Giving Voice: Using Patient-Reported Outcomes to Enhance HIV Care

ANDREW KAPLAN & GARY REITER MEMORIAL LECTURE

Continuum
June 10, 2025

CNICS
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- **Why do PROs**
- Practical considerations
- CNICS as an example
- Can it help care
- Can it help research
- PROs vs. EHR?

Why Do We Want to Collect PROs in Care?

- Accurately capture information about potentially stigmatizing domains such as substance use or sexual risk behavior that may be easier to acknowledge on the electronic questionnaire than in a conversation with the provider
- Patient-reported outcomes (PROs) such as mental health symptoms, substance use, symptom burden, and medication adherence can:
  - Enhance patient-provider communication
  - Improve care
    - Listening to the patient voice in a systematic standardized way
      - Adherence: poorly assessed by providers
      - Substance use: societal bias, higher rates reported with PROs than provider assessment
    - Helping providers "hear" the patient through tailored, personalized, evidence-based, actionable recommendations
    - Using modern informatics standards and tools
    - Ultimate goal: Tailored, personalized, evidence-based recommendations for clinical actions
  - Facilitate clinical research

Figure 1A. Common situation in routine clinical

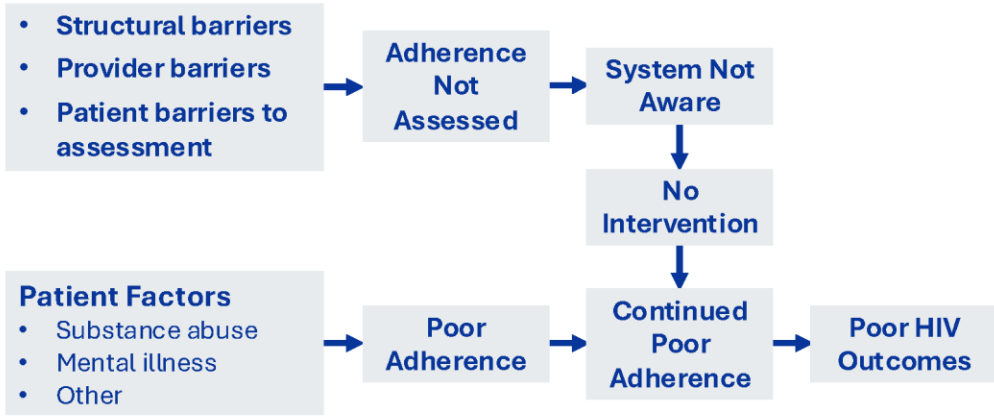
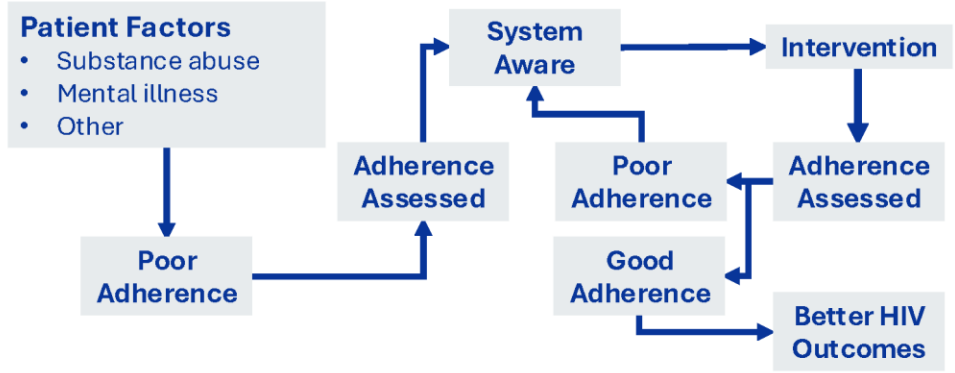


Figure 1B. Situation with valid adherence measurement incorporated into clinical care



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General Principles: Using Electronic Collection

- More feasible with drop in costs, touch-screens, and more common use of computers in everyday life
- Well tolerated, particularly when done with touch screens eliminating the mouse and the keyboard
- Patients prefer electronic PROs over other modes, this may be due in part to ease of use and speed
- Patients feel more at ease reporting socially undesirable or stigmatizing behaviors
- Feasible by patients with disabilities, mental illness or other potential challenges
- Elimination of additional data entry step that can result in delays, costs, and errors
- Facilitates conditional branching and complex skip patterns which dramatically reduces patient burden
- Lower rates of unanswered questions than paper
- Safeguards can be automated
- PRO results available in real time at the point of care

Wilson AS, et al., Rheumatology Mar 2002; Perlis et al., Addiction. Jul 2004; Wolford, et al. Psychiatr Serv. Jul 2008; Chan-Pensley E. Alcohol Alcohol. Nov-Dec 1999; Chinman et al. J Clin Psychiatry. Oct 2004; Velikova et al. J Clin Oncol. Mar 1999; etc. (email for rest of reference list)

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Implementation Considerations - Environment

- Space/location/privacy
  - Location: waiting room vs. triage (where vitals are done) vs. examination room vs. remote on own device
  - *What works for patients?*
- Audio (Needed? Privacy?)
- Security of clinic environment
- Hardware
  - Choice of devices: touch screen vs own device
  - Cases, cleaning, replacement, anti-theft
  - More locked down vs less locked down
  - Where to store, charge, etc?

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Implementation Considerations - Workflow

- Security of devices
- Managing workflow
  - Flow: front desk staff vs. medical assistant vs. “research coordinator”; study vs. part of clinical care (“another vital sign”)
- Interaction with appointment system, download scheduled patients for day, upload all clinic patients so no typing, etc
  - What helps? How much effort does it take?
  - Do staff see the impact?
- EHR embedded vs standalone
  - EHR embedded-depends on vendor support, limited user interface options, better IT enthusiasm/support, sometimes the only option
  - Standalone – flexibility in workflows, use across organizations, better user experience, capacity to tailor/personalize, ability to innovate

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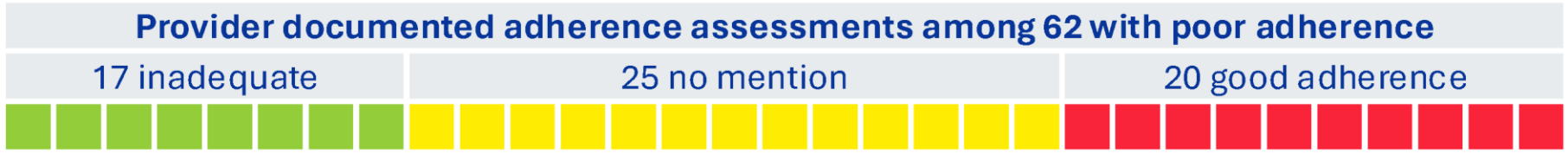
Practical Considerations: Stakeholder Buy-in Provider Assessment of Adherence

- 62 of initial 500 patients self-reported very poor adherence
- Providers documented (same day):
  - Inadequate adherence for only 17 (27%)
  - No mention of adherence for 25 (40%)
  - Good adherence for 20 (32%)
- Furthermore, among the 17 in whom providers correctly documented inadequate adherence
  - 5 (29%) had moderate depression that was not acknowledged
  - 4 (24%) had current substance abuse that was not acknowledged



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Practical Considerations: Content

- Domains and instruments (more = more clinical benefit, richer data, but also greater impact on flow, more patient burden)
  - Top tier: alcohol, drugs, adherence, depression, tobacco
  - Middle tier examples: sexual risk behavior
  - Lower tier examples: physical activity
  - Tiers and priorities vary based on patient population and priorities
- HIV-specific vs. non-specific instruments
- Patient burden: Computer adaptive testing/skip patterns
- Comprehensive multiple subdomains vs. single item or brief screeners
- QOL/general health measures
- Input from different stakeholders leads to different choices

Rank	Providers	All Patients	Age <30	Age 30-54	Age ≥55
1	Substance Abuse	Medication Adherence	Medication Adherence	Medication Adherence	HIV Treatment/ Symptoms
2	Depression	HIV Treatment/ Symptoms	HIV Treatment/ Symptoms	HIV Treatment/ Symptoms	Medication Adherence
3	Medication Adherence	Depression	Depression	Depression	Pain
4	Alcohol Abuse	Sexual Risk Behavior	HIV Stigma	Sexual Risk Behavior	Depression
5	Tobacco Use	HIV Stigma	Sexual Risk Behavior	HIV Stigma	Cognitive Function
6	Sexual Risk Behavior	Pain	Social Support	Pain	Sexual Risk Behavior
7	HIV Treatment/ Symptoms	Physical Function	Positive Affect	Physical Function	HIV Stigma
8	Cognitive Function	Social Support	Physical Function	Substance Abuse	Social Support
	…	…	…	…	…
23	Shortness of Breath	Anger	Tobacco Use	Shortness of Breath	Domestic Violence or IPV
24	Positive Affect	Shortness of Breath	Sexual Function	Tobacco Use	Anger
25	Spirituality or Meaning of Life	Tobacco Use	Shortness of Breath	Sexual Function	Tobacco Use

Fredericksen, et. al AIDS & Behavior. 2020: 1170-1180

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CNICS Cohort

- ~50,000 PWH total, ~44% alive and still in care at CNICS sites
- 8 sites, recently expanded to 10 sites across the United States
- Multiple data sources including EHR, specimens, and CNICS clinical assessment of PROs
- Expanding geocoding to add more social determinants of health

- Expanding genetic data (currently at ~12,000 PWH and growing)
- Adjudicated outcomes including key comorbidities such as MI, stroke, etc.

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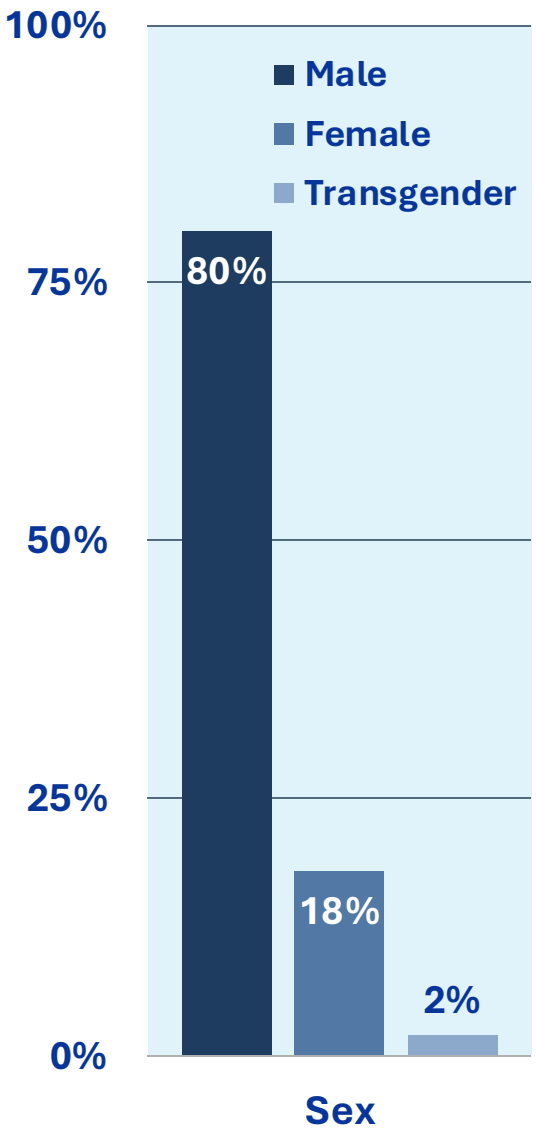
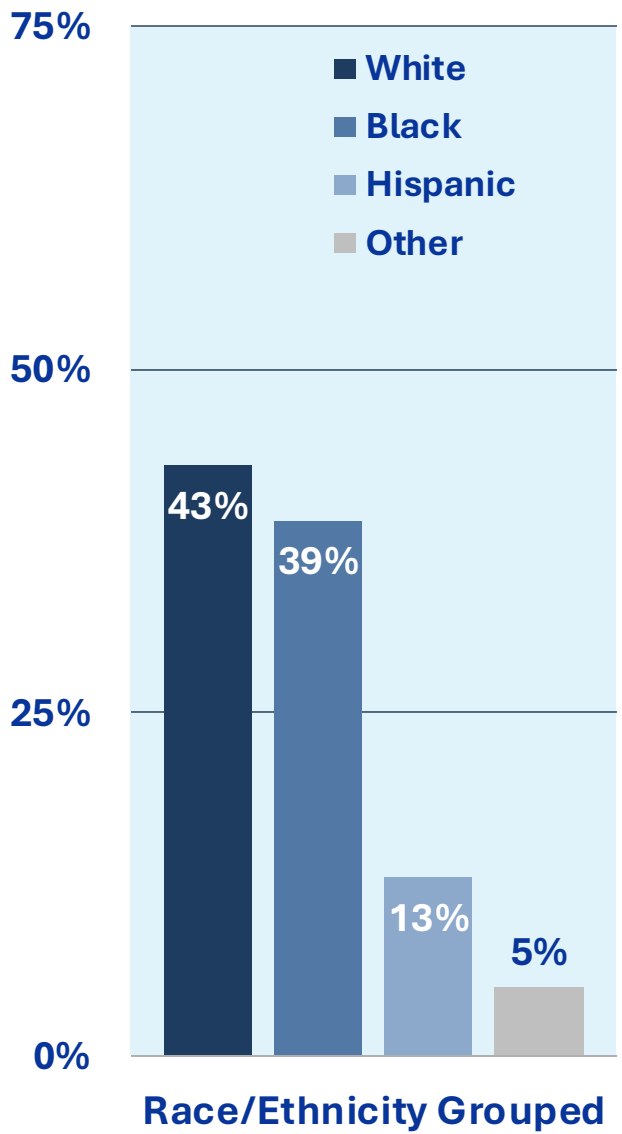
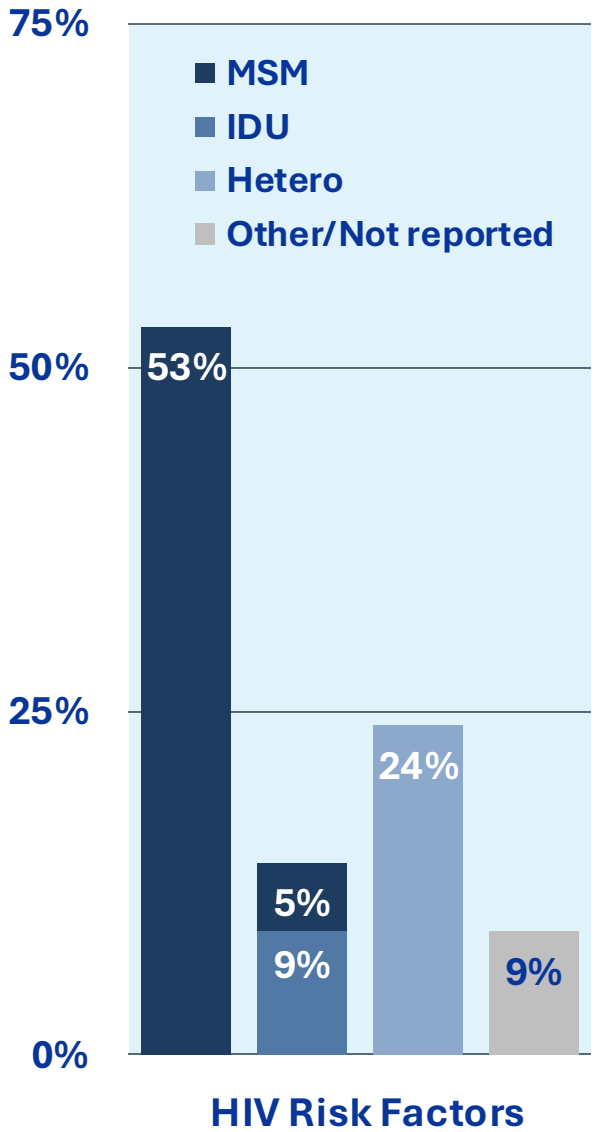
Expanding CNICS Cohort N=50,131







- 365,000 person-years of follow up
- Mean follow up: 8.3 years
- 35% of PWH >10 years of follow up

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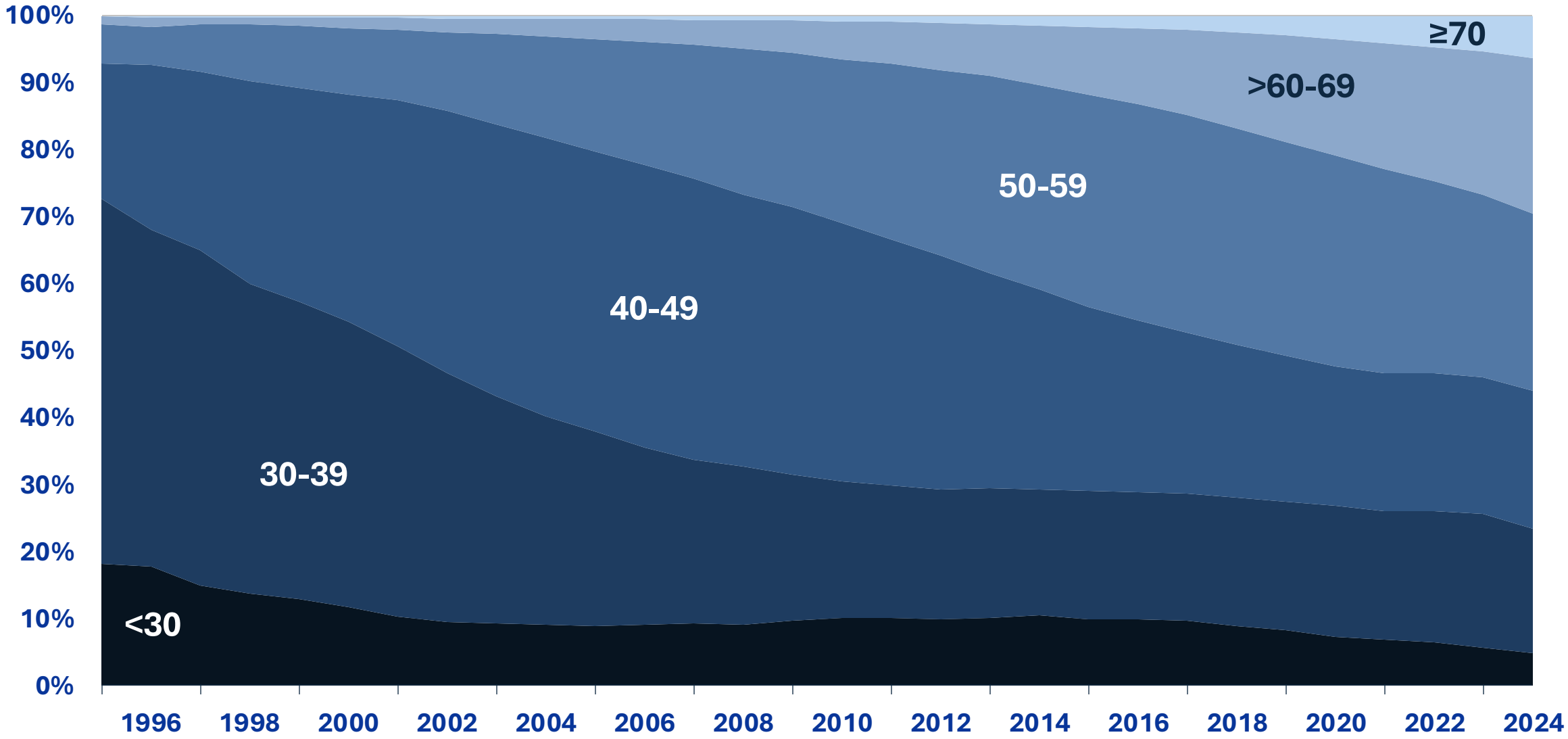
CNICS Cohort Age Distribution Over 30 Years



CNICS PROS in Routine Clinical Care

- Open-source, non-proprietary web-based survey software; encrypted SSL/TLS
- Touch-screen tablets
- Maximum 5th-6th grade reading level
- No mouse or keyboard to maximize inclusiveness
- Remote option available for those doing telehealth appointments (added during pandemic)
- Substance use and other domains measured as part of comprehensive assessment, minimizes social desirability bias and potential underreporting that occurs in specific study settings or when using interviewer-based approaches

	1-5 Point Scale (5 best)
Easy to use assessment	4.7
How understandable	4.7
Enjoyable	3.8
Helpful in describing your symptoms	4.3
Time acceptable	4.3
Overall satisfaction	4.3

- Automated alerts allow for real time safety assessment (e.g., suicidal ideation, intimate partner violence, etc.)
- Tracks patient eligibility, time since last assessment, and time to complete each assessment for each patient: mean < 12 minutes
- Skip patterns built in
- Structured, real-time information from assessment to provider to improve clinical care
- Multiple languages: Spanish, Haitian Creole, Amharic, Brazilian Portuguese, English

PROs by site										
PROs	CWRU	FCH	JH	Miami	UAB	UCSD	UCSF	UNC	UW	Total
Unique patients total	1213	2,840	2,177	829	4,586	9,714	2,400	2,866	4,759	31,384
Sessions total	3,837	8,896	17,027	1065	34,971	35,867	6,092	8,790	18,370	135,015

Fredericksen R et al. Journal of AIDS and HIV Research
Crane et al, Current HIV Research, 2007, 5(1): 109-18

Current PRO Content

MOOD/WELL-BEING

- Depression/SI
- **Anxiety**
- Health-related QOL

SOCIO-ENVIRO CONTEXT

- Housing
- Intimate partner violence (Annual*)
- **Social support (Annual)**
- HIV stigma (Annual)
- Food security
- Financial situation
- **Incarceration history**

HEALTH BEHAVIORS

- **ART adherence**
- **Substance use**
- **Substance use tx history***
- **Substance use tx modality***
- **Fentanyl test strips/Narcan access***
- **Recent/lifetime overdose***
- **Alcohol use**
- **Alcohol dependence (Annual*)**
- **Nicotine use/vaping**
- **Sexual risk behavior (incl exchange sex and DoxyPEP use)**
- Physical activity

PHYSICAL

- Review of symptoms
- **Fall risk***
- Body morphology (Every 2 yrs)
- Cognitive function (Annual)
- Respiratory symptoms among those with COPD*

IDENTITY/ORIENTATION

- Gender identity (Every 2 yrs)
- Sexual orientation (Annual)

HISTORY

- **Childhood household violence and other adverse childhood conditions**
- **Fam. hx chronic conditions**

Skip-patterned *within* measure

Admin 1x only

*Level of risk determines frequency/whether shown

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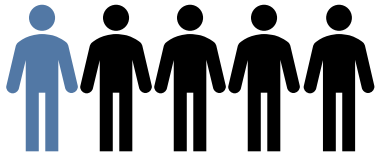
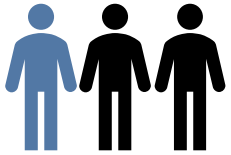
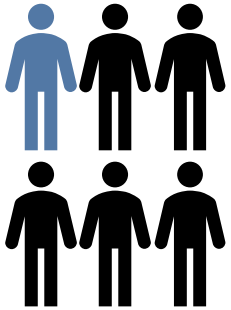
Selected CNICS Findings After >100,000 PROs from PWH in Care Across the US



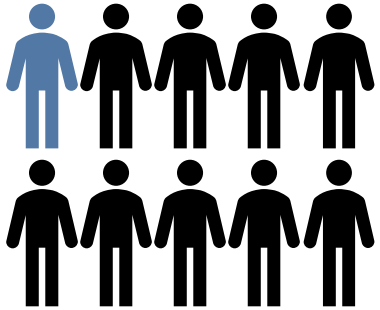
1 in 5 reported **moderate-severe depression**



1 in 3 reported **heavy episodic (binge) drinking**



More than **1 in 6** reported current **cocaine, opioid, or methamphetamine use**



1 in 10 reported current concern for **intimate partner violence**

20,455 unique PWH patients
with an average of
5.7 PROs completed

	Initial PRO % (95%CI)	Last PRO % (95%CI)		Initial PRO % (95%CI)	Last PRO % (95%CI)
Moderate-severe depression	25 (24, 26)	22 (21, 22)	Current cocaine use	9 (8, 9)	8 (7, 8)
Suicidal ideation	4 (2, 4)	5 (5, 5)	Current methamphetamine use	11(10, 11)	11 (10, 11)
Anxiety/panic attack	28 (27, 29)	27 (25, 27)	Current opioid use	4 (3, 4)	4 (3, 4)
At-risk/hazardous alcohol use	19 (18, 19)	17 (16,17)	Any current meth, cocaine, opioid use	18 (18, 19)	17 (17,18)
Current binge alcohol use	35 (35, 36)	32 (31, 33)	Intimate Partner Violence	11 (10,12)	10 (9, 10)
Current cigarette use	39 (38, 40)	36 (35, 37)	Concern for STI	18 (18, 20)	18 (17, 19)

CROI, 2024

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Study Design

PRO assessment integrated into care at UW

- ~600 pts completed in first 8 month after integration, **with** report delivery
- ~800 pts completed **without** report delivery, prior to integration

Chart review

- Reviewers blinded to whether or not provider received report
- Reviewed same-day provider documentation of awareness and/or action within 4 domains 8 months before and after integration

AIDS and Behavior, 2017

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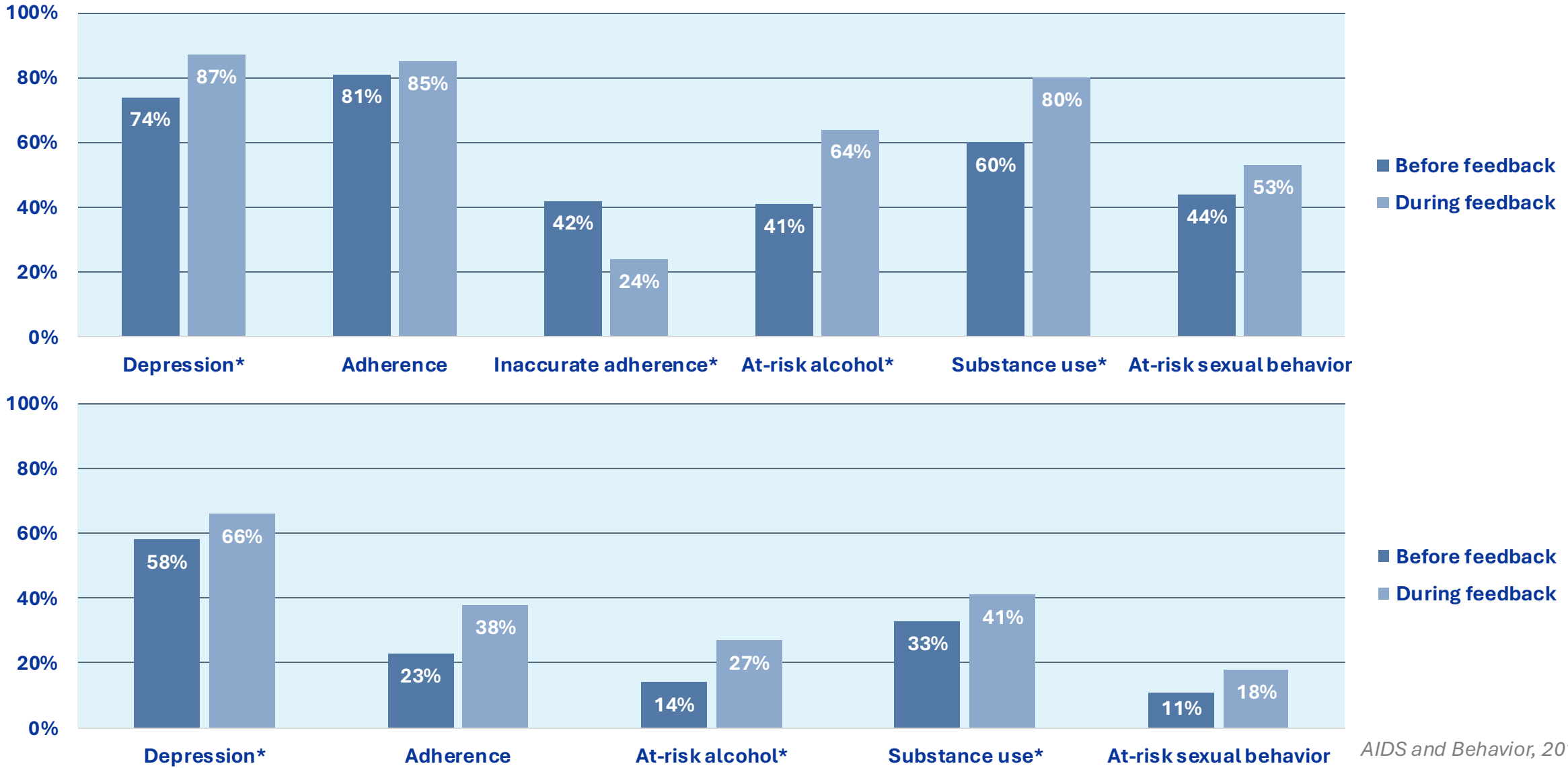
Provider Documentation: Awareness and Actions Before vs. After PRO Delivery



AIDS and Behavior, 2017

Findings

- PRO collection improves:
  - Accuracy in assessing ARV adherence
  - Identification of at-risk alcohol use
  - Action to address at-risk alcohol use and adherence
  - Identification of moderate-to-severe depression
  - Identification of substance use
- Actions needed:
  - Improve provider ability and/or willingness to assess and respond to sexual risk behavior
  - Build referral and intervention options into PRO assessment to stimulate more proactive provider response across all domains
- This study focused on provider behaviors and actions, but this does not minimize the importance of case managers and other members of the health care team

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Provider interviews: key themes

- Helps structure agenda for clinic visit
  - *I'll say, "I notice [from the PRO] you're missing some of your medicine. So what's happening?" So to me it's a nice starting point with a conversation as opposed to the more traditional, you know, starting at the bottom and working up. Physician, Birmingham*
- Eases discussion of sensitive issues
  - *I didn't know the extent of one guy's alcohol use [because] I'd known him for a while, and I knew he drank a bit, but we hadn't talked about it for some time. So it's actually quite useful to say "here's what you told the [PROs], let's talk more about that"-- less out of left field. Physician, Boston*
- Helps identify less observable/difficult to discuss issues
  - *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. Physician, San Diego*
  - *We have found a number of people that were suicidal [in the PROs] that were not being honest with their provider [in person]…there's a lot of people that don't want to 'disappoint' their provider by telling them what's really going on. RN, Birmingham*

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Patient interviews: key themes

- Facilitates honest responses
  - *It's just easier to answer [PRO questions] that way [on the iPad tablet]…if somebody was asking those questions [in person], it would be like you're being, I don't know, on trial. (Patient, 57)*
  - *I wouldn't just randomly go to my doctor and say, "Okay, I have – [this sexual issue]", no. But just the fact of seeing the question there, look at the [response options], I was able to answer that… (Patient, 55)*
- Improves recall of health needs and sense of preparedness for visit
  - *It just kind of got me in the mood of answering questions and thinking about some of the things that I might want to talk to [my provider] about… like having trouble getting enough sleep, things that I didn't really even think about talking to her about it's like, 'Okay, yeah maybe I should bring that up.'" (Patient, 56)*
  - *I think the questionnaire is a good thing to quickly filter out what needs to be addressed…not everybody comes mentally prepared in terms of having questions and a goal…sometimes you don't realize that something needs to be discussed until you have to fill out a questionnaire. So that's a good thing. (Patient, 47)*

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COVID: Not What We Planned
Data from Summer 2021: Ability to Respond to Changes Quickly

Percentage of PWH who completed a PRO who have not received the covid vaccine and their reason for not getting one (N=570)

	Frequency	Percent
I prefer to wait until more is known about covid vaccines	107	18.5%
I do not believe a covid vaccine will work	14	2.4%
I am concerned about side effects	88	15.2%
I am concerned a covid vaccine will hurt my health	71	12.3%
I worry it might make my HIV medication less effective	37	6.4%
I do not think I am at risk for covid	10	1.7%
I have already had covid	14	2.4%
I am okay with getting covid	7	1.2%
I worry that I might get covid from a vaccine	22	3.8%
I do not trust US government approval of vaccines	44	7.6%
I do not trust the health care system	14	2.4%
I have heard there is something in the vaccine that can track you	14	2.4%

Percentage of PWH who completed a PRO who have had at least one dose of covid vaccine (N=1,414)

	Frequency	Percent
Have you already had at least one dose of a vaccine for coronavirus (COVID-19)?		
Yes	830	58.7%
No	575	40.7%
I am currently participating in a vaccine study	9	0.6%
Total	**1,414**	**100.00%**

Percentage of PWH who completed a PRO who have not received the covid vaccine and how likely they are to get one (N=570)

	Frequency	Percent
Would definitely get	366	64.2%
Would probably get	84	14.7%
Would probably not get	52	9.1%
Would definitely not get	68	11.9%
Total	**570**	**100.00%**

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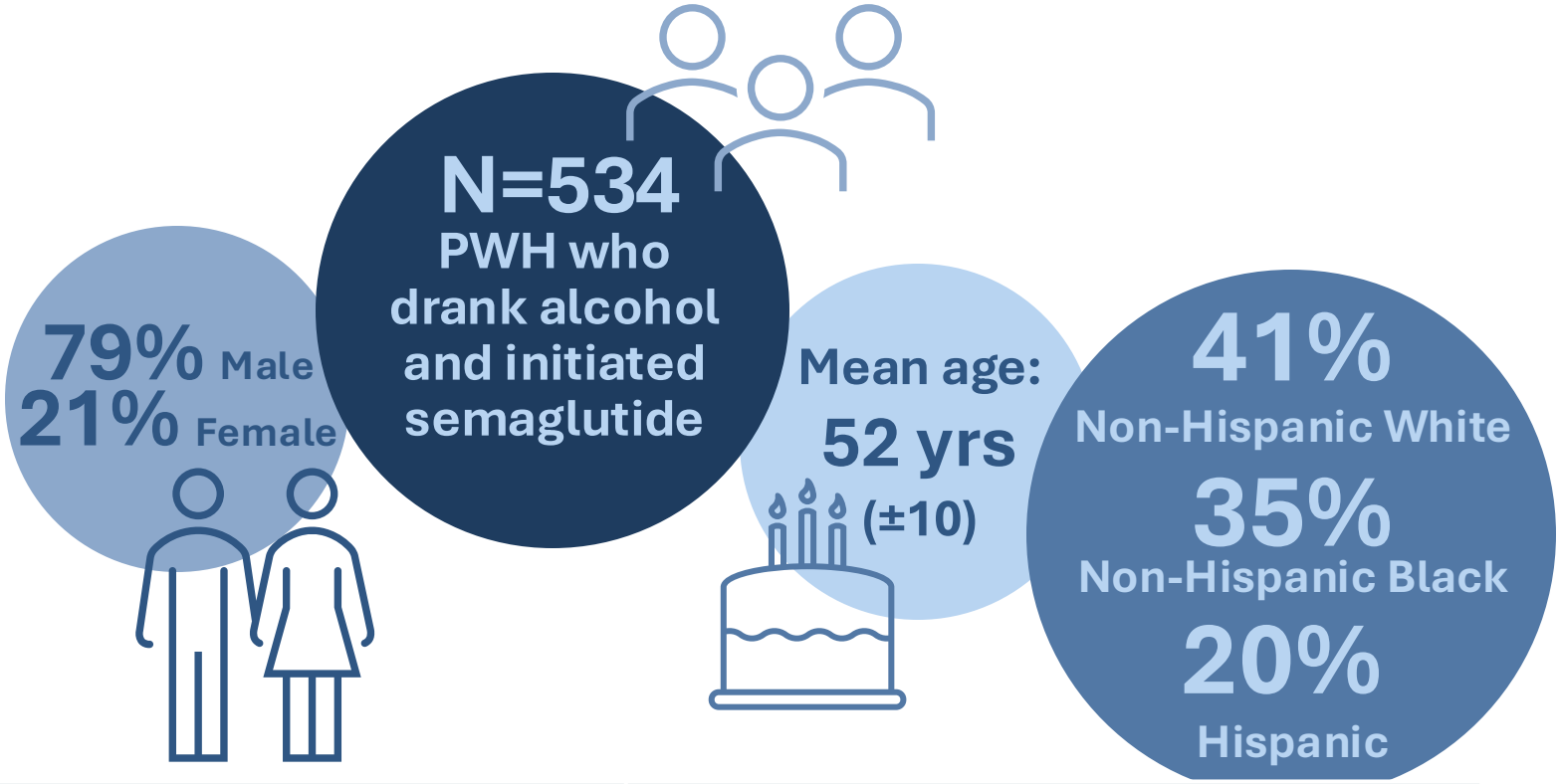
Impact of Semaglutide on Alcohol Use among People with HIV



Outcome	Model Description	Change in Outcome with Semaglutide Use
AUDIT-C score	All	**-0.3 (-0.4, -0.1), 0.004**
	Higher risk alcohol use	**-1.2 (-1.6, -0.8), <0.001**
	Higher risk alcohol use and obese (BMI≥30)	**-1.0 (-1.5, -0.6), <0.001**
	Higher risk alcohol use and not obese	**-2.0 (-3.1, -0.9), <0.001**
	Lower risk alcohol use	0.1 (-0.1, 0.2), 0.4
Days of alcohol use/month	All	**-0.6 (-1.1, -0.1), 0.01**
	Higher risk alcohol use	**-3.4 (-4.8, -2.1), <0.001**
Days of heavy episodic drinking/month	Heavy episodic (binge) drinking at baseline	-0.1 (-0.7, 0.5), 0.8

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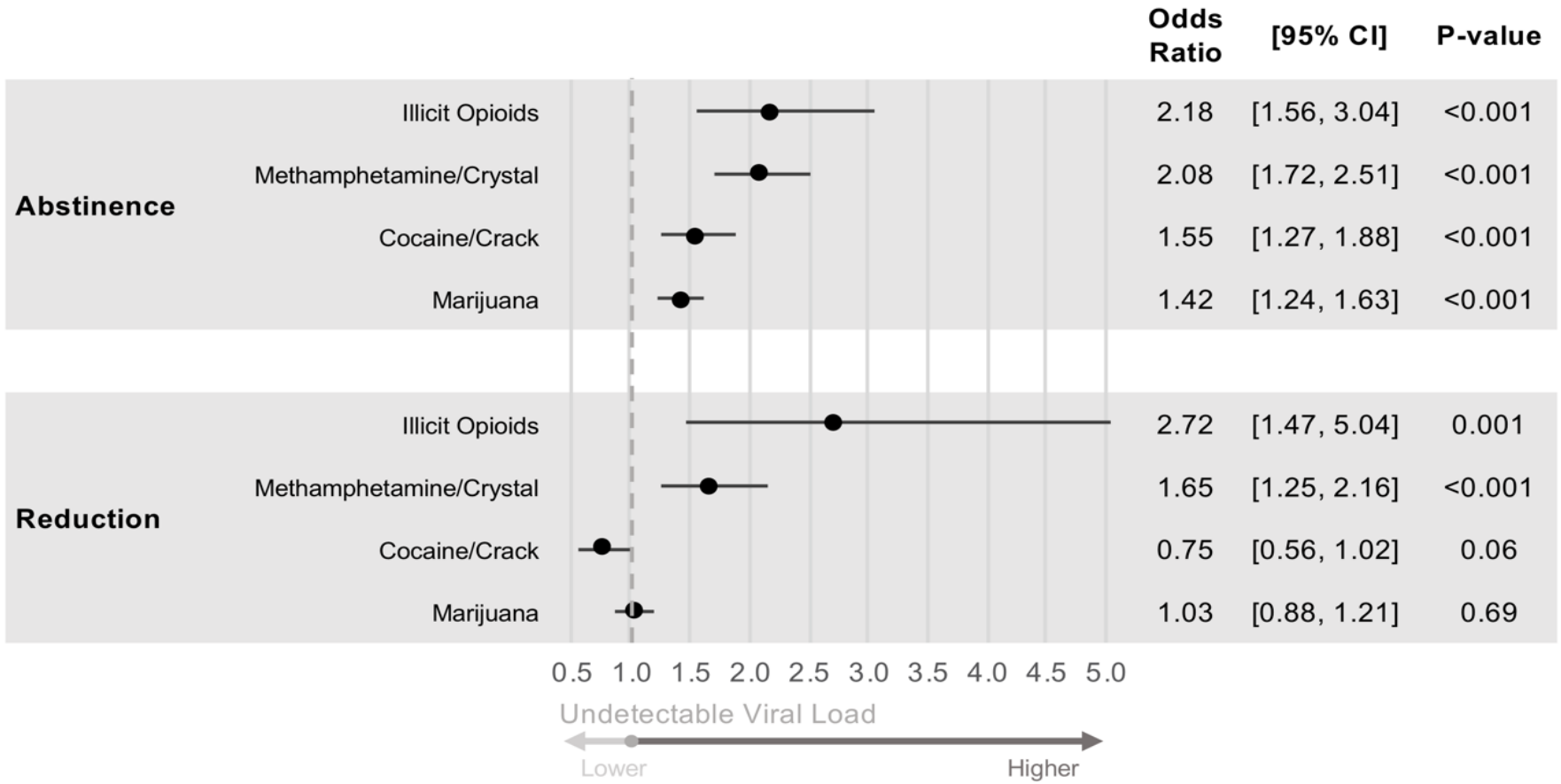
Association of Decreasing or Abstinence of Four Classes of Drug Use with Undetectable Viral Load



Models adjusted for age, sex, and year of cohort entry and years of follow-up. Models also adjusted for concomitant use of other substances including other drugs, alcohol frequency and binge alcohol use

Nance et al., CID, 2019

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PROs and Research: Aging

Domain

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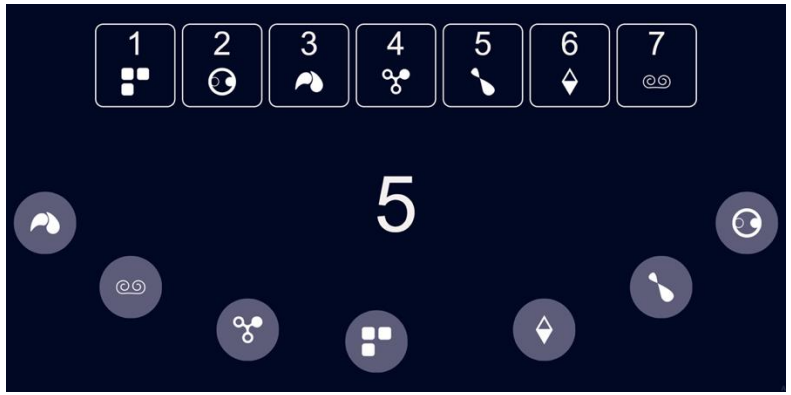
Factors Associated with Cognition: DSST Score

- Digit Symbol Substitution Test (DSST) measured by the Match Test from the Brain Health Assessment (developed at UCSF) incorporated into the PROs
- Not comprehensive approach to all aspects of cognition but does include executive function, motor speed, attention, and visuospatial function
- Recent addition to the PROs but early results show significant findings related to cognition and:
  - Financial insecurity
  - Food security
  - Adherence to ART

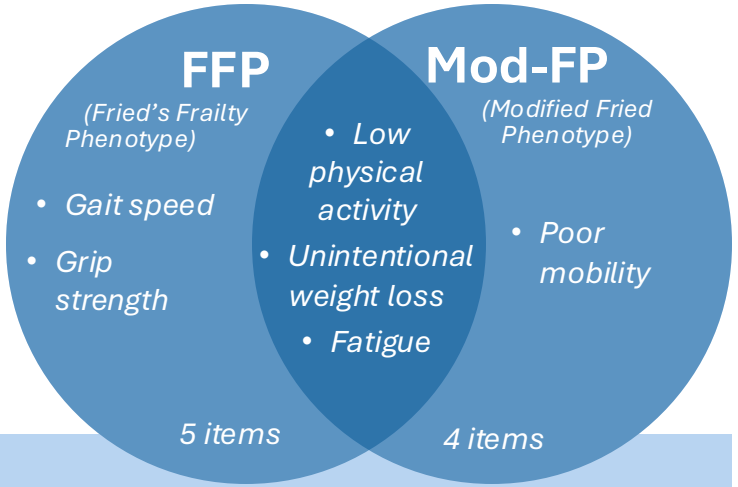
		Coefficient	95% CI	P-value
AUD Diagnosis		-1.78	-3.36, -0.19	0.03
Finance Situation	Comfortable	REF		
	Have necessities	-2.24	-4.22, -0.25	0.03
	Barely paying bills	-4.03	-6.26, -1.81	<0.001
	Struggling to survive	-4.08	-6.57, -1.59	0.001
Food Insecurity	Secure	REF		
	Low Security	-1.82	-3.57, -0.07	0.04
	Very Low Security	-2.91	-5.79, -0.02	0.048
Depression – PHQ-9 Score *(per point)*		-0.16	-0.29, -0.04	0.01
Anxiety with Panic	No symptoms	REF		
	Some panic	-1.41	-3.90, 1.08	0.3
	Panic disorder	-3.03	-5.39, -0.66	0.01

Models adjusted for age, sex, and race/ethnicity



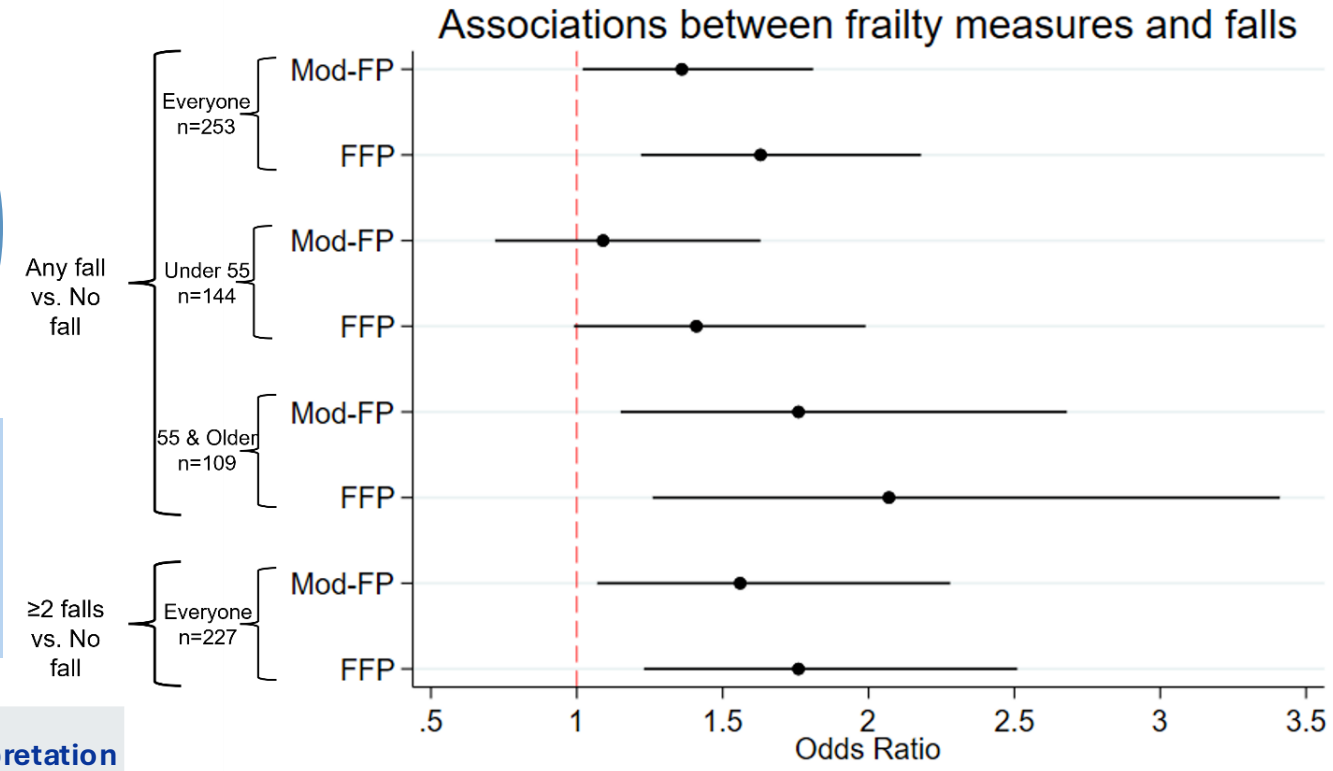
Possin, J Am Ger Soc, 2018

Validated, 4-Item CNICS Frailty



Issue

- Frailty is an important issue for aging PWH
- Time consuming to measure
- Normally requires healthcare provider engagement



Weighting Scheme	Agreement	Expected Agreement	κ	Interpretation
Unweighted	79.5%	42.5%	0.64	Substantial
Weighted linear	89.8%	67.2%	0.69	Substantial
Weighted quadratic	94.9%	79.5%	0.75	Substantial

Ruderman et al, JANAC, 2023

CNICS Solution

- Self-reported frailty phenotype component measures have good validity and reliability with FFP standard

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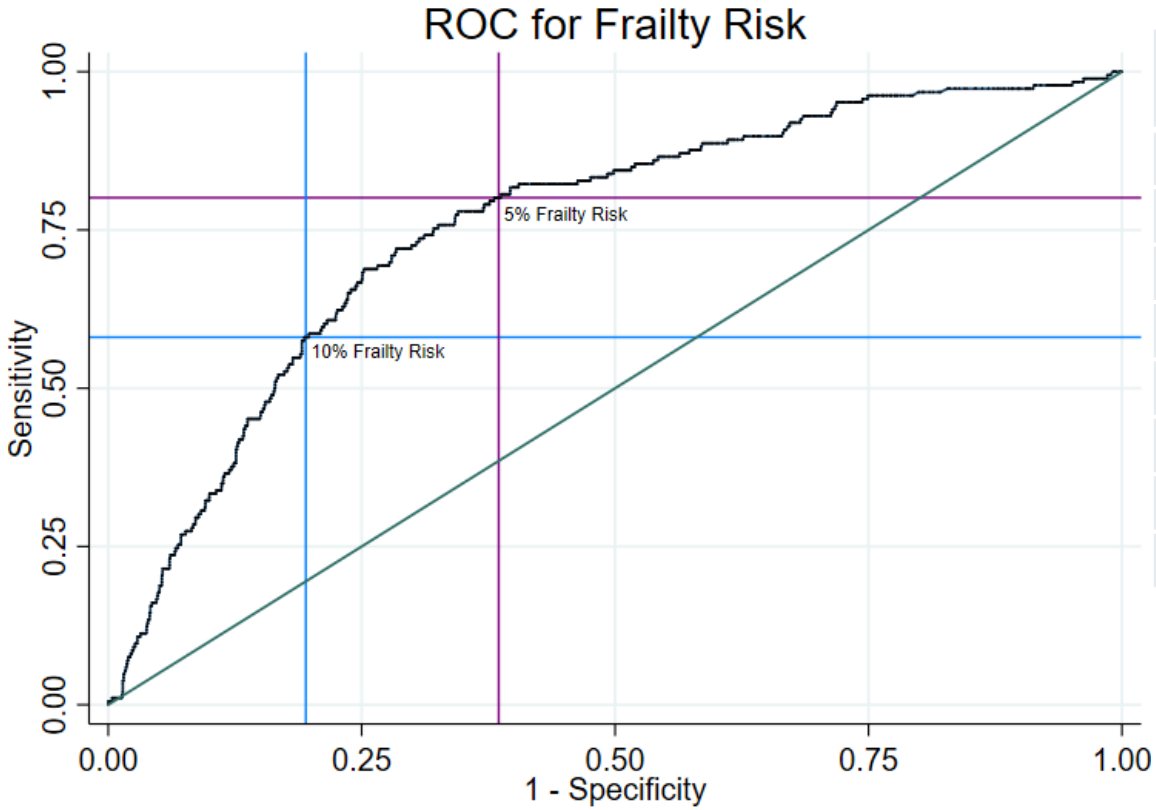
Predictors of Frailty Over 2 Years

Using two different predictive modeling approaches (BMA and Lasso) we identified 8 key predictors for becoming frail within 2 years

- **Depressive symptoms** and **drug use** were important predictors
- Included flexibility in cut points to increase sensitivity or specificity based on need
- Recalibration of these models is also possible making this type of predictive model useful across care and research



Variable	Hazard Ratio	95% CI	P-value
Baseline frailty score	2.9	2.4-3.6	<0.001
Depressive symptomology	1.1	1.0-1.1	<0.001
Current illicit opioid use	2.3	1.3-4.2	0.01
Current marijuana use	1.4	1.1-1.9	0.01
Prescribed antidepressants	1.4	1.1-2.0	0.02
Not prescribed ART	0.6	0.3-0.97	0.04
Female sex	1.5	1.1-2.1	0.02
Age (per decade)	1.1	0.96-1.2	0.2

Ruderman et al, AIDS, 2023

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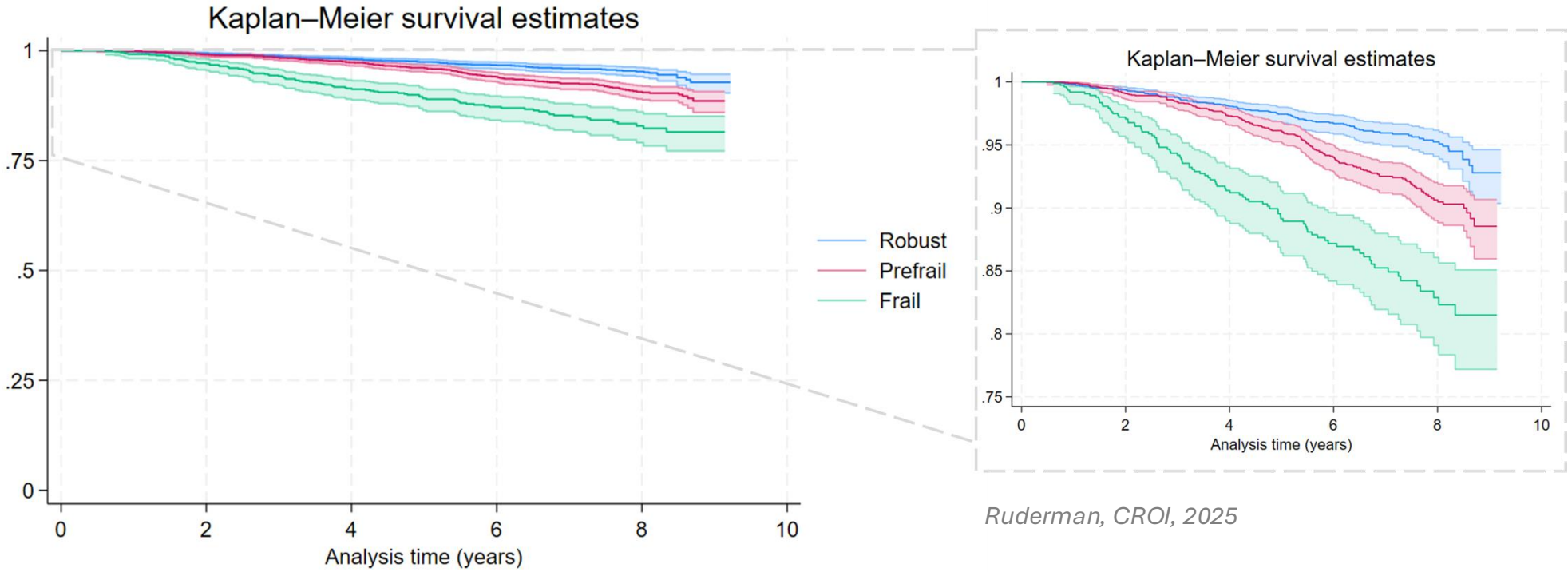
Frailty and Mortality



Ruderman, CROI, 2025

N=6752	Frailty Status	Hazard Ratio (95% CI)	Pvalue
Deaths=360	Robust	Ref	
	Prefrail	1.54 (1.20-1.97)	<0.01
	Frail	2.69 (2.01-3.61)	<0.001

Cox proportional hazards model adjusted for age, sex, race/ethnicity, site, HIV viral load (time-updated), current CD4 count (time-updated), diabetes status, treated dyslipidemia, treated hypertension, HCV, HBV, FIB-4, eGFR, BMI category

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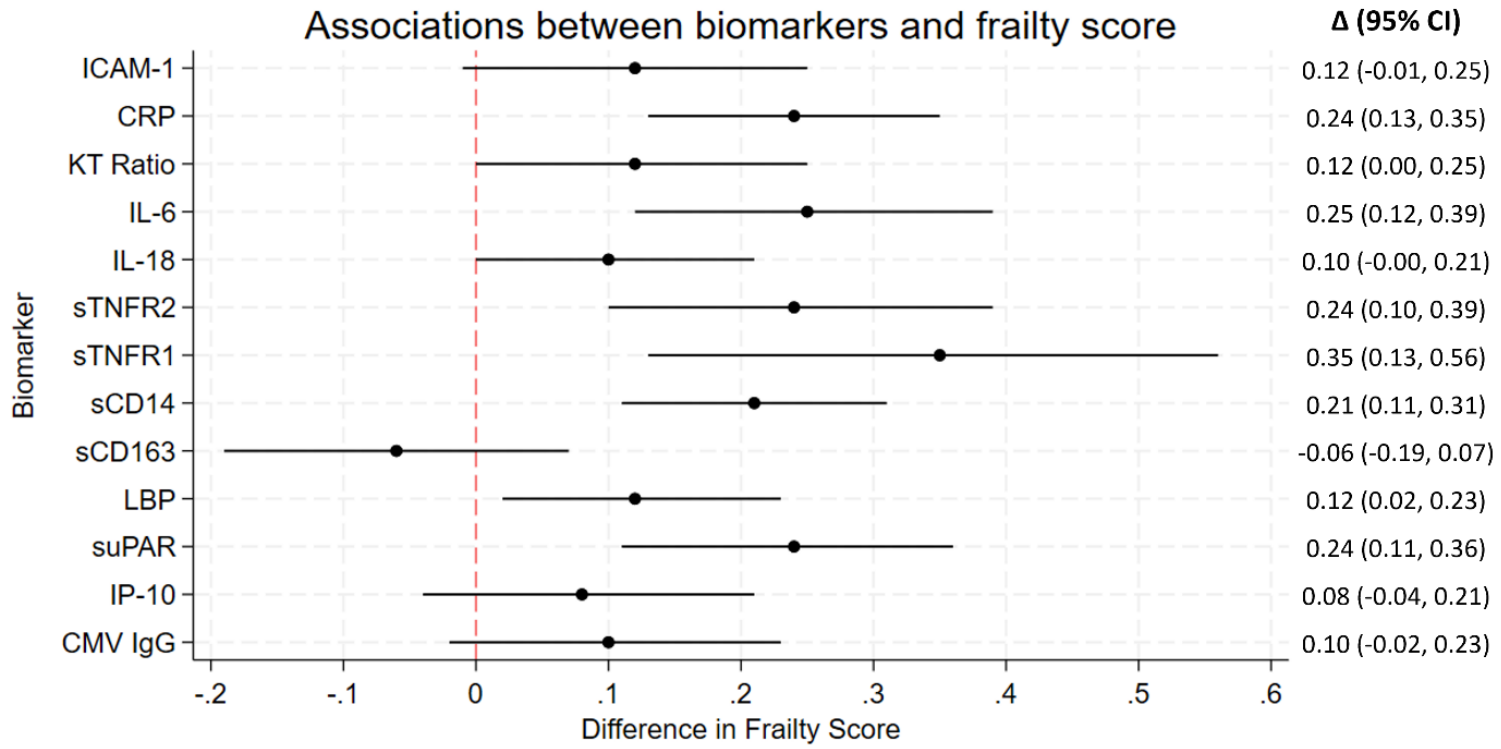
Biomarkers of Microbial Translocation & Generalized Inflammation are Associated with Frailty among People with HIV



Average: 5.5-year follow-up
Median baseline age: 45
9% female **91%** male
12% frail at baseline

Observed multiple inflammatory pathways associated with higher frailty scores

- Generalized inflammation / monocyte signatures: CRP, sCD14, IL-6, sTNFR1, sTNFR2
- Microbial translocation: LBP, sCD14, KT ratio

Published in AIDS. 2025;39(2):153-161.

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PROs and Research: Physical Health & Comorbidities

Domain

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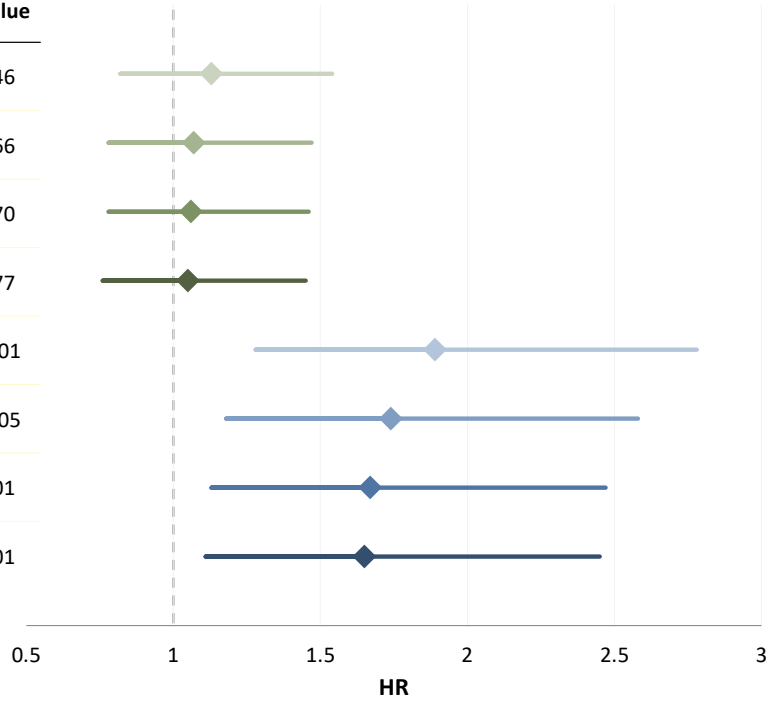
Depression & Risk of Stroke, Insomnia, & Myocardial Infarction Risk Among PWH

Association between Insomnia and First Incident MI by MI Type

	Adjustment Factors	HR (95% CI)	p-value
T1MI	Demographics[a]	1.13 (0.82-1.54)	0.46
T1MI	Demographics & CVD risk factors[b]	1.07 (0.78, 1.47)	0.66
T1MI	Demographics & CVD risk factors, & HIV markers[c]	1.06 (0.78, 1.46)	0.70
T1MI	Demographics, CVD risk factors, HIV markers, & stimulant use[d]	1.05 (0.76, 1.45)	0.77
T2MI	Demographics[a]	1.89 (1.28, 2.78)	0.001
T2MI	Demographics & CVD risk factors[b]	1.74 (1.18, 2.58)	0.005
T2MI	Demographics & CVD risk factors, & HIV markers[c]	1.67 (1.13, 2.47)	0.01
T2MI	Demographics, CVD risk factors, HIV markers, & stimulant use[d]	1.65 (1.11, 2.45)	0.01



Adjustment Covariates for Time–Varying Depression Severity and Stroke	HR *(per 5 pts PHQ-9)*	95% CI	P-value
Sociodemographic factors	1.18	1.05, 1.33	0.004
Sociodemographic and CV factors	**1.16**	**1.03, 1.30**	**0.01**
Sociodemographic and HIV factors	1.15	1.02, 1.29	0.02
Sociodemographic, CV, and HIV factors	1.13	1.00, 1.27	0.046

Ma, CROI, 2024
Lu, JAIDS, 2022

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PROs and Research: Measurement

Domain

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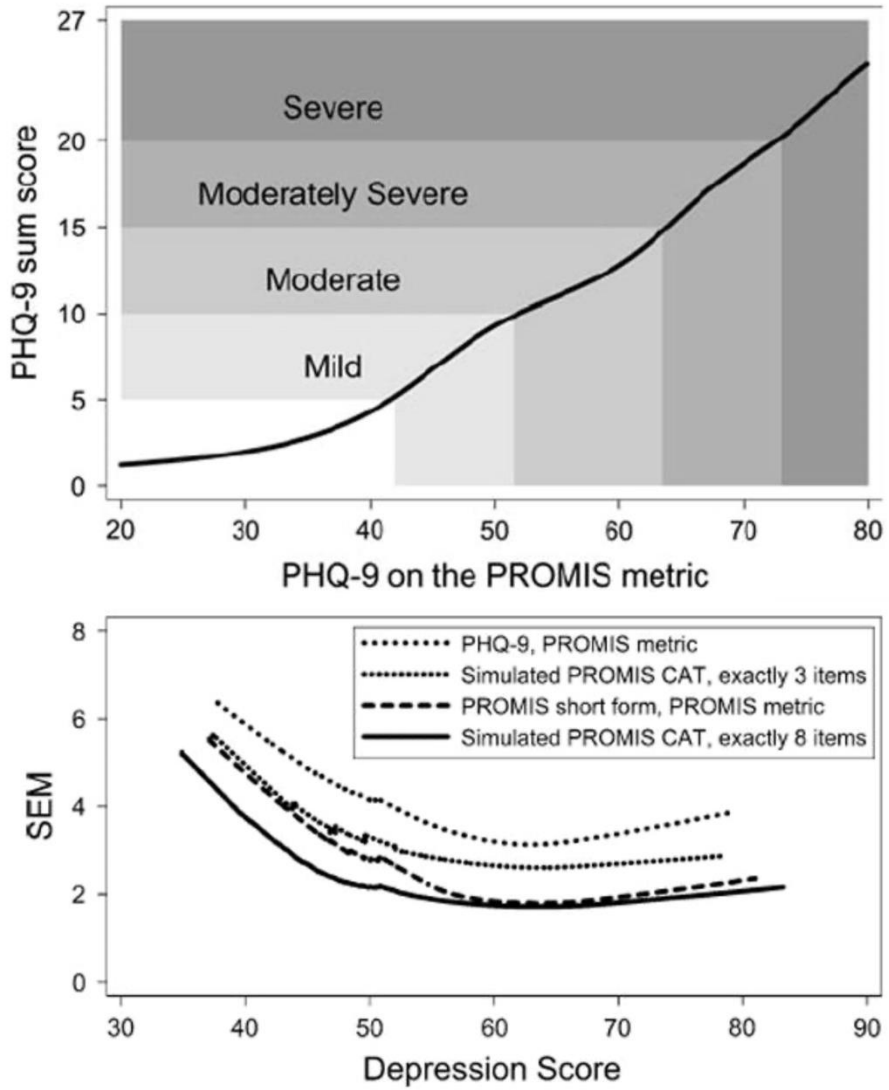
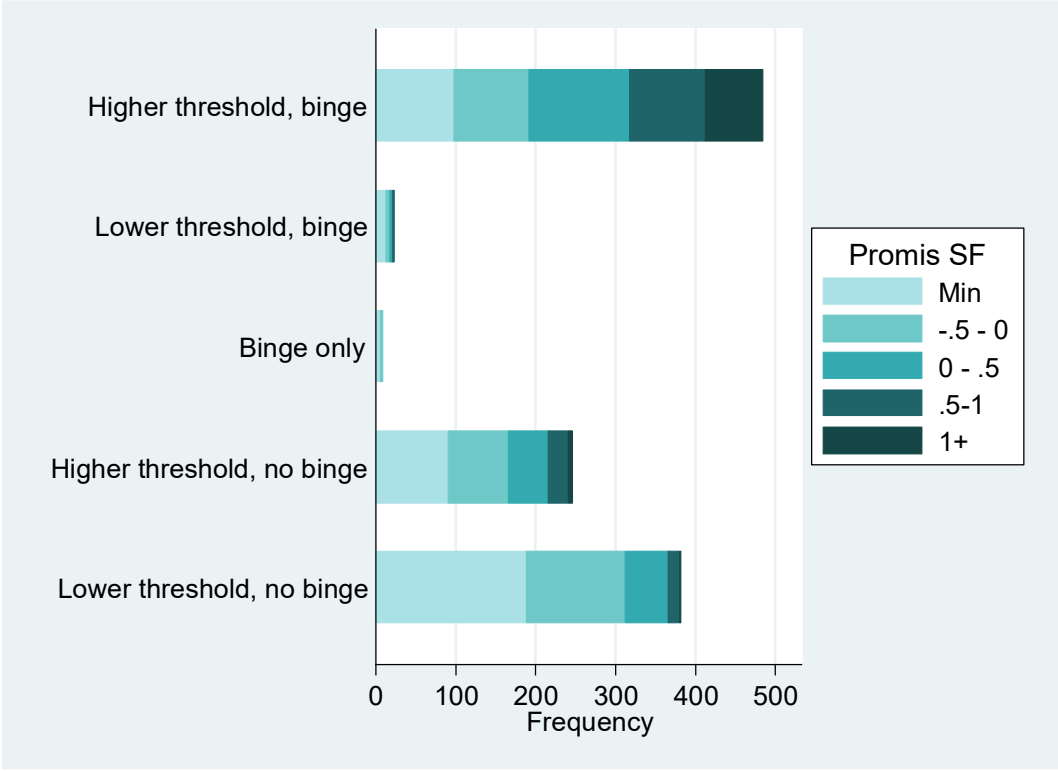
Not Just Domains but Measures: Co-Calibration, Content, and Measurement Precision



Gibbons et al., Qual Life Research, 20(9): 1349-1357

AUDIT-C vs. PROMIS Alcohol Short Form in PWH



AUDIT-C: better assessment of quantity of alcohol consumed
PROMIS: better measurement precision and assessment of how someone feels about their alcohol use, but not a good measure of the behavior itself

Gibbons et al., 2016, Drug Alc Dep, 164: 113-119

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PROs and Research: Substance Use

Domain

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Prevalence Ratios of Demographic Characteristics & Mental Health by Non-fatal Overdose

		PR	95% CI	P-value
Age, *for every 5 years*		0.91	0.85, 0.97	0.004
Gender	Cisgender Men	REF		
	Cisgender Women	1.62	1.02, 2.56	0.041
	Transgender Women	4.02	1.89, 8.51	<0.001
	Other Genders	0.94	0.13, 6.68	0.953
Race/Ethnicity	White	REF		
	Black/African American	1.54	1.00, 2.37	0.050
	Latine/Hispanic	1.98	1.15, 3.41	0.014
	Other	1.21	0.48, 3.06	0.694
Sexual Identity	Gay/Lesbian	REF		
	Heterosexual	2.34	1.52, 3.58	<0.001
	Bisexual	2.80	1.57, 4.98	<0.001
	Other Identities	2.65	1.30, 5.44	0.008
Region	Southwest	REF		
	Northeast	2.28	1.24, 4.19	0.008
	West	2.40	1.36, 4.22	0.002
	Midwest	1.06	0.39, 2.91	0.906
Depression*	None	REF		
	Mild	2.99	1.74, 5.12	<0.001
	Moderate	6.99	4.05, 12.06	<0.001
	Moderate Severe	7.78	4.16, 14.56	<0.001
	Severe	6.63	3.09, 14.23	<0.001
Anxiety/Panic* *(yes vs no)*		3.01	2.47, 4.38	<0.001
Housing Situation*	Stable	REF		
	Unstable	5.29	2.10, 13.36	<0.001
	Unhoused	15.00	7.46, 30.12	<0.001
	Unknown to Respondent	6.19	1.18, 21.16	0.004
	Not Collected	6.94	3.91, 12.31	<0.001

**Adjusted for age, gender, race/ethnicity, sexual identity and geographic census region*
Presented at CPDD, 2024

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Impact of Current Use on Recent Overdose Risk by Drug and Combinations of Drugs Used (methamphetamine, cocaine/crack, and illicit opioids)

Current (3 month) use of methamphetamines, cocaine/crack, illicit opioids	RR for Overdose in past 6 months	Adjusted* RR for Overdose in past 6 months
None	0.26	0.23 (0.14, 0.35)
Methamphetamines Only	REF	REF
Cocaine/Crack Only	1.69	1.30 (0.76, 2.21)
Illicit Opioids Only	1.87	1.49 (0.72, 3.09)
Methamphetamine and Cocaine/Crack	2.71	2.42 (1.32, 4.42)
Methamphetamine and Illicit Opioids	4.44	4.34 (2.49, 7.58)
Cocaine/Crack and Illicit Opioids	7.30	5.00 (2.90, 8.59)
Methamphetamines, Cocaine/Crack, and Illicit Opioids	7.73	7.48 (4.40, 12.72)

** Adjusted for age, sex, race/ethnicity*
Presented at CPDD, June, 2024

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PROs and Research: Contextual

Domain

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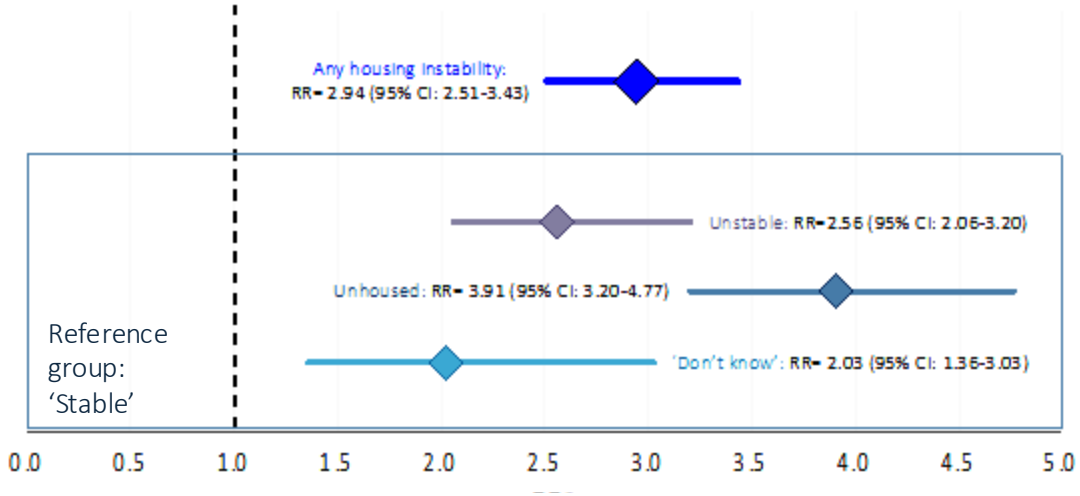
Housing Stability & Drug Use

- Participants at 6 CNICS sites in 2019 or later who completed a PRO battery including housing stability & drug use (via ASSIST) → most recent assessment used
  - "In the past month, how would you describe your living situation?"
    - 'Homeless,' 'Unstable,' 'Stable,' or 'Don't know'
  - Drug use parameterized as any use of any of methamphetamine, cocaine/crack, and/or opioids (MCO) in the past 3 months
- N=5,580 PWH included – 9.1% reported housing instability:
  - 4.5% 'Unstable,'
  - 2.9% 'Homeless,'
  - 1.7% 'Don't know'

Lack of stable housing, particularly being unhoused, was associated with an increased burden of MCO use

Associations Between Housing Instability & MCO Use



*Relative risk (RR) regression adjusted for age, birth sex, race/ethnicity, & site.

- Overall, 10.9% of participants reported past 3-month use of ≥1 MCO substance:
  - 7.2% methamphetamine
  - 4.3% cocaine/crack
  - 2.1% opioids

2024 Society for Epidemiologic Research Meeting. Austin. Jun 2024.

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- Why do PROs
- Practical considerations
- CNICS as an example
- Can it help care
- Can it help research
- **PROs vs. EHR?** *e.g. substance use*

Rates of Ever Use by EHR vs. Ever and Current Use by PRO

- Results suggest PROs capture a much higher percentage of substance use than EHR:
  - Drug use ever reported on PRO is at least **2X** as high as by diagnoses from EHR
  - Current cannabis use on PRO is **3X** that of diagnosis reported cannabis
  - Risky alcohol use is higher in prior 12 months from PROs than ever on the EHR

Drug	EHR Ever	PRO Ever	PRO Current (prior 3 months)
Tobacco	45%	61%	33%
Methamphetamine	16%	33%	11%
Cocaine/Crack	15%	43%	7%
Illicit Opioids	10%	20%	4%
Cannabis	11%	63%	33%
	EHR Ever Risky Use	**PRO Risky Use in Last 12 months**	
Alcohol	21%	26%	

EHR Ever - any EHR diagnosis at any time period
PRO Ever - former and current use on the PROs
PRO Current - drug use is use within last 3 months; alcohol use within the last 12 months

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Association of Drug Use from EHR Diagnoses and PROs with Mortality

Drug	EHR diagnoses	Adjusted HR*	From PROs	Adjusted HR*
Tobacco	No	Ref	Never	Ref
	Yes	1.00 (0.96,1.04)	Former	1.15 (1.03,1.28)
			Current	2.48 (2.26,2.73)
Methamphetamine	No	Ref	Never	Ref
	Yes	0.78 (0.73,0.84)	Former	1.41 (1.28,1.56)
			Current	1.76 (1.54,2.02)
Cocaine/Crack	No	Ref	Never	Ref
	Yes	1.39 (1.32,1.46)	Former	1.26 (1.16,1.37)
			Current	2.05 (1.79,2.35)
Illicit Opioids	No	Ref	Never	Ref
	Yes	1.49 (1.41,1.57)	Former	1.36 (1.23,1.50)
			Current	2.43 (2.08,2.85)
Cannabis	No	Ref	Never	Ref
	Yes	0.85 (0.80,0.91)	Former	1.25 (1.13,1.37)
			Current	1.25 (1.12,1.38)

**adjusted for age, sex, race*

- EHR diagnoses show no association between tobacco use and mortality and methamphetamine diagnoses appear protective.
- Based on PROs, current tobacco use is associated with a 2-fold increased risk of mortality, former methamphetamine is associated with 41% increased mortality risk and current methamphetamine use is associated with 76% increased mortality risk.

EHR substance use diagnoses data should not be used as they result in tremendous misclassification and under capture of risk!

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PROs vs. EHR for Substance Use

- PROs provide more information such as frequency and severity of use
- EHR substance use severity codes are:
  - Too sparse to have face validity
  - Not systematically collected, so lack of code does not provide meaningful information
- PROs identify much more substance use than EHR based approaches
  - More PWH indicate at-risk drinking in prior 12 months on PROs than have EHR diagnosis codes for at-risk drinking ever
- PRO-based substance use has much more face validity when examining substance use and other outcomes
  - e.g., tobacco use from PROs is associated with outcomes including mortality, type 1 MI, etc., while tobacco use from EHR diagnoses are weakly or not associated at all → lack of face validity
- Substance use is just one example – many domains captured by PROs and relevant for clinical care are not captured by the EHR at all!

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Summary of a Few Key Findings

- PROs allow us to incorporate the patient's voice and collect information that is otherwise often missed
- PROs can be difficult to implement, but when done well are highly acceptable and can become a routine part of clinical care
- PROs facilitate clinical care including patient provider communication, identifying barriers and issues that impact outcomes
- PROs by themselves do not address all issues. Improve awareness and actions but impacts vary by domain
- PROs provide essential information to address clinically relevant research questions. By focusing on domains relevant for care, corresponding research is directly relevant to patient care and outcomes
- PRO-based measures of substance use provide needed information regarding timeframe, intensity of use, etc. that are not available in EHR-based diagnosis approaches
- EHR-based approaches to measuring substance use result in substantial misclassification and do not predict many negative outcomes such as mortality among PWH while PRO-based approaches to substance use do a much better job

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Gratitude:
Too Many Great Colleagues to Thank Them All

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- If questions: my email is hcrane@uw.edu