability, and validity. *Medical care* 1998;36:138-54.
36. Greenhalgh J, Long AF & Flynn R. The use of patient reported outcome measures in routine clinical practice: lack of impact or lack of theory? *Soc Sci Med* 2005;60:833-43.
37. Osoba D. Translating the science of patient-reported outcomes assessment into clinical practice. *J Natl Cancer Inst Monogr* 2007:5-11.

38. Wood E, Hogg RS, Yip B, et al. Effect of medication adherence on survival of HIV-infected adults who start highly active antiretroviral therapy when the CD4+ cell count is 0.200 to 0.350 x 10⁹ cells/L. *Ann Intern Med* 2003;139:810-6.
39. Paterson DL, Swindells S, Mohr J, et al. Adherence to protease inhibitor therapy and outcomes in patients with HIV infection. *Ann Intern Med* 2000;133:21-30.
40. Bangsberg DR, Hecht FM, Charlebois ED, et al. Adherence to protease inhibitors, HIV-1 viral load, and development of drug resistance in an indigent population. *AIDS* 2000;14:357-66.
41. Bangsberg DR, Perry S, Charlebois ED, et al. Non-adherence to highly active antiretroviral therapy predicts progression to AIDS. *AIDS* 2001;15:1181-3.
42. Wood E, Hogg RS, Yip B, et al. Is there a baseline CD4 cell count that precludes a survival response to modern antiretroviral therapy? *AIDS* 2003;17:711-20.
43. Donnell D, Baeten JM, Kiarie J, et al. Heterosexual HIV-1 transmission after initiation of antiretroviral therapy: a prospective cohort analysis. *Lancet* 2010;375:2092-8.
44. Gross R, Bilker WB, Friedman HM, et al. Provider inaccuracy in assessing adherence and outcomes with newly initiated antiretroviral therapy. *AIDS* 2002;16:1835-7.
45. Bangsberg DR, Hecht FM, Clague H, et al. Provider assessment of adherence to HIV antiretroviral therapy. *J Acquir Immune Defic Syndr* 2001;26:435-42.
46. Dobscha SK, Gerrity MS & Ward MF. Effectiveness of an intervention to improve primary care provider recognition of depression. *Eff Clin Pract* 2001;4:163-71.
47. Espallargues M, Valderas JM & Alonso J. Provision of feedback on perceived health status to health care professionals: a systematic review of its impact. *Medical care* 2000;38:175-86.
48. Fredericksen RJ, Tufano J, Ralston J, et al. Provider perceptions of the value of same-day, electronic patient-reported measures for use in clinical HIV care. *AIDS Care* 2016;28:1428-33.
49. Kjaer A, Rasmussen TA, Hjollund NH, et al. Patient-reported outcomes in daily clinical practise in HIV outpatient care. *Int J Infect Dis* 2018;69:108-14.
50. Ruland CM, Holte HH, Roislien J, et al. Effects of a computer-supported interactive tailored patient assessment tool on patient care, symptom distress, and patients' need for symptom management support: a randomized clinical trial. *J Am Med Inform Assoc* 2010;17:403-10.
51. Cleeland CS, Wang XS, Shi Q, et al. Automated symptom alerts reduce postoperative symptom severity after cancer surgery: a randomized controlled clinical trial. *J Clin Oncol* 2011;29:994-1000.
52. Mark TL, Johnson G, Fortner B, et al. The benefits and challenges of using computer-assisted symptom assessments in oncology clinics: results of a qualitative assessment. *Technol Cancer Res Treat* 2008;7:401-6.
53. Mazonson PD, Mathias SD, Fifer SK, et al. The mental health patient profile: does it change primary care physicians' practice patterns? *J Am Board Fam Pract* 1996;9:336-45.
54. Velikova G, Booth L, Smith AB, et al. Measuring quality of life in routine oncology practice improves communication and patient well-being: a randomized controlled trial. *J Clin Oncol* 2004;22:714-24.
55. Chen J, Ou L & Hollis SJ. A systematic review of the impact of routine collection of patient reported outcome measures on patients, providers and health organisations in an oncologic setting. *BMC Health Serv Res* 2013;13:211.
56. Basch E, Deal AM, Kris MG, et al. Symptom monitoring with patient-reported outcomes during routine cancer treatment: a randomized controlled trial. *J Clin Oncol* 2016;34:557-65.
57. Taenzer P, Bultz BD, Carlson LE, et al. Impact of computerized quality of life screening on physician behaviour and patient satisfaction in lung cancer outpatients. *Psychooncology* 2000;9:203-13.
58. Crane HM, Tufano J, Fredericksen R, et al. Evaluating integration of an HIV medication adherence computer assisted self-administered interview (CASI) with routine patient care. *Oral*

abstract 62145 presented at 5th International Conference on HIV Treatment Adherence; May 23–25, 2010; Miami, FL, USA.

59. Detmar SB, Muller MJ, Schornagel JH, et al. Health-related quality-of-life assessments and patient-physician communication: a randomized controlled trial. *JAMA : the journal of the American Medical Association* 2002;288:3027-34.
60. Lawrence ST, Willig JH, Crane HM, et al. Routine, self-administered, touch-screen, computer-based suicidal ideation assessment linked to automated response team notification in an HIV primary care setting. *Clin Infect Dis* 2010;50:1165-73.
61. Barr PJ, Berry SA, Gozansky WS, et al. No date for the PROM: the association between patient-reported health events and clinical coding in primary care. *J Patient Rep Outcomes* 2020;4:17.
62. Mark TL, Fortner B & Johnson G. Evaluation of a tablet PC technology to screen and educate oncology patients. *Support Care Cancer* 2008;16:371-8.
63. Greenhalgh J, Gooding K, Gibbons E, et al. How do patient reported outcome measures (PROMs) support clinician-patient communication and patient care? A realist synthesis. *J Patient Rep Outcomes* 2018;2:42.
64. Mejdahl CT, Schougaard LMV, Hjollund NH, et al. Patient-reported outcome measures in the interaction between patient and clinician: a multi-perspective qualitative study. *J Patient Rep Outcomes* 2020;4:3.
65. Basch E, Artz D, Dulko D, et al. Patient online self-reporting of toxicity symptoms during chemotherapy. *J Clin Oncol* 2005;23:3552-61.
66. Greenhalgh J, Dalkin S, Gooding K, et al. Functionality and feedback: a realist synthesis of the collation, interpretation and utilisation of patient-reported outcome measures data to improve patient care. *Health Serv Deliv Res* 2017;5(2)
67. Stover A, Irwin DE, Chen RC, et al. Integrating patient-reported outcome measures into routine cancer care: cancer patients' and clinicians' perceptions of acceptability and value. *EGEMS (Wash DC)* 2015;3:1169.
68. Kotronoulas G, Kearney N, Maguire R, et al. What is the value of the routine use of patient-reported outcome measures toward improvement of patient outcomes, processes of care, and health service outcomes in cancer care? A systematic review of controlled trials. *J Clin Oncol* 2014;32:1480-501.
69. Takeuchi EE, Keding A, Awad N, et al. Impact of patient-reported outcomes in oncology: a longitudinal analysis of patient-physician communication. *J Clin Oncol* 2011;29:2910-7.
70. Sharma P, Dunn RL, Wei JT, et al. Evaluation of point-of-care PRO assessment in clinic settings: integration, parallel-forms reliability, and patient acceptability of electronic QOL measures during clinic visits. *Qual Life Res* 2016;25:575-83.
71. Wolpin S, Berry D, Austin-Seymour M, et al. Acceptability of an electronic self report assessment program for patients with cancer. *Comput Inform Nurs* 2008;26:332-8.
72. Basch E, Artz D, Iasonos A, et al. Evaluation of an online platform for cancer patient self-reporting of chemotherapy toxicities. *J Am Med Inform Assoc* 2007;14:264-8.
73. Santana MJ, Feeny D, Johnson JA, et al. Assessing the use of health-related quality of life measures in the routine clinical care of lung-transplant patients. *Qual Life Res* 2010;19:371-9.
74. Fredericksen RJ, Short D, Fitzsimmons E, et al. Provider perceptions of utility and impact of a same-day routine electronic patient-reported outcomes (PRO) assessment in clinical HIV care 27th Annual Conference of International Society for Quality of Life Research (ISOQOL); October 19–23, 2020; Virtual conference.
75. Sinha N, Yang A, Pradeep A, et al. Feasibility and acceptability of a psychosocial and adherence electronic patient reported outcomes (PROs) system at an HIV care center in southern India. *AIDS Care* 2020;32:630-6.

76. Howell D, Molloy S, Wilkinson K, et al. Patient-reported outcomes in routine cancer clinical practice: a scoping review of use, impact on health outcomes, and implementation factors. *Ann Oncol* 2015;26:1846-58.
77. Sarabia S, Perez-Cosio A, Brown C, et al. Are palliative patients less accepting to self-report symptom measures for clinical management than curative patients? *J Clin Oncol* 2015;33:79.
78. Thewes B, Butow P, Stuart-Harris R, et al. Does routine psychological screening of newly diagnosed rural cancer patients lead to better patient outcomes? Results of a pilot study. *Aust J Rural Health* 2009;17:298-304.
79. Fredericksen RJ, Short D, Fitzsimmons E, et al. Patient perceptions of the utility and impact of a same-day self-administered routine electronic patient-reported outcomes (PRO) assessment in HIV care in two North American clinics. 27th Annual Conference of International Society for Quality of Life Research (ISOQOL); October 19–23, 2020; Virtual conference.
80. Fredericksen RJ, Harding BN, Ruderman SA, et al. Patient acceptability and usability of a self-administered electronic patient-reported outcome assessment in HIV care: relationship with health behaviors and outcomes. *AIDS Care*
81. Turner GM, Litchfield I, Finnikin S, et al. General practitioners' views on use of patient reported outcome measures in primary care: a cross-sectional survey and qualitative study. *BMC Fam Pract* 2020;21:14.
82. Boyce MB, Browne JP & Greenhalgh J. The experiences of professionals with using information from patient-reported outcome measures to improve the quality of healthcare: a systematic review of qualitative research. *BMJ Qual Saf* 2014;23:508-18.
83. Wohlfahrt P, Zickmund SL, Slager S, et al. Provider perspectives on the feasibility and utility of routine patient-reported outcomes assessment in heart failure: a qualitative analysis. *J Am Heart Assoc* 2020;9:e013047.
84. Basch E, Deal AM, Dueck AC, et al. Overall survival results of a trial assessing patient-reported outcomes for symptom monitoring during routine cancer treatment. *JAMA : the journal of the American Medical Association* 2017;318:197-8.
85. Marshall S, Haywood K & Fitzpatrick R. Impact of patient-reported outcome measures on routine practice: a structured review. *J Eval Clin Pract* 2006;12:559-68.
86. Berry DL, Hong F, Halpenny B, et al. Electronic self-report assessment for cancer and self-care support: results of a multicenter randomized trial. *J Clin Oncol* 2014;32:199-205.
87. Nance RM, Trejo MEP, Whitney BM, et al. Impact of abstinence and of reducing illicit drug use without abstinence on HIV viral load. *Clin Infect Dis* 2020;70:867-74.
88. Delaney JA, Nance RM, Whitney BM, et al. Reduced use of illicit substances, even without abstinence, is associated with improved depressive symptoms among people living with HIV. *J Acquir Immune Defic Syndr* 2018;79:283-7.
89. Valderas JM, Kotzeva A, Espallargues M, et al. The impact of measuring patient-reported outcomes in clinical practice: a systematic review of the literature. *Qual Life Res* 2008;17:179-93.
90. Lewis G, Sharp D, Bartholomew J, et al. Computerized assessment of common mental disorders in primary care: effect on clinical outcome. *Fam Pract* 1996;13:120-6.
91. Boyce MB & Browne JP. Does providing feedback on patient-reported outcomes to healthcare professionals result in better outcomes for patients? A systematic review. *Qual Life Res* 2013;22:2265-78.
92. Faden R & Leplege A. Assessing quality of life. Moral implications for clinical practice. *Medical care* 1992;30:MS166-75.
93. Fitzpatrick R, Fletcher A, Gore S, et al. Quality of life measures in health care. I: applications and issues in assessment. *BMJ* 1992;305:1074-7.
94. Fitzpatrick R & Boulton M. Qualitative methods for assessing health care. *Qual Health Care* 1994;3:107-13.

95. Ware JE, Jr., Kosinski M, Bayliss MS, et al. Comparison of methods for the scoring and statistical analysis of SF-36 health profile and summary measures: summary of results from the Medical Outcomes Study. *Medical care* 1995;33:AS264-79.
96. Johnson S, Thornicroft G, Phelan M, et al.: Thornicroft. G, Tansella. M, eds. *Assessing needs for mental health services*; 1996: 217-26.
97. Black N, Varaganum M & Hutchings A. Relationship between patient reported experience (PREMs) and patient reported outcomes (PROMs) in elective surgery. *BMJ Qual Saf* 2014;23:534-42.
98. Bengtson AM, Pence BW, Moore R, et al. Relationship between ever reporting depressive symptoms and all-cause mortality in a cohort of HIV-infected adults in routine care. *AIDS* 2017;31:1009-16.
99. Crane PK, Gibbons LE, Willig JH, et al. Measuring depression levels in HIV-infected patients as part of routine clinical care using the nine-item Patient Health Questionnaire (PHQ-9). *AIDS Care* 2010;22:874-85.
100. Cholera R, Pence BW, Bengtson AM, et al. Mind the gap: gaps in antidepressant treatment, treatment adjustments, and outcomes among patients in routine HIV care in a multisite U.S. clinical cohort. *PLoS One* 2017;12:e0166435.
101. Crane HM, McCaul ME, Chander G, et al. Prevalence and factors associated with hazardous alcohol use among persons living with HIV across the US in the current era of antiretroviral treatment. *AIDS Behav* 2017;21:1914-25.
102. Bilal U, McCaul ME, Crane HM, et al. Predictors of longitudinal trajectories of alcohol consumption in people with HIV. *Alcohol Clin Exp Res* 2018;42:561-70.
103. Crane HM, Nance RM, Merrill JO, et al. Not all non-drinkers with HIV are equal: demographic and clinical comparisons among current non-drinkers with and without a history of prior alcohol use disorders. *AIDS Care* 2017;29:177-84.
104. Fojo AT, Lesko CR, Calkins KL, et al. Do symptoms of depression interact with substance use to affect HIV Continuum of Care outcomes? *AIDS Behav* 2019;23:580-91.
105. Monroe AK, Lau B, Mugavero MJ, et al. Heavy alcohol use is associated with worse retention in HIV care. *J Acquir Immune Defic Syndr* 2016;73:419-25.
106. Hartzler B, Dombrowski JC, Crane HM, et al. Prevalence and predictors of substance use disorders among HIV care enrollees in the United States. *AIDS Behav* 2017;21:1138-48.
107. Hartzler B, Dombrowski JC, Williams JR, et al. Influence of substance use disorders on 2-year HIV care retention in the United States. *AIDS Behav* 2018;22:742-51.
108. Merlin JS, Long D, Becker WC, et al. Marijuana use is not associated with changes in opioid prescriptions or pain severity among people living with HIV and chronic pain. *J Acquir Immune Defic Syndr* 2019;81:231-7.
109. Cropsey KL, Willig JH, Mugavero MJ, et al. Cigarette smokers are less likely to have undetectable viral loads: results from four HIV clinics. *J Addict Med* 2016;10:13-9.
110. Hutton HE, Lesko CR, Li X, et al. Alcohol use patterns and subsequent sexual behaviors among women, men who have sex with men and men who have sex with women engaged in routine HIV care in the United States. *AIDS Behav* 2019;23:1634-46.
111. Mimiaga MJ, Reisner SL, Grasso C, et al. Substance use among HIV-infected patients engaged in primary care in the United States: findings from the Centers for AIDS Research Network of Integrated Clinical Systems cohort. *Am J Public Health* 2013;103:1457-67.
112. Short D, Kotsopoulos N, Crane HM, et al. Can patient-reported measures and outcomes (PROs) improve routine HIV consultations? A targeted review of the literature. Poster 23 presented at Patient Reported Outcome Measures (PROMs) Annual UK Research Conference; June 20, 2018; Birmingham, UK.