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Identifying Opportunities for Implementing Home Blood Pressure Monitoring in Newly Diagnosed or Worsening Hypertension at a Family Health Clinic

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Final Manuscript

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Abstract

The literature is clear that the diagnosis, treatment, and plan of care for hypertension in adults should rely, at least in part, on ambulatory blood pressure. Using in-office blood pressures alone risks inaccurate measurements and can result in inappropriate treatments. Many clinics, however, do not adhere to this recommendation and will fall back on clinic readings which puts the patient at risk of mismanaged hypertension and polypharmacy. This project was formulated to identify the extent to which hypertensive patients were diagnosed and managed without the use of home blood pressure monitoring in a small local community clinic**.** This project will also explore and identify sources for low-to-no cost at-home monitors for patient use. The hope is that this project will encourage a future project to initiate routine home blood pressure monitoring for hypertensive patients at this clinic to improve adherence to evidence-based practice.

Keywords: white coat hypertension, ambulatory blood pressure, home blood pressure, hypertension, outpatient clinic

Identifying Opportunities for Implementing Home Blood Pressure Monitoring in Newly Diagnosed or Worsening Hypertension at a Family Health Clinic

Hypertension is a relatively simple disease. Its diagnosis does not require expensive tests or imaging and the treatments options include some of the cheapest drugs available. Its relative simplicity, however, belies the complexity and severity the condition can have on the human body.

Affecting close to half of the adult population in the United States, hypertension's hold on the country cannot be understated (Center for Disease Control, 2020). It is silent, insidious, and deadly, and though relatively simple in its pathophysiology, mainly increased arterial pressure in the blood vessels of the body, hypertension can be stubborn to treat. Aside from being exceedingly common, chronic hypertension can have significant lasting effects on a person's health. Not only is hypertension the primary or contributory factor in the deaths of nearly half a million Americans every year (Center for Disease Control, 2020), but it is also the most important modifiable risk factor in premature deaths worldwide as reported by the World Health Organization in 2009. In 2010 alone it was reported to have been a factor in 18% or 9.4 million deaths worldwide (Campbell et al., 2015). Chronically elevated blood pressure can have system wide effects ranging from stroke, cardiovascular disease, renal disease, some forms of dementia, and retinopathy, conditions that affect millions.

Historically, hypertension was not considered a disease until the early 1800's, less than a hundred years after blood pressure was first identified as a measurement of the body's vital function (Kotchen, 2011). Essential hypertension, the name for elevated blood pressure without a primary cause, was coined in the early 20th century making the diagnosis fairly new in the lexicon of human disease (Esunge, 1991). It took until the middle of the 1900's before treatment

was even considered for “mild” hypertension (blood pressures below 210/100 mmHg) (Moser, 2006) (Pickering, 1952). Around the same time diuretics were discovered, heralding a new era of improved cardiovascular health. It is presumed that the 50% decrease in stroke and ischemic heart disease between 1972 and 1994 was at least partially due to the subsequent treatment of hypertension (Dustan, Roccella, & Garrison, 1996).

Today hypertension is diagnosed and treated far more liberally. Systolic blood pressure readings routinely above 120mmHg are now considered elevated and a formal diagnosis of hypertension is made when they are above 130mmHg, a far cry from the 200s range required in the 20th century. Treatment typically starts slowly with lifestyle changes such as weight loss, exercise, and reduced sodium intake. Medications such as diuretics, calcium channel blockers, angiotensin II receptor blockers, and angiotensin converting enzyme inhibitors are often added later if lifestyle changes are unable to make a significant dent in readings.

Simple to diagnose and usually simple to treat, hypertension has become a one of the most frequently seen conditions in the primary care clinic and it is often easily managed by most general clinicians. There is, however, always room for improvement. This project will serve to highlight one clinic’s deviation from recommended practice and how it might be encouraged to follow guidelines to better manage this common but potentially serious condition.

Purpose

Currently, a small adult general medicine clinic in Southern California provides hypertension diagnoses and bases treatment plans on attended blood pressure measurements taken at the clinic. The provider does not routinely rely on home measurements for the diagnosis or treatment of hypertension. Most, if not all, patients are diagnosed and treated based on isolated elevated measurements obtained in-office. This project was created with the purpose of identifying just how extensive the use of in-office blood pressures is at this particular clinic for

hypertensive patients and whether this is a significant defect in following evidence-based guidelines that would benefit from a change in practice. This project is a stepping-stone created to identify an opportunity for a future project to encourage the practice of using home blood pressure monitoring at this location. It did not serve to implement a change in practice, only to establish the need for a practice change.

This original purpose of this project was to prove the existence of and better recognize falsely elevated in-clinic blood pressure, also called White Coat Hypertension, and to create a plan around managing the condition. In practice, however, finding enough patients who fit that criteria as well as designing a treatment plan would have required time and dedication this project could not muster. And so, the plan was revised and devised to essentially encourage evidenced-based practice in the ambulatory clinic by highlighting an opportunity for change.

Evidence for Problem

A review of literature was completed using the following search engines: Cochrane, PubMed, and CINAHL. Keywords utilized with each search engine were hypertension, diagnosis/treatment/management of hypertension, ambulatory blood pressure, in-office blood pressure, and White Coat Hypertension. This search yielded over 242 articles from the past 5 years from peer-reviewed publications. Articles were ranked based on the rigor of the study with priority taken for meta-analyses. Policies and guidelines for large organizations and public health centers nationally and internationally were also included in the research as sources of evidence.

Most major organizations for cardiovascular health including the American Heart Association (AHA) and the American College of Cardiology (ACC) follow the “Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults” created by the ACC/AHA task force in 2017. This guideline outlines the current recommended practice for diagnosing hypertension which requires a resting systolic blood pressure average at

or above 130mmHg from 2-3 measurements taken over 2-3 separate occasions while the patient is at rest and on a chair. Measurements above 120mmHg are considered “elevated” but are not quite high enough for a formal diagnosis. Once consistently above 130mmHg the diagnosis is divided into two stages: stage I for average measurements between 130-140mmHg and stage II for average measurements above 140mmHg.

The 2020 International Society of Hypertension Global Hypertension Practice Guidelines offers another perspective on how providers diagnose and manage patients outside of the United States. This guideline differs slightly from the American guideline by classifying hypertension as systolic blood pressures equal or above 140mmHg or diastolic blood pressures equal or above 90mmHg, but like its American counterpart, it recommends averaging results over 2-3 separate *visits* as opposed to separate *occasions* (Unger et al. 2020).

One key recommendation that all medical powerhouses agree on is that the diagnosis of hypertension should rely more on multiple unattended or home blood pressure measurements rather than on single, attended, infrequent measurements taken in-office. It is preferred to utilize ambulatory or home measurements to confirm the diagnosis as it is often lower than in-clinic measurements with an average of a 5-point decrease (Keely, 2020). It is even noted in the 2020 International Society of Hypertension Global Hypertension Practice Guidelines that blood pressure cut-offs for the diagnosis of hypertension depend on the source of the results. Ambulatory blood pressure readings have a threshold of diagnosis 5 points lower than that of readings taken in the office (Unger, 2020). This difference can even be found in unattended measurements (wherein the patient has their vitals taken during an office visit without the presence of a staff member). The use of unattended, ambulatory blood pressure readings is vital because it is more accurate and is more accurately tied with an increased risk of death and cardiovascular heart disease and stroke compared to readings taken in the clinic (Whelton et al., 2017). Not only does home blood pressure monitoring make a difference in diagnosis, it also has been shown to improve adherence to treatment and thereby improving hypertension control rates overall (Stergiou et al., 2014). It also important to note that treating patients who are diagnosed

with hypertension based solely on elevated blood pressure in the clinic, also called White Coat Hypertension, did not reduce the risk of cardiovascular events (Xiang, 2020). This highlights the importance of identifying whether a patient has consistently elevated blood pressure that could benefit from antihypertensives or whether they just have transient hypertension that may be unaffected by medication.

Medicare has attempted to addresses the issue of false hypertension by covering the use of a yearly "Ambulatory Blood Pressure Device". This device is a small instrument worn on the arm that will take blood pressure measurements at different intervals during a full 24- or 48-hour period, creating a more accurate picture of a patient's usual blood pressure on a given day. It can be ordered by a provider for patients with suspected White Coat Hypertension or Masked Hypertension, in which the blood pressure is normally higher than what is seen in the office (AARP Medical Plans, n.d.). This device differs from the more commonly seen "home blood pressure monitor" that can be purchased at any pharmacy over the counter and needs to be applied and operated to take a single blood pressure measurement at a chosen moment. Though it produces a more accurate and detailed log of a patient's typical blood pressure, the Ambulatory Blood Pressure Device, is cumbersome and inconvenient, most physicians and patients are disinclined to use it. The over-the-counter option is preferred in most cases instead.

Framework

The decision to choose the 8A's framework was originally chosen as it is a San Diego native EBP model. Created in 2007 by Carolyn Brown EdD, RN and Laurie Ecoff PhD, RN for the San Diego Evidence-Based Practice Consortium, the model was adapted from an earlier EBP model formulated by Mary Ann Rossworm and June Larrabee (Brown & Ecoff, 2011). This framework was built in order to better formulate a streamlined process in which to establish evidence-based change in practice.

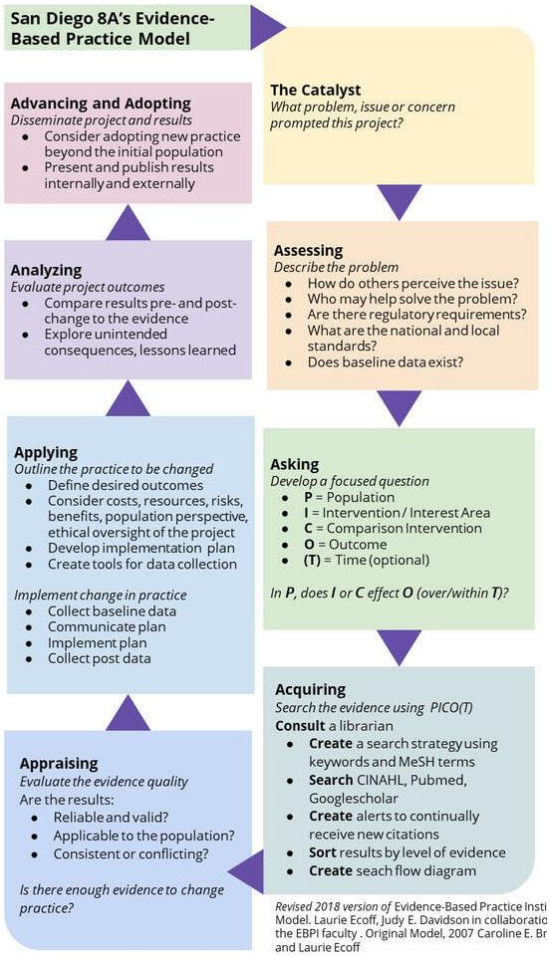
The 8A's EBP model begins by identifying a "Catalyst" which is the original reason behind the project and is followed by "Assessing" which, as the name implies, is the process of investigating the extent of the problem and how much of a "problem" it is. The model continues

with “Asking” in which the PICOT (Population, Intervention, Comparison, Timeline) question is formulated then “Acquiring” and “Appraising” which involves acquiring the evidence that supports the change and appraising the quality of the research and evidence found. Finally, the evidence is implemented or “applied” in the “Application” stage and the project truly gets underway. Once implemented and the timeline is reached, the project outcomes are “Analyzed” at which point the project is at the final stage: “Advancing and Adopting” wherein the results are published and disseminated to spread change outside the confines of the original project.

It was really the “Assessing” stage that this project was developed for. Its purpose was not to create a practice change but rather to identify the need for one.

Figure 1

San Diego’s 8A’s Evidence-Based Practice Model



Note. This figure lists the 8A’s stages to follow in order to implement an EBP change.

Project Plan Process

As it was discovered that this clinic does not routinely utilize the recommendations of home blood pressure monitoring it was decided to center this project around examining the true extent of hypertension diagnosed at the clinic to determine if this change in practice recommendations was likely to have a significant effect on a large percentage of its patient population. The project also served to identify which patients diagnosed with hypertension could qualify for a covered ambulatory monitoring device and whether this is a significant percentage of the patient population seen at this clinic.

Patients whose blood pressure when taken in the office was above 130mmHg systolic were included in the project and their demographics were recorded including their age, biological sex, stated race or ethnicity, previous blood pressure readings, history of hypertension or diabetes, and whether they were currently on blood pressure medication. Lastly, their insurance information was also recorded to establish whether they would be entitled to free home monitoring.

Assessment of Findings

Out of 75 patients whose records were examined, 50 presented with an elevated blood pressure based on their blood pressure readings at the time of their visit. Those 50 patients were included in the project and their data was subsequently collected. The information was extracted from visits during the last two weeks of November where approximately 10 patients were seen per day except for Wednesdays which had 5 patients for a rough total of 220 patients seen over two weeks. The overwhelming majority of patients in any given day had blood pressure readings above SBP 130, in fact typically only 1-3 patients per day had a normal blood pressure reading. Save for a handful of patients who had taken matters into their own hands, most also did not

regularly check their blood pressure at home so a true baseline was not established. None of the patients had been offered to use a home blood pressure monitoring system or an ambulatory blood pressure device to more accurately diagnosed and rate their hypertension even though every Medicare patient seen qualified for one of these devices.

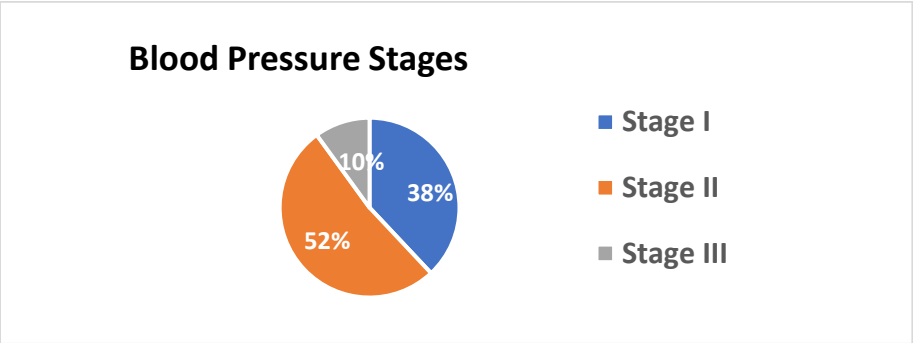
Of the 50 patients identified, over half (52%) presented with a reading above 140mmHg and 10% had systolic blood pressures exceeding 180mmgHg which qualified them for a diagnosis of hypertension based on that single reading alone (Whelton et al., 2017). Many of the patients (40%) were at or above the age of 65, when Medicare coverage may potentially apply. Ages ranged from 21 - 92 years and the group was divided pretty evenly amongst gender lines (24 women and 26 men). Half were of Hispanic or Latino ethnicity, 19 were Caucasian, 4 were of an unstated race, and 2 were Asian.

Of the patients seen, 19 had Medicare or a Medicare Replacement/Advantage plan which would cover the yearly ambulatory device (AARP Medical Plans, n.d.) and 11 had Medicaid or Medicaid Replacement/Advantage which covers a home device but only for malignant hypertension or end-stage renal disease (California Health and Wellness, n.d.).

Of the 50 patients seen with an elevated in-office blood pressure, 32 had a history of hypertension, 2 of which were not being treated with medication, 3 did not have a history of diagnosed hypertension but had been prescribed anti-hypertensives. 17 had a comorbidity of diabetes mellitus as well, while 5 had diabetes but no history hypertension, and 12 had no history of hypertension or diabetes.

Figure 2

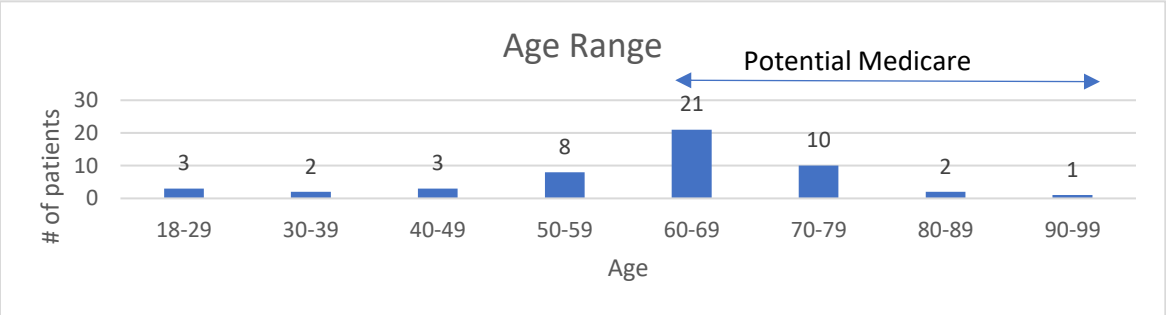
Blood Pressure Stages



Note. The division of blood pressure stages based on the patient's initial reading.

Figure 3

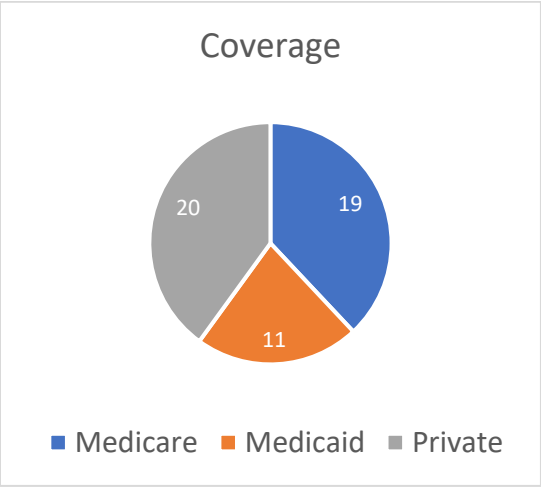
Age Range



Note. The range of ages for the 50 patients included in the project.

Figure 4

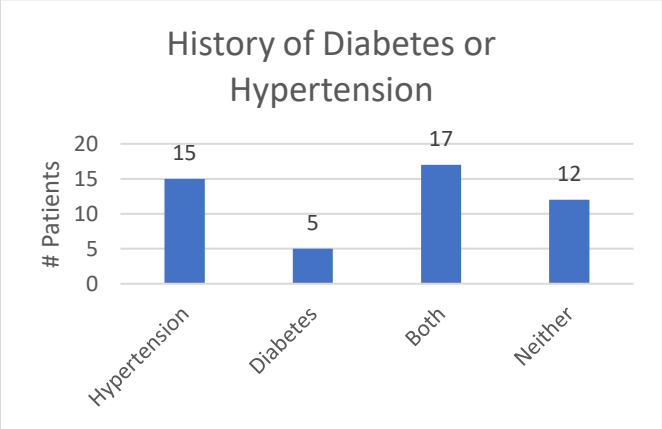
Coverage Breakdown



Note. Number of patients in each coverage type.

Figure 5

Medical History



Note. Patients divided by medical history.

Cost/Benefit Analysis for Sustainability of Project:

The cost of hypertension cannot be ignored, both as a cost to the individual with the diagnosis and to the country at large. The increase in annual healthcare costs for patients with hypertension is significant at $2,000 and the costs for hypertension as a disease in the United States is $131 billion (Kirkland, 2018).

By implementing this project patients may save up to $2,000 annually. For every dollar spent $200 will be saved for the patient. CBA= (benefits) $2,000/(cost) $100= $200, making the return of investment is 1,900%. ROI= {($2,000-$100)/$100}x100=1,900%.

Table 1

Cost/Benefit Analysis

Costs – Utilizing home blood pressure monitors		**Costs – Continuing with in-office blood pressure readings alone**	
Financial	**Non-Financial**	**Financial**	**Non-Financial**
-$0-100 per unit per patient depending on insurance coverage -No added cost to the clinic	-Risk of inaccuracy of home monitors -Increased responsibility for patients	-Potential increased cost to patients to treat hypertension unnecessarily	-Risking over-diagnosing and treating of hypertension
Benefits			
Financial		**Non-Financial**	
-Potential saving up to $2,000 annually per patient who can avoid a diagnosed of hypertension		-Decrease in polypharmacy and unnecessary treatment for patients	

Implications for Practice

Implementing this project will require buy-in from the clinic staff and from the patients themselves. It will change the entire process of diagnosing and treating hypertension that is in place at the clinic now. This change can only be successful if the participants give it their best effort. It will also require more maintenance and surveillance to assure the accuracy of each induvial home monitor. As with some other practices, such as more specialized cardiology clinics, this office should implement the use of manual blood pressure devices in order to prevent technological errors or variances. This practice however requires training of staff and runs the risk of variances in readings due to human error.

Conclusions

The results of this project will hopefully show that there is a great opportunity for implementing home blood pressure monitoring to establish a more accurate picture of a patient's condition and better identify tailored treatment options and care plans. This will also integrate the patient into their own healthcare and make them a more active participant in their health.

It should be noted that this project is limited to the office in which it was conducted and future projects using this data should only be attempted at this particular office.

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