Comorbidity-Related Treatment Outcomes among HIV-Infected Adults in the Bronx, NY

Carolyn Chu, Galina Umanski, Arthur Blank, Paul Meissner, Robert Grossberg, and Peter A. Selwyn

ABSTRACT *Aging, HIV infection, and antiretroviral therapy have been associated with increasing rates of chronic comorbidities in patients with HIV. Urban minority populations in particular are affected by both the HIV/AIDS and chronic disease epidemics. Our objectives were to estimate the prevalence of and risk factors for hypertension, dyslipidemia, and diabetes among HIV-infected adults in the Bronx and describe comorbidity-related treatment outcomes. This was a cross-sectional study of 854 HIV-positive adults receiving care at 11 clinics which provide HIV primary care services; clinics were affiliated with a large urban academic medical center. Data on blood pressure (BP), cholesterol, and glycemic control were collected through standardized chart review of outpatient medical records. We found prevalence rates of 26%, 48%, and 13% for hypertension, dyslipidemia, and diabetes, respectively. Older age, obesity, family history, and current protease inhibitor use were consistently associated with comorbidity. Diabetes treatment goals were achieved less often than BP and lipid goals, and concurrent diabetes was a significant predictor for BP and lipid control. In conclusion, major cardiovascular-related comorbidities are prevalent among HIV-positive adults in the Bronx, especially older and obese individuals. Differences exist in comorbidity-related treatment outcomes, especially for patients with concurrent diabetes. Because cardiovascular risk is modifiable, effective treatment of related comorbidities may improve morbidity and mortality in HIV-infected patients.*

KEYWORDS *Comorbidities and HIV, Treatment outcomes and HIV, Combination antiretroviral therapy*

INTRODUCTION

Combination antiretroviral therapy (cART) markedly improves survival for HIV-infected patients, and much research now focuses on the development and impact of chronic complications and comorbidities among the aging HIV-positive population. Increased rates of dyslipidemia, cardiovascular disease, and diabetes are well-documented,^{1–3} with multiple factors (inflammation caused by HIV, antiretroviral effects, traditional risk factors, etc.) accounting for these findings. These comorbid-

Chu, Umanski, Blank, Meissner, and Selwyn are with the Department of Family and Social Medicine, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, NY, USA; Grossberg is with the Division of Infectious Diseases, Department of Medicine, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, NY, USA.

Correspondence: Carolyn Chu, Department of Family and Social Medicine, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, NY 10467, USA. (E-mail: cchu@montefiore.org)

Previous presentations A portion of the data was presented in poster format at the 2009 AHRQ Practice-Based Research Network Conference in Bethesda, Maryland (June 24–26, 2009) and at the 2010 International AIDS Conference in Vienna, Austria (July 18–23, 2010).

ities also contribute to changing trends in mortality in the HIV-infected population. Leading causes of death have shifted dramatically from opportunistic infections to non-AIDS-related diagnoses—notably chronic liver, kidney, and cardiovascular diseases.⁴ Because effective prevention and management of these conditions may improve morbidity and mortality, it is important to better characterize comorbidity-related delivery of care and treatment outcomes among patients with HIV/AIDS. However, very little has been published on these issues.^{5,6}

HIV/AIDS and other major chronic illnesses are prevalent among low-income and urban residents,^{7–9} putting these populations at risk for adverse health outcomes including death. This is likely due to several reasons including differential access to (or utilization of) health services and resources, differences in the quality of care received, and other environmental/health behavior-related factors. To address these inequalities, researchers, medical systems, and public health organizations must adequately describe the scope of such disparities in order to develop targeted interventions and appropriate measures of evaluation.

The purposes of this study were to (1) estimate the prevalence of and risk factors for comorbid hypertension, dyslipidemia, and diabetes in a sample of HIV-infected adults in the Bronx, and (2) describe comorbidity-related care and treatment outcomes among this urban, at-risk population.

METHODS

Research Subjects. Subjects were non-pregnant, HIV-positive adults (18 years and older) who initiated HIV and primary medical care at study sites between January 1, 2005 and December 31, 2007 and were followed through December 31, 2008. Subjects must have received all medical treatment at either the hospital-based specialty center or within the community-based network (see below) during the study period, with at least one medical visit per year. Subjects were excluded if they transferred care between a study site and non-study site, as complete data were not able to be collected for these patients.

Study Sites and Providers. Subjects received care at Montefiore Medical Center, a large academically affiliated, integrated healthcare delivery system in the Bronx, NY. Montefiore provides outpatient care to HIV-positive individuals in various settings, 2 of which are a hospital-based HIV/AIDS center and community-based HIV program. Both the hospital specialty center and clinics participating in the community-based program offer long-term comprehensive management of patients' chronic medical issues (both HIV and non-HIV-related). Non-HIV-related issues are addressed by each patient's primary care provider—who is an infectious disease-trained clinician at the specialty center, a generalist-trained HIV expert in the community-based program, or a non-HIV-expert generalist in the community-based program.

Study Design. This was a cross-sectional study.

Outcome Measures. Six treatment outcomes were assessed, including both process- and disease-related measures. Process-related measures were: (1) proportion of medical visits with documented blood pressure, (2) whether LDL-cholesterol (LDL-C) was checked yearly and within 6 months of starting new cART,¹⁰ and (3) frequency of hemoglobin A1c measurements. Disease-related measures were: (1)

proportion of blood pressure measurements at goal as defined by the 7th Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7);¹¹ (2) proportion of LDL-C measurements at goal as defined by the 3rd Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (NCEP ATPIII);¹² and (3) proportion of hemoglobin A1c values <7% as recommended by the American Diabetes Association (ADA).¹³

“Comorbid hypertension” was defined according to JNC7 criteria; “comorbid dyslipidemia” was defined as a history of lipid-lowering medication use or according to NCEP ATPIII guidelines; “comorbid diabetes” was defined according to ADA definitions. For comorbidity prevalence, subjects were considered to have comorbid disease if it was already identified prior to the study period or if disease developed at any time during this observation period.

Data Collection. Data were collected by one author (CC) from outpatient records and the medical center’s electronic clinical information system, which houses data on numerous demographic and clinical variables as well as results from all diagnostic and laboratory tests performed at Montefiore since the system’s implementation in 1997. In addition to longitudinal laboratory data, the system contains medication records through a computerized physician order entry system. An electronic standardized chart abstraction tool, adapted from established quality improvement initiatives and research protocols, was developed and translated into Microsoft Access.

Statistical Analyses. Statistical analyses were performed using Stata/IC v. 10.1 (StataCorp LP, College Station, TX). After inspecting data for accuracy and consistency, categorical data were compared with Pearson’s chi-square or Fisher’s exact test and continuous data were compared with Student’s *t* test or Wilcoxon rank-sum test as appropriate. Continuous data with non-normal distributions were tested using both parametric and non-parametric methods. When there was no difference in significance, results are reported based on parametric testing; if there was a difference, the more conservative non-parametric estimate is given.

Separate multivariate logistic regression models for the presence of comorbid disease (hypertension, dyslipidemia, and diabetes) were constructed. Variables identified for possible inclusion were either clinically relevant based on demographic and HIV-specific considerations (age, sex, HIV transmission risk factor, time since HIV diagnosis, history of AIDS, hepatitis C coinfection) or established risk factors for comorbid disease (ethnicity, obesity, tobacco use, alcohol use, relevant family history, comorbid coronary artery disease/cerebrovascular disease/chronic kidney disease, protease inhibitor exposure). Location of care was included to account for potential variability between the 2 settings. Because this was a cross-sectional study, duration of follow-up was included to account for potential differences in the opportunity to develop comorbid disease over the study period. Final models included variables selected for their [a priori] theoretical/clinical relevance and/or empirical evidence found on bivariate testing. Hosmer and Lemeshow goodness-of-fit testing yielded $p > 0.05$ for all χ^2 test statistics for the 3 models, indicating good fits with the data. Similarly, multiple linear regression models for continuous treatment outcomes were constructed and evaluated. In addition to the variables identified above, we considered visit frequency, continuity of care (measured as the percentage of visits to the PCP), mental health diagnosis, illicit substance use, and

use of anti-hypertensive/lipid-lowering/diabetes medications. Differences were considered statistically significant at $\alpha=0.05$; reported confidence intervals are 2-sided.

This study, including waiver of informed consent, received approval from the Institutional Review Board at Montefiore Medical Center and was funded through the New York State Department of Health's Empire Clinical Research Investigator Program. In addition, it was also made possible by CTSA Grants UL1 RR025750, KL2 RR025749, and TL1 RR025748 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH), and NIH Roadmap for Medical Research. Its contents are solely the responsibility of the authors and do not necessarily represent the official view of the NCRR or NIH.

RESULTS

Identification of Subjects. We identified 446 subjects receiving care at community-based sites who were eligible for inclusion; complete data from 423 (95%) were obtained. Seven hundred sixty-six potential subjects were identified at the hospital specialty center, and 450 were selected randomly for data collection to create similar sizes between the community and hospital groups. Complete data were obtained for 431 (96%) hospital-based subjects.

Subject Characteristics at Presentation. Table 1 describes demographic and clinical characteristics at initial presentation of all 854 subjects. There were no statistically significant differences in baseline characteristics between subjects receiving care at community- versus hospital-based sites with respect to age, gender, time since HIV diagnosis, hepatitis C coinfection, and antiretroviral (including protease inhibitor) exposure. Mean follow-up time for all subjects was 595 days.

Prevalence of and Risk Factors for Comorbid Disease. Prevalence rates of hypertension, dyslipidemia, and diabetes in our study population were 26% ($n=223$), 48% ($n=414$), and 13% ($n=108$), respectively. Furthermore, 517 subjects (61%) had any one of the 3 conditions, 182 (21%) had 2 comorbidities, and 46 (5%) had all 3. Subjects reported high rates of hypertension (32.1%), diabetes (34.3%), and premature cardiovascular disease (16.3%) among immediate family members.

Multivariate analyses revealed several factors which significantly increased the odds of having comorbidity (Table 2), specifically older age, obesity, relevant family history, and current protease inhibitor use. We found no consistently significant associations between comorbidity and HIV risk factor, hepatitis C coinfection, or current tobacco and/or alcohol use.

Delivery of Comorbidity-Related Care and Treatment Outcomes

A. Hypertension. Process of care and treatment outcomes for hypertension are shown in Table 3. Blood pressures were measured and recorded at approximately 90% of clinical visits, and approximately, 90% of readings were at JNC7-defined goal. Concurrent diabetes, visit frequency, and use of anti-hypertensive medication were the only factors significantly associated with meeting target blood pressure. Although older subjects, men, and obese individuals were less likely to have well-controlled blood pressure, none of these associations were statistically significant in

TABLE 1 Subject characteristics at baseline

Mean (SD), median [IQR], or frequency (%)	N=854
Mean age in years	44.0 (9.96)
Gender	
Male	486 (56.9%)
Transgender (MTF)	8 (0.90%)
Female	360 (42.2%)
Ethnicity ^a	
African American	389 (45.6%)
Latino	373 (43.7%)
Other	92 (10.8%)
HIV risk factor	
MSM	121 (14.2%)
HSP	454 (53.2%)
IDU	185 (21.7%)
Other (including dual risk) or unidentified	94 (11.0%)
Median years since HIV diagnosis	9 [3–16]
History of AIDS-defining condition	446 (52.2%)
Hepatitis C coinfection	273 (32.0%)
Antiretroviral exposure	
Current	341 (39.9%)
Ever	220 (25.8%)
None/unknown	293 (34.3%)
Protease inhibitor exposure	
Current	226 (26.5%)
Ever	195 (22.8%)
None/unknown	433 (50.7%)
Median body mass index (BMI)	25.1 [21.9–29.6]
Obese (BMI ≥ 30)	233 (27.3%)
Comorbid CAD/CVD/CKD	60 (7.03%)
Current tobacco use	507 (59.4%)
Current alcohol use	373 (43.7%)
Current illicit substance use	360 (42.2%)
Recent hospitalization	411 (48.1%)
HIV-related diagnosis	192 (22.5%)
Non HIV-related diagnosis	219 (25.6%)

SD standard deviation, IQR interquartile range, MTF male-to-female, MSM men who have sex with men, HSP high-risk sexual partner, IDU intravenous drug use, CAD/CVD/CKD coronary artery disease/cerebrovascular disease/chronic kidney disease

^aBased on hospital administrative data

our sample. Location of care (hospital- versus community-based) was not a significant predictor of blood pressure outcome.

B. Dyslipidemia. Table 4 shows results of lipid surveillance/screening. Two hundred eight subjects were not on antiretroviral therapy during the study: of these individuals, 126 (60.6%) had a yearly LDL-C measurement. Six hundred forty-six subjects were on cART during the review period; this included 625 subjects who started a new regimen. Four hundred nine (65.4%) of subjects starting new cART had lipids checked within 6 months. Of all 646 subjects on cART (who either started new cART or were already on antiretroviral therapy at baseline), 498 (77.1%) had

TABLE 2 Multivariate adjusted odds ratios for comorbid disease^a

	Hypertension	Dyslipidemia	Diabetes
Age ≥45 years	3.89 [2.57–5.87]*	1.42 [1.03–1.96]*	3.48 [2.06–5.87]*
Male sex	1.45 [0.96–2.20]	2.06 [1.46–2.89]*	1.48 [0.89–2.47]
Ethnicity (versus other)			
Latino	0.89 [0.45–1.76]	1.30 [0.78–2.18]	1.03 [0.46–2.30]
African-American	2.16 [1.11–4.17]*	0.82 [0.49–1.37]	1.33 [0.60–2.94]
BMI ≥30 kg/m ²	2.02 [1.33–3.08]*	1.91 [1.34–2.72]*	2.07 [1.24–3.42]*
CAD/CVD/CKD	6.70 [3.42–13.1]*	2.26 [1.20–4.27]*	2.71 [1.40–5.24]*
Family history	2.56 [1.74–3.78]*	–	2.90 [1.83–4.61]*
PI use (versus none)			
Current	1.07 [0.68–1.67]	1.74 [1.19–2.54]*	1.74 [1.01–3.01]*
Ever/previous	0.84 [0.51–1.38]	1.89 [1.27–2.80]*	1.41 [0.76–2.60]

* $p < 0.05$ (based on Pearson χ^2 or Fisher's exact test)
^aAdjusted for age, sex, ethnicity, HIV risk factor, time since HIV diagnosis, history of AIDS, hepatitis C coinfection, concurrent cardio/cerebrovascular or chronic kidney disease, protease inhibitor exposure, obesity, current tobacco use, current alcohol use, related family history, location of care, and duration of follow-up

yearly lipid measurements. Of all LDL-C measurements, 82.6% were at ATPIII-defined goal. Again, only concurrent diabetes, visit frequency, and medication (lipid-lowering therapy) use were significant predictors of lipid control. Subjects on protease inhibitors tended to have less well-controlled cholesterol, although not to a statistically significant degree. Location of care did not predict lipid outcomes.

C. Diabetes. One hundred eight subjects had comorbid diabetes, and the average number of hemoglobin A1c measurements among these subjects was 2.25 per year (Table 5). Of all A1c measurements, 59% met ADA-defined treatment goal (<7%). Diabetes medication use was the only statistically significant predictor of glucose control among our study sample. Additionally, as mentioned previously, comorbid diabetes was a significant predictor for blood pressure and lipid control: subjects with diabetes had ~5% fewer blood pressure and ~20% fewer LDL-C measurements at goal compared to subjects without diabetes ($p = 0.03$ and < 0.01 , respectively).

DISCUSSION

This study confirms that comorbidities commonly found in the general population—namely hypertension, dyslipidemia, and diabetes—are prevalent among HIV-infected adults in the Bronx. Such conditions affected 13–48% of our subjects, rates similar to those published from other studies of HIV-infected patients.^{3,14,15}

TABLE 3 Hypertension assessments and treatment outcomes

	Frequency among all subjects (N = 854)
Process of care measure	
Mean percentage of clinical visits with recorded blood pressure	90.5%
Treatment outcome	
Mean percentage of blood pressures at JNC7-defined goal	89.8%

TABLE 4 Dyslipidemia assessments and treatment outcomes

	Frequency among subjects
Process of care measures	
Yearly LDL-C checked for subjects not on cART during study period	60.6% (<i>n</i> = 208)
Yearly LDL-C checked for all subjects on cART during study period	77.1% (<i>n</i> = 646)
LDL-C measured within 6 months for subjects starting new cART during study period	65.4% (<i>n</i> = 625)
Treatment outcome	
Percentage of all LDL-C measurements at ATPIII-defined goal	82.6% (<i>N</i> = 854)

Our work also demonstrates that many relationships between traditional risk factors and chronic diseases in the general population (e.g., obesity and hypertension) persist for HIV-infected patients. Furthermore, although much has been made of the contribution of antiretroviral therapy toward development of these conditions, our study indicates that the risk conferred by traditional factors is often comparable to—and occasionally greater than—that due to antiretroviral therapy. For example, the degree of association between older age and diabetes was twice that of the association between protease inhibitor use and diabetes. Obesity also emerged as a relatively strong predictor for comorbidity and with a striking prevalence of 27% in our population. Given the growing epidemic of obesity among HIV-infected patients in the United States¹⁶ and the role of obesity in cardiovascular-related disease development, this will undoubtedly become an important topic both for future research and for clinicians when counseling patients.

Finally, our results indicate that guideline-based recommendations for comorbidity-related disease monitoring and treatment goals are inconsistently met in HIV-infected patients. Approximately 90% of blood pressure recommendations were met, 60–85% of lipid-related goals were achieved, and only 60% of hemoglobin A1c results were at target. These outcomes are similar to findings from other samples of HIV-infected patients: less than 60% of adults initiated on cART received timely lipid screening in a Veterans Administration study,¹⁷ and only 54% of patients with diabetes at a Chicago HIV specialty clinic had hemoglobin A1c <7%.⁵ Although such findings are likely due to multiple factors, systems-related causes may play a role in process of care measures. Patients likely get blood pressure checked more routinely because it is often done by support/nursing staff at the beginning of each medical visit. This is in contrast to lipid and hemoglobin A1c testing which must be provider-initiated. Insufficient screening and monitoring may result in lost

TABLE 5 Diabetes assessments and treatment outcomes

	Frequency among subjects with diabetes (<i>n</i> = 108)
Process of care measure	
Mean frequency of hemoglobin A1c measurements	2.25/year
Treatment outcome	
Percentage of hemoglobin A1c measurements at ADA-defined goal (<7%)	59%

opportunities for patient education and timely treatment. Therefore, systems-based interventions that improve disease monitoring are important and modifiable areas of focus. Electronic medical record systems may offer particular benefit when designing strategies to improve healthcare delivery: electronic “alerts” or clinical flow sheets can be created to notify providers when labs are due. Additionally, point-of-care clinical decision support (i.e., specific disease management guidelines and algorithms) can be incorporated into electronic health systems and possibly lead to improved treatment outcomes.

Despite inconsistencies in comorbidity-related care and outcomes, our findings suggest that blood pressure and cholesterol are actually better controlled in HIV-infected patients compared with uninfected patients. Results from large, population-based studies such as NHANES suggest that only 30% of the general population is at target blood pressure,¹⁸ and approximately 40% of patients enrolled in primary medical care are at goal LDL-C.¹⁹ In contrast, glycemic control in HIV-infected patients with diabetes does not seem to differ remarkably from that in uninfected diabetics.^{20,21} Although our blood pressure and lipid outcomes may not be representative of all clinics/providers and patient populations, it is possible that hypertension and dyslipidemia are followed more closely in HIV-infected patients. This is likely due to more frequent outpatient visits and lipid testing, and possibly differences in provider awareness and prescribing practices.

This research has several limitations. First, our disease outcomes do not reflect long-term, major clinical events: rather, they reflect cardiac risk control and should be interpreted cautiously as such. Our outcomes also involve a complex interplay of factors that the data do not directly and/or comprehensively capture. For example, we could not measure patient adherence to anti-hypertensive/lipid-lowering/diabetes medications because this was inconsistently assessed and documented. Our results may therefore be of limited clinical application—particularly for the development of interventions to improve treatment outcomes. Finally, it is still relatively unknown whether the progression of comorbid disease (especially hypertension and diabetes) among HIV-infected patients differs from that in uninfected individuals. It is also largely unknown whether treatment response to blood pressure/lipid/diabetes medications is affected by HIV itself. Until this is further clarified, it will be difficult to determine whether “sub-optimal” treatment outcomes reflect patient, provider, system, or disease-related factors.

In conclusion, this study confirms that: (1) hypertension, dyslipidemia, and diabetes are prevalent among people with HIV and that (2) both traditional and HIV-related factors contribute to their prevalence. However, (3) comorbidity-specific treatment goals are met to a variable degree among infected patients. Experts believe that effective treatment of chronic comorbid diseases in HIV-positive patients will reduce the risk of major conditions associated with mortality in the decades to come.²² Because cardiovascular risk in particular is modifiable through prevention and effective treatment, successful management of HIV-infected patients with cardiovascular-related conditions could improve health outcomes in this medically vulnerable population. Central to this is the recognition that comprehensive, coordinated, and accessible primary care will be increasingly important for HIV-infected populations. Patients, providers, and health systems alike will benefit from further work on how primary care and chronic disease management is implemented for infected patients in the current era of HIV treatment.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the support and helpful contributions of the Research Division in the Department of Family and Social Medicine at Montefiore Medical Center, the Albert Einstein College of Medicine's Clinical Research Training Program, and the MMG/Bronx Community Health Network's CICERO program.

Financial Support. This work was funded through the New York State Department of Health's Empire Clinical Research Investigator Program. In addition, it was made possible by CTSA Grants UL1 RR025750, KL2 RR025749, and TL1 RR025748 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH), and NIH Roadmap for Medical Research. Its contents are solely the responsibility of the authors and do not necessarily represent the official view of the NCRR or NIH.

REFERENCES

1. Justman JE, Benning L, Danoff A, et al. Protease inhibitor use and the incidence of diabetes mellitus in a large cohort of HIV-infected women. *J Acquir Immune Defic Syndr*. 2003; 32(3): 298–302.
2. Brown TT, Cole SR, Li X, et al. Antiretroviral therapy and the prevalence and incidence of diabetes mellitus in the multicenter AIDS cohort study. *Arch Intern Med*. 2005; 165(10): 1179–84.
3. Glass TR, Ungsedhapand C, Wolbers M, et al. Prevalence of risk factors for cardiovascular disease in HIV-infected patients over time: the Swiss HIV cohort study. *HIV Med*. 2006; 7(6): 404–10.
4. Palella FJ Jr, Baker RK, Moorman AC, et al. Mortality in the highly active antiretroviral therapy era: changing causes of death and disease in the HIV outpatient study. *J Acquir Immune Defic Syndr*. 2006; 43(1): 27–34.
5. Adeyemi O, Vibhakkar S, Max B. Are we meeting the American Diabetes Association goals for HIV-infected patients with diabetes mellitus? *Clin Infect Dis*. 2009; 49(5): 799–802.
6. Bury JE, Stroup JS, Stephens JR, Baker DL. Achieving American Diabetes Association goals in HIV-seropositive patients with diabetes mellitus. *Proc Bayl Univ Med Cent*. 2007; 20(2): 118–23.
7. Centers for Disease Control and Prevention. HIV prevalence estimates—United States, 2006. *MMWR*. 2008; 57(39): 1073–6.
8. Link CL, McKinlay JB. Disparities in the prevalence of diabetes: is it race/ethnicity or socioeconomic status? Results from the Boston Area Community Health (BACH) survey. *Ethn Dis*. 2009; 19(3): 288–92.
9. Clark AM, DesMeules M, Luo W, Duncan AS, Wielgosz A. Socioeconomic status and cardiovascular disease: risks and implications for care. *Nat Rev Cardiol*. 2009; 6(11): 712–22.
10. Aberg JA, Kaplan JE, Libman H, et al. Primary care guidelines for the management of persons infected with human immunodeficiency virus: 2009 update by the HIV medicine association of the infectious diseases society of America. *Clin Infect Dis*. 2009; 49(5): 651–81.
11. Chobanian AV, Bakris GL, Black HR, et al. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. *JAMA*. 2003; 289(19): 2560–72.
12. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). *JAMA*. 2001; 285(19):2486–97.

13. American Diabetes Association. Standards of medical care in diabetes—2008. *Diab Care*. 2008; 31(Suppl 1): S12–54.
14. Jung O, Bickel M, Ditting T, et al. Hypertension in HIV-1-infected patients and its impact on renal and cardiovascular integrity. *Nephrol Dial Transplant*. 2004; 19(9): 2250–8.
15. Bergersen BM, Sandvik L, Dunlop O, Birkeland K, Bruun JN. Prevalence of hypertension in HIV-positive patients on highly active antiretroviral therapy (HAART) compared with HAART-naïve and HIV-negative controls: results from a Norwegian study of 721 patients. *Eur J Clin Microbiol Infect Dis*. 2003; 22(12): 731–6.
16. Crum-Cianflone N, Tejidor R, Medina S, Barahona I, Ganesan A. Obesity among patients with HIV: the latest epidemic. *AIDS Patient Care STDs*. 2008; 22(12): 925–30.
17. Korthuis PT, Asch SM, Anaya HD, et al. Lipid screening in HIV-infected veterans. *J Acquir Immune Defic Syndr*. 2004; 35(3): 253–60.
18. Bell TJ, Tang S, Jamieson MJ. Evaluation of hypertension prevalence and blood pressure goal attainment using data from the 1999–2000 national health and nutrition examination survey (NHANES). *Am J Hypertens*. 2004; 17(5): S193.
19. Pearson TA, Laurora L, Chu H, Kafonek S. The lipid treatment assessment project (L-TAP): a multicenter survey to evaluate the percentages of dyslipidemia patients receiving lipid-lowering therapy and achieving low-density lipoprotein cholesterol goals. *Arch Intern Med*. 2000; 160(4): 459–67.
20. Beaton SJ, Nag SS, Gunter MJ, Gleeson JM, Sajjan SS, Alexander CM. Adequacy of glycemic, lipid, and blood pressure management for patients with diabetes in a managed care settings. *Diab Care*. 2004; 27(3): 694–8.
21. Saydah SH, Fradkin J, Cowie CC. Poor control of risk factors for vascular disease among adults with previously diagnosed diabetes. *JAMA*. 2004; 291(3): 335–42.
22. Justice AC. Prioritizing primary care in HIV: comorbidity, toxicity, and demography. *Top HIV Med*. 2006; 14(5): 159–63.