HIV Comorbidities: Pay Attention to Hypertension Amid Changing Guidelines – An Analysis of Texas Medical Monitoring Project Data

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Based on new clinical hypertension guidelines set forth by the American Heart Association and the American College of Cardiology (ACC/AHA) in November 2017:

- **69% of people living with HIV (PLWH) who received medical care in Texas in 2013-2014 were hypertensive.**
- **Hypertension was prevalent among those with traditional risk factors, such as smoking (65%), obesity (84%) and age (≥ 50 years: 83%).**
- **Age, sex, race or ethnicity, obesity, smoking, duration of antiretroviral therapy (ART) and time since HIV diagnosis were significant predictors of hypertension.**
- **Men were 2.2 times more likely to have hypertension than women (95% CI: 1.4-3.4).**
- **Obese participants had 5.7 times greater odds of being hypertensive than those with a body mass index (BMI) <25 (95% CI: 3.3-9.9).**

Background

Before treatment for HIV became widely available, PLWH typically died within 12 years of infection.[1] Nearly 90% of deaths among PLWH between 1987-1989 were attributable to AIDS-defining opportunistic infections or malignancies.[2] After thirty years of advancement in treatment regimens, availability of testing, and access to care, HIV is no longer a death sentence. PLWH who achieve durable viral suppression can now survive decades after infection with a life expectancy comparable to the general population of the United States; however, with longer lifespans comes increased burden of chronic disease.[3] In high-income countries like the U.S., the majority (53%) of deaths in PLWH are from non-AIDS causes, 15% of which result from cardiovascular disease.[4]

Hypertension is a chief risk factor for cardiovascular disease and is implicated in 75% of all strokes and heart attacks.[5,6] Upon review of available literature, we found that studies of the burden of hypertension among PLWH were sparse relative to the number available for the general population with very little discussion of undiagnosed hypertension, when patients with charted high blood pressure readings do not receive a formal diagnosis of hypertension. No studies specific to Texas were available.

Methods

To address this gap, we investigated the prevalence of hypertension and associated risk factors among participants in the 2013-2014 Medical Monitoring Project (MMP), a surveillance system designed by the Centers for Disease Control and Prevention (CDC) to capture clinical and behavioral data from a representative sample of PLWH who are receiving HIV care.[7] We examined abstracted medical record data of 957 participants from the Texas and Houston, Texas, project areas. Participants with hypertension were identified by formal diagnosis, antihypertensive medication use or high blood pressure readings within the preceding two years. We used both the diagnostic criteria set forth by the Joint National Commission (JNC 7) in 2003[8] – the commonly used threshold of 140/90 mmHg – and the lower threshold of 130/80 mmHg recently recommended by the ACC/AHA in 2017 (Table 1) in order to assess the impact of changing guidelines.[9] Associations with sociodemographic characteristics were assessed using Rao-Scott chi-square tests at significance level of $p<0.05$. Odds of hypertension were calculated using multivariable logistic regression models while adjusting for several demographic and HIV-related variables.

Table 1. Diagnostic criteria used to identify hypertensive participants.[8-10]

Measure	2003 JNC 7 Guidelines	2017 ACC/AHA Guidelines
Average of last three systolic readings	≥ 140 mmHg	≥ 130 mmHg
Average of last three diastolic readings	≥ 90 mmHg	≥ 80 mmHg
One systolic reading	>180 mmHg	>180 mmHg
One diastolic reading	>120 mmHg	>120 mmHg
Three systolic readings	≥ 140 mmHg	≥ 130 mmHg
Three diastolic readings	≥ 90 mmHg	≥ 80 mmHg

Results

JNC 7: The diagnostic criteria recommended in JNC 7 (140/90 mmHg) were the standard at the time of the 2013-2014 MMP survey. Under these criteria, prevalence of hypertension was markedly higher among sampled PLWH (47.6%) than the general adult population in Texas at that time (31%).[11] Age, race or ethnicity, obesity, smoking, binge drinking, duration of ART use and time since HIV diagnosis were associated with hypertension (Table 2). It should be noted, however, that age may attenuate these relationships.

ACC/AHA: After applying the lower diagnostic threshold of 130/80 mmHg recently recommended by ACC/AHA to 2013-2014 MMP survey data, prevalence of hypertension among sampled PLWH rose by more than 20 percentage points, from 47.6% to 68.7% (Table 2). Nearly one-third of PLWH with hypertension lacked evidence of hypertension diagnoses or treatment in their medical chart. The ACC/AHA expect that 14% more people in the general population will be diagnosed with hypertension once these new guidelines are adopted as standard;[12] therefore, we anticipate that hypertension prevalence among PLWH will still remain substantially higher than the general population. Age, race or ethnicity, obesity, smoking, duration of ART use and time since HIV diagnosis remained significantly associated with hypertension; however, binge drinking became only marginally significant (Table 2).

Discussion

Our results show that PLWH are disproportionately burdened by hypertension. Why?

- **Aging:** Incidence and prevalence of chronic disease increases with age and as a whole, PLWH are aging.[13] Incidence of hypertension in PLWH increases by 34% for every 10-year increase in age, with the highest risk among those 40 years of age or older who have lived 10 or more years with HIV.[14,15] Nearly 60% of PLWH in care in Texas are over the age of 45, and more than half have lived 10 or more years since their HIV diagnosis.

- **Modifiable Risk Factors:** Additionally, the presence of traditional modifiable risk factors of hypertension, such as smoking and obesity, is high among PLWH. A third of the 2013-2014 MMP survey sample were current smokers, and another 21% were former smokers. Prevalence of hypertension was higher among former smokers than current smokers or those who never smoked. Wasting, which once characterized advanced HIV infection, is now more an exception than the rule.[16] Just 6% of our sample were underweight, while 64% were overweight or obese. This may be the result of improved health status or side effects of HIV medications, or may simply reflect the growing obesity epidemic in the U.S.[16]

- **Biological Pathways:** Emerging research indicates that inflammatory immune response to HIV infection may damage the endothelial receptors in the lining of vasculature that regulate blood pressure, leaving PLWH predisposed to development of hypertension.[17] While there are conflicting studies on the relationship between hypertension and the class and/or duration of ART, our results demonstrate a significant association between length of time on any ART and hypertension. Future analysis of MMP survey data may involve cross-tabulation by class of ART.

Limitations

The 2013-2014 MMP survey only sampled PLWH in care, so the results may not be generalizable to those who are not linked to care or are unaware of their HIV status. It is possible that those sampled may receive primary care elsewhere, and resulting diagnoses may not be captured in the abstracted medical record. We also cannot guarantee the accuracy of blood pressure readings or control for white coat syndrome. General population data from the Behavioral Risk Factor Surveillance System survey rely on self-report, and we lack a HIV-negative control group for comparison. We intended to use the Centers for Disease Control and Prevention Million Hearts Hypertension Prevalence Estimator Tool to simulate a HIV-negative cohort; however, the tool has not yet been updated to reflect the latest hypertension guidelines. Data are not currently available to determine if sampled PLWH had hypertension at the time of their HIV diagnosis (prevalent hypertension) or if they developed hypertension in the time since (incident hypertension). This is a point of future research interest, as it will further clarify the relationship between HIV and hypertension.

Table 2. Hypertension prevalence among the 2013-2014 MMP sample by characteristics and guideline set

Characteristic	Hypertension Prevalence*			
	JNC 7 (140/90 mmHg)		ACC/AHA (130/80 mmHg)	
Total	**47.6%**		**68.7%**	
Age				
18-39	24.9%		50.2%	
40-49	43.4%	$p < 0.0001$	67.8%	$p < 0.0001$
50+	67.7%		83.0%	
Sex				
Male	47.4%		70.2%	
Female	48.5%	$p = 0.7859$	64.0%	$p = 0.0882$
Race/Ethnicity				
Non-Hispanic white	50.2%		73.3%	
Non-Hispanic black	53.4%	$p = 0.0007$	72.9%	$p = 0.0003$
Hispanic	38.6%		60.2%	
Body Mass Index (kg/m2)				
24.9 or below (underweight to normal)	40.8%		55.9%	
25 to 29.9 (overweight)	43.6%	$p < 0.0001$	70.5%	$p < 0.0001$
30 and above (obese)	62.9%		84.4%	
Education				
<High school diploma	49.7%		66.8%	
=High school diploma or equivalent	45.1%	$p = 0.6186$	68.1%	$p = 0.8002$
>High school diploma	48.4%		69.7%	
Insurance				
Uninsured	34.2%		51.2%	
Public (including Ryan White)	49.3%	$p = 0.2562$	69.0%	$p = 0.2519$
Private	44.5%		69.1%	
Poverty				
Above federal poverty level	46.4%		69.3%	
Below federal poverty level	50.0%	$p = 0.2852$	67.9%	$p = 0.6551$
Smoking Status				
Never smoker	42.8%		66.2%	
Former smoker	58.3%	$p = 0.0027$	79.4%	$p = 0.0050$
Current smoker	47.3%		65.3%	
Binge Drinking				
Yes	40.8%		65.4%	
No	49.4%	$p = 0.0467$	69.4%	$p = 0.3757$
Duration of ART Use				
<10 years	37.0%		60.4%	
≥ 10 years	61.1%	$p < 0.0001$	79.6%	$p < 0.0001$
Time Since HIV Diagnosis				
<5 years	35.4%		61.1%	
5-9 years	37.2%	$p < 0.0001$	58.7%	$p < 0.0001$
≥ 10 years	58.9%		77.2%	
Viral Load (copies/mL)				
<200 (undetectable)	48.7%		69.7%	
≥ 200	45.1%	$p = 0.3560$	66.2%	$p = 0.3361$

*Weighted frequencies

Conclusion

Hypertension is highly prevalent among PLWH, and with changing guidelines a sizeable number may be undiagnosed despite indicative blood pressure readings. Since PLWH in care are living longer after HIV infection, chronic diseases and their risk factors should be routinely addressed in HIV care, particularly hypertension and weight management. This will facilitate continued improvement in quality and length of life for PLWH. This may require cross-training of both primary care providers and infectious disease specialists on the concepts of both HIV care and chronic disease prevention and management. Case manager workflow may need to be revisited so that patients can be navigated to both the HIV care and chronic disease management services they need. Public health professionals can help fill these gaps by increasing clinicians' awareness; leveraging community-clinical linkages to support behavioral change by connecting PLWH to community resources for chronic disease management; and promoting health systems interventions to mitigate missed opportunities for diagnosis and treatment of hypertension and other chronic disease risk factors.

Human Subjects

IRB approval was not needed as this was an analysis of secondary data.

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