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| Hypertension Management in UCLA Primary Care Clinics |
| Exploring Undiagnosed and Undermanaged Hypertension  |
| October 31 |

# Acknowledgement

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# Introduction

The link between undiagnosed and uncontrolled hypertension

Uncontrolled hypertension has continued to remain a leading, modifiable risk factor for cardiovascular disease and premature death worldwide.1,3,16 Due to its strong prevalence and associated graded risk for cardiovascular morbidity, it is estimated that hypertension (HTN) costs the US over 300 billion dollars each year.4 Despite efforts to reduce barriers to healthcare with the expansion of medical insurance through the Affordable Care Act, uncontrolled hypertension continues to be one of the most prevalent, preventable diseases in our nation. 3,16

This is explained in part by the underdiagnosis or decreased awareness of hypertension in patients. Multiple studies previously conducted to identify the prevalence of hypertension reported a high rate of undiagnosed hypertension.1,2,6,7 Data from the 2011-2012 National Health and Nutrition Examination Survey (NHANES) revealed that over 36% of patients with uncontrolled hypertension were not aware that they met hypertensive criteria and were not on anti-hypertensive treatment.8 Though age-adjusted hypertension control (with a systolic blood pressure [SBP] <140 mmHg and diastolic blood pressure [DBP] <90 mmHg) improved from around 32% in 1999-2000 to nearly 49% in 2007-2008, control has declined to 44% in 2017-2018, making hypertension control a high priority target to reduce morbidity/mortality.15

Specifically, within Los Angeles, Hales et. al estimates that of the 1.7 million people with hypertension, 300,000 were unaware of their diagnosis, 400,000 were not being treated and 800,000 were not being adequately managed.7 Though it can be thought that access to services served as an additional barrier to diagnosis/treatment, prior NHANES analyses reported approximately 82% of the population of undiagnosed, untreated hypertensive patients had health insurance and 62% had received care at least two times.1,8

Despite the substantial burden of disease, updated guidelines for earlier diagnosis of hypertension, and cost effectiveness of treatment, hypertension often goes undiagnosed. Moreover, with additional research demonstrating increased likelihood to receive treatment and management of hypertension in patients diagnosed with hypertension in the electronic medical records, compared to those patients without a diagnosis, it is not surprising that many undiagnosed patients with hypertension are undermanaged and uncontrolled.6

Landscape Analysis of Hypertension at UCLA

To address undermanaged hypertension, this assessment aimed to understand the characteristics of undiagnosed hypertensive patients within University of California, Los Angeles (UCLA) primary care clinics to improve blood pressure control. The UCLA Health outpatient care system has over 670,000 patients currently in their care. From the 2019 UCLA Community Health Needs Assessment report, the UCLA patient service area covers 28 zip codes, representing 18 cities and communities mainly in SPA 5 of Los Angeles County.  Patient demographics consist of 59.4% white, 16.7% Latinx/Hispanic, 13.6% Asian and 5.6% Black/African American. Patients served in the UCLA health system include 11.9% at or below the federal poverty level (FPL) and 23% are at 200% of FPL or below, which is considered low-income. Sixty-seven percent of patients are adults over the age of 18 with approximately 23% diagnosed with hypertension and their related conditions.9 Given the wealth of patient data and outcomes recorded in the system, the UCLA health system provided a large and unique outpatient sample pool to analyze and assess initiatives to improve hypertension management.

The following report includes two components: an assessment of the prevalence/characteristics of undiagnosed hypertension patients in the current UCLA health primary care system and a description of a pilot project that could support engagement of those identified with undiagnosed hypertension to improve blood pressure control. Utilizing retrospective data from the electronic medical record (EMR) for the assessment, we aimed to gain a better understanding of the sociodemographic characteristics of undiagnosed and undermanaged UCLA patients with hypertension. To comply with both updated guidelines from the American Heart Association (AHA) and American College of Cardiology (ACC) 2017 criteria and Eighth Joint National Committee (JNC 8) criteria, patients included in the analysis were deemed as meeting hypertension diagnosis if they met stage 2 hypertension (AHA/ACC) and stage 1 hypertension (JNC 8), which is defined as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg, on at least two occasions.5,10

Data Assessment

Identifying Individuals with Undiagnosed Hypertension

Retrospective EMR data analysis included patients 18 years and older that have been assigned a primary care physician within the UCLA healthcare system and have had at least two BP readings with SBP at least 140 mmHg or DBP at least 90 mmHg. Patients were excluded from the analysis if they had received a documented diagnosis of HTN in their chart, chronic kidney disease (CKD) stage 3 or more, white coat hypertension, or were a hospice care patient (Table 1).

De-identified data was obtained via the UCLA Hypertension Tableau, which is a platform that allows for building, querying, and filtering data related to blood pressures and other patient characteristics. Initial data assessment included all patients that were seen in the UCLA primary care clinic and had at least 2 ambulatory blood pressure readings in the past 3 years from the data pull date of 08/01/2022 that met inclusion/exclusion criteria (Table 1). Data requests from this platform were sent to the UCLA Clinical and Translational Science Institute (CTSI) team and de-identified to ensure patient privacy and protection. A final compiled list of de-identified patients included information about their age, gender, race/ethnicity, primary language, insurance type, social vulnerability index (SVI) score, last 3 documented blood pressures, EMR documented hypertension diagnosis status, if seen in a UCLA primary care office, history of CKD stage 3 or more, type 2 diabetes mellitus status, and number of anti-hypertensive medications.

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| Table 1. |
| Inclusion Criteria | Exclusion Criteria |
| * Assigned a UCLA primary care physician
* 18 years or older
* At least 2 EMR documented BP readings from 08/01/2019-08/01/2022
* At least 2 BP readings with SBP ≥140 mmHg and/or DBP ≥90 mmHg
 | * EMR documented diagnosis of HTN
* CKD stage 3 or more
* White coat hypertension
* Hospice care
 |

De-identified data was analyzed in excel spreadsheets using graphs and pivot tables. Data was screened by team members to ensure that the final data being assessed included only those patients without a HTN diagnosis in their chart, had at least two ambulatory blood pressure readings that met JNC 8 or ACC/AHA elevated BP criteria as defined above, and were undermanaged (i.e. not on hypertensive medications) at the time of the data pull. As chronic kidney disease stage 3 or greater is a commonly linked condition associated with elevated blood pressure, patients who had this diagnosis were excluded from the final data analysis. Sub-analyses were performed to stratify the prevalence of patients with undiagnosed HTN by patients’ sociodemographic characteristics including race/ethnicity, gender, insurance type, and SVI score.

Characteristics of Undiagnosed and Uncontrolled Hypertension

 The initial data pull identified 312,900 patients seen at a UCLA primary care office with at least 2 ambulatory blood pressure readings over the last 3 years and no diagnosis of white coat hypertension documented. After excluding for CKD stage 3 or more diagnosis, data on 301,273 patients were analyzed from the initial data. About 222,345 patients (73%) were noted to not have a diagnosis of hypertension in their chart and approximately 39,927 patients (13%) were noted to have 2 or more blood pressure readings that met hypertension criteria of SBP ≥140 mmHg or DBP ≥90 mmHg. Of these patients that met this hypertension criteria, 13,807 patients (35%) did not have a diagnosis of hypertension in their charts and 11,881 patients (86%) of these patients did not have a diagnosis of hypertension nor were on any anti-hypertensive medications (Figure 1).

Of the patients that were undiagnosed (i.e. no EMR documentation of hypertension), met defined hypertension criteria, and undermanaged (i.e. not on any anti-hypertensive medications) (n=11,881), when stratified by gender, approximately half of patients identified as male (51%) and female (49%) respectively (Figure 2).

Those that identified as non-Hispanic White made up a little over half (55%) of the hypertensive patients that were undiagnosed and undermanaged. This was followed by patients that identified as Asian (9%), Hispanic/Latinx (7%) and those that declined to answer (9%) (Figure 3). However, when looking at the respective proportions of patients that met hypertensive criteria by race/ethnicity, those that identified as ‘Asian, Hispanic/Latinx’ had the highest percentage (43%) of being undiagnosed and undermanaged. This was followed by those that were unknown (38%) and patients that identified as ‘Black or African American, Hispanic/Latinx’ (33%) as well as ‘Native Hawaiian or Other Pacific Islander, Hispanic/Latinx’ (33%) (Figure 4).

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When stratified by insurance type, the majority of patients with undiagnosed, undermanaged hypertension had commercial insurance (Figure 5). As previously done, respective proportions of patients by insurance type were analyzed and of patients that met hypertensive criteria, those that had group health plans had the highest percentage (57%) of undiagnosed, undermanaged hypertension. This was followed by international payors (50%) and commercial insurance (38%) (Figure 6).

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Social vulnerability index (SVI) scores were also included in the Hypertension Tableau and analyzed as part of the data review. These scores were compiled based on the Centers for Disease Control and Prevention(CDC)/Agency for Toxic Substances and Disease Registry (ATSDR) social vulnerability index if available for the patient’s census tract. The CDC/ATSDR score incorporates four themes: socioeconomic status, household composition, minority status and language, housing type and transportation.11 If the patient’s census tract was unavailable, the Tableau data would include UCLA’s SVI score, which aimed to identify Zip Code Tabulation Areas (ZCTA) with increased risk factors for COVID-19 infection. The UCLA scores were based on four indicators of medical vulnerability: preexisting health conditions, barriers to services, environmental risk, and social vulnerability.12 A resultant SVI score was included in the Hypertension Tableau and separated into categories: 50 and below, >50 and <70, 70 and <80, 80 and <90, 90 and above. Overall, a higher score corresponded to increased vulnerability. When stratified by SVI score categories, the majority of undiagnosed, undermanaged hypertension had SVI scores of 50 or less (Figure 7). As a proportion of all patients that met hypertensive criteria, Figure 8 shows that a little less than a third of patients with SVI scores of 50 or less and between 50-70 were undiagnosed and undermanaged. This was closely followed by patients with unknown SVI scores (29%), SVI scores of 70-79 (28%), of 80-89 (27%), and of 90 or more (26%).

Lessons Learned and Future Recommendations

 Through identifying the characteristics of undiagnosed hypertension in UCLA primary care clinics, this assessment helps capture a fuller picture of undermanaged hypertensive patients and the necessity to both recognize and address the pervasiveness of undocumented, undertreated hypertension within the UCLA health system. First, this assessment identified that over one-third of patients meeting hypertension criteria did not have a documented diagnosis of hypertension in the EMR. However, as this assessment utilized a defined hypertension criteria that complied with stage 2 hypertension criteria of the 2017 ACC/AHA guidelines, this occurrence is in fact expected to be higher and highlights current gaps in diagnosis/documentation and the urgent need to raise recognition and improve management of high blood pressure.

 Moreover, this assessment revealed additional communities that would benefit from increased awareness and BP control. Nationally, studies have commonly identified a higher prevalence of high blood pressure among non-Hispanic black adults, but higher hypertension control rates among non-Hispanic white adults.8 When accounting for race/ethnicity, this assessment shows a higher proportion of undiagnosed and undermanaged hypertension (i.e. not started on anti-hypertensive medications) among persons that identified as ‘Black, Hispanic/Latinx, ‘Asian, Hispanic/Latinx’, and ‘Native Hawaiian or Other Pacific Islander, Hispanic/Latinx’. Though a high proportion of patients also declined to answer, selected unknown, or left such demographic information blank, this assessment nevertheless reveals specific communities that may benefit from targeted hypertension management and increased advocacy.

 Finally, this assessment showed the need to improve documentation and blood pressure control among patients across all SVI categories as on average, nearly 30% of patients, regardless of SVI score, were undiagnosed and not on any anti-hypertensive medications despite meeting ACC/AHA stage 2 hypertension criteria. As socially determined vulnerability is a recognized risk factor for BP control, this data could suggest that decreased awareness of hypertension diagnosis among all SVI categories contributed to undermanagement.17 This further highlights the importance of documentation and recognition of hypertension in UCLA primary care patients.

Pilot Program Plans

 Given the wealth of data recorded in the UCLA health system regarding undiagnosed and undermanaged hypertensive patients, this team aimed to collaborate with the UCLA Quality Improvement Department to assess a mobile health application to improve identification, awareness, and management of hypertensive patients in the primary care clinic. This application incorporated a primary care provider-clinical pharmacist collaborative remote blood pressure monitoring program. This collaborative approach was used as strong evidence has shown that pharmacist-managed blood pressure in the primary care clinic has improved blood pressure management with the ability for more frequent follow-up and home BP monitoring.13,14

In addition, an existing UCLA hypertension best practice advisory (BPA) in the electronic medical record was updated to ensure that primary care physicians were notified if patients had two or more elevated blood pressure readings (i.e. SBP ≥140 mmHg or DBP ≥90 mmHg) on their most recent readings and prompted the primary care provider to act on the blood pressure. Actions included repeating the blood pressure, starting or adjusting anti-hypertension medications, or referral to the Pharmacist-led Hypertension Management program (PLHP). Furthermore, the BPA excluded patients with other diagnoses linked to elevated hypertension such as: solid organ transplant, chronic kidney disease stage 3b and above, end stage renal disease, pregnancy, white coat hypertension, hospice patients, pheochromocytoma, uncontrolled thyroid disease, renal artery stenosis, Conn’s syndrome, severe aortic stenosis, heart failure with left ventricular ejection fraction 30% or less, heart block, recurrent hypotension, drug/alcohol abuse, other secondary causes of hypertension, or uncontrolled hypertension with office blood pressures ≥180/110 mmHg. These conditions were excluded to focus on enrolling patients with uncomplicated hypertension into the pharmacist-led management program and ensure UCLA clinical pharmacists are able to direct and manage hypertensive patients within their scope of practice.

This program incorporated a group of 8-10 clinical pharmacists that would educate patients on elevated blood pressure, optimize lifestyle and pharmacotherapy management, provide home blood pressure cuff/monitors for patients, as well as closely follow-up home blood pressure readings to guide subsequent treatment. All visits were done online via telehealth visits and both visits as well as home blood pressure cuffs/monitors were provided free of charge. The program incorporated a UCLA MyChart mobile toolkit called CareCompanion that allowed pharmacists to send patients reminders to check/log their blood pressures as well as helpful educational videos/handouts to learn more about their hypertension-related health conditions or related treatments.

Optimizing UCLA HTN Initiatives and Outcome Measures

As part of the quality improvement initiatives, data analysis from this assessment was used to augment program team members’, clinical pharmacists’, as well as PCP awareness of the prevalence of underdiagnosed and undermanaged hypertension among UCLA primary care clinics. As the PLHP initiative specifically depended on primary care provider-directed referrals, perspectives from this data analysis also helped to formulate an informational handout that was distributed to primary care providers highlighting underdiagnosis of hypertension. This was aimed to both improve gaps in provider cognizance of hypertension documentation/diagnosis and prompt PCP management or referral to the pharmacist-led hypertension management program for elevated BPs. Moreover, this assessment may be used to increase awareness amongst primary care providers, quality department committee staff, and clinical pharmacists on the UCLA Hypertension Steering Committee of the need for targeted, supportive interventions aimed to control blood pressures in specific communities.

 Given the wealth of information obtained from the assessment of the UCLA Hypertension Tableau, an additional 6-month data analysis is planned implementing similar methods to this assessment to assess overall process/outcome measures of the quality improvement HTN initiatives at UCLA and help guide next steps. Data from the pilot PLHP program will be separately monitored bimonthly to guide continual PDSA cycles to improve the implementation of the program with a 6-month data analysis from a de-identified list of PHLP participants to review their listed interventions and subsequent blood pressure management/control.

Based on our assessment, data from the Hypertension Tableau will be obtained at 6-months to assess an aggregate summary of overall impact on undiagnosed hypertension patients identified at UCLA. This data will be compared to our initial assessment to evaluate for differences in the collective data after prolonged implementation of the quality improvement initiatives (i.e. updated BPA, PLHP program). Like previously done, data requests from the Tableau platform will be sent to the UCLA informatics team to compile a list of de-identified patients with information about their age, gender, race/ethnicity, primary language, insurance type, SVI score, last 3 documented blood pressures, HTN diagnosis status in the EMR, seen in UCLA primary care office, history of CKD stage 3 or more, type 2 diabetes mellitus status, and number of anti-hypertensive medications. Data will be analyzed and graphed in Excel spreadsheets and pivot charts used to ensure data is filtered for those patients meeting inclusion criteria for undiagnosed hypertension and excluded for linked conditions such as chronic kidney disease stage 3 or more.

Brief surveys will also be conducted with the clinical pharmacists involved in the PLHP program to obtain feedback about their experiences working with providers and the mobile health application. Subsequent short surveys will be sent to primary care providers regarding their attitudes surrounding undiagnosed hypertension and experience with this clinical pharmacy team-PCP collaborative program. Combined with these surveys, our assessment data and a similar planned 6-month aggregate data analysis will help compile an overall quality improvement evaluation to investigate the prevalence of undiagnosed hypertension in UCLA primary care patients and the impact of UCLA HTN initiatives, including the pilot PHLP program, on improving blood pressure control. This evaluation will be used to guide next steps to address undiagnosed and undermanaged hypertension in primary care clinics and future initiatives.

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