IMPROVING BLOOD PRESSURE SCREENING AND CONTROL IN PRIMARY CARE: A QUALITY INITIATIVE

by

Wendy Michelle Gomendi

A scholarly project submitted in partial fulfillment
of the requirements for the degree

of

Doctor of Nursing Practice

in

Family/Nurse Practitioner

MONTANA STATE UNIVERSITY
Bozeman, Montana

May 2023

ACKNOWLEDGEMENTS

I express my sincere gratitude to Dr. Molly Secor and Dr. Elizabeth Johnson for their valuable guidance and support. I am also grateful to my parents and siblings for their love and support throughout my academic journey. Thanks to my daughters Claire, Kate, and Ella for their inspiration, love, and patience as I have pursued this goal.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS CONTINUED

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

ABSTRACT

Background: Hypertension costs the United States healthcare system billions of dollars and accounts for 1 in 6 deaths annually. Management of hypertension is a priority in primary care settings. Strategies to prevent the adverse health effects of hypertension in the United States include increasing awareness of the health risks of uncontrolled hypertension, promoting the use of healthcare teams to manage hypertension, and empowering patients to use self-measured blood pressure monitoring.

Local Problem: To address the high rate (58%) of uncontrolled hypertension at a family practice clinic in Montana, a QI project was implemented aimed at improving blood pressure screening, management, and control.

Methods: The Knowledge to Action model guided the development of a workflow that incorporated an existing hypertension management policy based on USPSTF hypertension screening and management recommendations.

Interventions: Interventions were implemented over four weeks. All patients presenting to the clinic with a blood pressure ≥ 140/90 were rescreened at the end of the visit. If the blood pressure remained elevated, the clinic staff was asked to provide an informational packet and ask the patient to obtain home blood pressure measurements or return in 7-14 days for a blood pressure check. Individuals with three elevated blood pressures on three separate occasions were referred to their care team for further hypertensive management.

Results: The project goals were not achieved; however, the percentage of hypertensive patients with a blood pressure ≥ 140/90 decreased by 4%.

Conclusion: The QI initiative resulted in a modest increase in hypertension control for the project site. Although goals were not met, the project provided insight into hypertension management barriers, including time constraints on the providers and staff, patient willingness to engage in serial blood pressure measurements, and readiness of providers and patients to escalate hypertensive medication therapy.

CHAPTER ONE

REVIEW OF LITERATURE

Introduction

According to the Centers for Disease Control and Prevention (2022), one person dies every 34 seconds in the United States from cardiovascular disease. Cardiovascular disease is the leading cause of premature death, and stroke is the second most common cause of mortality and the third most common cause of morbidity worldwide (Weingarten & Silfa, 2019). High blood pressure is the most significant risk factor for heart and vascular disease development. Although 77.9 million adults in the United States have hypertension, only 81.5% are aware of the condition, and only 52.5% have their hypertension controlled (Department of Veterans Affairs Department of Defense, 2014). The diagnosis and management of hypertension depend on accurate systolic blood pressure (SBP) and diastolic blood pressure (DBP) measurement. According to the 2017 American College of Cardiology (ACC)/American Heart Association (AHA) guidelines, out-of-office BP measurements should be used to confirm the diagnosis of hypertension. This project aims to assess and address the routine-practice gap for home blood pressure monitoring for adults and a family practice clinic in the Northwest United States.

Background and Significance

Correct blood pressure measurement is the underpinning of accurate hypertension diagnosis and management. The direct measurement of blood pressure is the clinical reference method, typically performed during high-risk surgery or intensive care settings. This method

requires arterial cannulation, which proves invasive, unsafe, and impractical in the clinical setting. Complications associated with this technique include embolism, risk for laceration of nerves and vessels, and ischemia (Meidert & Saugel, 2018).

Historically, indirect blood pressure measurement has been utilized in research and clinical settings. Non-invasive techniques include palpatory, auscultatory, and oscillometric methods. Although these methods are safer, they are not without shortcomings. Commonly cited disadvantages of non-invasive techniques relate to user error, including digit preference, observer bias, incorrect placement of the stethoscope, and inaccurate interpretation of Korotkoff sounds (Sharman et al., 2022). Automated blood pressure devices that measure BP based on the amplitude of oscillations against the lateral walls of the upper arm have emerged in research and clinical practice in the preceding decades (Muntner et al., 2017). These devices estimate mean arterial blood pressure based on the maximal oscillation amplitude and determine systolic and diastolic blood pressure through a proprietary algorithm (Muntner et al., 2017, Meidert & Saugel, 2018). Although these devices reduce some elements of human error, they have the potential to produce inaccurate BP readings and are challenging to validate.

Data indicate that single office BP measurements obtained by the auscultatory method demonstrate considerable variability. Meanwhile, oscillometric and automated device measurements require validation and may not account for physiologic conditions such as arterial stiffness (Arhga et al., 2020; Muntner et al., 2017). According to the 2017 American College of Cardiology (ACC)/American Heart Association (AHA) guidelines regarding blood pressure in adults, out-of-office BP measurements should be used to confirm the diagnosis of hypertension. In adults not prescribed antihypertensives, ambulatory BP monitoring or home BP monitoring

should be used to detect white coat hypertension and masked hypertension (Whelton et al., 2017).

Ambulatory blood pressure measurement came about in the early 20th century. Currently, ambulatory monitors are fully automated and utilize oscillometric technology to obtain blood pressure readings for 24 continuous hours (Shimbo et al., 2015). This technology is programmed to obtain patient blood pressure on a customizable schedule as the patient goes about their usual daily and nighttime activities. Readings are not provided to the patient but are downloaded for provider interpretation. Multiple studies report associations between average blood pressure measured by ABPM and cardiovascular disease (Shimbo et al., 2015; Viera et al., 2015; Rrecke et al., 2019). This BP measuring technique is the only one that can capture BP during sleep and BP variability throughout the day, keeping in mind that actual BP varies on a beat-by-beat basis. ABPM is particularly useful for confirming the diagnosis of hypertension by ruling out variability and hypertensive phenotypes, including white coat hypertension (WCHT) and masked hypertension (MH) (Breaux-Shropshire et al., 2015 & Viera et al., 2010). Although ABPM is considered the measurement standard for determining hypertensive risks and outcomes, it is not without disadvantages. Limitations of ABPM include poor patient uptake, limited availability, and cost. Furthermore, health disparities exist for several populations, including inadequate access to devices, lack of internet or cellular access, poor payor reimbursement, and technology knowledge deficits.

Home blood pressure measurement provides another modality for obtaining BP outside the clinic setting. HBPM devices are usually oscillometric and must be validated by the manufacturer and in the clinic. The American Heart Association endorses using HBPM as a

diagnostic modality based on two measurements in the morning and two at night for a minimum of 3 days to estimate average at-home blood pressure (Muntner et al., 2017). Multiple studies indicate that HBPM is a more sensitive predictor of cardiovascular events and mortality than office blood pressure measurements (Breaux-Stropshire et al., 2015; Uhlig et al., Zou et al., 2020). HBPM devices are generally more available than ABPM devices, are less expensive, and are more tolerable to patients. However, these devices are not reimbursable under all healthcare plans, require a longer duration of monitoring, and must be validated by the manufacturer and again in the office (Shimbo et al., 2015).

Synthesis of Literature

The literature review concentrates on research investigating the efficacy of home blood pressure measurement regarding correct diagnoses and management of hypertension and the relationship to improved patient outcomes. Additionally, articles that focused on 2-way communication between the patient and provider pertaining to home blood measurement and alterations in the plan of care were examined. Databases employed to find relevant investigations included Web of Science, CINAHL, PubMed, PRISMA, Joanna Briggs Institute EBP Database, and Google Scholar. Search terms included home blood pressure monitoring, self-blood pressure monitoring, hypertension diagnosis, hypertension management, patient portal, e-health, and mobile health.

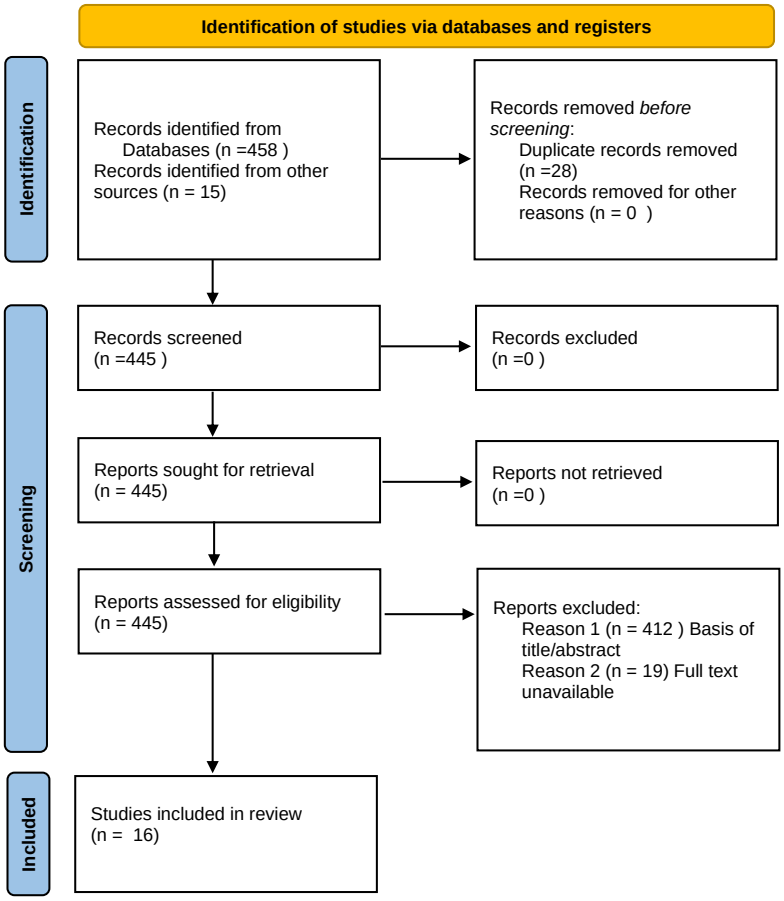


Figure 1. PRISMA 2020 Flow Diagram.

Hypertension Prevalence, Morbidity, and Mortality in Adults

Hypertension is the leading risk factor for morbidity and mortality worldwide. Because an established relationship exists between increased BP and vascular mortality, it is necessary to create cut-off values to diagnose and make treatment decisions regarding hypertension. Blood pressure is currently categorized as normal (<120 and < 80), elevated (systolic 120-129 and diastolic <80), hypertension stage 1 (systolic 130-139 or diastolic 80-89), and hypertension stage 2 (systolic greater than or equal to 140 or diastolic greater than or equal to 90) (Vischer & Burkard, 2017; Brian & Byrd, 2019). Approximately 1 billion individuals globally have a

systolic BP greater than 140 mm Hg (Byrd & Brook, 2019). Hypertension is a major contributing factor to heart failure, myocardial infarction, stroke, peripheral vascular disease aneurysms, retinopathy, neurocognitive decline, atrial fibrillation, and kidney disease. End organ damage secondary to high blood pressure results in left ventricular hypertrophy, proteinuria, atherosclerosis, and white matter disease (Byrd & Brook, 2019, Breaux et al., 2015; Asayama et al., 2004). Although hypertension is a modifiable risk factor with clear evidence supporting effective treatment modalities, it remains underdiagnosed and undertreated (Cappuccio et al., 2004). Previous guidelines utilized a BP goal of 140/90 mm Hg. More recently, data indicate that patients at higher cardiovascular risk gain more significant overall risk reduction from the same degree of lowered BP. BP goals should consider overall cardiovascular risk and actual BP measurement (Muntner et al.,2019; United States Preventive Services Task Force, 2021; Department of Veterans Affairs Department of Defense, 2014). Research indicates that treating systolic BP to a target of 130 mmHg produces a more acceptable balance of health benefits to risk. These data contribute to improved patient outcomes. However, lowering the target BP increased the number of individuals with diagnosable hypertension. This practice recommendation thus contributes to an increased burden of hypertensive patients within the US health care system (Muntner et al., 2019; Krist et al., 2021; Bangalore et al., 2017).

Screening for Hypertension in Primary Care

Hypertension is the most frequently diagnosed condition at outpatient office visits in the United States (Ostchega et al., 2020). Historically, office blood pressure monitoring (OBPM) has been the gold standard for hypertension diagnosis and treatment. More recent data indicate that ambulatory blood pressure monitoring (ABPM) and home blood pressure monitoring (HBPM)

result in more accurate hypertension diagnoses, improved BP control, and enhanced medication adherence (Breaux-Shropshire et al., 2015; Cappuccio et al., 2004; Viera et al., 2010, Uhlig et al., 2013). Error in the measurement of BP of as little as 5 mm Hg can lead to the misdiagnosis and mistreatment of hypertension, with significant individual and public health consequences (Argha et al., 2020).

Although data indicate that BP measured by ABPM has a stronger association with hypertension-related poor outcomes and clinical cardiovascular risk compared to OBPM, uptake of the practice remains relatively low in the United States due to cost and tolerability (Muntner et al., 2019; Breaux-Shropshire et al., 2015). One theme emerging from the literature involves the usefulness of HBPM as a tool for hypertension diagnosis and management (US. Preventive Services Task Force, 2021; Zou et al., 2020; Mutner et al., 2019; Karnjanapiboonwong et al., 2020; & Cappuccio et al., 2004). Breaux-Shropshire et al. (2015) conducted a systematic review comparing the clinical effectiveness of HBPM and 24-hour ABPM on blood pressure control and patient outcomes. They determined that associates between BP measurement type and mortality differ among study populations, making it essential to consider comorbidities such as renal disease when translating these data into practice. In terms of BP control, these data indicate that OBP overestimates the systolic BP response to therapy by an average of 4.6 mmHg compared to HBP, making the latter a more sensitive measure of possible morbidity and mortality (Breaux-Stropshire et al., 2015). Similarly, in a meta-analysis of randomized trials, Cappcuuio et al. (2004) concluded that blood pressure control increased when HBPM, as opposed to OBPM, was employed with systolic measurements lowered by 4.2% (95% confidence interval 1.5 to 6.9) mmHg and diastolic lowered by 2.4 (95% confidence interval 1.2 to 3.5) mmHg. These

reductions in blood pressure are clinically significant in reducing vascular morbidity and mortality in the studied populations (Cappuccio et al., 2004).

Blood Pressure Screening Modality and Phenotype

Four BP phenotypes can be defined by examining in-clinic versus out-of-clinic blood pressure measurements. The first two indicate agreement between in-clinic and out-of-clinic blood pressure, with sustained normotension defined as non-elevated in both settings and sustained hypertension defined as elevated blood pressure readings in both settings. However, blood pressure readings are not congruent in and out of the clinic for white coat and masked hypertension. White coat hypertension refers to the phenomenon in which blood pressure is normotensive out-of-clinic and elevated in-clinic. On the other hand, masked hypertension occurs when blood pressure readings are normal in-clinic but elevated outside of the clinic (Shimbo et al., 2015; Muntner et al., 2019). A narrative review conducted by Simbo et al. (2015) determined the prevalence of white coat hypertension ranged from 5% to 65% in 22 studies utilizing ABPM and 16% to 55% in 6 studies employing HBPM. Comparably, Muntner et al. (2019) concluded that the prevalence of white coat hypertension is 15% to 30% for patients with hypertensive OBP readings and 30% to 40% for patients diagnosed and treated for hypertension. Of the two non-congruent phenotypes, masked hypertension carries risks most similar to sustained hypertension (Viera et al., 2010, Shimbo et al., 2015; Muntner et al., 2019). In a study evaluating the reproducibility of masked hypertension comparing OBPM to APMB and HBPM, Viera et al. (2010) concluded that OBPM systematically fails to identify masked hypertension while ABPM should remain the gold standard for diagnosis. Given the current shift to quality-based reimbursement, risk of treatment, and patient outcomes, these data are vital to the

development of blood pressure measuring policy that is both valid and feasible in the primary care setting.

Implementation and Workflow

A robust body of literature indicates that adequate blood pressure control could have a profound impact on decreasing morbidity and mortality due to cardiovascular disease worldwide (Pasha et al., 202; Lee et al., 2018; Olsen et al., 2016; Ferdinand et al., 2020). Despite the data, the uptake of evidence-based approaches to improve BP control remains suboptimal. Successful translation of knowledge regarding appropriate BP management to day-to-day practice must include strategies for both diagnosis and treatment. Once accurate measurement is obtained, a feasible workflow must be implemented and maintained.

The literature supports team-based care as an impactful intervention for improving high blood pressure control (Kravetz & Walsh, 2016; Carter et al., 2009; Pasha et al., 2021; Chattopadhya et al., 2015). Team-based care is a strategy that aims to enhance patient care by including health professionals from multiple disciplines, working collaboratively with the patient and the PCP to enhance outcomes. Team members include the patient and the PCP along with other clinical health professionals such as pharmacists, social workers, nurses, nutritionists, and community health workers. Specific strategies that the health team can use to improve blood pressure include patient education, patient follow-up, medication management, medication adherence support, self-management support, and self-measured blood pressure (Centers or Disease Control and Prevention, n.d.). A systematic review by Proia et al. (2014) concluded that team-based care increased the proportion of people with controlled BP and reduced both systolic and diastolic BP. Evidence further indicates that improvement in the proportion of patients with

controlled BP was higher with the addition of nurses and pharmacists to care team, as compared to other blood pressure control interventions (Proia et al, 2014; Pasha et al., 2021; Kravetz & Walsh, 2016; & Carter et al., 2022).

Conclusion/Implications

The United States Preventive Services Task Force recommends screening for hypertension in adults 18 years or older. Initial screening should occur in the office and continue with blood pressure measurements outside the clinic setting for diagnostic confirmation and treatment initiation (US Preventitive Services Task Force, 2021). Given the global burden of hypetension and its associated risk factors, an urgency exists to translate evidence supporting appropriate blood pressure screening into daily practice. Although ABPM offers the most accurate blood pressure data, it is cumbersome to patients. Home blood pressure monitoring devices more accessible, less expensive, and offer more sensitive blood pressure measurement thant office blood pressure monitoring (Breaux-Stropshire et al., 2015; Muntner et al., 2017; Uhlig et al. 2013, Zou et al., 2020). Although this method is more feasible in ambulatory care setting patient education regarding the purpose of screening, risk reduction, and proper technique is warranted (Ohio Colleges of Medicine, 2017).

Once hypertension has been diagnosed and confirmed, it is necessary to establish a chronic disease management workflow. The literature supports muli-faceted intervention strategies with emphasis on patient education and a team-based care approach (Proia et al, 2014; Pasha et al., 2021; Kravetz & Walsh, 2016; & Carter et al., 2022). These data are applicable to the U.S. healthcare system, particularly in the clinc setting. The largest improvements in blood pressure were found when team members could prescribe medications independently or with

support of the PCP (Proia et al., 2014). As the United States grapples to balance the rising cost of healthcare with quality improvement, frameworks such as the patient centered medical home that emphasize shared-decision making and interprofessional teams, may provide the solution to translating blood pressure diagnosis and management into feasible practice.

References

Argha, A., Celler, B. G., & Lovell, N. H. (2020). Artificial intelligence based blood pressure estimation from ausculatory and oscillometric waveforms: A methodological review. *IEEE Review in Biomedical Engineering*, *15*, 152–168. https://doi.org/10.1109/RBME.2020.3040715

Asayama, K., Ohkubo, T., Kikuya, M., Metoki, H., Hoshi, H., Hashimoto, J., Totsune, K., Satoh, H., & Imai, Y. (2004). Prediction of stroke by self-measurement of blood pressure at home versus casual screening blood pressure measurement in relation to the joint national committee 7 classification. *Stroke*, *35*(10), 2356–2361. https://doi.org/10.1161/01.str.0000141679.42349.9f

Bangalore, S., Toklu, B., Gianos, E., Schwartzbard, A., Weintraub, H., Ogedegbe, G., & Messerli, F. H. (2017). Optimal systolic blood pressure target after sprint: Insights from a network meta-analysis of randomized trials. *The American Journal of Medicine*, *130*(6), 707–719.e8. https://doi.org/10.1016/j.amjmed.2017.01.004

Breaux-Shropshire, T. L., Judd, E., Vucovich, L. A., Shropshire, T. S., & Singh, S. (2015). Does home blood pressure monitoring improve patient outcomes? A systematic review comparing home and ambulatory blood pressure monitoring on blood pressure control and patient outcomes. *Integrated Blood Pressure Control*, *8*, 43–49. https://doi.org/10.2147/IBPC.S49205

Byrd, J., & Brook, R. D. (2019). Hypertension. *Annals of Internal Medicine*, *170*(9), ITC65. https://doi.org/10.7326/aitc201905070

Cappuccio, F. P., Kerry, S. M., Forbes, L., & Donald, A. (2004). Blood pressure control by home monitoring: Meta-analysis of randomised trials. *BMJ*, *329*(7458), 145. https://doi.org/10.1136/bmj.38121.684410.ae

Carter, B. L., Rogers, M., Daly, J., Zheng, S., & James, P. A. (2009). The potency of team-based care interventions for hypertension. *Archives of Internal Medicine*, *169*(19). https://doi.org/10.1001/archinternmed.2009.316

Centers for Disease Control and Prevention. (n.d.). *Promoting team-based care to improve high blood pressure control*. https://doi.org/https://www.cdc.gov/dhdsp/pubs/guides/best-practices/team-based-care.htm

Centers for Disease Control and Prevention. (2022). *Heart disease in the United States*. https://doi.org/https://www.cdc.gov/heartdisease/facts.htm

Department of Veterans Affairs Department of Defense. (2014). *VA/DoD clinical practice guideline for the diagnosis and management of hypertension in primary care setting guideline summary*. VA/DoD. https://doi.org/https://permanent.fdlp.gov/gpo114995/HTNSUM3FIA20151209.pdf

Karnjanapiboonwong, A., Anothaisintawee, T., Chaikledkaew, U., Dejthevaporn, C., Attia, J., & Thakkinstian, A. (2020). Diagnostic performance of clinic and home blood pressure measurements compared with ambulatory blood pressure: A systematic review and meta-analysis. *BMC Cardiovascular Disorders*, *20*(1). https://doi.org/10.1186/s12872-020-01736-2

Kravetz, J. D., & Walsh, R. F. (2016). Team-based hypertension management to improve blood pressure control. *Journal of Primary Care & Community Health*, *7*(4), 272–275. https://doi.org/10.1177/2150131916645580

Meidert, A. S., & Saugel, B. (2018). Techniques for non-invasive monitoring of arterial blood pressure. *Frontiers in Medicine*, *4*. https://doi.org/10.3389/fmed.2017.00231

Muntner, P., Shimbo, D., Carey, R. M., Charleston, J. B., Gaillard, T., Misra, S., Myers, M. G., Ogedegbe, G., Schwartz, J. E., Townsend, R. R., Urbina, E. M., Viera, A. J., White, W. B., & Wright, J. T. (2019). Measurement of blood pressure in humans: A scientific statement from the american heart association. *Hypertension*, *73*(5). https://doi.org/10.1161/hyp.0000000000000087

Ostchega, Y., Fryar, C. D., Nwankwo, T., & Nguyen, D. T. (2020). *Hypertension prevalence among adults aged 18 and over: United States, 2017-2018*. Centers for Disease Control and Prevention. https://doi.org/https://stacks.cec.gov/view/cdc/87559

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S.,...Moher, D. (2021). The prisma 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, n71. https://doi.org/10.1136/bmj.n71

Pasha, M., Brewer, L. C., Sennhauser, S., Alsawas, M., & Murad, M. (2021). Health care delivery interventions for hypertension management in underserved populations in the

united states: A systematic review. *Hypertension*, *78*(4), 955–965. https://doi.org/10.1161/hypertensionaha.120.15946

Roerecke, M., Kaczorowski, J., & Myers, M. G. (2019). Comparing automated office blood pressure readings with other methods of blood pressure measurement for identifying patients with possible hypertension. *JAMA Internal Medicine*, *179*(3), 351. https://doi.org/10.1001/jamainternmed.2018.6551

Shaikh, U., Petray, J., & Wisner, D. H. (2020). Improving blood pressure screening and control at an academic health system. *BMJ Open Quality*, *9*(1), e000614. https://doi.org/10.1136/bmjoq-2018-000614

Sharman, J. E., Tan, I., Stergiou, G. S., Lombardi, C., Saladini, F., Butlin, M., Padwal, R., Asayama, K., Avolio, A., Brady, T. M., Murray, A., & Parati, G. (2022). Automated 'oscillometric' blood pressure measuring devices: How they work and what they measure. *Journal of Human Hypertension*. https://doi.org/10.1038/s41371-022-00693-x

Shimbo, D., Abdalla, M., Falzon, L., Townsend, R. R., & Muntner, P. (2015). Role of ambulatory and home blood pressure monitoring in clinical practice. *Annals of Internal Medicine*, *163*(9), 691–700. https://doi.org/10.7326/m15-1270

Uhlig, K., Patel, K., Kitsios, G. D., & Balk, E. M. (2013). Self-measured blood pressure monitoring in the management of hypertension: a systematic review and meta-analysis. *Annals of Internal Medicine*, *159*, 18885–194. https://www-acpjournals-org.proxybz.lib.montana.edu/doi/epdf/10.7326/0003-4819-159-3-201308060-00008

United State Preventive Services Task Force. (2021). *Screening for hypertension in adults US Preventive Services Task Force reaffirmation recommendation statement*. US Preventive Services Task Force. https://doi.org/10.1001/jama.2021.4987

US Preventive Services Task Force. (2021). *Screening for hypertension in adults: US Preventive Services Task Force reaffirmation recommendation Statement*. JAMA. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/hypertension-in-adults-screening

Viera, A. J., Hinderliter, A. L., Kshirsagar, A. V., Fine, J., & Dominik, R. (2010). Reproducibility of masked hypertension in adults with untreated borderline office blood pressure: Comparison of ambulatory and home monitoring. *American Journal of Hypertension*, *23*(11), 1190–1197. https://doi.org/10.1038/ajh.2010.158

Vischer, A. S., & Bukard, T. (2017). Principles of blood pressure measurement-Current techniques, office vs ambulatory blood pressure measurement. In M. S. Islam (Ed.), *Hypertension: From basic research to clinical practice: Volume 2 (advances in*

experimental medicine and biology, 956) (1st ed., 2017, pp. 85–96). Springer. https://link-springer-com.proxybz.lib.montana.edu/chapter/10.1007/5584_2016_49#Tab1

Wajngarten, M., & Silva, G. (2019). Hypertension and stroke: Update on treatment. *European Cardiology Review*, *14*(2), 111–115. https://doi.org/10.15420/ecr.2019.11.1

Whelton, P. K., Carey, R. M., Aronow, W. S., Casey, D. E., Collins, K. J., Dennison Himmelfarb, C., DePalma, S. M., Gidding, S., Jamerson, K. A., Jones, D. W., MacLaughlin, E. J., Muntner, P., Ovbiagele, B., Smith, S. C., Spencer, C. C., Stafford, R. S., Taler, S. J., Thomas, R. J., Williams, K. A.,...Wright, J. T. (2018). 2017 acc/aha/aapa/abc/acpm/ags/apha/ash/aspc/nma/pcna guideline for the prevention, detection, evaluation, and management of high blood pressure in adults. *Journal of the American College of Cardiology*, *71*(19), e127–e248. https://doi.org/10.1016/j.jacc.2017.11.006

Zuo, H.-J., Ma, J.-X., Wang, J.-W., & Chen, X.-R. (2020). Assessing the routine-practice gap for home blood pressure monitoring among chinese adults with hypertension. *BMC Public Health*, *20*(1). https://doi.org/10.1186/s12889-020-09901-0

CHAPTER TWO

PROJECT PROPOSAL

Introduction

The global burden of hypertension (HTN) is expansive and expanding. Elevated blood pressure (BP) is the most significant modifiable risk factor for the development of cardiovascular disease and its associated morbidity and mortality. Despite a vast body of literature regarding the prevention, diagnosis, and management of HTN, the incidence of the condition continues to climb (Lee et al., 2018; Olsen et al., 2016; Ferdinand et al., 2020). Hypertension has reached pandemic proportions affecting 1.4 billion people worldwide (Ferdinand et al., 2020). Between 1990 and 2013, hypertension-related mortality increased by 49% to 10.4 million people, and disability-adjusted life years increased by 45%, partially due to the globally aging population (Pokharel et al., 2022). In the United States, approximately half of individuals 18 years or older live with uncontrolled hypertension, defined as a BP of 140/90 mmHg or greater. In 2020, 670,000 deaths in the United States listed hypertension as a primary contributing cause (Centers for Disease Control and Prevention, 2022). Montana is no exception. In 2017 heart disease and stroke were the first and fifth leading causes of mortality, resulting in 2,651 deaths (CDC, 2018).

Problem Description

Hypertension is considered a silent killer because it often occurs without associated symptoms. Accurate blood pressure measurement is the underpinning of hypertension diagnosis and management. In 2017, the American College of Cardiology and the American Heart

Association released joint guidelines establishing the use of out-of-office BP measurements to confirm the diagnosis and treatment of hypertension (Whelton et al., 2017).

With specific, evidence-based guidelines in place, why does control of hypertension remain suboptimal? Although management of hypertension is central to primary care, the condition often is not the patient's chief complaint and therefore does not receive adequate attention during a visit. Furthermore, poor BP control can be partially attributed to clinical inertia and low patient engagement (Lewinski et al., 2021). For this QI project, interventions will focus on enhancing patient knowledge, adequate follow-up, and maximizing a fully empowered patient care team to overcome competing demands on the primary care provider.

Context

This quality-improvement project will occur at a primary care clinic in Montana. The site is part of an extensive network of more than 40 primary care and specialty clinics. The network is associated with a hospital system with facilities throughout the Western United States. The project site population includes 7,783 empaneled patients managed by three physicians, one APN, one PharmD, a licensed clinical social worker (LCSW), and support staff. Patient-age demographics span from birth to the end of life. Appointments are scheduled in 15-minute or 30-minute blocks, with most providers seeing at least 20 patients daily.

The clinic manager and the providers indicated that the care gap involving hypertension management was their primary focus for the upcoming year. The hypertension metric utilized by the clinic calculates the percentage of patients 18-75 years of age with a diagnosis of hypertension whose most recent blood pressure was less than 140/90 mmHg. The performance threshold established by CMS for this metric is as follows (see Table 1):

Table 1. Medicare Metric Standards.

Measure Name	Below Threshold	Threshold	Target	Exceptional
Hypertension Control	< 59 %	59-64%	64-72%	>72%

The year-to-date hypertension metric for the site is 58%. The site stakeholders have established a goal of achieving the target in the next 12 months. The organization has an updated policy addressing blood pressure measurement and the follow-up process for elevated readings that is in alignment with the 2017 ACC/AHA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults. Unfortunately, the uptake and incorporation of the policy into day-to-day practice have been suboptimal.

Organizational Microsystem

The healthcare system associated with the project site is a Medicare Accountable Care Organization (ACO) that recently merged with a larger multi-state healthcare organization. Medicare evaluates how well an ACO meets cost-saving goals and specific CMS quality performance standards each year. High-performing ACOs receive a portion of any savings that result from reducing costs and meeting quality requirements, which may be used to invest in patient care or share a portion directly with participating providers. This provides a financial incentive to both the organization and the provider. The agency is working to improve care quality through better chronic disease management. Primary care quality measures for 2022 include diabetes, breast cancer screening, colorectal cancer screening, cervical cancer screening, controlling high blood pressure, tobacco screening, and screening for future fall risk.

The care network associated with the project site adopted the patient-centered-medical-home (PCMH) model of care in 2015. Primary care activities emphasize disease prevention and

management, population health improvement, and integrated care coordination. The site clinicians admit that the paradigm shift from fee-for-service to value-based care came with some growing pains, especially regarding scheduling and charting. The overall culture of the clinic, however, is now in alignment with the goals of PCMH. Performance measures for wellness screening and pilot measures are currently at target or exceptional.

Regarding chronic disease management, the diabetes metric indicates that the project site is at target, while hypertension management remains below threshold. A barrier identified by the clinic stakeholders is an unusual provider and staff turnover in the last two years. The clinic lost two physicians and a nurse practitioner in rapid succession. Although they are actively recruiting, only one new physician has been hired. This situation has created a workload strain on the remaining providers as they have struggled to absorb the empaneled patients with no primary care provider.

Further, there has been a turnover in the nursing staff that has required the recruitment and training of new hires. These personnel deficits have likely contributed to the current shortfall in hypertension management. Although an organizational policy was released in 2020 to guide the workflow for blood pressure measurement and follow-up process, implementation has not been a priority due to the clinic-wide staff shortage. The clinic still down two providers, but all nursing and support positions are currently filled. Stakeholders indicate improved patient outcomes and financial incentives as strong motivators for improving hypertension screening and believe the clinic is poised to initiate change.

Rationale

Graham and colleagues developed the Knowledge to Action (KTA) Framework in 2006 to streamline translating knowledge into sustainable practice change (Field et al., 2014). Ultimately, this conceptual framework aims to make the knowledge translation process more systematic and increase the likelihood of evidence-based practice change and dissemination (Field et al., 2014; Graham & Tetroe, 2007). In a systematic review investigating the practical application of the KTA Framework, Field et al. (2014) concluded that the model provides a feasible and adaptable guide to incorporating best evidence into practice. The KTA framework is comprised of two main elements 1) the knowledge creation process and 2) the action cycle. The knowledge creation phase involves developing a knowledge product/tool, practice guideline, decision aid, or clinical pathway. The action cycle includes several phases, including 1) identification of the problem, selecting knowledge to address the problem, and determining the gap between knowledge and practice 2) adapting the knowledge to context 3) assessing barriers and facilitators to knowledge use, 4) selecting the appropriate implementation strategies for the setting 5) monitoring knowledge use, 6) evaluating outcomes, and 7) sustaining the change (Graham & Tetroe, 2007). In this case, a practice guideline is in place but has yet to be incorporated into the daily workflow. The clinic stakeholders voiced that adapting current BP screening and management recommendations to the local context of the clinic is desirable. However, time and staffing have posed consistent barriers.

Specific Aims

The clinic stakeholders identified hypertension management as an ongoing struggle. The primary care network associated with the project site utilizes an EMR that allows clinicians to display key metrics for hypertension management. These metrics are calculated for empaneled patients for a provider or specific medical group. An analysis was run to compare the hypertension metric for the intervention site and two other clinics with similar patient demographics within the provider network and in the same community. The year-to-date hypertension control metric for the project site is 58% compared to 62% and 74% at the other two clinics. Although all three sites utilize the same policy to guide blood pressure measurement and follow-up, the project site lags behind its counterparts. The adaptability of the KTA framework is well-suited to help stakeholders integrate the current practice guidelines into an achievable practice change. Providers, nurses, and support staff indicate that interventions aimed at increasing proper patient HBPM technique and a feasible workflow that assists the clinicians in addressing elevated HBPM would assist the clinic in achieving specific metric goals and improving patient outcomes. Ultimately, this project aims to increase the hypertension metric to reflect 100% of diagnosed hypertensive patients achieving a blood pressure of <140/90 mmHg.

Goals

Short-term Outcome Goals

1. Develop a patient handout designed to increase patient knowledge regarding the significance of blood pressure management, how to monitor blood pressure at home, and timely follow-up.

2. Employ team change strategies regarding the follow-up and management of hypertension, including the care manager and pharmacist working in conjunction with the primary care provider and nursing staff. Submit hypertension treatment algorithm.

Intermediate Outcome Goals

1. Personalized tip sheet, home blood pressure instructions, and blood pressure log will be handed out to 100% of patients with a blood pressure ≥140/90 mmHg.

2. 100% of patients with blood pressure greater than or equal to ≥ 140/90 mmHg will receive communication from the designated clinician regarding blood pressure cuff validation, home blood pressure readings, and blood pressure management.

Long-term Outcome Goals

1. Clinic hypertension control will be at or above the CMS threshold of 59%.

2. Clinic hypertension control will reflect that 100% of patients on the hypertension registry will have blood pressure controlled to < 140/90 mmHg.

SMART Goals

1. 100% of patients meeting BP criteria will receive education regarding the significance of home blood pressure monitoring, proper technique, and timely follow-up.

2. Greater than 50% of patients meeting BP criteria will receive team-based care with collaboration between the pharmacist and PCP.

3. Long-term goal is to achieve hypertension control at or above the CMS threshold. Increase metric percentage to 59%.

Interventions

The uptake of evidence-based approaches to improve BP control remains suboptimal. Although the organizational network associated with the project site has developed a policy to address this gap, implementation barriers have prohibited the incorporation of the policy into the daily workflow. The project site employs a patient-centered medical home (PCMH) model to deliver high-quality, cost-effective primary care. The clinic has been working toward integrated health for several years and currently has a pharmacist, care coordinator, and LCSW on site. The PCMH model emphasizes that patient care be organized around an individual patient's needs. This model allows for a team approach in which care may be delegated to team members, allowing healthcare professionals to work to the top of their license by collaborating directly with the patient to identify problems and barriers to achieving disease control. In terms of hypertension, delegated tasks may include screening, lifestyle modification, and medication adjustment (Carter et al., 2012).

The QI strategy for this project underscores the intention of the PCMH model by utilizing a combination of interventions, including team change, home blood pressure education, and timely follow-up to work toward the desired outcomes. A substantial body of evidence indicates that teams are effective in treating hypertension. Walsh et al. (2006) conducted a systematic review examining QI strategies to improve hypertension. The authors determined that team change had the largest effect on systolic blood pressure (SBP) and diastolic blood pressure (DPB) compared to other interventions, including provider-specific and patient-specific interventions. A common feature of team change studies involves reassigning specific patient care responsibilities to a care professional other than the provider (Walsh et al., 2006). For this

QI project, the current workflow will be revised to encompass the full professional capacity of the onsite team. Evidence supports the increasing role of pharmacists in hypertension management. A meta-analysis of team care by Carter et al. (2009) evaluated the effectiveness of pharmacist-assisted management of hypertension. The analysis found a significantly greater probability of controlled BP in studies involving pharmacists embedded in the clinics. Variables included pharmacist-recommended therapy to the physician, patient education, pharmacist performing the intervention, medication adherence, and use of a treatment algorithm.

Similarly, a review by Wagner et al. (2020) revealed that numerous randomized controlled trials had demonstrated the efficacy of pharmacist-led team interventions to improve BP control in the primary care setting. The onsite pharmacist indicated willingness and motivation to take on hypertension management responsibilities. The clinic's PCPs also indicated enthusiasm for this intervention and a desire to support a collaborative prescriptive agreement with the pharmacist.

Historically, office blood pressure monitoring (OBPM) has been the gold standard for hypertension diagnosis and treatment. Recent data indicate that home blood pressure monitoring (HBPM) results in more accurate hypertension diagnoses, improved BP control, and enhanced medication adherence (Breaux-Shropshire et al., 2015; Cappuccio et al., 2004; Viera et al., 2010, Uhlig et al., 2013). Inaccuracy in the measurement of BP of as little as 5 mm Hg can lead to the misdiagnosis and mismanagement of hypertension, with significant repercussions for both individual and population management (Argha et al., 2020).

The literature supports using HBPM as a tool for hypertension diagnosis and management (US. Preventive Services Task Force, 2021; Zou et al., 2020; Mutner et al., 2019;

Karnjanapiboonwong et al., 2020; & Cappuccio et al., 2004). Patient education regarding the proper technique for HBP measurement is currently built into the clinic workflow and has the potential to help clinicians accurately diagnose hypertensive patients. The office currently has a protocol for rechecking an initial elevated blood pressure. The workflow becomes inconsistent from that point. Patients are asked to begin monitoring blood pressure from home if they have a cuff or to return in one week for a recheck. However, patients are not provided with individualized BP education or a consistent avenue for follow-up or communication. Patients with an elevated average home BP or an elevated office BP recheck should be scheduled for a follow-up to provide education, discuss lifestyle modification, initiate treatment, address barriers to medication taking, or intensify medications.

Methods

All patients presenting to the clinic with an SBP >140 mmHg or DBP > 90 mmHg will be rechecked. If the second BP remains elevated, the patient will receive an individualized handout with their most recent BPs and basic information regarding the increased cardiovascular risk of a sustained elevated BP. If the patient has a home-BP cuff, they will be asked to schedule a nurse visit for cuff validation, and a BP recheck in one week. Education will be provided regarding proper home blood pressure measuring techniques and recording. If the patient does not have a home BP cuff, they will be asked to schedule a nurse visit for BP recheck in one week. If the home or rechecked office BP remains above the specified parameter, a referral will be placed to the pharmacist, and a note will be sent to the provider. The pharmacist will reach out to the patient to initiate therapy that is collaboratively agreed upon with the PCP. The patient will be asked to follow up via telehealth or face-to-face with the provider in 30 days.

The project site utilizes a hypertension registry to track patients with BPs≥ 140/90. The registry report can be filtered to show patients who have presented to the clinic within any specified time frame. The project lead will review the report weekly and reach out to the patients that have been seen and not followed up with a BP recheck. When blood pressure is elevated during the initial recheck, the patient will be provided with a blood pressure folder including home BP measuring instructions, plain language explanation of the risks of hypertension and cardiovascular disease, and a blood pressure log. This will be tracked based on a dot phrase in the EMR that indicates the provision of hypertension education. A nurse will be available to provide information and support if patients have questions or concerns. Necessary resources will include access to the EMR, clinician buy-in, and the ability to print and provide BP material. Figures 2 and 3 show the current and proposed hypertension management workflows.

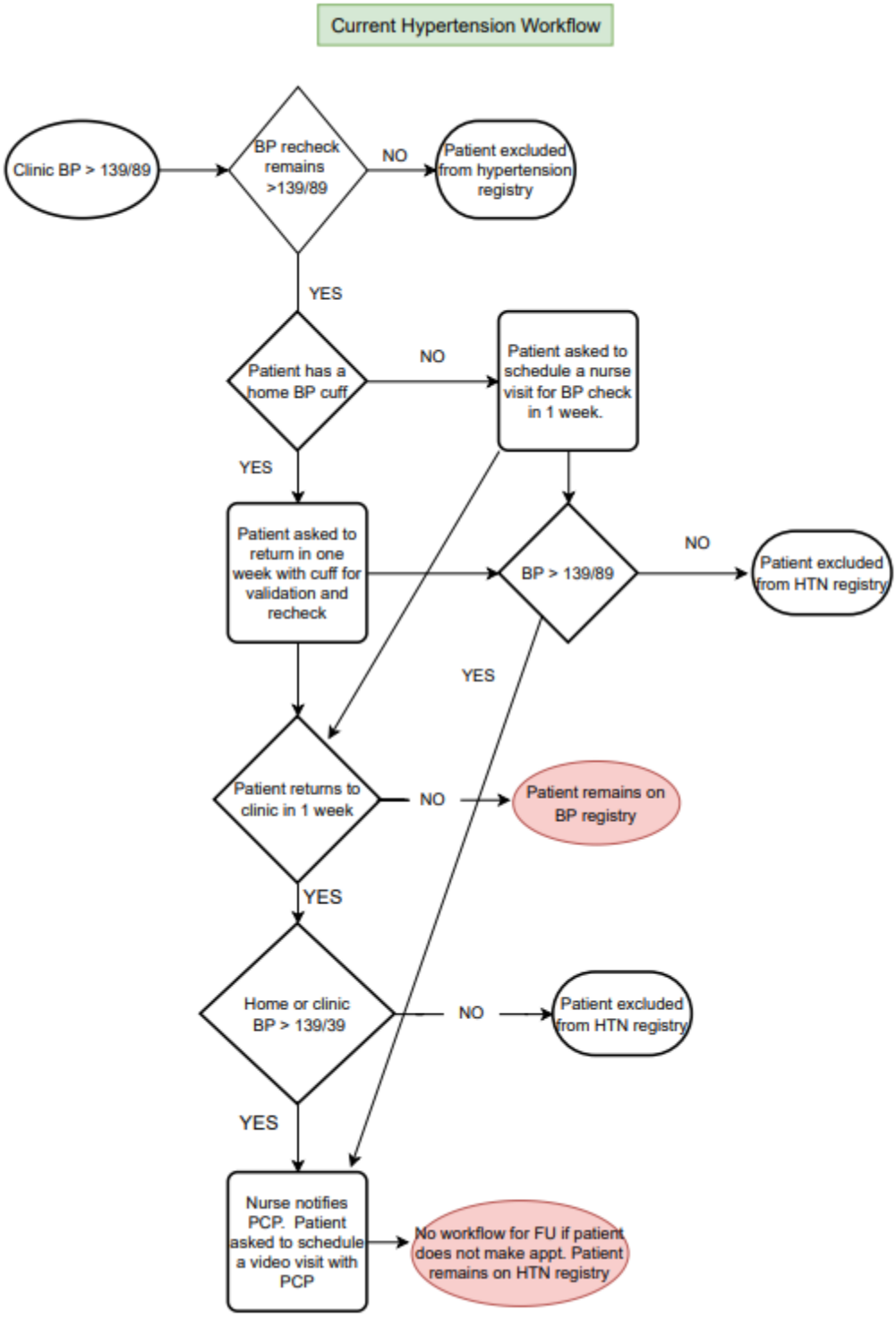


Figure 2. Current Hypertension Workflow.

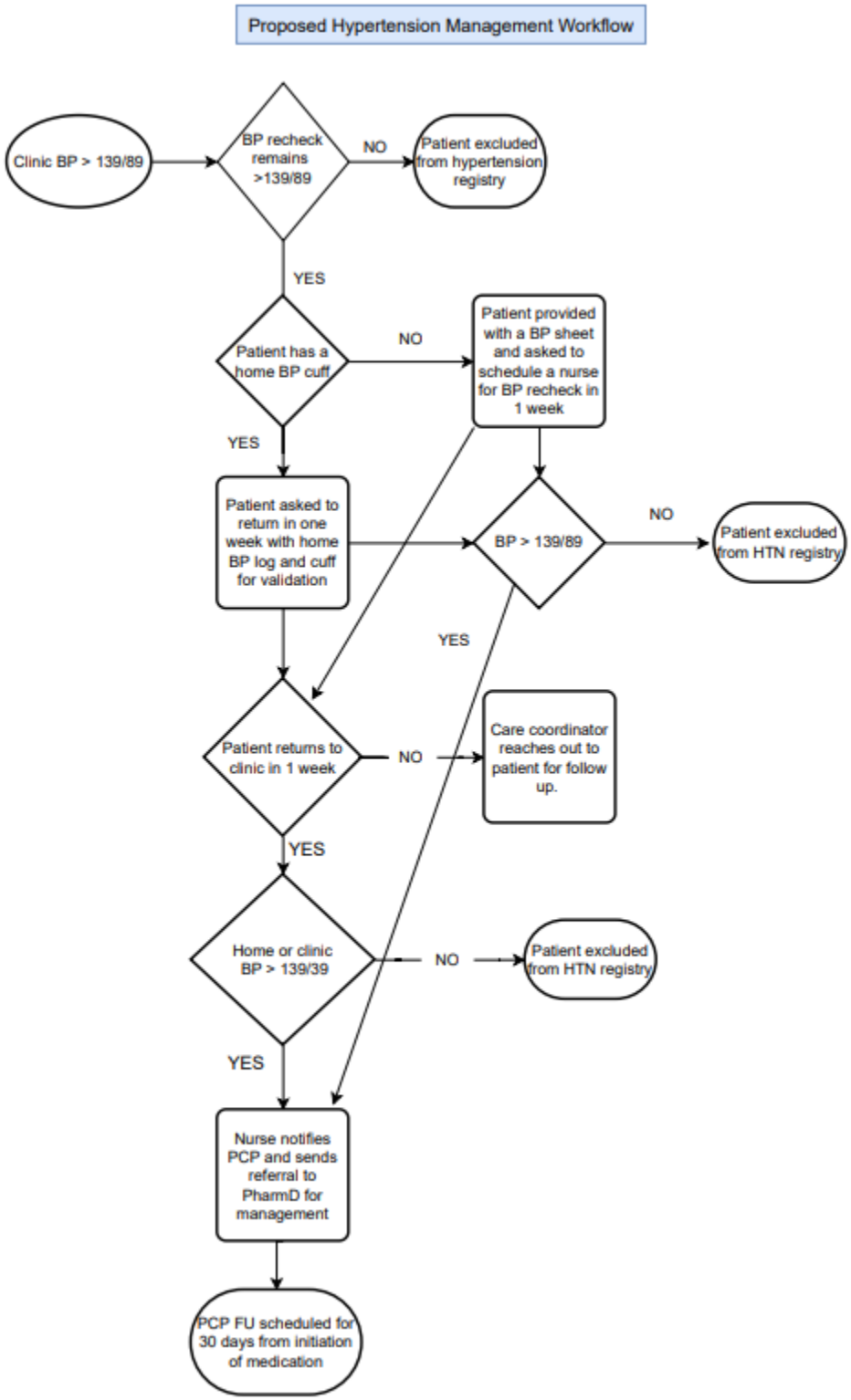


Figure 3. Proposed Hypertension Workflow.

Measures

Descriptive statistics will be used to interpret the collected data. Specific measures that will be evaluated include the total number of patients that meet the diagnostic criteria (blood pressure ≥ 140/90) compared to 1) the number of patients that receive the designated education as documented by the SmartPhrase and 2) the number of patients that receive a referral to the pharmacist for BP management. These data will be presented in percentages. In addition, the CMS metric tracked by the EMR system will be evaluated on a weekly basis to determine if the clinic is moving toward the goal of "threshold" which is 59-64% of adults with a diagnosis of hypertension that is controlled. Run charts will be used to monitor trends and patterns in the intervention data, on a weekly basis throughout the implementation period.

Limitations

The challenges of this project lie in resource reallocation, financing material, and patient participation. The clinic currently has an effective workflow for ensuring that every patient with an elevated BP is rechecked, resulting in appropriate office screening, but the workflow breaks down from there. The PCMH model places the patient at the center of the team. This project relies on patient participation, which is not necessarily guaranteed. Patients who choose not to follow up will remain on the hypertension registry despite attempted intervention. The BP handout with individualized patient data will be used to educate the patient regarding the cardiovascular benefits of controlling blood pressure and incorporate them as a team member. Clinic stakeholders are highly motivated to initiate change and are willing to provide folders and patient handouts, and chart education in the EMR.

Although the project site is moving toward a team-based model of care, this intervention will require reorganizing patient care roles and responsibilities. Primary care provider comfort level in delegating hypertension could present a potential barrier. Evidence indicates that interventions incorporating team member roles that permit medication management using evidence-based protocols, independent of primary care providers or with their approval, are more effective than outreach support only (Proia et al., 2014). The pharmacist at the project site holds a collaborative agreement with the providers, permitting prescriptive privileges of blood pressure medications. The team members should remain in close communication regarding initiating new drugs and appropriate follow-up. Additionally, using an agreed-upon algorithm for prescribing could increase the comfort level of delegated medication management.

Evaluation

Descriptive statistical methods will be utilized to interpret project data. Based on the hypertension registry, all patients that present to the clinic with a blood pressure ≥ 140/90 will be tracked. The frequency of patient follow-up and pharmacist intervention will be evaluated by comparing weekly percentages, with the goal being 75% and 50%, respectively, for all eligible patients. Because this project incorporates new interventions into the workflow, it is anticipated that there will be a baseline of 0 documented hypertension education encounters in the EMR. The goal for week 1 will be that 75% of patients seen in the office with a blood pressure ≥ 140/90 will receive education. The goal will be increased by 5% for each ongoing week of the 6-week project period.

The outcome focused on pharmacist referral states that > 50% of patients meeting elevated BP criteria will receive team-based care within the guidelines of the collaborative

agreement between the providers and the pharmacist. This goal will be analyzed at baseline (with an expectation of 0), at three weeks with a goal of 35%, and at 6 weeks with a goal of 50%.

The third outcome involves increasing the CMS hypertension metric to achieve a score of "target" which is 64%. Currently, the clinic metric is 58%. The goal is to increase the metric by 1% each week of project implementation. According to the EPIC MGPS Quality Dashboard, the hypertension metric is determined as follows:

1)Denominator: Patients 18-75 that are in the hypertension registry

2) Numerator: Patients with a most recent blood pressure reading <140/<90

3)Exclusion: Patients enrolled in hospice or receiving palliative care during the measurement period. Patients with ESRD, dialysis, a renal transplant, or pregnancy during the calendar year, patients who are aged 66+ and spent more than 90 days in long-term care within the calendar year.

Table 2. Smart Goal #1,

SMART Goal # 1: 100% of patients meeting BP criteria will receive education regarding the significance of home blood pressure monitoring, proper technique, and follow-up.		
Description of strategies to be utilized to accomplish the goal, including any needed resources. • The care team will agree on a patient handout that includes basic hypertension information, how to take home BP, the importance of risk reduction, and individual patient blood pressures (last three clinic BPs). • The project lead will work with IT to determine if this can be included as a smart phrase in AVS. • Previously established BP technique teaching will be reinforced. • Funding for paper and printing services for a handout will need to be determined if it cannot be included in the clinic budget.		
Data to be collected	Method of Collection and who is responsible	Planned data analysis
Number of patients with a blood pressure ≥ 140/90	The care coordinator or project lead will run a weekly EMR report that captures patients based on established parameters. Project lead will conduct a chart audit on patients to determine how many were provided with appropriate education material. Project lead will enter deidentified data into excel spreadsheet to capture number of patients flagged and number of patients provided with material.	Data will be presented in a run chart indicating total number of patients that meet criteria and number of patients receiving appropriate education.

Table 3. Smart Goal #2.

SMART Goal #2: > 50% of patients meeting BP criteria will receive team-based care with collaboration between the pharmacist and PCP.		
Description of strategies to be utilized to accomplish goal, including any needed resources. • Nurse will refer patient meeting criteria to pharmacist and notify provider via an encounter message. • Pharmacist will review chart and collaborate with PCP as needed. • Pharmacist will reach out to patient via phone or mychart message. • Pharmacist or PCP will initiate intervention. • Follow up will be scheduled for 1 month with PCP (telehealth or face-to-face).		
Data to be collected	Method of Collection and who is responsible	Planned data analysis
Total number of outreach contacts made by pharmacist on a weekly basis.	Pharmacist will document the number of weekly calls. Project lead will enter de-identified data into an excel spreadsheet to capture the number of patients referred to pharmacist and number of patient receiving an outreach call.	Data will be presented in a run chart indicating total number of patients that meet criteria who are contacted for intervention.

Table 4. Smart Goal #3.

SMART Goal #3: Long-term goal is to achieve hypertension control at or above CMS threshold. Increase metric percentage to 59%.		
Description of strategies to be utilized to accomplish goal, including any needed resources. • Implementation of QI interventions, including home blood pressure measurement follow-up, care coordination, and team-based management, will be implemented as outlined.		
Data to be collected	Method of Collection and who is responsible	Planned data analysis
CMS quality metric will be compared for the three months prior to intervention, during intervention, and post-intervention.	Site lead will run hypertension metric report for designated time frame.	Data will be presented in a run chart.

References

Argha, A., Celler, B. G., & Lovell, N. H. (2020). Artificial intelligence based blood pressure estimation from ausculatory and oscillometric waveforms: A methodological review. *IEEE Review in Biomedical Engineering*, *15*, 152–168. https://doi.org/10.1109/RBME.2020.3040715

Asayama, K., Ohkubo, T., Kikuya, M., Metoki, H., Hoshi, H., Hashimoto, J., Totsune, K., Satoh, H., & Imai, Y. (2004). Prediction of stroke by self-measurement of blood pressure at home versus casual screening blood pressure measurement in relation to the joint national committee 7 classification. *Stroke*, *35*(10), 2356–2361. https://doi.org/10.1161/01.str.0000141679.42349.9f

Band, R., Bradbury, K., Morton, K., May, C., Michie, S., Mair, F. S., Murray, E., McManus, R. J., Little, P., & Yardley, L. (2017). Intervention planning for a digital intervention for self-management of hypertension: A theory-, evidence- and person-based approach. *Implementation Science*, *12*(1). https://doi.org/10.1186/s13012-017-0553-4

Bangalore, S., Toklu, B., Gianos, E., Schwartzbard, A., Weintraub, H., Ogedegbe, G., & Messerli, F. H. (2017). Optimal systolic blood pressure target after sprint: Insights from a network meta-analysis of randomized trials. *The American Journal of Medicine*, *130*(6), 707–719.e8. https://doi.org/10.1016/j.amjmed.2017.01.004

Breaux-Shropshire, T. L., Judd, E., Vucovich, L. A., Shropshire, T. S., & Singh, S. (2015). Does home blood pressure monitoring improve patient outcomes? A systematic review comparing home and ambulatory blood pressure monitoring on blood pressure control and patient outcomes. *Integrated Blood Pressure Control*, *8*, 43–49. https://doi.org/10.2147/IBPC.S49205

Cappuccio, F. P., Kerry, S. M., Forbes, L., & Donald, A. (2004). Blood pressure control by home monitoring: Meta-analysis of randomised trials. *BMJ*, *329*(7458), 145. https://doi.org/10.1136/bmj.38121.684410.ae

Carter, B. L., Bosworth, H. B., & Green, B. B. (2011). The hypertension team: The role of the pharmacist, nurse, and teamwork in hypertension therapy. *The Journal of Clinical Hypertension*, *14*(1), 51–65. https://doi.org/10.1111/j.1751-7176.2011.00542.x

Carter, B. L., Rogers, M., Daly, J., Zheng, S., & James, P. A. (2009). The potency of team-based care interventions for hypertension. *Archives of Internal Medicine*, *169*(19). https://doi.org/10.1001/archinternmed.2009.316

Centers for Disease Control an Prevention. (2022). *Facts about hypertension*. Centers for Disease Control and Prevention. https://www.cdc.gov/bloodpressure/facts.htm

Centers for Disease Control and Prevention. (n.d.). *Promoting team-based care to improve high blood pressure control*. https://doi.org/https://www.cdc.gov/dhdsp/pubs/guides/best-practices/team-based-care.htm

Centers for Disease Control and Prevention. (2018). *Stats of the state of Montana* (2017). https://www.cdc.gov/nchs/pressroom/states/montana/montana.htm

Centers for Disease Control and Prevention. (2022). *Heart disease in the United States*. https://doi.org/https://www.cdc.gov/heartdisease/facts.htm

Department of Veterans Affairs Department of Defense. (2014). *VA/DoD clinical practice guideline for the diagnosis and management of hypertension in primary care setting*

guideline summary. VA/DoD. https://doi.org/https://permanent.fdlp.gov/gpo114995/HTNSUM3FIA20151209.pdf

Ferdinand, K. C., Vo, T. N., & Echols, M. R. (2020). State-of-the-art review: Hypertension practice guidelines in the era of covid-19. *American Journal of Preventive Cardiology*, *2*, 100038. https://doi.org/10.1016/j.ajpc.2020.100038

Field, B., Booth, A., Ilott, I., & Gerrish, K. (2014). Using the knowledge to action framework in practice: A citation analysis and systematic review. *Implementation Science*, *9*(1). https://doi.org/10.1186/s13012-014-0172-2

Graham, I. D., & Tetroe, J. (2007). Some theoretical underpinnings of knowledge translation. *Academic Emergency Medicine, 14*(11), 936–941. https://doi.org/10.1111/j.1553-2712.2007.tb02369.x

Kario, K. (2021). Home blood pressure monitoring: Current status and new developments. *American Journal of Hypertension*, *34*(8), 783–794. https://doi.org/10.1093/ajh/hpab017

Karnjanapiboonwong, A., Anothaisintawee, T., Chaikledkaew, U., Dejthevaporn, C., Attia, J., & Thakkinstian, A. (2020). Diagnostic performance of clinic and home blood pressure measurements compared with ambulatory blood pressure: A systematic review and meta-analysis. *BMC Cardiovascular Disorders*, *20*(1). https://doi.org/10.1186/s12872-020-01736-2

Kravetz, J. D., & Walsh, R. F. (2016). Team-based hypertension management to improve blood pressure control. *Journal of Primary Care & Community Health*, *7*(4), 272–275. https://doi.org/10.1177/2150131916645580

Lee, J., Kim, S.-H., Kang, S.-H., Cho, J., Cho, Y., Oh, I.-Y., Yoon, C.-H., Lee, H.-Y., Youn, T.-J., Chae, I.-H., & Kim, C.-H. (2018). Blood pressure control and cardiovascular outcomes: Real-world implications of the 2017 acc/aha hypertension guideline. *Scientific Reports*, *8*(1). https://doi.org/10.1038/s41598-018-31549-5

Lewinski, A. A., Bosworth, H. B., Goldstein, K. M., Gierisch, J. M., Jazowski, S., McCant, F., White-Clark, C., Smith, V. A., & Zullig, L. L. (2021). Improving cardiovascular outcomes by using team-supported, ehr-leveraged, active management: Disseminating a successful quality improvement project. *Contemporary Clinical Trials Communications*, *21*, 100705. https://doi.org/10.1016/j.conctc.2021.100705

Liyanage-Don, N., Fung, D., Phillips, E., & Kronish, I. M. (2019). Implementing home blood pressure monitoring into clinical practice. *Current Hypertension Reports*, *21*(2). https://doi.org/10.1007/s11906-019-0916-0

Meidert, A. S., & Saugel, B. (2018). Techniques for non-invasive monitoring of arterial blood pressure. *Frontiers in Medicine*, *4*. https://doi.org/10.3389/fmed.2017.00231

Muntner, P., Shimbo, D., Carey, R. M., Charleston, J. B., Gaillard, T., Misra, S., Myers, M. G., Ogedegbe, G., Schwartz, J. E., Townsend, R. R., Urbina, E. M., Viera, A. J., White, W. B., & Wright, J. T. (2019). Measurement of blood pressure in humans: A scientific statement from the american heart association. *Hypertension*, *73*(5). https://doi.org/10.1161/hyp.0000000000000087

Ohio Colleges of Medicine. (2017). *Hypertension Quality Improvement Change Package*. Ohio Cardiovascular and Diabetes Health Collaborative. https:/www.cardi-oh/org/qip/hypertension/change-package

Olsen, M. H., Angell, S. Y., Asma, S., Boutouyrie, P., Burger, D., Chirinos, J. A., Damasceno, A., Delles, C., Gimenez-Roqueplo, A.-P., Hering, D., López-Jaramillo, P., Martinez, F., Perkovic, V., Rietzschel, E. R., Schillaci, G., Schutte, A. E., Scuteri, A., Sharman, J. E., Wachtell, K., & Wang, J. (2016). A call to action and a lifecourse strategy to address the global burden of raised blood pressure on current and future generations: The lancet commission on hypertension. *The Lancet*, *388*(10060), 2665–2712. https://doi.org/10.1016/s0140-6736(16)31134-5

Ostchega, Y., Fryar, C. D., Nwankwo, T., & Nguyen, D. T. (2020). *Hypertension prevalence among adults aged 18 and over: United States, 2017-2018*. Centers for Disease Control and Prevention. https://doi.org/https://stacks.cec.gov/view/cdc/87559

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S.,...Moher, D. (2021). The prisma 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, n71. https://doi.org/10.1136/bmj.n71

Pasha, M., Brewer, L. C., Sennhauser, S., Alsawas, M., & Murad, M. (2021). Health care delivery interventions for hypertension management in underserved populations in the united states: A systematic review. *Hypertension*, *78*(4), 955–965. https://doi.org/10.1161/hypertensionaha.120.15946

Pokharel, Y., Karmacharya, B. M., & Neupane, D. (2022). Hypertension—a silent killer without global bounds. *Journal of the American College of Cardiology*, *80*(8), 818–820. https://doi.org/10.1016/j.jacc.2022.05.043

Proia, K. K., Thota, A. B., Njie, G. J., Finnie, R. K., Hopkins, D. P., Mukhtar, Q., Pronk, N. P., Zeigler, D., Kottke, T. E., Rask, K. J., Lackland, D. T., Brooks, J. F., Braun, L. T., & Cooksey, T. (2014). Team-based care and improved blood pressure control. *American Journal of Preventive Medicine*, *47*(1), 86–99. https://doi.org/10.1016/j.amepre.2014.03.004

Roerecke, M., Kaczorowski, J., & Myers, M. G. (2019). Comparing automated office blood pressure readings with other methods of blood pressure measurement for identifying patients with possible hypertension. *JAMA Internal Medicine*, *179*(3), 351. https://doi.org/10.1001/jamainternmed.2018.6551

Shaikh, U., Petray, J., & Wisner, D. H. (2020). Improving blood pressure screening and control at an academic health system. *BMJ Open Quality*, *9*(1), e000614. https://doi.org/10.1136/bmjoq-2018-000614

Sharman, J. E., Tan, I., Stergiou, G. S., Lombardi, C., Saladini, F., Butlin, M., Padwal, R., Asayama, K., Avolio, A., Brady, T. M., Murray, A., & Parati, G. (2022). Automated 'oscillometric' blood pressure measuring devices: How they work and what they measure. *Journal of Human Hypertension*. https://doi.org/10.1038/s41371-022-00693-x

Shimbo, D., Abdalla, M., Falzon, L., Townsend, R. R., & Muntner, P. (2015). Role of ambulatory and home blood pressure monitoring in clinical practice. *Annals of Internal Medicine*, *163*(9), 691–700. https://doi.org/10.7326/m15-1270

Uhlig, K., Patel, K., Kitsios, G. D., & Balk, E. M. (2013). Self-measured blood pressure monitoring in the management of hypertension: a systematic review and meta-analysis. *Annals of Internal Medicine*, *159*, 18885–194. https://www-acpjournals-org.proxybz.lib.montana.edu/doi/epdf/10.7326/0003-4819-159-3-201308060-00008

United State Preventive Services Task Force. (2021). *Screening for hypertension in adults US Preventive Services Task Force reaffirmation recommendation statement*. US Preventive Services Task Force. https://doi.org/10.1001/jama.2021.4987

Viera, A. J., Hinderliter, A. L., Kshirsagar, A. V., Fine, J., & Dominik, R. (2010). Reproducibility of masked hypertension in adults with untreated borderline office blood pressure: Comparison of ambulatory and home monitoring. *American Journal of Hypertension*, *23*(11), 1190–1197. https://doi.org/10.1038/ajh.2010.158

Vischer, A. S., & Bukard, T. (2017). Principles of blood pressure measurement-Current techniques, office vs ambulatory blood pressure measurement. In M. S. Islam (Ed.), *Hypertension: From basic research to clinical practice: Volume 2 (advances in experimental medicine and biology, 956)* (1st ed., 2017, pp. 85–96). Springer. https://link-springer-com.proxybz.lib.montana.edu/chapter/10.1007/5584_2016_49#Tab1

Wagner, T. D., Jones, M. C., Salgado, T. M., & Dixon, D. L. (2020). Pharmacist's role in hypertension management: A review of key randomized controlled trials. *Journal of Human Hypertension*, *34*(7), 487–494. https://doi.org/10.1038/s41371-020-0331-7

Wajngarten, M., & Silva, G. (2019). Hypertension and stroke: Update on treatment. *European Cardiology Review*, *14*(2), 111–115. https://doi.org/10.15420/ecr.2019.11.1

Walsh, J. E., McDonald, K. M., Shojania, K. G., Sundaram, V., Nayak, S., Lewis, R., Owens, D. K., & Goldstein, M. (2006). Quality improvement strategies for hypertension management. *Medical Care*, *44*(7), 646–657. https://doi.org/10.1097/01.mlr.0000220260.30768.32

Whelton, P. K., Carey, R. M., Aronow, W. S., Casey, D. E., Collins, K. J., Dennison Himmelfarb, C., DePalma, S. M., Gidding, S., Jamerson, K. A., Jones, D. W., MacLaughlin, E. J., Muntner, P., Ovbiagele, B., Smith, S. C., Spencer, C. C., Stafford, R. S., Taler, S. J., Thomas, R. J., Williams, K. A.,...Wright, J. T. (2018). 2017 acc/aha/aapa/abc/acpm/ags/apha/ash/aspc/nma/pcna guideline for the prevention, detection, evaluation, and management of high blood pressure in adults. *Journal of the American College of Cardiology*, *71*(19), e127–e248. https://doi.org/10.1016/j.jacc.2017.11.006

Zuo, H.-J., Ma, J.-X., Wang, J.-W., & Chen, X.-R. (2020). Assessing the routine-practice gap for home blood pressure monitoring among chinese adults with hypertension. *BMC Public Health*, *20*(1). https://doi.org/10.1186/s12889-020-09901-0

CHAPTER THREE

IMPROVING BLOOD PRESSURE CONTROL IN PRIMARY CARE: A QUALITY INITIATIVE

Introduction

Problem Description

The global burden of hypertension (HTN) is expansive and expanding. Elevated blood pressure (BP) is the most significant modifiable risk factor for the development of cardiovascular disease and its associated morbidity and mortality. Despite a vast body of literature regarding the prevention, diagnosis, and management of HTN, the incidence of the condition continues to climb (Lee et al., 2018; Olsen et al., 2016; Ferdinand et al., 2020). Hypertension has reached pandemic proportions affecting 1.4 billion people worldwide (Ferdinand et al., 2020). In the United States, approximately half of individuals 18 years or older live with uncontrolled hypertension, defined as a systolic BP greater than or equal to 130 mm Hg or a diastolic BP greater than or equal to 80 mm Hg. In 2020, 670,000 deaths in the United States listed hypertension as a primary contributing cause (Centers for Disease Control and Prevention, 2022). Montana is no exception. In 2017 heart disease and stroke were the first and fifth leading causes of mortality, resulting in 2,651 deaths (CDC, 2018).

The high morbidity and mortality associated with cardiovascular disease (CVD) make it one of the costliest health conditions in the United States. Between 2018 and 2019, the estimated direct and indirect costs of CVD were $407.3 billion (Tsao et al., 2023). According to Virani et al. (2020), hypertension is the most prevalent modifiable risk for developing CVD in women and

the second leading modifiable risk factor for developing CVD in men. Controlling hypertension would profoundly impact the reduction of morbidity, mortality, and the associated financial burden of cardiovascular disease nationwide. In 2020, the Office of the Surgeon General identified effective HTN management and optimizing patient care for hypertension control as a health priority in the United States (US Department of Health and Human Services, 2020; Saunders et al., 2022). Effective management of hypertension is a key priority for primary care. Strategies to prevent the adverse health effects of hypertension in the United States include increasing awareness of the health risks of uncontrolled hypertension, promoting the use of healthcare teams to manage hypertension, and empowering patients to use self-measured blood pressure monitoring (US Department of Health and Human Services, 2020).

Available Knowledge

Hypertension is the most frequently diagnosed condition at outpatient office visits in the United States (Ostchega et al., 2020). Office blood pressure monitoring (OBPM) has historically been the gold standard for hypertension diagnosis and treatment. More recent data indicate that home blood pressure monitoring (HBPM) results in more accurate hypertension diagnoses, improved BP control, and enhanced medication adherence (Breaux-Shropshire et al., 2015; Cappuccio et al., 2004; Viera et al., 2010, Uhlig et al., 2013). Error in the measurement of BP of as little as 5 mm Hg can lead to the misdiagnosis and mistreatment of hypertension, with significant individual and public health consequences (Argha et al., 2020). Breaux-Shropshire et al. (2015) conducted a systematic review examining the clinical effectiveness of HBPM. The review revealed that OBPM overestimates the systolic BP response to therapy by an average of 4.6 mmHg compared to HBPM, making the latter a more sensitive measure of possible

hypertension-related morbidity and mortality (Breaux-Stropshire et al., 2015). Similarly, in a meta-analysis of randomized trials, Cappcucio et al. (2004) concluded that blood pressure control increased when HBPM, as opposed to OBPM, was employed with systolic measurements lowered by 4.2% (95% confidence interval 1.5 to 6.9) mmHg and diastolic reduced by 2.4 (95% confidence interval 1.2 to 3.5) mmHg. These reductions in blood pressure are clinically significant in reducing vascular morbidity and mortality in the studied populations (Cappuccio et al., 2004).

The literature supports team-based care as an impactful intervention for improving high blood pressure control (Kravetz & Walsh, 2016; Carter et al., 2009; Pasha et al., 2021; Chattopadhya et al., 2015). Team-based care is a strategy that aims to enhance patient care by including health professionals from multiple disciplines, working collaboratively with the patient and the primary care provider (PCP) to improve outcomes. Team members include the patient, the PCP, and other clinical health professionals such as pharmacists, social workers, nurses, nutritionists, and community health workers. Specific strategies that the health team can use to improve blood pressure include patient education, patient follow-up, medication management, medication adherence support, self-management support, and self-measured blood pressure (Centers for Disease Control and Prevention, n.d.). A systematic review by Proia et al. (2014) concluded that team-based care increased the proportion of people with controlled BP and reduced both systolic and diastolic BP. The evidence further indicates that improvement in the proportion of patients with controlled BP was higher with the addition of nurses and pharmacists to the care team, as compared to other blood pressure control interventions (Proia et al., 2014; Pasha et al., 2021; Kravetz & Walsh, 2016; & Carter et al., 2022)

Rationale

Graham and colleagues developed the Knowledge to Action (KTA) Framework in 2006 to streamline translating knowledge into sustainable practice change (Field et al., 2014). Ultimately, this conceptual framework aims to make the knowledge translation process more systematic and increase the likelihood of evidence-based practice change and dissemination (Field et al., 2014; Graham & Tetroe, 2007). In a systematic review investigating the practical application of the KTA Framework, Field et al. (2014) concluded that the model provides a feasible and adaptable guide to incorporating best evidence into practice. The KTA framework is comprised of two main elements 1) the knowledge creation process and 2) the action cycle. The knowledge creation phase involves developing a knowledge product/tool, practice guideline, decision aid, or clinical pathway. The action cycle includes several phases, including 1) identification of the problem, selecting knowledge to address the problem, and determining the gap between knowledge and practice 2) adapting the knowledge to context 3) assessing barriers and facilitators to knowledge use, 4) selecting the appropriate implementation strategies for the setting 5) monitoring knowledge use, 6) evaluating outcomes, and 7) sustaining the change (Graham & Tetroe, 2007). For this project, a practice guideline is in place but has yet to be incorporated into the daily workflow. The clinic stakeholders expressed that adapting current BP screening and management recommendations to the local context of the clinic is desirable. Time and staffing, however, have posed consistent barriers.

Specific Aims

Instituting an evidence-based hypertension screening and management process more accurately identifies patients with hypertension, quantifies the severity of hypertension, and

provides an opportunity to initiate team-based management strategies, including patient education, lifestyle modification, and the initiation or titration of pharmacotherapy. The clinic stakeholders identified hypertension management as a practice priority, increasing the potential for provider and staff buy-in. This project contributes to nursing by translating evidence for home blood pressure education and team-based hypertension management into daily clinical practice. By implementing evidence-based policy into practice at this clinic site, the project aims to improve outcomes for hypertensive patients through accurate diagnosis and evidence-based management of hypertension.

Methods

Context

This quality-improvement project occurred at a primary care clinic in a larger Montana city. The site is part of an extensive network of more than 40 primary care and specialty clinics. The network is associated with a hospital system with facilities throughout the Western United States. The project site population includes 7,783 empaneled patients managed by three physicians, one APN, one PharmD, a licensed clinical social worker (LCSW), and support staff. Patient-age demographics span from birth to the end of life. Appointments are scheduled in 15-minute or 30-minute blocks, with most providers seeing at least 20 patients daily.

The clinic manager and the providers indicated that the hypertension management care gap was their primary focus for the upcoming year. As the care model of the nation transitions from fee-for-service to quality-based care, reaching established quality metrics continues to become a practice priority. The hypertension metric utilized by the clinic calculates the percentage of patients 18-75 years of age diagnosed with hypertension whose most recent blood

pressure was less than 140/90 mmHg. The performance threshold established by CMS for this metric is as follows (see Table 5):

Table 5. Medicare Metric Standards Threshold.

Measure Name	Below Threshold	Threshold	Target	Exceptional
Hypertension Control	< 62.9%	63-72.9%	73-79.9%	≥ 80%

At the project inception, year-to-date hypertension metric for the site was 57.72%. The site stakeholders established a goal of achieving the target in the next 12 months. The organization has an updated policy addressing blood pressure measurement and the follow-up process for elevated readings that aligns with the 2017 ACC/AHA guideline for preventing, detecting, evaluating, and managing high blood pressure in adults. Unfortunately, the uptake and incorporation of the policy into day-to-day practice have been suboptimal.

Organizational weaknesses that affected project implementation included patient load volume, a support staff shortage, and a staff knowledge deficit in evidence-based hypertension screening and management. The purpose of this project was to evaluate the implementation of a system-wide policy supported by the 2017 American College of Cardiology (ACC)/American Heart Association (AHA) guideline for the prevention, evaluation, and management of high blood pressure in adults (Muntner et al., 2019). Three objectives were defined to measure the accomplishment of the project goals: 1) within five weeks, 75% of adult patients meeting BP criteria of ≥ 140/90 mm Hg will receive education regarding the significance of home blood pressure monitoring, proper technique, and follow up, 2) within six weeks, 50% of patients meeting BP criteria will receive team-based care with collaboration between the nurse,

pharmacist, and the PCP and, 3) the clinic will achieve hypertension control at or above the CMS threshold of ≥ 64%. The BP goal of 140/90 mm Hg was selected based on the facility policy. Clinical drivers utilized in this project include home blood pressure measurement support and team management. Figure 4 shows the clinical drivers and interventions implemented in this QI project.

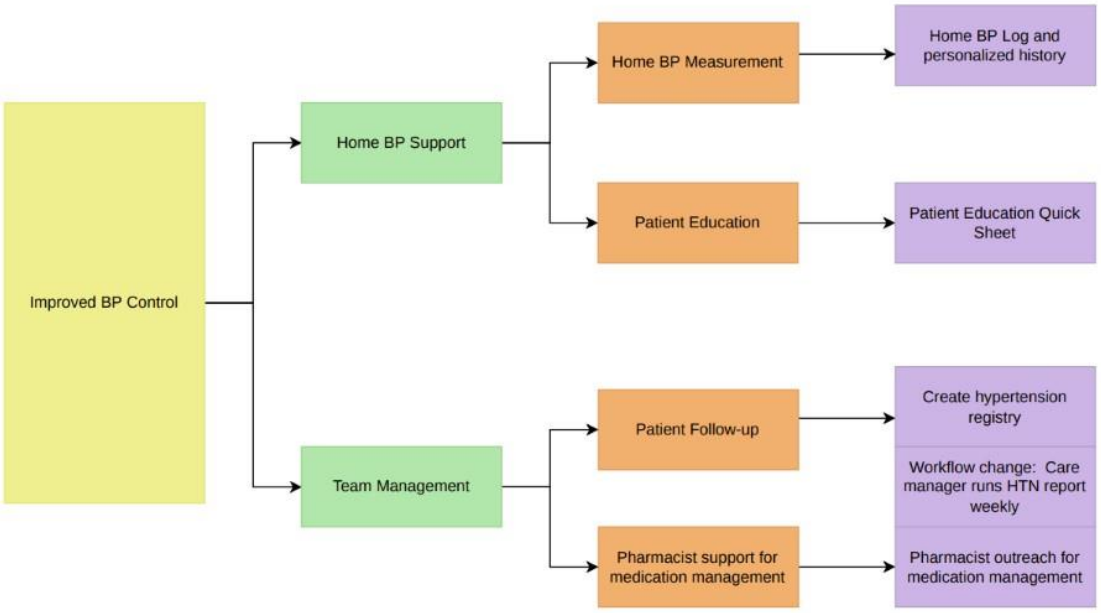


Figure 4. Driver Diagram.

Interventions

The QI strategy for this project underscores the intention of the patient-centered medical home (PCMH) model of building better relationships between patients and clinical care teams by utilizing two primary interventions. Patient empowerment through home blood pressure support requires evidence-based education regarding the purpose of blood pressure screening, proper technique, serial blood pressure measurement, and lifestyle modification. An individual's blood pressure varies based on a wide range of factors, making a single office reading a poor tool for

diagnosing hypertension. The literature supports home blood pressure measurement as an effective diagnostic tool (Mutner et al., 2020 & Whelton et al., 2018). A hypertension toolkit developed for this quality initiative included educational material regarding the long-term consequences of hypertension, proper self-measurement technique, hypertension diet guidelines, a blood pressure log, and a list of validated home BP measurement devices. Recognizing that not every patient is willing or able to participate in home blood pressure measurement, the second intervention focused on utilizing members of the care team to improve effective blood pressure management through timely follow-up.

The action cycle of the Knowledge to Action model provided a framework for adapting evidence-based practice guidelines to the context of the project site. At the project's onset, all staff received a one-hour in-service to raise awareness regarding the usefulness of home blood pressure measurement as a diagnostic tool, proper blood pressure measurement technique, team-based hypertension management, and EHR documentation. Each of these points originated from the pre-existing health system hypertension management policy. A Smartphrase for home blood pressure education documentation was introduced to all rooming staff. Each staff member was provided with a tip sheet for using the Smartphrase. In addition, the blood pressure toolkit was introduced. Evidence-based rationale was provided, and all questions were answered. Roomers were asked to distribute the toolkit and document the education with the Smartphrase. Weekly check-ins attempted to address questions and serve as a reminder to distribute and document the educational materials.

Blood Pressure Measurement Improvements. All patients presenting to the clinic between 18-75 years old were screened for hypertension using a valid, automated blood pressure device.

The staff rooming the patient completed the blood pressure measurement, documented the measurement in the EHR, and flagged BPs ≥ 140/90. If the initial measurement was elevated, the blood pressure was rechecked at the end of the visit. If the patient's second blood pressure measurement met the criteria for hypertension, the roomer provided the patient with a blood pressure toolkit. Distribution of the blood pressure toolkit was documented in the EHR with the SmartPhrase ".HOMEBPEDUCATION". If the patient owned a validated home BP cuff, they were asked to measure their BP two times in the morning and two times in the afternoon for three days and return the data to the clinic through the patient portal, phone, or in person. If the patient did not have a validated home BP cuff, they were asked to schedule nurse visits for blood pressure rechecks within the next two weeks.

Hypertension Follow-up Process Improvements. Patients with three elevated blood pressures on three separate occasions were referred to their provider for hypertension management. Treatment options focused on pharmacotherapy with antihypertension medication and lifestyle modification counseling. Providers engaged patients in shared decision-making to determine a customized plan to individual patient needs and preferences. To ensure timely follow-up for blood pressure screening or intervention, the project lead and care team concentrated on the hypertension registry in the EMR. A weekly report was run to determine the number of patients seen in the clinic that met hypertension criteria. Charts of qualifying patients were audited to determine if the patient received education and a follow-up plan. For each provider, a nurse or MA was tasked with outreach to patients without intervention to engage them in follow-up.

The overarching goal expressed by project site stakeholders focused on the eCQM tracking measure for hypertension control. The objective defined by clinic management was to achieve the CMS status of "target," which is 73%-79.9% of patients 18-75 years of age with a diagnosis of hypertension whose most recent blood pressure was less than 140/90 mm Hg.

Measures

The primary tool employed to measure this QI initiative's processes and interventions was EHR reviews. The frequency of documented hypertension intervention, scheduled follow-up, and patient education were tracked weekly. The project lead worked with the site manager to develop a report from the EHR. The report was designed to capture individual patients with a blood pressure ≥ 140/90 seen by their PCP in the previous seven days. Patients younger than 18 or older than 75, pregnant, or in hospice were excluded from the report. Information sought within the health record included patient problem list, chief complaint for a visit, provider notes, previous three blood pressure recordings, current blood pressure treatment, documentation of blood pressure education, and plan for follow-up.

The tool utilized to measure the long-term project outcome of achieving the CMS threshold standard was the electronic clinical quality measure (eCQM) generated by the project site's EHR for blood pressure control. Electronic clinical quality measures are measures specified in a standard electronic format that use data electronically extracted from the EHR. The Centers for Medicare & Medicare Services uses eCQMs as a reporting system for quality measures and value-based purchasing programs (Centers for Medicare and Medicaid Services, 2022).

During week three, an anonymous survey was provided to support staff, asking them to identify perceived barriers to workflow implementation. A total of four staff responded. Identified barriers included 1) appointment time constraints, 2) the chief complaint did not involve hypertension, 3) repetitive charting, and 4) the patient was not interested in intervention.

Analysis

Descriptive statistical methods were utilized to interpret project data and outcomes. All patients that presented to the clinic with a qualifying blood pressure of ≥ 140/90 were tracked through the EHR. The frequency of documented project interventions including 1) documented patient education and distribution of the blood pressure toolkit and 2) follow-up with a member of the care team within one month, were evaluated by comparing weekly percentages. The frequency of each of these elements was documented as yes or no. Each week the patients who had a documented element for either BP education or BP management interventions were divided by the total number of patients meeting blood pressure criteria. Each week, patients with a documented follow-up plan were divided by the total number of patients with a qualifying blood pressure. Similarly, each week the number of patients with the Smartphrase documented in their EHR was divided by the total number of patients with a qualifying blood pressure reading. These data were tracked week-by-week

Ethical Considerations

The project was reviewed by the Institutional Review Board through Montana State University to ensure ethical principles were maintained. The primary care clinic has no IRB; therefore, no other approval was required. Hypertensive patient management was observed, and

data collection included the Smartphrase within a care team note and a nursing or provider follow-up for blood pressure screening or management. Data collection was de-identified and retained in a secure Excel spreadsheet. All spreadsheets were destroyed at the conclusion of the project.

Results

Results reflect the overall impact of the QI workflow improvements, including the percentage of all patients with HTN who received the home BP toolkit and plan for follow-up. Results of the process measures are displayed in Table 3, with the percentage by week noted.

Table 6. QI Outcome Measures.

	Week 1	Week 2	Week 3	Week 4	Week 5	Total
Received Education						
yes	n = 2 (3.28%)	n = 3 (4.92%)	n =5 (8.20%)	n = 5 (8.20%)	n = 4 (6.56%)	n = 19 (31.15%)
no	n = 8 (13.11%)	n = 9 (14.75%)	n = 6 (9.84%)	n = 8 (13.11%)	n = 11 (18.03%)	n = 42 (68.85%)
Percentage that Received Education by Week	20%	25%	45%	38%	27%	
Overall Total	n = 10 (16.39%)	n = 12 (19.67%)	n = 11 (18.03%)	n = 13 (21.31%)	n = 15 (24.59%)	n = 61 (100.00%)
Plan for Follow-up						
yes,	n = 4 (6.56%)	n = 5 (8.20%)	n = 4 (6.56%)	n = 4 (6.56%)	n = 4 (6.56%)	n = 21 (34.43%)
no	n = 6 (9.84%)	n = 7 (11.48%)	n = 7 (11.48%)	n = 9 (14.75%)	n = 11 (18.03%)	n = 40 (65.57%)
Percentage with Documented Follow-up Plan by Week	40%	42%	36%	31%	27%	
Total	n = 10 (16.39%)	n = 12 (19.67%)	n = 11 (18.03%)	n = 13 (21.31%)	n = 15 (24.59%)	n = 61 (100.00%)

A total of 61 (n=61) participants were seen during the project interval that met the criteria of a recorded blood pressure of ≥ 140/90. The primary chief complaint for these visits was listed as a wellness exam, followed by acute visit and establish care. The primary outcome goal was that 75% of patients meeting BP criteria would receive the education intervention by week five of the project. Before the intervention, zero patients received the education intervention. The weekly percentage of patients receiving education peaked at 45% during week three, then decreased to 27% by week five. The blood pressure observations for patients receiving the education intervention included a systolic average of 158.06 (SD = 16.28) mm Hg and an average diastolic of 91.26 (SD = 16.25) mm Hg. The observations for patients not receiving the education intervention included an average systolic of 151.95 (SD = 16.28) mm HG and an average diastolic of 89.72 (SD = 8.75).

The second project outcome focused on team-based care involving collaboration between the nursing staff and the PCP. By the conclusion of the project, 34.43% of qualifying patients had a plan for blood pressure follow-up plan documented within the EHR. The average systolic and diastolic blood pressures for patients with a follow-up plan were 157.23 mmHg (SD= 18.36) and 94.23 (SD = 15.86) mm Hg, respectively. For patients with no follow-up plan documented within the EHR, the average systolic and diastolic blood pressures were 151.71 mm Hg (SD = 9.46) and 87.92 mm Hg (SD = 7.59), respectively.

The long-term goal for this quality improvement project was to achieve clinic population hypertension control at or above the established CMS threshold of 64%. For the month prior to project implementation, the quality sum score measure for blood pressure control at the clinical site was 57.72%. At the conclusion of the project, the quality sum score increased to 61.49%.

Although the project goal of reaching the threshold percentage of 63% was not met, there was a 3.77% increase in hypertensive patients at the therapeutic goal.

Discussion

Effective HTN management and optimizing patient care for hypertension control is a health priority in the United States. Primary care is well positioned within the healthcare system to improve patient outcomes related to proper hypertension control. The project outcome goal that 75% of patients meeting BP criteria would receive the education intervention by week five was not met. At the conclusion of the project, 31.15% (n = 19) of patients received the educational intervention compared to zero patients receiving standardized education before the project. Standardizing hypertension education across the system benefits both patients and the system. Using the education SmartPhrase and distributing a patient-centered home blood pressure toolkit aligned the project site with accepted practice change and network policy. Although this intervention did not reach the established outcome goal, the project site gained valuable knowledge through this QI project. Actual and perceived staff barriers, particularly time constraints, will help inform future opportunities to provide home BP management opportunities. Based on the outcomes of this project, the primary care site has gained new knowledge that will inform ongoing adaptations to the KTA cycle. The project site provided digital and physical copies of the toolkit material to continue the education intervention with future patients.

Similarly, the project goal that 50% of patients meeting BP criteria would receive follow-up care from the care team was unmet. Within five weeks, 34.43% (n = 21) of patients meeting blood pressure criteria had a documented plan for follow-up in the EHR. At the project conclusion and debrief, the care team identified timely follow-up as a critical element to future

successful blood pressure control. Strategies identified to improve workflow included intentional daily team huddles to enhance communication and developing a workflow to send an instant message to scheduling staff that ensures that patients are scheduled for follow-up before leaving the appointment. By assessing barriers and emphasizing real-time communication, the team was able to adapt the process to create a more manageable, evenly distributed team workflow.

The eCQM goal of achieving the threshold standard of 63% was also not met. The metric increased from 57.72% to 61.49%, the first instance of increasing hypertension management documented in the previous six months. Fine-tuning this project's interventions to better fit the workflow and staffing capacity of the project site provides a viable strategy for improving the eCQM metric for the clinic's hypertensive patient population.

Limitations & Lessons Learned

Limitations to executing this project included competing demands on clinic staff, lack of QI experience within primary care teams, change in staffing responsibilities during the project timeframe, and inconsistent team buy-in to process change. According to the Institute for Healthcare Improvement (2021), real and perceived barriers can result in practices being "stuck" in the planning or doing phases of the QI process. This leads to change fatigue for those expected to modify their daily workflow. Lessons learned include involving the staff responsible for facilitating the change as part of the planning process. Daily care team huddles to identify patients requiring hypertension management would facilitate enhanced communication and improved adherence to hypertension management processes.

Conclusion

Evidence-based care targets guide primary care practices striving for patient-centered, value-based results. Given the burden of hypertension and its associated risk factors, an urgency exists to translate evidence supporting effective blood pressure management into daily practice. Once hypertension has been diagnosed and confirmed, it is necessary to establish a chronic disease management workflow. The literature supports multi-faceted intervention strategies emphasizing patient education and a team-based care approach (Proia et al., 2014; Pasha et al., 2021; Kravetz & Walsh, 2016; & Carter et al., 2022). Although the outcome goals for this quality initiative were not met, the project site gained valuable knowledge regarding current clinic demographics, baseline hypertension data, opportunities for improvement, and barriers to successful implementation. This project indicated that a multifaceted intervention package could improve education and a team-based plan of care within the family practice setting. Project results and the anonymous survey administered during week three indicated barriers, including time constraints on the rooming staff and knowledge deficit. The fourth and sixth steps of the KTA framework involve identifying barriers and evaluating outcomes and knowledge use. These steps will aid the project site in the next knowledge cycle as the practice develops effective workflow processes to improve hypertension control and population health and sustain meaningful change.

References

Argha, A., Celler, B. G., & Lovell, N. H. (2020). Artificial intelligence based blood pressure estimation from ausculatory and oscillometric waveforms: A methodological review. *IEEE Review in Biomedical Engineering*, *15*, 152–168. https://doi.org/10.1109/RBME.2020.3040715

Breaux-Shropshire, T. L., Judd, E., Vucovich, L. A., Shropshire, T. S., & Singh, S. (2015). Does home blood pressure monitoring improve patient outcomes? A systematic review comparing home and ambulatory blood pressure monitoring on blood pressure control and patient outcomes. *Integrated Blood Pressure Control*, *8*, 43–49. https://doi.org/10.2147/IBPC.S49205

Cappuccio, F. P., Kerry, S. M., Forbes, L., & Donald, A. (2004). Blood pressure control by home monitoring: Meta-analysis of randomised trials. *BMJ*, *329*(7458), 145. https://doi.org/10.1136/bmj.38121.684410.ae

Carter, B. L., Rogers, M., Daly, J., Zheng, S., & James, P. A. (2009). The potency of team-based care interventions for hypertension. *Archives of Internal Medicine*, *169*(19). https://doi.org/10.1001/archinternmed.2009.316

Centers for Disease Control and Prevention. (2022). *Facts about hypertension*. Centers for Disease Control and Prevention. https://www.cdc.gov/bloodpressure/facts.htm

Centers for Disease Control and Prevention. (n.d.). *Promoting team-based care to improve high blood pressure control*. https://doi.org/https://www.cdc.gov/dhdsp/pubs/guides/best-practices/team-based-care.htm

Centers for Disease Control and Prevention. (2018). *Stats of the state of Montana* (2017). https://www.cdc.gov/nchs/pressroom/states/montana/montana.htm

Centers for Disease Control and Prevention. (2022). *Heart disease in the United States*. https://doi.org/https://www.cdc.gov/heartdisease/facts.htm

Centers for Medicare & Medicaid Services. (2022). *Electronic clinical quality measure basics*. https://ecqu.healthit.gov/sites/default/files/eCQMBasics-February-2022.pdf

Ferdinand, K. C., Vo, T. N., & Echols, M. R. (2020). State-of-the-art review: Hypertension practice guidelines in the era of covid-19. *American Journal of Preventive Cardiology*, *2*, 100038. https://doi.org/10.1016/j.ajpc.2020.100038

Field, B., Booth, A., Ilott, I., & Gerrish, K. (2014). Using the knowledge to action framework in practice: A citation analysis and systematic review. *Implementation Science*, *9*(1). https://doi.org/10.1186/s13012-014-0172-2

Graham, I. D., & Tetroe, J. (2007). Some theoretical underpinnings of knowledge translation. *Academic Emergency Medicine*, *14*(11), 936–941. https://doi.org/10.1111/j.1553-2712.2007.tb02369.x

Kravetz, J. D., & Walsh, R. F. (2016). Team-based hypertension management to improve blood pressure control. *Journal of Primary Care & Community Health*, *7*(4), 272–275. https://doi.org/10.1177/2150131916645580

Lee, J., Kim, S.-H., Kang, S.-H., Cho, J., Cho, Y., Oh, I.-Y., Yoon, C.-H., Lee, H.-Y., Youn, T.-J., Chae, I.-H., & Kim, C.-H. (2018). Blood pressure control and cardiovascular outcomes: Real-world implications of the 2017 acc/aha hypertension guideline. *Scientific Reports*, *8*(1). https://doi.org/10.1038/s41598-018-31549-5

Muntner, P., Shimbo, D., Carey, R. M., Charleston, J. B., Gaillard, T., Misra, S., Myers, M. G., Ogedegbe, G., Schwartz, J. E., Townsend, R. R., Urbina, E. M., Viera, A. J., White, W. B., & Wright, J. T. (2019). Measurement of blood pressure in humans: A scientific statement from the american heart association. *Hypertension*, *73*(5). https://doi.org/10.1161/hyp.0000000000000087

Olsen, M. H., Angell, S. Y., Asma, S., Boutouyrie, P., Burger, D., Chirinos, J. A., Damasceno, A., Delles, C., Gimenez-Roqueplo, A.-P., Hering, D., López-Jaramillo, P., Martinez, F., Perkovic, V., Rietzschel, E. R., Schillaci, G., Schutte, A. E., Scuteri, A., Sharman, J. E., Wachtell, K., & Wang, J. (2016). A call to action and a lifecourse strategy to address the global burden of raised blood pressure on current and future generations: The lancet commission on hypertension. *The Lancet*, *388*(10060), 2665–2712. https://doi.org/10.1016/s0140-6736(16)31134-5

Ostchega, Y., Fryar, C. D., Nwankwo, T., & Nguyen, D. T. (2020). *Hypertension prevalence among adults aged 18 and over: United States, 2017-2018*. Centers for Disease Control and Prevention. https://doi.org/https://stacks.cec.gov/view/cdc/87559

Pasha, M., Brewer, L. C., Sennhauser, S., Alsawas, M., & Murad, M. (2021). Health care delivery interventions for hypertension management in underserved populations in the united states: A systematic review. *Hypertension*, *78*(4), 955–965. https://doi.org/10.1161/hypertensionaha.120.15946

Proia, K. K., Thota, A. B., Njie, G. J., Finnie, R. K., Hopkins, D. P., Mukhtar, Q., Pronk, N. P., Zeigler, D., Kottke, T. E., Rask, K. J., Lackland, D. T., Brooks, J. F., Braun, L. T., & Cooksey, T. (2014). Team-based care and improved blood pressure control. *American Journal of Preventive Medicine*, *47*(1), 86–99. https://doi.org/10.1016/j.amepre.2014.03.004

Saunders, E., Teall, A. M., Zurmehly, J., Bolen, S. D., Crane, D., Wright, J., Perzynski, A., & Lever, J. (2022). Coaching quality improvement in primary care to improve hypertension control. *Journal of the American Association of Nurse Practitioners*, *34*(7), 932–940. https://doi.org/10.1097/jxx.0000000000000731

Tsao, C. W., Aday, A. W., Almarzooq, Z. I., Anderson, C. A., Arora, P., Avery, C. L., Baker-Smith, C. M., Beaton, A. Z., Boehme, A. K., Buxton, A. E., Commodore-Mensah, Y.,

Elkind, M. S., Evenson, K. R., Eze-Nliam, C., Fugar, S., Generoso, G., Heard, D. G., Hiremath, S., Ho, J. E.,...Martin, S. S. (2023). Heart disease and stroke statistics—2023 update: A report from the american heart association. *Circulation*, *147*(8). https://doi.org/10.1161/cir.0000000000001123

U.S. Department of Health and Human Services. (2020). *The Surgeon General's call to action to control hypertension*. Office of the Surgeon General. https://www.hhs.bov/surgeongeneral/index.html

Uhlig, K., Patel, K., Kitsios, G. D., & Balk, E. M. (2013). Self-measured blood pressure monitoring in the management of hypertension: a systematic review and meta-analysis. *Annals of Internal Medicine*, *159*, 18885–194. https://www-acpjournals-org.proxybz.lib.montana.edu/doi/epdf/10.7326/0003-4819-159-3-201308060-00008

Viera, A. J., Hinderliter, A. L., Kshirsagar, A. V., Fine, J., & Dominik, R. (2010). Reproducibility of masked hypertension in adults with untreated borderline office blood pressure: Comparison of ambulatory and home monitoring. *American Journal of Hypertension*, *23*(11), 1190–1197. https://doi.org/10.1038/ajh.2010.158

Virani, S. S., Alonso, A., Benjamin, E. J., Bittencourt, M. S., Callaway, C. W., Carson, A. P., Chamberlain, A. M., Chang, A. R., Cheng, S., Delling, F. N., Djousse, L., Elkind, M. S., Ferguson, J. F., Fornage, M., Khan, S. S., Kissela, B. M., Knutson, K. L., Kwan, T. W., Lackland, D. T.,...Tsao, C. W. (2020). Heart disease and stroke statistics—2020 update: A report from the american heart association. *Circulation*, *141*(9). https://doi.org/10.1161/cir.0000000000000757

Whelton, P. K., Carey, R. M., Aronow, W. S., Casey, D. E., Collins, K. J., Dennison Himmelfarb, C., DePalma, S. M., Gidding, S., Jamerson, K. A., Jones, D. W., MacLaughlin, E. J., Muntner, P., Ovbiagele, B., Smith, S. C., Spencer, C. C., Stafford, R. S., Taler, S. J., Thomas, R. J., Williams, K. A.,...Wright, J. T. (2018). 2017 acc/aha/aapa/abc/acpm/ags/apha/ash/aspc/nma/pcna guideline for the prevention, detection, evaluation, and management of high blood pressure in adults. *Journal of the American College of Cardiology*, *71*(19), e127–e248. https://doi.org/10.1016/j.jacc.2017.11.006

CHAPTER FOUR

DNP REFLECTION

Introduction

The American Association of Colleges of Nursing endorses the Essentials of Doctoral Education for Advanced Nursing Practice as a roadmap to define the curricular elements necessary in Doctor of Nursing Practice (DNP) programs (Waldrop et al., 2023). The DNP is a practice-focused terminal degree in the field of nursing. Over the last four years, the Montana State University DNP Program has provided ample opportunities to successfully attain advanced nursing competencies. This program has provided integrative practice experiences culminating in 675 hours of direct patient care coupled with a strong base in theory and research methodology that resulted in an application-oriented final project that allowed me to design and carry out a relevant QI experience in a real-life clinical environment. Researching, designing, implementing, evaluating, and disseminating a QI project was an enlightening and career-altering experience. This experience gave me valuable insight into the process and challenges of translating the best evidence into daily practice. Through the foundational courses, evidence interpretation, systems, theory, and frameworks came to life as I learned to navigate literature reviews, develop methods, evaluate outcomes, and share what I learned. In the most practical sense, this program also prepared me to work with and lead multidisciplinary teams, maintain flexibility, learn to apply new knowledge in real-time, and motivate others to work towards a common cause.

Essential I: Scientific Underpinnings for Practice

Essential I focuses on the scientific underpinnings for practice, including the optimal function of human beings through all phases of life, human behavior across all situations, the nursing role in facilitating positive changes in health, and human wholeness (AACN, 2006). In NRSG 602, Advanced Physio/Pathophysiology, I had the opportunity to develop a cardiac case study for other members of my cohort and facilitate an online discussion. This exercise was valuable because it allowed me to deeply learn cardiovascular physiology and assessment techniques and apply scientific reasoning to my diagnostics. I also learned to communicate succinctly new knowledge and evaluate how others learned. This course required frequent use of medical databases, including UpToDate, which allowed me to apply the most recent scientific knowledge to case scenarios and work through common illnesses associated with all the major body systems.

Other courses that emphasized Essential I included physical assessment, pharmacology, diagnostic reasoning, and all four clinical courses. In Advanced Health Assessment (NRSG 601), I successfully demonstrated a head-to-toe assessment of a patient while focusing on the current health status of the patient, analyzing, and synthesizing the information. This exercise was helpful as I moved into clinical courses, laying the foundation for making clinical decisions regarding patient health and beginning to formulate diagnostic differentials and plans. NRSG 603 and 620 focused on the science of therapeutic agents, pharmacokinetics, and pharmacodynamics.

Once I understood how medications impact the human body, I learned how to apply this new knowledge to the management of health and the ethical and legal responsibilities that I must

consider as a prescriber. NRSG 607 allowed me to build further on these fundamental skills as I was able to practice in a safe, virtual environment while I formulated diagnostics and plans while considering cultural and financial implications for patients. I integrated essential one into my DNP project by researching and gaining knowledge of the pathophysiology and management of hypertension to direct evidence-based interventions.

Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking

Essential II focuses on organizational and systems leadership for quality improvement and systems thinking (AACN, 2006). In NRSG 608, I was introduced to the APN role in organizations and systems leadership. I worked to develop a root-cause analysis using different visuals to examine telephone triage workflow in a primary care clinic. This was an important introduction to microsystem analysis and set me up for future success in NRSG 611 and NRSG 675.

In NRSG 611, I examined healthcare systems and how they impact care delivery across the country. This course provided a valuable opportunity to examine healthcare's micro and macro systems. I worked within the context of a group to develop a quality improvement project to establish a protocol for routine suicide screening at a primary care clinic to reduce suicide attempts by proactively providing resources. This project met Essential II by focusing on a panel of patients and targeting a specific population subset within the panel.

This project also allowed the group to translate knowledge to actual practice policies and procedural workflows, a vital element of this DNP Essential. This project provided an opportunity to apply theoretical underpinnings and conceptual framework by implementing PDSA cycles to facilitate actual practice change with measurable outcomes. Ultimately this

essential was necessary to complete a microsystem and mesosystem analysis and develop a feasible QI improvement project with stakeholder buy-in and future sustainability.

Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

Multiple courses contributed to achieving the objectives of Essential III, culminating in my DNP scholarly project. NRSG 604 and NRSG 605 focused on methods for evaluating and using the information to inform practice. I had the opportunity to utilize analytic methods to critically appraise evidence to ultimately improve patient outcomes. I again worked within the context of a group to create a complementary and allopathic health matrix examining treatment modalities for anxiety.

This project concluded with a proposal for change in practice based on the most current evidence of combining cognitive behavioral therapy and pharmacotherapy to maximize treatment modalities and improve outcomes for patients with anxiety.

My Scholarly DNP project completed in NRSG 674 and 674 focused on improving patient hypertension outcomes through workflow changes involving patient education and team-based follow-up. I appraised the literature and utilized it to guide my interventions. The KTA framework provided a model for implementing a network policy into daily practice. This was particularly useful as I could use the knowledge gained during each project step to address barriers in real-time. Through this project, the team at the project site was able to facilitate moderate improvement in the overall hypertension metric at the care site. More importantly, it laid a strong foundation for a comprehensive intervention package to enhance hypertension education and team-based management in the family practice setting. Both the team and I learned that KTA cycles could assist with identifying barriers, application of new knowledge,

and assessing results to increase hypertension control, improve population health, and maintain positive change within a clinic microsystem.

Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Healthcare

NRSG 610 (Health Care Informatics) was helpful in satisfying the requirements of essential four. Throughout this course, I examined how technology can improve healthcare. I created a diabetes management plan that utilized a patient portal for communication and lifestyle coaching. For this group project, we selected a wearable smart device allowing the patient to upload blood sugars, exercise, and diet information directly to the patient portal for provider review. This allowed for protected data transmission and direct communication between the patient and the healthcare team. This course also provided an opportunity to evaluate health-related websites available to the public. A particularly valuable exercise involved teaching patients how to critically appraise these websites to determine if they were consuming accurate healthcare information.

In NRSG 674 and NRSG 675, I collaborated with the project site IT department to implement a dot phrase for documenting home blood pressure education. I utilized the EHR to track patient population data to monitor the outcomes of my QI project. Furthermore, I utilized a report template to identify qualifying data, gather relevant data, and perform appropriate outreach. The EHR provided real-time data and facilitated two-way communication between patients and staff, enabling prompt management of hypertension.

Essential V: Healthcare Policy for Advocacy in Healthcare

The DNP plays a crucial role in patient advocacy through a strong knowledge base and active involvement in healthcare policy at both state and national levels (AACN, 2006). This was exemplified in NRSG 612 when I had the opportunity to research a topic of my choice and write an advocacy letter to a local politician. I researched adding a black box warning to commercial marijuana products to acknowledge the risks for pregnant and breastfeeding individuals and their infants. As an OB nurse, I have seen an increase in marijuana use among pregnant and lactating people. Unfortunately, many of the information resources available to the non-medical community have a conflict of interest and do not acknowledge the downstream consequences of THC use during these critical development times. I plan to continue advocating for safe and accurate public information resources regarding the impact of THC on Montana parents and children. I am now equipped with the knowledge and confidence to participate actively in healthcare activism. This experience instilled a solid duty to publicly advocate for patient populations as a doctorally-prepared nurse.

A measurable outcome for my final DNP project involved a patient outcome determined by CMS metrics. Through this process, I learned the absolute importance of understanding government involvement in healthcare and achieving established metrics to improve patient outcomes and the financial sustainability of both small clinics and larger healthcare facilities.

Essential VI: Interprofessional Collaboration or Improving Patient and Population Health Outcomes

The focus of essential six is working within a collaborative team to improve patient and population health outcomes (AACN, 2006). One element of my quality-improvement project in

NRSG 675 involved collaboration among the primary care provider, nursing staff, and pharmacist to diagnose, manage and treat hypertension. Initially, I worked with the clinic to develop a collaborative prescriptive agreement allowing the pharmacist to prescribe antihypertensive medications. Although this agreement remained in place, it did not become part of my final project. Given the project's time constraints, I developed a workflow for increasing nurse visits and teaching opportunities at office blood pressure rechecks. This project underscored the purpose of the patient-centered medical home by facilitating a multidisciplinary care team with the patient at the center.

I also had the opportunity to take an advanced nursing course with dietetics students. The group developed a care management plan for diabetic patients involving blood sugar monitoring, lifestyle modification, and medication management. This was an excellent opportunity to provide education to dieticians and learn how to manage the disease from their perspective. Both the DNP and dieticians enriched their knowledge of diabetes and disease management through this collaboration.

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health.

Essential seven involves health promotion, risk reduction, and illness prevention for individuals and families nationwide (AACN, 2006). Nearly every course in this program emphasized the importance of recognizing health inequities and systematic barriers built into the infrastructure of our healthcare system. This was one of the most valuable takeaways of the last four years. NRSG 614 focused on the care of vulnerable populations. This course required me to work within a group to examine healthcare disparities and barriers to care experienced by homeless youth throughout Montana. The number of hidden homeless children and the almost

complete lack of resources, particularly in rural settings, was eye-opening. Components of the project included a windshield survey and a presentation to the cohort that allowed us to disseminate our findings. I appreciated the opportunity to work with a group from different areas of Montana to brainstorm possible solutions to this challenging problem. Coming from a larger Montana city, learning about the homeless situation and solutions in rural areas was insightful. I carried this experience into each of my clinical courses. In one clinical situation, I cared for a transgender woman from a small community nearly 200 miles from my clinical site.
She was obtaining hormones from a different country because she feared seeing a physician in her community. The experience and knowledge I gained from the courses in this program helped me partner with her to find a solution for her to safely obtain hormones while maintaining privacy.

My DNP project aimed to improve population health in terms of hypertension and cardiovascular disease at a family practice clinic. Through this experience, I learned the importance of primary prevention in terms of patient education, secondary prevention through early detection and screening, and tertiary prevention through evidence-based treatment and prevention of sequelae. This hands-on experience emphasized my role as a nurse practitioner to help patients alter their disease outcomes.

Essential VIII: Advanced Nursing Practice

During the final four semesters of the program, I had the opportunity to practice the knowledge and skills I had learned through my coursework. NRSG 621, NRSG 622, NRSG 633, and NRSG 624 allowed me to care for patients throughout their entire lifespans. Foundational courses including NRSG 601 (Advanced Health Assessment), NRSG 602 (Advanced

Physio/Pathophysiology), NRSG 603 and 620 (Advanced Pharmacology I and II), NRSG 607 (Diagnostic Reasoning), and NRSG 625 (Advanced Diagnostics in Primary Care) gave me the skill set to confidently conduct patient history interviews, complete comprehensive and focused physical assessments, develop differential diagnoses, order diagnostics, discuss preventive tools, and formulate plans of care based on the patient's history and unique presentation. Over 675 patient hours, I increased my confidence and honed my clinical acumen.

As I developed the method and interventions for my DNP project, I had to draw on the patient experience as I have witnessed it through my clinical courses. To facilitate change, the patient has to be in the right frame of mind. My clinic experiences as an APN gave me insight into the clinic's workflow, the patient experience while in the clinic, how to prioritize complaints, actual and perceived barriers, and empathy. This program has prepared me to pass board examinations and begin my career as a primary care provider. Reflecting on the last four years, I know I have just scratched the surface. My intellectual curiosity is piqued daily as I meet new people and learn about their life, health, struggles, and victories. I look forward to carrying the knowledge and skills I have gained through the program to partner with my patients to help them achieve lifelong health.

References

American Association of Colleges of Nursing. (2006). *The essentials of doctoral education for advanced nursing practice*. www.nche.edu

Waldrop, J., Reynolds, S. S., McMillian-Bohler, J. M., Graton, M., & Ledbetter, L. (2023). Evaluation of dnp program essentials of doctoral nursing education: A scoping review. *Journal of Professional Nursing*, *46*, 7–12. https://doi.org/10.1016/j.profnurs.2022.11.009

REFERENCES CITED

American Association of Colleges of Nursing. (2006). *The essentials of doctoral education for advanced nursing practice*. https://www.aacnnursing.org/Portals/42/Publications/DNPEssentials.pdf

Argha, A., Celler, B. G., & Lovell, N. H. (2020). Artificial intelligence based blood pressure estimation from ausculatory and oscillometric waveforms: A methodological review. *IEEE Review in Biomedical Engineering*, *15*, 152–168. https://doi.org/10.1109/RBME.2020.3040715

Asayama, K., Ohkubo, T., Kikuya, M., Metoki, H., Hoshi, H., Hashimoto, J., Totsune, K., Satoh, H., & Imai, Y. (2004). Prediction of stroke by self-measurement of blood pressure at home versus casual screening blood pressure measurement in relation to the joint national committee 7 classification. *Stroke*, *35*(10), 2356–2361. https://doi.org/10.1161/01.str.0000141679.42349.9f

Band, R., Bradbury, K., Morton, K., May, C., Michie, S., Mair, F. S., Murray, E., McManus, R. J., Little, P., & Yardley, L. (2017). Intervention planning for a digital intervention for self-management of hypertension: A theory-, evidence- and person-based approach. *Implementation Science*, *12*(1). https://doi.org/10.1186/s13012-017-0553-4

Bangalore, S., Toklu, B., Gianos, E., Schwartzbard, A., Weintraub, H., Ogedegbe, G., & Messerli, F. H. (2017). Optimal systolic blood pressure target after sprint: Insights from a network meta-analysis of randomized trials. *The American Journal of Medicine*, *130*(6), 707–719.e8. https://doi.org/10.1016/j.amjmed.2017.01.004

Breaux-Shropshire, T., Judd, E., Vucovich, L., Shropshire, T., & Singh, S. (2015). Does home blood pressure monitoring improve patient outcomes? a systematic review comparing home and ambulatory blood pressure monitoring on blood pressure control and patient outcomes. *Integrated Blood Pressure Control*, 43. https://doi.org/10.2147/ibpc.s49205

Breaux-Shropshire, T. L., Judd, E., Vucovich, L. A., Shropshire, T. S., & Singh, S. (2015). Does home blood pressure monitoring improve patient outcomes? A systematic review comparing home and ambulatory blood pressure monitoring on blood pressure control and patient outcomes. *Integrated Blood Pressure Control*, *8*, 43–49. https://doi.org/10.2147/IBPC.S49205

Byrd, J., & Brook, R. D. (2019). Hypertension. *Annals of Internal Medicine*, *170*(9), ITC65. https://doi.org/10.7326/aitc201905070

Cappuccio, F. P., Kerry, S. M., Forbes, L., & Donald, A. (2004). Blood pressure control by home monitoring: Meta-analysis of randomised trials. *BMJ*, *329*(7458), 145. https://doi.org/10.1136/bmj.38121.684410.ae

Carter, B. L., Bosworth, H. B., & Green, B. B. (2011). The hypertension team: The role of the pharmacist, nurse, and teamwork in hypertension therapy. *The Journal of Clinical Hypertension*, *14*(1), 51–65. https://doi.org/10.1111/j.1751-7176.2011.00542.x

Carter, B. L., Rogers, M., Daly, J., Zheng, S., & James, P. A. (2009). The potency of team-based care interventions for hypertension. *Archives of Internal Medicine*, *169*(19). https://doi.org/10.1001/archinternmed.2009.316

Centers for Disease Control and Prevention. (2022). *Facts about hypertension*. Centers for Disease Control and Prevention. https://www.cdc.gov/bloodpressure/facts.htm

Centers for Disease Control and Prevention. (n.d.). *Promoting team-based care to improve high blood pressure control*. https://doi.org/https://www.cdc.gov/dhdsp/pubs/guides/best-practices/team-based-care.htm

Centers for Disease Control and Prevention. (2018). *Stats of the state of Montana* (2017). https://www.cdc.gov/nchs/pressroom/states/montana/montana.htm

Centers for Disease Control and Prevention. (2022). *Heart disease in the United States*. https://doi.org/https://www.cdc.gov/heartdisease/facts.htm

Centers for Medicare & Medicaid Services. (2022). *Electronic clinical quality measure basics*. https://ecqu.healthit.gov/sites/default/files/eCQMBasics-February-2022.pdf

Chattopadhyay, S. K., Thota, A. B., Proia, K. K., Njie, G., Hopkins, D. P., Finnie, R. K., Pronk, N. P., & Kottke, T. E. (2015). Economics of team-based care in controlling blood pressure. *American Journal of Preventive Medicine*, *49*(5), 772–783. https://doi.org/10.1016/j.amepre.2015.04.003

Department of Veterans Affairs Department of Defense. (2014). *VA/DoD clinical practice guideline for the diagnosis and management of hypertension in primary care setting guideline summary*. VA/DoD. https://doi.org/https://permanent.fdlp.gov/gpo114995/HTNSUM3FIA20151209.pdf

Ferdinand, K. C., Vo, T. N., & Echols, M. R. (2020). State-of-the-art review: Hypertension practice guidelines in the era of covid-19. *American Journal of Preventive Cardiology*, *2*, 100038. https://doi.org/10.1016/j.ajpc.2020.100038

Field, B., Booth, A., Ilott, I., & Gerrish, K. (2014). Using the knowledge to action framework in practice: A citation analysis and systematic review. *Implementation Science*, *9*(1). https://doi.org/10.1186/s13012-014-0172-2

Graham, I. D., & Tetroe, J. (2007). Some theoretical underpinnings of knowledge translation. *Academic Emergency Medicine, 14*(11), 936–941. https://doi.org/10.1111/j.1553-2712.2007.tb02369.x

Kario, K. (2021). Home blood pressure monitoring: Current status and new developments. *American Journal of Hypertension, 34*(8), 783–794. https://doi.org/10.1093/ajh/hpab017

Karnjanapiboonwong, A., Anothaisintawee, T., Chaikledkaew, U., Dejthevaporn, C., Attia, J., & Thakkinstian, A. (2020). Diagnostic performance of clinic and home blood pressure measurements compared with ambulatory blood pressure: A systematic review and meta-analysis. *BMC Cardiovascular Disorders*, *20*(1). https://doi.org/10.1186/s12872-020-01736-2

Kravetz, J. D., & Walsh, R. F. (2016). Team-based hypertension management to improve blood pressure control. *Journal of Primary Care & Community Health*, *7*(4), 272–275. https://doi.org/10.1177/2150131916645580

Krist, A. H., Davidson, K. W., Mangione, C. M., Cabana, M., Caughey, A. B., Davis, E. M., Donahue, K. E., Doubeni, C. A., Kubik, M., Li, L., Ogedegbe, G., Pbert, L., Silverstein, M., Stevermer, J., Tseng, C.-W., & Wong, J. B. (2021). Screening for hypertension in adults. *JAMA*, *325*(16), 1650. https://doi.org/10.1001/jama.2021.4987

Lee, J., Kim, S.-H., Kang, S.-H., Cho, J., Cho, Y., Oh, I.-Y., Yoon, C.-H., Lee, H.-Y., Youn, T.-J., Chae, I.-H., & Kim, C.-H. (2018). Blood pressure control and cardiovascular outcomes: Real-world implications of the 2017 acc/aha hypertension guideline. *Scientific Reports*, *8*(1). https://doi.org/10.1038/s41598-018-31549-5

Lewinski, A. A., Bosworth, H. B., Goldstein, K. M., Gierisch, J. M., Jazowski, S., McCant, F., White-Clark, C., Smith, V. A., & Zullig, L. L. (2021). Improving cardiovascular outcomes by using team-supported, ehr-leveraged, active management: Disseminating a successful quality improvement project. *Contemporary Clinical Trials Communications*, *21*, 100705. https://doi.org/10.1016/j.conctc.2021.100705

Liyanage-Don, N., Fung, D., Phillips, E., & Kronish, I. M. (2019). Implementing home blood pressure monitoring into clinical practice. *Current Hypertension Reports*, *21*(2). https://doi.org/10.1007/s11906-019-0916-0

Meidert, A. S., & Saugel, B. (2018). Techniques for non-invasive monitoring of arterial blood pressure. *Frontiers in Medicine*, *4*. https://doi.org/10.3389/fmed.2017.00231

Muntner, P., Shimbo, D., Carey, R. M., Charleston, J. B., Gaillard, T., Misra, S., Myers, M. G., Ogedegbe, G., Schwartz, J. E., Townsend, R. R., Urbina, E. M., Viera, A. J., White, W. B., & Wright, J. T. (2019). Measurement of blood pressure in humans: A scientific

statement from the american heart association. *Hypertension*, *73*(5). https://doi.org/10.1161/hyp.0000000000000087

Ohio Colleges of Medicine. (2017). *Hypertension Quality Improvement Change Package*. Ohio Cardiovascular and Diabetes Health Collaborative. https:/www.cardi-oh/org/qip/hypertension/change-package

Olsen, M. H., Angell, S. Y., Asma, S., Boutouyrie, P., Burger, D., Chirinos, J. A., Damasceno, A., Delles, C., Gimenez-Roqueplo, A.-P., Hering, D., López-Jaramillo, P., Martinez, F., Perkovic, V., Rietzschel, E. R., Schillaci, G., Schutte, A. E., Scuteri, A., Sharman, J. E., Wachtell, K., & Wang, J. (2016). A call to action and a lifecourse strategy to address the global burden of raised blood pressure on current and future generations: The lancet commission on hypertension. *The Lancet*, *388*(10060), 2665–2712. https://doi.org/10.1016/s0140-6736(16)31134-5

Ostchega, Y., Fryar, C. D., Nwankwo, T., & Nguyen, D. T. (2020). *Hypertension prevalence among adults aged 18 and over: United States, 2017-2018*. Centers for Disease Control and Prevention. https://doi.org/https://stacks.cec.gov/view/cdc/87559

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S.,...Moher, D. (2021). The prisma 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, n71. https://doi.org/10.1136/bmj.n71

Pasha, M., Brewer, L. C., Sennhauser, S., Alsawas, M., & Murad, M. (2021). Health care delivery interventions for hypertension management in underserved populations in the united states: A systematic review. *Hypertension*, *78*(4), 955–965. https://doi.org/10.1161/hypertensionaha.120.15946

Pokharel, Y., Karmacharya, B. M., & Neupane, D. (2022). Hypertension—a silent killer without global bounds. *Journal of the American College of Cardiology*, *80*(8), 818–820. https://doi.org/10.1016/j.jacc.2022.05.043

Proia, K. K., Thota, A. B., Njie, G. J., Finnie, R. K., Hopkins, D. P., Mukhtar, Q., Pronk, N. P., Zeigler, D., Kottke, T. E., Rask, K. J., Lackland, D. T., Brooks, J. F., Braun, L. T., & Cooksey, T. (2014). Team-based care and improved blood pressure control. *American Journal of Preventive Medicine*, *47*(1), 86–99. https://doi.org/10.1016/j.amepre.2014.03.004

Roerecke, M., Kaczorowski, J., & Myers, M. G. (2019). Comparing automated office blood pressure readings with other methods of blood pressure measurement for identifying patients with possible hypertension. *JAMA Internal Medicine*, *179*(3), 351. https://doi.org/10.1001/jamainternmed.2018.6551

Saunders, E., Teall, A. M., Zurmehly, J., Bolen, S. D., Crane, D., Wright, J., Perzynski, A., & Lever, J. (2022). Coaching quality improvement in primary care to improve hypertension control. *Journal of the American Association of Nurse Practitioners*, *34*(7), 932–940. https://doi.org/10.1097/jxx.0000000000000731

Shaikh, U., Petray, J., & Wisner, D. H. (2020). Improving blood pressure screening and control at an academic health system. *BMJ Open Quality*, *9*(1), e000614. https://doi.org/10.1136/bmjoq-2018-000614

Sharman, J. E., Tan, I., Stergiou, G. S., Lombardi, C., Saladini, F., Butlin, M., Padwal, R., Asayama, K., Avolio, A., Brady, T. M., Murray, A., & Parati, G. (2022). Automated 'oscillometric' blood pressure measuring devices: How they work and what they measure. *Journal of Human Hypertension*. https://doi.org/10.1038/s41371-022-00693-x

Shimbo, D., Abdalla, M., Falzon, L., Townsend, R. R., & Muntner, P. (2015). Role of ambulatory and home blood pressure monitoring in clinical practice. *Annals of Internal Medicine*, *163*(9), 691–700. https://doi.org/10.7326/m15-1270

Tsao, C. W., Aday, A. W., Almarzooq, Z. I., Anderson, C. A., Arora, P., Avery, C. L., Baker-Smith, C. M., Beaton, A. Z., Boehme, A. K., Buxton, A. E., Commodore-Mensah, Y., Elkind, M. S., Evenson, K. R., Eze-Nliam, C., Fugar, S., Generoso, G., Heard, D. G., Hiremath, S., Ho, J. E.,...Martin, S. S. (2023). Heart disease and stroke statistics—2023 update: A report from the american heart association. *Circulation*, *147*(8). https://doi.org/10.1161/cir.0000000000001123

U.S. Department of Health and Human Services. (2020). *The Surgeon General's call to action to control hypertension*. Office of the Surgeon General. https://www.hhs.bov/surgeongeneral/index.html

Uhlig, K., Patel, K., Kitsios, G. D., & Balk, E. M. (2013). Self-measured blood pressure monitoring in the management of hypertension: a systematic review and meta-analysis. *Annals of Internal Medicine*, *159*, 18885–194. https://www-acpjournals-org.proxybz.lib.montana.edu/doi/epdf/10.7326/0003-4819-159-3-201308060-00008

United State Preventive Services Task Force. (2021). *Screening for hypertension in adults US Preventive Services Task Force reaffirmation recommendation statement*. US Preventive Services Task Force. https://doi.org/10.1001/jama.2021.4987

Viera, A. J., Hinderliter, A. L., Kshirsagar, A. V., Fine, J., & Dominik, R. (2010). Reproducibility of masked hypertension in adults with untreated borderline office blood pressure: Comparison of ambulatory and home monitoring. *American Journal of Hypertension*, *23*(11), 1190–1197. https://doi.org/10.1038/ajh.2010.158

Virani, S. S., Alonso, A., Benjamin, E. J., Bittencourt, M. S., Callaway, C. W., Carson, A. P., Chamberlain, A. M., Chang, A. R., Cheng, S., Delling, F. N., Djousse, L., Elkind, M. S., Ferguson, J. F., Fornage, M., Khan, S. S., Kissela, B. M., Knutson, K. L., Kwan, T. W., Lackland, D. T.,...Tsao, C. W. (2020). Heart disease and stroke statistics—2020 update: A report from the american heart association. *Circulation*, *141*(9). https://doi.org/10.1161/cir.0000000000000757

Vischer, A. S., & Bukard, T. (2017). Principles of blood pressure measurement-Current techniques, office vs ambulatory blood pressure measurement. In M. S. Islam (Ed.), *Hypertension: From basic research to clinical practice: Volume 2 (advances in experimental medicine and biology, 956)* (1st ed., 2017, pp. 85–96). Springer. https://link-springer-com.proxybz.lib.montana.edu/chapter/10.1007/5584_2016_49#Tab1

Wagner, T. D., Jones, M. C., Salgado, T. M., & Dixon, D. L. (2020). Pharmacist's role in hypertension management: A review of key randomized controlled trials. *Journal of Human Hypertension*, *34*(7), 487–494. https://doi.org/10.1038/s41371-020-0331-7

Wajngarten, M., & Silva, G. (2019). Hypertension and stroke: Update on treatment. *European Cardiology Review*, *14*, 111–115.

Waldrop, J., Reynolds, S. S., McMillian-Bohler, J. M., Graton, M., & Ledbetter, L. (2023). Evaluation of dnp program essentials of doctoral nursing education: A scoping review. *Journal of Professional Nursing*, *46*, 7–12. https://doi.org/10.1016/j.profnurs.2022.11.009

Walsh, J. E., McDonald, K. M., Shojania, K. G., Sundaram, V., Nayak, S., Lewis, R., Owens, D. K., & Goldstein, M. (2006). Quality improvement strategies for hypertension management. *Medical Care*, *44*(7), 646–657. https://doi.org/10.1097/01.mlr.0000220260.30768.32

Whelton, P. K., Carey, R. M., Aronow, W. S., Casey, D. E., Collins, K. J., Dennison Himmelfarb, C., DePalma, S. M., Gidding, S., Jamerson, K. A., Jones, D. W., MacLaughlin, E. J., Muntner, P., Ovbiagele, B., Smith, S. C., Spencer, C. C., Stafford, R. S., Taler, S. J., Thomas, R. J., Williams, K. A.,...Wright, J. T. (2018). 2017 acc/aha/aapa/abc/acpm/ags/apha/ash/aspc/nma/pcna guideline for the prevention, detection, evaluation, and management of high blood pressure in adults. *Journal of the American College of Cardiology*, *71*(19), e127–e248. https://doi.org/10.1016/j.jacc.2017.11.006

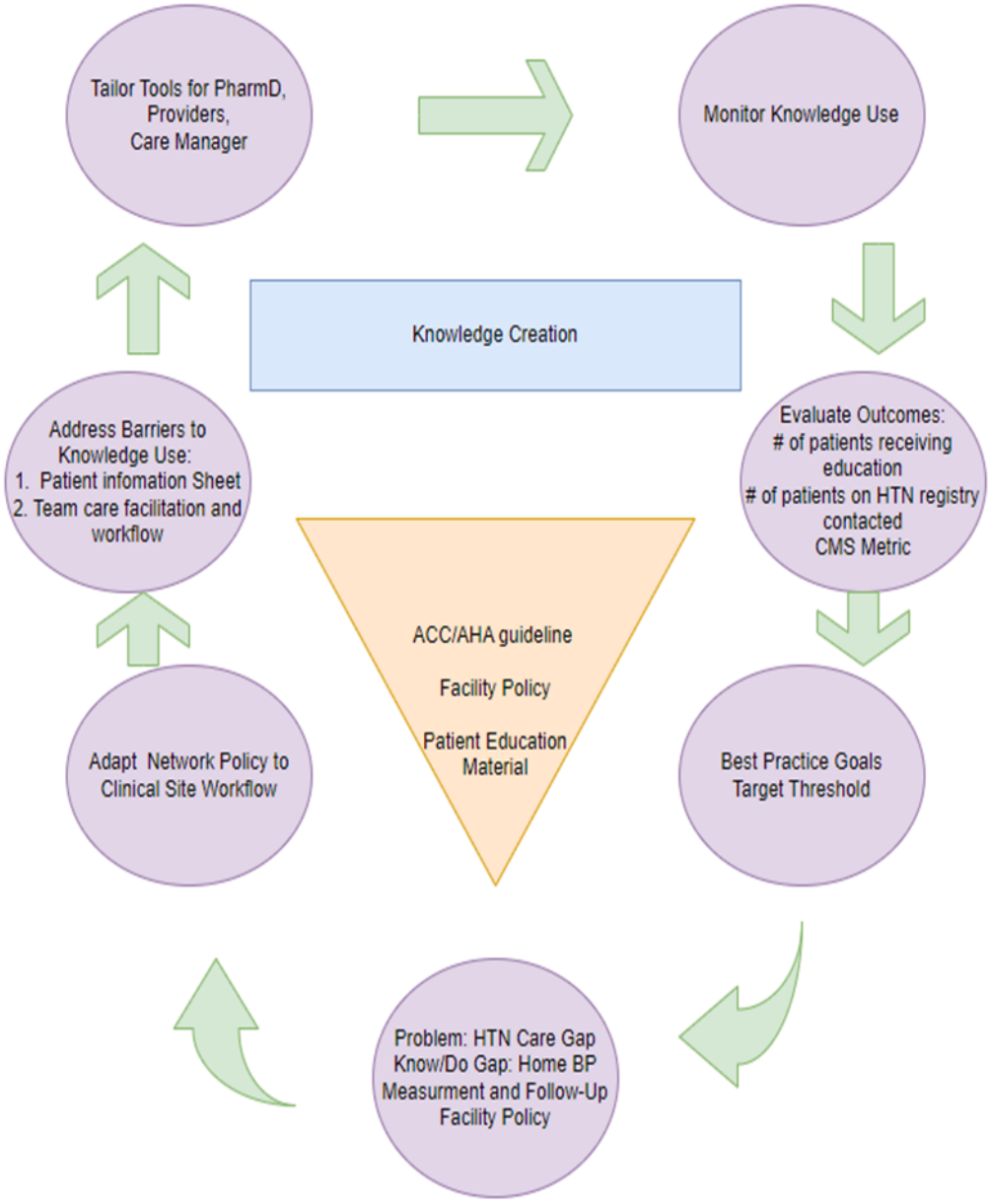
Zuo, H.-J., Ma, J.-X., Wang, J.-W., & Chen, X.-R. (2020). Assessing the routine-practice gap for home blood pressure monitoring among chinese adults with hypertension. *BMC Public Health*, *20*(1). https://doi.org/10.1186/s12889-020-09901-0

APPENDICES

APPENDIX A

KNOWLEDGE TO ACTION DIAGRAM

Knowledge to Action Diagram



APPENDIX B

BLOOD PRESSURE TIP SHEET AND LOG

Blood Pressure Tip Sheet and Log

<table>
<tr><td colspan="2">What do the numbers mean?
• High numbers mean you are at a greater risk of cardiovascular problems from your blood pressure.</td></tr>
<tr><td colspan="2">• Blood pressure is measured by two numbers.</td></tr>
<tr><td>• Top number or Systolic is the pressure in your blood vessels when your heart is beating.</td><td>• The bottom number or Diastolic is the pressure in your blood vessels between beats.</td></tr>
<tr><td>• When the top (systolic) number is high it can cause blood vessels to stiffen and that can lead to heart disease, stroke, and damage to kidneys and other major organs.</td><td>• When the bottom (diastolic) number is high, it can cause overstretched, weakened sections in the body’s main artery.</td></tr>
<tr><td colspan="2">Usually, you cannot tell if your blood pressure is too high. Blood pressure self-monitoring and taking your blood pressure medications are two important things you can do to manage blood pressure.</td></tr>
<tr><td>Your most recent clinic blood pressure was:</td><td>175/ 95</td></tr>
</table>

Date	**Morning**			**Evening**		
	Time	**Reading 1**	**Reading 2**	**Time**	**Reading 1**	**Reading 2**
12/1/22	*8 am*	*140/78*	*138/80*	*7 pm*	*145/90*	*141/88*

APPENDIX C

HOW TO TAKE YOUR BLOOD PRESSURE AT HOME HANDOUT

How to Take Your Blood Pressure at Home Handout

1. Prepare	2. Position	3. Measure
Avoid caffeine, cigarettes, and other stimulants 30 minutes before you measure blood pressure.	Put cuff on bare arm, above the elbow.	Rest for 5 minutes before starting.
Wait for 30 minutes after a meal.	Position your arm so that it is at heart level.	Take two or three measurements, one minute apart.
Measure blood pressure before at least 30 minutes after you take blood pressure medication.	Keep arm supported with muscles relaxed.	Keep your body relaxed and in position during measurements.
Empty your bladder before measuring.	Sit with legs uncrossed.	Sit quietly, without distractions-avoid talking, tv, and devices.
Find a quiet, comfortable place.	Keep feet flat on the floor.	Record your measurements when finished.
	Keep your back supported.	

APPENDIX D

EVIDENCE TABLE

Evidence Table

Citation: author(s), date of publication, & title	Design/Method	Sample/ Setting	Summary of Results
Asayama et al., 2004 Prediction of stroke by self-measurement of blood pressure at home versus casual screening blood pressure measurement in relation to the joint national committee 7 classification (The Ohasama Study)	Longitudinal observational study Objective: compare the predictive power of self measured HBP and casual BP for stroke risk.	N=1789	-HBP had a stronger predictive power than CBP for stroke or TIA risk. -Risk for stroke predicted when HBP was used for classification regardless of presence of CV disease but not with CBP.
Bangalore et al., 2017 Optimal systolic blood pressure target after SPRINT: Insights from a network meta-analysis of randomized trials	Meta-analysis	N= 17 trials 55, 163 patients	-Data from randomized BP target strategy trials suggest a significant reduction in stroke and MI with lower BPs. -SBPs of < 120 mm Hg was the most effective target BP. -Cluster plots for combined efficacy and safety outcomes showed SBP target of < 130 mm Hg achieved optimal balance between efficacy and safety
Breaux-Shropshire et al., 2015 Does home blood pressure monitoring improve patient outcomes? A systematic review comparing home and ambulatory blood pressure monitoring on blood pressure control and patient outcomes.	SR Objective: compare clinical effectiveness of HBPM and ABPM on BP control and patient outcomes	RCTs, prospective and retrospective cohort studies N = 19	HBPM increases patient-centered care and improves BP control and patient outcomes. HBPM should be incorporated int design of RCTs with hypertensive populations.
Cappuccio et al.,2004 Blood pressure control by home monitoring: meta-analysis of randomized trials	Meta-analysis of randomized trials	N=1359 individuals N=18 RCTs	Limitations:RCTs in a variety of settings with different methods and criteria. Publication bias potential. Strength: Meta-analysis Level of Evidence B Risk: Misdiagnosis, create a barrier to care with lack of access to equipment or technology

Evidence Table continued

Karnjanapiboonwong et al., (2020). Diagnostic performance of clinic and home blood pressure measurements compared with ambulatory blood pressure: a systematic review and meta-analysis	SR/MA	N=58 studies	-Diagnostic performances of HBPM were higher than CBPM. -Prevalence of MHT is often negative in CBPM -ABPM is most sensitive for confirming HT
Muntner et al., 2017 Measurement o blood pressure in humans: a scientific statement from the American Heart association	Scientific Statement	NA	-Strength: A USPSTF recommends this service. There is a high certainty that the net benefit is substantial. -Accuracy measuring BP is essential for proper diagnosis and treatment of HT HBPM requires 1. Patient and healthcare staff training 2. Use of preferred devices and cuffs 3. Best practices for patient 4. 2 readings 1 min apart taken in the AM and evening. 5. Duration of monitoring is 3-7 days. -HBPM can be used to assess out-of-office B when ABPM is not available or accepted by patient. -HBPM can be used to detect WCHT -HBPM devices must be validated HBPM by itself has limited effect on BP control, but it is effective in reducing BP when used in combination with supportive interventions. -HBPM devices should have an auto-store capacity.
Mustik et al. 2019 Diagnosing hypertension in primary care: A comparison of three methods	Cohort Study Objective: compare OBPM and HBPM with ABPM and determine best method to diagnose HT in primary care	n=29	HBPM were more compliant with ABPM than OBPM in the diagnosis of HT. HBPM is better for diagnosing MH and WCHT Limitation: Power of study with n = 29

Evidence Table continued

Roerecke et al., 2019 Comparing automated office blood pressure readings with other methods of blood pressure measurement for identifying patients with possible hypertension	Systematic Review and Meta-analysis Objective: To examine the association of AOBP and office BP readings in routine clinical practice	31 articles comprising 9279 participants	-Automated office blood pressure readings, only when recorded properly with patient sitting alone in a quiet place are more accurate than OBPM. -AOBP should now be preferred method for recording BP in office setting.
Shimbo et al. 2015 Role of ambulatory and home blood pressure monitoring in clinical practice	Review	Search of Medline through July using following key words: ambulatory blood pressure, home bold pressure, out of office blood pressure, self-measured blood pressure, and self-measurement of blood pressure.	-Mean out-of-clinic BP measured by ABPM and HBPM maintains a stronger association with CVD and mortality risk than clinic BP. -Prevalence of WCHT is high (ABPM and HBPM should be used to identify this phenomenon.
Uhlig et al., (2013) Self-Measured Blood Pressure Monitoring in the Management of Hypertension	SR/MA Objective: summarize evidence about the effectiveness of SMPB in adults with HT	N=52 comparative studies of SMBP	-SMBP monitoring with or without additional support lowers BP compared to usual care. -Additional support enhances BP-lowering effect
US Preventive Services Task Force, 2021 Screening for hypertension in adults	Recommendation Statement	NA	-Level of Evidence:A -Recommend screening for hypertension in adults. Obtain BPM outside of clinical setting for diagnostic confirmation.
Viera et al., 2010 Reproducibility of masked hypertension with untreated borderline office blood pressure: comparison of ambulatory and home monitoring.	Cohort study	N = 50	-MH has fair-to-moderate reproducibility -OBPM systematically fails to identify some patients who should be treated as hypertensive.

Evidence Table continued

Wright et al. 2015 A randomized trial of intensive versus standard blood-pressure control	RCT Outcome: Determine if target of 120 mm Hg versus 140 mm Hg impacted outcomes of MI ACS, stroke, heart failure, or death from CV disease.	N = 9361 with SBP 130 mm Hg or higher and an increased CV risk but without diabetes	-Targeting SB of less than 120 mm Hg as compared with less than 140 mm Hg resulted in lower rates of fatal and nonfatal major CV events and death from any cause. Strengths: Large sample size and diverse population
Yue et al., 2018 The effectiveness of electronic health interventions on blood pressure control, self-care behavioral outcomes and psychosocial well-being in patients with hypertension: A systematic review and meta-analysis	SR/MA Objective: identify delivery mode and strategies used by current eHealth interventions and examine effectiveness in terms of BP control	N=15 articles	-eHealth interventions positively affect blood pressure control and could be useful in managing HT.

APPENDIX E

IMPACT OF HYPERTENSION ON HEALTH HANDOUT

Impact of Hypertension on Health Handout