Evaluating the Conceptual Structure of the Barriers to Oral Pre-Exposure Prophylaxis Access Survey: A Confirmatory Item Factor Analysis

Poster MSR92

Patrick Sullivan[1], Jeno Millechek[2], Woodie Zachry[3], Saeid Shahraz[3], Alice Hsiao[3], JeanPierre Coaquira Castro[3]

[1]Emory University Rollins School of Public Health, Atlanta, GA, US; [2]University of North Carolina at Chapel Hill, Chapel Hill, NC, US; [3]Gilead Sciences, Inc., Foster City, CA, US.

Presenter: James Jarrett, Gilead Sciences, Inc., Foster City, CA, US.

Copies of this poster obtained through QR (Quick Response) and/or text key codes are for personal use only and may not be reproduced without written permission of the authors.

Conclusions

- Confirmatory item factor analysis (CIFA) results provide acceptable support for the domain-level assessment of 21 items of the Barriers to Pre-Exposure Prophylaxis (PrEP) Access Survey supplementing the item-level assessment of all 35 items in the survey
- A 4-domain conceptual structure was found to fit data from the pilot study significantly better than a 3-domain model
  - Domains included in this model were: Physician communication, self-efficacy, attitudes, and financial burden
- Domain-level analyses of survey items require thoughtful design of question structure and response options
  - Two-level items could not be included in the analysis
  - Handling “does not apply” responses required comparing methodological choices
- In an item-level analysis of survey results presented at IDWeek[1], only financial burden was found to significantly affect timely pickup of an initial PrEP prescription
- Augmenting item-level interpretation of this survey with a domain-level interpretation will better inform clinical and patient decision making

Plain Language Summary

- Medicines that help prevent HIV, called PrEP, are available in the US, but some people who need or want PrEP — especially those who are young, Black or Hispanic/Latine, or living in the Southern US — still face challenges getting it
- To better understand these challenges, we created a survey for people picking up PrEP to ask them about their experiences when getting PrEP from the pharmacy for the first time
- Researchers usually look at survey questions one at a time, but we wanted to know if we could group questions together to understand bigger ideas or themes that affect how hard it is for people to get PrEP
- Using a method called CIFA, we tested two ways of grouping our survey questions together to see which one better fit data we collected in a small trial run of the survey
- We found that grouping the survey questions into four themes worked better than using three themes. These four themes were: Talking with doctors, confidence in getting and using PrEP, beliefs and feelings about PrEP, and money and insurance concerns
- These results show us that, for our survey, we can study both individual answers and these overall themes. This will give us a better understanding of what helps or gets in the way of people starting PrEP

Background

- HIV-1 PrEP is critical in preventing new HIV infections, reducing the risk of acquiring HIV by as much as 99% when taken as directed[2]
- PrEP use, however, remains disproportionately low among many in the US who are at increased risk of acquiring HIV-1, including those who are young, Black or Hispanic/Latine, or who live in the South[3]
- Uptake of PrEP is influenced by multiple factors, including perceived risk of HIV-1, HIV-associated stigma, knowledge and awareness of PrEP, trust in and access to PrEP providers, and costs of PrEP[4]
- To capture the perspective of individuals who need or want PrEP and factors driving uptake of PrEP at the pharmacy level in the US, a survey was deployed to individuals picking up an initial PrEP prescription in a pilot phase (March–April 2024) and a final study phase (July–December 2024)
  - In an item-level analysis, cost concerns and insurance coverage issues were found to be associated with delayed or no pickup of a first PrEP prescription[1]
- Domain-level analyses of survey results allow a more integrative interpretation of data but are restricted to surveys that are confirmed to contain a broader conceptual structure
- CIFA is a statistical technique that is used to assess how well a pre-defined conceptual model fits observed data[5]

Objective

- To assess the conceptual structure of the Barriers to PrEP Access Survey using *post-hoc* analysis results from the pilot survey and determine if items can be described at the domain level

Methods

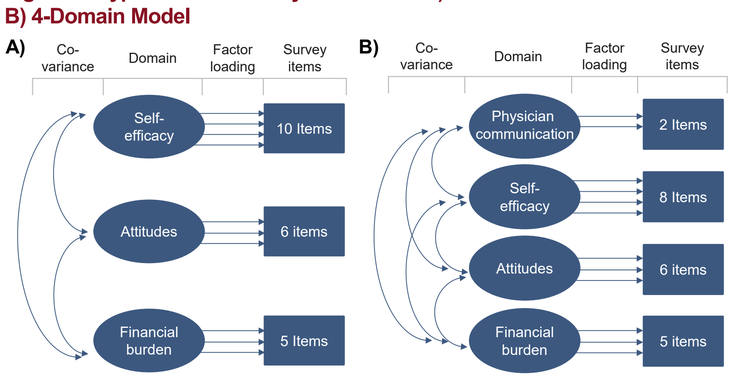
Survey Items

- The Barriers to PrEP Access Survey comprises 35 items assessing psychosocial and structural barriers individuals may experience when receiving their initial PrEP prescription
  - Responses were obtained from 235 individuals during the pilot phase of the study (March–April 2024)
- A total of 21 survey items were included in the *post-hoc* analysis of the theoretical conceptual structure
  - Removed items (n=14) assessed background information, were fact-checking items, or were subordinate in a skip pattern
- Items in the analysis (n=21) were sorted into domains according to the Information-Motivation-Behavioral Skills Model,[6] supplemented with concepts from validated instruments aligned with survey objectives

Assessment of Conceptual Structure

- CIFA[5] was used to assess the fit of the pilot study data to the conceptual models: A 3-domain model (**Figure 1A**) and a 4-domain model (**Figure 1B**)
- Model parameters were estimated using robust maximum likelihood (ML) estimation
  - Models using diagonal weighted least squares and unweighted least squares failed to converge properly and were not included in this analysis
- Fit of the pilot study data to each conceptual structure was assessed using the comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA)[6]
  - Fit of the model was considered adequate when values were ≥0.90 (CFI and TLI) and ≤0.08 (RMSEA)[7,8]
- The Akaike information criterion (AIC), Bayesian information criterion (BIC), and likelihood ratio test (LRT), were used to compare how well the 3- and 4-domain models fit the pilot study data[7]
  - Lower AIC and BIC values indicate better model fit
  - LRT was performed to compare the fit between the 3-domain and 4-domain models
- Estimated factor loadings were used to assess the strength and direction of the relationship between items and domains

Figure 1. Hypothesised Survey Structures: A) 3-Domain Model and B) 4-Domain Model



Missing Data

- All responses that selected “I prefer not to answer” or indicated the respondent does not remember the answer were considered informative missing data and were handled using full information ML estimation
- Selection of the response “does not apply” was handled in two ways:
  1. It was considered missing data and handled using ML
  2. Through LD followed by ML
- A separate dataset was created for each method of handling missing data

Results

Survey Structure and Model Fit

- Among the 235 respondents, 212 (90.2%) remained after using LD to remove respondents with “does not apply” responses
- The best fit performance among the assessed conditions was observed for the 4-domain model using ML only to handle missing data (**Table 1**)
  - Under these conditions, RMSEA was less than 0.08, indicating an acceptable fit to the data
  - CFI and TLI values were slightly less than 0.90, indicating a less than acceptable fit
- A comparison of the two models with LRT revealed the 4-domain model fit the data significantly better than the 3-domain model, regardless of the strategy used for missing data (**Table 2**)
  - AIC and BIC were lowest, however, with four domains and LD + ML of missing data

Table 1. Fit Indices for 3-Domain and 4-Domain Factor Models to Pilot Study Data

Model	Missing data	CFI	TLI	RMSEA (90% CI)
3-domain	ML	0.764	0.734	0.073 (0.062, 0.084)
4-domain		**0.852**	**0.830**	**0.058 (0.047, 0.070)**
3-domain	LD + ML	0.740	0.706	0.078 (0.067, 0.089)
4-domain		0.827	0.802	0.064 (0.052, 0.076)

Red bolded text indicates the best outcome, defined by the highest CFI and TLI and lowest RMSEA value.
CFI, comparative fit index; CI, confidence interval; LD, listwise deletion; ML, maximum likelihood; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index.

Table 2. Comparison Statistics for 3-Domain and 4-Domain Factor Models

Model	Missing data	AIC	BIC	LRT χ^2 Diff. (p-value)
3-concepts	ML	11038	11267	27.19 (p<0.001)
4-concepts		10949	11188	
3-concepts	LD + ML	10009	10230	23.75 (p<0.001)
4-concepts		9927	10158	

AIC, Akaike information criterion; BIC, Bayesian information criterion; LD, listwise deletion; LRT, likelihood ratio test; ML, maximum likelihood.

Factor Loading Results

- In the 4-domain model with missing data handled with ML only, most items had acceptable (>0.30) standardised factor loadings (**Table 3**)
- Factor loadings for items 11, 14, and 21 were not statistically different from zero, indicating these item responses had weak relationships with their domains

Table 3. Question Content and Factor Loading Values for Items Included in 4-Domain Model[a]

Domain	Item[b]	Question	Loading factor (λ)
Phys comm	2	My doctor explained how to use PrEP in a way that I could understand.	0.765*
	18	My doctor explained how to get access to or obtain PrEP in a way that I could understand.	0.634*
Self-efficacy	1	How difficult was it for you to find information about PrEP to decide if it is right for you?	0.503*
	4	How difficult was it or would it be for you to find a way to pay for PrEP, based on the cost you were told to pay by the pharmacy?	0.309*
	11	Have you talked with your most recent sexual partner(s) about the decision to take PrEP?	-0.002
	13	How difficult was it for you to visit the doctor who prescribed PrEP for you?	0.571*
	14	Did you talk about your sexual behaviours with your doctor?	-0.011
	17	How difficult was it for you to get tested for HIV before starting PrEP?	0.443*
	19	Before starting or considering to start taking PrEP, how difficult did you think it would be for you to take PrEP as your doctor told you to take it?	0.483*
	20	How difficult would it be for you to visit a doctor every 3 months for routine screenings, which are typically recommended when taking PrEP?	0.521*
Attitudes	21	Without taking PrEP, I believe my chances of getting HIV are:	-0.130
	22	I believe that if I take PrEP as told by my doctor, it will protect me from HIV.	0.263*
	23	I believe that people who take PrEP are responsible in protecting themselves from HIV.	0.345*
	24	I believe that PrEP is safe to take.	0.451*
	25	I would be concerned if my family, friends, or sexual partners found out I was taking PrEP.	0.597*
	26	People who take PrEP are promiscuous.	0.483*
Financial burden	27	My out-of-pocket medical expenses are more than I thought they would be (in the past 14 days).	0.508*
	28	I am able to meet my monthly expenses (in the past 14 days)	1.035*[c]
	29	I am concerned about keeping my job and income, including work at home (in the past 14 days).	0.808*
	30	What is your living situation today?	0.325*
	31	How hard is it for you to pay for the very basics like food, housing, medical care, and heating?	0.537*

Intensity of colour highlighting indicates magnitude of loading factor from lowest (yellow) to highest (green). Asterisks denote numbers significantly different from zero.
[a]Missing data were handled with ML, with no LD. [b]14/35 survey items were excluded from the conceptual analysis because they assessed background information or were subordinate in a skip pattern. [c]Standardised factor loading can sometimes exceed 1.00 due to sampling variability.
Comm, communications; LD, listwise deletion; ML, maximum likelihood; phys; physician; PrEP, pre-exposure prophylaxis.

Post-Hoc Item Removal

- Goodness-of-fit was assessed upon combinatorial removal of poorly fitting items (**Table 4**)
- Removal of items 11 and 14 produced the best fit, with RMSEA (0.055) indicating acceptable fit and TLI (0.871) and CFI (0.890) indicating approximately acceptable fit
- Similar results were found when all three items were removed

Table 4. Goodness-of-Fit of 4-Domain Model[a] After Post Hoc Removal of Items With Poor Fit

Better outcome
lowest — *highest*
highest — *lowest*

Removed items	CFI	TLI	RMSEA
None	0.852	0.830	0.058
11	0.880	0.861	0.055
14	0.861	0.839	0.060
21	0.855	0.832	0.061
11, 14	0.890	0.871	0.055
11, 14, 21	0.888	0.868	0.059

Intensity of colour highlighting indicates the best outcomes, defined by the highest (blue) and lowest (red) values depending on the statistic.[a]Missing data were handled with ML, with no LD.
CFI, comparative fit index; LD, listwise deletion; ML, maximum likelihood; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index.

Limitations

- Approximately acceptable fit was achieved after *post-hoc* removal of several items; such *post-hoc* changes run the risk of overfitting the model to the sample, making it less likely that support for the conceptual structure will be replicated in a different sample
- The results indicated that how one handles the “does not apply” responses has a notable impact on the model fit of the hypothesised conceptual structures
- The relatively small sample size used in this study might have led to higher standard errors and lower precision with the analytical methods used

References **1.** Sullivan PS, et al. Poster presented at: IDWeek: October 19–22, 2025; Atlanta, GA. **2**. Anderson PL, et al. *Sci Transl Med*. 2012;4:151ra25. **3.** AIDSVu. AIDSVu Releases 2024 PrEP Use Data Showing Growing Use Across the U.S. 2025. Available at: https://aidsvu.org/news-updates/aidsvu-releases-2024-prep-use-data-showing-growing-use-across-the-u-s/ (Accessed October 2025). **4.** Mayer KH, et al. *Adv Ther.* 2020;37:1778–811. **5.** Wirth RJ and Edwards MC. *Psychol Methods.* 2007;12:58–79. **6.** West SG, et al. Handbook of Structural Equation Modeling. *Guilford Press.* 2023. **7.** Bentler PM and Bonett DG. *Psychological Bulletin*. 1980:88:588–606. **8.** Jöreskog KG and Sörbom D. *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Scientific Software International.1993.

Acknowledgments: This study was funded by Gilead Sciences, Inc. Medical writing support was provided by Erin McMullin, PhD, and Sherriden Beard, MA, of Ashfield MedComms (Macclesfield, UK), an Inizio company, and funded by Gilead Sciences, Inc.

Conflicts of Interest: **Patrick Sullivan** has received research grants and speaker fees from Gilead Sciences Inc. He has also received research grants from Merck and ViiV Healthcare. **Jeno Millechek** has no potential conflicts to disclose. **Woodie Zachry, Saeid Shahraz, Alice Hsiao,** and **JeanPierre Coaquira Castro** are employees and shareholders of Gilead Sciences, Inc.