

Living With HIV: Is Hypertension Adequately Addressed?

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Abstract

Background: Hypertension is an ongoing health concern for the aging U.S. population but is also a concern for people living with chronic disease. People with HIV are living longer and need to have their other medical conditions managed. Yet, care delivery is often disjointed and hypertension may be overlooked.

Methods: A retrospective analyses of the longitudinal cohort data from the AIDS Linked to the IntraVenous Experience (ALIVE) study was conducted. Participants with HIV, followed between 7/1/2009 to 6/30/2012, and age >18 were examined. High blood pressure was defined as a systolic blood pressure ≥ 140 and a diastolic blood pressure ≥ 90 on two consecutive visits. Risk factors for hypertension were examined including behavioral (weight, smoking), disease/therapy related (treatment, viral load, and CD4 counts), and socioeconomic (homelessness, social support, education).

Results: The study sample included 368 HIV infected participants with a median age of 53. Nearly all were African American (93%) and 65% were male. The overall prevalence of uncontrolled hypertension was found to be 18%. In a multivariable logistic regression analysis, smoking >1 pack/day was independently associated with hypertension (OR=2.77; 95% CI, 1.13 – 6.67). People with a CD4 T-cell count of <200 cells/mm³ were two times more likely to have hypertension (OR=2.11; 95% CI, 1.05-4.25).

Conclusions: The high prevalence of hypertension in the HIV infected ALIVE sample calls for improved care for a treatable comorbidity. Although 97% of the sample reported accessing clinical care in the past six months, 18% have uncontrolled hypertension. Moreover, the strong association between smoking and hypertension calls for targeted teaching and referral for treatment, whether detected in a research study like ALIVE or in primary care.

Background and Problem

Hypertension has been identified as one of the most common chronic conditions affecting more than 74.5 million Americans age 20 and older (AHA, 2011). The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure was published providing clear guidelines for the prevention and management of hypertension (Chobanian, Bakris, Black, Cushman, et al., 2003). Between 1988–1994 and 2005–2008, the overall prevalence of uncontrolled high blood pressure among adults aged 20 and over decreased from 74% to 54% (CDC, 2011). Although significant progress in managing hypertension has occurred, opportunities to improve care remain such as improving individual healthy behaviors (i.e., stop smoking, reducing salt intake, weight control, and increased daily exercise), improved medication adherence, and improved medical management of multiple chronic conditions.

Human Immunodeficiency Virus (HIV) is one disease that is now managed as a chronic condition by combinations of specialists and primary care providers. While mortality rates for patients with HIV have remained essentially unchanged since the advent of antiretroviral therapy, the CDC predicts that by 2017, 50% of the people living with HIV will be over the age of 50 (CDC, 2011). Therefore, HIV patients experience co-morbid/multi-morbid conditions associated with aging in addition to the conditions associated with on-going HIV treatment. One of these is hypertension, which may not be well-controlled. As a nurse practitioner in an inner city research study following HIV positive patients, significantly elevated blood pressures are commonly identified during the study visits. While the research study does not provide any treatment, the majority of the patients have care providers. Yet, the frequency of hypertension

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seems to indicate that the primary focus is on HIV treatment with less attention to co-morbid conditions. The difficulty of coordinating care among multiple primary care providers and specialists is a well-recognized challenge. Prior to the development of a practice change to address this issue, it is important to better understand the prevalence of hypertension and the effect of potential risk factors. This is consistent with Rosswurm and Larrabee's Model for Evidence-based Practice Change (1999), reflecting a 6-step model to facilitate a shift from intuition driven practice to evidence-based practice (Rosswurm & Larabee, 1999).

Review of evidence of association between hypertension and HIV

An evidence search was performed to evaluate the literature addressing HIV positive patients with hypertension/high blood pressure, focusing on associated risk factors. The results of the CINAHL and Pub Med database searches produced 20 unique articles. The synthesis of the evidence has been organized according to known risk factor categories associated with hypertension: clinical, demographic, behavioral, and socioeconomic. These apply to hypertension patients in general as well as HIV patients with hypertension.

Clinical factors

HIV treatment itself may influence risk of hypertension although there are conflicting findings from studies. Multiple studies have found that the no specific regimen of antiretroviral therapy is necessarily associated with increased rates of hypertension (Jerico, Knobel, Montero, Sorli, Guelar, et al., 2005; Thiebaut, El-Sadr, Friis-Moller, Rickenbach, et al., 2005; Chow, Souza, Chen, Richmond-Crum, et al., 2003). However, the Multicenter AIDS Cohort Study (MACS), with almost a 20 year follow-up of 5,578 HIV+ men, noted significantly increased blood pressure in patients that had been treated for greater than 5 years on highly active antiretroviral therapy (HAART). Additionally, this increase in blood pressure was not noted in

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patients that had been treated for less than 2 years on HAART (Seaberg, Munoz, Phair, et al., 2005).

A cross-sectional study conducted at two large HIV clinics (Naval Medical Center San Diego, California and the National Naval Medical Center in Bethesda, Maryland) evaluated the prevalence and factors associated with hypertension in HIV positive patients (Medina-Torne, Ganesan, Barahone, & Crum-Cianflone, 2011). Of the 707 HIV positive patients studied, the majority of the participants were male (92%) with a mean age of 41. The study found that the overall prevalence of hypertension in the HIV positive sample was 31% (32% no HAART vs. 29% with HAART, $p = 0.47$). This is similar to U.S. reported prevalence of HIV and hypertension (31%) (Medina-Torne, et al., 2011; CDC, 2011). These results suggest that though hypertension is common among HIV positive patients, it is not associated with the use of HAART therapy. However, these results are not generalizable due to differences between the military population and the general population.

Other factors such as duration of the HIV infection may predispose patients to metabolic changes that could contribute to the elevated blood pressures. The duration of HIV infection may contribute to the prevalence of hypertension due to the virally-mediated endothelial changes or possibly the contribution of the immune activation (Medina-Torne et al, 2012).

Demographic, behavioral, and sociocultural factors

The majority of the literature identified male, age, family history, and African American as risk factors associated with hypertension in both HIV positive and negative patients (Baekken et al., 2008; Bernardino et al., 2011; Medina-Torne et al., 2011). Most of the articles reviewed included smoking, obesity, alcohol, drug use, other co morbidities, and the management of HIV in the analysis. Type of health insurance and number of appointments (scheduled and kept) was

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included in the demographics for only one of the studies which examined an HIV sample (Vance et al., 2011). This trend study of comorbidity prevalence and clinical characteristics across decades of life found that as patients get older, more patients have insurance which improves their access to health care which improves compliance with primary care appointments. No studies examined the relationship between socio-economic factors such as income, homelessness, access to health care, education level, and health literacy in a specific HIV population.

In summary, there are few studies that examine clinical, demographic, behavioral, and socioeconomic predictors of hypertension in the HIV population. While the HIV treatment itself may have an important influence on hypertension, many of the important behavioral and sociodemographic factors that may influence hypertension are the same as for the general population. Yet, the opportunity to examine a rich, longitudinal database where some HIV patients have hypertension and some do not presents an opportunity to identify potential risk factors that can be addressed. Moreover, findings could inform a potential practice change within the ALIVE study to better link hypertensive patients to care.

Theoretical Model

The theoretical model that informs the variables to be examined in this secondary analysis is the Interaction Model of Client Health Behavior model developed in 1982 by Cheryl Cox, PhD, RN (Cox, 1982). This model recognizes the psychological, environmental, and sociological determinants of behavior. Furthermore, the model recognizes the importance of changing individual behavior through the uniqueness of the client and the influence of the healthcare provider through the client-provider relationship. The model recognizes the influence of client individuality in obtaining positive health outcomes. Achieving client centered care is

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the focus of this model, incorporating the patient, patient factors, the provider, and the patient/provider relationship will positively influence patient care and ultimately patient care outcomes.

Methods

Study Design

The study utilized a retrospective descriptive correlational design using existing patient-level data from the AIDS Link to Intravenous Experience (ALIVE) study. The prevalence and characteristics of those patients with and without hypertension is described. The disease/therapy, behavioral, and socioeconomic risk factors associated with hypertension are then examined in bivariate and multivariate associations.

Data Source

The data source for this study was the ALIVE study, which is an ongoing longitudinal study that was initiated in 1988. The primary purpose of the ALIVE study is to characterize the incidence and natural history of HIV among injection drug users. The ALIVE study criteria included \geq to 18 years of age and a history of injecting illicit drugs at any time within the previous 11 years. Of the 2921 injection drug users originally recruited for the study in Baltimore, Maryland, 703 (24.1%) participants were HIV positive (Vlahov Anthony, Munoz, Margolick, Nelson, Celentano, Solomon, & Polk, 1991). Due to attrition, 4 additional recruitment efforts (1994-1995, 1998, 2000, and 2005 to 2008) occurred over the past 20 years to maintain adequate study numbers. At the time of the study, there are about 1,000 active participants in the ALIVE study and about 30% of the participants HIV positive. This ongoing research study is a platform for numerous projects focused on intravenous drug use and HIV in Baltimore, Maryland.

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The majority of the participants (85.7%) were recruited into the study through word of mouth (Vlahoh, Anthony, Munoz, Margolick, Nelson, Celentano, et al., 1991). The study utilized nonprobability sampling the snowball sampling technique. The study clinic screened 3,375 individuals for potential enrollment. During this time 2,921 active drug users were recruited for participation and 703 (24.1%) of the participants were HIV-1 sero-positive. The ALIVE study includes participants age 18 to 68 with the majority of the participants age 25 to 44. The sample is predominantly African American (88.4%) and male (81%). An income level of less than \$5,000 was reported by 71 % of the participants. A significant number of the participants (75%) reported being arrested with 66% reported having been in prison. Thirty six percent of the participants reported homelessness within the previous ten years. Additionally, 77% reported current unemployment (Vlahoh, et al, 1991). The sample is representative of African American males of low socioeconomic status, which makes this sample quite different from those reported in the literature examining HIV-HTN co-morbidity.

Sample

The target sample for this study is the ALIVE study participants that meet the following inclusion criteria: (1) age greater than/equal to 18, (2) diagnosis HIV positive, (3) documented elevated blood pressure \geq 140/90 at two consecutive visits between July 1, 2010 to July 31, 2012, and (4) participation in at least two study visits between July 1, 2010 to June 31, 2012.

The sample size was determined by the number of HIV positive participants currently in follow-up with the ALIVE study. At the time the study was planned, about 1,000 study participants were in active follow up in the ALIVE study and about 300 study participants were HIV positive. Thus, it was anticipated that at least 108 of the participants will also be hypertensive. Furthermore, considering that a large majority of the ALIVE participants were

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African American and African Americans develop hypertension more often than other ethnic groups, good representation within the sample was expected. According to the American Heart Association (2011) hypertension occurs in African American males 42.2%, Mexican Americans 24.8% and Whites 31.2% (AHA, 2011). Since, the ALIVE study is comprised of 88.4% African American it was anticipated that the sample would be adequate to identify a hypertensive sample.

Measures

The ALIVE data were collected through in person interviews conducted by trained interviewers, clinicians, and also by self administered computer interviews. A subset of 22 variables from the existing database was analyzed. All of the data analyses were conducted by ALIVE analysts based on specifications of the writer. This will protect the confidentiality of the data.

Hypertension is being defined according to current standard of care guideline, the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JAMA, 2003). It is defined as systolic ≥ 140 and diastolic ≥ 90 . BP will be determined from two consecutive visits between July 1, 2010 and June 31, 2012. The ALIVE study has a protocol for obtaining three blood pressure readings in a standardized manner. The blood pressure utilized in the data set was an average of the last two measurements. Prior diagnosis of hypertension or an account of current hypertension medications was not utilized as criteria for this study since the data was acquired through patient self report and was not otherwise verified. Blood pressure readings from two consecutive patient encounters were utilized, this allowed for the identification of participants that could be diagnosed as hypertension and additionally had a blood pressure that was not controlled.

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Analysis

Descriptive statistics were used to describe the demographic and socioeconomic characteristics of the study population. Age, gender, race/ethnicity, are valuable indicators of the specific characteristics of the study population. Chi square test was chosen because the identified risk factors, behavioral, disease/therapy related and lower socioeconomic factors, are all categorical variables and the resulting outcome data will also be reported as categorical.

The prevalence of hypertension in the HIV positive study participants during the specified timeframe was determined using the definition of two consecutive readings described above. The association between hypertension and the risk factors was examined by calculating unadjusted odds ratios. Risk factors identified as significant (P value of $<.05$) were included in a multiple logistic regression analysis.

Human Subjects

The ALIVE study, a Johns Hopkins University Bloomberg School of Public Health (JJUBSPH) research study, has been reviewed and approved by the Institutional Review Board yearly and has been reviewed/funded by the National Institute on Drug Abuse. The data analyses reported here were conducted by a third party and results were delivered in aggregate summary tables. Thus, no identified data were used. The University of Maryland IRB determined that this study is not human subject's research.

Results

A total of 368 HIV positive participants were included in this study. The participant mean age was 53 years (range 48 – 57); 65% were male and 93% were African American (see Table 1). The majority of the participants (64%) never completed high school or obtained a GED. Seventy percent of the participants had a low economic status, defined as a legal income

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of < \$5, 00.00/ year and nearly $\frac{3}{4}$ (70%) were never married. More than half of the sample (52%) had an under/ normal BMI and 171 (48%) were classified as overweight or obese. Seventy-nine percent of the participants reported no current intravenous drug use, while 7% reported intravenous drug use of > 1 day. Two hundred and eighty four participants (77%) are currently receiving HAART and 278 (76%) have a CD₄ T-cell count greater than 200 cells/mm³. One hundred and ninety eight participants (54%) have a HIV RNA of undetectable, defined as less than 50 copies/mL.

The JNCC guideline was used to define hypertension which is a blood pressure measurement of a systolic ≥ 140 and a diastolic ≥ 90 at two separate visits and or current treatment for hypertension. The overall prevalence of elevated blood pressure in the HIV infected participants was 18%. Twenty seven percent of the participants had documented high blood pressure at one of the two consecutive visits. The number of hypertensive patients currently controlled or partially controlled on medication could not be determined from this data set.

Table 2 compares the risk factors for people with and without high blood pressure with regards to behavioral, clinical, and socioeconomic risk factors. Behavioral risk factors that are not modifiable (i.e., age, gender and race) were not significantly associated with hypertension. BMI and alcohol use were not association with hypertension. However, HIV positive patients that reported smoking \geq one pack of cigarettes per day was three times more likely to be hypertensive (OR= 2.77; 95% CI: 1.13 – 6.67) than those who did not smoke. Intravenous drug use and any drug use were not significantly associated with hypertension.

The clinical risk factors related to treatment (i.e., Usual source of care, seeing the same provider, and seeing the same provider for more than two years) were not significantly

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associated with hypertension. ART therapy or having HAART therapy in the last six months were also not associated. The risk of hypertension was twice as high among study participants with a CD4 T-cell count of < 200 cells/mm³ (OR= 2.11; 95% CI: 1.05-4.25) as compared to those with CD4 counts ≥ 500 . Half (50%) of the sample with high blood pressure had a non detectable HIV RNA, defined as < 50 copies/mL; the non hypertensive group was slightly higher (55%) but this difference was not significant.

Multiple socio-economic risk factors were explored but were not found to be associated with hypertension. Of those with high blood pressure, 9% were homeless as compared to 3% of those who did not have high blood pressure. But the low frequency in this category (N=16) make the results difficult to evaluate. The other risk factors of current employment status, legal income level $< \$5,000.00$, high school education or less, no prior marriage status, and incarceration were not identified as statistically significant factors related to having hypertension in this population.

To evaluate the independent effects of risk factors on high blood pressure a multiple logistic regression included age, gender as well as factors found to be significantly associated in the bivariate analysis. As summarized in Table 3, the multiple regression identified that tobacco use of < 1 pack/day was significantly more likely to have high blood pressure (OR= 2.14; 95% CI: 0.99-4.62, $p = 0.05$) as compared to those who do not smoke, even controlling for age, gender, BMI, and CD4 count. Tobacco use of ≥ 1 pack/day increased likelihood of high blood pressure by 3 times as compared to those who do not smoke (OR= 2.92; 95% CI: 1.13-7.57, $p = 0.03$). Patients with a CD₄ of less than 200 cells/mm³ were two times more likely to have documented high blood pressure than those with CD₄ ≥ 200 (OR= 2.31; 95% CI: 1.23-4.31, $p = 0.009$).

Discussion

Hypertension is an ongoing health concern for the aging United States population as well as for HIV patients. Based on personal experience as a care provider in an inner-city clinic that cares for patients having both HIV-HTN diagnoses, blood pressure management in this population is a challenge. The exact prevalence of this co-morbid disease, the extent of control, and the risk factors associated with poor control have not been fully examined. Salter et al. (2011), utilizing data from the ALIVE study reported a prevalence of hypertension to be 36.5%, although that included self-reported history of hypertension, current hypertension medications or documented blood pressure of $\geq 140/90$. The current study documents the prevalence of uncontrolled blood pressure using a stricter measure (two consecutive visits) and found a smaller though not ignorable prevalence, 18%.

As discussed previously, age, gender, and race/ethnicity are risk factors that globally affect patients including patients with HIV. The importance of aging as a risk factor in hypertension is becoming more significant as the demographics in the United States are changing. The ALIVE study participants can be characterized as an aging cohort with a mean age of 53.

In 2005, 29% of patients living with HIV were over the age of 50. A HIV positive 20-year-old starting on HAART has a life expectancy of 43 years (Simone & Appelbaum, 2008). This study population had more males (65%) and though high blood pressure affects males more frequently before the age of 45, generally it affects females and males equally over a lifetime (CDC, 2011). No difference was found in this study. It is important to note that the ALIVE population consists of 93% African Americans who develop hypertension at an earlier age and more frequently than other race/ethnicities. Hypertension occurs in 33.9% men and 31.3% women non-Hispanic whites, as opposed to non-Hispanic blacks at 43.0% men and 45.7%

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women (AHA, 2012). African Americans are more frequently infected by HIV than any other race/ethnicity. In 2009 African Americans comprised 14% of the US population but accounted for 44% of all New HIV infections (CDC, 2011). Although these are not modifiable risk factors, they have been identified as significant since it informs the importance of screening and treatment in hypertension.

Since 50% of the HIV population will be over the age of 50 by 2015, hypertension, and these other co morbidities are important in directing patient care and future research. ALIVE study participants continue to age and co morbidity profiles continue to change (Vance, Mugavero, Willig, Raper & Saag, 2011). Historically, HIV positive patients older than age 50 were categorized as a heterogeneous group as opposed to younger patients that are studied according to their current decade of life. HIV infected persons as compared to the general population were found to experience multiple pathologies 10 years earlier than was noted in the general population (Giovanni et al., 2011). This finding again supports the importance of earlier comorbidity screening and treatment of HIV positive patients

Obesity, has been identified as a common risk factor associated with hypertension. Obesity rates in HIV positive groups have been reported as comparable to those in HIV negative groups (Crum-Cianflone, Tejedor, Medina, Barahona and Ganesan, 2008). A retrospective study at two large U.S. Navy HIV clinics identified an association between being overweight or obese at the last clinic visit and hypertension, 36% overweight/obese with hypertension versus 23% with normal weight and normal blood pressure ($p=.001$) (Crum-Cianflone et al., 2008). The findings in this study did not support these results. Others have identified BMI as an independent risk factor associated with hypertension suggesting that primary care efforts aimed at controlling this modifiable risk factor are warranted (Arruda, Lacerda, Moura, Albuquerque,

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Filho, Diziz, et al., 2010). Further research is needed in this challenging area to develop more effective treatment and counseling modalities.

Smoking tobacco is a modifiable risk factor associated with hypertension. The results of this study showed that smoking at both the levels of less than 1 pack/day and greater than or equal to 1 pack/day was significantly related to having an elevated blood pressure. Blood pressure is raised for a brief time after a person has smoked a cigarette but has not been proven to cause hypertension (AHA, 2012). Smoking cessation has been an ongoing campaign due to its many health risks associated such as cardiovascular disease and lung disease. The findings of this study could be used to illustrate to ALIVE patients the direct relationship between smoking and hypertension. It may be worth examining the occurrence of stroke in the ALIVE sample.

HAART has been studied as a potential factor influencing the problem of hypertension in HIV positive patients. Seventy seven percent of the HIV infected participants in this study have been on Haart within the last six months but this was not found to be significantly associated with elevated blood pressure. The use of HAART is essential in the care of HIV positive patients, the management of this potential risk factor must focus on the early detection and treatment of hypertension.

Level of viral control in HIV has been associated with hypertension; a low viral load and a high CD4 are consistent with well controlled HIV. Over 50% of the study participants had an undetectable viral and this finding was not associated with the measurement of blood pressure. In a study of 70 diabetic and 291 hypertensive patients who were also HIV positive, it was noted that patients with higher viral loads frequently had uncontrolled diabetes or hypertension (Monroe, Chander, and Moore, 2011). No difference was found in this study. In this study, CD4 levels below 200 were associated with elevated blood pressure (OR, 2.31: 95% CI, 1.23-4.31, p

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= 0.01). The results in this study were incongruent, with viral load level not influencing blood pressure and a CD4 level < 200 cells/mm³ significantly associated with elevated blood pressure. These findings suggest that consistent high quality HIV care provides an opportunity to positively impact the management of associated co morbidities.

Socioeconomic risk factors such as incarceration, homelessness, unemployment have been associated with decreased access, utilization and benefits from health care. In contrast, NHANES III data reported that 92% of the patients with uncontrolled hypertension had health insurance and reported a regular source of health care (Wang, 2005). These risk factors are often discussed in relationship to uncontrolled hypertension in patients studied from the inner city and having a lower socioeconomic status but have not been found to have a causative relationship (Wang, 2005). The results of this study support these findings in that none of these risk factors were found to be significantly related to high blood pressure. Though it is expected that these risk factors may have an increased influence in some subsets of the population, it is unclear how much they contribute to uncontrolled hypertension.

This study has several limitations. The study population is largely African American male, over the age of 50, history of IVDU, HIV infected, and of a low socio-economic level not allowing these results to be generalized to the overall population. The study population, being mostly AA, male and older, has most likely inflated the number of patients with high blood pressure more than the general population. Also, the ALIVE study was a sample of convenience. The duration of HIV infection, an expected risk factor for hypertension was not reported in this study but the majority of the study population has been infected for greater than ten years and this may be influencing the amount of high blood pressure identified. Additionally, the number of participants with a history of hypertension and or treatment for hypertension was not

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determined in this study since the data were self reported and not independently verified. Blood pressures were measured using an automated blood pressure cuff with multiple examiners which contribute to measurement error even though strict blood pressure measurement protocols were in place. The two measures is a strength of this study. It is unclear why the results for the viral load and the CD4 counts did not trend together as expected. A CD₄ count >200 cells/mm³ was associated with high blood pressure while no RNA viral load level (non-detectable, 50 -100,000 copies/mL, or \geq 100,000 copies/mL) was not associated with high blood pressure. The numbers of measures for some of the categories though adequate to test were smaller than desired.

This study identifies a relatively large proportion (18%) of HIV infected individuals with uncontrolled high blood pressure in this population of who report accessing clinical care at 97% in the past six months. Since almost all of the HIV infected participants have access to health care, it is concerning that high blood pressures continue to be a problem. Despite being followed in the ALIVE study, basic primary care management seems to be lacking. Follow-up with individual patients is needed to determine what factors are influencing the problem such as access to medication, ability to pay for medication, or knowledge base concerns. As HIV has become a chronic condition, it is not clear if HIV should be treated in specialty clinics or should it be moved to a medical home model of care. The current approach of specialty HIV clinics may focus on the specific HIV care and expect the patient to obtain general medical care at their primary care site but is this multi-provider approach too cumbersome for aging patients with more than one co morbidity. The medical home model may allow for a more focused health care approach that additionally provides the provider with the ability to consult with the appropriate specialists.

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These results will be utilized to inform clinical care for HIV infected patients with hypertension in the Baltimore, inner city area. These results will be shared with the health care providers serving the ALIVE study population. Increasing or continuing awareness of this significant problem will translate into an increased focus on this issue and ultimately an improvement in blood pressure control. Using the three pronged approach identified in the Cox model, the patient, the health care provider, and the patient-provider relationship, all need to be included in the development of strategies that will produce positive health outcomes. The development of patient specific educational materials and health care strategies may assist to engage the individual in care. Continuing to provide patient education regarding disease awareness, medication compliance, smoking cessation, decreasing alcohol, improving diet, and increasing exercise, though minimal in effort, may have a positive effect when the patient and provider have a strong therapeutic relationship. Regardless of where the patient is receiving health care, a HIV specialty clinic or a primary care clinic, blood pressure is routinely assessed at every visit. Our goal as health care providers should be to have no missed opportunities to support the patient in achieving an acceptable blood pressure of less than 140/90.

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Table 1

Characteristics of HIV positives ALIVE participants between 2010 and 2012 (N=368)

Measure	Total Sample (N=368)
Age (median, IQR)	53 (48 – 57)
Female	127 (35%)
African American vs not	341 (93%)
>= High school	135 (37%)
Never married	257 (70%)
Legal income <5,000	256 (70%)
BMI:	
under/normal	187 (52%)
overweight	101 (28%)
obese	70 (20%)
Frequent IV use (within last 6 months)	
none	291 (79%)
<1/day	55 (13%)
>=1/day	5 (7%)
Haart (within last 6 months)	284 (77%)
CD4	
>=500	120 (33%)
350 – 499	65 (18%)
200 – 249	93 (25%)
<200	89 (24%)
HIV viral load	
non-detectable	198 (54%)
50-100,000	138 (41%)
>=100,000	30 (8%)

Note. Hypertension is defined as BP \geq 140/90 for two consecutive visits.
If more than two consecutive visits data retrieved from latest visit in timeframe.

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Table 2

Bivariate Analysis of Behavioral, Clinical and Socioeconomic Factors Associated with High Blood Pressure in the Study Sample

Measure	HTN (%) N = 67	No HTN (%) N=301	p- value	OR (unadjusted)	CI
Demographic					
Age/10yrs	54 (49 – 58)	52 (47 – 56)	0.15	1.34	0.90 – 2.01
Female	23 (34%)	104 (35%)	0.97	0.99	0.57 – 1.73
African American	66 (99%)	275 (91%)	0.23	2.08	0.62 – 7.18
Behavioral **					
BMI:					
Normal	31 (48%)	156 (53%)		1.00	
Overweight	20 (31%)	81 (28%)	0.49	1.24	0.67 – 2.32
Obese	13 (20%)	57 (19%)	0.71	1.15	0.56 – 2.35
Frequency alcohol (within last 6 months)					
None	33 (49%)	168(56%)		1.00	
Weekly	32 (48%)	124 (41%)	0.32	1.31	0.77 – 2.25
Daily	2 (3%)	9 (3%)	0.88	1.13	0.23 – 5.48
Frequency tobacco (within last 6 months)					
None	10 (15%)	81 (27%)		1.00	
<1 pack/day	42 (64%)	178(59%)	0.09	1.91	0.91 – 4.00
≥1 pack/day	14 (21%)	41 (14%)	0.03	2.77	1.13 – 6.76
Frequency IV use (within last 6 months)					
None	53 (79%)	238 (79%)		1.00	
<1/day	9 (13%)	46 (15%)	0.74	0.88	0.41 – 1.91
≥1/day	5 (7%)	17 (6%)	0.60	1.32	0.47 – 3.74
Any drug use (within last 6 months)					
None	41 (61%)	189 (63%)		1.00	
Not IV only	12 (18%)	48 (16%)	0.70	1.15	0.56 – 2.36
Any IV	14 (21%)	63 (21%)	0.94	1.02	0.52 – 2.00
Clinical					
Usual source of care	64 (96%)	294 (98%)	0.40	0.51	0.12 – 2.02
See the same person	61 (91%)	283 (94%)	0.32	0.61	0.23 – 1.61
Same person ≥2 yrs	50 (75%)	225 (75%)	0.95	0.98	0.53 – 1.80
Art	56 (84%)	239 (79%)	0.44	1.32	0.65 – 2.67
Haart (within last 6 months)	52 (78%)	232 (77%)	0.93	1.03	0.55 – 1.94
CD ₄					
≥500	17 (26%)	103 (34%)		1.00	
200 – 499	26 (40%)	132 (44%)	0.60	1.19	0.62 – 2.32
<200	23 (35%)	66 (22%)	0.04	2.11	1.05 – 4.25

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Bivariate Analysis of Behavioral, Clinical and Socioeconomic Factors Associated with High Blood Pressure in the Study Sample (cont.)

Measure	HTN (%) N = 67	No HTN (%) N=301	p-value	OR (unadjusted)	CI
HIV viral load					
Non-detectable	33 (50%)	165 (55%)		1.00	
50-100,000	27 (41%)	111 (37%)	0.50	1.22	0.69 – 2.14
≥100,000	6 (9%)	25 (8%)	0.70	1.25	0.47 – 3.30
Socio-Economic					
Currently employed	5 (7%)	30 (10%)	0.52	0.72	0.27 – 1.94
Legal income <5,000	46 (69%)	210 (71%)	0.74	0.91	0.51 – 1.61
≥ High school	23 (35%)	112 (37%)	0.77	0.92	0.53 – 1.61
Never married	50 (77%)	207 (69%)	0.20	1.50	0.80 – 2.80
Homelessness (within last 6 months)	6 (9%)	10 (3%)	0.09	2.85	1.00 – 8.14
Incarceration (≥1 wk)	2 (3%)	15 (5%)	0.48	0.58	0.13 – 2.62

** median and IQR are for continuous age, the OR and CI for 10 yr increments

Note. Hypertension is defined as BP \geq 140/90 for two consecutive visits. If more than two consecutive visits data retrieved from latest visit in timeframe. Additionally, characteristics determined from the 1st of two consecutive visits.

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Table 3

Multivariable Logistic Regression of the Likelihood of Hypertension in HIV Positive ALIVE Participants With and Without Hypertension Seen Between 7/1/2009 to 6/30/2012

Measure	OR (adjusted)	CI	p-value
Age/10yrs	1.68	1.07 – 2.63	0.02
Female	1.07	0.57 – 2.00	0.83
BMI:			
Overweight/Obese	1.62	0.89 – 2.94	0.11
Frequency tobacco (within last 6 months)			
<1 pack/day	2.14	0.99 – 4.62	0.05
≥1 pack/day	2.92	1.13 – 7.57	0.03
CD ₄			
<200	2.31	1.23 – 4.31	0.01

** median and IQR are for continuous age, the OR and CI for 10 yr increments

*** 12 observations were deleted due to missing values for the response or explanatory variables

Note. Hypertension is defined as BP \geq 140/90 for two consecutive visits. If more than two consecutive visits data retrieved from latest visit in timeframe. Additionally, characteristics determined from the 1st of two consecutive visits.