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# The Patient Reported Outcomes as a Clinical Tool (PROACT) Pilot Study: What Can be Gained by Sharing Computerized Patient-Reported Mental Health and Substance Use Symptoms with Providers in HIV Care?

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## Abstract

Substance use and mental health (SU/MH) disorders are insufficiently recognized in HIV care. We examined whether conveying SU/MH screening results to patients and providers increased SU/MH discussions and action plans. Intervention participants completed a computerized patient-reported questionnaire before their HIV visit; screened positive on ≥ 1 measure: depression, anxiety, PTSD symptoms, at-risk alcohol use, or drug use; and reviewed screening results to decide which to prioritize with their provider. Screening results and clinical recommendations were conveyed to providers via medical record. A historic control included patients with positive screens but no conveyance to patient or provider. The patient-provider encounter was audio-recorded, transcribed, and coded. For the overall sample (n = 70; 38 control, 32 intervention), mean age (SD) was 51.8 (10.3), 61.4% were male, and 82.9% were Black. Overall, 93.8% raised SU/MH in the intervention compared to 50.0% in the control ($p < 0.001$). Action plans were made for 40.0% of intervention and 10.5% of control encounters ($p = 0.049$). Conveying screening results with clinical recommendations increased SU/MH action plans, warranting further research on this intervention to address SU/MH needs.

**Keywords** HIV care · Patient-reported outcomes · Mental health · Substance use

## Introduction

Nearly half (48%) of people living with HIV (PLWH) have a substance use (SU) disorder, 20% of whom have a polysubstance use disorder [1]. For mental health (MH) disorders, 20–50% of PLWH experience MH disorders [2–4]. A "triple diagnosis" of HIV, SU, and MH disorders is prevalent [5, 6], affecting an estimated 38% of PLWH [7]. SU and MH disorders are associated with worse HIV health outcomes, including poor retention in care [8–13], antiretroviral adherence [14–17], viral load suppression [6, 12, 13, 17, 18], and risky sexual [19–22] behaviors. Furthermore, MH and SU are each associated with increased mortality among PLWH [18, 23–27].

SU and MH disorders are often under detected and under managed in HIV care [3, 28–36]. Reasons for low levels of SU/MH detection and treatment are multifaceted, involving patient, provider, and system-level factors. Patients may not realize their symptoms represent a mental health disorder or feel comfortable raising SU/MH symptoms with their provider [37], due to HIV-related stigma [38] and lack of trust in the healthcare system [39]. At the provider-level, time constraints, busy clinic flow, and patients with multiple complex medical issues may hinder effective SU/MH screening and management [40]. Providers may experience discomfort and insufficient training with SU/MH treatment guidelines [30, 41]. System-level barriers include the absence of standardized screening practices or clinic-level

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management guidelines [40]. These barriers demonstrate the need for interventions to improve SU/MH disorders dectection and management in HIV care.

Use of patient-reported outcomes (PROs) is increasingly common in clinical practice [42, 43] and can potentially improve SU/MH symptoms detection and management in HIV care. The FDA defines PROs as "any report of 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" [44]. PROs have many potential applications to clinical care, such as for screening, priority setting, treatment monitoring, and to improve patient engagement [43, 45–47]. PROs can also convey real-time or current symptoms and can be tracked longitudinally in a standardized delivery format [48]. Many studies have found that self-administered computerized PROs decrease social desirability bias and increase disclosure of stigmatized behaviors as compared to in-person interviews [49–54].

PROs have long been used in HIV research but are only recently becoming integrated into HIV clinical care. There is promising evidence that sharing PROs with providers improves detection of SU/MH diagnoses in HIV care [6, 55], which has been shown to increase documentation of SU and depression and increase provider intervention to treat depression but not for SU [56]. While many HIV providers see value in PROs data, they have emphasized the need for PROs to be well integrated into their workflow with the option for patients to decide which of the many PROs domains they would like to prioritize [40, 57]. More research is needed about the implementation, acceptability, and effectiveness of PROs interventions in clinical care [45, 58].

This pilot study examined the acceptability and preliminary efficacy of the Patient Reported Outcomes as a Clinical Tool (PROACT) pilot intervention. We assessed whether conveying computerized SU/MH PROs screening results to patients and providers along with management recommendations increased (1) SU/MH issues raised during outpatient HIV encounters and (2) action plans to address SU/MH care needs. We also analyzed patient feedback regarding acceptability of the PROACT intervention.

## Methods

### Study Design and Setting

The PROACT pilot study enrolled an intervention group and used a historic control group among patients in the Johns Hopkins HIV Clinical Cohort (JHHCC). The JHHCC is an observational cohort study of patients receiving HIV care at the Johns Hopkins HIV Clinic in Baltimore, MD [59]. Since 2013, JHHCC participants complete a computer-assisted self-interview PROs assessment on a tablet computer every 6 months. Outside of the PROACT study, PROs results are for research purposes and are not conveyed to the clinical team. The Johns Hopkins Institutional Review Board approved this study, and patient and provider participants provided written informed consent.

### Provider Participants

HIV primary care providers for the intervention group were invited to participate through: (a) a study overview presentation given by the principal investigator at a providers' meeting, (b) an IRB-approved email introducing the study, and (c) individual conversations between the PI and providers to answer questions.

### Intervention Participants

Patient participants were eligible for PROACT if they were ≥ 18 years old, English-speaking, enrolled in the JHHCC, their provider enrolled in the PROACT study, able to come to clinic before their HIV appointment to complete the PROs assessment, able to provide informed consent to study procedures, and if they scored positive for ≥ 1 of the following SU/MH PROs measures: moderately severe/severe depression symptoms (Patient-Health Questionnaire-8 ≥ 15) [60, 61]; moderate/severe anxiety symptoms (Generalized Anxiety Disorder (GAD-7 ≥ 10) Scale) [62]; positive PTSD symptoms (Post-traumatic Stress Disorder (PTSD) Primary Care Screen) Yes to 3/4 questions = at risk [63]; at-risk alcohol use (Alcohol Use Disorders Identification Test Alcohol Consumption questions AUDIT-C ≥ 3 for men; ≥ 4 for women) [64]; and heroin, amphetamines, and/or cocaine use in the past 3 months (Alcohol, Smoking and Substance Involvement Screening Test) [65].

### Control Participants

Historic control participants consisted of JHHCC participants enrolled in the Maximizing Respect and Patient Outcomes in HIV and Substance Abuse (MaRIPOHSA) study, an observational study where clinical encounters were audio-recorded. MaRIPOHSA participants with audio-recordings between June 2015 and January 2017 were retrospectively reviewed and included in the PROACT historic control if they scored positive for ≥ 1 SU/MH PROs outcome (same PROs assessment and thresholds as the intervention group described above) and completed the PROs questionnaire prior to their audio-recorded patient-provider HIV visit (same day or within 14 days before their HIV clinical encounter). For these participants, neither the patient nor the

provider was aware of a patient's performance on the MH/SU PROs results.

### Intervention Design

Participants were enrolled in the intervention group from February to August 2017. Participants came to the clinic before their HIV medical appointment, completed the computer-assisted PROs questionnaire, and met with a trained research assistant (RA). Using a script, the RA reviewed the results with the participant, so they knew which SU/MH PROs screening results were positive. Participants were asked to choose which, if any, of the SU/MH PROs positive screening results they wanted to prioritize with their provider. During the consent process, participants were notified that all SU/MH screening results would be shared with their provider during the PROACT study.

The SU/MH scores, severity thresholds, and clinical recommendations tailored to local clinical resources were conveyed to the provider via a note that was placed in the electronic medical record (EMR) before the participant's HIV visit. For example, if a participant scored positive and wanted to prioritize severe depression, the EMR note would include links to orders for psychiatry referrals and suggested medications by class and starting dosages. The patient-provider encounter was audio-recorded and transcribed, which both patient and provider consented to as part of the study protocol.

Following their recorded HIV medical visit, intervention patient participants met with the RA to complete a short semi-structured exit interview that was audio-recorded and transcribed. Interview topics included their experiences with the PROACT study and if they would want the PROs results to be shared with their provider in the future.

### Participant Characteristics

Information abstracted from the electronic medical record included: demographics (sex, race, and age); HIV clinical values (CD4 count and viral load in the 6 months before the PROACT study visit); and HIV clinic psychiatry visits or psychotropic medications prescribed in the 6 months prior to the PROACT study visit. We extracted referrals or medication to address SU/MH from the date of the recorded encounter for the control or PROACT intervention clinic visit.

### Outcome Assessment

Two investigators, not blinded to study group membership, independently reviewed the clinic visit transcripts and highlighted text containing SU/MH discussion. Blinding was not possible for this feasibility study, because some discussions in the intervention transcripts referenced the PROACT study, which made us unable to blind investigators during the analysis process. Using an iterative process, we developed codes and operative definitions to assess the outcomes for both the intervention and control group transcripts. For each SU/MH screen we coded whether the topic was raised in the visit (regardless of who raised the issue and regardless of whether in the intervention group the PROACT study was specifically mentioned) and whether an action plan (new treatment, referrals placed, plan for follow-up, or adjustment of current treatment plan) was made during the encounter. Each SU/MH screen was coded separately, because in some transcripts more than one SU/MH domain was discussed. Two investigators independently coded the transcripts and discussed the codes to establish agreement, via a discussion-consensus process [66, 67].

### Statistical Analysis

We generated summary statistics (means and standard deviations for continuous variables and frequencies and proportions for categorical variables) to describe the sample. We compared proportions of individuals who had an issue raised or action plans made using the Fisher's exact test. We calculated the proportion of issues a patient reported on their PROs screening that were raised by patient or provider and the proportion of issues raised that had an action plan, comparing between the intervention and the control groups. For individual patients whose providers had patients both in the control and intervention groups, we used Wilcoxon signed rank test to compare those proportions in the control and intervention groups.

## Results

### Patient Participants

Participant clinical and demographic characteristics are presented in Table 1. The study sample included 70 participants, 32 in the intervention group and 38 in the control. The overall sample had a mean age (SD) of 51.8 (10.3). The sample was predominantly male (61.4%) and Black (82.9%). Additionally, 12.9% of the overall sample endorsed PTSD symptoms. Nearly two-thirds (61.4%) of the sample screened positive for at-risk alcohol use, 14.3% for current heroin use, and 1.4% for current amphetamine use. Nearly half the intervention group (46.9%) self-reported current cocaine use, compared to 18.0% of the control group ($p = 0.019$).

**Table 1** Demographic and clinical characteristics of study sample, PROACT intervention (N = 70)

| Characteristic | Total (N = 70) | Control group (N = 38) | Intervention group (N = 32) | p-value |
|---|---|---|---|---|
| | Mean (SD) or % | Mean (SD) or % | Mean (SD) or % | |
| Age | 51.8 (10.3) | 51.7 (11.5) | 51.6 (8.9) | 0.952 |
| Sex | | | | 0.566 |
| Male | 43 (61.4%) | 22 (59.0%) | 21 (65.6%) | |
| Female | 27 (38.6%) | 16 (41.0%) | 11 (34.4%) | |
| Race | | | | 0.249 |
| Black | 58 (82.9%) | 29 (76.3%) | 29 (90.6%) | |
| White | 9 (12.9%) | 7 (18.0%) | 2 (6.3%) | |
| Other | 3 (4.3%) | 2 (5.3%) | 1 (3.1%) | |
| HIV transmission risk factors | | | | 0.161 |
| MSM[a] | 15 (21.4%) | 11 (28.9%) | 4 (12.5%) | |
| IDU[b] | 26 (37.1%) | 10 (26.3%) | 16 (50.0%) | |
| HET[c] | 26 (37.1%) | 15 (39.5%) | 11 (34.4%) | |
| Unknown | 3 (4.3%) | 2 (5.3%) | 1 (3.1%) | |
| Insurance status | | | | 0.277 |
| Public | 58 (82.9%) | 29 (76.9%) | 29 (90.6%) | |
| Private | 10 (14.3%) | 7 (18.0%) | 3 (9.4%) | |
| Unknown | 2 (2.9%) | 2 (5.1%) | 0 (0.0%) | |
| CD4 cell count (cells/mm$^3$) | | | | 0.133 |
| ≤ 200 | 8 (11.4%) | 2 (5.1%) | 6 (18.8%) | |
| 201–499 | 16 (22.9%) | 9 (23.1%) | 7 (21.9%) | |
| ≥ 500 | 19 (27.1%) | 10 (25.6%) | 9 (28.1%) | |
| Missing | 28 (40.0%) | 18 (46.2%) | 10 (31.3%) | |
| HIV viral load (copies/ml) | | | | 0.350 |
| < 200 | 46 (65.7%) | 22 (57.9%) | 24 (75.0%) | |
| ≥ 200 | 7 (10.0%) | 5 (13.2%) | 2 (6.3%) | |
| Missing | 17 (24.3%) | 11 (28.2%) | 6 (18.8%) | |
| Psychotropic medications (prescribed in past 6 months) | | | | 0.897 |
| Yes | 37 (52.9%) | 19 (51.3%) | 18 (56.3%) | |
| No | 32 (45.7%) | 18 (46.2%) | 14 (43.8%) | |
| Missing | 1 (1.4%) | 1 (2.6%) | 0 (0.0%) | |
| Depression screening (PHQ-8 ≥ 15)[d] | | | | 0.894 |
| Yes | 11 (15.7%) | 5 (12.8%) | 6 (18.8%) | |
| No | 56 (80.0%) | 31 (82.1%) | 25 (78.1%) | |
| Missing | 3 (4.3%) | 2 (5.1%) | 1 (3.1%) | |
| Anxiety screening (GAD-7 ≥ 10)[e] | | | | 0.730 |
| Yes | 11 (15.7%) | 7 (18.0%) | 4 (12.5%) | |
| No | 30 (42.9%) | 15 (38.5%) | 15 (46.9%) | |
| Missing | 29 (41.4%) | 16 (42.1%) | 13 (40.6%) | |
| PTSD screening[f] | | | | 0.341 |
| At-risk | 9 (12.9%) | 7 (18.0%) | 2 (6.3%) | |
| Not at-risk | 31 (44.3%) | 16 (41.0%) | 15 (46.9%) | |
| Missing | 30 (42.9%) | 15 (39.5%) | 15 (46.9%) | |
| Alcohol screening (AUDIT-C)[g] | | | | 0.224 |
| At-risk | 43 (61.4%) | 26 (69.2%) | 17 (53.1%) | |
| Not at-risk | 27 (38.6%) | 12 (30.8%) | 15 (46.9%) | |
| Cocaine screening (ASSIST, any use in past 3 months) | | | | 0.019 |
| Yes | 22 (31.4%) | 7 (18.0%) | 15 (46.9%) | |
| No | 48 (68.6%) | 31 (82.1%) | 17 (53.1%) | |

**Table 1** (continued)

| Characteristic | Total (N = 70) | Control group (N = 38) | Intervention group (N = 32) | p-value |
|---|---|---|---|---|
| | Mean (SD) or % | Mean (SD) or % | Mean (SD) or % | |
| Heroin screening (ASSIST, any use in past 3 months) | | | | 0.169 |
| Yes | 10 (14.3%) | 3 (7.7%) | 7 (21.9%) | |
| No | 60 (85.7%) | 35 (92.3%) | 25 (78.1%) | |
| Amphetamines screening (ASSIST, any use in past 3 months) | | | | 0.457 |
| Yes | 1 (1.4%) | 0 (0.0%) | 1 (3.1%) | |
| No | 69 (98.6%) | 38 (100.0%) | 31 (96.9%) | |
| Number of issues reported total for positive screens | | | | |
| 1 | 48 (68.6%) | 28 (73.7%) | 20 (62.5%) | .518 |
| 2 | 10 (14.3%) | 4 (10.5%) | 6 (18.8%) | |
| 3 | 10 (14.3%) | 5 (13.2%) | 5 (15.6%) | |
| 4 or more | 2 (2.8%) | 1 (2.6%) | 1 (3.1%) | |

Missing data indicates patient did not answer question on PROs questionnaire or unable to obtain specific demographic variable with chart review

[a]Men who have sex with men

[b]Injection drug use

[c]Heterosexual transmission

[d]Yes indicates screened positive for moderately severe/severe depression symptoms on PHQ-8

[e]Yes indicates screened positive for moderate/severe anxiety symptoms on GAD-7

[f]At-risk if answered yes to ¾ question on Post-traumatic Stress Disorder (PTSD) Primary Care Screen

[g]At-risk if AUDIT-C score was ≥ 3 for men or ≥ 4 for women

## Provider Participants

The characteristics of the providers are shown in Table 2. The majority of providers were female (80%), physicians (60%), and had a mean (SD) of 11.9 (9.6) years in practice. We examined whether having an action plan differed between providers in the control and intervention groups (data not shown in a table). Among providers in the control group, the mean (SD) proportion of all issues raised (defined as SU/MH topic discussed during the encounter, including times issue was raised with and without mention of the PROACT study) was 43% (27%). Among providers in the intervention group, the mean (SD) proportion of all reported issues raised was higher at 82% (31%). Among providers in the control group, the mean (SD) proportion of all reported issues with action was 10% (27%), while among intervention group providers, the mean (SD) proportion of all reported issues with action was 34% (35%).

## SU/MH Issue Raised

Table 3 shows whether an issue was raised in the clinical encounter. Overall, ≥ 1 issue was raised in 50.0% of control group participants (19/38) and among almost all intervention group participants (93.8%; (30/32)); p ≤ 0.0001). Among control group participants, alcohol use was raised in the clinical encounter in 50.0% (13/26). However, among intervention group participants, alcohol was raised among almost all participants (94.1%; (16/17)); p = 0.003). The proportion of each issue raised in the intervention group was greater than or equal to the proportion in the control group; though only alcohol use reached statistical significance due to sample size. PTSD was not raised in any encounter, despite being reported by 13% of the total sample.

## SU/MH Action Plan

Table 4 shows the result of whether an action plan was devised in the clinical encounter among those with a positive SU/MH screen for which the issue was raised in the clinical encounter. Compared to the control group, intervention group members were significantly more likely to have action taken on ≥ 1 issue (p = 0.049). In each domain except alcohol use, there were a higher proportion of action plans in the intervention group (none reached statistical significance).

## Participant Feedback

We collected patient feedback on the intervention and compiled representative quotations from patients (Supplemental Table 1). Comments highlighted: (1) the intervention allowed the patient to open up about issues they had

**Table 2** Provider characteristics (N = 22)

| Characteristic | Providers with patients in intervention only (N = 10) | Providers with patients in both intervention and control (N = 4) | Providers with patients in control only (N = 8) | p-value |
|---|---|---|---|---|
| | N | N | N | |
| Sex | | | | |
| Female | 8 | 4 | 6 | .80 |
| Male | 2 | 0 | 2 | |
| Race | | | | |
| Black | 1 | 1 | 1 | .95 |
| White | 7 | 2 | 5 | |
| Asian | 1 | 0 | 1 | |
| Other/biracial | 1 | 1 | 1 | |
| Type | | | | |
| PA | 2 | 1 | 0 | 0.78 |
| NP | 2 | 1 | 2 | |
| MD | 5 | 2 | 4 | |
| MD—fellow | 1 | 0 | 2 | |
| Years in practice, Mean (SD) | 11.9(9.6) | 18.8(5.3) | 18.1 (12.0) | 1 |

previously not revealed, (2) the intervention resulted in a prolonged discussion of treatment options, (3) the provider's access to the questionnaire meant the patient needed no segue into SU/MH discussion, and, in contrast (4) there was no difference for the patient, because the patient and provider talk about SU/MH each visit.

In the audio-recorded clinical encounter transcripts, we looked for examples of quotations where the intervention was specifically mentioned or referenced to prompt the discussion, a selection of which is presented in Supplemental Table 2. In one example, the provider confirmed the questionnaire results with the patient and moves directly into referral options. In another, the provider performed a more detailed assessment prior to offering a referral.

## Discussion

The PROACT pilot study evaluated the impact of conveying self-administered computerized SU/MH screening results to patients and providers as well as clinical recommendations to providers. Encounters where the provider had access to SU/MH screening results and clinical recommendations were more likely to raise that issue, notably for increased alcohol use discussions in the intervention group. Overall, participants in the intervention group were more likely to have action taken for at least 1 SU/MH issue raised; however, there was no statistically significant difference for establishing an action plan between the intervention and control groups for the individual SU/MH domains. This study is unique given the combination of integrating PROs with clinical care, providing recommendations to providers, and giving the patient the opportunity to prioritize a SU/MH issue with the provider. These three steps in combination may maximize the use of the information generated in the PROs process.

This intervention offers a potential strategy to improve identification and management of SU/MH disorders in HIV care [5, 68], which is important given that provision of evidence-based SU/MH screening and interventions are a needed and crucial component of optimizing HIV care continuum outcomes [34, 69]. While many studies have described the expanded use of PROs in HIV clinical care [70], only a few have evaluated the impact of PROs on SU/MH outcomes [6, 71]. Our study advances our understanding of the impact of PROs on increasing recognition and clinical action to address SU/MH disorders.

There are several possible explanations for our findings. Because of social desirability bias, patients may be less likely to disclose potentially stigmatizing behaviors or symptoms in-person [49–54]. The computerized assessment tool performed by the patient alleviates some of the patient's fear of revealing these issues. Of course, knowing that the issues are going to be transmitted to the provider may influence how individuals complete the questionnaire. Further, having the results and treatment recommendations outlined before the clinical encounter may have alleviated providers' hesitancy towards SU/MH screening [72]. The goal of the intervention was to "prime the pump" for having the issue raised during the clinical encounter. By explaining the screening results with the patient prior to the clinical encounter and having them prioritize an issue, we allowed

**Table 3** Among PROACT participants with SU/MH positive screen(s), the number who had an issue raised in their subsequent clinical encounter, examined by study group, PROACT Intervention (N = 70)

| Issue raised in clinical encounter? N (%) | | | p-value |
|---|---|---|---|
| | Control | Intervention | |
| At least 1 issue | | | |
| Not raised | 19 (50.0%) | 2 (6.3%) | 0.00006 |
| Raised | 19 (50.0%) | 30 (93.8%) | |
| Total reporting at least 1 issue | 38 | 32 | |
| Alcohol | | | |
| Not raised | 13 (50.0%) | 1 (5.9%) | 0.003 |
| Raised | 13 (50.0%) | 16 (94.1%) | |
| Total with positive screen | 26 | 17 | |
| Cocaine | | | |
| Not raised | 3 (42.9%) | 4 (26.7%) | 0.63 |
| Raised | 4 (57.1%) | 11 (73.3%) | |
| Total with positive screen | 7 | 15 | |
| Heroin | | | |
| Not raised | 1 (33.3%) | 0 (0.0%) | 0.30 |
| Raised | 2 (66.7%) | 7 (100.0%) | |
| Total with positive screen | 3 | 7 | |
| Depression | | | |
| Not raised | 1 (20.0%) | 0 (0.0%) | 0.45 |
| Raised | 4 (80.0%) | 6 (100.0%) | |
| Total with positive screen | 5 | 6 | |
| Anxiety | | | |
| Not raised | 5 (71.4%) | 0 (0.0%) | 0.06 |
| Raised | 2 (28.6%) | 4 (100.0%) | |
| Total with positive screen | 7 | 4 | |
| PTSD | | | |
| Not raised | 7 (100.0%) | 2 (100.0%) | 1 |
| Raised | 0 (0.0%) | 0 (0.0%) | |
| Total with positive screen | 7 | 2 | |

**Table 4** Among PROACT participants with SU/MH positive screen(s) and an issue raised, the number who had an action taken in their subsequent clinical encounter, examined by study group, PROACT Intervention

| Action taken in clinical encounter? | | | p-value |
|---|---|---|---|
| | Control | Intervention | |
| Alcohol | | | |
| No action | 12 (92.3%) | 14 (87.5%) | 1 |
| Action | 1(7.7%) | 2 (12.5%) | |
| Total with positive screen | 13 | 16 | |
| Cocaine | | | |
| No action | 4 (100.0%) | 6 (54.5%) | 0.5 |
| Action | 0 (0.0%) | 5 (45.5%) | |
| Total with positive screen | 4 | 11 | |
| Heroin | | | |
| No action | 2 (100.0%) | 4 (57.1%) | 1 |
| Action | 0 (0.0%) | 3 (42.9%) | |
| Total with positive screen | 2 | 7 | |
| Depression | | | |
| No action | 3 (75.0%) | 2 (33.3%) | 0.52 |
| Action | 1 (25.0%) | 4 (66.7%) | |
| Total with positive screen | 4 | 6 | |
| Anxiety | | | |
| No action | 2 (100.0%) | 3 (75.0%) | 1 |
| Action | 0 (0.0%) | 1 (25.0%) | |
| Total with positive screen | 2 | 4 | |
| PTSD | | | – |
| No action | 0 (0.0%) | 0 (0.0%) | |
| Action | 0 (0.0%) | 0 (0.0%) | |
| Total with positive screen | 0 | 0 | |
| At least 1 issue | | | |
| No action | 17 (89.5%) | 18 (60.0%) | 0.05 |
| Action | 2 (10.5%) | 12 (40.0%) | |
| Total with positive screen | 19 | 30 | |

them to think about what they might like to discuss and empowered them to bring the issue into the encounter [73, 74]. Participants reiterated this in their exit questionnaire, during which they conveyed how taking the survey and getting the feedback was an educational opportunity. This highlights the importance of providing patients with the space to review and reflect on which positive screen they would like to prioritize. Outside the study infrastructure, this is a process that would need to be integrated into routine clinical flow. Further studies should investigate different modes of conveying positive screens to patients (e.g. through discussion as in our study, written handout, or potentially an interactive web program), and how these modes impact patient preferences and outcomes.

The intervention significantly increased discussions regarding alcohol use, which has important implications given its detrimental HIV related effects [9]. One reason alcohol use may have been prioritized by patients and discussed more is because the questionnaire helped participants realize, via learning the AUDIT-C screening results, their risk-level associated with alcohol consumption. This potentially helped them to increase their readiness to engage in discussions on reducing alcohol intake. Further, providers may have more training in alcohol counseling and treatment modalities. Additionally, although many patients reported PTSD symptoms, the issue was not raised in clinical visits. Given the high prevalence and health impacts of PTSD among PLWH, these results point to an increased need for provider training on PTSD counseling and interventions in HIV care [75].

One reason for no observed difference in action plan for each individual SU/MH domain is that the discussion

between the clinician and patient served as a starting point to increase the patient's readiness to change. Patients must be ready to change, and even if there was no concrete action plan at the end of the clinical encounter studied in PROACT, perhaps their participation helped them move closer to readiness to change. It will be important to evaluate ways PROACT and other similar interventions increase readiness to change on a larger scale.

There were several strengths and limitations to our study. The strengths include our mixed methods approach with both quantitative and qualitative assessment of intervention effectiveness and acceptability [40]. This expands on prior work where solely the providers' opinions are captured [57]. Our work also laid the groundwork for a systems-level intervention. We systematically developed the intervention overcome previously identified barriers to PROs intervention implementation [40, 76], particularly diminishing workflow disruptions and ensuring clinical utility by giving the participants the opportunity to prioritize a positive screen. The availability of audio-recorded transcripts allowed us to capture how providers introduced the questionnaire findings into their clinical encounters, which allowed us to uniquely analyze the impact of the intervention. Future research could use additional analysis of the transcripts to further elucidate changes in communication resulting from the intervention [77].

Limitations are that the study was not a randomized controlled trial and rather used a historic control. Clinicians were aware of the study and may have been more likely to take action. Alternatively, they may have had concerns deemed higher priority during the study visit, but a subsequent visit focused on SU/MH. Providers who chose to participate may be different from those who did not. Additionally, our sample was not balanced between groups for different SU and MH domains. During the analysis, coders were not blinded by study group, which potentially influenced code application. Having two independent coders who reconciled any coding differences via a discussion and consensus method may have mitigated this potential bias.

## Conclusion

These results indicate that the PROACT intervention is a promising way to improve SU/MH symptoms management in HIV care. The findings warrant further research on implementing this intervention and its impact on readiness to change and long-term health outcomes along the HIV Care Continuum.

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**Availability of Data and Materiasl (Data Transparency)** Deidentified data available upon written request.

**Code Availability (Software Application or Custom Code)** Analytic code available upon written request.

## Compliance with Ethical Standards

**Conflict of interest** The authors have no relevant financial or non-financial interests to disclose.

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Johns Hopkins University Institutional Review Board (IRB00115401).

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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