VIEWPOINT

Patients With Undiagnosed Hypertension
Hiding in Plain Sight

Hilary K. Wall, MPH
Centers for Disease Control and Prevention, Atlanta, Georgia.

Judy A. Hannan, RN, MPH
Centers for Disease Control and Prevention, Atlanta, Georgia.

Janet S. Wright, MD
Centers for Disease Control and Prevention, Atlanta, Georgia.

According to the 2011-2012 National Health and Nutrition Examination Survey (NHANES), a nationally representative, cross-sectional survey of the noninstitutionalized US population that combines interviews and physical examinations, 1 of 3 US adults (estimated at approximately 71 million people) has high blood pressure and almost half of these individuals (48.2%) do not have their blood pressure under control.[1] Closer examination of the population with uncontrolled blood pressure reveals that 36.2% (estimated at approximately 13 million people) are neither aware of their hypertension nor taking antihypertensive medications.[1]

A common assumption might be that these individuals are among the uninsured population without regular access to the health care system and who, consequently, have not had an opportunity for detection and diagnosis of hypertension. However, data from analysis of 2009-2012 NHANES show that among the unaware, untreated, and uncontrolled hypertensive population, 81.8% have health insurance, 82.5% have a usual source of care, and 61.7% have received care 2 or more times in the past year (written communication from Cathleen Gillespie, MS, Centers for Disease Control and Prevention, October 30, 2014). These data suggest that potentially millions of people with uncontrolled high blood pressure are being seen by health care professionals each year but remain undiagnosed and "hiding in plain sight" within clinical settings.

Closer examination of the population with uncontrolled blood pressure reveals that 36.2% (estimated at approximately 13 million people) are neither aware of their hypertension nor taking antihypertensive medications.

Million Hearts is a federal initiative launched by the US Department of Health and Human Services in 2012 with the goal of preventing 1 million myocardial infarctions and strokes by 2017 by implementing proven interventions in clinical settings and communities. Upon inception, this initiative focused on blood pressure control as one of the most important clinical preventive services for heart disease and stroke.[2] Through efforts to identify and disseminate best practices, it became apparent that some health care systems have, in their attempts to improve blood pressure control, discovered that some patients are at risk for undiagnosed hypertension. These "at-risk" patients were seen regularly, often multiple times in the previous year, and had multiple high blood pressure readings documented, but they had not been diagnosed as having hypertension.

To address this issue, some practices use health information technology to identify patients with undiagnosed hypertension. Most follow a similar process of (1) establishing clinical criteria for potential undiagnosed hypertension, (2) searching the electronic health record (EHR) data for patients that met the clinical criteria, and (3) determining a plan for addressing the identified population.

NorthShore University Health System used its EHR to detect individuals with undiagnosed hypertension in its primary care network. Using an enterprise-wide data warehouse of records from 2009 and 2010, NorthShore embedded several algorithms into the EHR to identify patients at risk for undiagnosed hypertension and then implemented a diagnostic protocol using an automated office blood pressure (AOBP) machine to verify whether patients identified by the algorithms actually had hypertension. Of the 520 patients who were identified by the algorithms and had a subsequent visit during which an AOBP was measured, 246 (47%) were found to have hypertension and another 185 (36%) were determined to have "white coat" hypertension, prehypertension, or elevated blood pressure (all based on *International Classification of Diseases, Ninth Revision, Clinical Modification* [*ICD-9-CM*] codes). Rakotz and colleagues[3] also reviewed 50 randomly selected patient charts from the cohort identified by the algorithms to validate that patients had undiagnosed hypertension and not undocumented hypertension. Of the 50 patients, 2 patients (4%) had physician notes that mentioned hypertension; only 1 of those 2 patients and an additional patient (4%) received antihypertensive medications despite not having a hypertension-related diagnosis code.

Geisinger Health System used EHR data from more than 400 000 adult outpatients with at least 3 encounters between January 1, 2004, and December 31, 2008, to identify patients with hypertension based on the clinical problem list, the *ICD-9-CM* diagnosis associated with a clinical encounter, antihypertensive medications prescribed, or 2 elevated clinical blood pressure values (2 systolic measures ≥140 or 2 diastolic measures ≥90) based on the Seventh Joint National Committee (JNC 7) criteria. More than 106 000 patients met 1 or more of the above criteria and, among those, 30% had not been identified as hypertensive based on the 3 physician-dependent criteria (ie, problem list documentation,

Corresponding Author: Hilary K. Wall, MPH, Centers for Disease Control and Prevention, 4770 Buford Hwy NE, MS F72, Atlanta, GA 30341 (hwall@cdc.gov).

ICD-9-CM diagnosis code assignment, or antihypertensive prescription), despite having 2 or more elevated blood pressure readings. These patients represent a large pool for which further clinical intervention should be considered.[4]

The Palo Alto Medical Foundation examined a cross-sectional sample of EHR records from more than 250 000 adult patients, active between 2006 and 2008, and found that among patients with 2 or more blood pressure readings of 140/90 or higher, an antihypertensive medication prescription, or both, 37.1% did not have an *ICD-9-CM* code for hypertension. Using this broader definition of hypertension, Banerjee and colleagues[5] determined the health system hypertension prevalence was 28.7%, much higher than the 18.0% prevalence found when using diagnosis codes only. Through predictive modeling, the authors found that having a hypertension diagnosis was associated with significantly higher medication treatment rates (92.6% diagnosed vs 15.8% undiagnosed, $P < .001$).

Baus and colleagues[6] assessed issues with the structure, consistency, and completeness of EHR data as those data pertain to hypertension diagnosis. In this retrospective study of essential hypertension in all active patients as of December 31, 2010, from 11 primary care centers in West Virginia, the authors used the Chronic Disease Electronic Management System, public-domain registry program to query EHR data for 3 mutually exclusive groups of patients with hypertension: patients with *ICD-9-CM* code 401, patients with 2 or more blood pressure readings of 140/90 or higher, and patients with a diagnosis of essential hypertension based on free-text entries. The query identified 14 893 patients; 13.3% had 2 or more elevated blood pressure readings (n = 1076) or free-text diagnosis (n = 898) only. The percent of missed potentially hypertensive patients varied across the 11 sites from 3.6% to 47.9%.

These examples indicate that when EHR data for a patient population are closely examined, up to approximately 40% of patients who meet clinical criteria for hypertension may not have been assigned a diagnosis code. These patients are less likely to receive treatment[3,5] and remain at increased risk for myocardial infarction, stroke, and kidney or heart failure. Moreover, because performance measures for blood pressure control typically rely on the use of *ICD-9-CM* codes to generate measure denominators, hypertensive patients without a diagnosis code are excluded from quality metrics, resulting in a potentially inaccurate and inflated blood pressure control rate for the population.

Health care professionals can identify and treat patients in their practices whose hypertension has not been diagnosed, by taking several steps. First, assess practice data, as undertaken in the examples described. Among the approaches are querying an EHR registry, extracting data using quality improvement software, and embedding automated algorithms into the EHR. Practices should select the clinical criteria to be applied from the published literature using the most current evidence-based criteria available.[7-10]

Second, adopt a systematic approach to assess patients identified as potentially having hypertension. Design care pathways that direct patients at risk to appropriate confirmatory studies and timely follow-up with the treating clinician. For patients confirmed to have hypertension, institute standardized treatment algorithms and at least monthly feedback to the clinical care team to help patients achieve and maintain blood pressure control.

Third, estimate the hypertension prevalence of the practice [(adult patients with a diagnosis of essential hypertension / adult patients) × 100] and compare the estimate to the national estimate of 29.1%.[1] Alternatively, use valid state or local prevalence estimates as comparisons. Although patient population characteristics vary across practices, a prevalence estimate that is considerably below national or local estimates signals the need for additional systematic searching for those patients with patterns of elevated blood pressure whose hypertension has not yet been diagnosed. This is particularly important for practices that provide care for the non-Hispanic black population or individuals older than age 60 years, as these groups have hypertension prevalence rates of 42.1% and 65.0%, respectively.[1] Comparing practice prevalence to national or local values could add much needed context to blood pressure control rates and may help identify patients who might benefit from additional clinical action.

The nation can and must improve hypertension control to reduce preventable myocardial infarctions and strokes. However, improvement can only occur if all patients with hypertension are promptly identified, accurately diagnosed, and provided with evidence-based treatment and support.

ARTICLE INFORMATION

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

Disclaimer: The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Additional Contributions: We thank Cathleen Gillespie, MS (Centers for Disease Control and Prevention), for analyzing the 2009-2012 National Health and Nutrition Examination Survey data. No compensation was provided for this work.

REFERENCES

1. Nwankwo T, Yoon SS, Burt V, Gu Q. Hypertension among adults in the United States: National Health and Nutrition Examination Survey, 2011–2012. http://www.cdc.gov/nchs/data/databriefs/db133.pdf. Accessed October 24, 2014.

2. Farley TA, Dalal MA, Mostashari F, Frieden TR. Deaths preventable in the US by improvements in use of clinical preventive services. *Am J Prev Med*. 2010;38(6):600-609.

3. Rakotz MK, Ewigman BG, Sarav M, et al. A technology-based quality innovation to identify undiagnosed hypertension among active primary care patients. *Ann Fam Med*. 2014;12(4):352-358.

4. Shah NR. *Identifying hypertension in electronic health records: a comparison of various approaches*. Paper presented at: AHRQ Comparative Effectiveness Research Methods Symposium; June 2009; Rockville, MD.

5. Banerjee D, Chung S, Wong EC, Wang EJ, Stafford RS, Palaniappan LP. Underdiagnosis of hypertension using electronic health records. *Am J Hypertens*. 2012;25(1):97-102.

6. Baus A, Hendryx M, Pollard C. Identifying patients with hypertension: a case for auditing electronic health record data [published online April 1, 2012]. *Perspect Health Inf Manag*. 2012;9:1e.

7. James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, Handler J, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*. 2014;311(5):507-520.

8. Weber MA, Schiffrin EL, White WB, et al. Clinical practice guidelines for the management of hypertension in the community. *J Clin Hypertens (Greenwich)*. 2014; 16(1):14-26.

9. Wright JT, Fine LJ, Lackland DT, et al. Evidence supporting a systolic blood pressure goal of less than 150 mm Hg in patients aged 60 years or older. *Ann Intern Med*. 2014;160(7):499-503.

10. Mancia G, Fagard R, Narkiewicz K, et al. 2013 ESH/ESC guidelines for the management of arterial hypertension. *J Hypertens*. 2013;31(7):1281-1357.