

Factors associated with adherence to guideline-recommended cardiovascular disease prevention among HIV clinicians

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Abstract

Integrating cardiovascular disease (CVD) prevention in routine HIV care remains a challenge. This study aimed to identify factors associated with adherence to guideline-recommended CVD preventive practices among HIV clinicians. Clinicians from eight HIV clinics in Atlanta were invited to complete an online survey. The survey was informed by the Consolidated Framework for Implementation Research and assessed the following: clinician CVD risk screening and advice frequency (never to always), individual characteristics (clinician beliefs, self-efficacy, and motivation), inner setting factors (clinic culture, learning climate, leadership engagement, and resources available), and outer setting factors (peer pressure and patient needs). Bivariate correlations examined associations between these factors and guideline adherence. Thirty-eight clinicians completed the survey (82% women, mean age 42 years, 50% infectious disease physicians). For risk screening, clinicians *always* check patient blood pressure (median score 7.0/7), while they *usually* ask about smoking or check their blood glucose (median score 6.0/7). For advice provision, clinicians *usually* recommend quitting smoking, controlling cholesterol or controlling blood pressure (median score 6.0/7), while they *often* recommend controlling blood glucose, losing weight, or improving diet/physical activity (median score 5.5/7). Clinician beliefs, motivation and self-efficacy were positively correlated with screening and advice practices ($r = .55-.84$), while inner setting factors negatively correlated with lifestyle-related screening and advice practices ($r = -.51$ to $-.76$). Peer pressure was positively correlated with screening and advice practices ($r = .57-.89$). Clinician psychosocial characteristics and perceived peer pressure positively influence adherence to guideline-recommended CVD preventive practices. These correlates along with leadership engagement could be targeted with proven implementation strategies.

Keywords

Implementation science, Evidence-based practice, Quality of care, Clinician behavior

INTRODUCTION

Cardiovascular disease (CVD) has become a leading cause of morbidity and mortality in people living with HIV (PLHIV) [1–3]. The global burden of HIV-associated CVD tripled over the past two decades and accounted for 2.6 million disability-adjusted life-years per year [4]. PLHIV face twice the risk of CVD

Implications

Research: This study identifies potential targets for future implementation studies aimed at integrating evidence-based cardiovascular disease (CVD) prevention in routine HIV care.

Practice: Clinic leaders should consider active training/supporting clinicians, identifying clinic champions, engaging clinic leaders, and obtaining funding for CVD prevention in HIV care.

Policy: Clinical guideline developers should consider active dissemination and implementation strategies to facilitate the adoption and implementation of CVD preventive recommendations.

events than HIV-negative individuals [5–7], likely due to the interplay among traditional risk factors (e.g., smoking), HIV-specific factors (e.g., chronic immune activation), HIV medication-related metabolic disturbances, and disparities in access to, or receipt of care [8–10]. Unless the excess CVD risk is effectively reduced in PLHIV, the life expectancy gains achieved through HIV control may be compromised.

Addressing CVD risk among PLWH requires identifying patients at increased risk and advising them on the appropriate preventative and therapeutic measures, including lifestyle modification and/or medication [11,12]. Although HIV clinical guidelines recommend this [8], CVD prevention has not been effectively integrated in routine HIV care [13,14]. While guidelines recommend targeting behavioral and clinical risk factors to reduce CVD risk in PLHIV [15], major risk factors such as hypertension and diabetes remain significantly under-diagnosed, under-monitored, or under-treated in PLHIV [16,17]. Barriers at the clinician (e.g., inertia, lack of knowledge), and system levels (e.g., lack of resources) observed in chronic disease care may explain this [18–22] but this has not been explored in the context of HIV care.

Understanding this implementation gap is critical for designing strategies to address the

increasing burden of adverse CVD outcomes facing PLHIV. The Consolidated Framework for Implementation Research (CFIR) [23] is a tool that can help identify factors driving implementation gaps. Specifically, CFIR provides a menu of constructs arranged across five domains that influence the implementation of evidence-based interventions: intervention characteristics, outer setting factors (outside of the healthcare setting), inner setting factors (within the healthcare setting), characteristics of individuals adopting the intervention, and implementation process. CFIR has been found to be an effective framework for identifying barriers to implementing evidence-based interventions [24] and for designing strategies to address them [25]. Guided by CFIR, this study aims to identify factors associated with adherence to guideline-recommended CVD preventive practices among HIV clinicians. This is the first step towards designing future implementation strategies focused on effectively integrating evidence-based CVD prevention strategies into routine HIV care.

METHODS

This was a cross-sectional study including a convenience sample of eight HIV clinics in Atlanta identified by the authors. Of these, four belonged to public healthcare systems, and four to private healthcare systems in Georgia. Between March and July 2020, the directors of these clinics were contacted via email and invited to participate in the study. Those who accepted our invitation were asked to share the study survey with HIV care providers in their clinic (these included infectious disease physicians, clinical infectious diseases fellows, nurse practitioners, and physician assistants). This was done via an email containing the letter of informed consent and a link to the study survey; clinicians who agreed to participate completed the survey by clicking on the link provided. The Emory University Institutional Review Board reviewed and approved the study protocol.

In line with CIFR, the exposures of interest were the characteristics of individuals (i.e., clinicians), inner setting (i.e., clinic) factors, and outer setting factors [23]. The individual characteristics assessed were clinician knowledge and beliefs about CVD prevention, self-efficacy, and motivation to adopt CVD prevention in practice. Knowledge was assessed by asking clinicians if they knew the CVD prevention guidelines for PLHIV (Yes, No). In line with recommended methods [26], beliefs, self-efficacy and motivation were assessed using 12 statements with answers anchored on a seven-point scale (e.g., strongly disagree = 1 to strongly agree = 7). Responses were averaged to obtain a score for each construct, where higher scores indicate more favorable attitudes, self-efficacy, and motivation to adhere to CVD prevention guidelines.

To assess constructs from the inner setting domain of CIFR, we employed a scale developed and tested among pediatricians [27]. The inner setting scale assesses the clinic's culture (its norms, values, and basic assumptions), learning climate (feeling valued and that there is time for evaluation and reflection), leadership engagement (commitment, involvement, and accountability of leaders), and available resources dedicated for implementation and on-going operations in the clinic (including money, training, education, physical space, and time). Each domain was assessed using a set of statements with answers anchored on a five-point scale (strongly disagree = 1 to strongly agree = 5). Responses were averaged to obtain a score for each domain, where higher scores indicate more favorable culture, learning climate, leadership, and resources available in the clinic.

Two outer setting factors from CIFR were assessed: patient needs and resources, and peer pressure. Patient needs and resources were captured through 12 statements from the Preventive Medicine Attitudes and Activities Questionnaire [28] which lists barriers clinicians may face in their practice. Clinicians rated each statement using a five-point scale ranging from not important = 1 to very important = 5, where higher scores indicate higher importance for a particular barrier. These statements also captured clinic-level barriers clinicians may face. Peer pressure was assessed using recommended methodologies [26] via four statements capturing beliefs about whether others approve/disapprove adherence to CVD prevention guidelines. Answers were anchored on a seven-point scale with answers ranging from strongly disagree = 1 to strongly agree = 7. Responses were averaged to obtain a score, where higher scores indicate higher perceived pressure.

The outcome of interest was clinician adherence to guideline-recommended CVD risk screening and advice [8]. Screening and advice provision were based on the American Heart Association's Life's Simple 7 health habits for better cardiovascular health: increase physical activity, follow a heart-healthy diet, lose weight, quit smoking, manage blood pressure, control total cholesterol, and reduce blood glucose levels [15]. The frequency with which clinicians screen for, and advice on each of the Life's Simple 7 recommendations was assessed using an adapted version of the Preventive Medicine Attitudes and Activities Questionnaire [28]. Answers were anchored on a seven-point scale ranging from never = 1 (with 0% of the patients at risk) to always = 7 (with 100% of the patients at risk).

The survey containing these measures was built and managed by one of the authors (KIG) using the system for Research Electronic Data Capture. Clinician demographic characteristics were summarized using frequency counts or means and standard deviations. Frequency of CVD preventive practices were summarized using medians and interquartile

ranges, while scores for individual characteristics, inner setting and outer setting factors were summarized using means and standard deviations. Spearman bivariate correlations were computed to examine associations between individual characteristics, inner setting, and outer setting factors with CVD preventive practices. Analyses were conducted in R programming language version 4.0.2.

RESULTS

Of the eight clinics invited to participate, five agreed: one from the county health department, one from a public healthcare system, one from the federal government, one from a university, and one from a private healthcare system in Atlanta. From these clinics, 38 clinicians completed the survey (82% women, mean age 42 years) most of whom (55%) worked at a public clinic serving low-income PLHIV in Atlanta. Half of the respondents were infectious disease physicians, and the other half were physician assistants (25%) or nurse practitioners (25%). On average, clinicians have been in clinical practice for six years (Table 1).

Most clinicians reported knowing the American Heart Association's CVD guidelines for PLHIV (76%), while only 32% reported knowing about the Life's Simple 7 recommendations. To identify patients at increased CVD risk, clinicians reported they *always* check patients' blood pressure (median score 7 [scale 1 = never to 7 = always]), while they *usually* ask patients about their smoking habits, or check their blood glucose (median score 6.0). Clinicians also reported they *often* check patients' cholesterol (median score 5.5) or weight (median score 5.0), and that they *often* ask patients about their diet or physical activity (median score 5.0). Regarding CVD risk reduction advice, clinicians reported they *usually* recommend quitting smoking, or controlling blood pressure, or controlling cholesterol (median score 6.0) to their patients at risk. Further, clinicians *often* recommend controlling blood glucose (median score 5.5), or increasing physical activity, or following a heart healthy diet (median score 5.0; Table 1).

Clinicians had favorable beliefs (mean score 6.7) and high motivation (mean score 6.3) towards addressing CVD risk among their patients, though self-efficacy to do so was lower (mean score 4.7 [scale 1 = strongly disagree to 7 = strongly agree]). Regarding inner-setting factors, clinic culture (mean score 3.1), learning climate (mean score 3.0) and leadership engagement (mean score 3.1) were perceived as moderately supportive of CVD prevention (scale 1 = strongly disagree to 5 = strongly agree). The resources available at the clinic received the lowest scores (mean score 2.4), indicating clinicians perceive these as less supportive of CVD prevention. Indeed, clinicians identified lack of time (median score 4.0),

Table 1 | Distribution of clinician sample characteristics ($N = 38$) and study measures

Variable	Median (IQR), mean (SD), or % (N)
Demographic characteristics	
Age (years)	40.4 (9.6)
Female	82% (31)
Infectious disease physician	50% (19)
Nurse practitioner	25% (10)
Physician assistant	25% (9)
Years in practice	6.1 (5.9)
CVD risk screening frequency^a	
Ask about physical activity	5.0 (4.0, 5.0)
Ask about a heart-healthy diet	5.0 (4.0, 6.0)
Check weight	5.0 (4.0, 6.0)
Ask about smoking	6.0 (5.3, 7.0)
Check blood pressure	7.0 (6.0, 7.0)
Check cholesterol	5.0 (4.3, 6.0)
Check blood glucose	6.0 (5.0, 6.8)
CVD risk reduction advice frequency^a	
Increase physical activity	5.0 (4.0, 6.0)
Follow a heart-healthy diet	5.0 (4.0, 6.0)
Lose weight	5.0 (4.0, 6.0)
Quit smoking	6.0 (5.3, 7.0)
Manage blood pressure	6.0 (5.0, 7.0)
Control cholesterol	6.0 (5.0, 6.8)
Reduce blood glucose levels	5.5 (4.3, 6.0)
Individual characteristics^b	
Attitudes	6.7 (0.5)
Self-efficacy	4.7 (0.9)
Motivation	6.3 (1.0)
Inner setting measures^c	
Clinic culture	3.1 (0.6)
Learning climate	3.0 (0.9)
Leadership engagement	3.1 (1.1)
Resources available	2.5 (0.9)
Outer setting measures	
Peer pressure ^b	5.1 (1.1)
Addressing comorbid priorities ^d	4.0 (3.0, 5.0)
Lack of patient interest ^d	3.0 (1.0, 4.0)
Patient came for a different purpose ^d	4.0 (3.0, 4.0)
Patient access/psychosocial issues ^d	3.0 (1.0, 4.0)

SD = standard deviation; IQR = interquartile range.

^a Measured on a scale from never = 1 (with 0% of patients) to always = 7 (with 100% of patients).

^b Measured on a scale from 1 = strongly disagree to 7 = strongly agree, where higher scores indicate more favorable attitudes, higher perceived social pressure, higher perceived control, and higher intention to address CVD risk among HIV patients.

^c Measured on a scale from 1 = strongly disagree to 5 = strongly agree, where higher scores indicate more favorable perceptions.

^d Measured on a scale from 1 = not important to 5 = very important, where higher scores indicate higher importance.

lack of a health educator on site (median score 4.0), and lack of patient educational materials (median score 3.0) as the most important clinic-level barriers towards CVD prevention (scale 1 = not

important to 5 = very important). For outer setting factors, clinician perceived peer pressure to be moderate (scale 1 = strongly disagree to 7 strongly agree, mean score 5.1/7), while they identified comorbid priorities (median score 4.0/5), lack of patient interest (median score 3.0/5.0), the patient's visit purpose (median score 4.0/5.0), and patient access to resources or psychosocial issues (median score 3.0/5.0) as important barriers for CVD prevention (scale 1 = not important to 5 = very important).

Bivariate correlations between CFIR constructs and clinician practices are shown in Table 2. For correlation analyses, clinician practices were grouped into lifestyle (physical activity, diet, weight loss, and smoking) and clinical (blood pressure, cholesterol and glucose) screening and advice. Clinician beliefs, motivation and self-efficacy were positively correlated with *clinical* screening and advice ($r = .65$ and $.88$, respectively). Clinician motivation and self-efficacy were positively correlated with *lifestyle* screening ($r = .56$ and $.62$, respectively), while clinician beliefs and self-efficacy were positively correlated with *lifestyle* advice ($r = .60$ and $.64$, respectively). Inner setting factors were negatively correlated with *lifestyle* screening and advice ($r = -.59$ to $-.76$). From the outer setting factors, only peer pressure correlated with *lifestyle* screening and with *clinical* screening and advice ($r = .57-.89$).

DISCUSSION

Preventing CVD among PLHIV requires identifying those at increased risk and advising on effective preventive measures, such as lifestyle modification and/or medication initiation [11,12]. HIV clinical guidelines recommend following these steps [8], all of which are grade A or B recommendations from

the US Preventive Services Task Force [29]. Yet, the present study shows adherence to these recommendations is suboptimal and varies widely among HIV clinicians. Specifically, clinicians in this study mostly focus on screening for high blood pressure, smoking and elevated blood glucose, and on advising about smoking cessation, blood pressure or cholesterol control. Further, weight loss was often addressed, while diet and physical activity were the least commonly addressed risk factors. This study also shows that clinician psychosocial factors and perceived social pressure are positively correlated with adherence to CVD preventive recommendations, while clinic-level factors are negatively associated with adherence. These could be targeted in future implementation studies aimed at integrating evidence-based CVD prevention strategies in routine HIV care.

Our findings align with those from a study among HIV clinicians in Australia where the most common CVD risk factors addressed were elevated lipids followed by elevated blood pressure [14]. In the USA, there is limited data about CVD preventive practices among HIV clinicians but a study among veterans found patients living with HIV were less likely to receive lipid lowering therapy than veterans without HIV [30]. Another U.S. study found glucose, cholesterol and blood pressure control among women living with HIV and diabetes was poor, with only 11% of women included in the study achieving recommended targets and avoiding smoking [31]. Taken together, the present and previous findings suggest strategic integration of CVD prevention in routine HIV care is needed.

Regarding factors associated with guideline adherence, we found individual characteristics (i.e.,

Table 2 | Spearman correlations between individual characteristics, inner setting factors, and outer setting factors with clinician adherence to guideline-recommended CVD preventive practices

	Lifestyle screening	Lifestyle advice	Clinical screening	Clinical advice
Individual characteristics				
Beliefs	0.54	0.60*	0.84**	0.69*
Motivation	0.56*	0.54	0.76**	0.55*
Self-efficacy	0.62*	0.64*	0.77**	0.64*
Inner setting factors				
Clinic culture	-0.70**	-0.76**	-0.25	-0.32
Learning climate	-0.51	-0.62**	-0.15	-0.19
Leadership engagement	-0.66**	-0.74**	-0.22	-0.32
Resources available	-0.59*	-0.71**	-0.32	-0.29
Outer setting factors				
Patient needs	0.03	0.20	0.44	0.26
Peer pressure	0.57*	0.55	0.89**	0.70*

Lifestyle screening = asking about physical activity, diet, smoking, and weight loss.

Lifestyle advice = advising to improve physical activity and diet, quit smoking, and lose weight.

Clinical screening = checking blood pressure, cholesterol and glucose.

Clinical advice = advising to control blood pressure, cholesterol and glucose.

* Statistically significant correlation at $p < .05$.

** Statistically significant correlation at $p < .005$.

clinician beliefs, motivation, and self-efficacy) and outer setting factors (i.e., peer pressure) were positively correlated with adherence. In line with this, self-efficacy and motivation have been found to positively influence lifestyle advice provision among primary care clinicians [32]. Similarly, positive beliefs and adequate training have been previously identified as facilitators to CVD preventive practices among primary care clinicians [22]. Our findings also align with evidence showing that peer pressure influences the care provided by clinicians and that they constantly calibrate their behavior according to that of their peers [33]. In contrast, inner setting factors (i.e., clinic culture, learning climate, leadership engagement, and available resources) were negatively correlated with adherence to lifestyle-related recommendations. This could be explained by the fact that clinics included in this study are dedicated to HIV care delivery and may neither focus on, nor promote, integration of lifestyle modification-related practices. Overall, our findings suggest clinician psychosocial factors are promising targets for future implementation strategies but engaging clinic leadership in such strategies will be critical for successfully integrating CVD prevention in routine HIV care.

There are several implementation strategies that can be used to promote adherence to guideline-recommended CVD preventive practices in HIV care. Implementation strategies are methods designed

to promote the adoption, implementation and sustainability of evidence-based interventions in real-world practice. The Expert Recommendations for Implementing Change identify 73 discrete implementation strategies [25] that can be mapped onto the CFIR domains that were explored in this study [23]. According to these recommendations, training strategies can be used to promote improvements in clinician knowledge, beliefs and self-efficacy to implement CVD preventive practices. Ongoing consultation, educational outreach visits, and audit and feedback provision are also promising implementation strategies to promote these practices. For inner setting factors, identifying and preparing clinic champions, facilitation, involving executive boards, and accessing new funding are implementation strategies that can influence clinic culture, learning climate, leadership engagement, and resources available, respectively. Finally, altering incentive/allowance structures and identifying early adopters of a new practice may positively influence peer pressure to adopt a new practice [25]. These and other examples of implementation strategies are included in Table 3.

The limitations in this study are as follow. The clinician sample was small and selected by convenience; thus, it is not representative of the overall HIV clinician population in Atlanta. Further, since we did not track the number of clinicians invited by clinic directors, we could not calculate a response rate. While we could not analyze the extent of variability by clinical site or patient population served,

Table 3 | CFIR correlates of adherence to guideline-recommended CVD preventive practices and implementation strategies that can be used to address them

CFIR domain	Correlate	Examples of potential implementation strategies (from ERIC taxonomy)
Individual characteristics (clinician level)	Knowledge and beliefs Motivation Self-efficacy	Conduct ongoing training Conduct educational meetings Make training dynamic Develop educational materials Identify and prepare clinic champions Provide ongoing consultation Provide educational outreach visits Audit and provide feedback
Inner setting (clinic level)	Clinic culture Leadership engagement Learning climate Resources available	Access new funding Identify and prepare clinic champions Facilitation ^a Involve executive boards Create a learning collaborative Use advisory boards and workgroups Inform/engage local opinion leaders Assess for readiness and identify barriers and facilitators Recruit, designate and train for leadership
Outer setting	Peer pressure	Alter incentive/allowance structures Identify and prepare champions Identify early adopters Involve patients and family members

CFIR = consolidated framework for implementation research.

ERIC = expert recommendations for implementing change.

^a ERIC define this as a process of interactive problem solving and support that occurs in a context of a recognized need for improvement and a supportive interpersonal relationship [25].

although this limitation was partly offset by clinician report on patient needs. This study employed self-reported measures which may elicit social desirability and bias responses. Also, the scales employed to assess psychosocial factors were not previously tested in the study target population. The inner setting scale employed in this study was not specific to CVD preventive practices and, since it was self-administered by clinicians, it did not capture the perspectives from clinic leadership/administrators. Finally, the cross-sectional nature of the study only allows for exploration of associations and do not reflect any temporal or causal association.

CONCLUSION

While HIV clinicians are rightly focused on helping their patients achieve and maintain viral suppression, non-AIDS comorbidities have become highly prevalent in PLHIV and require effective prevention and care. Unless the excess CVD risk PLHIV face is effectively reduced, the life expectancy gains achieved through successful HIV control may be compromised. Integrating CVD prevention and care in existing HIV care settings has become a major focus in several countries [34], and lessons to do so successfully are numerous. One important lesson is the use of implementation science to scale up and expand integrated HIV and cardiovascular disease care models [35]. Our study sheds light on potential targets for future implementation studies and represents a promising step towards improving our understanding on how to effectively integrate evidence-based CVD prevention in routine HIV care.

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Compliance with Ethical Standards

Conflict of Interest: Authors have no conflict of interest to declare during the course of this work.

Human Rights: 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 Emory University Institutional Review Board reviewed and approved the study protocol (IRB00115110).

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

Welfare of Animals: This article does not contain any studies with animals performed by any of the authors.

Transparency Statements

- This study was not formally registered.
- The analysis plan was not formally preregistered.
- De-identified data from this study are not available in a public archive. De-identified data from this study will be made available (as allowable according to institutional IRB standards) by emailing the corresponding author.
- Analytic code used to conduct the analyses presented in this study are not available in a public archive. They may be available by emailing the corresponding author.
- Materials used to conduct the study are not publicly available.

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