

# Why Do People Living with HIV Adhere to Antiretroviral Therapy and Not Comorbid Cardiovascular Disease Medications? A Qualitative Inquiry

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Charles Muiruri<sup>1,2</sup>  
Isabelle P Sico<sup>1</sup>  
Julie Schexnayder<sup>3</sup>  
Allison R Webel<sup>3</sup>  
Nwora Lance Okeke<sup>4</sup>  
Christopher T Longenecker<sup>5</sup>  
Juan Marcos Gonzalez<sup>1</sup>  
Kelley A Jones<sup>1</sup>  
Sarah E Gonzales<sup>1</sup>  
Hayden B Bosworth<sup>1</sup>

<sup>1</sup>Department of Population Health Sciences, Duke University School of Medicine, Durham, NC, USA; <sup>2</sup>Duke Global Health Institute, Duke University, Durham, NC, USA; <sup>3</sup>Frances Payne Bolton School of Nursing, Case Western Reserve University, Cleveland, OH, USA; <sup>4</sup>Department of Medicine, Duke University Medical Center, NC, USA; <sup>5</sup>Department of Medicine, Case Western Reserve University School of Medicine, Cleveland, OH, USA

**Background:** After achieving viral suppression, it is critical for persons living with HIV (PLWH) to focus on prevention of non-AIDS comorbidities such as cardiovascular disease (CVD) in order to enhance their quality of life and longevity of life. Despite PLWH elevated risk of developing CVD compared to individuals without HIV, PLWH do not often meet evidence-based treatment goals for CVD prevention; the reasons for PLWH not meeting guideline recommendations are poorly understood. The objective of this study was to identify the factors associated with adherence to CVD medications for PLWH who have achieved viral suppression.

**Methods:** Qualitative data were obtained from formative research conducted to inform the adaptation of a nurse-led intervention trial to improve cardiovascular health at three large academic medical centers in the United States. Transcripts were analyzed using content analysis guided by principles drawn from grounded theory.

**Results:** Fifty-one individuals who had achieved viral suppression (<200 copies/mL) participated: 37 in 6 focus groups and 14 in individual semi-structured interviews. Mean age was 57 years (SD: 7.8); most were African Americans (n=31) and majority were male (n=34). Three main themes were observed. First, participants reported discordance between their healthcare providers' recommendations and their own preferred strategies to reduce CVD risk. Second, participants intentionally modified frequency of CVD medication taking which appeared to be related to low CVD risk perception and perceived or experienced side effects with treatment. Finally, participants discussed the impact of long-term experience with HIV care on adherence to CVD medication and motivational factors that enhanced adherence to heart healthy behaviors.

**Conclusion:** Findings suggest that future research should focus on developing interventions to enhance patient-provider communication in order to elicit beliefs, concerns and preferences for CVD prevention strategies. Future research should seek to leverage and adapt established evidence-based practices in HIV care to support CVD medication adherence.

**Keywords:** medication adherence, persons living with HIV, viral suppression, cardiovascular disease, qualitative research

## Background

The United States is on course to reach the targets of the Joint United Nations Programme on HIV/AIDS (UNAIDS) 90-90-90 goals.<sup>1</sup> 90-90-90 targets stipulate that 90% of people living with HIV (PLWH) will know their status; 90% of those

Correspondence: Charles Muiruri  
Email charles.muiruri@duke.edu

will be on antiretroviral therapy (ART); and 90% of those on ART will be virally suppressed.<sup>2</sup> After achieving viral suppression, it is critical for PLWH to focus on prevention of non-AIDS comorbidities such as cardiovascular disease (CVD) in order to enhance quality of life and increase lifespan.<sup>3</sup> PLWH have a 1.5 to 2 times higher risk of developing CVD compared to individuals without HIV, a risk that persists despite viral suppression.<sup>4,5</sup> Unfortunately, PLWH do not often meet evidence-based treatment goals for CVD prevention and the reasons are poorly understood.<sup>6–10</sup>

A critical factor for achieving CVD treatment guidelines is optimal CVD medication adherence.<sup>11</sup> To date, a majority of research in medication adherence for PLWH has focused on ART.<sup>12</sup> For PLWH to achieve viral suppression, they must attain and maintain near perfect ART adherence (90–95%).<sup>13</sup> For those who have achieved viral suppression, their experience in overcoming treatment barriers for ART may transfer to other non-AIDS comorbidities.<sup>14</sup> Yet some evidence suggests disparate levels of medication adherence are found across conditions among PLWH. For example, to date, in two studies it was observed that PLWH had significantly higher medication adherence to ART compared to hypertension, mental health and type 2 diabetes medications.<sup>15,16</sup> In two other studies significant differences between rates for ART and hypertension, chronic kidney disease, or diabetes medications were not observed.<sup>17,18</sup>

Barriers to CVD medication adherence for PLWH who are adherent to ART may be different than for PLWH who are nonadherent to ART. It is therefore important to study these groups independently. Since treatment barriers that affect PLWH who are highly adherent to ART, may remain unchanged across different comorbid conditions like CVD, there is a need to look beyond barriers in evaluating the observed CVD medication nonadherence. For PLWH who are adherent to ART and have achieved viral suppression, nonadherence to CVD medications may be influenced by a combination of healthcare providers and individual patient factors including the health delivery systems.<sup>19</sup>

On the healthcare provider level, HIV healthcare providers have an important role in encouraging and monitoring ART adherence as described in their practice guidelines.<sup>20,21</sup> HIV providers' role in monitoring and encouraging adherence to other non-AIDS conditions such as CVD for PLWH who have achieved viral suppression is understudied. At the individual patient level, Cioe et al found that in a study of PLWH, greater than 90% of the participants knew that smoking, being overweight, high cholesterol and lack of exercise

contributed to an increased risk of heart disease, but this knowledge was not associated with perceived risk of CVD.<sup>22</sup> Weibel et al also found no differences in perceived susceptibility, severity of CVD, perceived benefits of engaging in CVD prevention behaviors and perceived barriers between PLWH and those without HIV.<sup>23</sup> Finally, since medication-taking decision may be driven by individual valuation of the underlying attributes of medications such as perceived medication benefits, side effects, dosage frequency among others,<sup>24–26</sup> it is critical to evaluate how these factors affect CVD medication adherence in a population that is highly adherent to HIV treatment.

In order to develop a better understanding of the factors that influence adherence to CVD medications for PLWH who have achieved viral suppression, we analyzed qualitative data from an ongoing multi-site nurse-led intervention trial to improve cardiovascular health.<sup>19</sup> The objective of this current study was to identify factors associated with adherence to CVD medications for PLWH who have achieved viral suppression.

## Methods

In order to address the prevention of CVD among PLWH, the National Heart Lung and Blood Institute (NHLBI) recently announced and funded projects under RFA-HL-18-007 “ImPlementation REsearch to Develop interventions for People Living with HIV (PRECLuDE)” in 2017.<sup>27</sup> The purpose of PRECLuDE was to stimulate the use of late-stage T4 translation research and implementation science strategies that address barriers impeding the scale-up and application of guideline-based interventions in community and clinical settings for the prevention, treatment, and control of co-morbid heart lung blood and sleep diseases and disorders for PLWH.<sup>28</sup> Qualitative data for this study were obtained from baseline formative research conducted to inform the adaptation of a one of the PRECLuDe funded trials – A nurse-led intervention trial to extend the HIV treatment cascade for cardiovascular disease prevention (EXTRA-CVD).<sup>19,28,29</sup> EXTRA-CVD is an implementation trial of a multicomponent, nurse-led intervention to control hypertension and hypercholesterolemia in individuals with well-controlled HIV infection.

To be eligible for EXTRA-CVD trial, participants had to be  $\geq 18$  years old, received care at a participating medical centers' HIV clinic, with confirmed HIV diagnosis and undetectable HIV viral load, defined as the most recent HIV viral load  $< 200$  copies/mL checked within the past year. We used undetectable HIV viral load as an

indicator for high adherence to ART in this study.<sup>2</sup> Participants had to have hypertension (defined as systolic BP >130 mmHg on  $\geq 2$  occasions in the past 12 months or on an antihypertensive medication) and hyperlipidemia (defined as a non-HDL cholesterol >130 mg/dL or on cholesterol-lowering medication), assessed via chart abstraction for both.

## Recruitment Process

Eligible PLWH were identified from the electronic medical record at Duke University Medical Center (DUMC) Durham NC, MetroHealth (MH) and University Hospitals (UH), Cleveland OH based on the study criteria. To increase participation, PLWH were also informed of the study by their healthcare providers during routine clinic visits. Eligible participants were approached by study coordinators and were consented. Study participants were recruited by purposive sampling technique from the clinics in which they received care.<sup>30</sup>

## Data Collection

Data were collected through a combination of focus group discussions (FGDs) and individual semi structured interviews with PLWH at the three study sites. FGDs were approximately 60 minutes in length and conducted face-to-face with four to nine PLWH. Duration of individual interviews was approximately 30 minutes. PLWH who declined to participate in FGDs had the option to complete a face-to-face or telephone interview. Authors ARW and JS conducted the FGDs at UH and MH sites while SG conducted one FGD and individual semi structured interviews at DUMC between October 2018 and January 2019. All interviewers did not have any affiliations or relationships with participants. ARW and JS have extensive experience and training in conducting qualitative health research with PLWH. SG has extensive experience and training in conducting qualitative health research. Participants signed a written informed consent, except for telephone interviews for which verbal consent was provided according to an IRB approved script. All participants completed a brief survey. In the survey questions included demographics; whether they had a first degree relative with a risk factor for CVD; ability to take all their medications as prescribed within the past 30 days; percent of time they took their medication exactly as prescribed on a slider scale from 0 to 100, with anchors at 0%, 50–100% as well as a 6-point scale from “very poor” to “excellent.”

These items were inclusive of all medications the participant took, regardless of reason.

During the interviews, participants were asked about CVD risk reduction behavior, how their HIV providers engaged them in discussing and managing CVD, their perceptions of their CVD risk, CVD medication adherence, and barriers and facilitators of adhering to CVD prevention.<sup>19</sup>

## Data Analysis

Since the factors associated with CVD medication adherence for PLWH who have achieved viral suppression had not been described previously, transcripts were analyzed using content analysis-inductive approach<sup>31,32</sup> guided by principles drawn from grounded theory (ie, open coding and constant comparison) to identify factors associated with hypertension and hyperlipidemia medication adherence.<sup>33</sup> Two authors (CM and IS) first reviewed 7 transcripts in their entirety. In open coding, they independently segmented text into as many codes as possible using Dedoose software.<sup>34</sup> The two analysts met to compare codes generated and discussed any discrepancies. In axial coding, they developed categories by combining conceptually related codes. These categories were applied to remaining transcripts, allowing for new emergent categories. During this process, the coders routinely met to discuss their emerging categories in order to cross-check their initial interpretations of the data. Through constant comparison and peer discussion, theoretical properties of the categories emerged, such as the relationships between categories and the conditions in which existing categories explained the research question. Additionally, the two analysts wrote brief memos, updated the codebook and summarized the dimensions of the categories. Another author (HB) was consulted to review any discrepancies between the analysts. As the properties of the categories were further developed and the relationships between categories made clearer, inter-related categories were linked under unifying concepts or themes that explained the multi-level factors associated with medication adherence.

This study was covered under the EXTRA-CVD trial protocol that was IRB approved at UH Cleveland Medical Center (Protocol # 03–18-16), with reliant review at all participating sites in accordance with the NIH single IRB policy (Duke IRB Protocol #00092437; MetroHealth IRB Protocol #00000685).<sup>35</sup> The study was also registered at clinicaltrials.gov (NCT03643705). This study was conducted in accordance with the principles of the Declaration of Helsinki.

## Results

Fifty-one individuals participated in this study. Thirty-seven participated in 6 FGDs and 14 were in individual semi structured interviews. Mean age was 57 years (SD: 7.8); most were African American (n= 31) and majority were male (n=34). Forty-eight (94%) were on hypertension medications, cholesterol medications, or both. Thirty-seven had public health insurance and 31 rated their ability to take medications as prescribed as “excellent.” [Table 1](#).

We identified three main themes: 1) CVD prevention preferences and practices; 2) Impact of long-term HIV care on adherence to CVD medication; and, 3) Motivating factors for adoption and adherence to heart healthy behaviors. [Table 2](#).

### Theme 1: CVD Prevention Preferences and Practices

Depending on the type of CVD risk factor, some participants agreed and followed their healthcare providers' recommendations while others disagreed with the recommendations and described their preferred approach to CVD prevention. There were four subthemes identified including: Discordance between providers' recommendations and PLWH preferred strategy for CVD prevention; CVD prevention knowledge inconsistent with PLWH CVD risk behavior; Experienced or perceived medication side effects; and perceived symptoms as cues to taking medication.

### Discordance Between Providers' Recommendations and PLWH Preferred Strategy for CVD Prevention

Participants reported that their providers were more likely to prescribe medication than provide counseling for lifestyle modification even though they would have preferred the latter. For lifestyle modification counseling, a majority of participants reported that their provider recommendations did not come with clear instructions, benchmarks or directions. Others also emphasized a dissatisfaction with more prescription medication and questioned providers' motivations in prescribing these medications. For example, a FGD participant at UH said,

My concern is I don't wanna take any more medications than I absolutely, positively have to. And so often you go to a doctor, and you walk outta there with two or three

**Table 1** Demographics of PWH at Duke, University Hospitals and Metro Health

	Overall N=51 N (%) <sup>a</sup>
Age in years, mean (SD) (n=49)	57.0 (7.8)
Sex at birth	
Female	17 (33.3%)
Male	34 (66.7%)
Race/ethnicity <sup>b</sup>	
Black/African American	31 (60.8%)
White	9 (17.7%)
Hispanic	7 (13.7%)
Multiracial or Other	4 (7.8%)
Highest education level	
Less than high school degree	6 (11.8%)
High school degree or GED	12 (23.5%)
Some college or technical training	12 (23.5%)
2 years of college or technical training	11 (21.6%)
College degree	4 (7.8%)
Master's degree or higher	6 (11.8%)
Insurance status	
None	1 (2%)
Public only	37 (72.6%)
Private only	11 (21.6%)
Both public and private	1 (2%)
Other	1 (2%)
Monthly income in US dollars, median (Q1, Q3) <sup>c</sup> (n=48)	983 (750, 1850)
Any first-degree relatives with a risk for CVD (n=49)	49 (100%)
Medication use	
Medication for hypertension	47 (92.2%)
Medication for high cholesterol	35 (68.6%)
Medication for either hypertension or high cholesterol	48 (94.1%)
Self-rated ability to take all medications as prescribed in the past 30 days (n=49)	
Poor	0 (0%)
Very poor	0 (0%)
Fair	1 (2%)
Good	4 (8.2%)
Very good	13 (26.5%)
Excellent	31 (63.3%)
Self-reported percent of time took medication exactly as prescribed, median (Q1, Q3) <sup>c</sup> (n=48)	100 (90, 100)

**Notes:** <sup>a</sup>Sample size is 51, except where otherwise noted in italics. <sup>b</sup>All participants who reported Hispanic ethnicity are categorized as Hispanic; remaining categories are all non-Hispanic. <sup>c</sup>Median (Q1, Q3) was used due to skewness of data.

**Abbreviations:** SD, standard deviation; Q1, first quartile; Q3, third quartile; GED, General Education Diploma; CVD, cardiovascular diseases.

**Table 2** Summary of Qualitative Themes

Themes and Sub-Themes	Participants (Total, n=20 FGDs Considered as 1)	Illustrative Quotes
Theme 1. CVD prevention preferences and practices	16	
Sub theme: Discordance between providers' recommendations and PLWH preferred strategy for CVD prevention.	13	My doctor's been pushing me toward –visits with a heart doctor . . . I don't wanna take any more medications than I absolutely, positively have to. And so often you go to a doctor, and you walk outta there with two or three possible prescriptions. Focus group, University Hospital
Sub theme: CVD prevention knowledge inconsistent with PLWH CVD risk behavior	14	But things about heart-healthy habits like eating a low cholesterol diet, getting exercise, monitoring stress, watching alcohol – those are all things that I feel I know a fair amount about. Implementing them, though, can sometimes be a different thing. Duke University Medical Center
Sub theme: Experienced or Perceived Medication Side Effects	12	And sometimes with my cholesterol pills, because of the whole thing about affecting my liver, I need to take every other day. That's what I do. And I'm supposed to take them every day. But when my doctor told me about the liver situation, I was like, oh, I ain't taking this stuff every day. I take it every other day. And I didn't tell her that and I probably should. Focus group, Duke University Medical Center.
Sub theme: Perceived Symptoms as Cues to Taking Medication	8	My vein is actually running right behind my eardrum. And when I get a high blood pressure, it sounds like a sonogram in my right ear. So, I take it to try to minimize that, 'cause that in itself can be annoying and a stress factor. Focus group, University Hospital
Theme 2. Impact of long-term HIV care on adherence to CVD medication	14	I take my medication at the same time every day, or I try to. I don't know if it helps or not but I've been undetectable for so long it doesn't matter anymore anyway. Focus Group, University Hospital
Theme 3. Motivating factors for adoption and adherence to heart healthy behaviors	19	Extrinsic Motivator: "I'm just now getting back into a gym situation with guys I just want to work out with now. And I was trying to do it by myself. No fun." Focus Group, Metro Health Hospital Intrinsic Motivator: [Medication] helps my heart; I wanna keep that heart going. I don't want any heart disease—I don't have a history of it—but I don't want to . . . I have high risk factors, and I try to take care of that with diet, and exercise, and medicine. So you only get one heart and it's okay. Focus Group, University Hospital

possible prescriptions; and I'm like, 'No, I don't want it, I don't want any more prescriptions!.'

Another FGD participant from UH said,

Well, the idea of taking more, the fact that it makes me question the motivation for some of these prescriptions, and it's like there's evidence that the more medications that you take, the more risks that you have for heart disease and other stuff!.

## CVD Prevention Knowledge Inconsistent with PLWH CVD Risk Behavior

An overwhelming majority of participants were generally knowledgeable about CVD-risk reduction strategies from personal experience, research, or provider recommendations, though they exhibited a divergence towards acting on and applying this knowledge to engage in CVD prevention. For example, participants were aware of the CVD



risk associated with the use of tobacco products but were unable to achieve smoking cessation due to other perceived benefits. One FGD participant at UH said,

That's one of my bad habits, smoking. My doctor's already said, 'You need to quit smoking.' Smoking, to me, is not just a habit but it's something I enjoy ... When I get stressed out, that's when I smoke.

Some participants intentionally modified the frequency of taking their CVD-related medications. Participants often noted optimal adherence to ART citing its importance in their overall life and health, though expressed having a more relaxed attitude towards taking CVD-related medication as prescribed. For example, a FGD participant at MH said,

Because you know [ART] are keeping us alive. The other pills, we can kind of play with. We know we need to take them but I'm pretty sure, with me, the high blood pressure, take it – the cholesterol, I play with it. I might take it once a week, twice a week.

## Experienced or Perceived Medication Side Effects

A majority of participants cited medication side effects as a reason for not adhering to CVD-prevention medication. Side effects experienced by patients in the past due to medication included allergic reactions, muscle and joint pains, and headaches. For example, a FGD participant at MH said,

The diuretics, a lot of times, they pull a lot of your fluids out and they cause you to cramp.

Other participants also discussed medication interactions as the source of perceived side effects. This was especially heard from patients who were taking cholesterol medications. For example, FGD participant at MH said,

The only thing I really worry about is the statin is part of your liver and the HIV meds are hard on your liver. I just worry about the liver. I'd rather have a heart attack than a liver problem.

## Perceived Symptoms as Cues to Taking Medication

Some participants reported that they had experienced a physical symptom or discomfort that they perceived was related to their cardiovascular system before they

took their CVD-preventative medication. These symptoms included swelling, increased heart rate, lightheadedness and distorted vision. These symptoms were triggers for them to take medication, but they did not continue taking medication when the symptoms subsided. For example, FGD participant at UH said,

I haven't needed any blood pressure [medication] but ... – last night it looked like my legs and feet were swollen, so I said, 'I better try to take this high blood pressure medication,' so I started back taking that.

Another FGD participant at MH said,

But I skip my high blood pressure as well. Unless I can feel my heart beating real hard, I don't take it.

## Theme 2: Impact of Long-Term HIV Care on Adherence to CVD Medication

An overwhelming majority of participants used their experience with ART medication taking as reference points of guidance for CVD prevention. For some, there were similarities between the reasons and process behind ART adherence and CVD medications. For example, a participant at DUMC said,

Like I said, it was like with the HIV I was like kind of in denial and then I started taking my medications and then I seen the results of taking it and the results of not taking it. So, I mean, when I found out about the heart it was kind of hard for me to accept that. But then I got to thinking, well if my HIV was – HIV medication was working, my heart medication will work.

Many participants described the differences they perceived between the outcomes of ART and CVD medication adherence. While ART adherence offered short-term outcomes in the form of reduction of viral load, the outcomes for CVD prevention medications adherence were not the same and this led to nonadherence. For example, FGD participant at MH said,

It's easier to remember to take your HIV meds because you know what's going to happen if you don't. But the blood pressure, the cholesterol ... I'll take it today. I ain't taking it tomorrow. ... I don't think we really see the now from yesterday's report when I got my blood pressure checked.

When reflecting on their HIV care especially with respect to the healthcare providers who had supported them to the

point of achieving viral suppression, some participants observed that as a result of achieving viral suppression, their providers were not as committed to them compared to when they were first diagnosed with HIV. Participants reported that most of the focus was on newly diagnosed patients. As one FGD participant at UH said,

“[Doctors] have a tendency to push you aside as you get older, and you get more progressive in being undetectable, and you’re an older patient. And they kinda shine on the new ones coming in because there’s this one over here who’s just getting started”.

### Theme 3: Motivating Factors for Adoption and Adherence to Heart Healthy Behaviors

A majority of participants discussed reasons for engaging in CVD risk reduction including medication adherence. For some participants, engaging in heart healthy behaviors was for their own internal sense of satisfaction. For example, some expressed their desire to stay alive as long as possible, or the need to avoid further significant health problems and acknowledgment that taking medication could prevent further health complications. For example, one FGD participant at DUMC said;

I haven’t been told I have heart disease, per se, but blood pressure and cholesterol can lead to heart disease. That’s why I take my medication on blood pressure and cholesterol.

Another participant from DUMC said;

Mainly I just want to live and have a healthy – live a good life and knowing that that’s a part of your living is to have a happy, healthy heart. So whatever I have to do, I’ll do to make sure that I can be here a while.

For other participants, motivation for engaging in heart healthy behaviors came from social connections through family, friends, and healthcare providers. Familial experiences with adverse CVD-related health events were a leading motivator for CVD medication adherence. Similarly, participants were motivated to live longer to care for their children and grandchildren. Some participants also discussed the support they received from their healthcare providers, especially those that had established long-term relationships through the course of their HIV management. For example, one participant from DUMC said,

I want to be here to see my grandkids off to school, off to college. I wanna be able to get out and play with my grandkids. So, I got to do something to make my life better in order for me to be able to do this.

Another FGD participant from UH said,

Every time I see my doctor she emphasizes – I think she emphasizes [my CVD-risk] more than the HIV.

Apart from relationship-based motivators, some participants described memory aids and medication organizers as reminder tools that helped with the timing of taking their medication and helped to streamline the process of taking multiple medications.

### Discussions

Through interviews with treatment-experienced PLWH who were virally suppressed, we explored factors that were related to adherence to medications used to reduce the risk of CVD. In order to achieve CVD prevention goals, participants described issues related to their healthcare providers' recommendation, self-management, and the impact of their long-term experience with HIV care.

In this study, participants preferred approaches to CVD prevention that were not aligned with their healthcare providers' recommendations. Misalignment of strategies for CVD prevention maybe reflect inadequate discussions of patient preferences and healthcare providers' rationale for recommended therapies.<sup>36</sup> Optimal patient-provider communication has been shown to increase patients' understanding of the logic of treatment plans and ability to obtain needed information in order to increase participation in care.<sup>37</sup> Future studies should focus on developing strategies to enhance PLWH-provider communication on CVD prevention and particularly CVD medication adherence.

Participants in this study expressed adequate knowledge of CVD prevention including optimal CVD medication adherence. However, their CVD prevention knowledge and their behaviors toward CVD prevention were not consistent. Discordance between CVD risk perception and CVD prevention knowledge among PLWH has been documented in previous studies.<sup>22,38</sup> Future interventions should focus on individualizing CVD risk for PLWH and development of strategies to overcome barriers in engaging in CVD prevention behaviors.<sup>23</sup>

Some participants in this study intentionally adjusted the frequency of taking their CVD medications. This

occurred when they experienced physical symptoms which they attributed to CVD, when they perceived or experienced side effects, and when they compared the importance of ART relative to CVD medications. Previous studies have found that patients may not take their CVD medications as prescribed because of their beliefs about the efficacy of the medication, dosing frequency, side effects and because they do not experience any adverse symptoms.<sup>39–42</sup> Given that study participants had developed a habit of ART medication taking with different side effects, dosage frequency, and adverse HIV infection symptoms, it is critical for future research to evaluate and quantify the relative influence of CVD medication attributes on intentional CVD medication nonadherence for PLWH who have achieved viral suppression.<sup>43</sup>

Participants described the differences in timing and certainty of benefits between ART and CVD medications. While they linked short-term outcomes of ART adherence to reduction in viral load, participants did not associate CVD medications adherence to reduction of CVD risk or severe CVD events. Compared to other conditions, participants in this study reported that their HIV self-management was a major priority. This is consistent with the idea that patients are more adherent to treatments for chronic conditions that they perceive to be more severe.<sup>44</sup> However, since they had achieved viral suppression, there may be an opportunity to leverage their interactions with their healthcare providers to support the management of other comorbidities. For example, since HIV care guidelines recommend that HIV providers monitor and support ART adherence,<sup>20,21</sup> future research should focus on adapting and tailoring these evidence-based practices to support CVD medication adherence for PLWH who have achieved viral suppression.

These findings should be interpreted in light of the study's limitations. Even though participants were reassured that their responses would have no impact on their clinical care to limit social desirability bias, they may still have been inclined to respond in a positive manner. The use of viral load suppression may be an imperfect indicator for ART adherence since PLWH who experience HIV drug resistance may be highly adherent, yet have detectable viral load.<sup>45</sup> Another limitation of this study was the lack of including healthcare providers' perspective on CVD medication adherence. Finally, the perspectives presented in this study were from PLWH at 3 large academic medical centers and may not be generalizable to other health systems.

Notwithstanding limitations, this study contributes to a growing body of literature on CVD prevention among PLWH. To our knowledge, this is the first study to characterize contextual factors associated with adherence to CVD medications in treatment experienced PLWH who were virally suppressed. Specifically, our finding suggests that future research should focus on developing interventions to enhance patient-provider communication in order to elicit beliefs, concerns and preferences for CVD prevention strategies. Future research should also seek to leverage and adapt established evidence-based practices in HIV care to support CVD medication adherence in order to meet CVD treatment guidelines.

## Data Sharing Statement

Corresponding author has access to the data and is able to provide them upon request.

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