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The objective of this study was to identify medical providers' perceptions of and response to adolescent hypertension (HTN) and to identify if and how social determinants of health (SDOH) play a role in the medical providers' messaging to these adolescents. In addition, barriers experienced by medical providers were assessed regarding the management of HTN and the collection and use of SDOH data. A mixed-methods study was conducted using an online survey (n=110) and semi-structured phone interviews (n=12) of medical providers who treat adolescents ages 13 to 18 years old in North Carolina. Most providers expressed limited comfort with the treatment of HTN (67%). When looking at providing lifestyle recommendations, 44% of providers were completely comfortable with providing nutrition recommendations and 49% were completely comfortable with providing physical activity recommendations to adolescents with HTN. In addition, most medical providers reported rarely having knowledge of their patients' SDOH factors like access to healthy food (64%) or caregiver's educational status (81%). Main themes identified in the interviews included (1) monitoring of BP in adolescents, (2) level of comfort associated with HTN diagnosis and management, (3) approaches to weight and diet related chronic disease discussions, (4) SDOH data collection and influence on provider messaging, and (5) resources desired. Providers had variable approaches to managing HTN with greater comfort in recommending lifestyle changes than prescribing medications. Collection methods varied related to a patient's SDOH, and these factors were used differently among providers. Most providers considered access to food and a safe space to exercise in their messaging to adolescents and families. The management of adolescent HTN is challenging because medical providers must consider clinical symptoms as well as unmet social needs when

making recommendations to their patients. Altering messages to meet adolescents and families where they are and providing referrals to appropriate community resources supports patients in their efforts to make changes for the better. Providers identified barriers and opportunities for improvement which should be further investigated to improve overall care of patients.

MEDICAL PROVIDERS' PERCEPTIONS OF AND RESPONSE TO ADOLESCENT
HYPERTENSION: THE ROLE OF SOCIAL DETERMINANTS OF HEALTH IN
MESSAGING

by

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CHAPTER I: INTRODUCTION

Adolescent hypertension (HTN) affects 3.5% of adolescents and elevated blood pressure (BP) affects 2.2 – 3.5% of adolescents in the United States yet an adolescent's BP is often not fully analyzed by medical providers who routinely treat these patients (Flynn et al., 2017; Guzman-Limon & Samuels, 2019; Riley et al., 2018). The American Academy of Pediatrics (AAP) released updated clinical practice guidelines for the screening and management of BP in adolescents. These guidelines provided new BP thresholds, rather than utilizing BP tables, to simplify the identification of elevated BP and HTN in adolescents over 13 years old. According to the new AAP guidelines, for adolescents 13 years or older, normal BP is $<120/<80$ mmHg, elevated BP is $120/<80$ to $129/<80$ mmHg, stage 1 HTN is $130/80$ to $139/89$ mmHg, and stage 2 HTN is $\geq 140/90$ mmHg (Flynn et al., 2017). Per the guidelines, adolescents should have their BP checked on a yearly basis and physicians should follow up at closer intervals for those adolescents presenting with elevated BP or HTN.

Lifestyle modifications should be encouraged by medical providers for adolescents diagnosed with HTN. While dietary and physical activity habits have been demonstrated to influence adolescent BP status, these factors were insufficient for explaining rates of elevated BP and warrant medical providers broaden their investigation into other factors such as social determinants of health (SDOH) which may also influence health outcomes of adolescents (Ewald et al., 2017). Children are particularly vulnerable to SDOH limitations given the physical, social and emotional developments that are made during this timeframe in life. Research has shown that an infant's development is affected by the SDOH that impact a mother during pregnancy, and childhood SDOH risks often persist into adulthood (Morone, 2017). For example, differences in cognitive development of children from low socioeconomic status families have

been observed specifically in regions of the brain associated with language, memory and cognitive control (T. G. Moore et al., 2015). This could partially be related to the mother's prenatal care, parent and child interactions, and opportunities for cognitive stimulation. Adequately meeting developmental milestones provides the concrete foundation for overall well-being and life longevity (Sokol et al., 2019). Food insecurity, inadequate housing accommodations, and low parental education level are all psychosocial concerns associated with higher rates of behavioral, developmental, and learning issues in children (Garg et al., 2007, 2015; Sokol et al., 2019). Adolescents are negatively impacted in adulthood with higher rates of poverty, lower educational status, and greater rates of chronic diseases like heart disease and diabetes (Fierman et al., 2016; Garg et al., 2015). Despite knowing that early identification and intervention of these factors can improve long term health outcomes, few pediatricians routinely assess family psychosocial problems at well child visits (Garg et al., 2007; Sokol et al., 2019).

To our knowledge, no studies have been conducted since the release of the 2017 guidelines assessing medical provider comfort with diagnosing and treating elevated BP and HTN in adolescents. In addition, studies lack a clear assessment of medical providers' knowledge of SDOH factors in patients and how knowledge of those factors influence treatment recommendations to improve long term health outcomes. Furthermore, adolescents of normal weight status are often overlooked in the diagnosis process. Medical providers must be prepared to diagnose, treat, and manage adolescent HTN in all adolescents to decrease the risk of HTN continuing into adulthood.

Long-term Goal and Specific Aims

The long-term goal of this research project was to improve diagnosis and treatment of HTN and decrease risk of cardiovascular disease (CVD) among high-risk adolescents. By better

understanding medical providers' methods towards management of adolescent HTN, the gaps in care can be elucidated and medical providers can receive the necessary continuing education to improve care of adolescents. This research encourages that the 2017 guidelines and SDOH screening become more routinely utilized to assess health risk in adolescents. These changes would be protective against adolescent HTN because they encourage medical providers to better tailor their recommendations based on a patients' social factors, and, ultimately, could decrease chronic disease risk in adolescents. This is imperative as often these chronic disease risk factors that begin in youth will follow into adulthood if not treated. The ultimate outcome is healthy adolescents that are not burdened by chronic disease as young adults.

Three specific aims were identified to conduct this research study:

- ***Specific Aim 1:** To identify medical providers' perceptions of and responses to adolescent hypertension in North Carolina.*
- ***Specific Aim 2:** To identify if and how social determinants of health play a role in messaging to adolescents with elevated blood pressure or hypertension.*
- ***Specific Aim 3:** To examine the process used and the barriers experience by medical providers with regard to the diagnosis of elevated blood pressure and access to treatments for these adolescents.*

Specific aim 1 provided insight on how medical providers diagnose and treat adolescent HTN and whether those strategies are different dependent upon the weight status of the adolescent. Regarding specific aim 2, research has shown that activity and dietary habits do not adequately explain rates of obesity and HTN.(Ewald et al., 2017) Identification of SDOH linked to HTN in adolescents can ultimately help improve treatments offered to adolescents; however, medical providers must be diligent in their collection and utilization of this information. Specific

aim 3 was evaluated to identify and discuss barriers experienced by medical providers, adolescents, and families in order to better address adolescent HTN.

This research fills a gap in the literature regarding medical providers' comfort in assessing and treating elevated BP and HTN. In addition, it provides greater insight into how medical providers utilize the SDOH to inform treatment plans. This improved understanding of medical providers' practices provides evidence of what is working well and what is missing in the treatment of adolescent HTN. This information can be used to improve the diagnosis process, assessment of SDOH within the primary care setting, and access to nutritional interventions that are sustainable for low-income families.

CHAPTER II: REVIEW OF THE LITERATURE

HTN affects approximately 3.5% of children and adolescents, with prevalence expected to increase once assessed using the new 2017 AAP clinical guidelines (Flynn et al., 2017; Guzman-Limon & Samuels, 2019; Riley et al., 2018). The prevalence of elevated BP is approximately 2.2% - 3.5%, with higher rates in those adolescents falling in the overweight or obese BMI category (Flynn et al., 2017; Riley et al., 2018). Research has shown that elevated BP during adolescence increases the risk of HTN in adulthood (Beal, 2018; South et al., 2019). Adolescents with elevated BP were shown to progress to HTN at a rate of 7% per year in a study by Faulkner et al (Falkner et al., 2008). In addition, adolescents with elevated BP are more likely to experience target organ damage and accelerated vascular aging that may lead to cardiovascular disease (CVD) or stroke in adulthood, making it crucial to diagnose HTN as early as possible (Beal, 2018; Ewald & Haldeman, 2016; Flynn et al., 2017; Riley et al., 2018; Ward et al., 2016).

Poverty affects approximately 14.4% of children under the age of 18 which equates to nearly 1 in 7 children in the United States (Semega et al., 2020). Children living in socioeconomically disadvantaged situations are more likely to experience negative health outcomes including increased risk of chronic diseases, have less stable housing, and live in food insecure households (Buitron de la Vega et al., 2019; Chung et al., 2016; Fierman et al., 2016; Garg et al., 2015). In addition, poorer children demonstrate higher rates of developmental delays, negative behavioral outcomes, and fewer educational achievements. These negative effects can continue into adulthood as evidenced by adult poverty, low educational status, criminal justice system involvement, and increased risk substance abuse and depression (Fierman et al., 2016; Pediatrics, 2016). Higher income is related to better health outcomes including

lower prevalence of chronic diseases, depression, and longer life-expectancy rates.(Adler et al., 2016) Health disparities are also evident by sex, race, ethnicity, educational status, sexual orientation, and living situations (Adler et al., 2016). While some of these factors may be addressed on medical intake forms, other factors must be assessed through conversation by the medical provider in the exam room. Prior research has established this dynamic relationship between a patients' social needs and their health outcomes; therefore, providers must determine how they can best screen for a patients' health-related social circumstances (Chung et al., 2016; Sokol et al., 2019). This is a unique process from utilizing traditional diagnostic tests and screening methods for medical problems like HTN or heart disease (Garg et al., 2016).

Both chronic disease prevention and social environment improvements are focuses of various Healthy People 2030 objectives. It is evident that adolescents with elevated BP will become adults who lack BP control, supporting the need to investigate influences of adolescent HTN to meet this objective. Other objectives highlight the need to improve adolescent weight status, reduce added sugar consumption, and increase physical activity participation. All of these objectives are related to lifestyle changes that can reduce the risk of adolescent HTN. In addition, there are multiple objectives that stress the need to improve social environments for community members. These include, but are not limited to, improved health care access, improved quality housing conditions, improved access to safe exercise spaces, and decreased exposure to secondhand smoke (*Healthy People 2030 | Health.Gov*, 2021). These objectives, developed based on national data, emphasize the importance of achieving BP control and meeting social needs during adolescence.

Defining Hypertension

The AAP released their Clinical Practice Guidelines for Screening and Management of High Blood Pressure in Children and Adolescents in September 2017. These new guidelines provided an update from the 2004 Fourth Report of the Working Group on High BP in Children and Adolescents (Fourth Report) and provided simplified screening tables for identifying elevated BP in adolescents. According to the new AAP guidelines, for children 13 years or older, normal BP is $<120/<80$ mmHg, elevated BP is $120/<80$ to $129/<80$ mmHg, stage 1 HTN is $130/80$ to $139/89$ mmHg, and stage 2 HTN is $\geq 140/90$ mmHg (Flynn et al., 2017). In addition, new normative pediatric BP tables based on normal-weight children were released which include systolic and diastolic BP arranged by age, gender, and height values. Unlike the Fourth Report, these tables do not include data from overweight or obese children and adolescents to reduce bias, as overweight and obesity are associated with elevated BP and HTN. According to the Morbidity and Mortality Weekly Report from the CDC, an additional 1.3 million adolescents ages 12 to 19 would be classified as having HTN according to the new AAP guidelines (Jackson et al., 2018).

Numerous studies have assessed the performance of the new AAP threshold guidelines in comparison to the AAP percentile tables. General conclusions state that the new BP thresholds perform well in identifying elevated BP in adolescents (Fan et al., 2019; Liu et al., 2019). The cutoffs; however, did not perform well in some subgroups including among girls, younger adolescents, Hispanic adolescents, and those with low height percentiles based on the lower sensitivity values found in these groups. For girls and younger adolescents, the cut-off values for diagnosing HTN were lower using the percentile tables than when using the threshold values. Ultimately, these studies concluded that the use of the simple threshold measures are suitable and

accurate for clinical practices to employ for the routine diagnosis of elevated BP and HTN (Fan et al., 2019; Liu et al., 2019).

Obtaining Accurate Blood Pressure Measurements

It is important that an accurate BP measurement is obtained for the diagnosis of HTN. BP measures can vary widely between each measurement taken in the same sitting with the first measure often being the highest and the fourth measure being the lowest. BP measures can also vary over time. Falkner et al found variations in BP classification at 2-year and 4-year intervals, justifying the need to measure BP multiple times in order to make a clinical diagnosis of HTN (Falkner et al., 2008). Per the updated AAP guidelines, the initial BP measurement can be obtained using oscillometric or auscultatory methods on the right arm with the appropriate cuff size while the adolescent is seated and has been at rest for 3-5 minutes prior to the measurement. If the initial BP measurement is elevated, then two additional measurements should be taken at the same visit. The average of the second and third measures should be taken to determine whether the adolescent has normal BP, elevated BP, stage 1 HTN, or stage 2 HTN. Practitioners should begin measuring BP at the age of 3 and should measure it annually for healthy children or at every visit for children with obesity, renal disease, diabetes, aortic arch obstruction or coarctation, or if taking a medication that may cause an increase in BP (Flynn et al., 2017). A survey of pediatric specialists revealed that the most common problem was over referral due to inaccurate BP readings suggesting that increased staff training and provision of appropriate equipment are needed to improve BP measurement accuracy in the primary care setting (E. Yoon et al., 2015).

Studies have shown that oscillometric devices may overestimate systolic and diastolic BP when compared to auscultatory measures. Park et al. reported a 10 mmHg higher measure when

using an oscillometric device in comparison to a BP obtained by auscultation (Park et al., 2005). This difference could result in the misclassification of an adolescent. In addition, the within visit variation of BP taken by an oscillometric device was greater, with the initial measurement needing to be ignored due to it being inaccurately high. The average of subsequent measures was more comparable to measures taken by auscultation (Negroni-Balasquide et al., 2016). NHANES records the average of three consecutive BP measurements taken by a trained professional using a mercury sphygmomanometer (South et al., 2019). Many studies assessing BP and health outcomes collect two to three BP measures and use the average of those measures in analyses for these reasons (Hojhabrimanesh et al., 2017; Manios et al., 2019; Xu et al., 2018). Taking an accurate BP measure is imperative so medical practitioners can accurately diagnose and treat elevated BP and HTN according to the guidelines. If BP measures are not taken properly or physicians do not accurately assess what that reading means, adolescents that do actually have elevated BP or HTN may be overlooked.

Risk Factors of Adolescent HTN

The American Heart Association has identified “Life’s Simple 7” for adults to obtain a healthy lifestyle (*My Life Check | Life’s Simple 7*, 2020). These seven factors include eating a healthy diet, incorporating physical activity, maintaining a healthy weight, quitting smoking, as well as, managing BP, cholesterol, and blood sugar. While these are factors that can influence CVD development in adults, it is evident that many adolescents also do not practice a healthy lifestyle as described by “Life’s Simple 7”. Data show that many adolescents have poor diets, inactive lifestyles, obesity, and use cigarettes, making it evident that adult CVD may have its origins in adolescence when some of these detrimental practices begin (Flynn et al., 2017; Fowokan et al., 2018). Fruit and vegetable intake was shown to start to decrease prior to

adolescence with fruit intake at the lowest during adolescence (Albani et al., 2017). In a study of 557 Iranian adolescents, there was a positive association between BP and a western dietary pattern that contained foods high in energy, sodium, saturated fat, and sugar (Hojhabrmanesh et al., 2017). Ponzo et al. found that snacks accounted for almost half of the average daily sodium intake and those adolescents with higher sodium intake had higher systolic and diastolic BP values. (Ponzo et al., 2015). The recommended sodium intake for adolescents ages 14 to 18 years is 1.5 grams, yet some data show a much higher sodium consumption of 6 grams in children over 5 years of age (Hanevold, 2013). In the United States, sodium is prevalent in our prepared food sources including breads, cereals, and restaurant foods, which account for more than 65% of the sodium consumed (Ewald & Haldeman, 2016; Hanevold, 2013). Less than 10% of US children and adolescents consume the daily recommended intake of fruits and vegetables. A review of NHANES 2001 to 2004 data reported that 97.0% of male and 98.6% of female adolescents age 14 to 18 were below the minimum recommended consumption of vegetables, while 86.6% males and 84.8% females were below the minimum recommended consumption of fruits according to the dietary guidelines for each food group (Krebs-Smith et al., 2010). Interventions should focus on developing a healthy lifestyle including improved dietary habits by lowering sodium and added sugar intake and increasing fruits, vegetables, and whole grain intake. While these dietary changes are strongly recommended, they are often unsuccessful at helping a patient maintain lasting blood pressure control (Wühl, 2019).

Physical activity guidelines, like dietary guidelines, are also under met by adolescents. The Physical Activity Guidelines for Americans recommends a minimum of 60 minutes of activity per day of moderate to vigorous physical activity, yet 85% of adolescents do not meet these recommendations (Kornides et al., 2018). A decline of one moderate-to-vigorous physical

activity session per week was associated with a 0.29 mmHg and a 0.19 mmHg higher BP in girls and boys ages 13-15, respectively (Maximova et al., 2009). In addition to physical activity, other lifestyle habits may influence the rising BP rates. According to the American Lung Association, 9.3% of high school students report smoking cigarettes and approximately 2,500 children try cigarettes every day (*Tobacco Use Among Children and Teens* | American Lung Association, 2020). Obesity is also prevalent in the United States with 1 in 5 adolescents between ages 6 to 19 falling in the obese category (Hales, 2017). Early and sustained HTN in youth can be detrimental to vascular health and lead to an increased risk of CVD in adulthood making an accurate diagnosis of HTN in adolescents imperative (Guzman-Limon & Samuels, 2019).

While lifestyle habits are incredibly important in their ability to decrease risk of chronic disease, nutritional intake and physical activity levels were not sufficient at explaining the rates of HTN seen in adolescents, suggesting that some other factor may be influencing the rise in BP seen in adolescents (Ewald et al., 2017). Social Determinants of Health (SDOH) refer to conditions in the environments where adolescents and their families live, work, attend school, and play which may affect a variety of health risk factors or quality-of-life outcomes. Resources available in certain settings can influence the well-being of individuals, ultimately considering a person's social environment as a predictor of their health status may indicate expected health outcomes. The SDOH are made up of five determinants including economic stability, education, social and community context, health and health care, and neighborhood and built environment. Examples of social determinants include access to health care, quality education, safe places to be physically active, access to transportation, availability of safe and healthful foods, and income level. Identifying if and how the SDOH influence medical providers' messaging to adolescents

that have elevated BP and their families can uncover gaps in interventions that may be improved upon if SDOH were considered.

Significance of Risk Factors

Awareness regarding adolescent HTN remains low despite the large number of individuals affected by HTN in both adult and pediatric care settings. Primary care providers and pediatricians must be prepared to diagnose, provide treatment, and follow-up appointments regarding adolescent HTN; however, research shows that medical providers may not feel comfortable in this role (Boneparth & Flynn, 2009; Saini et al., 2020). Additionally, studies have shown that adolescents who are phenotypically of normal weight status but metabolically obese may be more likely to go undiagnosed with HTN, despite recommendations by the 2017 guidelines to assess BP yearly, at minimum, in all children (Ewald et al., 2017). Future research needs to elucidate how closely the 2017 AAP guidelines are being adhered to and concerns of primary care providers regarding the evaluation of BP in adolescents. Medical providers' perceptions of and response to adolescent HTN has not been sufficiently researched, especially regarding normal-weight adolescents. As evidenced by the release of the SDOH Screening Questionnaire from North Carolina Department of Health and Human Services, healthcare institutions have started to collect SDOH data on patients and their families. Future research also needs to evaluate the different methods used for the inclusion of SDOH in the full assessment of adolescents so providers can be advised of best practices to tailor treatment recommendations to meet each individual adolescent's needs.

Underdiagnosis of Adolescent Hypertension

While HTN has been shown to be a common chronic disease in children, many medical providers do not recognize that their patients fall in the elevated BP or hypertensive categories

(Hansen et al., 2007). Prior to the release of the 2017 AAP guidelines, the diagnosis of HTN required knowing the child's age and having accurate height and BP measures to then assess where the child was categorized based on the BP tables. These BP tables contained numerous cutoff points based on age, height, and gender making it difficult for medical providers to remember all of the values. Furthermore, many of the electronic medical record programs may or may not have the ability to integrate these cumbersome BP cut-offs into their system, potentially requiring that medical providers are the ones utilizing these tables to complete their assessment of an adolescent's BP (Hansen et al., 2007). Studies have shown that HTN screening occurs at about only one-third of pediatric appointments and two-thirds of preventive care visits; however, pediatricians self-report that they evaluate BP up to 90% of the time (Bijlsma et al., 2014). Studies assessing accurate BP diagnoses in adolescents have found that 74% - 87% of adolescents within the study population had undiagnosed elevated BP or HTN (Brady et al., 2010; Hansen et al., 2007). Only 25% of physicians claimed to measure BP as often as possible; however, 71% reported measuring BP only when the child was diagnosed or suspected to have a condition associated with abnormal BP. In addition, the ability of physicians to classify a BP without utilizing the reference tables was not perfect with 74% of physicians underestimating a BP category in at least one of six elevated BP or hypertensive case studies (Bijlsma et al., 2014). Much of the research on this subject happened prior to the release of the 2017 AAP clinical guidelines and has not explored whether or not the diagnosis rates have improved since the implementation of the single point BP cut-off thresholds for adolescents age 13 years or older.

Several patient characteristics have been associated with under recognition of elevated BP in adolescents including older age, male gender, normal weight status, and lack of family history of CVD. Decreased recognition of elevated BP was also associated with being seen by a

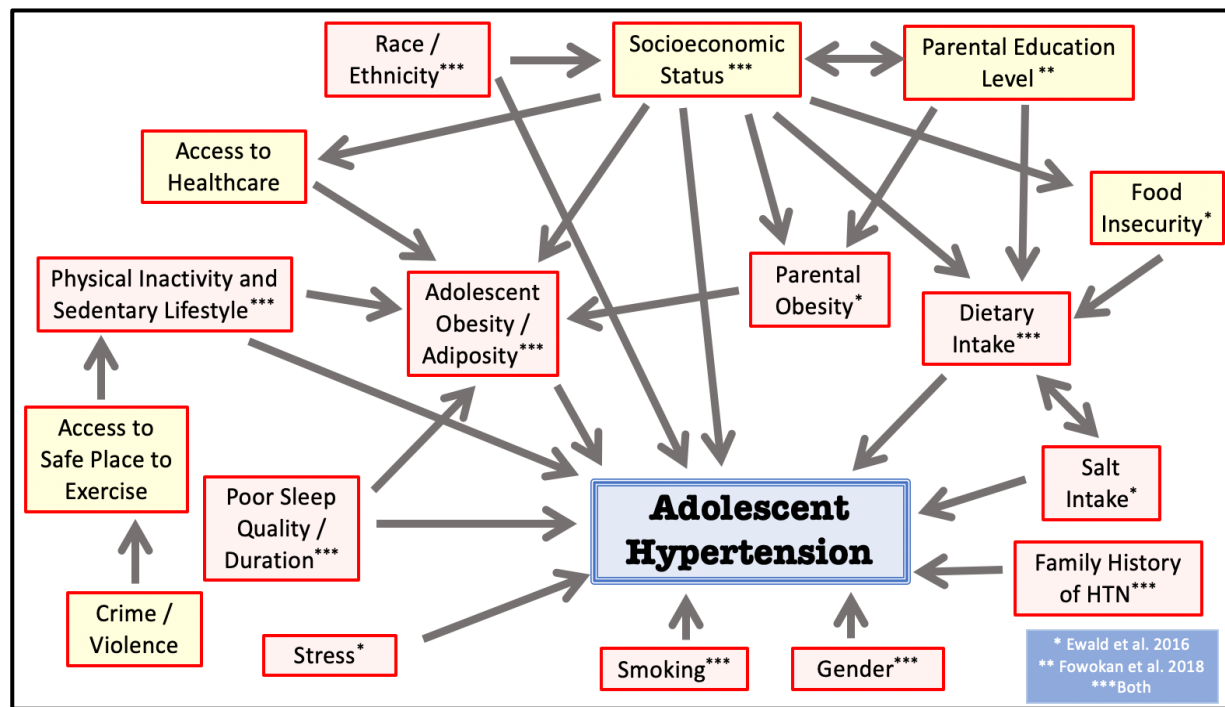
less experienced physician or a nurse practitioner (Brady et al., 2010). Certain patient characteristics are more likely to prompt recognition of elevated BP. Obesity is a known risk factor for HTN and CVD; therefore, it is no surprise that adolescents with higher BMI scores are more likely to have a hypertensive status diagnosed. One study showed the predicted probability of recognizing elevated BP was the highest for obese children and was lower among children over 14 years of age (Brady et al., 2010). While overweight and obese children were more likely to be recognized as hypertensive, the overall rate of recognition was still only 20% for this population (compared to 7% in normal weight adolescents) showing the need for more education of pediatric health care providers regarding this important diagnosis (Brady et al., 2010). Medical providers may be falsely reassured by BP readings that are not obviously elevated, especially when the adolescent does not possess other CVD risk factors (Brady et al., 2010). A study by Yoon et al. found that the adolescent's weight status, age, and symptoms were determining factors in whether or not additional medical testing was necessary. Physicians were more likely to consider adult risk factors associated with HTN, like poor dietary intake or sedentary lifestyle, for obese adolescents while physicians often recommended further medical testing for a thinner, younger patient to assess for secondary HTN (E. Y. Yoon et al., 2013). While weight is an important consideration, obtaining accurate BP measures for all adolescents and reassessing at the appropriate time intervals is the first step to knowing when to initiate the appropriate preventive health care measures with adolescents. Proper assessment of BP in all adolescents will ensure that fewer cases of adolescent HTN go undiagnosed.

The Importance of Assessing SDOH in Clinical Settings

The influence of SDOH on health outcomes has become apparent but how to address these in clinical settings is still up for discussion. Ewald and Haldeman reviewed the literature

regarding risk factors of adolescent HTN, some of which are pillars of SDOH (Ewald & Haldeman, 2016). The conceptual model in Figure 1 was developed to demonstrate how risk factors of adolescent HTN are related to the SDOH. Some of the SDOH directly influence adolescent HTN while others have more of an indirect effect by influencing known risk factors. Despite the knowledge that socially disadvantaged individuals are at a higher risk of having poor health outcomes, medical providers often focus on recommending medical treatments and lifestyle changes without asking about or considering social implications that may pose a challenge for patients (Andermann, 2016). Adolescents living in poverty often experience adverse childhood experiences and are susceptible to a variety of child and adult health problems including heart disease (Chung et al., 2016). Although SDOH have been shown to have a detrimental effect on children's health status, few health providers routinely address the social and psychosocial factors that may be affecting the adolescents health status during wellness visits (Chung et al., 2016; Pinto & Bloch, 2017). Surveillance and screening of SDOH include identifying parental concerns by asking general questions at routine visits (for example: what are your family concerns?) and assessing for the presence of risk factors and protective factors which must be considered when providing treatment recommendations. Screening patients for specific social issues and referring patients and families to other resources and professionals is needed to help improve health equity in communities. Utilizing a team approach to conduct regular screenings can ease the burden of facilitating the routine assessment of SDOH (Chung et al., 2016).

Figure 1. Conceptual Model Showing the Relationship Between Risk Factors of Adolescent Hypertension



Note: The yellow highlighted risk factors are related to social determinant of health factors.

Medical providers must avoid stereotyping and assess their biases to create a safe space for patients to discuss the challenges they face. While time has often been cited as a barrier, spending an additional two to three minutes with patients to discuss social concerns has been shown to improve coordinated patient care (Andermann, 2016). Lastly, medical providers must be knowledgeable about local community resources to which they can refer patients to in order to address social challenges patients deal with (Garg et al., 2010). Healthcare workers need continued training opportunities to hone their skills and promote more equitable health outcomes for all patients in their community (Andermann, 2016; Garg, Cull, et al., 2019).

Non-modifiable risk factors identified in the conceptual model include family history of HTN or CVD, gender, race, parental obesity, parental educational level, and socioeconomic status (SES). In a recent study, parental history of HTN was associated with overweight, obesity, abdominal obesity, and elevated BP in adolescents (Yoo & Park, 2017). Male adolescents were shown to have increased risk of HTN compared to female adolescents (Fowokan et al., 2018; Kurnianingsih et al., 2019). Non-Hispanic Black children were found to have elevated BP or HTN at higher rates than Hispanic or Non-Hispanic White children (Ewald & Haldeman, 2016). Parental education level, a SDOH factor, has been shown to be protective against chronic medical conditions; however, race and ethnicity may alter health gains expected to be seen in response to parental educational attainment. White youth have the greatest health gain from their parent's education, while Black and Hispanic youth gain the least (Assari et al., 2019). Other studies have shown the inverse association between high BP and low parental education (Fowokan et al., 2018). Additionally, studies have shown that richer, more educated individuals tend to experience longer life spans while poorer, less educated individuals die earlier, showing how SES can influence health outcomes (Andermann, 2016; Marmot et al., 2008).

Other risk factors to consider are modifiable and can be altered with behavioral changes. These modifiable risk factors include dietary habits, salt intake, obesity, physical inactivity, stress, smoking, and poor sleep quality or duration. Fruit and vegetable intake and variety was shown to decrease from childhood to adolescence, with fruit intake at the lowest during adolescence (Albani et al., 2017; Hoy et al., 2020). Higher BP was found in Iranian adolescents who consumed a Western dietary pattern, high in added sugars, added fats, and fried foods. Higher total intakes of fruits, non-starchy vegetables, dairy, and grains were associated with 40%

to 60% lower cardiometabolic risk factor clustering in girls (L. L. Moore et al., 2016). A recent prospective study followed a group of 1526 Chinese children and adolescents with normal weight (<85th percentile) for three years and found that higher BMI was associated with an increased risk of developing HTN (Xu et al., 2018). Excess adiposity is the most powerful risk factor for elevated BP; however, since adolescents are experiencing rapid body composition changes during growth an increase in BMI should not be automatically interpreted as an increase in fat mass (Ewald & Haldeman, 2016). Adiposity measured by BMI does not indicate where the fat is distributed on the body. Visceral fat, or central abdominal fat, has different metabolic characteristics than subcutaneous fat which puts individuals at greater risk of developing HTN, insulin resistance, altered lipid levels, and other CVD indicators. Higher adiposity, BMI, or waist circumference are associated with higher BP or increased risk of HTN in adolescents (Ewald & Haldeman, 2016; Fowokan et al., 2018). Positive associations were observed between BMI and systolic and diastolic BP, with greater effects in boys than girls (Fowokan et al., 2018; Jago et al., 2013).

Metabolically obese normal weight individuals refer to those of normal or slightly elevated BMI status but possess a cluster of symptoms possibly including HTN, abdominal obesity, glucose intolerance, or dyslipidemia. Studies have found nearly 30% of overweight children in the United States meet the classification of metabolic syndrome and 23.2% of those at risk for being overweight have at least two components of metabolic syndrome (Ewald & Haldeman, 2016; Kelishadi et al., 2008). Additional research is needed to see how medical providers respond to and treat HTN in minority children of normal weight status with ethnic predisposition to chronic disease to understand how cardiovascular risk factors are addressed in this population.

Physical activity has been shown to improve lipid markers and BP associated with CVD risk. After adjusting for age, sex, mothers' education, and alcohol/cigarette use, adolescents had lower odds of having a BP in the hypertensive range if they engaged in any level of physical activity that was more intense than light (Wellman et al., 2020). Ewart et al. found modest BP improvements in African-American adolescent girls participating in an aerobic exercise group in comparison to those participating in regular physical education classes (Ewart et al., 1998). This aerobic exercise group was offered in a school setting, so it is not known if the participants' activity level changed outside of the school setting.

A study by Ewald et al. analyzed data collected from 573 ethnically diverse patients at a low-income, largely minority-based clinic in central North Carolina. Data collected in this study included self-reported nutrition and physical activity habits by the adolescent patients and weight, height, and BP which was measured by a medical professional for each adolescent. This study found that the dietary and activity behaviors reported by the participants were not sufficient to explain the large proportion of normal-weight adolescents with elevated BP. Elevated BP was greater among male participants in all weight categories. Duration of TV watching was virtually the same for overweight girls with normal BP and obese girls with abnormal BP. Approximately 86% of overweight boys with abnormal BP reported at least one hour of TV watching per day in comparison to 66% of overweight boys with normal BP. At least 60 minutes of daily exercise was reported by more girls with abnormal BP than by girls with normal BP, with overweight girls with abnormal BP reporting the greatest amount of exercise per day and obese girls (with normal or elevated BP) reporting the least amount of exercise. Results showed that 67% of overweight girls with a normal BP ate home-cooked meals and about a quarter of all female participants with normal or elevated BP reported eating fast

food two to three times per week. Girls and boys with abnormal BP reported less frequent sugar sweetened beverage consumption overall than those in normal weight and BP classifications. More overweight and obese adolescents consumed 2% or skim milk than whole milk. For all weight categories, girls with normal BP drank more water than those with abnormal BP while boys with abnormal BP drank more water than those with normal BP (Ewald et al., 2017). The prevalence of abnormal BP in this study was found to be 43.1%, much higher than the estimated rates of elevated BP and HTN in the United States. Furthermore, the large number of normal weight adolescents with elevated BP identified in this study represent a population of children that are most unlikely to be diagnosed with HTN (Ewald et al., 2017).

This preliminary study conducted by Ewald et al. alludes to the need for the consideration of SDOH as potential risk factors for adolescent HTN, as dietary intake and physical activity alone did not sufficiently explain the rates of HTN seen in this low income, ethnically diverse population. Modification of some of these risk factors could potentially be inhibited by SDOH barriers. For example, a family may face challenges to improve their dietary intake if their income level does not support purchasing fruits and vegetables or if fruits and vegetables are not available at stores within their community. Even if families do have access, they may not know what foods are considered healthy to purchase and when they get home, they may not know how to prepare these foods. Some families perceive healthy eating as expensive or unappealing and need education to encourage changes in their diet that fit within their economic constraints (Siu et al., 2019). Nutrition education that is sensitive to low-income populations, who perhaps live in food deserts, may be warranted in order to help families make informed choices when shopping for foods and making these healthy foods palatable for adolescents. When looking at food security in a nationally representative sample, high BP was more common in children and

adolescents living in food insecure homes (15.3%) than in those living in food secure homes (12.1%) (South et al., 2019).

Crime and violence can influence whether or not an adolescent has a safe place to exercise after school and may be potential barriers to families who are encouraged to incorporate more physical activity into their daily routines. One study found that lack of school physical activity facilities, unsafe neighborhoods, and financial burden of physical activity were all barriers experienced by parents of children ages 8-10 years old. Parents cited that due to gang activity, gun violence, and the prevalence of drugs in their community they were forced to keep children at home where they were mainly sedentary, but safe (Kornblit et al., 2018).

Affordability of after school exercise programs also limits the opportunity for adolescents from low-income families to participate due to financial limitations (Kornblit et al., 2018; Schroeder et al., 2019). In addition, families who lack transportation may attend fewer health care appointments which may result in delayed treatment for health ailments that could have been prevented. Medical providers should consider altering their practices to improve their approach to addressing childhood poverty and SDOH within routine visits to improve health equity and provide more patient-centered care that is tailored to the family (Fierman et al., 2016).

Barriers to Care

There are multiple barriers that may prevent the diagnosis or treatment of adolescent HTN. These barriers may be experienced by the medical provider, the adolescent, and the adolescent's family. Lack of insurance coverage for weight management and obesity care is a barrier experienced by families and a hindrance to physicians as they receive limited reimbursements for care provided (Ewald & Haldeman, 2016). Klein et al. found that 56% of pediatricians reported that reimbursement for overweight counseling and treatment was

insufficient and in 69% of cases insurance did not cover weight management programs. Furthermore, more than half of dietetics services were not covered by insurance and more than half of the pediatricians experienced a lack of referral services for weight management (Klein et al., 2010). The benefit of a Registered Dietitian (RD) as part of a care team is not experienced by primary care physicians who do not have a RD within their practice or do not have a RD whom they can refer patients to for outside services. Lack of time represents another barrier experienced by medical providers. In the same study by Kline et al., 67% of physicians reported not having enough time to counsel the adolescent during a well visit, yet noted that counseling parents was the best method for changing a child's weight status (Klein et al., 2010). Time to assess nutritional habits and recommend lifestyle changes, in addition to the other components of physicians' appointments, was also described as insufficient by physicians interviewed in prior research (Sastre et al., 2019). Increasing physician consultations by two to three minutes may allow for the evaluation of social determinants and the referral to additional resources (Andermann, 2016).

Compliance with medical provider recommendations and patient's readiness to change (or lack of) are barriers experienced by adolescents and families. A survey of general pediatricians revealed that 81% of respondents estimated that less than 33% of hypertensive adolescents are compliant with recommended behavior modifications (Boneparth & Flynn, 2009). Pediatricians participating in a focus group identified a major concern regarding adolescent's readiness to change, stating that the hypertensive state would be hard to correct since dietary modifications and physical activity are primary changes recommended. Patients had less success with weight loss or changing eating habits when family members did not view the adolescent's weight or BP measures as a concern (Cha et al., 2014).

Barriers to obtaining accurate BP measures are also inhibiting proper care of adolescents with elevated BP. The 2017 AAP guidelines recommend routine measuring of BP on a yearly basis; however, there is a lack of repeated measures being taken in the appropriate time frame to meet requirements to diagnose elevated BP (Daley et al., 2013). The varying cut off points of the 2004 Fourth Report guidelines made it more complicated to determine BP in children, especially since providers needed access to the reference tables and the age, height, and BP of the adolescent to determine the appropriate BP classification (Ward et al., 2016). To diagnose HTN according to the Fourth report, an additional measure was required within one month. A study by Daley et al. showed that 21% of adolescents had a follow-up BP measure within one month after an initial elevated BP measurement and only 1.4% of adolescents had second and third repeat measures (Daley et al., 2013). Furthermore, results showed that often follow-up BP measures were taken as part of normal office routines at appointments for other health concerns outside of BP, rather than at a follow-up appointment scheduled purposefully to recheck the adolescent's BP (Daley et al., 2013). A review of electronic medical records of family practices in Toronto showed 62% of children with at least one BP measure recorded, 14% of which had at least one abnormal BP reading recorded, with only 5% of these individuals with an abnormal reading having a follow-up measure (Aliarzadeh et al., 2016). The new guidelines recommend rechecking an elevated BP measure in 6 months and to recheck a stage 1 HTN measure in one to two weeks (Flynn et al., 2017).

Another potential barrier for some medical providers is comfort in evaluating an adolescent for elevated BP. The medical provider's comfort level is partially dependent upon their level of experience managing pediatric HTN (Cha et al., 2014). In a survey by Boneparth et al., 40% of respondents identified as "uncomfortable" in evaluating and treating hypertensive

adolescents. This could partially be due to 54% of respondents being unfamiliar with the guidelines in the Fourth Report, which provided the AAP recommendations for treatment of adolescent HTN at the time of this study. In addition, of the 46% of individuals who had heard of or read the report, 33% of those respondents still rated themselves as uncomfortable with evaluating adolescent HTN (Boneparth & Flynn, 2009). The lack of comfort may partially due to lack of medical school or residency training regarding the monitoring of BP in adolescents or the lack of continuing education provided to medical providers as these new guidelines are released. Medical students reported lack of knowledge as a barrier to childhood obesity prevention and treatment and requested more relevant education on nutrition recommendations, available nutrition resources, and counseling skills to prepare for working with adolescents (Cooke et al., 2017).

HTN occurs in obese, overweight, and normal weight adolescents, yet it is those adolescents without excess adipose tissue that frequently go undiagnosed and untreated because they are often not exhibiting other concerning factors including abnormal blood lipid or blood sugar levels. By the time these changes are more noticeable and are further investigated, permanent organ damage may have occurred including left ventricular hypertrophy, atherosclerosis, and arterial stiffening (Ewald & Haldeman, 2016). The most effective way to prevent adolescent HTN is to accurately assess BP on a yearly basis in all adolescents, despite weight status, and follow up at the proper intervals and provide adequate treatments so any organ damage can be avoided (Ewald & Haldeman, 2016). While BP may be regularly measured and recorded, medical providers must analyze the BP value recorded for each patient to ensure that adolescents receive the necessary follow-up and treatment recommendations according to the 2017 AAP guidelines.

Preliminary data from Haldeman et al., in addition to an in-depth review of the literature, points to the need to assess pediatricians' comfort with, process of, and barriers experienced while addressing adolescent HTN. The accurate diagnosis of HTN is the responsibility of medical providers who care for adolescents and is an essential first step to providing quality care that improves adolescent health outcomes by reducing chronic disease risk factors, like elevated BP. Additionally, gaining an understanding of medical providers response to HTN can allow for the identification of gaps that are occurring within the care process. As stated, nutrition and physical activity do not sufficiently explain the level of HTN seen in adolescents, so assessing SDOH in addition to nutrition and physical activity habits may provide an additional explanation for adolescents who are diagnosed with elevated BP or HTN. Furthermore, treatments provided by medical providers must be individualized based on challenges faced because of SDOH and follow-up appointments are necessary to monitor for success. Understanding what successful lifestyle therapies are often recommended by medical providers and identifying regions in North Carolina where these services are unavailable can provide direction for future development of interventions that are meaningful for the intended population.

Interventions

It is most effective to measure and accurately assess BP for every child on a yearly basis and follow up as necessary, providing corrective measures before organ damage occurs (Ewald & Haldeman, 2016; Flynn et al., 2017). Prevention is the best strategy to reduce the incidence of overweight and obesity which increases the risk of developing HTN. Encouraging exercise and a healthy balanced diet can promote the development of healthy behaviors for adolescents which can then be carried forward into adulthood. Utilization of multidimensional behavioral modification approaches that include lifestyle, diet, and exercise components have been shown to

be effective at producing modest weight reduction as well as improvements in systolic BP (Ewald & Haldeman, 2016; Lloyd-Richardson et al., 2012). The most successful interventions also include parental support and modeling of desired healthy behaviors and consider the adolescent's developmental stage to provide relevant recommendations (Ewald & Haldeman, 2016). In addition, adaptability to different cultural backgrounds, language barriers, or perceptions of health and illness must be considered as different cultures have different beliefs regarding what is considered a healthy or attractive weight. The presence of negative psychosocial risk factors (migration history, low education, parental employment status) have been shown to influence the outcome of lifestyle interventions in a study of obese children and adolescents resulting in less access to therapeutic programs, and therefore ultimately less weight loss (Röbl et al., 2013).

Therapeutic programs need to be developed for adolescents who face challenges because of SDOH. Medical providers must consider negative consequences of the adolescent's psychosocial risk factors when recommending behavioral interventions to adolescents and their families (Ewald & Haldeman, 2016; Röbl et al., 2013). Medical providers may consider adaptations to conventional nutrition and physical activity recommendations to better meet their patients' needs and accommodate for limitations due to SDOH. Furthermore, ongoing surveillance is needed to ensure that all needs of the family are met over time, as attempting to address all of the needs at once may be overwhelming for the medical provider and family (Chung et al., 2016). By prioritizing the family's needs and identifying what community resources they may already be using, clinicians and social workers can work to connect families to any additional resources needed. Often, medical offices have lists of community resources to provide to patients with identified needs. Resource lists need to be updated periodically because

the availability of local and national resources may vary over time based on funds and community needs (Chung et al., 2016; Fierman et al., 2016).

Consideration of SDOH Limitations

In October 2020, the United States Surgeon General released a report highlighting the need for hypertension control to be a focus of public health initiatives. Several main goals were established including “build and sustain communities that help individuals control high BP” and “optimize patient care to control HTN” (*Surgeon General*, 2020). To optimize patient care we must consider SDOH challenges in populations with high rates of HTN, in order to overcome these limitations and provide these patients an equal opportunity to control their HTN. We can easily diagnose and treat HTN without the significant costs that are often associated with other disease states. It is no secret that diet and exercise are instrumental in BP control; however, not everyone has equal opportunities to eat a healthy diet or increase physical activity. Medical providers need to not only consider the medical preexisting conditions, but to also consider the social preexisting conditions which may prohibit a patient from achieving BP control through a routine intervention. Factors like transportation, childcare, a job that pays a fair salary, the built environment, and access to food and routine health care all play a role in a family’s ability to adhere to a lifestyle intervention geared towards managing BP. Non-Hispanic Black patients were found to have a reduced prevalence of BP control when compared to non-Hispanic white patients. This could potentially be tied to poor access to health care or substandard insurance coverage (Saeed et al., 2020). Lower parental education status was found to have an inverse relationship with adolescent systolic BP (Kwok et al., 2016). Lower socioeconomic status and adverse childhood events affected CVD risk in young adulthood through educational attainment, health behavior, and financial stress pathways (Doom et al., 2017). Medical providers must also

be knowledgeable and comfortable with altering their intervention messages to underserved populations to help overcome barriers to the adoption of a healthy lifestyle. We need to investigate and invest in evidence-based treatment programs that have allowed communities of all races and socioeconomic statuses to achieve 80% of higher HTN control (*Surgeon General*, 2020).

Screening for SDOH Barriers

In 2018, North Carolina announced that Medicaid recipients must undergo SDOH screening as part of their care management (Sokol et al., 2019). This new requirement brings to light the need for routine screening of not only medical symptoms and concerns, but also the need for social factors, in addition to medical symptoms, to be a prime focus of medical providers as they are influential to determining an individualized treatment plan. In addition, leaders of the AAP and their Bright Futures guidelines support the argument that addressing a child's social needs falls within the scope of practice of adolescent medical providers (Garg et al., 2015). While this practice is greatly needed, currently there are few evidence-based practice guidelines for providers to identify best methods for the collection of this social data. The Center for Medicare and Medicaid Services (CMS) has announced their Integrated Care for Kids Model which focuses on higher quality care, lower expenditures and ultimately improved population health through early identification and treatment of physical health needs in children. These aims integrate the roles of the health care sector with community agencies related to human services, education, and job preparedness (Garg, Homer, et al., 2019). A value-based model where payment is based on quality measures and health outcomes is a promising model as long as the community-based programs are prepared to support a potentially large number of referrals. Reinvestment of savings into social services expansion and cross-sector collaborations

will be necessary to strength the availability of quality resources for those in need (Garg, Homer, et al., 2019).

Universal screening tools like the WE CARE survey, the Health Leads Survey, HealthBegins Upstream Risks Screening Tool, and the Bright Futures Pediatric Intake Form are all options to consider as a screening tool to be adopted by a medical practice, but it would be best for practices to utilize a community advisory group to review the screening tool for relevance with their patient population (Fierman et al., 2016; Hensley et al., 2017). Optimal length of questionnaire, frequency of screening, and logistical challenges are all considerations that need more investigation to provide practices with concrete evidence-based practice recommendations for the collection of social determinant data.

The high prevalence of family poverty and the major impact of social determinant factors on health outcomes are compelling rationale for initiating routine screening in pediatric primary care practices. Collection of this data may come from a screener or directly from the questioning of health professionals in the clinic. In order to achieve health equity, medical providers must also be educated on social determinants and how to address these factors with their patient population. The National Academies of Sciences, Engineering, and Medicine (NASEM) has released statements encouraging academic medical centers to prepare their students to understand and address these SDOH and to advocate for their patients as young professionals. Studies report that we are in the early stages of including SDOH in medical school curriculum but lack clear instructional strategies for medical educators to utilize in the classroom setting and do not have standardized competencies identified for the medical students to demonstrate mastery of their skills (Doobay-Persaud et al., 2019).

A study of Federally Qualified Health Centers resulted in 97.4% of patients being classified as being at risk for at least one of fourteen social categories when screened with the Upstream Risks Screening Tool and 99% were found to be at risk for at least one of the 26 screening issues. Dietary pattern, social connection and isolation, and physical activity were the categories with the highest percentage of at-risk patients (Hensley et al., 2017). The quality improvement assessment of this study suggested that SDOH screening in a pediatric clinic is possible and benefits both the family and the medical provider. Families were appreciative of the additional information on their social risk factors and the medical providers reported increase confidence in working with patients on their SDOH barriers (Hensley et al., 2017).

Limitations to Screening for SDOH

Screening for social needs can detect adverse factors and conditions that must be dealt with and may require resources beyond those available to the medical provider. This leads to an ethical consideration of whether to screen for conditions that a provider may not have the resources for or know of a community organization for which to refer the patient (Garg et al., 2016; Hensley et al., 2017). This requires that the medical sector be linked with a variety of other community-based resources including transportation, affordable housing, and employment sectors. Furthermore, medical providers may not be comfortable with questioning patients regarding their social needs due to their lack of training on social screenings and how to respectfully respond to patient's concerns (Garg et al., 2016). Social needs cannot be met if the community has an insufficient social safety net and if resources become diverted from one at-risk population to another it may leave families in need. Government policies, hospital systems, and community agencies all need to work together to actually impact the well-being of low-socioeconomic status patients (Garg, Homer, et al., 2019; Krugman, 2021).

Generating referrals requires a lot of time on behalf of the medical provider and necessitates follow up with patients and families to see if they were able to access the resources recommended. This must be done in a timely manner and requires a systemic approach whether it be from the use of electronic referrals, patient care navigators or case managers, or through interagency collaboration and communication (Garg et al., 2016). Twenty-four percent of medical providers identified having a dedicated team to help connect patients to supporting services as the best strategy to use SDOH data to improve quality of care (Palacio et al., 2018). One study showed that 76% of physician respondents believed the healthcare system should cover the costs of connecting patients with the needed services. These providers also expressed the desire to write prescriptions for social needs like food or fitness programs and transportation or housing assistance (“Understanding Social Determinants of Health,” 2020). Not having the health system infrastructure in place to address SDOH issues was identified as a primary concern by 44% of medical providers surveyed. In this same survey, non-minority faculty and specialists were more likely to identify uncertainty as to how to use SDOH information to benefit their patients. Minority and primary care providers were more likely to identify liability concerns related to not addressing a social risk that leads to an adverse outcome (Palacio et al., 2018).

Concerns are not only apparent at the medical provider level but also at the patient level. Patients may feel uncomfortable reporting their social needs to their provider and this could result in unintentional harm if the patient has expectations that are not met as a result of sharing this private information (Palacio et al., 2018). This highlights the importance of training medical providers to respectfully screen and respond to this information. The AAP has already identified that this task falls within the scope of practice for pediatricians, so medical schools must evolve

their curriculum to equip their students with the necessary skills to deal with a patient's social needs (Doobay-Persaud et al., 2019).

Developing Quality Lifestyle Interventions for Adolescents with HTN

Pediatric medical providers are in the unique position to promote the adaptation of healthy lifestyle habits and to screen and support families to overcome social limitations experienced. Social risk-informed care may help improve a patient's adherence with a medical provider's lifestyle recommendations which ultimately improves the clinical outcomes (Gurewich et al., 2020). Health care institutions need to invest time and resources into exploring screening resources, adapting those questionnaires to meet their population's needs, and creating resource databases so they are prepared to make referrals. Consideration of the Outcomes from Addressing SDOH in Systems (OASIS) framework shows that the identification of unmet social needs and referral to social services for these needs leads to improved adherence to medications and appointments (Gurewich et al., 2020). Addressing one unmet social need may free up resources for other needs, for example, helping a family register for SNAP benefits may free up resources to purchase medications. It is important to work with families to prioritize their needs so they can work on one or two resources at a time to not overwhelm the medical provider or the family (Chung et al., 2016). Ultimately target clinical outcomes are improved, like controlled blood pressure or blood glucose status. These clinical outcomes not only include improved health status and well-being, but also suggests decreased medical costs and hospitalizations (Gurewich et al., 2020). These cost savings can then be used to reinvest into the local community resources to continue helping families in need.

Conclusion

With the knowledge of adolescent obesity and HTN rates, as well as the number of families living in poverty, we must work to improve the health and social status of our young adolescent patients. This can be achieved by fostering a long-term relationship between the patient and the medical provider. Like adolescent HTN, unmet social needs can also persist into adulthood and affect the overall health and wellbeing of the patient. The adolescent and their family must feel comfortable sharing their needs with the provider and the provider must be equipped to make respectable recommendations that are actionable for the family. In addition, the provider must be comfortable with the diagnosis and treatment of adolescent hypertension and feel confident in their ability to help a patient overcome their social limitations to make sustainable changes to improve their overall health. While this is easier said than done, the national goals, the recent body of research and the AAP recommendations make it clear that it should be everyone's priority to help raise healthy adolescent patients that become healthy adult patients.

CHAPTER III: TIME FOR ACTION: A REVIEW OF SOCIAL DETERMINANT OF HEALTH SCREENING METHODS AND BARRIERS EXPERIENCED IN PEDIATRIC MEDICAL PRACTICES

Abstract

Social determinants of health are conditions in the environment including access to food, parental education level, access to health care, safety of neighborhood, and access to transportation. When and adolescent's social needs are unmet, this can have negative consequences on their health outcomes. The purpose of this review is to identify the need for screening adolescents for social determinant factors, investigate best practices identified for incorporating screening into health care centers, consider barriers experienced by medical providers and families, and to provide recommendations for developing meaningful interventions.

Introduction

Social determinants of health (SDOH) are conditions in the environments where adolescents and their families live, work, attend school, and play which may affect a variety of health risk factors or quality-of-life outcomes. The five key areas of SDOH include health care access and quality; education access and quality; social and community context; economic stability; and neighborhood and built environment (*About Social Determinants of Health (SDOH)*, 2021). Examples of social determinants include access to health care, quality education, safe places to be physically active, access to transportation, availability of safe and healthful foods, health literacy and income level. Distribution of wealth, power, and resources at the global, national, and local levels influence SDOH conditions experienced by children and

their families. Resources available in certain settings can influence the well-being of individuals, ultimately considering a person's social environment as a predictor of their health status may indicate expected health outcomes. The importance of SDOH is made evident by one of the five main Healthy People 2030 overarching goals specifically related to SDOH. This goal specifically states to “create social, physical, and economic environments that promote attaining the full potential for health and well-being for all” (*Healthy People 2030 Framework*, 2021). The health of individuals is not only affected by medical concerns but also by these social factors that limit those disadvantaged populations from having the same resources as the wealthy, ultimately putting them at disadvantage. For example, private insurance may cover a visit with the Registered Dietitian to help improve dietary habits and better manage blood pressure, while those individuals without insurance are left to find free programs or simply go without this resource. These specific objectives were developed by the federal government to improve the overall health and well-being of Americans and the communities in which they live.

The importance of decreasing social disparities in communities is also highlighted by the American Academy of Pediatrics (AAP) which recognizes that poverty is an important determinant of child health (Pediatrics, 2016). Poverty affects approximately 14.4% of children under the age of 18 which equates to nearly 1 in 7 children (Semega et al., 2020). According to the 2019 U.S. Census Bureau, 14.1% of children less than 18 years old were living below 100% of poverty and 34.1% of children were living below the 200% poverty threshold (U.S. Census Bureau, 2021). Children living in socioeconomically disadvantaged situations are more likely to experience negative health outcomes including increased risk of chronic diseases, have less stable housing, and live in food insecure households (Buitron de la Vega et al., 2019; Chung et al., 2016; Fierman et al., 2016; Garg et al., 2015). In addition, poorer children demonstrate

higher rates of developmental delays, negative behavioral outcomes, and fewer educational achievements. These negative effects can continue into adulthood as evidenced by adult poverty, low educational status, criminal justice system involvement, and increased risk substance abuse and depression (Fierman et al., 2016; Pediatrics, 2016).

With over 10 million children living in poverty and the knowledge of poverty's serious negative effects on health, the medical system recognizes that a patient's social needs must be addressed (Garg, Homer, et al., 2019; Pediatrics, 2016). The AAP released a policy statement that highlights the need for screening for and addressing social determinants in primary care settings and have published the *Bright Future Guidelines* in support of this viewpoint (Chung et al., 2016; Garg, Homer, et al., 2019). With these recommendations, the research regarding social determinants of health in pediatric settings has greatly increased over the past few years, but still leaves many questions to be answered regarding best practices.

While lifestyle habits are important for decreasing risk of chronic disease, it is difficult to improve nutritional intake and physical activity levels of adolescents without considering social factors that may inhibit families from making the beneficial changes recommended by health care providers. As evidenced by the release of the SDOH Screening Questionnaire from North Carolina Department of Health and Human Services, healthcare institutions have started to collect SDOH data on patients and their families. The questions now are how should the information be managed, who should follow up on the information, and are the necessary community resources in place to meet the needs of those underserved populations. The purpose of this review is to investigate what methods are being used to assess an adolescent's social needs and to address barriers we need to overcome as a community to ensure that individuals

have access to assistance programs so we can work towards improving health outcomes and achieving healthy equity.

Connecting Disease Risk Factors to SDOH

Chronic disease risk can often be mitigated by adopting healthy lifestyle habits. Many chronic diseases, like cardiovascular disease or type 2 diabetes, have their origins in adolescence as this is when many unhealthy practices are adopted and continue through adulthood. Factors like consuming a balanced diet, incorporating physical activity, maintaining a healthy weight, and quitting smoking are all things that must be modeled for children to encourage the development of these healthful practices.

When looking at dietary intake we know that less than 10% of US children and adolescents consume the daily recommended intake of fruits and vegetables (Albani et al., 2017). A review of NHANES 2001 to 2004 data reported that 97.0% of male and 98.6% of female adolescents age 14 to 18 were below the minimum recommended consumption of vegetables, while 86.6% of males and 84.8% of females were below the minimum recommended consumption of fruits according to the dietary guidelines for each food group (Krebs-Smith et al., 2010). Food insecure participants were found to have a significantly poorer diet profile with a lower frequency of fruit and vegetable consumption, less use of food labels when choosing foods, and consume fewer home cooked meals than food secure participants (Ranjit et al., 2020). This suggests that interventions provided to this population may need to consider food access, education and self-efficacy skill building in terms of the procurement and preparation of healthy foods (Ranjit et al., 2020).

Financial status and moral superiority were cited by adolescents as characteristics of healthy eating. Adolescents from families of middle- to high-socioeconomic status often viewed

their family as healthy eaters and therefore morally superior to those of lower-socioeconomic status who were characterized as lazy or less aware (Fielding-Singh, 2019). Adolescents from lower-socioeconomic status families report financial constraints prevent their family from adopting healthy eating habits. This is concerning as cost, access, and availability must first be addressed to improve the diets of low-income populations (Fielding-Singh, 2019). Health literacy also must be improved in this population to encourage development of skills needed to support sustained behavior changes. While a medical provider may see that an adolescent has elevated blood glucose levels or high blood pressure readings, traditional interventions must be adapted so families with unmet social needs can achieve the treatment recommendations. This may require connecting families to community resources first, so families can then work to make lifestyle changes with fewer barriers.

Ewald and Haldeman recommend the consideration of SDOH as potential risk factors for adolescent HTN, as dietary intake and physical activity alone did not sufficiently explain the rates of HTN seen in the population (Ewald et al., 2017). Modification of some of these risk factors, like diet or physical activity, could potentially be inhibited by SDOH barriers. For example, a family may face challenges to improve their dietary intake if they have insufficient income or if fresh fruits and vegetables are not available at stores within their community. Even if families do have access, they may not know what foods are considered healthy to purchase and when they get home they may not know how to prepare these foods. Some families perceive healthy eating as expensive or unappealing and need education to encourage changes in their diet that fit within their economic constraints (Siu et al., 2019). Nutrition education that is sensitive to low-income populations, who perhaps live in food deserts, may be warranted in order to help families make informed choices when shopping for foods and making these healthy foods

palatable for adolescents. When looking at food security in a nationally representative sample, high BP was more common in children and adolescents living in food insecure homes (15.3%) than in those living in food secure homes (12.1%) (South et al., 2019). Children from food insecure homes often utilized public insurance, had higher rates of emergency department usage, missed more days of school, and overall had lower access to health care (Peltz & Garg, 2019).

Physical activity guidelines, like dietary guidelines, are also under met by adolescents. The Physical Activity Guidelines for Americans recommends a minimum of 60 minutes of activity per day of moderate to vigorous physical activity, yet 85% of adolescents do not meet these recommendations (Kornides et al., 2018). Obesity is also prevalent in the United States with 1 in 5 adolescents between ages 6 to 19 falling in the obese category (Hales, 2017). Managing obesity is challenging since many SDOH factors may inhibit the adoption of healthy behaviors, especially in vulnerable populations (Bryant et al., 2015). Crime and violence can influence whether or not an adolescent has a safe place to exercise after school and may be potential barriers to families who are encouraged to incorporate more physical activity into their daily routines. Lack of school physical activity facilities, unsafe neighborhoods, and financial burden of physical activity were all barriers experienced by parents of children ages 8-10 years old. Parents are often forced to keep children at home where they are mainly sedentary, but safe, due to gang activity, gun violence, and the prevalence of drugs in their community (Kornblit et al., 2018). Affordability of after school exercise programs also limits the opportunity for adolescents from low-income families to participate due to financial limitations (Kornblit et al., 2018; Schroeder et al., 2019). Families who lack transportation may attend fewer health care appointments which may result in delayed treatment for health ailments that could have been prevented.

Family history of chronic disease, race, gender parental obesity, parental educational level, and socioeconomic status (SES) are additional social risk factors that have been tied to health outcomes. In a recent study, parental history of HTN was associated with overweight, obesity, abdominal obesity, and elevated BP in adolescents (Yoo & Park, 2017). Male adolescents were shown to have increased risk of HTN compared to female adolescents (Fowokan et al., 2018; Kurnianingsih et al., 2019). Non-Hispanic Black children were found to have elevated BP or HTN at higher rates than Hispanic or Non-Hispanic White children (Ewald & Haldeman, 2016). Parental education level has been shown to be protective against chronic medical conditions; however, race and ethnicity may alter health gains expected to be seen in response to parental educational attainment. White youth have the greatest health gain from their parent's education, while Black and Hispanic youth gain the least (Assari et al., 2019). Other studies have shown the inverse association between high BP and low parental education (Fowokan et al., 2018). Studies have also shown that richer, more educated individuals tend to experience longer life spans while poorer, less educated individuals die earlier, showing how SES can influence health outcomes (Andermann, 2016; Marmot et al., 2008).

Many of these families experience conflicting demands between their unmet social needs with some limiting factors directly influencing chronic disease development and others having more of an indirect effect. Access to food directly affects diet quality while parental educational level indirectly influences diet quality because, for example, the parent may not know which foods are healthier choices or the components of a balanced meal. These SDOH ultimately will affect an adolescent's health status whether it be due to poor diet quality, lack of access to health care, or other factors. Despite the knowledge that socially disadvantaged individuals are at a higher risk of having poor health outcomes, medical providers often focus on recommending

treatments and lifestyle changes without asking about or considering social implications that may pose a challenge for patients (Andermann, 2016). Immigrants and their families are also at increased risk due to lack of income, limited access to community resources, and challenges with accessing health care (Chang, 2019). These difficulties are further impacted by the stigma of this population.

Adolescents living in poverty often experience adverse childhood experiences and are susceptible to a variety of child and adult health problems including heart disease (Chung et al., 2016). Although SDOH have been shown to have a detrimental effect on children's health status, few health providers routinely address the social and psychosocial factors that may be affecting the adolescents health status during wellness visits (Chung et al., 2016; Pinto & Bloch, 2017).

Screening for SDOH in Clinical Settings

The influence of SDOH on health outcomes has become apparent but how to address these in clinical settings is still up for discussion. Medical providers do not deny that psychosocial risk factors play a role in chronic disease development, but often they may not be prepared, for a variety of reasons, to screen patients for these concerns. In response to initiatives for health systems to address factors related to income, food security, violence, and educational level, a survey of medical providers was conducted to investigate medical provider's perspectives on the collection of SDOH data (Palacio et al., 2018). It revealed that 83% of the providers agreed that SDOH are important predictors of health outcomes and 85% felt that knowledge of these factors was needed for the development of programs for populations in need. A greater number of primary care providers (78%) than specialists (54%) felt that the benefits would outweigh the burden of collecting this informative SDOH data. Over half of the

respondents (54%) thought the primary care provider should be the medical provider responsible for evaluating the social health status of patients. In addition, 72% felt that collection of this data would put unnecessary burden on providers; however, 65% of respondents did feel that a dedicated health team should be created to support efforts in evaluating and referring a patient based on their SDOH. This survey also revealed that more females than males thought that SDOH should be included in the electronic health record (EHR) and that more minorities felt a population health team should lead the effort to incorporate SDOH into patient evaluations (Palacio et al., 2018). These data provide an important understanding of medical providers' viewpoints in regards to considering a patient's social needs to better improve health outcomes.

The AAP has clearly identified that it is within a pediatrician's scope of practice to screen for and consider SDOH limitations when making recommendations to patients. The Center of Medicare and Medicaid Services (CMS) has also announced an Integrated Care for Kids Model which aims to improve the quality of care for children while reducing expenditures (Garg, Homer, et al., 2019; Gurewich et al., 2020; Sokol et al., 2019). This model promotes health equity by engaging both the healthcare and non-medical sectors to help meet a patient's needs. It highlights the need for prevention and early screening and treatment of a patient's needs, which has already been put in action by some statewide Medicaid programs, including in North Carolina, which now require that patients complete a SDOH screener as part of the medical visit (Garg, Homer, et al., 2019; Sokol et al., 2019). Medicaid enrollees in clinics screening for SDOH have had higher use of primary care services and lower use of emergency services and hospitalizations showing a 4:1 return on investment (Palacio et al., 2018). Additional research has highlighted how the use of a value-based model in medical practices can achieve the triple aim of providing higher quality care, lowering costs, and improving population health.

Transitioning the focus to preventive care which addresses families' adverse social circumstances could potentially improve children's health care and wellbeing (Garg, Homer, et al., 2019).

Screening Tools

Surveillance and screening of SDOH includes identifying parental concerns by asking general questions at routine visits and assessing for the presence of risk factors and protective factors. While this often happens in exam room conversations, the AAP and other organizations have encouraged practices to develop their own standardized screening tools to address the relevant social risk factors in populations they treat. Only three of eleven screening tools evaluated in one study had been tested for reliability and validity. This means that we do not know how accurately these tools measures a patient's social needs. Factors influencing a screening tool's ability to correctly evaluate a child's SDOH status include whether the screening tool is available in the patient's primary language, at the appropriate reading level, and worded with clear reference ranges (Sokol et al., 2019).

The WE CARE project was instituted during well-child visits at a site that primarily treats low-income children. This study utilized a 10-item self-report screener completed by patients in the intervention group. Medical providers in the intervention group were trained and given access to a resource book with community resources to utilize with their patients. Parents in the intervention group discussed 2.9 psychosocial topics and 51% received at least one referral which was higher in comparison to the control group (1.8 and 11.6%). Most medical providers reported that the screening tool did not slow the visit which further shows the feasibility of using this method in pediatric practices (Garg et al., 2007).

Use of the WE CARE model was evaluated in eight community health centers where half of the health centers received the usual care and half received the increased evaluation of social needs through the WE CARE model. Patients at the four WE CARE clinics filled out the self-report screening tool, providers made referrals for their social needs, and clinic staff followed up with patients at one month. In all, 70% of WE CARE mothers received one or more referral while only 8% of control mothers received a referral. WE CARE mothers had higher odds of being employed, their children had greater odds of being in childcare, and the families had lower odds of living in a homeless shelter (Garg et al., 2015). The use of WE CARE clearly connects patients to more community resources than those who were not screened for social risk factors. This model suggests that comprehensive screening for multiple social needs, rather than just one, is beneficial to patients and that it is important to act on these screening results during the well child visit as it is the prime opportunity to connect the patient with the resources needed.

Project HEALTH is a non-profit organization that established a Family Help Desk in an urban-based academic medical center to provide community resources referrals to families in need. This help desk was run by student volunteers who would receive referrals from medical providers and then meet with at-risk families to help connect them with the services they needed. The benefit of this design was that the patient was supported through the whole referral process and medical providers received reports about the referrals and the patient outcomes. Of the patients who utilized the Family Help Desk, 64% contacted a community resource and about one-third of patients enrolled in one community program. Furthermore, medical schools could integrate an advocacy rotation where one task is running the Family Help Desk to provide firsthand experience with making recommendations based on a family's social needs (Garg et al., 2010).

HealthBegins Upstream Risks Screening Tool was utilized in a low-income, federally qualified health clinic as a pilot project to investigate best practices for implementing the screening process and to better understand the time investment needed to screen and connect patients with resources. This survey was a bit longer than the WE CARE screening tool, as it contained 26 questions and it was administered verbally by trained students and then scored immediately for use by the medical provider. A community resource guide was developed and made available to patients during their visit and online. Results show that implementation of a brief screening tool into a busy clinic was feasible and potentially could improve the care coordination between medical providers and patients and may reduce health disparities related to SDOH (Hensley et al., 2017).

The effectiveness of a web-based intervention was assessed in youth who completed a self-administered survey using a tool called The Online Advocate. Once the questionnaire was completed, feedback was provided based on the nine social determinant areas that were assessed. This tool had a database of over 650 agencies in the region and utilized an algorithm to provide recommendations based on the participants home address and their unmet social needs identified. At least one social need was identified in 76% of participants and 47% reported that their top priority problem was resolved. Participants completed this questionnaire using laptops while waiting to see their medical provider and were immediately connected to resources, which are kept up to date by The Online Advocate, taking this burden off of providers (Hassan et al., 2015).

An additional online screening platform known as NowPow was also shown to be useful screening tool at a large, urban academic medical center (D. Meyer et al., 2020). This pilot screening program utilized tablets to complete the screening questionnaire at visits. After

screening, NowPow automatically identified patient's risk and provided referrals based on the identified needs. An additional benefit of NowPow was that this information was connected with the patient's electronic medical record, however there were occasionally technological difficulties with this connection that led to workflow disruptions. Overall results showed that as the medical practice staff learned more about the social needs of their patients, they became more motivated and engaged in the screening process (D. Meyer et al., 2020).

Screening patients for specific social issues and referring patients and families to the needed resources and professionals to reduce the number of unmet social needs is still an overwhelming task, even though research has shown it is possible to do in outpatient settings. Utilizing a team approach to conduct regular screenings can ease the burden of facilitating the routine assessment of SDOH (Chung et al., 2016). Development of community resource directories that include the most updated information on local food pantries, GED programs, and childcare resources is a daunting task, especially since program offerings and services may change overtime. Local practices could consider partnering with each other or with the local health department to help maintain an updated directory of information (Fierman et al., 2016).

Barriers to Screening

Barriers to screening patients for SDOH have been identified including lack of time, professional training, knowledge of community resources, and reimbursement (Fierman et al., 2016; Garg et al., 2007, 2010; Palacio et al., 2018). While time has often been cited as a barrier, spending an additional two to three minutes with patients to discuss social concerns has been shown to improve coordinated patient care (Andermann, 2016). In addition, most residents who implemented the WE CARE program found that it took less than two additional minutes to completely screen and provide recommendations to patients (Garg et al., 2007). This could be

attributed to a well-designed screening tool and the training that the residents received to better prepare them for these discussions. Social screening is recommended to take place during an initial intake appointment with the patient and family, with annual follow-up appointments that could align with well-child care visits (Garg et al., 2015). This alleviates medical providers from having to fully screen each patient at every visit; however, it is still important that recommendations provided consider barriers experienced by the family.

Lack of infrastructure to address SDOH has also been cited as a barrier to screening for social needs (Palacio et al., 2018). This could mean that a clinic does not have a personalized screening tool that is validated for their patient population or that a clinic does not have the manpower needed to collect this large amount of additional data and provide referrals for all patients. Providers must be knowledgeable about local community resources that can address a family's social challenges. Healthcare systems can empower medical providers to address SDOH by ensuring that these referral channels and patient handouts are available for their providers to utilize with families in need. Since these resources change over time, community resource lists must be updated, and providers need to be made aware of these changes. In addition, referring a patient by providing a phone number to call may yield different outcomes than referrals that support patients until the needed resources are acquired. For example, an electronic referral system linking clinical sites to community agencies may allow for the programs to receive referrals and contact patients directly. These community agencies can then report back to medical providers on those families that receive the resources (Palacio et al., 2018).

Lack of professional training to deal with social determinant factors is reflected in the lack of curriculum developed for medical schools to prepare students to deal with health

inequalities rooted in unmet social needs. Medical schools need to evaluate best teaching practices to prepare their students for the evaluation of SDOH factors. Residency programs could consider an advocacy rotation where medical providers gain experience working with low-income patients and connecting them to community resources (Garg et al., 2010). Research suggests that the incorporation of a screening survey allows providers to utilize this tool as a prompt to start a discussion between the provider and the family (Garg et al., 2007). The use of prompting could potentially make providers more comfortable with further investigating their patient's social needs since a patient has already identified their needs on the tool. This could also save time because providers will have an idea of what areas to focus on due to the screener rather than having to probe about each SDOH through questioning in the exam room. Medical providers need continuing education opportunities to further hone their skills and promote more equitable health outcomes for all patients in their community (Andermann, 2016). These trainings could also help medical providers assess and address their biases to create a safe space for patients to discuss the challenges they face.

Patients and caregivers also experience barriers to discussing their social needs with a medical provider. Most notably, parents and caregivers may be influenced to report answers on a screening questionnaire that are socially desirable for fear of being judged by the medical provider or potentially being reported to child protective services. Surveys beginning with a statement that has an empathetic tone and makes caregivers aware of the medical practice's desire to help with any issues identified could potentially make the caregivers more comfortable about sharing this personal information (Sokol et al., 2019). In addition, medical providers should foster a relationship based on trust with the patient and their family.

Like medical providers, 66.7% of parents reported not contacting a community resource because of a lack of time (Garg et al., 2007). This is important to consider because without families reaching out to the resource, their social need may remain unmet which could ultimately translate into negative health outcomes. Medical centers could consider electronic referrals that provide the patient's information to the community organization, so those community members can reach out to support the family through the enrollment process (Palacio et al., 2018). Community health workers often already have an established relationship with patients, so this method could help improve the number of families who receive the resources needed. Also, because caregivers may have established trust with this community health work, they may feel more comfortable being completely honest about their needs.

Developing Meaningful Interventions

Medical providers face the challenge of collecting information on an adolescent's medical symptoms and their social needs and then utilizing this knowledge to devise social risk informed treatment plans. Once medical providers are aware of their patient's social needs, they have the obligation to provide patient-centered treatment recommendations that can be met despite social barriers. Ideally, part of the medical intervention for a patient also involves the treatment of the family's SDOH needs. The most successful interventions also include parental support and modeling of desired healthy behaviors and consider the adolescent's developmental stage to provide relevant recommendations (Ewald & Haldeman, 2016). In addition, adaptability to different cultural backgrounds, language barriers, or perceptions of health and illness must be considered as different cultures have different beliefs regarding what is considered a healthy or attractive weight. The presence of negative psychosocial risk factors (migration background, low education, parental employment status) have been shown to influence the outcome of

lifestyle interventions in a study of obese children and adolescents resulting in less access to therapeutic programs, and therefore ultimately less weight loss (Röbl et al., 2013). Therapeutic programs need to be developed for adolescents who face challenges because of SDOH and the negative consequences of the adolescent's psychosocial risk factors must be considered when recommending behavioral interventions to adolescents and their families (Ewald & Haldeman, 2016; Röbl et al., 2013). Medical providers may consider adaptations to conventional nutrition and physical activity recommendations to better meet their patient's needs and accommodate for limitations due to SDOH. Research is needed to identify if and how the SDOH influence a medical provider's message to adolescents and their families that have chronic disease risk factors. In addition, more research assessing the use of a team of health care providers to support low-income families in meeting medical provider recommendations should be investigated as this could provide the necessary support for a family to make sustainable changes.

Call to Action

The time is here that we all come together: medical providers, community workers, and government officials to create an environment where adolescents and families are connected to resources they need. Everyone benefits by moving towards a value-based model in healthcare systems which aims to provide higher quality care, lower per capita costs, and improve overall population health. This model would require training of medical providers to improve screening techniques and would require expanded community resources that were prepared to support those families referred based on social needs. Incentivizing the collection of SDOH data in the electronic health record, providing healthcare workers with SDOH tool kits, and developing validated computer-based self-completed screening questionnaires are all methods that we can

move forward with to overcome the barriers with screening for SDOH in adolescents (Palacio et al., 2018).

With the improved screening methods, treatments would be more individualized than ever because medical providers would be equipped to really consider all symptoms, medical and social, so traditional treatment plans could be tailored to meet the immediate needs of the patient. For example, if the provider knows that the single parent leaves for work early in the evening, and the neighbor watches her son, then the provider would avoid recommending home cooked dinners where the parent and child sit down together to eat. These changes in the method of health care screening and delivery will be protective against chronic disease risk factors like elevated blood pressure or blood glucose levels. Shifting the focus to preventive care can decrease the risk of chronic disease development during adolescence as the treatment of social factors is an imperative first step for many children to improve their diet and physical activity habits. Often these risk factors begin in youth and will follow these children into adulthood if not treated. The ultimate outcome of redesigning healthcare practices to address a patient's social needs are healthy adolescents that are not burdened by chronic disease as young adults. When this happens, we all win – the community, the health system, the medical providers, the caregivers, and the adolescent.

CHAPTER IV: ADDRESSING ADOLESCENT HYPERTENSION AND KNOWLEDGE OF SOCIAL DETERMINANTS OF HEALTH: HOW COMFORTABLE ARE MEDICAL PROVIDERS?

Abstract

The objective of this study was to examine medical providers' (n=110) comfort with diagnosing, treating, providing nutrition recommendations, and providing physical activity recommendations to hypertensive adolescents, in addition to investigating medical providers' knowledge of their patients' social needs. Findings from an online survey completed by medical providers of adolescent patients indicated that most providers expressed limited comfort with the treatment of hypertension (67%). When looking at providing lifestyle recommendations, 44% of providers were completely comfortable with providing nutrition recommendations and 49% were completely comfortable with providing physical activity recommendations to adolescents with hypertension. In addition, most medical providers reported rarely having knowledge of their patients' social determinants of health factors like access to healthy food (64%) or caregiver's educational status (81%). Results suggest that both provider comfort and knowledge of social determinants of health need to be improved to better meet adolescent patients' needs and ensure that no adolescent is overlooked in the diagnosis process. A team approach may be necessary to reduce the burden on the medical provider.

Introduction

Adolescent hypertension (HTN) affects 3.5% of adolescents and elevated blood pressure (BP) affects 2.2 – 3.5% of adolescents in the United States yet an adolescent's BP is often not fully evaluated by medical providers who routinely treat these patients.(Flynn et al., 2017;

Guzman-Limon & Samuels, 2019; Riley et al., 2018) Research has shown that elevated BP during adolescence increases the risk of HTN in adulthood (Beal, 2018; South et al., 2019). Adolescents with elevated BP have been shown to progress to HTN at a rate of 7% per year (Falkner et al., 2008). Persistent elevated BP in adolescence increases risk of target organ damage and accelerates vascular aging, which may lead to cardiovascular disease (CVD) or stroke in adulthood, making it crucial to diagnose HTN as early as possible (Beal, 2018; Ewald & Haldeman, 2016; Flynn et al., 2017; Riley et al., 2018; Ward et al., 2016).

The American Academy of Pediatrics (AAP) released updated clinical practice guidelines for the screening and management of BP in adolescents in 2017. These guidelines provided new BP thresholds, rather than utilizing BP tables, to simplify the identification of elevated BP and HTN in adolescents over 13 years old. The guidelines recommend that practitioners begin measuring BP annually at the age of 3 for healthy children or at every visit for children with obesity, renal disease, diabetes, aortic arch obstruction or coarctation, or if taking a medication that may cause an increase in BP (Flynn et al., 2017). A survey of pediatric specialists revealed that overreferral due to inaccurate BP readings was a common issue, suggesting that increased staff training and provision of appropriate equipment are needed to improve BP measurement accuracy in the primary care setting (E. Yoon et al., 2015). Studies have shown that oscillometric devices may overestimate systolic and diastolic BP when compared to auscultatory measures. On average a blood pressure measure was 10 mmHg higher when using an oscillometric device in comparison to a BP obtained by auscultation (Park et al., 2005). This difference could result in the misclassification of an adolescent.

HTN screening occurs at about only one-third of pediatric appointments and two-thirds of preventive care visits; however, pediatricians self-report that they evaluate BP up to 90% of the

time (Bijlsma et al., 2014). In another study, only 25% of physicians claimed to measure BP as often as possible; however, 71% reported measuring BP only when the child was diagnosed or suspected to have a condition associated with abnormal BP (Bijlsma et al., 2014). Much of the research on this subject happened prior to the release of the 2017 AAP clinical guidelines and has not explored whether or not the diagnosis rates have improved since the implementation of the single point BP cut-off thresholds for adolescents age 13 years or older. Studies assessing accurate BP diagnoses in adolescents have found that 74% - 87% of adolescents within the study population had undiagnosed elevated BP or HTN, and therefore could be at risk for future negative health implications (Brady et al., 2010; Hansen et al., 2007). It is imperative that medical providers are knowledgeable about the new guidelines to ensure that all adolescents are properly assessed for elevated blood pressure and hypertension in a timely manner.

Primary care providers and pediatricians must be prepared to diagnose, provide treatment, and follow-up appointments regarding adolescent HTN; however, research shows that they may not feel comfortable in this role (Boneparth & Flynn, 2009; Saini et al., 2020). The medical provider's comfort level is partially dependent upon their level of experience managing pediatric HTN (Cha et al., 2014). In a survey by Boneparth et al., 40% of respondents identified as "uncomfortable" in evaluating and treating hypertensive adolescents. This could partially be due to 54% of respondents being unfamiliar with the guidelines in the Fourth Report, which provided the AAP recommendations for treatment of adolescent HTN at the time of this study. In addition, of the 46% of individuals who had heard of or read the report, 33% of those respondents still rated themselves as uncomfortable with evaluating adolescent HTN (Boneparth & Flynn, 2009). The lack of comfort may partially be due to lack of medical school or residency training regarding the monitoring of BP in adolescents or the lack of continuing education

provided to physicians as these new guidelines are released. Medical students reported lack of knowledge as a barrier to childhood obesity prevention and treatment and requested more relevant education on nutrition recommendations, available nutrition resources, and counseling skills to prepare for working with adolescents (Cooke et al., 2017).

Lifestyle modifications should be encouraged to adolescents diagnosed with HTN. While dietary and physical activity habits have been demonstrated to influence BP status, these factors were insufficient for explaining rates of elevated BP seen in adolescents (Ewald et al., 2017). This warrants that medical providers broaden their investigation into other factors, such as social determinants of health (SDOH), which may also influence health outcomes of adolescents (Ewald et al., 2017). SDOH refer to conditions in the environments where adolescents and their families live, work, attend school, and play which may affect a variety of health risk factors or quality-of-life outcomes. Resources available in certain settings can influence the well-being of individuals, ultimately considering a person's social environment as a predictor of their health status may indicate expected health outcomes. The SDOH are made up of five determinants including economic stability, education, social and community context, health and health care, and neighborhood and built environment. Examples of social determinants include access to health care, quality education, safe places to be physically active, access to transportation, availability of safe and healthful foods, and income level. Identifying if and how the SDOH influence medical providers exam room conversations with adolescents that have elevated BP and their families can uncover gaps in interventions that may be improved upon if SDOH were considered.

Modification of some HTN risk factors could potentially be inhibited by SDOH barriers. For example, a family may face challenges to improve their dietary intake if their income level

does not support purchasing fruits and vegetables or if fruits and vegetables are not available at stores within their community. Even if families do have access, they may not know what foods are considered healthy to purchase and when they get home, they may not know how to prepare these foods. Some families perceive healthy eating as expensive or unappealing and need education to encourage changes in their diet that fit within their economic constraints.(Siu et al., 2019) Nutrition education that is sensitive to low-income populations, who perhaps live in food deserts, may be warranted in order to help families make informed choices when shopping for foods and making these healthy foods palatable for adolescents. When looking at food security in a nationally representative sample, high BP was more common in children and adolescents living in food insecure homes (15.3%) than in those living in food secure homes (12.1%) (South et al., 2019).

Crime and violence can influence whether or not an adolescent has a safe place to exercise after school and may be potential barriers to families who are encouraged to incorporate more physical activity into their daily routines. Lack of school physical activity facilities and lack of affordability of after school exercise programs are barriers to adolescents being more active (Kornblit et al., 2018; Schroeder et al., 2019). Gang activity, gun violence, and the prevalence of drugs in communities also force parents to keep children at home where they were mainly sedentary, but safe (Kornblit et al., 2018). Families who lack transportation may attend fewer health care appointments which may result in delayed treatment for health ailments that could have been prevented. Medical providers may consider adaptations to conventional nutrition and physical activity recommendations to better meet their patients' needs and provide more patient-centered care.

The influence of SDOH on health outcomes has become apparent but how to address these in clinical settings is still up for discussion. Despite the knowledge that socially disadvantaged individuals are at a higher risk of having poor health outcomes, medical providers often focus on recommending medical treatments and lifestyle changes without routinely addressing the social and psychosocial factors that may be affecting the adolescent's health status during wellness visits (Andermann, 2016; Chung et al., 2016; Pinto & Bloch, 2017). Adolescents living in poverty often experience adverse childhood experiences and are susceptible to a variety of child and adult health problems including heart disease (Chung et al., 2016). Surveillance and screening of SDOH include identifying parental concerns by asking general questions during the exam room visit or utilizing a screening questionnaire at routine visits to assess for the presence of risk factors and protective factors. Providers should refer families to community organizations or governmental agencies as needed to help connect them with needed resources. Time to assess nutritional habits and recommend lifestyle changes, in addition to the other components of physicians' appointments, was described as insufficient by physicians who participated in an interview related to managing chronic disease in adolescents (Sastre et al., 2019). This may also be a limiting factor associated with SDOH assessment in patients.

To our knowledge, no studies have been conducted since the released of the 2017 guidelines assessing medical provider comfort with diagnosing HTN, assessment methods of SDOH in patients, and treatments recommended to improve long term health outcomes. The purpose of this study was to provide insight on how medical providers diagnose and treat adolescent HTN, how comfortable they are with this process, and their knowledge of their patient's social determinant of health factors. The long-term goal of this research is to improve

diagnosis and treatment of HTN and decrease risk of cardiovascular disease (CVD) among high-risk adolescents. By better understanding medical providers' methods towards management of adolescent HTN, the gaps in care can be elucidated and medical providers can receive the necessary continuing education to improve care of adolescents.

Methods

Participants and Recruitment

Medical providers in North Carolina (NC) who treat adolescents, defined as being within 13 to 18 years old, were recruited through the NC Pediatric Society listserv and Federally Qualified Health Centers. Participants were also recruited through contacts within three academic medical centers (two located in central NC and one located in eastern NC) and three major healthcare systems (all located in central NC). Recruitment flyers and emails were sent to practice managers and directly to medical providers to request participation and sharing of the study information with colleagues. Inclusion criteria included medical providers with one of the following credentials: Doctor of Medicine (MD), Doctor of Osteopathic Medicine (DO), Physician Assistant (PA), and Nurse Practitioner (NP). Medical providers who did not hold these credentials or those who did not treat adolescent patients were excluded. Five participants had a chance to win one of five \$50 Amazon gift cards as an incentive to participate in the electronic survey. This study was approved by the institutional review board at the University of North Carolina at Greensboro and Cone Health. Informed consent was received electronically from each participant at the start of the survey.

Survey Design

The online survey conducted through Qualtrics consisted of thirty-seven items, starting with two screening questions to verify that the participant met the inclusion criteria (*Qualtrics*,

2021). The survey questions were developed from a thorough review of the literature regarding adolescent hypertension and assessment social determinants of health factors in healthcare settings. In particular, questions related to adherence to updated AAP clinical guidelines and comfort were adapted from previous research done on physician's comfort based on previous AAP HTN management guidelines (Boneparth & Flynn, 2009). The survey included questions regarding medical provider demographics (gender, age, ethnicity, race, years of experience, city of practice, and additional degrees), patient population demographics (socioeconomic status, race, and ethnicity), and standard operating procedures for addressing BP (method of BP measurement, frequency of follow up, best course of action). Gender was asked with the following options: female, male, cisgender female or male, transgender female or male, non-binary, other, or prefer not to say. In addition, adherence to the 2017 clinical guidelines was assessed through several case study questions, and at the end of the survey participants were asked to identify if they knew of and utilized the guidelines in their clinical practice. Participants were asked to rank their comfort level associated with diagnosing, treating, providing nutrition recommendations, and providing physical activity recommendations for elevated BP and HTN statuses on a 5-point Likert scale ranging from not comfortable at all to completely comfortable.

Medical providers were asked to assess their knowledge of their patients SDOH factors (parental education level and income level, safety of neighborhood, access to transportation, access to healthy foods, recipient of food assistance, and access to health care). How often a medical provider had knowledge of each factor was ranked on a 5-point Likert scale ranging from never knowing to always knowing a patient's SDOH factors. Participants were asked to consider how SDOH impact their messaging by identifying the primary three social determinants that they consider. Messaging was defined for participants as the communication of health care

regimens, recommendations, print materials, and referrals provided to the adolescent and their family. Medical providers were asked to identify their access to and how often they refer patients to a Registered Dietitian (RD). Types of training they have received to prepare them for lifestyle discussions with patients was also evaluated. Respondents had an opportunity to expand on why they rated their comfort levels and knowledge of SDOH as they did through two open-ended questions.

Prior to administration, this survey was reviewed by one medical staff member and four nutrition experts to content validate the survey. As a result of this process, two questions were added to better identify when BP readings were obtained in medical practices and wording was update for several questions. Face-validation was completed by four practicing medical providers to ensure that the survey is appropriate for the aims of the study. As a result of face-validation, answer options for gender were updated to include cisgender female or male, transgender female or male, non-binary, and prefer not to say. Also, treatment answer choices were expanded to include referral to cardiovascular specialist and types of education or training answer choices were expanded to include specializations.

Data Entry and Analysis

Descriptive statistics were used to summarize all available demographic characteristics of the medical providers (age, gender, race, ethnicity) and of the patient population treated by the providers (socioeconomic status and race/ethnicity). Descriptive statistics were also used to characterize medical providers' use of the guidelines and frequency of referral to a Registered Dietitian. All responses to open ended questions were evaluated by the primary investigator and main themes were identified which were supported by a second reviewer. A total of eight variables were assessed individually regarding medical provider's comfort level in diagnosing,

treating, and providing nutrition recommendations or physical activity recommendations, once for adolescents with elevated BP and once for adolescents with HTN. One overall comfort scale score was determined by adding up each of the numerical responses to the eight items regarding comfort. This comfort scale score ranges from 8 to 40 with a higher score indicative of greater comfort. A total of seven variables were assessed in response to medical provider knowledge of SDOH measures in the patients they treat (caregiver's education level, caregiver's income level, safety of patient's neighborhood, patient's access to transportation, patient's access to healthy foods, patient's receiving food assistance, and patient's access to health care). One overall SDOH knowledge score, ranging from 7 to 35, was computed by adding up each of the numerical responses to the seven items regarding SDOH knowledge. A higher SDOH knowledge score was indicative of greater knowledge of their patient's social determinant factors. Both the comfort scale and SDOH knowledge scale were utilized as variables in independent t-tests for gender (male and female) and in one-way ANOVAs for race (white, black, and other), years of practice (<5 years, 5-10 years, and >10 years) and credentials (MD, DO, PA, and NP). Prior to analyzing data, all IP addresses from each electronic survey submission were reviewed to ensure that there were no duplicate submissions. Statistical significance was signified by $p < 0.05$. SPSS software was used for data management and statistical analyses (*IBM SPSS Statistics for Macintosh*, 2021).

Results

Baseline Characteristics

Table 1 reports the baseline characteristics of the 110 medical providers who responded to the electronic survey. The majority of respondents were female (83.5%), and the mean age of all participants was 39 years. Based on participant's credentials, 71.8% were MDs, 14.5% were

NPs, 10.0% were DOs, and 3.6% were PAs. When considering race, 81.1% were Caucasian, 9.9% were African American, and 9.0% were Asian, Native Hawaiian, or Pacific Islander. There were 38.5% of respondents with less than five years of practice, 22% of respondents with five to ten years of practice, and 39.5% of respondents with more than ten years of practice. Most participants (79.1%) reported that they treat a diverse patient population in terms of race and ethnicity. Over half of the participants (56.4%) reported that they treat a primarily low or low-middle income populations, and about one third of participants reported that they serve all income levels (32.7%). Some participants had earned additional degrees including 13.7% with a MPH and 12.3% with a Masters (in sports management, nursing, or research related). The response rate for the survey was 6%.

Collection of BP Readings

Use of an oscillometric or electronic BP device for measuring adolescent BP was reported by 65% of participants, with the remaining percentage using auscultation with a sphygmomanometer. Figure 2 shows when medical providers reported collecting BP readings. All participants (100%) reported that BP measures were recorded at every wellness visit, and 72% reported that BP readings were taken at sick visits. In all, 98% of participants reported that BP was taken if an adolescent had symptoms of elevated BP, 99% reported that BP was taken because it was standard protocol in the practice, and 46% reported taking BP readings because it was a billing or insurance requirement. Regarding weight status, 73% of participants take BP readings if an adolescent appears to be overweight or obese, and 63% take BP readings in an adolescent appears to be underweight or normal weight.

Most medical providers believed the best course of action for dealing with an adolescent patient who comes in for a visit and has elevated BP would be to recheck the adolescent within

the same visits (82%), while 13% of providers said they would schedule a follow up appointment to recheck the adolescent's BP in the future. Participants were asked to respond to two case study questions to identify when they would follow up on a patient's BP status. One question focused on an asymptomatic, 15-year-old, normal weight, male patient with a BP of 124/79 (elevated BP) where 34% responded that the patient should be followed up with between one to three months, while the remaining participants almost split evenly between following up at less than one month, four to six months, or at the next well check appointment (Figure 3). The second case study question, shown in Figure 3, asked about when to follow up on an asymptomatic, 15-year-old, normal weight, female patient with a BP of 135/82 (stage 1 HTN). Close to 70% of respondents said the patient should be followed-up with within one month. A diagnosis of HTN should be assigned after two BP measures over 130/80 according to 44% of respondents and after three elevated readings according to 51% of respondents.

Figure 2. When Blood Pressure Readings are Taken by Medical Providers

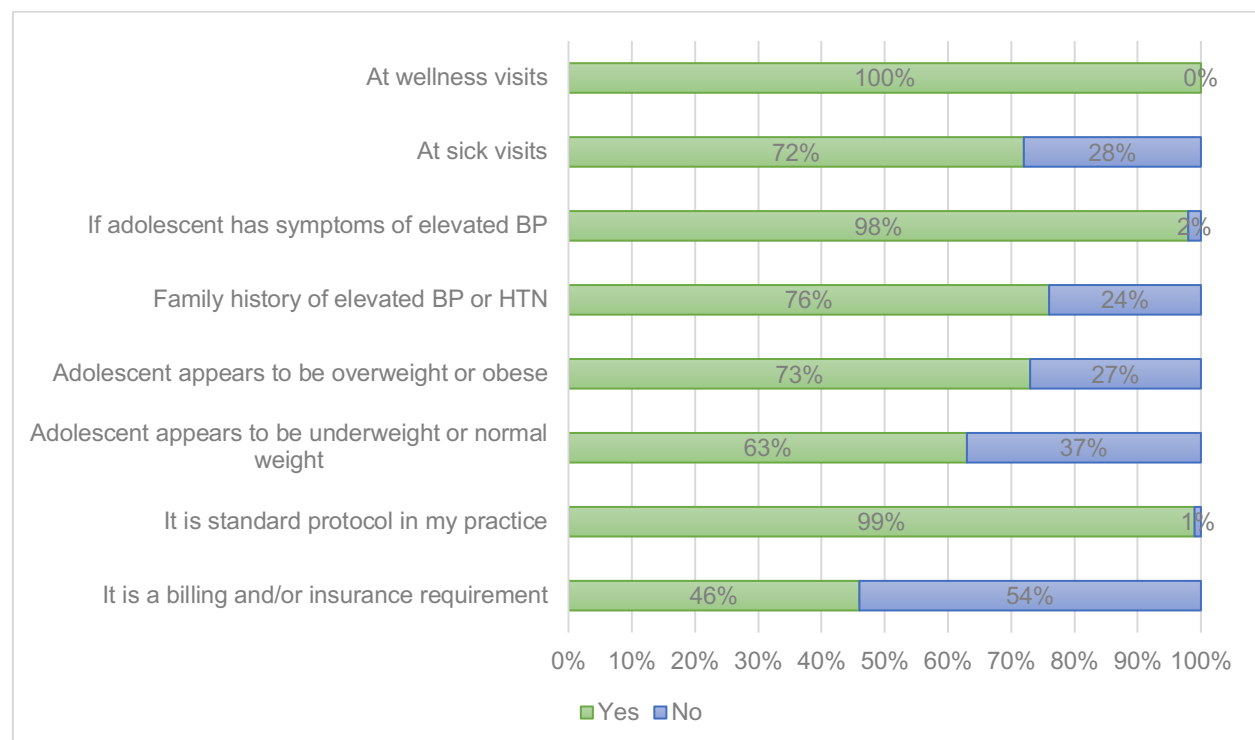


Table 1. Baseline Characteristics of Medical Provider Respondents

Characteristic		<i>n</i>	%
Credential	MD	79	71.8
	DO	11	10.0
	PA	4	3.6
	NP	16	14.6
Gender*	Male	18	16.5
	Female	91	83.5
Age	25-34	46	42.6
	35-44	32	29.6
	45-54	22	20.4
	55-64	5	4.6
	65+	3	2.8
Race	African American	11	9.9
	Caucasian	90	81.1
	Asian, Native Hawaiian, or Pacific Islander	10	9.0
Ethnicity	Hispanic	5	4.8
	Non-Hispanic	99	95.2
Years of Practice	<5 years	42	38.5
	5-10 years	24	22.0
	>10 years	43	39.5
Additional Degree	MPH	10	13.7
	MS	9	12.3
	PhD	1	1.4
	Other	11	15.1
	None	42	57.5
Patient Race/ Ethnicity	Diverse population	87	79.1
	Primarily white, non-Hispanic population	11	10.0
	Primarily black, non-Hispanic population	4	3.6
	Primarily Hispanic population	8	7.3
Patient Socioeconomic Status	Primarily a low or low-to-middle income population	62	56.4
	Primarily a middle- to upper-income population	12	10.9
	Serve all income levels	36	32.7
Familiarity with New Guidelines	Familiar with and use guidelines	40	42.6
	Know of guidelines but do not use	28	29.8
	Do not know of new guidelines	26	27.7
Use of BP Thresholds in Messaging to Adolescents	Always	26	28.0
	Often	33	35.5
	Rarely	34	36.5

*One respondent did not provide gender.

Figure 3. Best Course of Action for Follow-up on an Elevated Blood Pressure Reading

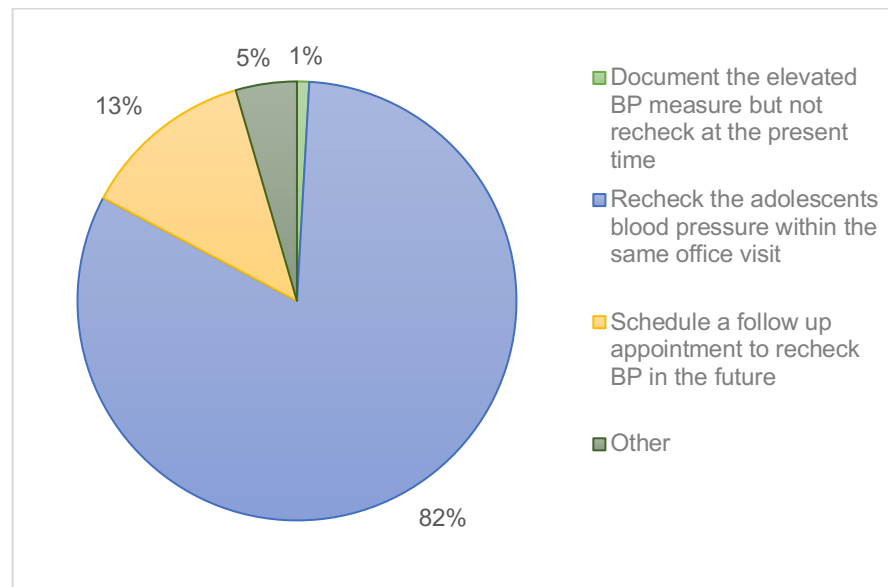


Figure 4. Medical Provider Comfort in Diagnosing, Treating, Providing Nutrition Recommendations, and Providing Physical Activity Recommendations to Adolescents with Elevated Blood Pressure

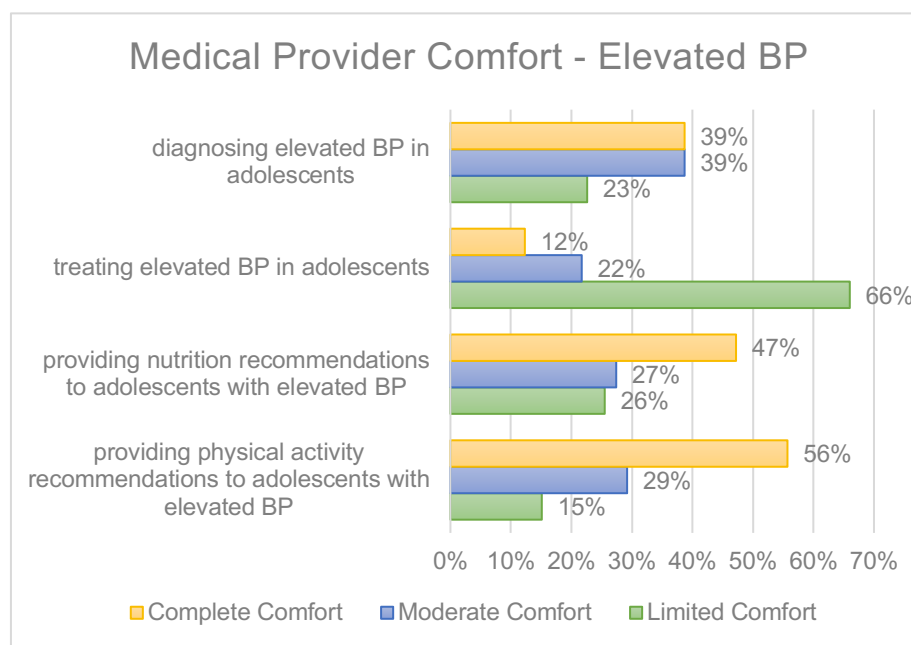
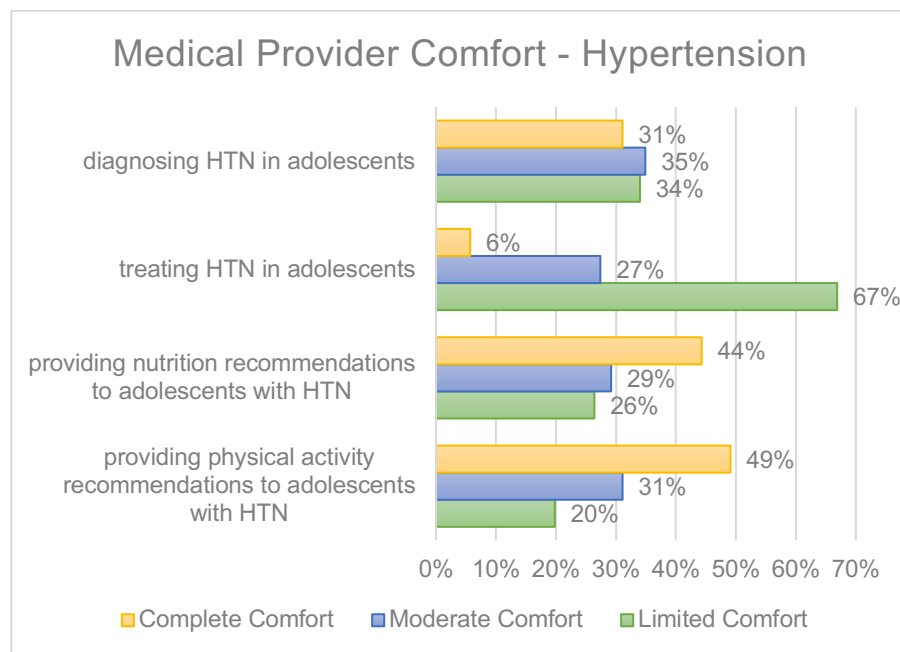


Figure 5. Medical Provider Comfort in Diagnosing, Treating, Providing Nutrition Recommendations, and Providing Physical Activity Recommendations to Adolescents with Hypertension



Medical Provider Comfort

Figure 4 and Figure 5 show medical provider comfort regarding elevated BP and HTN, respectively. In all, 39% of medical providers were completely comfortable, 39% were moderately comfortable, and 23% had limited comfort with diagnosing elevated BP in adolescents. When looking at comfort related to diagnosing HTN, medical providers were split with about one third falling into each of the three comfort level categories. Medical providers exhibited the least comfort with treating elevated BP (66%), with only 12% feeling completely comfortable. Even fewer medical providers were completely comfortable (6%) with treating HTN, with only 27% having moderate comfort, and 67% having limited comfort. More medical providers were completely comfortable with providing nutrition and physical activity recommendations to adolescents with elevated BP and HTN (47% and 56%; 44% and 49%).

While medical providers demonstrated greater comfort with recommending lifestyle changes for both elevated BP and hypertensive statuses, there were still a decent proportion of them who expressed limited comfort with providing these recommendations to adolescents (elevated BP: nutrition 26% and physical activity 15%; HTN: nutrition 26% and physical activity 20%).

There were 46 responses to the open-ended question that allowed participants to elaborate more on why they ranked their comfort level the way they did. Of these responses, many highlighted medical providers limited familiarity with anti-hypertensive medications making them feel less prepared to provide treatment. While treatment was not defined in the comfort questions, it was evident from medical provider's open-ended responses that they identified treatment as medicinal treatment. This perhaps was influenced by providing nutrition recommendations and providing physical activity recommendations as separate categories. Multiple respondents (30%) suggested that the use of a specialist, like a pediatric cardiologist or nephrologist, were common practice. In addition, multiple respondents noted that they had very little training on initiating and managing BP medications in adolescents and that while the guidelines are quite clear, they are not always practical. Medical providers elaborated on increased comfort with nutrition and physical activity recommendations, citing that they see a large number of obese patients, so they often practice this skill set. One respondent stated that often BP medication could be avoided if the teenager lost a significant amount of weight; however, the provider worries about contributing to feelings of low self-esteem or even the onset of an eating disorder.

Primary Course of Treatment

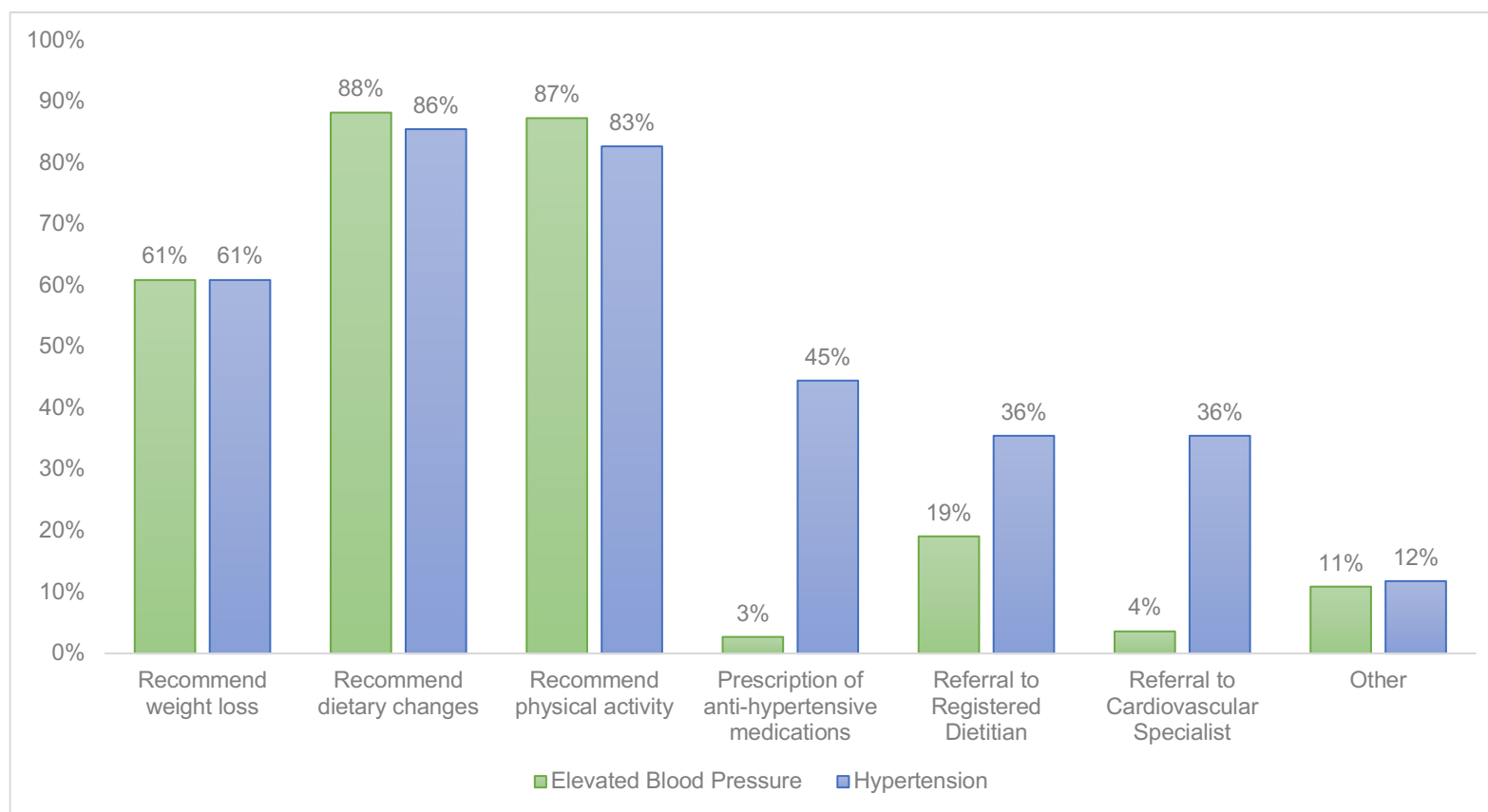
If an adolescent has a BP falling in the elevated BP category, 94% of medical providers reported talking about it with the patient or caregiver. Figure 6 shows how often medical

providers utilize the following items as a primary course of treatment for elevated BP or HTN: recommend weight loss, recommend dietary changes, recommend physical activity, prescription of anti-hypertensive medications, referral to a RD, referral to a Cardiovascular specialist, or other. Medical provider recommendations of dietary changes were often reported as a course of treatment for elevated BP (88%) and HTN (86%). The same was seen for physical activity with 87% recommending these changes to adolescent patients with elevated BP and 83% recommending these changes to those with HTN. For both elevated BP and HTN, 61% of medical providers identified that they recommend weight loss to adolescents.

Medical providers were more likely to recommend prescription of anti-hypertensive medication and referral to a RD or Cardiovascular Specialist for patients with HTN than for patients with elevated BP (medications: 45% vs. 3%, RD: 36% vs. 19%, CVD: 36% vs. 4%). The other category included reports of referral to nephrology and community programs for weight management or lifestyle changes.

Most medical providers reported that they do not have access to a RD within their practice (Figure 7) but do have one they can refer to outside of their practice (75%). Only 24% had access to a RD within their practice and 2% did not have any access to a RD at all for referrals. Only 2% of medical providers who had access to a RD reported always referring hypertensive adolescents to a RD, while 24% reported very often making this referral (Figure 8). Most providers (40%) reported sometimes referring hypertensive adolescents to a RD. Approximately one third of respondents reported rarely or never referring adolescents with hypertension to an RD (rarely 25%, never 10%).

Figure 6. Primary Course of Treatment for Elevated Blood Pressure and Hypertension



Impact of SDOH on Messaging to Adolescent Patients

Medical providers were asked to identify how often SDOH impact their messaging to adolescent patients (Figure 9) and surprisingly only 21% said that this always happens. Most medical providers said that SDOH very often (38%) or sometimes (29%) impact their messaging, while 11% said that SDOH rarely or never impact their exam room discussions with adolescents. Medical providers rarely had knowledge of all social determinant factors that they were asked about as shown in Figure 10. Over 80% of respondents rarely had knowledge of their patient's caregiver's education level or income level, or the safety of their patient's neighborhood. Approximately two thirds of participants said they rarely have knowledge of their patient's access to transportation (67%) or to healthy foods (64%), while about a quarter of respondents said they often had knowledge of these SDOH factors. More medical providers reported that they always have knowledge of their patient's access to health care (18%) than any other social factors they were asked about. Always having knowledge of receiving food assistance was close behind at 15%.

When asked to rank the top three SDOH that they primarily consider in their messaging to adolescent patients, medical providers most frequently ranked access to healthy foods, access to health care, caregiver's education level, or access to transportation in their top three factors. Safety of neighborhood and caregiver's income level were least often ranked in the top three factors considered.

Medical providers were able to provide more information on how SDOH impact messaging for an open-ended question. There were 47 responses that were analyzed for main themes by the primary investigator with results supported by a second reviewer. Many of the responses highlighted meeting the family where they are and considering the barriers they have

prior to making recommendations. These respondents highlighted ideas like joint decision making, starting with small achievable changes that the family can do together, or utilizing community health workers to connect the family to needed resources. Other providers mentioned providing alternatives that are not cost prohibitive when discussing options for healthy food and exercise, as well as connecting patients to free food and activity recourses within the community. Transportation was highlighted numerous times with medical providers stating that lack of transportation prevents their patients from making it to appointments to see specialists or even to the store to access healthy foods. One provider commented that knowledge of SDOH factors do not really impact their messaging and another provider commented that the messaging is not difficult but if the patient does not have access to healthy foods, a safe space to exercise, or a caregiver who understands the importance of making some changes, then recommendations are rarely followed, even when decided on together.

Training and Resources

Just over half of the participants reported that they received training on how to work with adolescent patients that face challenges because of SDOH (56%). Figure 11 shows that types of education or training received to prepare medical providers to have lifestyle discussions with adolescent patients included: class during medical school (41%), educational conferences (49%), and experience during residency (56%). Webinars (24%), RD led in-service trainings (11%), and specializations (8%) were less commonly reported as areas of training to prepare them for working with socially disadvantaged adolescents and their families. Medical providers who selected the ‘other’ category most commonly highlighted their years of experience in practice as a source of preparation for lifestyle discussions.

Figure 7. Medical Provider Access to a Registered Dietitian

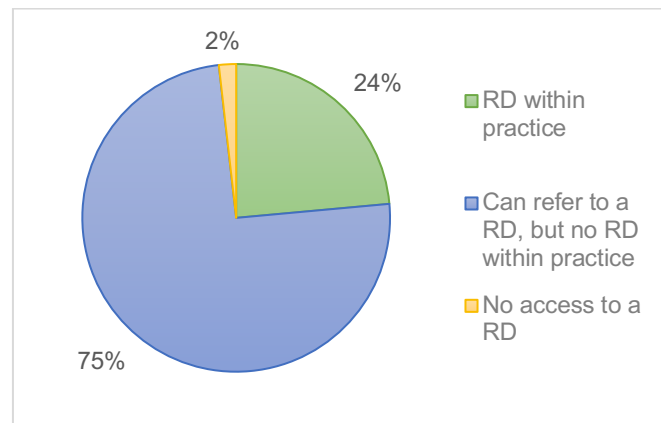


Figure 8. Medical Provider Frequency of Referral of a Hypertensive Adolescent Patient to a Registered Dietitian

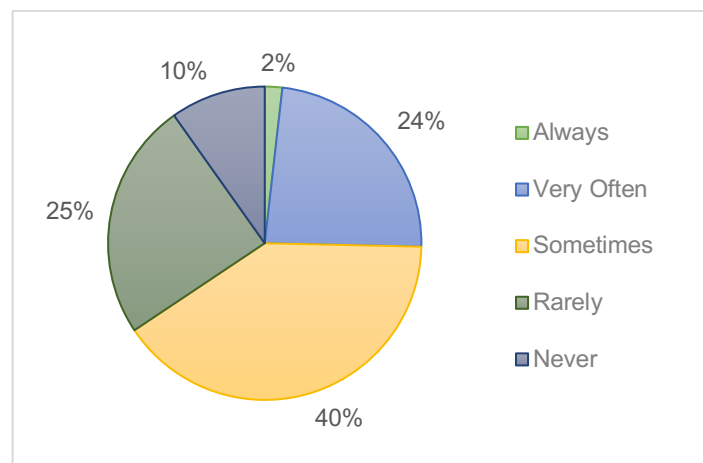


Figure 9. How Often SDOH Impact Medical Provider Messaging to Adolescent Patients

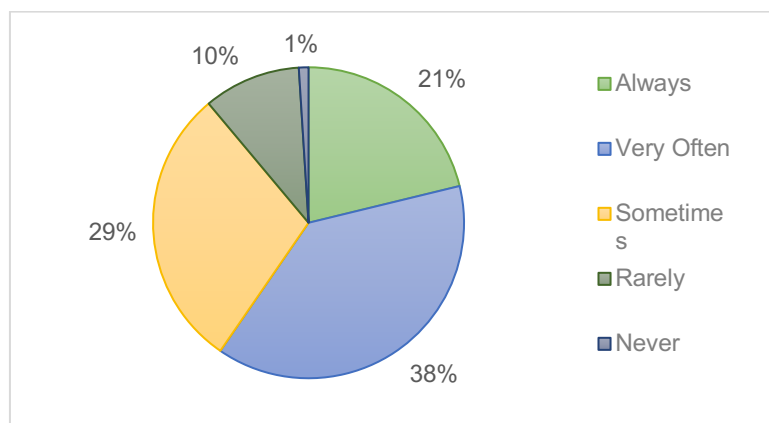


Figure 10. Medical Provider Knowledge of Social Determinant of Health Factors

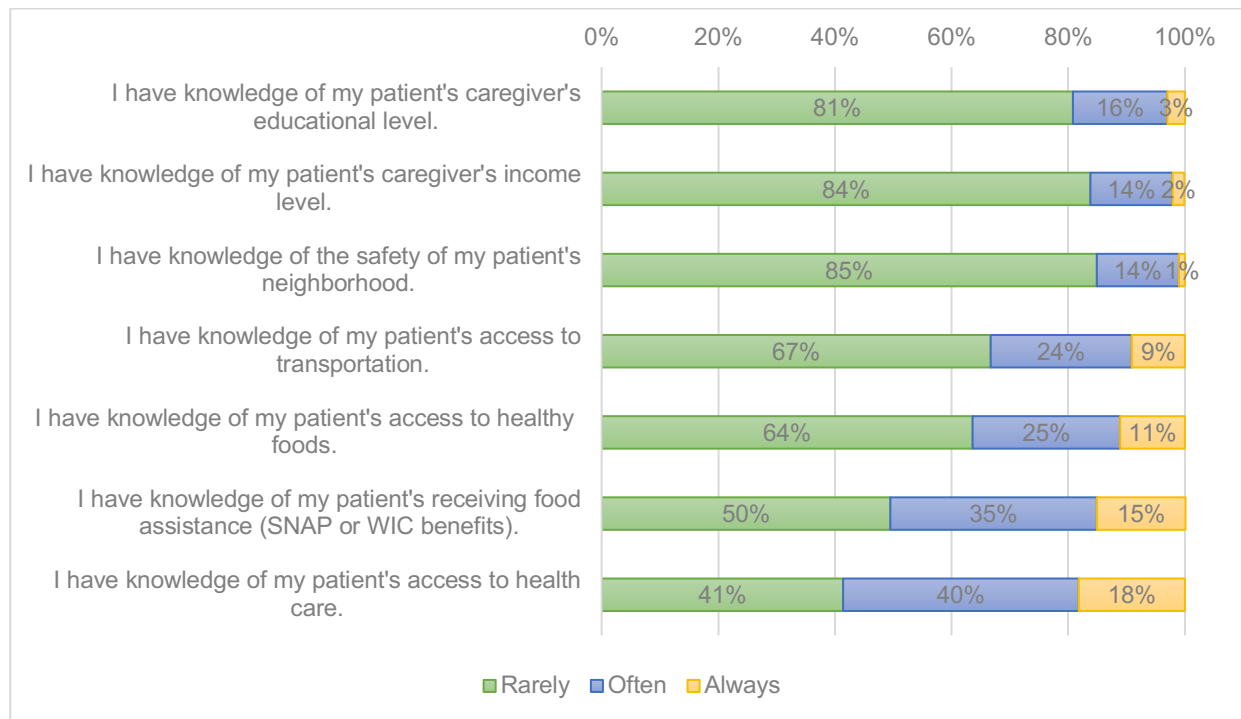
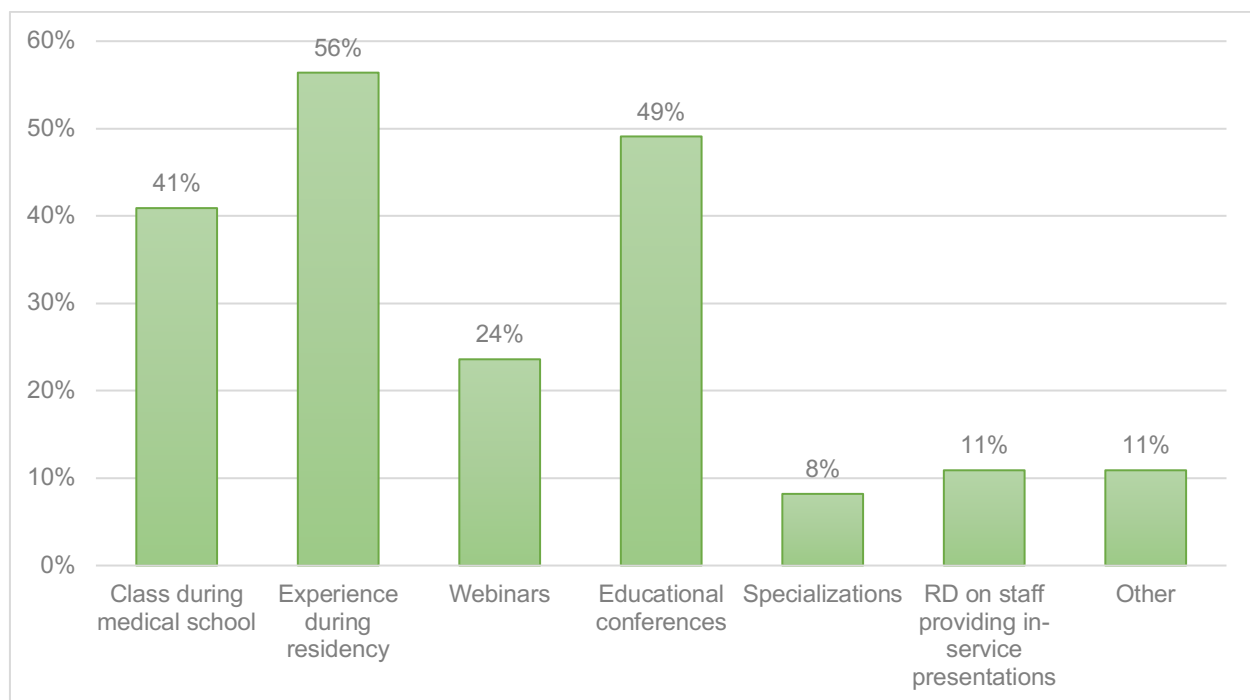


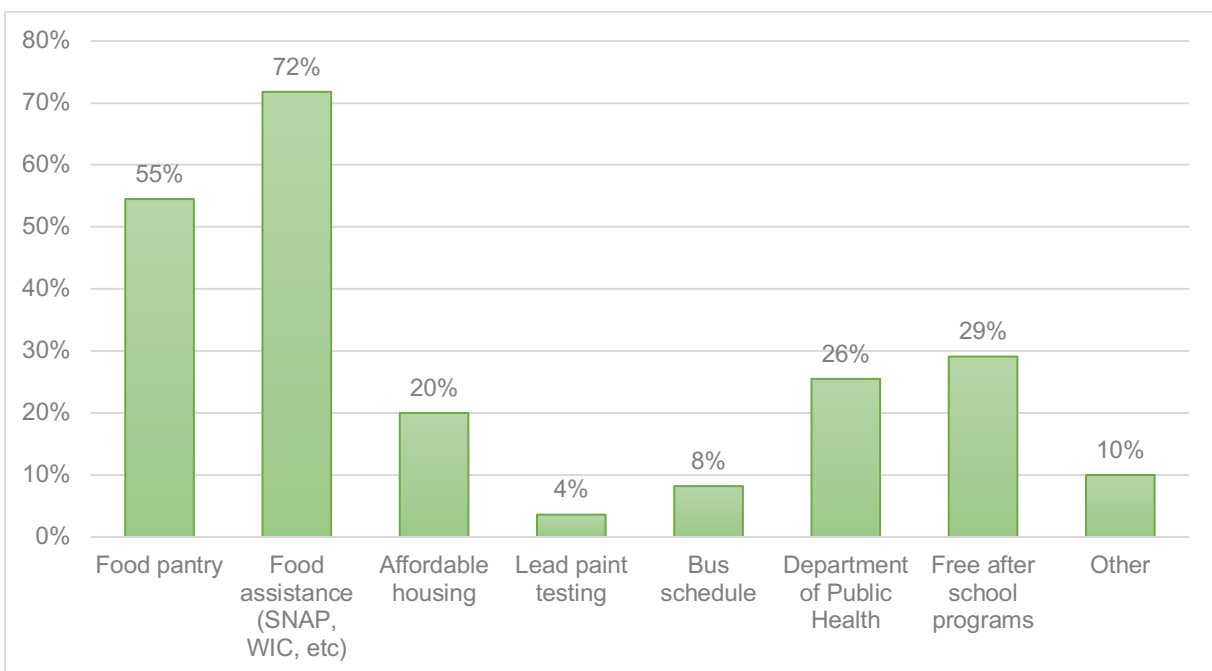
Figure 11. Types of Education or Training Received by Medical Providers to Prepare Them for Lifestyle Discussions with Adolescent Patients



Respected websites (47%), in-service trainings or clinic education (24%), and peer-reviewed journal articles (21%) were the most frequently identified resources used by medical providers or recommended to adolescent patients with elevated BP or HTN. Books (8%) and webinars (10%) were less frequently utilized resources. Other resources identified included community programs, podcasts, handouts, and apps for phones.

Figure 12 identifies patient resources related to SDOH that are recommended to adolescents with elevated BP or HTN. Food assistance (72%) and food pantry resources (55%) were identified most often as resources recommended to patients. Free after school programs (29%), Department of Public Health (26%), and affordable housing (20%) were less likely to be used with patients. Other resources mostly highlighted the use of a case manager or a social worker within the clinic to help connect patients to resources.

Figure 12. Resources that Medical Providers Use with Patients with Elevated Blood Pressure or Hypertension That are Also Impacted by Social Determinants of Health



Knowledge and Use of the 2017 AAP Practice Guideline

Table 1 also shows respondents knowledge and use of the new 2017 AAP guidelines. Over 40% of participants reported that they were familiar with and utilize the guidelines, while about 30% of participants identified that they know of the guidelines but do not utilize them. The remaining portion of respondents (28%) reported not knowing of the new guidelines. The 2017 guidelines contained new BP thresholds for adolescents 13 to 18 years of age. In all, 28% of providers stated that they always use those thresholds in their exam room conversations with adolescents. More participants cited often using (35.5%) or rarely using (36.5%) these threshold measures in their messaging with adolescent patients.

Bivariate Analyses Using Comfort Scale Score and SDOH Knowledge Score

The overall comfort scale score depicted the medical provider's comfort with diagnosing, treating, and providing nutrition and physical activity recommendations for adolescent patients with elevated BP or HTN. The mean for the overall comfort scale score was 31 and ranged from a minimum of 15 to a maximum of 40. The SDOH knowledge score identified medical providers' knowledge of their patient's social limitations including access to food and health care, safety of the neighborhood, use of food assistance programs, and the caregiver's income and education level. The mean SDOH knowledge score was 22 and ranged from a minimum of 12 to a maximum of 34. A one-way ANOVA showed significance between medical provider's years of practice experience and the comfort scale score ($p = 0.007$), but not in relationship to the SDOH knowledge score. These results indicate that providers with more years of experience were more comfortable with the overall management of HTN. Specifically, those providers who had 5-10 years of practice were more comfortable with the management of elevated BP and HTN than those with <5 years practicing ($p = 0.006$). In addition, significance was found between

medical provider's familiarity with the updated 2017 AAP Practice Guideline and the comfort scale score, with medical providers who are familiar and use the guidelines having greater comfort than those providers who were unfamiliar with the guidelines ($p<0.001$). Providers who were only familiar with the guidelines were less comfortable than those who were familiar and use the guidelines ($p=0.013$). Providers who were within the 5 to 10 year experience range were likely trained using the new guidelines, perhaps influencing their overall comfort with elevated BP and HTN.

A one-way ANOVA showed significance between medical provider's patient's socioeconomic status and the SDOH knowledge scale score ($p<0.001$), but not in relationship to the comfort scale score. The results indicate that providers who treat patients of low or low to middle income status had greater knowledge of SDOH factors for their patients in comparison to providers primarily treating middle to higher-income patients ($p=0.042$). Significance was also seen when comparing providers that primarily treat adolescents of low or low to middle income status in comparison to providers who treat all income levels, with providers treating all income levels having less knowledge of SDOH factors than those providers that primarily treat low-income adolescents ($p<0.001$). Providers who treat patients from primarily low-income families may have greater awareness of social limitations because they are used to patients sharing these barriers, and therefore reported greater knowledge of social factors. No significance was found when looking at race, gender, or credentials in comparison to the comfort scale score or the SDOH knowledge score.

Discussion

This study examined medical providers' comfort with diagnosing, treating, providing nutrition recommendations, and providing physical activity recommendations to hypertensive

adolescents, in addition to investigating medical providers' knowledge of their patients' social needs. Medical providers reported that they regularly recorded BP measures at all wellness visits (100%) and fairly often at sick visits (72%). Adolescents were more likely to have a BP recorded if they were of overweight or obese weight status (73%) than if they were of underweight or normal weight status (63%). Obesity is a known risk factor for HTN and CVD; therefore, it is no surprise that adolescents with higher BMI scores are more likely to be diagnosed with HTN. One study showed the predicted probability of recognizing elevated BP was the highest for obese children (Brady et al., 2010). While overweight and obese children were more likely to be recognized as hypertensive, the overall rate of recognition was still only 20% for this population (compared to 7% in normal weight adolescents) showing the need for more education of pediatric health care providers regarding this important diagnosis (Brady et al., 2010). While weight is an important consideration, obtaining accurate BP measures for all adolescents and reassessing at the appropriate time intervals is the first step to knowing when to initiate the appropriate preventive health care measures with adolescents. Proper assessment of BP in all adolescents will ensure that fewer cases of adolescent HTN go undiagnosed.

Multiple measurements over time must be collected prior to assigning a diagnosis of hypertension (Flynn et al., 2017). BP measures were more frequently taken by an electronic device (64.5%) than by auscultation (35.5%). While the first measure may be taken using oscillometric methods, all follow-up measures should be taken by auscultatory methods with an appropriate cuff size, per the guidelines. Oscillometric devices may overestimate systolic and diastolic BP by up to 10 mmHG when compared to auscultatory measures (Park et al., 2005). This difference could result in the misclassification of an adolescent.

Follow-up within the appropriate time frame is imperative for preventing negative outcomes of prolonged elevated BP. Medical providers reported that an adolescent with an elevated BP reading should have their BP rechecked within the same office visit (82%). This blood pressure reading could be elevated due to the child being nervous about potential vaccinations or anxiety about coming to the medical appointment in general. Allowing time for the adolescent to relax and then remeasuring the BP is one method of immediate follow-up. Per the guidelines, if the initial BP measure is elevated, the provider should confirm with a measurement obtained by auscultation to confirm diagnosis (Flynn et al., 2017). Other providers (13%) said they would schedule a follow up in the future to recheck the BP measure which would be necessary either way if the BP measure remained elevated from the initial BP recheck within the same appointment, which is not in line with the recommendations.

One case study question asked about the appropriate follow-up interval for a 15-year-old male patient with normal weight status, no symptoms of HTN, and a BP reading of 124/79. Per the guidelines, follow up at 6 months would be appropriate since this adolescent falls within the elevated BP range. Over half of the respondents said they would bring the adolescent back in within 3 months for a recheck showing they are potentially following up with elevated BP measures more frequently than guidelines suggest. A second case study question asked about a 15-year-old female patient with normal weight status, no symptoms of HTN, and a BP reading of 135/82. Per the guidelines, follow up at one to two weeks would be appropriate for this adolescent whose BP reading falls in the stage 1 HTN range. While almost 70% of providers said they would bring this patient back in under a month, 27% said they would wait either one to three months or four to six months to reassess this patient, and 4% said they would even wait until the next well check appointment. Medical providers may be falsely reassured by BP

readings that are not obviously elevated, especially when the adolescent does not possess other CVD risk factors (Brady et al., 2010). Adolescent weight status, age, and symptoms were determining factors in whether or not additional medical testing was necessary. Physicians were more likely to consider adult risk factors associated with HTN, like poor dietary intake or sedentary lifestyle, for obese adolescents while physicians often recommended further medical testing for a thinner, younger patient to assess for secondary HTN (E. Y. Yoon et al., 2013). The AAP guidelines are a great resource for medical providers to guide them through the recommended best practice methods for measuring and follow up on concerning BP measures. These guidelines should be adhered to in practice to avoid overlooking any adolescent with concerning BP measures (Flynn et al., 2017). Medical providers could be further supported in this practice by having electronic health records that flag concerning BP measures and prompt the medical provider to generate a follow-up plan.

Comfort in diagnosing HTN has been addressed in several studies prior to the release of the 2017 AAP guidelines, but no study has broken down comfort into four categories (diagnosis, treatment, nutrition recommendations, physical activity recommendations) related to both elevated BP and HTN, separately. This study revealed a high percentage of providers who have limited comfort with treating elevated BP (66%), while even more providers (73%) were uncomfortable with treating HTN. These rates are higher than previously reported, for example, one study found that 40% of physicians marked themselves as uncomfortable with evaluating and treating adolescent HTN (Boneparth & Flynn, 2009). This difference may be explained by the fact that this study separated a medical provider's interactions with HTN into the four separate categories as mentioned above, rather than looking at overall comfort as a whole. In all, 47% of participants were completely comfortable with providing nutrition recommendations and

56% were completely comfortable with providing physical activity recommendations to adolescents with elevated BP. These numbers were still relatively high for recommending lifestyle changes to adolescents with HTN (nutrition: 44%; physical activity: 49%). These results demonstrated that medical providers may have lower levels of comfort with medicinal treatment and higher levels of comfort with providing recommendations for behavioral changes at treatment. Given the lack of nutrition education in medical schools, it was surprising that medical providers expressed more comfort in an area that they potentially have less training.(Adamski et al., 2018; Cooke et al., 2017) This perhaps could be due to their career experience with providing general nutrition recommendations to many of their patients and less experience prescribing of hypertensive medications.

Medical providers who had 5-10 years of experience were more comfortable with elevated BP and HTN than those providers who had less than 5 years of experience or greater than 10 years of experience. This is likely due to the fact that medical providers in the 5 to 10 years of practice range were educated on the new 2017 standards during medical school and/or residency. Therefore, this group of medical providers felt better equipped to address the diagnosis and medicinal or lifestyle treatments for HTN based on their more in-depth knowledge of the guidelines. This point was further supported since providers who were familiar with and utilize the 2017 AAP Practice Guideline were significantly more comfortable than those medical providers who were unfamiliar with the guidelines and than those medical providers who knew of the guidelines but did not utilize them in practice. Our findings support previous research which has shown that physicians vary in their comfort level associated with diagnosis and treating HTN, which may partially be due to their experience with adolescent HTN (Cha et al., 2014).

The most popular selections for primary course of treatment included recommending weight loss, dietary changes, and physical activity for both elevated BP and HTN. Interestingly, only 19% of medical providers reported referral of a patient with elevated BP to a RD and only 36% reported referring a patient with HTN. The lack of nutrition education in medical curricula globally has been identified as a major barrier within medical training. Medical education lacks standardized competencies for students to demonstrate mastery of nutrition information, so curriculum varies from no inclusion of nutrition, to short lectures, to nutrition rotations (Adamski et al., 2018). A RD has successfully completed didactic education and supervised-practice experiences within accredited programs and completed the Registration Examination for Dietitians to earn their credential by demonstrating their expertise in dietary counseling and medical nutrition therapy (Jortberg & Fleming, 2014). Therefore, it is understandable that medical providers report low levels of confidence and knowledge in their skills to provide patient-centered nutrition counseling (Adamski et al., 2018). Because a RD has the training and knowledge of nutrition education, the in-depth counseling an RD provides could be a beneficial resource for both the patient and the medical provider and for these reasons could be a beneficial partner on multidisciplinary health care teams.

A dietitian develops rapport with patients and fostering healthy dietary changes in the adolescent by meeting the patient and family where they are and supporting small sustainable changes. While RD's are often not directly part of a primary care practice, a RD with experience in pediatrics can work with families to set goals, develop balanced eating plans, and encourage parents to be positive role models for their children (Brown & Perrin, 2018). Since 98% of medical providers in this study reported having access to a RD, either within their practice or through external referrals, it seems that this is an underutilized resource that could benefit the

adolescent patient in their primary course of treatment for elevated BP or HTN. To support behavior change, medical providers must understand the patient's psychosocial needs and maintain knowledge of current nutrition recommendations, which may be more challenging given the competing demands for continuing education topics including new care guidelines, medications, and technologies. In addition, the short 15-minute time frame of a general pediatric appointment does not allow for the comprehensive nutrition care that patients need (Adamski et al., 2018; Russell, 2019). Since medical providers often cite time as a limiting factor for in-depth nutrition discussions with patients, the utilization of nutrition experts could support medical providers by providing families more personalized recommendations to improve lifestyle behaviors and BP levels seen in adolescents. The RD is in a unique position with the expertise, the time, and the practical skills to deliver effective medical nutrition therapy to produce the desired behavior change in adolescents and their families (Adamski et al., 2018; Jortberg & Fleming, 2014).

SDOH must also be considered when making recommendations to patients. The AAP published a policy statement in 2016 which connects known health risks of adolescents to poverty and clearly identifies the role that pediatrician health care providers have in reducing its effects on their patients (Pediatrics, 2016). Medical providers who treat adolescents are in the optimal position to support children because they witness the negative effects of inadequate housing, food insecurity, and limited health care access on an adolescent's health (Federico et al., 2018). In addition, they have a longitudinal relationship with their patients, so they are able to follow up on the patient's social needs over time (Garg et al., 2012). Screening for SDOH is not enough. Medical providers must be knowledgeable about their patients' social needs and utilize this information to modify their recommendations given during exam room conversations with

the adolescent and their families. Only 21% of medical providers in this study reported that SDOH always impact their messaging with adolescents and 40% reported rarely using SDOH information to alter their messaging. It is imperative that medical practices and providers take steps to ensure this information is collected from their patients and that the providers are aware of the social limitations so they can provide tailored treatments that are achievable by vulnerable populations. Numerous studies have shown successful implementation of a screening questionnaire in practices with results integrated into the electronic medical record or in the hands of the medical provider once they enter the patient's room (Garg et al., 2007; H. Meyer, 2019).

When assessing SDOH knowledge, it was revealed that medical providers rarely have knowledge of their patient's limiting factors including patient's caregiver's educational and income level, safety of the patient's neighborhood, access to transportation, access to health care, access to healthy foods, and utilization of food assistance programs. With up to 85% of medical providers rarely knowing about neighborhood safety, a medical provider could potentially provide unachievable recommendations. Many adolescents may experience multiple social limitations, for example a patient may have limited access to healthy foods because they do not have transportation to the grocery store, or they may not be able to go for a run in their neighborhood, not only because it is not safe, but also because the caregiver does not have money to purchase the appropriately sized shoes for them. It is not enough to only "sometimes" have knowledge about a patient's social limitations as this does not support the AAP recommendations which encourages clinicians to address patients' adverse social circumstances regularly (Garg, Cull, et al., 2019). Lack of awareness of psychosocial risk factors could leave the families without actionable recommendations and stall behavior changes, or potentially leave

them without needed resources (food, shelter, income, education) to improve their health outcomes.

Medical providers stated that they received training on how to work with adolescent patients that face challenges because of SDOH primarily during residency (56%), at educational conference (49%), and during a class in medical school (41%). Medical curriculum must be updated to better prepare future providers for these discussion with patients. Alternate educational experiences (webinars, educational conferences, in-service presentations) can provide continuing education to enhance providers practices and keep them up to date on relevant recommendations; however, these fundamental skills need to be learned and practiced from the beginning of their medical education. Medical schools currently lack this curriculum, but recognize the importance of filling this gap to improve health equity by ensuring the next generation of physicians are trained to better care for the most underserved patients (Adamski et al., 2018; Doobay-Persaud et al., 2019). Identification of a patient's immediate unmet social needs during medical appointment offers an opportunity to improve the individual's health and over time the health of the population (Garg et al., 2012). Medical providers that consider SDOH to tailor their messages to adolescents and provide community resources may promote greater health equity by addressing low-income families' unmet needs (Garg et al., 2012). The long term effects of providing social risk-informed care may help reduce barriers to adherence but more research is needed to assess the potential impact on adolescent health and development (Garg et al., 2012; Gurewich et al., 2020).

Medical providers are reluctant to ask about social limitations if they do not have resources to share with families in need (Garg et al., 2010; Sokol et al., 2019). Food assistance programs were recommended by 72% of participants, likely because SNAP and WIC benefits are

widely known in all communities as federally funded programs. Providers may not have knowledge of resources to make recommendations for affordable housing, free after school programs, or to help a family meet transportation needs, which is evident by fewer respondents reporting use of these resources with their patient population. Some participants reported that a social worker or a case manager helped provide patients with referrals to community services. The WE CARE program utilizes a family resource book with pages that families can tear out with community resource information on a variety of social needs. This model has been cited as easy to incorporate into pediatric clinics and utilized a team approach to make the family resource book (Garg et al., 2007). Other programs have utilized a family help desk model where students and community members manned a desk that patients could visit after meeting with the medical provider to receive help connecting with community based resources. Each individual practice must determine what method works best to incorporate within their workflow while meeting their patients' needs.

While this research provided important data regarding medical providers' knowledge and use of SDOH in the treatment of adolescents with elevated BP and HTN, there are several limitations that must be mentioned. This research is largely exploratory and does not provide generalizable data regarding NC medical providers practices as related to HTN. In addition, neither the comfort scale nor the SDOH knowledge scale were evaluated for reliability. "Treatment" was not defined within the questions regarding comfort which could have influenced providers to only consider medicinal treatment since nutrition and physical activity recommendations were asked about separately. In addition, the respondents were a fairly homogeneous group as they were primarily female and lacked diversity. Nonetheless, this research provides an interesting perspective of what is and is not being done by medical

providers regarding care of hypertensive adolescents, specifically those that experience limitations due to social determinant factors.

Conclusion

The results of this study suggest that medical providers are more comfortable with lifestyle interventions than medicinal interventions, and rarely alter their messages based on SDOH limiting factors experienced by the adolescent and their family. While medical providers are routinely measuring BP, it is unclear if they are utilizing auscultatory methods as recommended in the 2017 AAP Practice Guideline to ensure accurate BP measures. Pediatric medical providers, because of their longitudinal relationship with these patients, have the critical and complex role of considering their adolescent patient's medical information and social information and developing an individualized plan that aims to overcome the barriers their patient experiences. This study provided information that can be used to improve the diagnosis process, to improve the assessment of SDOH within the primary care setting, and to develop sustainable nutritional interventions. More research is needed to ensure early and accurate identification of abnormal BP in adolescents to prevent damage in hopes of decreasing the risk of CVD in adulthood. Overall, this is going to require a team approach to ensure that BP measures are accurate, that all patients are screened for SDOH, and that their social limitations are ultimately met through referrals to appropriate community resources.

CHAPTER V: A QUALITATIVE STUDY EXAMINING MEDICAL PROVIDERS'
MANAGEMENT OF HYPERTENSION AND CONSIDERATION OF SOCIAL
DETERMINANTS OF HEALTH WHEN PROVIDING RECOMMENDATIONS TO
ADOLESCENTS FROM LOW-INCOME FAMILIES

Abstract

The objective of this study was to examine the processes used and barriers experienced by medical providers (n=12) regarding the diagnosis and treatment process of elevated blood pressure (BP) and hypertension (HTN) and to identify if and how social determinants of health (SDOH) play a role in exam room messaging to adolescents and their families. Semi-structured private phone interviews were conducted. All interviews were audio-recorded and transcribed. Content analysis of member checked transcripts revealed main themes and consensus was reached between all four reviewers. Main themes identified include (1) monitoring of BP in adolescents, (2) level of comfort associated with HTN diagnosis and management, (3) approaches to weight and diet related chronic disease discussions, (4) SDOH data collection and influence on provider messaging, and (5) resources desired. Results showed that providers had variable approaches to managing HTN with greater comfort in recommending lifestyle changes than prescribing medications. Collection methods related to SDOH varied and these factors were used differently among providers. Most providers considered access to food and a safe space to exercise in their messaging to adolescents and families. The management of adolescent HTN is challenging because medical providers must consider clinical symptoms as well as unmet social needs when making recommendations to their patients. Altering messages to meet adolescents

and families where they are and providing referrals to appropriate community resources supports patients in their efforts to make changes for the better. Providers identified barriers and opportunities for improvement which should be further investigated to improve overall care of patients.

Introduction

Elevated BP and HTN affect approximately 7% of children and adolescents, and poverty affects approximately 1 in 7 children in the United States (Flynn et al., 2017; Guzman-Limon & Samuels, 2019; Riley et al., 2018; Semega et al., 2020). Children living in socioeconomically disadvantaged situations are more likely to experience negative health outcomes including increased risk of chronic diseases, have less stable housing, and live in food insecure households (Buitron de la Vega et al., 2019; Chung et al., 2016; Fierman et al., 2016; Garg et al., 2015). This is concerning since research has shown that elevated BP during adolescence increases the risk of HTN in adulthood making them at greater risk of cardiovascular disease (CVD) or stroke (Beal, 2018; Ewald & Haldeman, 2016; Flynn et al., 2017; South et al., 2019; Ward et al., 2016). Higher income is related to better health outcomes including lower prevalence of chronic diseases, depression, and longer life-expectancy rates (Adler et al., 2016).

In 2017, the American Academy of Pediatrics (AAP) released the updated Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. These new guidelines provide clear recommendations for obtaining accurate BP measurements, following-up on concerning measures, and initiating treatment for adolescents in need. Barriers to obtaining accurate measures include use of oscillometric measurement devices which may overestimate a patients BP by up to 10 mmHg in comparison to using auscultatory methods, only taking one blood pressure measure in a visit, and the use of improper cuff size

when measuring an adolescent's blood pressure (Negroni-Balasquide et al., 2016; Park et al., 2005; E. Yoon et al., 2015). Primary care providers must be prepared to diagnose, provide treatment, and follow-up appointments regarding adolescent HTN; however, research shows that these medical providers may not feel comfortable in this role (Boneparth & Flynn, 2009; Saini et al., 2020). In addition, studies have shown that adolescents who are phenotypically of normal weight status but metabolically obese may be more likely to go undiagnosed with HTN, despite recommendations by the 2017 guidelines to assess BP yearly, at minimum, in all children (Ewald et al., 2017). While lifestyle habits are incredibly important in their ability to decrease risk of chronic disease, nutritional intake and physical activity levels were not sufficient at explaining the rates of HTN seen in adolescents, suggesting that some other factor may be influencing the rise in BP seen in adolescents (Ewald et al., 2017).

Social determinants of health (SDOH) refer to conditions in the environments where adolescents and their families live, work, attend school, and play which may affect a variety of health risk factors or quality-of-life outcomes. The factors could include access to health care, quality education, safe places to be physically active, access to transportation, availability of safe and healthful foods, and income level. Although SDOH have been shown to have a detrimental effect on children's health status, few health providers routinely address the social and psychosocial factors that may be affecting the adolescents health status during wellness visits (Chung et al., 2016; Pinto & Bloch, 2017). Medical providers often focus on recommending medical treatments and lifestyle changes without asking about or considering social implications that may pose a challenge for patients (Andermann, 2016). Surveillance and screening of SDOH include asking the patient or caregiver general questions at routine visits or utilizing a questionnaire to screening patients for specific social issues. Utilizing a team approach to

conduct regular screenings can ease the burden of facilitating the routine assessment of SDOH (Chung et al., 2016). Twenty-four percent of medical providers identified having a dedicated team to help connect patients to supporting services as the best strategy to use SDOH data to improve quality of care (Palacio et al., 2018). Time to assess nutritional habits and recommend lifestyle changes, in addition to the other components of physicians' appointments, was also described as insufficient by physicians interviewed on topics related to diet-related diseases in adolescents (Sastre et al., 2019). Increasing physician consultations by two to three minutes can allow for the evaluation of social determinants and the referral to additional resources which can improve health outcomes (Andermann, 2016).

Modification of some chronic disease risk factors could potentially be inhibited by SDOH barriers. For example, a family may face challenges to improve their dietary intake if their income level does not support purchasing fruits and vegetables or if fruits and vegetables are not available at stores within their community. Even if families do have access, they may not know what foods are considered healthy to purchase and when they get home, they may not know how to prepare these foods. Some families perceive healthy eating as expensive or unappealing and need education to encourage changes in their diet that fit within their economic constraints (Siu et al., 2019). When looking at food security in a nationally representative sample, high BP was more common in children and adolescents living in food insecure homes (15.3%) than in those living in food secure homes (12.1%) (South et al., 2019). Parents cited gang activity, gun violence, and the prevalence of drugs in their community reasons that force them to keep children at home where they were mainly sedentary, but safe (Kornblit et al., 2018).

Affordability of after school exercise programs also limits the opportunity for adolescents from

low-income families to participate due to financial limitations (Kornblit et al., 2018; Schroeder et al., 2019).

To provide individualized recommendations and meet patients where they are, SDOH data much be collected on patients and their families. Universal screening tools like the NC DHHS SDOH Screening Questionnaire, the WE CARE survey, the Health Leads Survey, the HealthBegins Upstream Risks Screening Tool, and the Bright Futures Pediatric Intake Form are all options to consider as a screening tool to be adopted by a medical practice, but it would be best for practices to utilize a community advisory group to review the screening tool for relevance with their patient population (Fierman et al., 2016; Hensley et al., 2017). Optimal length of questionnaire, frequency of screening, and logistical challenges all are considerations that need more investigation to provide practices with concrete evidence-based practice recommendations for the collection of social determinant data.

Medical providers must consider negative consequences of the adolescent's psychosocial risk factors when recommending behavioral interventions to adolescents and their families (Ewald & Haldeman, 2016; Röbl et al., 2013). Medical providers may consider adaptations of conventional nutrition and physical activity recommendations to better meet their patients' needs and accommodate for limitations due to SDOH. Furthermore, ongoing surveillance is needed to ensure that all needs of the family are met over time, as attempting to address all of the needs at once may be overwhelming for the medical provider and family (Chung et al., 2016). Medical offices may have lists of community resources to provide to patients with identified needs; however, these resource lists must be updated periodically because the availability of local and national resources may vary over time based on funds and community needs (Chung et al., 2016). Medical providers may not be comfortable with questioning patients regarding their

social needs due to their lack of training on social screenings and how to respectfully respond to a patients' concerns (Garg et al., 2016). The AAP has already identified that these tasks falls within the scope of practice for pediatricians, so medical schools must evolve their curriculum to equip their students with the necessary skills to deal with a patient's social needs (Doobay-Persaud et al., 2019).

Pediatric medical providers are in the unique position to promote the adaptation of healthy lifestyle habits and to screen and support families to overcome social barriers they experience. Social risk-informed care may help improve a patients' adherence with a medical providers lifestyle recommendations which ultimately improves the clinical outcomes like blood pressure status (Gurewich et al., 2020). Medical providers perceptions of and response to adolescent HTN has not been sufficiently researched, especially since the release of the updated guidelines. The purpose of this study is to examine the processes used and barriers experienced by the medical provider regarding the diagnosis and treatment process of elevated BP and HTN and to identify if and how SDOH play a role in exam room messaging to adolescents and their families.

Methods

Participant Recruitment and Study Design

Semi-structured interviews were conducted with twelve medical providers who treat adolescents in North Carolina (NC). Participants were recruited through the NC Pediatric Society listserv and Federally Qualified Health Centers. Participants were also recruited through contacts within three academic medical centers (two located in central NC and one located in eastern NC) and three major healthcare systems (all located in central NC). Recruitment flyers and emails were sent to practice managers and directly to medical providers to request

participation and sharing of the study information with colleagues. To participate, medical providers held one of the following credentials: Doctor of Medicine (MD), Doctor of Osteopathic Medicine (DO), Physician Assistant (PA), or Nurse Practitioner (NP). Medical providers who did not hold these credentials or those who did not treat adolescent patients were excluded. Participants were excluded if they did not treat adolescent patients in an outpatient setting with the potential for follow-up appointments. Interview questions were developed specifically for this study based on a thorough review of the literature and knowledge of the 2017 AAP guidelines. The interview guide was content and face validated by three medical providers and three nutrition experts whose feedback was used to update the questions accordingly. From this process, one question was added to better identify who within the medical practice was responsible for collecting social determinant data from patients during appointments. In addition, probes were added to better elucidate with who (adolescent, caregiver, or both) the medical provider discuss diet related chronic disease concerns. Private interviews were conducted over the phone with only the participant and the interviewer present. Interviews lasted approximately 15 minutes and no incentives were provided to participants. This study was approved by the Institutional Review Board at the University of North Carolina at Greensboro and Cone Health.

Interview Transcript

The interview guide is located in Table 2. All questions asked in the interview were open-ended to encourage participants to discuss the issues pertinent to the objectives of this study and allowed the moderator (PI) to have limited influence during the interview process. Provider demographics (gender, race/ethnicity, credential, number of years of practicing medicine) and patient population demographics (race/ethnicity and socioeconomic status) were collected at the

start of each interview. Interview questions for medical providers included: methods for obtaining and following-up on BP measures, comfort with diagnosing and treating HTN, approaches to discussing weight related chronic disease, methods of collecting SDOH information, if/how SDOH influence provider messaging, access to a RD, and resources needed related to HTN or SDOH. All interview questions were asked according to the interview guide and training on qualitative methods.

Table 2. Medical Provider Interview Guide

1. How long have you been a medical provider?
2. What is your gender and your race/ethnicity?
3. Describe your patient population?
4. What processes are used in your practice setting to obtain accurate blood pressure measurements? How often are they obtained and how often do you follow up on these measurements?
5. Describe the adolescent patient you think of when you are told a child has primary hypertension.
6. How comfortable do you feel with diagnosing and treating adolescent hypertension? What factors contribute to your comfort or discomfort with this diagnosis and treatment?
7. How do you approach discussing weight related or diet related chronic disease?
8. If an adolescent presents with elevated blood pressure, how do you include social determinants of health in your screening of causative factors?
9. What treatment options are you able to offer to children (families) to help improve blood pressure status?
10. Who is responsible for obtaining information from a patient (or family members) regarding social determinants of health factors?
11. Who provides nutrition related recommendations to patients in your practice setting?
12. What resources do you need, or would you like to have that would improve your ability to diagnose or treat hypertension in adolescents?

Data Entry and Analysis

All interviews were audio-recorded and transcribed verbatim with transcripts checked for accuracy. Transcripts were returned to participants for the member checking process to validate the transcripts and provided medical providers with the opportunity to confirm the data obtained in the interview. Member checking was performed of verbatim transcript data and was used as a

form of respondent verification of ideas shared during the interview (Carlson, Julie A., 2010). Verified transcripts were then reviewed by the PI who performed content analysis to identify codes as described in the article by Elo and Kyngäs (Elo & Kyngäs, 2008). Theme identification and content analysis of the interview transcripts was completed by the primary investigator (PI) and two other nutrition experts who hold a doctoral degree in nutrition and hold the Registered Dietitian (RD) credential. The fourth reviewer and faculty advisor reviewed and supported the themes identified by reviewers. Similar information was seen consistently through the interview transcripts and researchers felt like no new information would be gathered from conducting additional interviews. All investigators came to a consensus on the emergent themes related to the study aims and theme saturation was achieved through the content analysis process.

Themes were reached through a deductive approach as they were determined a priori based on the interview questions. Five themes were identified including: (1) monitoring of BP in adolescents, (2) level of comfort associated with HTN diagnosis and management, (3) approaches to weight and diet related chronic disease discussions, (4) SDOH data collection and influence on provider messaging, and (5) resources desired. Monitoring of BP included methods of obtaining accurate measures, following-up on elevated measures, and referrals to specialists. Level of comfort included comfort with diagnosis, medicinal treatment, and lifestyle recommendations as well as referrals and use of guidelines. Approaches included use of objective information, nutrition recommendation, physical activity recommendations, other recommendations, resources utilized, and barriers experienced. SDOH data collection included the practice screening process, factors included, adjustment of messaging, resources available, and barriers experienced. Resources desired included suggestions for both HTN and SDOH.

Results

Demographics

Table 3 shows participant demographic information. Twelve medical providers participated in the phone-interview, with 8 of them having the MD credential and 4 with other credentials including a DO, PA, or NP credential. Nine of the providers work in an outpatient family medicine or pediatric practice. Three of the providers were specialists working in adolescent outpatient clinics. Of the participants, seven were female and five were male and ten were Caucasian and two were African American. Years of practice ranged from 3 years to 28 years of experience with an average of 11 years of experience. The majority of the providers reported serving a diverse patient population and approximately seven providers reporting they serve a low to low-middle income population.

Table 3. Baseline Characteristics of Medical Provider Respondents

Characteristic		<i>n</i>
Credential	MD	8
	DO	1
	PA	1
	NP	2
Gender	Male	5
	Female	7
Race	African American	2
	Caucasian	10
Years of Practice	<10 years	7
	>10 years	5
Type of Practice	Pediatric or Family Medicine Practice	9
	Specialist Practice	3
Patient Race/ Ethnicity	Diverse population	9
	Primarily African American or Hispanic population	3
Patient Socioeconomic Status	Primarily a low or low-to-middle income population	7
	Serve all income levels	5

Themes

Assessing BP in Adolescents

All providers reported obtaining blood pressure measures at visits with about half identifying the use of an electronic device and the other half reporting that a manual method was used (Table 4). For those medical providers working in a family medicine or pediatric practice setting, all providers reported recording measures at well checks and occasionally at other visits if the patient was being seen for abnormal weight gain/BMI, ADHD, or headaches. Most all providers reported that they would follow up with another BP reading within the same visit if the first measure was elevated, with four providers mentioning bringing the patient back in the future for additional follow up. Several providers highlighted the use of nephrology or cardiology specialists for assistance.

Perceived Characteristics of Adolescents with HTN

All 12 of the medical providers identified an overweight or obese weight status as the primary description of an adolescent with hypertension. Other characteristics associated with an adolescent with hypertension included sedentary lifestyle, family history of HTN, and an unbalanced diet. Diabetes, acanthosis, and metabolic syndrome were also identified as likely characteristics. The primary race identified was African American or Hispanic. Social factors identified included low income, difficulty with transportation, and low food security. Two medical providers did acknowledge that an adolescent with normal weight status could still have HTN.

Comfort with Assessing and Managing HTN

Medical providers level of comfort with diagnosing, prescribing medicinal treatment, and recommending lifestyle modifications is shown in Table 5. They expressed varying levels of

comfort with diagnosing and often were even less comfortable with medicinal treatment. Providers mentioned use of specialists to assist in the management of medications. Medical providers stated they were comfortable to very comfortable with providing lifestyle modification recommendations to their patients. Three participants mentioned the use of the 2017 AAP guidelines or the new reference ranges as a factor that increases their comfort. Barriers include lack of knowledge regarding medications for hypertension and increasing time since residency training.

Approaches to Discussing Weight and Diet Related Chronic Diseases

Medical providers (n=7) reported utilizing objective information like height, weight, BMI, or plotting of growth charts as a method of initiating these conversations with their patients (Table 6). Nutrition recommendations were made which primarily focused (n=7) on decreasing the intake of sugar sweetened beverages. Three providers also focused on portion control and one provider really focused on the family mission of making healthy dietary changes by planning meals and selecting healthy foods at the grocery store while maintaining a budget. Physical activity suggestions generally focused on walking with very few other options discussed. Time recommendations ranged from 15 minutes to 30 minutes to 1-hour. Medical providers suggested meeting the adolescent where they were and encouraged patients to make gradual changes by being active more days per week than their current routine.

Two medical providers utilize the 5-2-1-0 rule which combines multiple recommendations into one mnemonic device for patients to easily remember. This rule suggests 5 servings of fruits and vegetables per day, less than 2 hours of screen time per day, 1 hour of physical activity per day, 0 sugar sweetened beverages, and 10 hours of sleep. One medical provider felt specifically that this rule was too general and not useful to their patients. Other

recommendations include the use of biblical or religious references to increase patient action, improving sleep hygiene, and managing anxiety. Weight loss was discussed by one provider; however, three other providers had a barrier with discussing weight for fear of contributing to an unhealthy relationship with food or negative body image.

Providers only discussed the use of two different tools with their patients including the CDC MyPlate model to help teach portions and community programs to encourage exercise and healthy nutrition habits. One barrier identified was the distance and lack of transportation for some patients to the community programs. Other barriers included safety of the walking environment and exercise recommendations in the wintertime when it is too cold to be outside.

SDOH Knowledge and Messaging

Medical practice screening methods included a questionnaire or screener completed by patients (either on paper or with a nurse asking the questions) and questioning by the medical provider when in the exam room (Table 7). Eight providers report that their practices use a screener and all 12 medical providers report using questioning during the visit as a method of assessing social needs. Factors investigated primarily included food security and access to a safe space to exercise. Other factors occasionally included were power security, transportation, home life, health care access, parental education, and income. Providers discussed efforts to alter messaging for exercise by suggesting adolescents watch YouTube or TikTok dance or exercise videos inside their home or participate in school sports if they do not have access to a safe space to exercise. Messages were modified when providers had food access concerns by discussion portion control or encouraging adolescents to choose the healthier foods of the options they have.

Very few resources were utilized by providers or offered to patients. Use of a social worker was mentioned by two participants. Community program or SNAP benefit referrals,

Medicaid transport, free food bags, and use of local parks or libraries were used or recommended to patients and their families. Barriers experienced by providers included lack of knowledge of community resources for referral, lack of specific template of SDOH questions available to guide exam room discussions, and form fatigue. In addition, one provider said it was hard to focus on things they do not have resources for or cannot help fix immediately for the family.

Use of Registered Dietitians

Only three participants had access to a registered dietitian (RD) within their practice while the other medical providers had to refer patients to outside clinics or community programs. Patient's insurance status was identified as a barrier for referral. Cultural relevance of the RD's messages were also expressed as a concern by one provider.

Resources Desired

A variety of resources related to HTN were identified including more education on the topic, consistent well child visits for BP evaluation, more time during visits to adequately address concerns, and improved workflow practices by having the electronic health record flag concerning BP values to ensure that none are overlooked (Table 8). Eight providers identified more community resources, updated lists of resources to give patients, and culturally relevant handouts as resources desired related to SDOH. Two medical providers identified the need for a dedicated staff member or care coordination manager to help connect families with resources and follow-up on their progress. Other SDOH resources included more time with patients to adequately screen and address all concerns, an electronic health record flag for SDOH concerns, and community screenings of all adolescents in Title I schools who may have reduced health care access among other social limitations.

Table 4. Monitoring Blood Pressure in Adolescents

Themes	Quotations	n
Obtaining accurate measures at routine visits	MD2: We use the Dinamap blood pressure machine for every patient, every visit the patient gets a blood pressure check. MD5: Blood pressures are measured in the clinic. We don't use the Dinamap. We use correct size cuffs for the size of the arm and the age. The nurses in our offices, at the time they room the patient in the seated position, will take the blood pressure. I routinely repeat the blood pressure during the office visit.	12
Measuring blood pressure based on other factors (BMI, abnormal weight, ADHD, headaches)	MD1: We also get them [bp] regularly on screening with oscillometry for BMI visits and ADHD visits, so BMI if they have abnormal weight gain we will get the blood pressure and ADHD visits we get the blood pressure. MD3: If we have a sick visit with headaches or syncope, or some sort of clinical indication, we will definitely check a blood pressure.	3
Following up on elevated readings	MD1: Typically, what we'll do is once they're elevated on oscillometry, we get a manual [bp]. We confirm with a manual, usually only in one extremity from there. And then based off of the manual blood pressure that determines our follow up. MD6: If they [the adolescent] are abnormal in the clinic, we will have our CNA's repeat the blood pressure before the child leaves. If the child had an elevated blood pressure on the first reading and they have a normal blood pressure on the second reading, we continue routine surveillance at the well visits.... But if you have an elevated blood pressure on the first check and then repeat check is elevated as well.... then we will bring you back to the clinic..... one-to-two-month range for a nurse visit to get repeat blood pressure. MD7: I would repeat it at the end of the visit but before vaccines. Then if I can tell or Mom says, "you know my kid is super anxious and I don't think they have high blood pressure" then depending how high it was, if they were asymptomatic then I would follow up within the month. NP2: Sometimes we'll get the nurses to obtain the blood pressure again once the patient has calmed down if they seem like they're nervous at the end of the visit and a lot of times if it looks like something that's kind of been trending in that direction or there's a family history, we will bring them back for some blood pressure readings.	10
Referrals	MD6: If it [bp] is persistently elevated at the repeat blood pressure then we go down the path of further working up the child and getting a little bit more history and getting basic blood work to look at kidney function and depending on how that goes, going down the route of further renal evaluation with urine studies and more kidney specific studies or cardiology focused work up. We actually have diagrams in each of the areas of our clinic that has the algorithm of what to do and when to get tests and when to refer to different providers. NP2: We do have some patients that are obese and are being followed by nephrology for their blood pressures.	2

Table 5. Level of Comfort Associated with Hypertension Diagnosis and Management

Themes	Quotations	n
Level of comfort with diagnosis	MD5: I'd say I feel very comfortable with it, mostly from seeing all age ranges. MD7: Because I did the medicine component of my residency, I feel probably a lot more comfortable than most of my colleagues do. It's becoming a little bit more uncomfortable as I get further and further away from my medicine training, but I do feel comfortable for sure referring.... or doing basic laboratory work up as well as working on lifestyle changes. MD8: In terms of diagnosis, I feel pretty comfortable with that, in part I'm a little bit newer out of residency training and there were new pediatric hypertension guidelines that came out in 2017, so I was still in the midst of training and because of that I may be a little bit more familiar with them than if they had come out after I completed my residency training.	11
Level of comfort with treatment (medicinal)	MD6: I would say to diagnose and to start treatment at the beginning, I would say I'm a 6.5 to 7 out of 10 for the initial work up and management. But if there's not good blood pressure control after starting one agent [medication]..., I would send them to a specialist.... So starting the process more comfortable then OK, we're not having good control with this, I need to move on to sending you somewhere else.	11
Level of comfort with treatment (lifestyle recommendations)	MD5: I'm very comfortable with that [recommending lifestyle changes] in terms of negotiating with the parent-child-dyad what each party is realistically responsible for in terms of shopping, food preparation, food choice in and outside the house, portion control, and also tailoring that to resources and educational status. Those are my big emphasis and I think we do a good job of that. Of course, the social determinants are the hardest yet most crucial things to link into that, and that's where we don't success as often as we should. MD6: Very comfortable, I'd say 9 out of 10 if not 10 out of 10. MD 7: I feel very comfortable with that [making lifestyle recommendations]. The main issue that I run into is that a lot of the socioeconomic concerns that a lot of our patients have, limits what we are able to do or how much they are able to comply with what we recommend. PA1: Very comfortable. I do that on almost every well child visit, whether they're obese or not.	12
Referrals	MD3: I would say that I'm not very comfortable with treating it [hypertension]. We do a lot of bringing people back for blood pressure checks and then if we are kind of consistently getting elevated measures, we will usually refer them to cardiology... or nephrology.... But we do not do a lot in our clinic with starting medicine on our own without some guidance from a Specialist. NP2: We typically don't, because we are a pediatric practice, determine if they have hypertension or not. I usually say elevated blood pressure reading without diagnosis and hypertension and then we do send them to nephrology for kidney function studies and usually they will manage hypertension and the medications they are on.	8
Use of guidelines or reference materials	MD1: The factor that contributes to it [being pretty comfortable] is that reference resources are readily available. We've posted signage in our work room as far as the algorithm, the workflow management, so we're able to quickly reference that based on elevated, stage one, or stage two, what the follow up recommendations are, and what any lab work up would be. We also work closely with pediatric nephrology, so we're able to incorporate ambulatory blood pressure monitoring into our diagnosis as well.	3

Table 6. Approaches to Weight and Diet Related Chronic Disease Discussions

Themes	Quotations	n
Use of objective information (height, weight, BMI, growth charts)	MD7: I bring in a picture of the growth curve and so I show them that, and I say “I’m happy anywhere between 10% and 90% and I’ll follow your curve and I want to make sure you’re staying about the same percentile with each visit. When I notice that you’re above the 90 th percentile, I start to get concerned about unhealthy behaviors that can result in things that are dangerous for your body. I’m noticing that you’re at the 97 th percentile and that your blood pressure is on the higher end, and so we need to make some changes so that we can get your body to being healthier.”	7
Nutrition recommendations made	MD1: For the most part, what I’m typically seeing is patients will be skipping breakfast... recommend a healthy cereal or oatmeal in the morning. Snacks are typically chips, or for the obese patients are typically chips, cookies, or candy, so I’ll make a recommendation for healthy snacking – fruit or vegetable with an added protein such as cheese, yogurt, peanut butter, or humus. Dinner, I’ll assess how often they’re eating out or going to fast food.... I try to do mutual decision making to see what two can we work on that day.... And then drinks are almost across the board doing juice or soda or sweet tea. So that’s kind of the easiest one. Usually that’ll be my primary focus of reducing high sugar, high calorie drinks. MD3: I try to make it more about healthy diet than about weight.... That doesn’t go over well when you make it about weight. I try to focus on healthy diet and try to find some places in there to make baby steps.	12
Physical activity recommendations made	MD5: Then I try to focus on the achievable exercise goals, particularly with involving the family.... the walking program, getting outside together, but one of the issues that I’ve had in some other practices and fortunately not so much with where we’re located, is the safety of the walking environment. That’s the really big thing. MD8: And then in terms of physical activity, again it depends on where the patient is, kind of what their current physical activity is, but I try to tell patients and their families 30 minutes of active play in which the heart rate is getting up and enough so where it’s causing you to sweat. So, whether that’s running around on the playground, or if they’re involved in youth sports.	11
Other recommendations made	MD6: The 5210 rule... 5 fruits or vegetables a day, 2 hours or less of screen time a day, 1 hour or more of activity per day and then 0 sugary beverages per day.... and 10 hours of sleep is kind of the goal we are shooting for.... I kind of like to give the framework [5210 rule] first... so that we have a basis of “these are examples, these are my goals for you” by this point we’ve talked about what their diet in general is like, what their activity levels are like, and we’ll go through and see, “of these areas, is there anything you know based on what you told me that you think would be easy for you to make a change or something that you may want to change?” MD7: I make a goal of staying the same weight, I don’t make a goal of losing weight for most children, but rather staying the same weight and becoming healthier at that weight.	6

Table 6 (Continued). Approaches to Weight and Diet Related Chronic Disease Discussions

Themes	Quotations	n
Tools or resources utilized	MD1: If they [the adolescent] offer [report] a healthy diet, not areas of a lot of sugar or oils or fats, then I work on portion control.... We look at plate size. I use the CDC healthy plate method. PA1: We have a program called [program name] which gets them [the adolescent] with a nutritionist, a personal trainer, and then another provider if they feel like other medications would be beneficial.	5
Barriers identified	MD8: Adolescent patients are just going through a lot of changes and talking about weight with anyone can be very delicate. But the last thing you want to do is create or further contribute, potentially in the same way or a different way to an unhealthy relationship with food and body image.	7

Table 7. Social Determinants of Health Data Collection and Influence on Medical Provider Messaging

Themes	Quotations	n
Practice screening process	MD1: So that's actually kind of in a dynamic state for us right now. Typically, it had just been the provider seeing the patient for a well check. In the well check, we update the social history and get the living situation. Typically, we ask if it's a safe, stable home, food security, electric security, power security, transportation. We do have a clinic social worker who in the past we had referred to for any needs assessed. But just recently, within the last two months we got enrolled in a study called We Care where we are going to initiate a site through Boston University.... they are screening if they have any needs for clothing, transportation, food, domestic violence... pretty much all the social determinants of health categories and then following up with a booklet where we can connect them with community resources in order to address those needs. MD3: We tried to institute a social determinants of health screening. I have not seen it lately. I think that it has fallen by the wayside. So, I would say that right now it is about questioning, just asking history questions.	12
SDOH Inclusion	MD5: We do [collect social determinants of health information] and generally in my place of work there's a program called Remarkable Rooming where we try to standardize the rooming procedures for all clinics and so the nurse that's rooming the patient will go through the social history, so I'm presented as I review the chart with a wheel of social determinants – food insecurity, tobacco, safety issues will be highlighted as red if there's a problem, or green if it's ok. NP2: We actually have a form.... Called a Seek form that has some of the social determinants of health on there about food and different things like that and stress and just family in general. But I usually try to talk a little bit about what our family is like... Do you have 2 parents? Do we have a single parent family? Is it a grandparent taking care of the child?... Because that happens quite a bit where grandparents are really the primary caregiver. Then we talk a little bit about family history and lifestyle choices... What kinds of foods we eat and what foods we have access to and different options as far as SNAP benefits.... talking about access and ability to do regular exercise activities	12

Table 7 (Continued). Social Determinants of Health Data Collection and Influence on Medical Provider Messaging

Themes	Quotations	n
Medical providers' adjustment of recommendations	<p>MD8: I will talk about portion control because regardless of what food you have access to, portion control is something that can be done, and that's also hard to get an idea of exactly what sort of portions we're getting but talking about one plate of food per meal with some snacks in between is generally a good guideline. Things that are going to be attainable hopefully regardless of what someone's socioeconomic status is.</p> <p>DO1: Especially my kids who are not able to go outside or don't feel safe outside, we talk about ways to increase physical activity at home, so if they're at home and they say they play video games all the time, I'm like "Ok, while you're playing, stand up and move your legs and do all these types of physical activities while you're playing your video game just to get something in."</p> <p>PA1: I do consider their access to health care and usually they've told me what they do for exercise so whether or not there's a safe place, I guess I'm kind of assessing that I don't know if my brain, my train of thought, always goes through that, but I am if they're already telling me what they're doing something. I don't think I'm very good about talking... what do you have in the house to eat? I don't think I get that specific. I ask them more like what they think their bad habits are and I go after that.</p>	11
Resources available	<p>MD5: We do offer food bags of healthy food at our clinic for families who are in need, so I will ask, are you concerned about getting food and if so, we can give you a food bag and once a week if you need [food] you can come to the clinic and ask for some.</p> <p>NP2: Transportation is a big issue sometimes.... Some of our patients do come by Medicaid Cab, but I would say most have their own family form of transportation, but some of them also get rides from friends, so that will also play a role in how they can get places to get food and to get activity.</p>	9
Barriers experienced by providers to improve messaging	<p>MD5: There's no template that you can go through and ask all these questions when it comes to social determinants of health. We'll have stuff related to more, I don't want to say minor, but with things like bike helmet safety, lead safety, but not much on food security or how often are you eating out per week. It's not built in concretely, so it's kind of left to each provider to ask or inquire based on their style.</p> <p>MD5: I feel personally sometimes it's hard if we can ask all these social determinants of health questions, but if there's nothing I can actively act on at the moment, it's kind of is hard to keep probing. Like when it comes to housing insecurity issues and that's causing problems because they don't have electricity half the time and can't keep refrigerated foods. It's like I can give you the contact information for a Legal Aid or the Housing Coalition, but I don't know how busy they are or how fast. That doesn't fix now.</p> <p>MD7: Currently we just have a three-question template that asks about food security as well as transportation and smoking. But in the past, there have been more complex forms. We found that a lot of our patients were getting a little bit of form fatigue and so we opted to decrease to the simple 3 questions.</p>	4

Table 8. Resources Desired Related to Hypertension or Social Determinants of Health

Themes	Quotations	n
HTN resources desired	<p>MD3: I guess some more education. We might feel more comfortable treating it [hypertension] before referring if we had a little more education. I think we're just afraid we'll miss a renal artery stenosis, or you know something like that, and we will be treating it like plain old high primary hypertension, and we don't want to do that. I think if we had maybe some more education about ruling out those worrisome things that need intervention that might help us.</p> <p>MD8: This would be more of a workflow or in office kind of system to implement but for one, we get so much data every time a child comes in: vital signs, their blood pressure, their growth, all these things, all of these other questions that we ask about development and mental health, family life, home life, all these things. We get so much information. Sometimes you can get a blood pressure reading that is abnormal that can go unnoticed either completely or until after the patient has left and you're going to close out some charts at the end of the day.... So having some sort of system in place where if we got an abnormal blood pressure reading then automatically something was triggered to ok, let's have the patient sit, for even just 5 minutes, in proper position and have a blood pressure repeated by the nurse and then have the nurse verbally let the provider know.... That would very much help because we would really avoid missing all the counseling and some of the discussion at the visit regarding blood pressure that really needs to be taking place and instead, we're sending a message over the patient portal or giving the patient a call after the fact.</p>	6
SDOH resources desired	<p>MD1: In a perfect world, I would love to have a dedicated staff member in our clinic. Like our social worker, she's already stretched really thin.... so, if we had a more dedicated stat member who could spent at time with patients addressing those needs and actually walking them through the process because the other concern I have is, if we give them the information are they going to follow up on that information? It'd be nice if we could spend the time there in the clinic, making the calls, getting them set up to address their needs. You know right there that visit, but that's kind of beyond our capabilities right now.</p> <p>MD3: In terms of the social determinants of health, we just need more time. We need more time to assess them more thoroughly and to guide people to more resources and it's just so hard to accomplish in 15 minutes.</p> <p>MD8: I think having readily available and by category, depending on whatever social determinant of health people are experiencing, having readily available resources to give patients would be really helpful because it's one thing to say "Yeah, there's this organization, you can look it up online and they have this" but if I could hand them a flyer and say "Hey, call this number. These are the services they can offer, and I think this would be a great resource." That would be really helpful.</p> <p>DO1: Maybe handouts or information about how to eat healthier that is culturally specific. Something that's really easy for me to add to the AVS or the paperwork that they get afterwards, that is very to the point and brief that I could discuss.... I just feel like some of the stuff we get is not applicable to my patient population and it would be great if I just had some material that was eye-catching and got them interested and was truly applicable to them and came in obviously English and Spanish. That would make things so much easier.</p>	12

Discussion

The high rates of families living in poverty and knowledge of how an adolescent's unmet social needs can lead to future negative health implications, like heart disease or diabetes, supports the need for further analysis of medical providers' perceptions and management of HTN and their consideration of SDOH in messaging with their young patients and families. The objective of this study was to examine processes used by medical practices to record and assess blood pressure measurements and to determine if and how providers alter their messages to patients based on the SDOH.

Providers in the study indicated that they have variable approaches for the measurement, diagnosis, treatment, and monitoring of HTN. Most providers reported collecting annual BP measures beginning at three years of age which aligns with the 2017 clinical guideline recommendations. While the use of oscillometric or auscultatory methods to measure BP is approved for the first blood pressure reading, all follow up readings should be taken manually with the appropriate cuff size per the guideline recommendations (Flynn et al., 2017). This practice was not reported by all practices, nor were practices reporting regular follow-up schedules per the guidelines. Oscillometric devices have been reported to overestimate systolic and diastolic BP by 10 mmHg in comparison to a BP obtained by auscultation (Park et al., 2005). This difference could result in the misclassification of an adolescent and highlights the importance of following up with a manual measure.

Several providers mentioned methods to ensure that nurses utilize the appropriate size arm cuff since use of the improper size cuff can result in an inaccurate blood pressure measure. A survey of pediatric specialists revealed that the most common problem was over referral due to inaccurate BP readings suggesting that increased staff training and provision of appropriate

equipment are needed to improve BP measurement accuracy in the primary care setting (E. Yoon et al., 2015).

Studies have concluded that the use of the simple threshold measures are suitable and accurate for clinical practices to employ for the routine diagnosis of elevated BP and HTN; however only two medical providers made mention of these guidelines and the threshold values (Fan et al., 2019; Liu et al., 2019). Providers who were more aware of these new guidelines were in their first six years of practice and were likely trained during residency on these updated practice guidelines.

All of the medical providers interviewed identified overweight or obese weight status as a characteristic associated with an adolescent that has hypertension. One study found the prevalence of abnormal BP to be 43.1%, much higher than the estimated rates of elevated BP and HTN in the United States (Ewald et al., 2017). The concern is that normal weight patients may not be deemed at risk and therefore they may not have their blood pressure adequately assessed to determine if the adolescent has elevated blood pressure. Other factors medical providers associated with a hypertensive adolescent were physical inactivity and poor diet. This supports prior research that physicians were more likely to consider adult risk factors associated with HTN, like poor dietary intake or sedentary lifestyle, for obese adolescents while physicians often recommended further medical testing for a thinner, younger patient to assess for secondary HTN (E. Y. Yoon et al., 2013).

Providers in this study indicated they were completely comfortable with providing lifestyle recommendations to adolescents with hypertension while they were less comfortable with prescribing medications for HTN. In a survey of medical providers, 40% of respondents identified as “uncomfortable” in evaluating and treating hypertensive adolescents. This could

partially be due to 54% of respondents being unfamiliar with the guidelines in the Fourth Report, which provided the AAP recommendations for treatment of adolescent HTN at the time of this study (Boneparth & Flynn, 2009). The lack of comfort may partially be due to lack of medical school or residency training regarding the monitoring of BP in adolescents or the lack of continuing education provided to medical providers as these new guidelines were released. In this study, providers who have been practicing three to six years mentioned the updated guidelines during the interview, stating that they were more recently trained on the guidelines which made them more comfortable with starting initial medicinal treatments than other providers. Previous research found that medical provider's comfort level is partially dependent upon their level of experience managing pediatric HTN which was supported in this study (Cha et al., 2014).

Research has shown that medical education is lacking in regards to preparing future physicians to provide applicable nutrition information and developing counseling skills so they are prepared to have productive diet related discussions with patients (Cooke et al., 2017). Despite most all providers in this study having access to a RD, a medical professional who is well equipped to provide tailored recommendations to patients, it was not clear how frequently referrals were made to further support the medical provider in the care plan. A RD can dedicate their whole time with the patient on providing recommendations that take into account the family's social needs while a medical provider must incorporate more analyses into their visit which may limit the amount of time they have to focus on dietary recommendations. Medical providers in this study identified time as a barrier to fully addressing an adolescent's whole dietary intake, so perhaps increasing use of RDs could provide more support to these providers and families. Furthermore, RDs are qualified to assess body size and diet quality and provide

recommendations that promote a healthy weight status in adolescents, making them uniquely positioned to support medical providers from the study who expressed concerns about addressing weight status without causing harm (Sastre et al., 2019).

Dietary recommendations provided often focused on sugar sweetened beverages or very general healthy eating practices. Often participants provided very generic recommendations when asked how they altered these messages based on knowledge of a patient's unmet social needs. Since the primary SDOH assessed were food access and safe space to exercise, recommendations did not always consider budget, living situations, and transportation which could play a role in the family's ability to adhere to the provider's recommendations. For example, a family may be unable to pick up free food from a local community center because they do not have a car. Improved nutrition training and SDOH training of medical providers could help to better prepare these practitioners to appropriately screen, provide tailored messages to adolescents, and connect families with community resources, ultimately promoting healthy weight and blood pressure statuses in these individuals (Bickerton et al., 2020; Cooke et al., 2017; Sastre et al., 2019). Health care workers need continued training opportunities to hone their skills and promote more equitable health outcomes for all patients in their community (Andermann, 2016).

Medical providers in this study rarely suggested physical activity guidelines that align with the Physical Activity Guidelines for Americans which recommends a minimum of 60 minutes of moderate to vigorous physical activity per day. Several providers emphasized meeting adolescents where they were which could be the reason for lower time recommendations, especially since studies show that 85% of adolescents do not meet physical activity recommendations (Kornides et al., 2018). Barriers to exercise were often related to

SDOH factors like access to a safe space to exercise or a caregiver that can accompany them outside while being more active. Providers suggested that messages could be altered based on social needs by suggesting adolescents are active in their home by watching exercise videos online or by playing a school sport, if desired. These altered messages assume that adolescents have internet access, transportation, and financial ability to provide any equipment needed to play a sport. For example, an adolescent may not be able to stay after school to play a sport because they must ride the bus home after school since their caregiver works in the evening. Without having knowledge about the family's home situation and access to transportation, the provider may not adjust their messaging to provide recommendations that are achievable.

Screening for social needs can detect adverse factors and conditions that must be dealt with and may require resources beyond those available to the medical provider. This leads to an ethical consideration of whether to screen for conditions that a provider may not have the resources or know of a community organization for which to refer the patient (Garg et al., 2016; Hensley et al., 2017). In this study, several providers identified their lack of knowledge of resources available as a barrier to providing specific recommendations, which may partially explain the more generalized messaging described by participants. Furthermore, medical providers may not be comfortable with questioning patients regarding their social needs due to their lack of training on social screenings and how to respectfully respond to a patients' concerns (Garg et al., 2016). As stated by one participant, without knowledge of community resources it is hard for providers to focus on needs when they do not know of or have resources to fix the problem.

Government policies, hospital systems, and community agencies all need to work together to actually impact the well-being of low-socioeconomic status patients (Garg, Homer, et

al., 2019; Krugman, 2021). Two interview participants suggested that this barrier could be overcome by having dedicated staff members who can keep resource lists up to date and help families navigate through registering for and acquiring resources need within the same office visit. Generating referrals requires a lot of time on behalf of the medical provider and necessitates follow up with patients and families to see if they were able to access the resources recommended. This must be done in a timely manner and requires a systemic approach whether it be from the use of electronic referrals, patient care navigators or case managers, or through interagency collaboration and communication (Garg et al., 2016).

Other barriers identified included lack of regular screening of children and the fact that it is easy to overlook a concerning BP due to the large amounts of information collected from patients during visits. Consistent well child visits would allow for regular BP checks, as well as evaluation of the family's unmet social needs. Incorporating flags in electronic health records for both elevated BP's and SDOH concerns could help ensure providers are aware of these factors during the assessment of the adolescent. These factors have been successfully integrated in primary care electronic health records and research recommends the creation of national standards for the representation of this data in electronic health records to support the development of the necessary infrastructure which not only supports the collection of the data but also maintains updated lists of community service providers for referrals (Buitron de la Vega et al., 2019; Cantor & Thorpe, 2018). One provider in the study identified receiving free and reduced lunch as a SDOH related risk factor that necessitates BP and BMI screening, perhaps even in the school setting to overcome transportation or cost barriers.

While this study was well thought out, there are still several limitations to identify. Due to the short time of the interviews, the information may lack some detail and may not provide

very specific examples. In addition, the small sample size, without more representation from minority providers may makes these conclusions less generalizable to all NC adolescent medical providers. Providers may have expressed biases as these interviews include self-reported data that cannot be verified. Unintended biases may have been introduced during the evaluation and interpretation of the interview transcripts despite following appropriate qualitative analysis procedures. We attempted to combat these limitations by using member checking to have participants validate the accuracy of their responses, and theme saturation was achieved showing that further data collection was unnecessary.

Conclusion

The results of this study show that improved care of adolescents with elevated BP status requires, for one, that their BP is accurately assessed on a yearly basis, and two, that medical providers need to be equipped to make tailored recommendations that are actionable for the family. When looking at BP measures, the provider must be comfortable with making the diagnosis and providing treatment recommendations based on the guidelines. Notably, the guidelines recommend lifestyle changes as the first line of defense for elevated blood pressure, stage 1 and stage 2 HTN. This highlights the importance of improving the nutrition education that providers receive while in medical school to prepare them to confidently initiate this conversation and provide culturally sensitive recommendations. In addition, the role of the RD as part of the care team should be embraced with this medical professional uniquely equipped to support patients in carrying out the medical providers recommendations by thoroughly assessing the adolescent's dietary intake and considering unmet social needs that may influence overall diet quality.

With the knowledge of the number of families living in poverty, medical providers cannot overlook the importance of assessing social needs in addition to the medical evaluation that they already complete. A more standardized SDOH assessment approach is needed while still providing flexibility for practices to customize a screener based on their population. Medical providers have suggested that they need support in this process, so further research should investigate methods to alleviate this stress on providers. Specifically utilizing electronic health records and other practice staff to support referrals and follow-up procedures could be good starting places. Importantly, a team approach may support both medical providers with the management of blood pressure and support families with unmet social needs as we work to improve the overall health and social status of our young adolescent patients. As one interview participant said, “the only reason that we’re spending time discussing this [chronic disease risk factors and lifestyle recommendations] is cause for the most part, the patients I’m talking to are young and relatively healthy, and it’s my job as their pediatrician to try to keep them as healthy as they can be going forward.” This profound statement emphasizes the core of preventive medicine and why it is a priority to support the growth and development of adolescents and fulfill social needs of families to keep them healthy for a lifetime.

CHAPTER VI: EPILOGUE

Overall Conclusions

This mixed-methods study led to some important conclusion regarding medical providers' comfort with managing hypertension (HTN) and how social determinants of health (SDOH) play a role in exam room messaging to adolescents and their families. Results of the survey showed that medical providers expressed limited comfort with treatment of hypertension (67%) while being completely comfort with providing nutrition recommendations (44%) and physical activity recommendations (49%). These results were also supported in the medical provider interviews. It was surprising that medical providers expressed greater level of comfort with providing nutrition education despite limited nutrition curriculum and training in medical schools (Cooke et al., 2017).

Most medical providers reported rarely having knowledge of their patients' social determinants of health factors like access to healthy food (64%) or caregiver's educational status (81%). Interviews revealed that collection methods related to SDOH varied. Some medical clinics used screening questionnaires and others primarily relied on questioning by the medical provider during the appointment. Most providers considered access to food and a safe space to exercise in their messaging to adolescents and families but provided general recommendations that may not meet a family's needs.

Overall, results suggest that both provider comfort and knowledge of SDOH need to be improved to better meet adolescent patients' needs and ensure that no adolescent is overlooked in the diagnosis process. The management of adolescent HTN is challenging because medical providers must consider clinical symptoms as well as unmet social needs when making recommendations to their patients. Altering messages to meet adolescents and families where

they are and providing referrals to appropriate community resources supports patients in their efforts to make changes for the better. A team approach, perhaps through the inclusion of a patient care manager as suggested by respondents, may be necessary to reduce the burden on the medical provider. While most all medical providers (98%) reported access to a Registered Dietitian (RD), only about a quarter of respondents reported that they very often refer hypertensive adolescents to a RD. Time as well as lack of knowledge of resources were cited by medical providers as limiting factors that prevent them from fully assessing a patient's food intake and providing achievable recommendations to improve their lifestyle habits. A RD is a valuable team member with expertise in nutrition education and time to address all dietary concerns while investigating social factors that may prevent families from making changes (Jortberg & Fleming, 2014). Future research should further investigate medical providers assessment of blood pressure measures in normal weight adolescents and methods to best collect and utilize SDOH data within primary care settings. In addition, more research should be done to further demonstrate the beneficial impact on quality of patient care from the addition of a RD as a care team member.

Problems Encountered

The process of researching for and writing a dissertation has been a challenging learning experience, to say the least. When returning to University of North Carolina at Greensboro in Fall 2018, I was excited to begin the process of researching on a topic that I am passionate about. My father has suffered from two heart attacks and his father also experienced heart issues, so when I landed on HTN as a focus I was motivated to add to the body of research. Along the way I have encountered several problems that I overcame to complete this research study.

The New Plan

Most notably was the COVID-19 pandemic which shutdown our community in March 2020. At this point, I had successfully prepared for a completely different research project. I had completed my literature review and developed and validated both a Caregiver Survey and a Teenager Survey to investigate the dynamics of the parent-child dyad as it relates to social determinant limitations and dietary habits of the adolescent. Upon meeting with Dr. Haldeman, we decided that by June 2020 we needed to make a call on whether or not we needed to alter my project due to the pandemic and the research restrictions in place on campus. Once June 2020 rolled around, it was very evident that the pandemic was here to stay for the time being, and that it was time to reevaluate my plans. In the meantime, I had started to investigate the role of the medical provider in the care of adolescents with elevated blood pressure. I expressed interest in further understanding if and how medical providers were assessing blood pressure status and how they were assessing social limitations of patients from underserved communities. We decided that this was a natural move for my doctoral research, given our inability to continue assessing from the patient's point of view.

Survey Challenges

With successful defense of my proposal in October 2020, I moved forward with obtaining IRB approval and beginning my recruitment process. I was highly optimistic that I would easily achieve my goal of 150 medical provider surveys and 15 interviews within a couple months. My optimism was further elevated because I already had a pediatrician who was willing to put in the request with the North Carolina Pediatric Society to have my research information sent out to their network of 3,500 providers. A week after this Listserv send out, I only had two survey responses. I called and emailed numerous Federally Qualified Health Centers and other clinics

across North Carolina. I targeted Academic Medical Centers and asked all friends and acquaintances if they could help me make any connections. We even added an incentive for participants, but I sat around thirty survey responses for months, until one day in May 2021 when I finally made a very important connection. A simple request of a local medical provider to connect me with a pediatric cardiologist, led to her confidently telling me that she could help me even more by sending out the research information to all pediatric clinics in her network. I was unaware of her leadership role which would enable her to support me in this manner. This experience taught me to network with anyone willing to speak with you, even if they don't seem like the person you are looking to recruit. After she sent out my recruitment email, I watched my survey responses go from the mid-thirties to mid-nineties within a 24-hour period.

This huge jump in responses was a big boost in confidence. Around this same time, I was connected with a Cone Health pediatric medical provider through a Cardiologist that I had worked closely with in my Graduate Assistant role. This pediatric medical provider was willing to serve as a Co-Primary Investigator (Co-PI), so I began down the pathway of attempting to get Cone IRB approval in hopes that this would bring in the remaining surveys needed. This took over three months due to some unidentified requests throughout the IRB process and the busy work schedule of my Cone Co-PI. When we finally received IRB approval, it took about another month before I was able to successfully contact several pediatric clinics in the Triad. This helped me obtain the total of 110 survey responses. While this did not meet my goal of 150 responses, with the additional stress of the pandemic on pediatric medical providers, especially due to the Delta variant affecting more pediatric patients, it has been increasingly difficult to obtain more survey responses.

In the future, I would try to obtain contact information of office managers as they were a great resource, especially after obtaining Cone IRB approval. Medical providers are very busy and were more likely to overlook an email request from me than from an office manager who communicated with providers on a weekly basis. In addition, if the climate was safe for me to visit clinics in person, in the future I think this would have been a helpful if I could have recruited in person at medical clinics.

Interview Challenges

There were approximately twelve medical providers who completed the online survey that opted in to participate in the interview. When I reached out to these medical providers, I only heard back from six to actually schedule and complete an interview. Thankfully, the contacts that I had made while recruiting for the survey were able to support me in finding six more providers to interview. The interviews were my favorite part of my research. It was totally different to hear their passion when discussing HTN and SDOH factors during the interview than when looking at the survey responses.

The analysis of the interview data was a challenge. I found myself second guessing my theme classifications, but ultimately by reviewing methods used for qualitative analysis in the literature and having a discussion with Dr. Haldeman about the process I was more confident in my completion of this portion of the research. I believe that in the future, I would feel more prepared to analyze transcripts from this experience.

Final Thoughts

While the challenges of writing a dissertation are abundant, I am proud of myself for being resilient through the process and am thankful for the guidance of my faculty advisor, Dr. Haldeman, who kept me on track. I really appreciate her encouragement and positivity

throughout the process and can still hear her saying “just keep going, you will have a breakthrough”! Research is challenging but very rewarding as you review the data and draw conclusions. I hope that I can add to the body of research related to adolescent HTN and SDOH, ultimately leading to improved care for adolescent patients and their families.

REFERENCES

- About Social Determinants of Health (SDOH)*. (2021, March 10).
<https://www.cdc.gov/socialdeterminants/about.html>
- Adamski, M., Gibson, S., Leech, M., & Truby, H. (2018). Are doctors nutritionists? What is the role of doctors in providing nutrition advice? *Nutrition Bulletin*, 43(2), 147–152.
<https://doi.org/10.1111/nbu.12320>
- Adler, N. E., Glymour, M. M., & Fielding, J. (2016). Addressing Social Determinants of Health and Health Inequalities. *JAMA*, 316(16), 1641. <https://doi.org/10.1001/jama.2016.14058>
- Albani, V., Butler, L. T., Traill, W. B., & Kennedy, O. B. (2017). Fruit and vegetable intake: Change with age across childhood and adolescence. *The British Journal of Nutrition; Cambridge*, 117(5), 759–765. <http://dx.doi.org/10.1017/S0007114517000599>
- Aliarzadeh, B., Meaney, C., Moineddin, R., White, D., Birken, C., Parkin, P., & Greiver, M. (2016). Hypertension screening and follow-up in children and adolescents in a Canadian primary care population sample: A retrospective cohort study. *CMAJ Open*, 4(2), E230–E235. <https://doi.org/10.9778/cmajo.20150016>
- Andermann, A. (2016). Taking action on the social determinants of health in clinical practice: A framework for health professionals. *CMAJ*, 188(17–18), E474–E483.
<https://doi.org/10.1503/cmaj.160177>
- Assari, S., Bazargan, M., & Caldwell, C. H. (2019). Parental Educational Attainment and Chronic Medical Conditions among American Youth; Minorities' Diminished Returns. *Children*, 6(9). <https://doi.org/10.3390/children6090096>

- Beal, J. A. (2018). Rethinking Blood Pressure Monitoring in Children and Adolescents. *MCN, The American Journal of Maternal Child Nursing*, 43(3), 172.
<https://doi.org/10.1097/NMC.0000000000000421>
- Bickerton, L., Siegart, N., & Marquez, C. (2020). Medical Students Screen for Social Determinants of Health: A Service Learning Model to Improve Health Equity. *PRiMER*, 4. <https://doi.org/10.22454/PRiMER.2020.225894>
- Bijlsma, M. W., Blufpand, H. N., Kaspers, G. J. L., & Bökenkamp, A. (2014). Why Pediatricians Fail to Diagnose Hypertension: A Multicenter Survey. *The Journal of Pediatrics*, 164(1), 173-177.e7. <https://doi.org/10.1016/j.jpeds.2013.08.066>
- Boneparth, A., & Flynn, J. T. (2009). Evaluation and Treatment of Hypertension in General Pediatric Practice. *Clinical Pediatrics*, 48(1), 44–49.
<https://doi.org/10.1177/0009922808321677>
- Brady, T. M., Solomon, B. S., Neu, A. M., Siberry, G. K., & Parekh, R. S. (2010). Patient-, Provider-, and Clinic-Level Predictors of Unrecognized Elevated Blood Pressure in Children. *Pediatrics*, 125(6), e1286–e1293. <https://doi.org/10.1542/peds.2009-0555>
- Brown, C. L., & Perrin, E. M. (2018). Obesity Prevention and Treatment in Primary Care. *Academic Pediatrics*, 18(7), 736–745. <https://doi.org/10.1016/j.acap.2018.05.004>
- Bryant, P. H., Hess, A., & Bowen, P. G. (2015). Social Determinants of Health Related to Obesity. *The Journal for Nurse Practitioners*, 11(2), 220–225.
<http://dx.doi.org/10.1016/j.nurpra.2014.10.027>
- Buitron de la Vega, P., Losi, S., Sprague Martinez, L., Bovell-Ammon, A., Garg, A., James, T., Ewen, A. M., Stack, M., DeCarvalho, H., Sandel, M., Mishuris, R. G., Deych, S., Pelletier, P., & Kressin, N. R. (2019). Implementing an EHR-based Screening and

- Referral System to Address Social Determinants of Health in Primary Care. *Medical Care*, 57, S133. <https://doi.org/10.1097/MLR.0000000000001029>
- Cantor, M. N., & Thorpe, L. (2018). Integrating Data On Social Determinants Of Health Into Electronic Health Records. *Health Affairs*, 37(4), 585–590.
<http://dx.doi.org/10.1377/hlthaff.2017.1252>
- Carlson, Julie A. (2010). Avoiding Traps in Member Checking. *The Qualitative Report*, 15(5), 1102–1113.
- Cha, S. D., Chisolm, D. J., & Mahan, J. D. (2014). Essential pediatric hypertension: Defining the educational needs of primary care pediatricians. *BMC Medical Education*, 14(1), 154.
<https://doi.org/10.1186/1472-6920-14-154>
- Chang, C. D. (2019). Social Determinants of Health and Health Disparities Among Immigrants and their Children. *Current Problems in Pediatric and Adolescent Health Care*, 49(1), 23–30. <https://doi.org/10.1016/j.cppeds.2018.11.009>
- Chung, E. K., Siegel, B. S., Garg, A., Conroy, K., Gross, R. S., Long, D. A., Lewis, G., Osman, C. J., Jo Messito, M., Wade, R., Shonna Yin, H., Cox, J., & Fierman, A. H. (2016). Screening for Social Determinants of Health Among Children and Families Living in Poverty: A Guide for Clinicians. *Current Problems in Pediatric and Adolescent Health Care*, 46(5), 135–153. <https://doi.org/10.1016/j.cppeds.2016.02.004>
- Cooke, N., Ash, S., & Goodell, L. (2017). Medical students’ perceived educational needs to prevent and treat childhood obesity. *Education for Health; Mumbai*, 30(2), 156–162.
http://dx.doi.org/10.4103/efh.EfH_57_16
- Daley, M. F., Sinaiko, A. R., Reifler, L. M., Tavel, H. M., Glanz, J. M., Margolis, K. L., Parker, E., Trower, N. K., Chandra, M., Sherwood, N. E., Adams, K., Kharbanda, E. O.,

- Greenspan, L. C., Lo, J. C., O'Connor, P. J., & Magid, D. J. (2013). Patterns of Care and Persistence After Incident Elevated Blood Pressure. *Pediatrics*, *132*(2), e349–e355. <https://doi.org/10.1542/peds.2012-2437>
- Doobay-Persaud, A., Adler, M. D., Bartell, T. R., Sheneman, N. E., Martinez, M. D., Mangold, K. A., Smith, P., & Sheehan, K. M. (2019). Teaching the Social Determinants of Health in Undergraduate Medical Education: A Scoping Review. *Journal of General Internal Medicine*, *34*(5), 720–730. <http://dx.doi.org/10.1007/s11606-019-04876-0>
- Doom, J. R., Mason, S. M., Suglia, S. F., & Clark, C. J. (2017). Pathways between childhood/adolescent adversity, adolescent socioeconomic status, and long-term cardiovascular disease risk in young adulthood. *Social Science & Medicine*, *188*, 166–175. <https://doi.org/10.1016/j.socscimed.2017.06.044>
- Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115. <https://doi.org/10.1111/j.1365-2648.2007.04569.x>
- Ewald, D. R., Bond, S. H., & Haldeman, L. A. (2017). Hypertension in Low-Income Adolescents: *Global Pediatric Health*. <https://doi.org/10.1177/2333794X17741819>
- Ewald, D. R., & Haldeman, L. A. (2016). Risk Factors in Adolescent Hypertension: *Global Pediatric Health*. <https://doi.org/10.1177/2333794X15625159>
- Ewart, C. K., Young, D. R., & Hagberg, J. M. (1998). Effects of school-based aerobic exercise on blood pressure in adolescent girls at risk for hypertension. *American Journal of Public Health*, *88*(6), 949–951. <https://doi.org/10.2105/AJPH.88.6.949>
- Falkner, B., Gidding, S. S., Portman, R., & Rosner, B. (2008). Blood Pressure Variability and Classification of Prehypertension and Hypertension in Adolescence. *Pediatrics*, *122*(2), 238–242. <https://doi.org/10.1542/peds.2007-2776>

- Fan, H., Liu, Y., & Zhang, X. (2019). Validation of recommended definition in identifying elevated blood pressure in adolescents. *The Journal of Clinical Hypertension*, 21(9), 1343–1349. <https://doi.org/10.1111/jch.13640>
- Federico, S. G., Cull, W., Olson, L., Garg, A., Racine, A. D., Fisher, A., & Dreyer, B. (2018). United States Pediatricians' Attitudes Regarding Public Policies for Low-Income Children and Their Profession's Advocacy Priorities. *Academic Pediatrics*, 18(7), 783–788. <https://doi.org/10.1016/j.acap.2018.04.003>
- Fielding-Singh, P. (2019). You're worth what you eat: Adolescent beliefs about healthy eating, morality and socioeconomic status. *Social Science & Medicine*, 220, 41–48. <https://doi.org/10.1016/j.socscimed.2018.10.022>
- Fierman, A. H., Beck, A. F., Chung, E. K., Tschudy, M. M., Coker, T. R., Mistry, K. B., Siegel, B., Chamberlain, L. J., Conroy, K., Federico, S. G., Flanagan, P. J., Garg, A., Gitterman, B. A., Grace, A. M., Gross, R. S., Hole, M. K., Klass, P., Kraft, C., Kuo, A., ... Cox, J. (2016). Redesigning Health Care Practices to Address Childhood Poverty. *Academic Pediatrics*, 16(3, Supplement), S136–S146. <https://doi.org/10.1016/j.acap.2016.01.004>
- Flynn, J. T., Kaelber, D. C., Baker-Smith, C. M., Blowey, D., Carroll, A. E., Daniels, S. R., Ferranti, S. D. de, Dionne, J. M., Falkner, B., Flinn, S. K., Gidding, S. S., Goodwin, C., Leu, M. G., Powers, M. E., Rea, C., Samuels, J., Simasek, M., Thaker, V. V., Urbina, E. M., & Children, S. on S. and M. of H. B. P. I. (2017). Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics*, 140(3). <https://doi.org/10.1542/peds.2017-1904>

- Fowokan, A. O., Sakakibara, B. M., Onsel, N., Punthakee, Z., Waddell, C., Rosin, M., & Lear, S. A. (2018). Correlates of elevated blood pressure in healthy children: A systematic review. *Clinical Obesity*, 8(5), 366–381. <https://doi.org/10.1111/cob.12271>
- Garg, A., Boynton-Jarrett, R., & Dworkin, P. H. (2016). Avoiding the Unintended Consequences of Screening for Social Determinants of Health. *JAMA*, 316(8), 813–814. <https://doi.org/10.1001/jama.2016.9282>
- Garg, A., Butz, A. M., Dworkin, P. H., Lewis, R. A., Thompson, R. E., & Serwint, J. R. (2007). Improving the management of family psychosocial problems at low-income children's well-child care visits: The WE CARE Project. *Pediatrics*, 120(3), 547–558. <https://doi.org/10.1542/peds.2007-0398>
- Garg, A., Cull, W., Olson, L., Boyd, A. F., Federico, S. G., Dreyer, B., & Racine, A. D. (2019). Screening and Referral for Low-Income Families' Social Determinants of Health by US Pediatricians. *Academic Pediatrics*, 19(8), 875–883. <https://doi.org/10.1016/j.acap.2019.05.125>
- Garg, A., Homer, C. J., & Dworkin, P. H. (2019). Addressing Social Determinants of Health: Challenges and Opportunities in a Value-Based Model. *Pediatrics*, 143(4), e20182355. <https://doi.org/10.1542/peds.2018-2355>
- Garg, A., Marino, M., Vikani, A. R., & Solomon, B. S. (2012). Addressing Families' Unmet Social Needs Within Pediatric Primary Care: The Health Leads Model. *Clinical Pediatrics*, 51(12), 1191–1193. <https://doi.org/10.1177/0009922812437930>
- Garg, A., Sarkar, S., Marino, M., Onie, R., & Solomon, B. S. (2010). Linking urban families to community resources in the context of pediatric primary care. *Patient Education and Counseling*, 79(2), 251–254. <https://doi.org/10.1016/j.pec.2009.10.011>

- Garg, A., Toy, S., Tripodis, Y., Silverstein, M., & Freeman, E. (2015). Addressing social determinants of health at well child care visits: A cluster RCT. *Pediatrics*, 135(2), e296-304. <https://doi.org/10.1542/peds.2014-2888>
- Gurewich, D., Garg, A., & Kressin, N. R. (2020). Addressing Social Determinants of Health Within Healthcare Delivery Systems: A Framework to Ground and Inform Health Outcomes. *Journal of General Internal Medicine*, 35(5), 1571–1575. <https://doi.org/10.1007/s11606-020-05720-6>
- Guzman-Limon, M., & Samuels, J. (2019). Pediatric Hypertension: Diagnosis, Evaluation, and Treatment. *Pediatric Clinics of North America*, 66(1), 45–57. <https://doi.org/10.1016/j.pcl.2018.09.001>
- Hales, C. M. (2017). *Prevalence of Obesity Among Adults and Youth: United States, 2015–2016*. 288, 8.
- Hanevold, C. D. (2013). Sodium Intake and Blood Pressure in Children. *Current Hypertension Reports; Philadelphia*, 15(5), 417–425. <http://dx.doi.org/10.1007/s11906-013-0382-z>
- Hansen, M. L., Gunn, P. W., & Kaelber, D. C. (2007). Underdiagnosis of Hypertension in Children and Adolescents. *JAMA*, 298(8), 874–879. <https://doi.org/10.1001/jama.298.8.874>
- Hassan, A., Scherer, E. A., Pikcilingis, A., Krull, E., McNickles, L., Marmon, G., Woods, E. R., & Fleegler, E. W. (2015). Improving Social Determinants of Health. *American Journal of Preventive Medicine*, 49(6), 822–831. <https://doi.org/10.1016/j.amepre.2015.04.023>
- Healthy People 2030* | health.gov. (2021, August). <https://health.gov/healthypeople>
- Healthy People 2030 Framework*. (2021, August). <https://health.gov/healthypeople/about/healthy-people-2030-framework>

- Hensley, C., Joseph, A., Shah, S., O'Dea, C., & Carameli, K. (2017). Addressing social determinants of health at a federally qualified health center. *International Public Health Journal*, 9(2), 189–198.
- Hojhabrimanesh, A., Akhlaghi, M., Rahmani, E., Amanat, S., Atefi, M., Najafi, M., Hashemzadeh, M., Salehi, S., & Faghih, S. (2017). A Western dietary pattern is associated with higher blood pressure in Iranian adolescents. *European Journal of Nutrition; Heidelberg*, 56(1), 399–408. <http://dx.doi.org/10.1007/s00394-015-1090-z>
- Hoy, M. K., Clemens, J., Martin, C., & Moshfegh, A. (2020). Fruit and Vegetable Intake Among Children by Level of Variety, What We Eat in America, NHANES 2013–2016. *Current Developments in Nutrition*, 4(Suppl 2), 206. https://doi.org/10.1093/cdn/nzaa043_057
- IBM SPSS Statistics for Macintosh (Version 28). (2021). [Computer software]. IBM Corp.
- Jackson, S. L., Zhang, Z., Wiltz, J. L., Loustalot, F., Ritchey, M. D., Goodman, A. B., & Yang, Q. (2018). Hypertension Among Youths—United States, 2001-2016. In *MMWR. Morbidity and Mortality Weekly Report; Atlanta* (Vol. 67, Issue 27, pp. 758–762). U.S. Center for Disease Control.
- <http://search.proquest.com/docview/2084357610/abstract/4EE5A26341714578PQ/1>
- Jago, R., Mendoza, J. A., Chen, T., & Baranowski, T. (2013). Longitudinal Associations Between BMI, Waist Circumference, and Cardiometabolic Risk in US Youth: Monitoring Implications. *Obesity; Silver Spring*, 21(3), E271–E279.
- <http://dx.doi.org/10.1002/oby.20080>
- Jortberg, B. T., & Fleming, M. O. (2014). Registered Dietitian Nutritionists Bring Value to Emerging Health Care Delivery Models. *Journal of the Academy of Nutrition and Dietetics*, 114(12), 2017–2022. <https://doi.org/10.1016/j.jand.2014.08.025>

- Kelishadi, R., Cook, S. R., Motlagh, M. E., Gouya, M. M., Ardalan, G., Motaghian, M., Majdzadeh, R., & Ramezani, M. A. (2008). Metabolically Obese Normal Weight and Phenotypically Obese Metabolically Normal Youths: The CASPIAN Study. *Journal of the American Dietetic Association*, 108(1), 82–90.
<https://doi.org/10.1016/j.jada.2007.10.013>
- Klein, J. D., Sesselberg, T. S., Johnson, M. S., O'Connor, K. G., Cook, S., Coon, M., Homer, C., Krebs, N., & Washington, R. (2010). Adoption of Body Mass Index Guidelines for Screening and Counseling In Pediatric Practice. *PEDIATRICS*, 125(2), 265–272.
<https://doi.org/10.1542/peds.2008-2985>
- Kornblit, A., Cain, A., Bauman, L. J., Brown, N. M., & Reznik, M. (2018). Parental Perspectives of Barriers to Physical Activity in Urban Schoolchildren With Asthma. *Academic Pediatrics*, 18(3), 310–316. <https://doi.org/10.1016/j.acap.2017.12.011>
- Kornides, M. L., Gillman, M. W., Rosner, B., Rimm, E. B., Chavarro, J. E., & Field, A. E. (2018). US adolescents at risk for not meeting physical activity recommendations by season. *Pediatric Research; New York*, 84(1), 50–56. <http://dx.doi.org/10.1038/s41390-018-0024-x>
- Krebs-Smith, S. M., Guenther, P. M., Subar, A. F., Kirkpatrick, S. I., & Dodd, K. W. (2010). Americans do not meet federal dietary recommendations. *The Journal of Nutrition*, 140(10), 1832–1838. <https://doi.org/10.3945/jn.110.124826>
- Krugman, S. (2021). Addressing Social Determinants of Health: Challenges and Opportunities in a Value-Based Model. *AAP News*.
<https://www.aappublications.org/news/2019/03/22/addressing-social-determinants-of-health-challenges-and-opportunities-in-a-value-based-model-pediatrics-3-22-19>,

- /news/2019/03/22/addressing-social-determinants-of-health-challenges-and-opportunities-in-a-value-based-model-pediatrics-3-22-19
- Kurnianingsih, M., Dewi, Y. L. R., & Pamungkasari, E. P. (2019). Risk Factors of Hypertension in High School Students: Multilevel Evidence of The Contextual Effect of School. *Journal of Epidemiology and Public Health*, 4(4), 259–269.
- Kwok, M. K., Schooling, C. M., Subramanian, S. V., Leung, G. M., & Kawachi, I. (2016). Pathways from parental educational attainment to adolescent blood pressure. *Journal of Hypertension*, 34(9), 1787–1795. <https://doi.org/10.1097/HJH.0000000000001003>
- Liu, Q., Hou, Y., Yang, L., Zhao, M., Li, S., & Xi, B. (2019). Diagnostic Effect of the Single BP Cut-Offs for Identifying Elevated BP and Hypertension in Adolescents Aged 13–17 Years. *Pediatric Cardiology*, 40(4), 738–743. <https://doi.org/10.1007/s00246-019-02058-7>
- Lloyd-Richardson, E. E., Jelalian, E., Sato, A. F., Hart, C. N., Mehlenbeck, R., & Wing, R. R. (2012). Two-Year Follow-up of an Adolescent Behavioral Weight Control Intervention. *Pediatrics*, 130(2), e281–e288. <https://doi.org/10.1542/peds.2011-3283>
- Manios, Y., Karatzi, K., Moschonis, G., Ioannou, G., Androutsos, O., Lionis, C., & Chrousos, G. (2019). Lifestyle, anthropometric, socio-demographic and perinatal correlates of early adolescence hypertension: The Healthy Growth Study. *Nutrition, Metabolism and Cardiovascular Diseases*, 29(2), 159–169. <https://doi.org/10.1016/j.numecd.2018.10.007>
- Marmot, M., Friel, S., Bell, R., Houweling, T. A. J., & Taylor, S. (2008). Closing the gap in a generation: Health equity through action on the social determinants of health. *The Lancet; London*, 372(9650), 1661–1669. [http://dx.doi.org/10.1016/S0140-6736\(08\)61690-6](http://dx.doi.org/10.1016/S0140-6736(08)61690-6)

- Maximova, K., O'Loughlin, J., Paradis, G., Hanley, J. A., & Lynch, J. (2009). Declines in Physical Activity and Higher Systolic Blood Pressure in Adolescence. *American Journal of Epidemiology*, 170(9), 1084–1094. <https://doi.org/10.1093/aje/kwp255>
- Meyer, D., Lerner, E., Phillips, A., & Zumwalt, K. (2020). Universal Screening of Social Determinants of Health at a Large US Academic Medical Center, 2018. *American Journal of Public Health*, 110, S219–S221. <http://dx.doi.org/10.2105/AJPH.2020.305747>
- Meyer, H. (2019). Most providers don't screen for social determinants of health. *Modern Healthcare*, 49(37), 12.
- Moore, L. L., Singer, M. R., Bradlee, M. L., & Daniels, S. R. (2016). Adolescent dietary intakes predict cardiometabolic risk clustering. *European Journal of Nutrition; Heidelberg*, 55(2), 461–468. <http://dx.doi.org/10.1007/s00394-015-0863-8>
- Moore, T. G., McDonald, M., Carlon, L., & O'Rourke, K. (2015). Early childhood development and the social determinants of health inequities. *Health Promotion International*, 30(suppl 2), ii102–ii115. <https://doi.org/10.1093/heapro/dav031>
- Morone, J. (2017). An Integrative Review of Social Determinants of Health Assessment and Screening Tools Used in Pediatrics. *Journal of Pediatric Nursing*, 37, 22–28. <https://doi.org/10.1016/j.pedn.2017.08.022>
- My Life Check | Life's Simple 7*. (2020, April). www.heart.org. <https://www.heart.org/en/healthy-living/healthy-lifestyle/my-life-check--lifes-simple-7>
- Negroni-Balasquide, X., Bell, C. S., Samuel, J., & Samuels, J. A. (2016). Is one measurement enough to evaluate blood pressure among adolescents? A blood pressure screening experience in more than 9000 children with a subset comparison of auscultatory to

- mercury measurements. *Journal of the American Society of Hypertension: JASH*, 10(2), 95–100. <https://doi.org/10.1016/j.jash.2015.12.001>
- Palacio, A., Seo, D., Medina, H., Singh, V., Suarez, M., & Tamariz, L. (2018). Provider Perspectives on the Collection of Social Determinants of Health. *Population Health Management*, 21(6), 501–508. <https://doi.org/10.1089/pop.2017.0166>
- Park, M. K., Menard, S. W., & Schoolfield, J. (2005). Oscillometric Blood Pressure Standards for Children. *Pediatric Cardiology*, 26(5), 601. <https://doi.org/10.1007/s00246-004-0828-9>
- Pediatrics, C. on C. (2016). Poverty and Child Health in the United States. *Pediatrics*, 137(4). <https://doi.org/10.1542/peds.2016-0339>
- Peltz, A., & Garg, A. (2019). Food Insecurity and Health Care Use. *Pediatrics*, 144(4), e20190347. <https://doi.org/10.1542/peds.2019-0347>
- Pinto, A. D., & Bloch, G. (2017). Framework for building primary care capacity to address the social determinants of health. *Canadian Family Physician*, 63(11), e476–e482.
- Ponzo, V., Ganzit, G. P., Soldati, L., De Carli, L., Fanzola, I., Maiandi, M., Durazzo, M., & Bo, S. (2015). Blood pressure and sodium intake from snacks in adolescents. *European Journal of Clinical Nutrition; London*, 69(6), 681–686. <http://dx.doi.org/10.1038/ejcn.2015.9>
- Qualtrics (October 2021). (2021). [Computer software]. Qualtrics. www.uncg.qualtrics.com
- Ranjit, N., Macias, S., & Hoelscher, D. (2020). Factors related to poor diet quality in food insecure populations. *Translational Behavioral Medicine*, 10(6), 1297–1305. <https://doi.org/10.1093/tbm/ibaa028>

- Riley, M., Hernandez, A. K., & Kuznia, A. L. (2018). High Blood Pressure in Children and Adolescents. *American Family Physician*, 98(8), 486–494.
- Röbl, M., Souza, M. de, Schiel, R., Gellhaus, I., Zwiauer, K., Holl, R. W., & Wiegand, S. (2013). The Key Role of Psychosocial Risk on Therapeutic Outcome in Obese Children and Adolescents. Results from a Longitudinal Multicenter Study. *Obesity Facts*, 6(3), 297–305. <https://doi.org/10.1159/000353468>
- Russell, M. (2019). Registered Dietitian Nutritionists Should Be Included in Patient Health Care Teams. *American Family Physician*, 99(3), 142–143.
- Saeed, A., Dixon, D., & Yand, E. (2020, April 6). *Racial Disparities in Hypertension Prevalence and Management: A Crisis Control?* American College of Cardiology. <https://www.acc.org/latest-in-cardiology/articles/2020/04/06/08/53/http%3a%2f%2fwww.acc.org%2flatest-in-cardiology%2farticles%2f2020%2f04%2f06%2f08%2f53%2fracial-disparities-in-hypertension-prevalence-and-management>
- Saini, P., Betcherman, L., Radhakrishnan, S., & Etoom, Y. (2020). Paediatric hypertension for the primary care provider: What you need to know. *Paediatrics & Child Health*. <https://doi.org/10.1093/pch/pxaa069>
- Sastre, L. R., Matson, S., Gruber, K. J., & Haldeman, L. (2019). A qualitative study examining medical provider advice, barriers, and perceived effectiveness in addressing childhood obesity to patients and families from a low-income community health clinic. *Sage Open Medicine; London*, 7. <http://dx.doi.org/10.1177/2050312119834117>
- Schroeder, K., Klusaritz, H., Dupuis, R., Bolick, A., Graves, A., Lipman, T. H., & Cannuscio, C. (2019). Reconciling opposing perceptions of access to physical activity in a gentrifying

- urban neighborhood. *Public Health Nursing*, 36(4), 461–468.
<https://doi.org/10.1111/phn.12602>
- Semega, J., Kollar, M., Shrider, E. A., & Creamer, J. F. (2020). *Income and Poverty in the United States: 2019*. 88.
- Siu, J. Y., Chan, K., & Lee, A. (2019). Adolescents from low-income families in Hong Kong and unhealthy eating behaviours: Implications for health and social care practitioners. *Health & Social Care in the Community*, 27(2), 366–374. <https://doi.org/10.1111/hsc.12654>
- Sokol, R., Austin, A., Chandler, C., Byrum, E., Bousquette, J., Lancaster, C., Doss, G., Dotson, A., Urbaeva, V., Singichetti, B., Brevard, K., Wright, S. T., Lanier, P., & Shanahan, M. (2019). Screening Children for Social Determinants of Health: A Systematic Review. *Pediatrics*, 144(4). <https://doi.org/10.1542/peds.2019-1622>
- South, A. M., Palakshappa, D., & Brown, C. L. (2019). Relationship between food insecurity and high blood pressure in a national sample of children and adolescents. *Pediatric Nephrology*, 34(9), 1583–1590. <https://doi.org/10.1007/s00467-019-04253-3>
- Surgeon General: Hypertension control must be national public health priority. (2020, October 7). <https://www.healio.com/news/cardiology/20201007/surgeon-general-hypertension-control-must-be-national-public-health-priority>
- Tobacco Use Among Children and Teens | American Lung Association. (2020, April). <https://www.lung.org/quit-smoking/smoking-facts/tobacco-use-among-children>
- Understanding Social Determinants of Health. (2020). *Hospital Case Management: The Essential Guide to Hospital-Based Care Planning*, 28(10).
<http://www.proquest.com/docview/2494829559/abstract/B1ABA01872E043A0PQ/1>

- U.S. Census Bureau. (2021, October 8). *Poverty Status: POV-01*. The United States Census Bureau. <https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-pov/pov-01.html>
- Ward, R. L., Robbins, J. M., Haden, R. N., Benson, B. J., & Esangbedo, I. C. (2016). Recognition and Management of Elevated Blood Pressure in Pediatric Patients: Challenges and Disparities in Community Health Centers. *Journal of Community Health; New York*, 41(2), 258–264. <http://dx.doi.org/10.1007/s10900-015-0091-4>
- Wellman, R. J., Sylvestre, M.-P., Nader, P. A., Chiolerio, A., Mesidor, M., Dugas, E. N., Tougri, G., & O’Loughlin, J. (2020). Intensity and frequency of physical activity and high blood pressure in adolescents: A longitudinal study. *The Journal of Clinical Hypertension*, 22(2), 283–290. <https://doi.org/10.1111/jch.13806>
- Wühl, E. (2019). Hypertension in childhood obesity. *Acta Paediatrica*, 108(1), 37–43. <https://doi.org/10.1111/apa.14551>
- Xu, R. Y., Zhou, Y. Q., Zhang, X. M., Wan, Y. P., & Gao, X. (2018). Body mass index, waist circumference, body fat mass, and risk of developing hypertension in normal-weight children and adolescents. *Nutrition, Metabolism and Cardiovascular Diseases*, 28(10), 1061–1066. <https://doi.org/10.1016/j.numecd.2018.05.015>
- Yoo, J. E., & Park, H. S. (2017). Relationship between parental hypertension and cardiometabolic risk factors in adolescents. *The Journal of Clinical Hypertension*, 19(7), 678–683. <https://doi.org/10.1111/jch.12991>
- Yoon, E., McCool, B., Filipp, S., Rocchini, A., Kershaw, D., & Clark, S. (2015). Pediatric Hypertension Specialists’ Perspectives About Adolescent Hypertension Management:

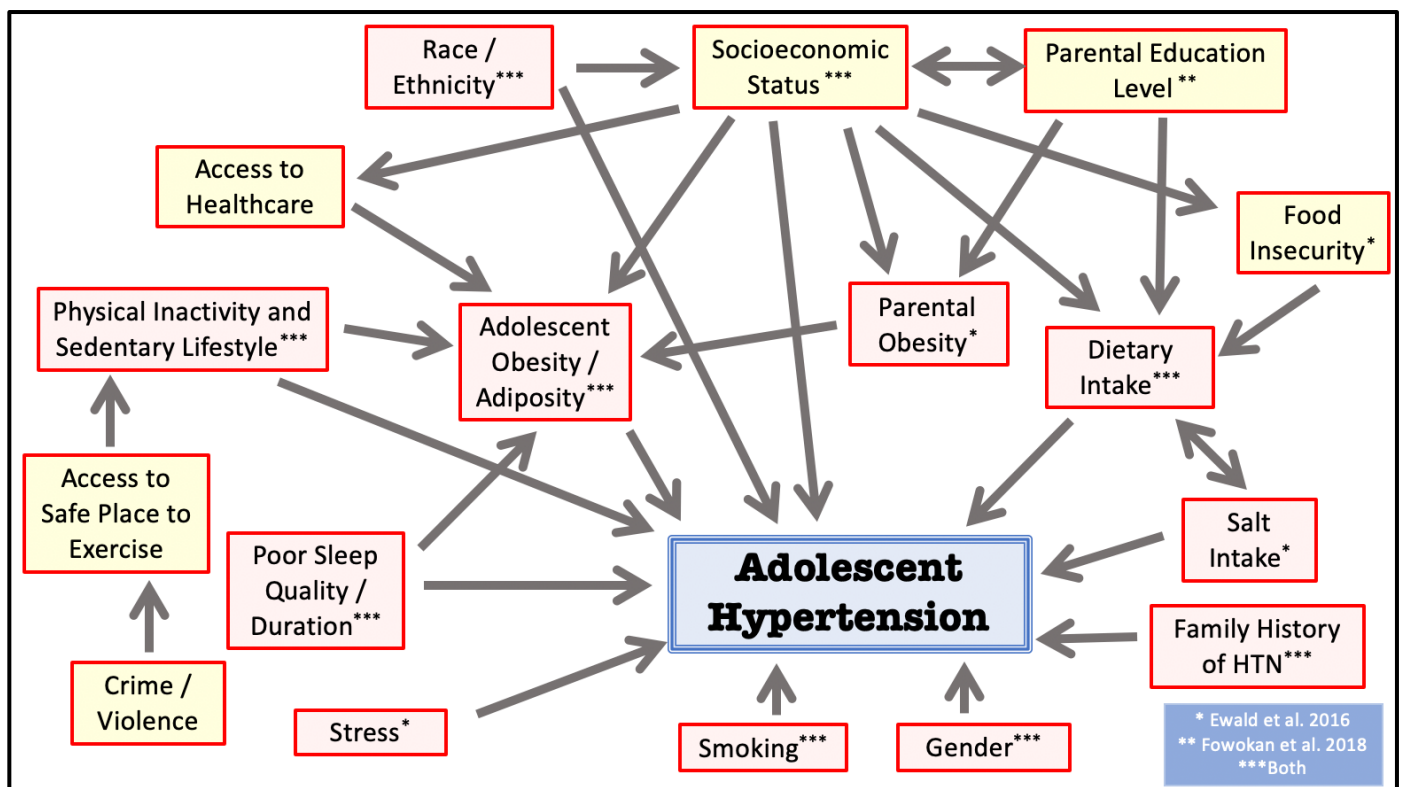
Implications for Primary Care Providers. *Clinical Pediatrics*, 54(6), 551–556.

<https://doi.org/10.1177/0009922814558248>

Yoon, E. Y., Weber, J. S., McCool, B., Rocchini, A., Kershaw, D., Freed, G., Ascione, F., & Clark, S. (2013). Underlying Rationale and Approach to Treat Hypertension in Adolescents by Physicians of Different Specialty. *Annals of Pediatrics & Child Health*, 1(1). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4300960/>

APPENDIX A: CONCEPTUAL MODEL

This conceptual model shows the relationship between risk factors of adolescent hypertension. The yellow highlighted risk factors are related to social determinants of health factors, for example, educational attainment reflected by parental education level and access to health care. Some of the social determinants of health directly influence adolescent hypertension while others have more of an indirect effect by influencing known risk factors.



APPENDIX B: ELECTRONIC SURVEY QUESTIONS

Adolescent Hypertension Study Medical Provider Electronic Survey Questions

Introduction:

The University of North Carolina at Greensboro is conducting a research study regarding adolescent hypertension. We are interested in learning more about the treatment of hypertension in adolescents, as well as, if and how social determinants of health play a role in how medical providers talk with their patients and families. **Your input is valued!!** Participate in the research study by completing this electronic survey. It will take approximately 10-15 minutes to complete, and all submissions are completely confidential.

You may download and review the consent form for this study:
[Adolescent Hypertension Study Information Sheet & Consent Form](#)

Click "continue" below to consent to participate in this research study and begin the survey.

PAGE BREAK

Screening Questions:

1. Do you treat adolescent patients (ages 13 – 18 years of age)?
 - a. Yes
 - b. No

2. Which of the following credentials do you currently practice medicine with?
 - a. MD
 - b. DO
 - c. PA
 - d. NP
 - e. None of the above

If NO to #1 or NONE OF THE ABOVE to #2, the participant is told they do not qualify to participate in the survey.

PAGE BREAK

Survey Questions:

3. What is your gender?
 - a. Female
 - b. Male
 - c. Cisgender female or male
 - d. Transgender female or male
 - e. Non-binary
 - f. Other _____
 - g. Prefer not to say
4. How old are you?
 - a. Age: _____ years
5. What is your race? (Check all that apply)
 - ☐ American Indian or Alaska Native
 - ☐ Asian
 - ☐ Black or African American
 - ☐ Native Hawaiian or Pacific Islander
 - ☐ White
6. Are you Hispanic or Latino?
 - a. Yes
 - b. No
7. How many years have you been working as a licensed medical provider with a pediatric population?
 - a. # of years: _____
8. In what city or town in do you practice pediatric medicine? (Please answer in city, state format)
 - a. _____, _____
9. Which of the following best describes the socioeconomic status of your patient population you serve?
 - a. Primarily a low-income population
 - b. Primarily a low-to-middle income population
 - c. Primarily a middle-income population
 - d. Primarily a middle-to-upper income population
 - e. Primarily an upper income population
 - f. We serve all income levels.
 - g. I don't know.

10. Which of the following best describes the race/ethnicity of the patient population you serve?
- a. Diverse population of children of all races/ethnicities
 - b. Primarily white non-Hispanic population
 - c. Primarily black non-Hispanic population
 - d. Primarily a Hispanic population

PAGE BREAK

11. What blood pressure measurement system is primarily used in your office for blood pressure measures performed by office staff?
- a. Auscultation sphygmomanometer
 - b. Oscillometric/electronic blood pressure device
12. Are blood pressure readings taken and recorded for adolescents (age 13 – 18 years old) seen in your practice setting?
- a. Yes
 - b. No

If answer A in #12, participant will see question #13 and #14

13. When are blood pressure readings taken in your practice?
- a. At every wellness visit Y/N
 - b. At every sick visit Y/N
 - c. If the adolescent appears to have symptoms of elevated BP Y/N
14. Why are blood pressure readings taken in your practice?
- a. Adolescent appears to be underweight or normal weight Y/N
 - b. Adolescent appears to be overweight or obese Y/N
 - c. There is a family history of elevated BP or hypertension Y/N
 - d. It is standard protocol in my practice Y/N
 - e. It is a billing and/or insurance requirement Y/N
 - f. Other: _____
15. An adolescent patient (age 13 – 18 years old) comes in and has elevated blood pressure, non-hypertensive? What would be the best course of action?
- a. Document the elevated blood pressure measure but not recheck at the present time
 - b. Recheck the adolescents blood pressure within the same office visit
 - c. Schedule a follow up appointment to recheck blood pressure in the future
 - d. Other _____

16. A 15-year-old male patient of normal weight has a blood pressure recorded of 124/79. The patient is asymptomatic and nothing on history or physical suggests secondary hypertension. When should the patient be scheduled for another blood pressure check?
- <1 month
 - 1-3 months
 - 4-6 months
 - At their next well check appointment in _____ months
17. A 15-year-old female patient of normal weight has a blood pressure recorded of 135/82. The patient is asymptomatic and nothing on history or physical suggests secondary hypertension. When should the patient be scheduled for another blood pressure check?
- <1 month
 - 1-3 months
 - 4-6 months
 - At their next well check appointment in _____ months

PAGE BREAK

18. On a scale of 1 to 5 where 1 is “not comfortable at all” and 5 is “completely comfortable”, please rate your level of comfort with the following regarding **elevated blood pressure**:

	1 = not comfortable at all	2	3	4	5 = completely comfortable
<i>diagnosing elevated blood pressure in adolescents</i>					
<i>treating elevated blood pressure in adolescents</i>					
<i>providing nutrition recommendations to adolescents with elevated blood pressure</i>					
<i>providing physical activity recommendations to adolescents with elevated blood pressure</i>					

19. On a scale of 1 to 5 where 1 is “not comfortable at all” and 5 is “completely comfortable”, please rate your level of comfort with the following regarding **hypertension**:

	1 = not comfortable at all	2	3	4	5 = completely comfortable
<i>diagnosing hypertension in adolescents</i>					
<i>treating hypertension in adolescents</i>					
<i>providing nutrition recommendations to adolescents with hypertension</i>					
<i>providing physical activity recommendations to adolescents with hypertension</i>					

20. Please expand on why you do or do not feel comfortable diagnosing, treating, and providing nutrition or physical activity recommendations for adolescent patients with elevated blood pressure or hypertension.

PAGE BREAK

21. For an adolescent patient (age 13 – 18 years old), after how many elevated blood pressure measurements over 130/80 should a diagnosis of hypertension be assigned?
- 1
 - 2
 - 3
 - 4 or more
22. For an adolescent patient (age 13 – 18 years old) whose blood pressure falls into the elevated blood pressure category (120/80 – 129/80) do you talk about it with the patient and/or caregiver?
- Yes
 - No
23. What is the primary course of treatment for adolescents (age 13 – 18 years old) who exhibit **elevated blood pressure**? (Select all that apply)
- ☐ Recommend weight loss
 - ☐ Recommend dietary changes
 - ☐ Recommend physical activity
 - ☐ Prescription of anti-hypertensive medications
 - ☐ Referral to Registered Dietitian
 - ☐ Referral to cardiovascular specialist
 - ☐ Other _____

24. What is the primary course of treatment for adolescents (age 13 – 18 years old) who **hypertension**? (Select all that apply)

- ☐ Recommend weight loss
- ☐ Recommend dietary changes
- ☐ Recommend physical activity
- ☐ Prescription of anti-hypertensive medications
- ☐ Referral to Registered Dietitian
- ☐ Referral to cardiovascular specialist
- ☐ Other _____

25. Which of the following describes your access to a Registered Dietitian (RD)?

- a. There is a RD who works within my practice.
- b. I can refer patients to a RD outside of my practice, but do not have access to a RD within my practice.
- c. I do not have access to a RD to refer patients to.

If answer A or B in #25, participant will see question #26

26. How often do you refer your hypertensive adolescent patients to a Registered Dietitian (RD)?

- a. Always
- b. Very Often
- c. Sometimes
- d. Rarely
- e. Never

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Social determinants of health (SDOH) refer to conditions in the environments where adolescents and their families live, work, attend school, and play. The SDOH are made up of five determinants including economic stability, education, social and community context, health and health care, and neighborhood and built environment. Examples of social determinants include access to health care, quality education, safe places to be physically active, access to transportation, availability of safe and healthful foods, and income level.

27. How often do social determinants of health impact your messaging for adolescent patients (age 13 – 18 years old)? Messaging refers to exam room conversations between medical provider, adolescent patient and/or caregiver regarding health care regimens.

- a. Always
- b. Very Often
- c. Sometimes
- d. Rarely
- e. Never

28. On a scale of 1 to 5 where 1 is “never” and 5 is “always”, please rate how often you have knowledge of the following: (Note: the word “patient” below refers to an adolescent between the age of 13 – 18 years old.)

	1	2	3	4	5
	Never	Rarely	Sometimes	Very Often	Always
I have knowledge of my patient’s caregiver’s educational level.					
I have knowledge of my patient’s caregiver’s income level.					
I have knowledge of the safety of my patient’s neighborhood.					
I have knowledge of my patient’s access to transportation.					
I have knowledge of my patient’s access to healthy foods.					
I have knowledge of my patient’s receiving food assistance (SNAP or WIC benefits).					
I have knowledge of my patient’s access to health care.					

29. Of the following social determinants of health, rank the top three that you primarily consider in your messaging to adolescent patients (ages 13 – 18 years old). Messaging refers to exam room conversations between medical provider, adolescent patient and/or caregiver regarding health care regimens. **Place a “1” by the item that you consider most often, a “2” by the item that you consider second, and a “3” by the item that you consider third, and leave other boxes blank.**

- ☐ _____ Caregiver’s educational level
- ☐ _____ Caregiver’s income level
- ☐ _____ Safety of neighborhood
- ☐ _____ Caregiver’s and/or patient’s access to transportation
- ☐ _____ Household access to healthy foods
- ☐ _____ Patient’s access to health care

30. Please describe how social determinants of health impact your messaging regarding elevated blood pressure and/or hypertension to adolescents (age 13 – 18 years old) and their families? Messaging refers to exam room conversations between medical provider, adolescent patient and/or caregiver regarding health care regimens.
31. Did you have any training in how to work with adolescent patients (age 13 – 18 years old) that face challenges because of social determinants of health?
- a. Yes
 - b. No

PAGE BREAK

32. What kind of education or training have you received to be prepared to have lifestyle discussions (including physical activity and nutrition recommendations) with your adolescent patients (age 13 – 18 years old)? (Select all that apply)
- ☐ Class during medical school
 - ☐ Experience during residency
 - ☐ Webinars
 - ☐ Educational conferences
 - ☐ Specializations
 - ☐ RD on staff providing in-service presentations
 - ☐ Other _____
33. What additional degrees do you have other than your MD, DO, PA, or NP credential?
- a. PhD _____
 - b. MPH _____
 - c. MS _____
 - d. Other _____
 - e. None
34. What resources, related to social determinants of health, do you utilize with adolescent patients with elevated blood pressure or hypertension?
- a. Books
 - b. In-service trainings or clinic education
 - c. Webinars
 - d. Peer-reviewed journal articles
 - e. Respected website
 - f. Other _____

35. For patients with elevated blood pressure or hypertension that are also impacted by social determinants of health, what resources do you refer them to?
- Food pantry
 - Food assistance (SNAP, WIC, etc)
 - Affordable housing
 - Lead paint testing
 - Bus schedule
 - Department of Public Health
 - Free afterschool programs
 - Other _____
36. Rate your familiarity with the guidelines in the *Clinical Practice Guideline for the Screening and Management of High Blood Pressure in Children and Adolescents* that were released by AAP in 2017.
- I have not heard of the 2017 Clinical Practice Guideline
 - I have heard of the 2017 Clinical Practice Guideline, but I am unfamiliar with its contents
 - I have read or heard about the recommendations in the 2017 Clinical Practice Guideline
 - I have read and utilize the 2017 Clinical Practice Guideline
37. How often do you utilize the blood pressure thresholds for adolescents age 13 – 18 years old, provided in the 2017 AAP Clinical Practice Guideline, in your messaging to adolescents? Messaging refers to exam room conversations between medical provider, adolescent patient and/or caregiver regarding health care regimens.
- Always
 - Very Often
 - Sometimes
 - Rarely
 - Never
38. Are you interested in being part of a brief interview (15-20 minutes) that addresses these topics of adolescent hypertension and social determinants of health in greater detail? **Note: This identifying information will not be associated with your survey answers. All survey answers will remain 100% confidential. In addition, no identifying information will be asked during the interview.**
- Yes
 - No

If answer NO in #38, participant redirected to a separate survey to enter information to potentially win one of five \$50 Amazon Gift Cards.

If answer YES in #38, participant will see question #39 to provide contact information so the research team can schedule an interview.

39. Thank you for expressing interest in participating in an interview. Please provide your name and preferred contact information below and the researcher will contact you to schedule the interview. **Note: This identifying information will not be associated with your survey answers. All survey answers will remain 100% confidential. In addition, no identifying information will be asked during the interview.**

- Name: _____
- Phone Number: _____
- Email Address: _____

After this question is submitted, participant redirected to a separate survey to enter information to potentially win one of five \$50 Amazon Gift Cards.

APPENDIX C: INTERVIEW QUESTIONS AND PROBES

Interview Question	Probes
1. How long have you been a medical provider?	<ul style="list-style-type: none"> ○ What type of medical provider are you? ○ How long have you been practicing?
2. What is your gender and your race/ethnicity?	
3. Describe your patient population?	<ul style="list-style-type: none"> ○ What is the primary race/ethnicity of your patient population? ○ What is the primary socioeconomic status of your patient population?
4. What processes are used in your practice setting to obtain accurate blood pressure measurements? How often are they obtained and how often do you follow up on these measurements?	<ul style="list-style-type: none"> ○ Who is responsible for measuring patients' blood pressure? ○ Is an auscultation sphygmomanometer or an oscillometric/electronic blood pressure device utilized? ○ Are blood pressure measurements recorded at all wellness and sick visits for all patients?
5. Describe the adolescent patient you think of when you are told a child has primary hypertension.	<ul style="list-style-type: none"> ○ Is this patient male or female? ○ What is their weight status? ○ What lifestyle habits (dietary intake and physical activity) do you imagine this adolescent would have?
6. How comfortable do you feel with diagnosing and treating adolescent hypertension? What factors contribute to your comfort or discomfort with this diagnosis and treatment?	<ul style="list-style-type: none"> ○ How comfortable are you in determining if a blood pressure reading qualifies as normal, elevated, or hypertensive? ○ How comfortable are you recommending lifestyle changes (nutrition and physical activity) to improve blood pressure status?

7. How do you approach discussing weight related or diet related chronic disease?	<ul style="list-style-type: none"> ○ Who do you discuss this with (adolescent, family, or both)? ○ What specific weight suggestions would you give to a patient? ○ What specific nutrition recommendations would you give to a patient? ○ What specific physical activity recommendations would you give to a patient?
8. If an adolescent presents with elevated blood pressure, how do you include social determinants of health in your screening of causative factors?	<ul style="list-style-type: none"> ○ Do you have knowledge of the caregiver's educational level or income level? ○ How do you assess the patient's access to health care? ○ How do you assess the patient's access to transportation to make it to health care visits or access to food? ○ How do you determine if the patient has access to healthy foods or a safe space for physical activity? ○ How do you alter your message based on knowledge of a patient's access (or lack of access) to healthy foods? Safe neighborhood?
9. What treatment options are you able to offer to children (families) to help improve blood pressure status?	<ul style="list-style-type: none"> ○ Do you prescribe antihypertensive medications? ○ What lifestyle changes do you recommend to improve blood pressure status? ○ Do you refer the adolescent to any other health care professional? ○ How receptive are patients (and families) to any nutrition or physical activity advice? ○ How do social determinants of health influence the recommendations you make to patients?
10. Who is responsible for obtaining information from a patient (or family members) regarding social determinants of health factors?	<ul style="list-style-type: none"> ○ Does this information come from appointment "check-in" paperwork that may be filled out in the waiting room? From a nurse? Asked directly by the medical provider? ○ If a patient you have been seeing for a while related to adolescent hypertension (or elevated blood pressure) does not improve, do you investigate if the family experiences limitations due to social determinants of health?

<p>11. Who provides nutrition related recommendations to patients in your practice setting?</p>	<ul style="list-style-type: none"> ○ Do you or a Registered Dietitian (or both) provide nutrition recommendations? ○ <i>If the medical provider provides nutrition recommendations:</i> <ul style="list-style-type: none"> ○ Do you feel comfortable providing these recommendations for (non-obese) adolescents with elevated blood pressure? With hypertension? ○ What nutrition changes do you most often suggest? ○ Do you feel confident in counseling on recommendations to overcome barriers to change? ○ Do you feel equipped to educate an adolescent on dietary changes to help decrease hypertension? ○ Do you have a Registered Dietitian to refer patients to? If not, would you like to have a Registered Dietitian to refer patients to? ○ <i>If a Registered Dietitian provides nutrition recommendations:</i> <ul style="list-style-type: none"> ○ Is the Registered Dietitian located within your practice or do you refer to an outside resource? ○ Do you communicate with the Registered Dietitian regarding treatment plans to improve blood pressure status in the adolescent?
<p>12. What resources do you need, or would you like to have that would improve your ability to diagnose or treat hypertension in adolescents?</p>	<ul style="list-style-type: none"> ○ What resources specifically related to social determinants of health could help you or your patients? ○ What resources specifically related to nutritional recommendations could help you or your patients? ○ Would access to a Registered Dietitian enhance your care of patients?

APPENDIX D: IRB INFORMATION SHEET

University of North Carolina at Greensboro IRB Information Sheet

Project Title: Medical Providers Perceptions of and Response to Adolescent Hypertension: The Role of Social Determinants of Health in Messaging

Principal Investigator: Coleman Murray, MS, RDN, LDN

Faculty Advisor: Lauren Haldeman, PhD

What is this all about? I am asking you to participate in this research study because we are investigating medical providers' perceptions of and response to adolescent hypertension and want to learn more about how medical providers consider social determinants of health in their messaging to adolescents and their families. This research project will only take about 10-15 minutes and will involve you completing an electronic survey. All answers will be completely confidential. At the end of the study, you can state whether or not you are interested in participating in a zoom or phone interview on the same topics. If you select that you are not interested in participating in the interview portion, you will not be contacted to do anything in addition to the survey. If you choose to volunteer to participate in an interview, it will last about 20 minutes. Your participation in this research project is voluntary.

How will this negatively affect me? No, other than the time you spend on this project there are no known or foreseeable risks involved with this study.

What do I get out of this research project? Your participation in our survey and/or interview may help improve the awareness of adolescent hypertension and may help change the future adolescent hypertension treatment services offered to adolescents and families in need.

Will I get paid for participating? There are no costs to you or payments made for participating in this study. For completing the survey, you will be entered into a drawing to potentially win one of five \$50 Amazon gift cards which will be chosen at random from the survey respondents.

What about my confidentiality? We will do everything possible to make sure that your information is kept confidential. All information obtained in this study is strictly confidential unless disclosure is required by law. Surveys completed in this study will be kept confidential through anonymous data collection procedures and storage in a password protected Qualtrics account. No names, medical ID numbers, or other identifiable information will be collected in the survey, further protecting your confidentiality. Absolute confidentiality of data provided through the Internet cannot be guaranteed due to the limited protections of Internet access. Please be sure to close your browser when finished so no one will be able to see what you have been doing.

There will not be any audio/video recording if you participate in the survey. If you elected to participate in an interview, the interview session will be audio and/or video recorded. Interviews will be conducted in a private locked room to maintain confidentiality. Because your voice and image (if on video) will be potentially identifiable by anyone who hears the recording, your confidentiality for things you say on the recording cannot be guaranteed although the researcher will try to limit access to the recording as described above.

What if I do not want to be in this research study? You do not have to be part of this project. This project is voluntary, and it is up to you to decide to participate in this research project. If you agree to participate at any time in this project, you may stop participating without penalty.

What if I have questions? You can ask Coleman Murray (cgmurra2@uncg.edu) or Lauren Haldeman (lahaldem@uncg.edu) anything about the study. If you have concerns about how you have been treated in this study call the Office of Research Integrity Director at 1-855-251-2351.

Are you a medical provider treating adolescents??



The University of North Carolina at Greensboro is conducting a research study on medical providers' perceptions of and response to **adolescent hypertension** and the role of **social determinants of health** in messaging to adolescents and their families.

Eligibility requirements include:

- MD, DO, PA, or NP credential
- Currently treating adolescents

Your input is valued!! Participate in the research study by completing the electronic survey linked below. It will take approximately 10-15 minutes to complete the survey and all submissions are completely confidential.

A \$50 Amazon gift card will be given through a random drawing to FIVE survey respondents for completing the survey!!

Access the survey on your
mobile device via QR Code:



-OR-

Access the survey on your
computer via weblink:

<https://bit.ly/39a9Jz9>

Questions? Contact Coleman Murray, MS, RDN, LDN at cgmurra2@uncg.edu or Lauren Haldeman, PhD at lahaldem@uncg.edu.

8/5/2021

APPENDIX F: RECRUITMENT SCRIPTS

Listserv Announcement for the North Carolina Pediatric Society:

Are you a medical provider (MD, DO, PA, NP) treating adolescents in NC? The University of North Carolina at Greensboro is conducting a research study on adolescent hypertension and social determinants of health and we need your input! The electronic survey will take about 10-15 minutes to complete and all submissions are completely confidential. Findings will be used to better understand medical provider recommendations, particularly as they relate to lifestyle behaviors and the integration of social determinants of health, in the prevention and treatment of elevated blood pressure and hypertension among adolescents. The long-term goal is to develop future lifestyle interventions to better meet the needs of patients and their families that experience limitations due to social determinants of health. Survey Link: https://uncg.qualtrics.com/jfe/form/SV_78tlzqFQiqPZe4Z. Contact: Coleman Murray, MS, RDN, LDN at cgmurra2@uncg.edu.

Telephone Script for Initial Communication with Clinic Representative(s):

Initial Communication: Hi! My name is Coleman, and I am doctoral student at UNCG. I am conducting a research study on adolescent hypertension and social determinants of health. I am recruiting medical providers, including those with MD, DO, PA, or NP credentials, who treat adolescents to complete an electronic survey. This survey will take approximately 10-15 minutes to complete, and all survey answers are completely confidential. There is also a chance for five survey respondents to win a \$50 Amazon gift card. Would you be willing to distribute a flyer for this research study to medical providers in your office?

(Provide opportunity for Clinic Representative to respond.)

If Clinic Representative Answers NO: Ok thanks, have a nice day! **(END)**

If Clinic Representative Answers YES: Ok, great! Would you prefer I send an electronic copy of the flyer via email or several hard copies of the flyer in the mail?

(Provide opportunity for Clinic Representative to respond.)

If Clinic Representative Answers Flyers via Email: Perfect, what email address should I send the flyer to?

If Clinic Representative Answers Flyers via Mail: Perfect, what physical address should I send the flyer to?

(Provide opportunity for Clinic Representative to respond.)

Final Response: Thank you for your willingness to share the flyer for the survey. If you or the providers have any questions you can contact me at 919-971-6214 or cgmurra2@uncg.edu. Have a nice day! (END)

Initial Email Script:

Good Afternoon,

My name is Coleman Murray, and I am a doctoral student in the Department of Nutrition at UNC-Greensboro working with Dr. Lauren Haldeman (faculty advisor). I am conducting a research study on adolescent hypertension and social determinants of health. I am recruiting medical providers, including those with MD, DO, PA, or NP credentials, who treat adolescents in North Carolina to complete an electronic survey. This survey will take approximately 10-15 minutes to complete, and all survey answers are completely confidential. A \$50 Amazon gift card can be won by FIVE survey respondents through a random drawing for completing the survey. The survey is available at: [Adolescent Hypertension Survey](#) (and is linked on the attached recruitment flyer). I recognize how busy everyone's schedule is, especially with the additional stress of the pandemic on our healthcare system but would be extremely grateful if you would be willing to distribute this flyer and encourage participation by colleagues (MD, DO, PA, NP) who treat adolescents in family practice/outpatient settings.

Findings will be used to better understand medical provider recommendations, particularly as they relate to lifestyle behaviors and the integration of social determinants of health, in the prevention and treatment of elevated blood pressure and hypertension among adolescents. The long-term goal is to develop future lifestyle interventions to better meet the needs of patients and their families that experience limitations due to social determinants of health.

If you or any of the medical providers have any questions you can contact me at 919-971-6214 or cgmurra2@uncg.edu.

I appreciate your time and consideration!

Sincerely,
Coleman

Coleman Murray, MS, RDN, LDN
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APPENDIX G: CONE HEALTH LETTER OF SUPPORT



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June 29, 2021

To: Coleman Murray, MS, RDN, LDN (Primary Investigator)
Lauren Haldeman, PhD (UNC Greensboro Faculty Advisor)

Subject: Letter of Support for Adolescent Hypertension Research Project

Dear Coleman Murray and Lauren Haldeman,

The Pediatric Department of Cone Health is aware of your proposed research project regarding adolescent hypertension and social determinants of health. We understand that the involvement of our Pediatric Department in assisting you to accomplish this project includes supporting recruitment of pediatric medical providers (MD, DO, PA, and NP) in the Cone Health system to complete a short 10-minute survey and encouraging participation in the follow-up interview portion of this research project.

As the Director of Pediatric Teaching/Pediatric Primary Care Residency, I have been informed of the goals and the methods proposed for this research project and support the involvement of our Pediatric Department in this project and look forward to working with you.

Sincerely,

A handwritten signature in black ink that reads "E. Kaye Gable, MD". The signature is fluid and cursive.

E. Kaye Gable, MD

APPENDIX H: ADDITIONAL FIGURES FROM SURVEY DATA ANALYSIS

Figure 13. Primary Blood Pressure Measurement System Used by Medical Providers and Office Staff

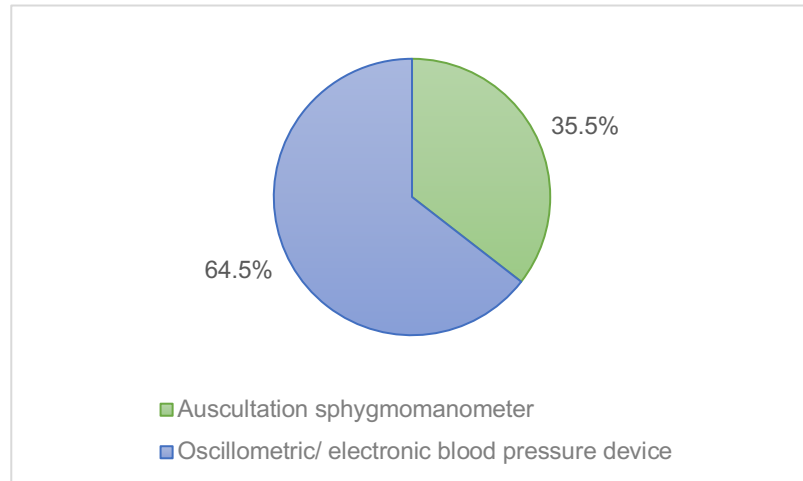


Figure 14. When to Reschedule Another Blood Pressure Check for an Asymptomatic 15-year-old Male Patient of Normal Weight with a Blood Pressure Recorded of 124/79

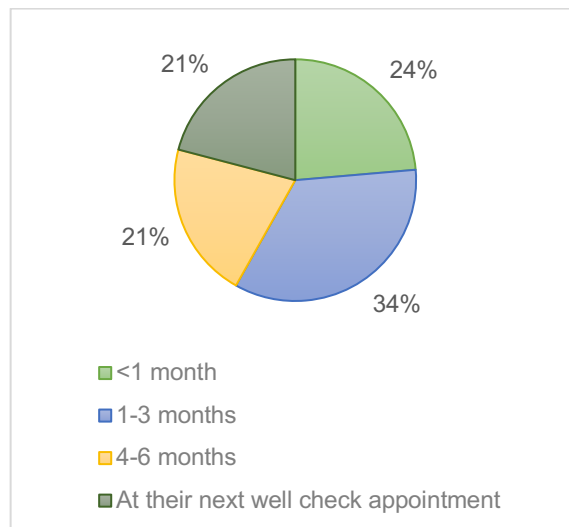


Figure 15. When to Reschedule Another Blood Pressure Check for an Asymptomatic 15-year-old Female Patient of Normal Weight has a Blood Pressure Recorded of 135/82

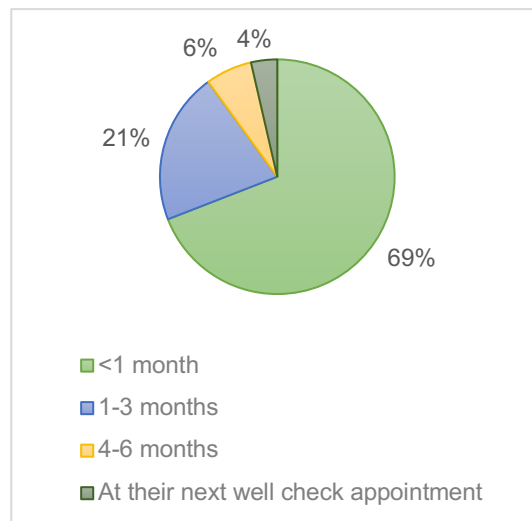


Figure 16. How Often Medical Providers Reported Discussing an Elevated Blood Pressure Reading with the Patient and/or Caregiver

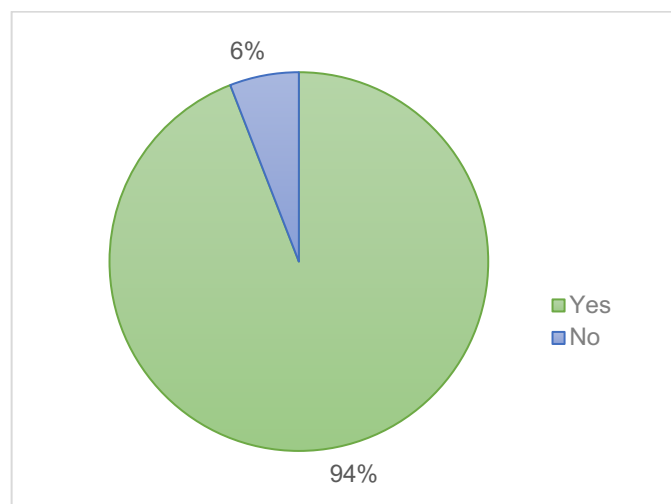


Figure 17. Resources Used by Medical Providers or Recommended to Adolescent Patients with Elevated Blood Pressure or Hypertension

