Hypertension Among Persons Living With HIV in Medical Care in the United States—Medical Monitoring Project, 2013–2014

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Hypertension is a leading modifiable risk factor for cardiovascular disease (CVD), and persons living with HIV are at increased risk for both hypertension and CVD. Therefore, using data from a nationally representative sample of patients living with HIV, we assessed missed opportunities for the optimal management of hypertension.

Keywords. HIV; hypertension; cardiovascular disease; prevalence; Medical Monitoring Project.

Cardiovascular disease (CVD) is a leading cause of morbidity and mortality among people living with HIV (PLWH) [1, 2], and hypertension is a primary modifiable risk factor for CVD. Some studies suggest that the prevalence of hypertension among PLWH is higher than among the general population, possibly explained by a higher prevalence of smoking and HIV-specific factors such as immune activation, inflammation, and long-term effects of antiretroviral therapy [3–5]. It is important to optimize hypertension screening and management in this at-risk group in order to decrease complications including CVD. We estimated prevalence of hypertension overall, as well as by diagnosis, treatment, and control status in a nationally representative sample of patients receiving HIV medical care in the United States.

METHODS

The Medical Monitoring Project (MMP) is a surveillance system designed to produce nationally representative estimates of the behavioral and clinical characteristics of HIV-infected adults in the United States. For the 2013 and 2014 data collection cycles, US states and territories were sampled, followed by outpatient facilities providing HIV care within those jurisdictions, and finally by HIV-infected adults aged 18 years and older who had at least 1 medical care visit in a participating facility during January–April of the referent year.

Data were collected via face-to-face or telephone interviews and medical record abstractions. A total of 10,184 participants were interviewed and had a medical record abstracted during this period. Medical records were abstracted for the 2 years preceding a respondent’s interview. A more detailed description of the MMP methods is provided elsewhere [6]. In 2013, response rates were 100% among states/territories, 85.0% among facilities, and 54.9% among participants with both interview and medical record abstraction (MRA data). In 2014, response rates were 100% (states/territories), 86.5% (facilities), and 55.7% (participants). Information on diagnoses, medications, and blood pressure readings were collected during MRAs.

MEASUREMENTS

Hypertension was defined using 3 criteria: diagnosis (documented diagnosis of hypertension), treatment (prescription of antihypertensive medication), and high blood pressure readings (an average of the last 2 systolic blood pressures ≥140 mm Hg or diastolic readings ≥90 mm Hg). These criteria were combined such that a participant was classified as hypertensive if they met both diagnosis and treatment criteria or they met high blood pressure reading criteria. Hypertension was categorized as “undiagnosed and untreated,” “diagnosed and treated,” and “unclassified.” Patients who were “diagnosed and treated” were further classified as controlled or uncontrolled (Supplementary appendix figure).

If a diagnosis of hypertension (or synonyms such as “high blood pressure” and “essential hypertension”) was abstracted from the medical records, the respondent met the diagnosis criterion. Respondents who had no diagnoses of any kind abstracted (eg, participants for whom a detailed MRA could not be conducted) were considered missing diagnosis information.

An extensive list of antihypertensive medication was used to classify respondents for the treatment criterion (Supplementary Appendix 1). Respondents who had no medications of any kind abstracted were considered to be missing treatment information.

Respondents were classified as having high blood pressure readings based on the average of the last 2 readings. Those who had only 1 set of blood pressure readings or those who had no blood pressure documented were considered to be missing blood pressure information.

Respondents who had hypertension were subclassified as follows:

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Undiagnosed and untreated hypertension—met high blood pressure readings criterion but not diagnosis and treatment criteria;
Treated and controlled hypertension—met diagnosis and treatment criteria but not the high blood pressure readings criterion;
Treated and uncontrolled hypertension—met all 3 criteria;
Unclassified hypertension—respondents who did not fall into any of the above categories and were missing information on any of the 3 criteria, or who met treatment and high blood pressure readings criteria but did not have a diagnosis (because antihypertensives can also be used to treat other conditions).

DATA ANALYSES

Respondents were excluded if there was not enough information to classify them as hypertensive or nonhypertensive using the aforementioned 3 criteria. We estimated the weighted prevalence and associated 95% confidence intervals (CIs) of hypertension, overall and by subcategory (undiagnosed and untreated, treated and controlled, treated and uncontrolled, and unclassified). We estimated the prevalence of overall and undiagnosed and untreated hypertension stratified by sociodemographic, behavioral, and clinical characteristics. Rao-Scott chi-square tests were used to assess differences in the prevalence of hypertension by characteristics. Data were weighted for unequal selection probabilities and nonresponse.

In accordance with the federal human subjects protection regulations at 45 Code of Federal Regulations 46.101c and 46.102d [7] and with the Guidelines for Defining Public Health Research and Public Health Non-Research [8], MMP was determined to be a nonresearch, public health surveillance activity used as a disease control program or for policy purposes. As such, MMP is not subject to federal investigational review board review. Participating states or territories and facilities obtained local institutional review board approval to conduct MMP if required locally. Informed consent was obtained from all interviewed participants.

RESULTS

The analytic sample included 8631 persons. Overall, 42.4% (95% CI, 40.4–44.5) of PLWH in medical care had hypertension. Of those, 13.3% (95% CI, 11.7–14.9) were undiagnosed and untreated, 48.9% (95% CI, 46.7–51.1) were treated and controlled, 26.3% (95% CI, 24.2–28.3) were treated and uncontrolled, and 11.5% (95% CI, 10.4–12.6%) were unclassified.

Hypertension was associated with age, gender, race/ethnicity, education, income, and body mass index (Table 1). For example, hypertension was more prevalent among PLWH aged ≥ 50 years than among younger age groups. About half of non-Hispanic blacks had hypertension compared with 38.9% of non-Hispanic whites and 33.5% of Hispanics/Latinos.

The prevalence of undiagnosed and untreated hypertension decreased with increasing age: 39.1%, 27.0%, 16.2%, and 9.4% among PLWH aged 18–29, 30–39, 40–49, and ≥ 50 years, respectively. There were no significant differences in the prevalence of untreated hypertension by race/ethnicity. Undiagnosed and untreated hypertension was more prevalent among recently incarcerated patients (25.7%) than among others (12.8%). PLWH who had no health insurance had a higher prevalence of untreated hypertension than those with health coverage. Undiagnosed and untreated hypertension was more prevalent among PLWH who were not virally suppressed at last test (17.0%) than among those who were (12.4%) and, though not statistically significant, was more prevalent among those who did not have a sustained viral suppression over the past 12 months (15.9%) than among those who had a sustained viral suppression (12.1%).

DISCUSSION

The prevalence of hypertension among people receiving HIV care in the United States was 42.4%, which is within the range of previously published estimates (13.0%–49.0%) [3, 4, 9, 10]. We found that about 1 in 8 patients had undiagnosed and untreated hypertension. Providers may be missing opportunities for diagnosing and treating hypertension among patients who are younger, male, uninsured, and recently incarcerated. As PLWH may be at increased risk for hypertension and its complications, including CVD, the importance of hypertension screening by providers, with the intent to effectively treat, cannot be overemphasized.

While the proportion with hypertension was lowest among younger patients (aged 18–29 years), they were more than 4 times as likely to be undiagnosed and untreated as older patients (aged ≥ 50 years). Because young PLWH are least likely to be virally suppressed [11], it is possible that providers are more focused on attaining viral suppression than addressing comorbidities, such as hypertension, in this group. With PLWH living longer lives as a result of highly active antiretroviral therapy [12], younger patients with undiagnosed and untreated hypertension potentially have many years to accrue complications of untreated and uncontrolled hypertension and therefore would benefit from early diagnosis and treatment.

Patients who experience difficulty accessing health care such as those who were recently incarcerated or have no health insurance were more likely than others to have undiagnosed and untreated hypertension. We found that patients who were not virally suppressed at last test were more likely to have their hypertension undiagnosed and untreated. Because HIV viremia is associated with increased risk of CVD [13], patients with undiagnosed and untreated hypertension who are not virally suppressed may have compounded risk for CVD. These patients may need additional support to ensure that their HIV infection and comorbidities are successfully managed.
Table 1. Sociodemographic and Clinical Characteristics of HIV-Infected Adults With Hypertension in the United States, Medical Monitoring Project 2013–2014

| Characteristics | Total | Rao Scott Chi-square | Undiagnosed and Untreated | Rao Scott Chi-square |
|-----------------|-------|-----------------------|---------------------------|----------------------|
|                 | Sample Size, No. | Weighted % (95% CI) | P Value | Sample Size With Hypertension, No. | Weighted % (95% CI) | P Value |
| Total           | 8631  | 42.4 (40.4–44.5)      | N/A | 3650  | 13.3 (11.7–14.9) | N/A |
| Age,a y         |       |                       | < .001 |       |                      | < .001 |
| 18–29           | 720  | 10.7 (8.0–13.4)       | 80 | 28.1 (25.2–31.0) | 308 | 27.0 (20.7–33.3) |
| 30–39           | 1326 | 23.1 (18.8–27.3)      | 308 | 27.0 (20.7–33.3) | 184 | 14.1 (10.4–18.0) |
| 40–49           | 2520 | 37.0 (33.8–40.3)      | 927 | 16.2 (13.9–18.6) | 595 | 12.9 (10.3–15.5) |
| ≥50             | 4065 | 58.5 (55.8–61.3)      | 2325 | 9.4 (7.7–11.2) | 1413 | 8.9 (7.0–10.8) |
| Gendera         |       |                       | < .001 |       |                      | .006 |
| Male            | 6158 | 41.2 (39.1–43.2)      | 2525 | 14.4 (12.6–16.3) | 184 | 14.1 (10.4–18.0) |
| Female          | 2353 | 46.3 (43.2–49.4)      | 1078 | 10.8 (8.6–13.1) | 151 | 5.3 (2.6–9.9) |
| Transgender     | 120  | 37.1 (28.3–45.9)      | 49 | 6.5 (2.2–12.9) | 7 | 1.0 (0.0–5.4) |
| Race/ethnicitya |       |                       | < .001 |       |                      | .059 |
| White non-Hispanic | 2498 | 38.9 (36.7–41.1) | 956 | 15.3 (12.4–18.3) | 169 | 14.7 (11.0–18.5) |
| Black non-Hispanic | 3693 | 49.8 (48.0–51.7) | 1856 | 11.4 (9.1–13.8) | 239 | 14.4 (10.4–18.4) |
| Hispanic/Latinoa | 2079 | 33.5 (31.1–36.0) | 700 | 15.4 (11.9–18.9) | 67 | 10.4 (5.7–15.1) |
| Other           | 361  | 39.6 (32.8–46.4)      | 138 | 15.0 (9.4–21.6) | 149 | 10.6 (6.2–15.1) |
| Homeless (past 12 mo)a |       |                       | < .001 |       |                      | .174 |
| No              | 7899 | 42.8 (40.6–44.1)      | 3365 | 13.1 (11.4–14.7) | 2400 | 13.3 (11.3–15.4) |
| Yes             | 731  | 38.0 (34.7–41.3)      | 284 | 16.2 (11.5–21.0) | 157 | 11.0 (6.4–15.6) |
| Poverty statusa |       |                       | < .001 |       |                      | .018 |
| Above poverty level | 4070 | 41.2 (39.1–43.3) | 1670 | 15.0 (12.7–17.3) | 436 | 14.3 (10.6–18.0) |
| At or below poverty level | 4165 | 44.3 (41.8–46.7) | 1831 | 11.8 (10.0–13.6) | 526 | 12.9 (10.2–15.5) |
| Educationa      |       |                       | < .001 |       |                      | .045 |
| <high school    | 1799 | 46.1 (43.5–48.7)      | 827 | 10.8 (8.0–13.9) | 233 | 10.0 (6.4–13.6) |
| high school     | 2390 | 43.7 (41.1–46.4)      | 1036 | 12.9 (9.6–16.4) | 370 | 13.3 (9.4–17.1) |
| >high school    | 4438 | 40.2 (38.0–42.5)      | 1785 | 15.2 (12.6–17.7) | 585 | 13.8 (10.7–17.0) |
| Incarceration (past 12 mo)a |       |                       | < .001 |       |                      | .001 |
| No              | 8246 | 42.7 (40.6–44.8)      | 3513 | 12.8 (11.2–14.4) | 1665 | 11.3 (9.8–12.8) |
| Yes             | 383  | 36.7 (32.0–41.5)      | 136 | 25.7 (16.2–35.1) | 151 | 18.1 (9.9–26.3) |
| Health insurance coveragea |       |                       | < .001 |       |                      | .003 |
| Any private insurance | 2257 | 36.5 (34.0–39.1) | 905 | 16.9 (13.3–20.5) | 229 | 14.5 (9.9–19.9) |
| Public insurance only | 4856 | 47.5 (44.9–50.2) | 2290 | 11.4 (8.9–12.9) | 1168 | 11.4 (9.3–13.5) |
| RW only         | 1135 | 30.4 (26.4–34.5)      | 330 | 15.9 (12.3–19.5) | 497 | 11.7 (8.6–14.9) |
| No insurance    | 117  | 35.0 (24.6–46.9)      | 41 | 19.7 (9.6–29.9) | 47 | 10.4 (4.3–16.5) |
| Unspecified     | 152  | 48.3 (39.7–56.9)      | 72 | 10.6 (3.3–20.9) | 58 | 11.7 (4.3–19.1) |
| Smoking statusa |       |                       | < .001 |       |                      | .042 |
| Never smoked/former smoker | 5397 | 42.8 (40.8–44.9) | 2318 | 12.3 (10.5–14.1) | 832 | 10.4 (7.2–13.7) |
| Current smoker  | 3201 | 41.7 (39.2–44.3)      | 1317 | 15.1 (12.6–17.5) |
### Table 1

| Characteristics                              | Total                           | Undiagnosed and Untreated |
|----------------------------------------------|--------------------------------|---------------------------|
|                                              | Sample Size, No. | Weighted % (95% CI) | P-Value | Sample Size With Hypertension, No. | Weighted % (95% CI) | P-Value |
| BMI                                          |                 |                     |         |                                   |                     |         |
| Underweight                                  | 192              | 32.2 (25.1–39.2)    | <.001   | 59                                | 11.9 (2.2–21.6)     | .62     |
| Normal/healthy weight                        | 2613             | 31.7 (29.3–34.1)    | .062    | 832                               | 13.7 (11.7–15.8)    | .063    |
| Overweight                                   | 2551             | 41.6 (39.3–43.9)    | .003    | 1064                              | 14.6 (12.5–16.7)    | .003    |
| Obese                                        | 2032             | 60.2 (57.0–63.4)    | .003    | 1211                              | 11.0 (9.1–12.9)     | .003    |
| Lowest CD4 count (past 12 mo), f cells/µL   |                 |                     |         |                                   |                     |         |
| 0–49                                         | 243              | 37.9 (31.2–44.6)    | .003    | 89                                | 22.1 (12.2–32.0)    | .003    |
| 50–199                                       | 860              | 37.0 (33.7–40.2)    | .003    | 325                               | 15.5 (11.7–19.2)    | .003    |
| 200–349                                      | 1444             | 43.1 (40.1–46.1)    | .003    | 625                               | 12.1 (9.4–14.8)     | .003    |
| 350–499                                      | 1883             | 42.9 (40.2–45.6)    | .003    | 905                               | 13.4 (11.0–15.8)    | .003    |
| ≥500                                         | 3883             | 43.7 (41.2–46.2)    | .003    | 1672                              | 12.3 (10.1–14.5)    | .003    |
| Virally suppressed at last test, f,g         |                 |                     | .508    |                                   |                     | .40     |
| No                                           | 1068             | 41.1 (37.5–44.7)    | .508    | 438                               | 17.0 (12.5–21.5)    | .508    |
| Yes                                          | 7063             | 42.4 (40.3–44.6)    | .508    | 2992                              | 12.4 (10.7–14.1)    | .508    |
| Sustained viral suppression, f,h             |                 |                     | .026    |                                   |                     | .057    |
| No                                           | 2033             | 39.2 (36.5–42.0)    | .026    | 826                               | 15.9 (12.6–19.3)    | .026    |
| Yes                                          | 6038             | 43.3 (40.9–45.8)    | .026    | 2604                              | 12.1 (10.0–14.1)    | .026    |

**Abbreviations:** ART, antiretroviral therapy; BMI, body mass index; CI, confidence interval; HIV, human immunodeficiency virus; No., sample size of each stratum of variables.

- Variables obtained from interview.
- Hispanics/Latinos could be of any race.
- McKinney-Vento definition of homelessness: living on the street, living in a shelter, living in a single room occupancy hotel, temporarily staying with friends or family, or living in a car. A person is categorized as homeless if that person lacks a fixed, regular night-time residence or has a steady night-time residence that is (1) a supervised public or privately operated shelter designed to provide temporary living accommodation, (2) an institution that provides a temporary residence for persons intended to be institutionalized, or (3) a public or private place not designed for or ordinarily used as a regular sleeping accommodation for human beings (eg, in an automobile or under a bridge; Stewart B. McKinney Homeless Assistance Act, 42 U.S.C. §11301, et seq; 1987).
- US Department of Health and Human Services. Available at: http://aspe.hhs.gov/poverty/09poverty.shtml.
- Includes general education development credential.
- Variables obtained from medical records.
- HIV RNA undetectable or <200 copies/mL at last test.
- HIV RNA undetectable or <200 copies/mL at all tests in the last 12 months.
This study has limitations. We were unable to directly compare hypertension prevalence among PLWH (42%) with prevalence in the general US population (29%) as measured by the National Health and Nutrition Examination Survey [14] because of methodologic differences between the 2 population surveys. We were conservative in our definition of hypertension by requiring both diagnosis and pharmacological treatment or high blood pressure readings; therefore, our prevalence may represent an underestimation of burden of hypertension among PLWH. MMP data do not indicate whether a patient is receiving lifestyle modification counseling. If this information were available and we had considered lifestyle modification as treatment, our estimates of the overall prevalence of hypertension and the prevalence of those who were “treated and uncontrolled” or “treated and controlled” might have been higher. Similarly, our estimate of the prevalence of untreated hypertension might have been lower.

In conclusion, PLWH who received medical care in the United States had a high prevalence of hypertension. Providers may be missing opportunities to diagnose and treat hypertension among their HIV patients, especially those who are younger or have less access to care. It is important to improve hypertension screening and management to prevent CVD outcomes, for which PLWH have high risk.

**Supplementary Data**
Supplementary materials are available at Open Forum Infectious Diseases online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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