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Cardiovascular risk factor knowledge and risk perception among HIV-infected adults

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Abstract

Cardiovascular disease (CVD) has emerged as a major cause of morbidity and mortality in HIV-infected adults. Research in non-infected populations has suggested that knowledge of CVD risk factors significantly influences perceptions of risk. This cross-sectional study describes CVD risk factor knowledge and risk perception in HIV-infected adults. We recruited 130 HIV-infected adults (mean age = 48 years, 62% male, 56% current smokers, mean years since HIV diagnosis, 14.7). The mean CVD risk factor knowledge score was fairly high. However, controlling for age, CVD risk factor knowledge was not predictive of perceived risk ($F[1,117] = 0.13$, $p > .05$). Estimated risk and perceived risk were weakly, but significantly, correlated, $r(126) = .24$, $p = .01$. HIV-infected adults are at increased risk for CVD. Despite having adequate risk factor knowledge, CVD risk perception was inaccurate. Improving risk perception and developing CVD risk reduction interventions for this population are imperative.

Keywords

cardiovascular disease; heart disease; HIV; risk factor knowledge; risk perception

Advances in the medical treatment of persons infected with HIV over the past 25 years have led to an increased lifespan for HIV-infected individuals. Recent studies have shown that mortality rates for HIV-infected persons now mirror those of the general population (Bhaskaran et al., 2008). Cardiovascular disease (CVD), however, has emerged as a major cause of morbidity and mortality in adults with HIV-infection (Gill et al., 2010), often accounting for one quarter of non-HIV-related deaths (Sackoff, Hanna, Pfeiffer, & Torian, 2006). A growing body of evidence suggests that there is an increased rate of acute

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myocardial infarction (MI) in HIV-infected persons (Triant, Lee, Hadigan, & Grinspoon, 2007).

Traditional risk factors for CVD, such as smoking, are more prevalent in HIV-infected adults, with some studies showing prevalence rates as high as 57% (Glass et al., 2006). Comorbidities, such as hypertension, diabetes, dyslipidemia, and obesity, are also common in this population and increase CVD risk (Kaplan et al., 2007). Importantly, however, traditional risk factors do not completely account for the increased rate of coronary events in this population (Sterne et al., 2007). Chronic inflammation related to HIV viral replication and metabolic changes associated with antiretroviral therapy (ART) might confer additional risk (Hadigan et al., 2003; Kuller et al., 2008). Persons with HIV infection also appear to have a higher prevalence and degree of premature coronary atherosclerosis compared to non-HIV-infected counterparts (Van Vonderen et al., 2009).

Cross-sectional studies have demonstrated that HIV-infected individuals have significant predicted risk for MI using the standard risk categories from the Framingham study. Across studies, 14%–33% of HIV-infected individuals met criteria for moderate risk of MI (Glass et al., 2006; Hadigan, et al., 2003). MI risk was significantly higher among HIV-infected men and women when compared to their non-HIV-infected counterparts (Bergersen, Sandvik, Bruun, & Tonstad, 2004).

Research in non-HIV-infected populations has suggested that knowledge of cardiovascular risk factors significantly influenced perceptions of risk (Choi, Rankin, Stewart, & Oka, 2008). In a sample of 143 adults, Choi et al. (2008) found that greater CVD risk factor knowledge was associated with higher perceived CVD risk. However, studies in non-HIV-infected women demonstrated that women were often unaware of CVD risk factors (Hart, 2005) and subsequently underestimated risk (Choi et al., 2008). Low education level has been associated with lower levels of CVD risk factor knowledge (Thanavaro, Moore, Anthony, Narsavage, & Delicath, 2006), and socioeconomic status has been associated with inaccurate estimates of CVD risk perception (Alwan, William, Viswanathan, Paccaud, & Bovet, 2009).

To our knowledge, studies have not been conducted to evaluate CVD risk perception or CVD risk factor knowledge in HIV-infected adults. The purpose of this study was to describe CVD risk factor knowledge and to examine predictors of CVD risk perception in a cohort of HIV-infected adults.

Methods

Sample

HIV-infected adults (N = 130) were recruited from two urban hospital-based outpatient HIV clinics. Eligibility criteria included: (a) ages 18 or older, (b) HIV-infected, (c) able to read and speak English, and (d) able to provide written informed consent. A history of a past cardiovascular event (MI or stroke) or intervention (coronary artery bypass surgery, cardiac stent placement, or vascular surgery) were study exclusions. Forty individuals were screened for the study but did not participate: 32 (80%) were ineligible and 8 (20%) declined to participate due to a lack of time or interest. Of those who were ineligible (N = 32), 16 (50%) did not speak and understand English and 16 (50%) had a history of a prior CVD event. There was no significant difference in age, gender, race, or ethnicity between those enrolled and not enrolled.

Data Collection

The institutional review board at Rhode Island Hospital approved the study. Between March and August 2011, clinic patients who presented for routinely scheduled appointments were invited to participate in the study. Each participant had one study visit, lasting approximately 1 hour, in which all demographic and clinical data were collected and all research instruments were completed during an individual, structured interview. Clinical data were then collected from the medical record using a standardized format. Participants received a $20 gift card as compensation for participation.

Measures

Demographic and clinical characteristics—Demographic variables, including age (in years), gender, education level (in years and also categorized as less than high school, high school graduate, or some college), self-reported race and ethnicity, employment status, and time since HIV diagnosis (in years), were obtained. A medication list and laboratory data were collected from the medical record, including most recent CD4+T cell count, nadir CD4+T cell count, and HIV viral load (HIV-RNA by PCR). Most recent fasting lipid parameters and blood glucose levels were obtained from the medical record; all labs that were obtained had been completed within the previous 12 months.

Height and weight were measured during the study visit and the body mass index (BMI) was calculated using the National Heart, Lung, and Blood Institute formula (National Heart, Lung, and Blood Institute [NHLBI], n.d.). A family history of premature CVD (at < 65 years in a mother, or < 55 years in a father) and personal history of diabetes mellitus was obtained by self-report during the study visit. Blood pressure was recorded as the average of three seated measurements taken 5 minutes apart on a manual mercury sphygmomanometer during the study visit, a method shown to increase the predictability of cardiovascular risk assessments (Bell, Hayen, McGeechan, Neal, & Irwig, 2011).

Estimated risk of CVD—The Framingham Risk Score (FRS) was calculated using the NHLBI worksheet, which included the measures of total cholesterol, smoking status, high-density lipoprotein, and systolic blood pressure (National Cholesterol Education Program, 2002). The FRS, defined as the percent risk of having a coronary event in the next 10-year period, was used to determine estimated risk of CVD. This score stratified individuals into three risk categories: low (< 10% risk of having an event in the next 10 years), intermediate (10%–20% risk), and high (> 20% risk). Because diabetes mellitus is considered a cardiovascular risk equivalent, any participant with a diagnosis of diabetes was categorized as having high estimated CVD risk.

CVD risk perception—The Perception of Risk of Heart Disease Scale (PRHDS) is a 20-item instrument that measures an individual's perception of the probability of developing heart disease (Ammouri & Neuberger, 2008). It is a self-report scale that takes approximately 20 minutes to complete. Each item on the scale has a 4-point Likert scale response option ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). Item scores are summed to obtain a total scale score. Higher scores indicate increased perception of risk.

CVD risk factor knowledge—The Heart Disease Fact Questionnaire (HDFQ) is a 25-item instrument that measures knowledge of major risk factors for the development of CVD (Wagner, Lacey, Chyun, & Abbott, 2005). Each item on the scale has responses of *true*, *false*, or *I don't know*. Total scale scores are calculated by summing the total number of correct answers and range from 0–25. Higher scores indicate a higher level of knowledge.

Statistical Analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences, version 17.0 (SPSS). Descriptive statistics were calculated for all study variables. A log transformation was performed on the FRS variable to achieve a normal distribution. Pearson correlation statistic was used to describe the relationship between estimated and perceived risk of CVD. The association of age with risk perception was controlled for in the analysis by running a partial correlation between estimated and perceived risk while using age as a covariate in the statistical model. Linear regression was used to examine the association of CVD risk factor knowledge with perceived risk of CVD. Pearson *r* was used to examine the relationship between age, education level, and time since HIV diagnosis with risk perception and risk factor knowledge. T-test statistic was used to examine differences by gender and ART status. Chi-square statistic was used to examine differences by race and ethnicity. Two-tailed tests and 95% significance levels were used to test statistical significance.

Results

Sociodemographic and Clinical Variables

Demographic and clinical characteristics are presented in Tables 1 and 2. Participants (*N* = 130) averaged 47.9 years of age, 62.3% were male, 41.5% were non-Hispanic Caucasian, 32.3% were Black/African American, and 23.1% were Hispanic. Mean years of education were 11.8 years; 41.5%, 27.7%, and 30.8% had less than a high school education, high school graduate, and some college education, respectively.

Mean years since diagnosis with HIV infection was 14.7 (*SD* ± 7.9) years. Eighty-seven percent (87%) of the cohort were currently taking ART, and an undetectable HIV viral load was noted in 71.5% of participants. Mean CD4+T cell count was 546 cells/mm^3 (*SD* ± 292), and mean nadir CD4+T cell count was 195 cells/mm^3 (*SD* ± 142). Clinical and demographic variables, including age, smoking status, hypertension, and discussion of CVD with a health care provider, were examined for differences based on gender, and no significant differences were found.

Cardiovascular Risk Factor Variables

Mean total cholesterol of the sample was 170 (*SD* ± 36) and mean LDL was 97 mg/dL (*SD* ± 33). Mean HDL was 44 mg/dL (*SD* ± 17). Mean fasting glucose was 96 mg/dL (*SD* ± 25). Fifty-six percent of participants identified as current smokers, with a mean number of cigarettes per day of 10 (*SD* ± 6.8), for a mean 27 (*SD* ± 12.3) years of smoking. Less than 8% of participants reported being involved in smoking cessation efforts at the time of the interview. Only 7% of participants reported that they were taking a daily aspirin, and 10% were diagnosed with diabetes mellitus. Eleven (8.5%) participants were currently taking a prescription statin medication for elevated cholesterol. More than three quarters of participants (76.2%) reported that they had never discussed CVD with their health care providers. A family history of heart disease in a father was reported by 11.5% and heart disease in a mother was reported by 16.2%. Mean BMI was 27 (*SD* ± 5.5) with 58.5% of participants in the overweight category (BMI > 25). Prehypertension was found in 48.5% of participants, defined as a systolic blood pressure between 120 mmHG and 139 mmHG or a diastolic blood pressure between 80 mmHG and 89 mmHG (NHLBI, 2010).

Estimated and Perceived Risk of CVD

The mean Framingham Risk Score was 7.9 (*SD* ± 6.0) with 67%, 21%, and 12% of participants scoring in the low-, moderate-, and high-risk categories, respectively. The mean total score on the PRHDS was 53.1 (*SD* ± 5.9). Cronbach's alpha was 0.78 demonstrating

good internal consistency of the scale in this cohort. Compared with nonsmokers, smokers were noted to have a higher perceived risk of heart disease (54.01 vs. 52.01, $p = .05$).

No statistically significant differences in mean scores of perceived risk were noted by participant gender ($p = .67$) or racial/ethnic background ($p = .98$). Participants who were currently taking ART did not differ significantly in perceived risk scores from those who had taken ART in the past or those who were naïve to ART ($M = 53.0, 51.1, 54.7$, respectively; $p = .44$ and $p = .39$). No significant difference between education level groups was found ($F[2,127] = 1.2$, $p = .29$).

CVD Risk Factor Knowledge

The mean score on the HDFQ was 19 ($SD \pm 3.5$). Using the Kuder-Richardson formula to examine internal consistency, the scale demonstrated good reliability (.74). Similar to the findings on the Perceived Risk Scale, there were no significant differences in knowledge by gender ($p = .57$), race and ethnicity ($p = .09$), ART status ($p = .85$), or smoking status ($p = .96$). It was noted that 97% of participants knew that smoking was a risk factor for heart disease; however, only 66% of participants knew that older age was associated with an increased risk of heart disease.

Estimated Versus Perceived Risk of CVD

A statistically significant, although weak, positive correlation was found between estimated and perceived risk of heart disease ($r[126] = 0.24$, $p = .01$). A partial correlation was run between estimated and perceived risk while controlling for age, and a similar positive correlation was noted ($r\ [126] = 0.22$, $p < .05$). A significant, strong positive correlation was noted between age and estimated risk ($r\ [126] = 0.57$, $p < .01$). No significant relationship was found between age and perceived risk ($r\ [130] = 0.112$, $p = .20$).

Risk Factor Knowledge and Perceived Risk

No significant relationships were found between age, years since HIV diagnosis, or years of education, and perceived risk of CVD and CVD risk factor knowledge (see Table 3). Controlling for age, risk factor knowledge was not predictive of perceived risk ($F[1,117] = 0.130$, $p > .05$).

Discussion

HIV infection in the United States has been transformed into a chronic illness and clinicians are directing greater attention to the management and prevention of comorbidities, such as CVD. Traditional risk factors that are strong contributors to the elevated risk of CVD, such as smoking, elevated BMI, and prehypertension were highly prevalent in our cohort. The contribution of such risk factors to an increased risk of CVD in the HIV-infected population is well documented (Armah et al., 2012; Glass et al., 2006; Kaplan et al., 2007).

Results of our study demonstrated that HIV-infected adults have a high prevalence of cigarette smoking, a major traditional risk factor for CVD. However, very few were involved in cessation efforts, and a majority reported that they had not discussed CVD risk with their health care providers.

One third of the sample had more than a 10% risk of having a cardiovascular event in the next 10 years, demonstrated by the FRS. Most participants had a fair degree of CVD risk factor knowledge; however, risk factor knowledge was not predictive of perceived risk of CVD. Perceived risk of CVD was only weakly associated with estimated risk, even when controlling for age of the participant.

The mean FRS in our sample was 7.9, a score that was consistent with the upper limit of low risk (defined as an FRS < 10%). Lo et al. (2010) and Falcone et al. (2011) reported similar results (mean FRS = 7.7 ± 5.1, mean age = 46.5; mean FRS = 7.0 ± 5.2, mean age = 44, respectively) in HIV-infected men and women. When participants were stratified into FRS categories, it was noted that 32% of our sample had FRSs consistent with moderate and high risk. Several large cross-sectional studies reported that 14%–33% of HIV-infected adults met criteria for moderate risk (Glass et al., 2006; Hadigan et al., 2003), and 3–12% met criteria for high risk (Bergersen et al., 2004; Glass et al., 2006; Law et al., 2006). Studies have suggested that the FRS, which was not developed for HIV-infected adults, may not be a robust measure of CVD risk for this population, and these studies suggested that the FRS underestimated the risk of MI in individuals on ART (Law et al., 2006). This implies that a significant percentage of HIV-infected adults are at considerable risk of a CVD event and these individuals may be at even higher risk than is actually predicted by the FRS. These data have substantial implications for the clinical management of adults in this population. Initiation of lifestyle modifications, routinely recommended for the general population to reduce cardiac risk and to prevent CVD, are also important considerations for HIV-infected adults.

Several behavior motivation theories stress the importance of knowledge and perceived risk on movement toward behavior change (Armitage & Conner, 2000). Prior to our study, knowledge of CVD risk factors in HIV-infected persons had not been measured. The mean CVD knowledge score in this study was 76%; however, almost one third of participants (27.7%) had a score less than 70%. Knowledge scores did not differ by age, gender, race and ethnicity, years living with HIV infection, years of education, or smoking status. In a separate, larger study of non-HIV-infected diabetics (mean age = 53.7), the mean knowledge score using the same instrument was 20.4, and significant differences by ethnic group were reported (Wagner, Lacey, Abbott, de Groot, & Chyun, 2006). Also, female gender, higher education, and health insurance status were predictive of higher scores. In a study of more than 3,000 participants with a history of ischemic heart disease, Dracup et al. (2008), using a different scale, reported a mean CVD knowledge score of 71%. The mean knowledge score in our cohort, therefore, was fairly high considering that the cohort was younger and had a higher percentage of non-high-school graduates than other non-HIV studies. Given the level of CVD risk factor knowledge reported in this study, it was surprising that more than three quarters of participants reported that they had never discussed heart disease with their health care providers.

When individual items on the knowledge scale were examined, it was notable that 97% of participants knew that smoking and being overweight were risk factors for CVD. Furthermore, more than 90% knew that a high cholesterol, high fat diet, and lack of exercise could contribute to an increased risk for heart disease. Importantly, one key concept, the effect of increasing age on increased cardiovascular risk, was not understood. With the aging of the HIV population, this piece of information should be included in patient-provider discussions. Diet and exercise were not addressed in this study; however, smoking cessation was and, despite the high prevalence of smoking, few participants reported being involved in efforts to stop smoking, inferring that knowledge alone is not an adequate motivator for behavior change.

In several studies examining CVD health-promoting behaviors, perceived susceptibility (risk) was most significantly correlated with adoption of new behaviors (Janz, 1988; Wilson, Sisk, & Baldwin, 1997). Knowledge was a significant predictor in one HIV prevention study examining condom use, but condom use is more skill-related than general health knowledge (Volk & Koopman, 2001). Efforts to broaden CVD risk factor knowledge and, more

importantly, to link risk factor knowledge to risk perception and health-related consequences are needed to help drive behavior change.

The perceived risk of CVD was weakly associated with estimated risk, even when controlling for the age of the participant. Perceived risk of CVD had not been previously measured in the HIV-infected population and it seemed to be poorly understood by our cohort of HIV-infected adults. This finding is consistent with other findings that CVD risk is a difficult concept for people to grasp (Angus et al., 2005). In the general population, one study found that 40% of diabetic patients could not estimate their CVD risk, and agreement between risk perception and clinical data was weak (Martell-Claros et al., 2011). Alwan et al. (2009) had similar findings, reporting that only half of their participants were able to estimate their perceived risk and the ability to do so was associated with higher socioeconomic status. Homko et al. (2010) found no relationship between actual and perceived risk in a group of 211 adults with Type 2 diabetes. Barnhart et al. (2009) reported that perceived risk and actual risk were significantly correlated with a similar strength correlation (r = .22), as we found in our study. Age was not found to be associated with ability to perceive risk in any of these studies, so it is not surprising that we did not find this association either.

Our results demonstrated that, in HIV-infected adults, risk factor knowledge was not associated with perceived risk of CVD. In other populations, such as adults with Type 2 diabetes, knowledge has been predictive of risk (Choi et al., 2008; Homko et al., 2010). The HIV-infected population may be different from other populations, such as diabetics, because HIV has historically been associated with early mortality. Until the early 1990s, most infected persons developed AIDS and died of an infectious or malignancy-related complication, often within a short period of time. HIV infection was not yet a chronic illness, cardiovascular events were rare, and, therefore, perceived CVD risk was likely not considered by patients or providers. For our participants, infected during a period of change in the treatment history of HIV disease, the Shifting Perspectives Model of Chronic Illness offers one way to understand our findings (Paterson, 2001). The model proposes that there is a continuous, shifting process that is ongoing in individuals living with chronic illnesses, affected by their perceptions of reality, their beliefs about the illness, and their understandings of wellness. They experience shifts in perspective, alternating between wellness and illness in the foreground. When wellness is in the foreground, they are future oriented and able to focus on wellness and health promotion. Conversely, with illness in the foreground perspective, the focus is on the chronic illness, its symptoms, and potential negative outcomes. In this perspective, the individual is unable to perceive of concepts associated with wellness, may lack motivation for health promotion, or be uninterested in preventing events that may occur sometime in the future. HIV-infected adults may hold an illness in the foreground perspective and, consequently, perceived risk for CVD is not salient. Addressing perspectives of chronic illness with HIV-infected patients may be an important clinical consideration.

This study has some limitations. The study was cross sectional and enrolled a convenience sample. Individuals with known CVD and those who could not speak and understand English were excluded and, thus, the findings may not be generalizable to all patients infected with HIV. Also, the sample consisted of patients who were actively engaged in HIV care and may have been different from those not seeking care. Data were collected by interview, which may have been affected by recall and social desirability bias.

Our study supports the need to develop innovative programs to reduce traditional CVD risk factors in HIV-infected adults. The high prevalence of smoking highlights the need to have tailored interventions to assist this population in its smoking cessation efforts. Often,

smoking cessation programs and research protocols have strict inclusion and exclusion criteria and exclude those with chronic illnesses, such as HIV infection. The development of smoking cessation trials specifically designed to meet the needs of HIV-infected adults is much needed.

Conclusion

Our study supports the need to develop programs to improve cardiovascular risk perception in this population, especially focusing on the role that advancing age, diet, physical inactivity, and behaviors, such as smoking, play in increasing cardiovascular risk. General CVD risk factor knowledge in our cohort was fairly high, but it did not seem to translate into perceptions of cardiovascular risk. Perhaps HIV-infected adults do not personalize the general knowledge that they have about heart disease. Specific messages, a broader focus to include wellness and health promotion, and interventions tailored to the individual in the clinical setting are needed. Calculating FRSs during clinical visits for each patient may help to personalize CVD risk information and increase perceptions of risk. As HIV-infected adults continue to age, researchers and health care providers will face the challenges of finding effective methods to accurately estimate cardiovascular risk, assess risk perception, translate risk factor knowledge into accurate risk perception, and ultimately develop interventions to effect behavior change to reduce CVD risk and improve cardiovascular health in this population.

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References

Alwan H, William J, Viswanathan B, Paccaud F, Bovet P. Perception of cardiovascular risk and comparison with actual cardiovascular risk. European Journal of Cardiovascular Prevention and Rehabilitation. 2009; 16:556–561.10.1097/HJR.0b013e32832d1 [PubMed: 19587602]

Ammouri AA, Neuberger G. The perception of risk of heart disease scale: Development and psychometric analysis. Journal of Nursing Measurement. 2008; 16(2):83–97.10.1891/1061-3749.16.2.83 [PubMed: 18939714]

Angus J, Evans S, Lapum J, Rukholm E, St Onge R, Nolan R, Michel I. “Sneaky disease”: The body and health knowledge for people at risk for coronary heart disease in Ontario, Canada. Social Science & Medicine. 2005; 60:2117–2128.10.1016/j.socscimed.2004.08.069 [PubMed: 15743659]

Armah, K.; Justice, A.; Oursler, K.; Budoff, M.; Brown, S.; Warner, A.; Freiberg, M. The impact of elevated and prehypertensive systolic blood pressure and the risk of acute myocardial infarction in HIV+ and HIV− veterans. Paper presented at the 19th Conference on Retroviruses and Opportunistic Infections; Seattle, WA. 2012 Mar.

Armitage CJ, Conner M. Social cognition models and health behavior: A structured review. Psychology and Health. 2000; 15:173–189.10.1080/08870440008400299

Barnhart JM, Wright ND, Freeman K, Silagy F, Correa N, Walker EA. Risk perception and its association with cardiac risk and health behaviors among urban minority adults: The Bronx coronary risk perception study. American Journal of Health Promotion. 2009; 23(5):339–342.10.4278/ajhp.07072574 [PubMed: 19445437]

Bell K, Hayen A, McGeechan K, Neal B, Irwig L. Effects of additional blood pressure and lipid measurements on the prediction of cardiovascular risk. European Journal of Cardiovascular Prevention & Rehabilitation. 2011; 19(6):1–12.10.1177/1741826711424494

Bergersen BM, Sandvik L, Bruun JN, Tonstad S. Elevated Framingham risk score in HIV-positive patients on highly active antiretroviral therapy: Results from a Norwegian study of 721 subjects. European Journal of Clinical Microbiology & Infectious Diseases. 2004; 23(8):625–630.10.1007/s10096-004-1177-6 [PubMed: 15322938]

Bhaskaran K, Hamouda O, Sannes M, Boufassa F, Johnson AM, Lambert PC, Porter K. Changes in the risk of death after HIV seroconversion compared with mortality in the general population. Journal of the American Medical Association. 2008; 300:51–59.10.1001/jama.300.1.51 [PubMed: 18594040]

Choi S, Rankin S, Stewart A, Oka R. Perceptions of coronary heart disease risk in Korean immigrants with type 2 diabetes. Diabetes Educator. 2008; 34(3):484–492.10.1177/0145721708316949 [PubMed: 18535321]

Dracup K, McKinley S, Doering LV, Riegel B, Meischke H, Moser DK, Paul SM. Acute coronary syndrome: What do patients know? Achives of Internal Medicine. 2008; 168(10):1049–1054.10.1001/archinte.168.10.1049

Falcone EL, Mangili A, Skinner S, Alam A, Polak JF, Wanke CA. Framingham risk score and early markers of atherosclerosis in a cohort of adults infected with HIV. Antiviral Therapy. 2011; 16:1–8.10.3851/IMP1682 [PubMed: 21311103]

Gill J, May M, Lewden C, Mugavero M, Ledergerber B, Mocroft A, Sterne JA. Causes of death in HIV-1-infected patients treated with antiretroviral therapy, 1996–2006: Collaborative analysis of 13 cohort studies. Clinical Infectious Diseases. 2010; 50:1387–1396.10.1086/652283 [PubMed: 20380565]

Glass TR, Ungsedhapand C, Wolbers M, Weber R, Vernazza PL, Rickenbach M, Bucher HC. Prevalence of risk factors for cardiovascular disease in HIV-infected patients over time: The Swiss HIV Cohort Study. HIV Medicine. 2006; 7(6):404–410.10.1111/j.1468-1293.2006.00400.x [PubMed: 16903986]

Hadigan C, Meigs JB, Wilson PW, D'Agostino RB, Davis B, Basgoz N, Grinspoon S. Prediction of coronary heart disease risk in HIV-infected patients with fat redistribution. Clinical Infectious Diseases. 2003; 36(7):909–916.10.1086/368185 [PubMed: 12652392]

Hart PL. Women's perceptions of coronary heart disease: An integrative review. Journal of Cardiovascular Nursing. 2005; 20(3):170–176. [PubMed: 15870587]

Homko CJ, Zamora L, Santamore WP, Kashem A, McConnell T, Bove AA. Gender differences in cardiovascular risk factors and risk perception among individuals with diabetes. The Diabetes Educator. 2010; 36(3):483–488.10.1177/0145721710366757 [PubMed: 20360597]

Janz NK. The Health Belief Model in understanding cardiovascular risk factor reduction behaviors. Cardiovascular Nursing. 1988; 24:39–41.

Kaplan RC, Kingsley LA, Sharrett AR, Li X, Lazar J, Tien PC, Gange SJ. Ten-year predicted coronary heart disease risk in HIV-infected men and women. Clinical Infectious Diseases. 2007; 45(8):1074–1081.10.1086/521935 [PubMed: 17879928]

Kuller LH, Tracy R, Belloso W, De Wit S, Drummond F, Lane HC, Neaton JD. Inflammatory and coagulation biomarkers and mortality in patients with HIV infection. PLoS Medicine. 2008; 5(10):e203.10.1371/journal.pmed.0050203 [PubMed: 18942885]

Law MG, Friis-Moller N, El-Sadr WM, Weber R, Reiss P, D'Arminio Monforte A, Lundgren JD. The use of the Framingham equation to predict myocardial infarctions in HIV-infected patients: Comparison with observed events in the D:A:D Study. HIV Medicine. 2006; 7(4):218–230.10.1111/j.1468-1293.2006.00362.x [PubMed: 16630034]

Lo J, Abbara S, Shturman L, Soni A, Wei J, Rocha-Filho JA, Grinspoon SK. Increased prevalence of subclinical coronary atherosclerosis detected by coronary computed tomography angiography in HIV-infected men. AIDS. 2010; 24(2):243–253. [PubMed: 19996940]

Martell-Claros N, Aranda P, Gonzalez-Albarran O, Dalfo-Baque A, Dominguez-Sardina M, De La Cruz JJ, De Alvaro C. Perception of health and understanding of cardiovascular risk among patients with recently diagnosed diabetes and/or metabolic syndrome. European Journal of Cardiovascular Prevention & Rehabilitation. 2011; 20(1):21–28.10.1177/1741826711423114

National Cholesterol Education Program. Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evlauation, and treatment of high blood cholesterol in adults

(Adult Treatment Panel III) final report. 2002. Retrieved from http://www.nhlbi.nih.gov/guidelines/cholesterol/atp3full.pdf

National Heart, Lung, and Blood Institute. The seventh report of the Joint National Committee on the prevention, detection, evaluation, and treatment of high blood pressure (JNC7). 2010. Retrieved from http://www.nhlbi.nih.gov/guidelines/hypertension

National Heart, Lung, and Blood Institute. BMI calculator. n.d. Retrieved April 1, 2010, from http://www.nhlbisupport.com/bmi/bminojs.htm

Paterson BL. The shifting perspectives model of chronic illness. Journal of Nursing Scholarship. 2001; 33(1):21–26.10.1111/j.1547-5069.2001.00021.x [PubMed: 11253576]

Sackoff JE, Hanna DB, Pfeiffer MR, Torian LV. Causes of death among persons with AIDS in the era of highly active antiretroviral therapy: New York City. Annals of Internal Medicine. 2006; 145(6): 397–406. [PubMed: 16983127]

Sterne JA, May M, Bucher HC, Ledergerber B, Furrer H, Cavassini M, Egger M. HAART and the heart: Changes in coronary risk factors and implications for coronary risk in men starting antiretroviral therapy. Journal of Internal Medicine. 2007; 261(3):255–267.10.1111/j.1365-2796.2006.01761.x [PubMed: 17305648]

Thanavaro JL, Moore SM, Anthony MK, Narsavage G, Delicath T. Predictors of poor coronary heart disease knowledge level in women without prior coronary heart disease. Journal of the American Academy of Nurse Practitioners. 2006; 18:574–581.10.1111/j.1745-7599.2006.00174.x [PubMed: 17184310]

Triant VA, Lee H, Hadigan C, Grinspoon SK. Increased acute myocardial infarction rates and cardiovascular risk factors among patients with human immunodeficiency virus disease. Journal of Clinical Endocrinology & Metabolism. 2007; 92(7):2506–2512.10.1210/jc.2006-2190 [PubMed: 17456578]

Van Vonderen MG, Hassink EA, Agtmael MA, Stehouwer CD, Danner SA, Reiss P, Smulders Y. Increase in carotid artery intima-media thickness and arterial stiffness but improvement in several markers of endothelial function after initiation of antiretroviral therapy. Journal of Infectious Disease. 2009; 199:1186–1194.10.1086/597475

Volk JE, Koopman C. Factors associated with condom use in Kenya: A test of the health belief model. AIDS Education & Prevention. 2001; 12:495–508.10.1521/aeap.13.6.495.21438 [PubMed: 11791782]

Wagner J, Lacey K, Chyun D, Abbott G. Development of a questionnaire to measure heart disease risk knowledge in people with diabetes: The heart disease fact questionnaire. Patient Education and Counseling. 2005; 58(1):82–87.10.1016/j.pec.2004.07.004 [PubMed: 15950840]

Wagner J, Lacey K, Abbott G, de Groot M, Chyun D. Knowledge of heart disease risk in a multicultural community sample of people with diabetes. Annals of Behavioral Medicine. 2006; 31(3):224–230. [PubMed: 16700635]

Wilson S, Sisk RJ, Baldwin KA. Health beliefs of blue collar workers: Increasing self efficacy and removing barriers. AAOHN Journal. 1997; 45:254–258. [PubMed: 9171531]

Key Considerations

- Cardiovascular disease has emerged as a significant cause of morbidity and mortality in HIV-infected adults over the past 10 years.
- Cardiovascular risk reduction is a priority for HIV-infected patients; they may be at higher risk for cardiovascular events compared to their uninfected counterparts.
- HIV-infected patients may not perceive themselves to be at risk for cardiovascular disease despite having adequate knowledge of cardiovascular risk factors.
- Further research is required to improve cardiovascular risk perception in HIV-infected adults. Targeted interventions to reduce cardiovascular risk in HIV-infected adults need to be developed.

Table 1

Demographic Characteristics (N = 130)

	Mean (*SD*)	**Range**	***n* (%)**
Age, years	47.9 (8.4)	22–67	
Education, years	11.8 (2.7)	4–19	
Employment status (unemployed)			90 (69.2)
Male gender			81 (62.3)
Race/Ethnicity			
White			54 (41.5)
Black			42 (32.3)
Hispanic			30 (23.1)
Other			4 (3.1)

Table 2

Clinical, CVD, and HIV Characteristics (N = 130)

	Mean (*SD*)	***n* (%)**
Body Mass Index (BMI)	26.7 (5.5)	
Years since HIV diagnosis	14.6 (7.9)	
Hepatitis C antibody positive		63 (48.5)
CVD Risk Factors		
Total Cholesterol	170 (36)	
LDL	97 (33)	
HDL	44 (17)	
Framingham Risk Score	7.9 (6.0)	
Fasting glucose	96 (25)	
Type 2 Diabetes		13 (10)
Current smoker		73 (56.2)
On lipid-lowering medication		11 (8.5)
On daily aspirin		9 (7.0)
Hypertension Stage		
Normal		43 (33.1)
Pre-Hypertension		63 (48.5)
Stage 1 Hypertension		22 (16.9)
Stage 2 Hypertension		2 (1.5)
HIV Characteristics		
CD4+Tcell, cells/mm^3	546 (292)	
Nadir CD4+T cells/mm^3	195 (142)	
HIV viral load, undetectable		93 (71.5)
Type of ART Regimen		
NNRTI-based		47 (36.2)
PI-based		54 (41.5)
NRTI-sparing		5 (3.8)
Other type of regimen		8 (6.2)
Not on ART		16 (12.3)

Note. CVD = cardiovascular disease; LDL = low density lipoproteins; HDL = high density lipoproteins; NNRTI = non-nucleoside reverse transcriptase inhibitor; PI = protease inhibitor; NRTI = nucleoside reverse transcriptase inhibitor; ART = antiretroviral therapy.

Table 3

Correlations Between Perceived Risk of CVD, Risk Factor Knowledge, and Demographic Variables (N = 130)

Variable	Age	Years of education	Years since HIV diagnosis
Perceived risk of CVD*	.110	.040	.002
P value	.20	.64	.98
Risk factor knowledge**	.09	.14	.11
P value	.27	.09	.21

Note. CVD = cardiovascular disease.

* Pearson correlation

** Spearman's rho correlation