

Recidivism to uncontrolled blood pressure in patients with previously controlled hypertension



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Background Control of hypertension has improved nationally with focus on identifying and treating elevated blood pressures (BPs) to guideline recommended levels. However, once BP control is achieved, the frequency in which BP falls out of control and the factors associated with BP recidivism is unknown. In this retrospective cohort study conducted at 2 large, integrated health care systems we sought to examine rates and predictors of BP recidivism in adults with controlled hypertension. No change for methods, results and conclusion.

Methods Patients with a prior diagnosis of hypertension based on a combination of *International Classification of Diseases, Ninth Revision*, codes, receipt of antihypertensive medications, and/or elevated BP readings were eligible to be included. We defined controlled hypertension as normotensive BP readings (<140/90 mm Hg or <130/80 mm Hg in those with diabetes) at 2 consecutive primary care visits. We then followed up patients for BP recidivism defined by the date of the second of 2 consecutive BP readings >140/90 mm Hg (>130/80 mm Hg for diabetes or chronic kidney disease) during a median follow-up period of 16.6 months. Cox proportional hazards regression assessed the association between patient characteristics, comorbidities, medication adherence, and provider medication management with time to BP recidivism.

Results A total of 23,321 patients with controlled hypertension were included in this study. The proportion of patients with hypertension recidivism was 24.1% over the 16.6-month study period. For those with BP recidivism, the median time to relapse was 7.3 months. In multivariate analysis, those with diabetes (hazard ratio [HR] 3.99, CI 3.67-4.33), high normal baseline BP (for systolic BP HR 1.03, CI 1.03-1.04), or low antihypertensive medication adherence (HR 1.20, CI 1.11-1.29) had significantly higher rates of hypertension recidivism. Limitations of this work include demographics of our patient sample, which may not reflect other communities in addition to the intrinsic limitations of office-based BP measurements.

Conclusions Hypertensive recidivism occurs in a significant portion of patients with previously well-controlled BP and accounts for a substantial fraction of patients with poorly controlled hypertension. Systematic identification of those most at risk for recidivism and implementation of strategies to minimize hypertension recidivism may improve overall levels of BP control and hypertension-related quality measures. (*Am Heart J* 2015;169:791-7.)

Over the past 2 decades, awareness, treatment, and control of hypertension (HT) have improved in the United States. This improvement has been attributed to community-based HT treatment strategies and programs,

performance measurement by organizations such as the National Committee of Quality Assurance, and promulgation of guideline-concordant care by professional societies.¹⁻³ To date, however, the focus of HT care has been on achieving blood pressure (BP) control with less emphasis on maintenance of control.

As overall rates of HT treatment and control continue to improve, maintenance of BP control becomes an increasingly important aspect of HT care. Limited prior work of patients with HT who achieved BP control after clinical intervention show that a significant portion falls out of control once the study intervention period is over. In addition, evidence suggests that this decline is rapid after completion of the trial.⁴ The extent to which BP falls out of control (BP recidivism) and the factors associated

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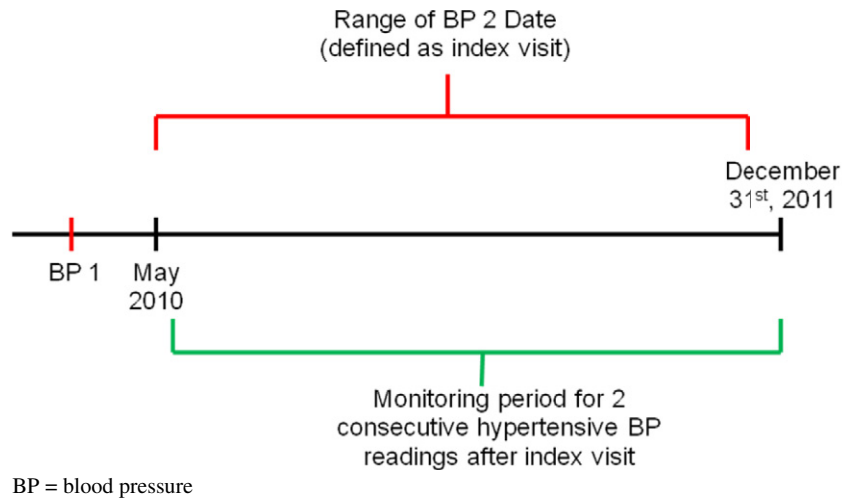
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Figure 1

Summary of the timeline of BP readings and index visit for patients enrolled in this study.

with recidivism have been understudied and have not been evaluated in large patient populations.

Accordingly, we assessed the prevalence and correlates of BP recidivism within 2 large integrated health care delivery systems in Minnesota and Colorado. Specifically, the objectives of this study were to (1) examine the rates of BP recidivism among a population of patients with HT with controlled BP and (2) identify patient and process of care factors associated with BP recidivism. The findings of this study may help health care systems identify and intervene proactively with patient populations at high risk of recidivism, thus improving overall population rates of HT control.

Methods

Study design

This longitudinal, retrospective cohort study was conducted at 2 large, integrated health care systems in Minnesota and Colorado with high baseline HT control in their respective patient populations participating in the Cardiovascular Research Network (CVRN) Hypertension Registry. Details regarding the CVRN Hypertension Registry are available elsewhere.⁵ No extramural funding was used to support this work. The authors are solely responsible for the design and conduct of this study, all study analyses, and drafting and editing of the manuscript.

Patients were eligible for inclusion if they could be linked to a primary care provider in 1 of the 2 health care systems noted above and had ≥ 1 visits with this provider to establish an index visit date. Adults were classified as having HT if they met any of the following criteria⁶: (1) receipt of *International Classification of Diseases, Ninth Revision (ICD-9)*, HT diagnostic code on 2 separate

office visits; (2) 1 *ICD-9* HT diagnostic code in addition to a filled prescription for an antihypertensive medication; (3) 1 *ICD-9* HT diagnostic code in addition to 1 elevated BP reading at an office visit; or (4) BP $>140/90$ mm Hg or $>130/80$ mm Hg if noted to have coexisting diabetes at 2 consecutive office visits on different days.

Among patients meeting study inclusion criteria for HT, we identified and included in the analysis all those who had 2 consecutive primary care office visits (based on an index primary care office visit and an antecedent office visit) with normal BP readings (defined as $\leq 140/90$ mm Hg or $\leq 130/80$ mm Hg if coexisting diabetes was present) between May 2010 through December 2011. Next, we followed up patients through December 31, 2011, and assessed BP recidivism defined by the date of the second of 2 consecutive BP readings $>140/90$ mm Hg ($>130/80$ mm Hg for diabetes) during a mean follow-up period of 15.8 months. Figure 1 summarizes the timeline of BP readings for this study. Figure 2 displays enrollment, inclusion criteria, and total target population. Of the 64,715 patients with HT, 23,321 patients were included because they met study criteria for HT and had normal BP readings at 2 consecutive primary care visits from integrated health care systems located in Minnesota and Colorado.

To determine medication treatment factors associated with BP recidivism, the multivariate analysis was limited to 61% of the complete data set ($n = 14,210$) who were on BP medications in the period after the index date, and had claims needed to compute proportion of days covered (PDC) as a surrogate of medication adherence.⁷

Data sources and definition of key variables

Data were collected from EpiCare electronic medical records and claims data via a common Virtual Data

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