Evaluating the Implementation of the 2017 Pediatric Blood Pressure Guidelines Within a Pediatric Nephrology Clinic

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Abstract

AIM: The aim of this practice evaluation was to assess the implementation of an adolescent hypertension protocol based off of the 2017 AAP Clinical Practice Guideline for the Screening and Management of High Blood Pressure in Children and Adolescents within a pediatric nephrology clinic, specifically examining the effectiveness of the quality improvement change and provider adherence to the protocol.

BACKGROUND: Hypertension is becoming more prevalent in children and adolescents in the United States. A child with unrecognized and untreated hypertension is at risk for cardiac, metabolic, and renal dysfunction that can extend into adulthood. The new guidelines include an emphasis on increased recognition of pediatric hypertension, updated blood pressure parameters, decreased utilization of diagnostic procedures, and increased utilization of ambulatory blood pressure monitoring. In the year after publication of the clinical practice guideline, an academic pediatric nephrology clinic at a Pacific Northwest university updated its hypertension protocol for new adolescent patients to reflect the new guideline.

METHODS: Medical charts of 89 adolescent patients ages 13-18 years who were referred to the nephrology clinic for hypertension between 2016 and 2020 were pooled from the electronic health record in order to compare pre-protocol and post-protocol data. Through retrospective chart review, data on individual patient demographics was extracted as well as patient stage and type of hypertension, patient symptoms of hypertension, and whether or not patients underwent ambulatory blood pressure monitoring, an echocardiogram, a renal ultrasound, and serum renin and aldosterone measurement in the hypertension diagnostic process.

RESULTS: There were significant associations between the hypertension protocol update and frequencies of each of the four diagnostic tests: ambulatory blood pressure monitoring [OR=

0.174: 95% CI 0.067-0.457], echocardiograms [OR=34.167: 95% CI 10.498-111.95], renal ultrasounds [OR=13.013: 95% CI 3.954-42.826], and serum renin and aldosterone laboratory testing [OR=6.833: 95% CI 2.394-19.502]. Provider adherence to the updated protocol was 59.5% during the post-protocol period.

CONCLUSION: This evaluation found that updating a pediatric nephrology clinic's hypertension protocol to reflect national guidelines resulted in significant changes to patient care. Provider adherence to the protocol can be improved through better coordination of the timing of care and more consistency in patient diagnostic testing.

Keywords: pediatric hypertension, adolescent, clinical guideline, program evaluation, pediatric nephrology

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Problem Description

The American Academy of Pediatrics defines pediatric hypertension as having a blood pressure reading at or above the 95th percentile according to gender, age, and height at three separate medical visits for children under 13 years of age, and as having a blood pressure reading greater than 130/80 at three separate medical visits for adolescents (Flynn et al., 2017). According to a recent study by the American Medical Association, 14.2% of children and adolescents in the United States have elevated blood pressure or hypertension (Sharma, Metzger & Rodd, 2018). Hypertension is more prevalent amongst those with specific health conditions; higher rates are seen in children who are obese, have chronic kidney disease, have coarctation of the aorta, have obstructive sleep apnea, or have past medical histories of prematurity or solid organ transplant (Flynn et al., 2017). At the local level, 14.1% of high school students in Oregon are currently obese, which places this adolescent population at high risk for elevated blood pressure (Oregon Health Authority, 2019). The true national prevalence of pediatric hypertension increased when the American Academy of Pediatrics published updated clinical practice guidelines on hypertension in children and adolescents in 2017; the revised guidelines were based off a sample of children in a healthy weight range rather than in an overweight weight range, which changed definitive blood pressure parameters for elevated blood pressure and pediatric hypertension (Flynn et al., 2017). The Centers for Disease Control and Prevention estimate that 795,000 more children and adolescents were classified as having hypertension once the guidelines were updated (Jackson et al., 2018). In response to the new national pediatric blood pressure guidelines, a Pacific Northwest pediatric nephrology clinic updated its hypertension protocol in 2018 to include the new guideline's recommendations; after the

protocol update, though, the clinic staff lacked knowledge of how updating the protocol had impacted patient outcomes and how clinic providers were adhering to the updated protocol.

The problems with hypertension in the pediatric population are that the diagnostic process is complex, and the condition is not consistently and accurately diagnosed. Hypertension in children is often missed and undiagnosed, thus the current prevalence is likely underestimated (Taylor-Zapata et al., 2019). In a large cohort study of 14,187 children, only 26% of the children who met the diagnostic criteria for hypertension had it documented in the electronic health record (Flynn et al., 2017). Improper diagnosis may result from the particular nature of the diagnostic criteria for hypertension in children as well as the numerous conditions that can cause primary or secondary hypertension in children.

Available Knowledge and Rationale

The current knowledge of pediatric hypertension is that it can be caused by multiple conditions and can have long-term negative effects if untreated, yet it is generally underdiagnosed by pediatric providers. The causal mechanisms of pediatric hypertension are multifactorial, making diagnosis complex. Primary hypertension can result from obesity or genetics, while secondary hypertension can result from renal, cardiac, adrenal, and pulmonary abnormalities as well as certain medications and environmental exposures (Flynn et al., 2017). Currently, primary hypertension is significantly more common than secondary hypertension in children and adolescents in the United States (Flynn et al., 2017). Upon diagnosing hypertension, the provider must determine its origin in order to most effectively treat the condition. If left undiagnosed and untreated, hypertension in a child can cause long-term cardiac, metabolic, ophthalmologic, and cognitive adverse effects (Flynn et al., 2017).

Previous studies have demonstrated that hypertension in the pediatric population is underdiagnosed and often improperly screened (Flynn et al., 2017; Shah, Hossain, Xie & Zaritsky, 2019). Diagnosing hypertension in a child requires blood pressure measurements over multiple visits and referencing parameters based on the child's age, height, and gender; for providers, the complexity of the diagnostic process is a known barrier to proper recognition of the condition (Weaver, 2017). Due to improper diagnosis of pediatric hypertension, one of the key gaps in the literature is accurate prevalence data (Rao, 2016; Taylor-Zapata et al, 2019). The problem may have greater significance in the pediatric population yet affected individuals are being missed.

This quality improvement project involved an evaluation of the project setting's updated hypertension diagnostic protocol in order to measure outcomes of the protocol change and to ensure providers were adhering to the most recent evidence-based practice recommendations. The theoretical framework guiding the evaluation was the Promoting Action on Research Implementation in Health Services (PARIHS) framework, which can be used when retrospectively evaluating quality improvement implementation (Hill et al., 2017). The PARIHS framework assess factors that affect the implementation process, specifically the context in which the implementation takes place, the characteristics of those facilitating the implementation, and the level of evidence being implemented (Hill et al., 2017). Since the American Academy of Pediatrics' Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents is a synthesis of high-level evidence, the clinical practice guideline was the standard of comparison for improving the project setting's hypertension diagnosis protocol (Flynn et al., 2017). A key assumption in developing the intervention- modifying the protocol to include updated blood pressure parameter tables,

increased utilization of ambulatory blood pressure monitoring, and decreased utilization of echocardiography and other diagnostic tests- was that implementing the most current evidence-based practices would generate improved diagnostic outcomes.

The intervention was expected to work based off of the theory that evidence-based practice generates the most accurate outcomes in clinical interventions. Within the field of pediatric nephrology, evidence-based protocols that are regularly updated and tested result in higher-quality, more efficient, and safer care for patients (Mammen, Matsell & Lemley, 2014). Implementing a hypertension screening protocol would improve detection of hypertension, identification of the source of hypertension, and would prevent long-term adverse effects of the condition.

Aim Statement

In response to the American Academy of Pediatrics publishing updated clinical practice guidelines on high blood pressure screening and management in 2017, an academic pediatric nephrology clinic at a Pacific Northwest university modified its adolescent hypertension screening protocol in 2018 so as to adhere to the updated guidelines, improve patient screening and diagnosis, and reduce unnecessary testing. Accurately diagnosing pediatric hypertension is essential as the condition can have significant adverse health consequences if undetected. This quality improvement project was an evaluation of the hypertension screening protocol to assess adherence to the protocol and determine if the change in protocol resulted in desired outcomes such as modified utilization of diagnostic tests.

The program evaluation project was guided by the following retrospective aim statement: Between October 2018 and March 2020, an academic pediatric nephrology clinic in the Pacific Northwest increased the number of 24-hour ambulatory blood pressure monitoring (ABPM)

checks by 50%, decreased the number of echocardiograms performed by 50%, and maintained a 75% provider adherence to the hypertension diagnosis protocol in patients ages 13-18 years who were referred for hypertension.

Methods

Context

The site of this evaluation was an academic pediatric nephrology clinic at a Pacific Northwest university. Patients were seen at the central clinic location or amongst four satellite clinics throughout the state. There are approximately 1,890 patient visits at the central clinic per year. The clinic employs six pediatric nephrology providers: five physicians with a Doctor of Medicine degree and one family nurse practitioner. All six providers were employed at the clinic during the pre-protocol and post-protocol periods. Multiple contextual elements were considered before the hypertension protocol evaluation began. Effective evaluation required knowledge of how, when, and by whom the updated protocol was implemented. Effective evaluation also required knowledge and understanding of the clinic's structure and how new adolescent hypertension referrals were managed by providers and staff. Workflow factors such as documentation in the electronic health record and the accessibility of archived patient data had to be considered before retrospective data collection was started. Cultural considerations included the clinic providers' attitudes toward change and quality improvement, and how receptive providers would be of the results of the evaluation. The providers at the clinic conducted a yearly quality improvement project, which increased the likelihood of an openness to project evaluation, though some providers had expressed resistance towards the hypertension protocol quality improvement change from the beginning. Overall, within this context the protocol evaluation appeared likely to be effective.

Intervention

The first step of the evaluation involved becoming familiar with the initial quality improvement change, which was the clinic's updated hypertension screening protocol. A data collection tool was then created based off of the clinical practice guideline and with stakeholder input, specifically a pediatric nephrologist and the nurse practitioner from the clinic. Inclusion and exclusion criteria were established for the patient population being evaluated with the assistance of the providers. These criteria included referral to the clinic for hypertension between October 2016 and March 2020, and being within the 13-18 year age group. The clinic's research coordinator was consulted and this team member used a data reporting tool within the electronic health record using the aforementioned criteria and the terms "new patient, chief complaint of elevated blood pressure" and "new patient, chief complaint of high blood pressure" to identify the patients being evaluated. Eligible patients were divided into two cohorts: patients seen at the clinic before the protocol change, which was October 2016 to mid- October 2018, and patients seen at the clinic after the protocol change, which was mid- October 2018 to March 1, 2020.

Retrospective chart reviews were then conducted on each patient; data was gathered on patient demographics, the patient's type and stage of hypertension (or if they were found to not have hypertension), whether or not the patient exhibited symptoms of hypertension, and whether or not four diagnostic tests were performed. Whether or not a patient had white coat hypertension was noted under type of hypertension; white coat hypertension is defined as having hypertensive blood pressure readings in a clinical setting but having normal blood pressure readings outside of a clinical setting (Flynn et al., 2017). Symptoms of hypertension were determined to be headaches, dizziness, chest pain, disturbed vision, fatigue, shortness of breath, and/ or sleep disturbance unexplained by other factors; these symptoms were reviewed during each clinic visit

and validated by current evidence (Weaver, 2017). The four diagnostic tests included ambulatory blood pressure monitoring, an echocardiogram, a renal ultrasound, and serum renin and aldosterone levels. For the patients in the post- protocol cohort, whether or not the staff and provider seeing the patient adhered to the updated protocol was also recorded. Adhering to the protocol involved seeing the patient within one month or two months of referral based on the patient's stage of hypertension, ordering specific lab work based on the patient's stage of hypertension, past medical history, and body mass index, and performing ambulatory blood pressure monitoring at the visit unless the patient had chronic kidney disease or a known urological history.

Study of the Intervention

This evaluation was the study of an intervention, the implementation of an updated hypertension protocol within a pediatric nephrology clinic. The impact of the intervention was assessed through the evaluation by comparing patient data such as demographics, type and stage of hypertension, and diagnostic testing from before and after the implementation of the intervention to assess for practice changes. The impact of the intervention was also assessed by measuring provider adherence to the intervention after the updated protocol was implemented. In order to establish that the observed outcomes were due to the intervention, two cohorts were formed; the first cohort consisted of adolescents referred to the clinic for hypertension before the protocol was updated, and the second cohort consisted of adolescents referred to the clinic for hypertension after the protocol was updated.

Measures

There were two key measures within this evaluation that were utilized to study processes and outcomes of the initial hypertension protocol implementation. The first was a comparison of

pre-protocol patient data to post-protocol patient data in order to assess for significant changes in the hypertension diagnostic process related to the protocol. The rationale for this measure was that implementing the new protocol would result in changes to patient care. The second measure involved measuring provider adherence to the protocol by analyzing each patient's chart in the post-protocol cohort and comparing the progression of care the patient received to the progression of care outlined in the protocol. Adequate evaluation of an improvement change requires an assessment of whether or not the change is being consistently implemented. Completing retrospective chart reviews provided the necessary information on diagnostic testing and the timing of patient care to determine adherence or non-adherence to the protocol.

The ongoing assessment of contextual elements included checking that each patient identified by the electronic data reporting tool fit the inclusion criteria for the two cohorts; a small group of patients had to be excluded from both cohorts due to factors such as age at the time of referral to the clinic and the date of the first clinic visit. Several patients that had been initially placed into one cohort were transferred to the other cohort due to the timing of clinic visits. In order to ensure complete and accurate data, stakeholder input was sought before and throughout the data collection process to confirm that the data collection tool being utilized was appropriate. Two groups of stakeholders approved the data collection tool: the two providers more closely involved with the project, and the remainder of the nephrology providers at the clinic. The data collection tool was also compared to the clinical practice guideline to ensure completeness. Clinic schedules were reviewed to ensure that no adolescent new patient seen for hypertension was missed. Even though the two cohorts consisted of different patients, demographics were compared to determine similarity between the two cohorts.

Analysis

The guiding questions during the data analysis process of this evaluation were whether or not there were significant associations between changing the protocol and the frequency of diagnostic tests, and whether or not there was significant provider adherence to the protocol. The pre-protocol and post-protocol cohorts were not the same group of patients, which had to be considered when selecting analysis. Data coding performed by the lead investigator was proofed by a second investigator in order to ensure accurate interpretation of statistical tests. Chi-squared tests and odds ratios were calculated in order to look for significant associations between the protocol change and frequency of each diagnostic test and to measure the effect size of each association. Pearson correlations were also run between each variable to look for other significant correlations within the data. Observation and categorization were the qualitative methods utilized to further analyze reasons for protocol non- adherence amongst providers.

Ethical Considerations

Before the evaluation began, the university's institutional review board approved the project and deemed it as non-human research. Since the evaluation was a retrospective chart review and patient data was regularly accessed, the main ethical considerations were patient privacy and information security. The electronic health record was only accessed on encrypted computers during data collection. Only patient data pertinent to the evaluation process was reviewed. All data recorded in SPSS was coded to ensure anonymity. When a patient in the cohorts had a restricted chart in the electronic health record, rationale for access was always provided. There were no conflicts of interest during the evaluation.

Results

Over the course of the evaluation, 89 retrospective chart reviews were completed, starting first with the pre-protocol cohort and then moving to the post-protocol cohort. Data on patient

demographics (see Table 1), type and stage of hypertension, symptoms of hypertension, and diagnostic testing during the hypertension workup was collected for both cohorts. During the evaluation, it became difficult to record the stage of hypertension as many patients had a discrepancy between the stage of hypertension at the time of referral and the stage of hypertension determined by the nephrology provider. Thus, the data collection process evolved to include both the referral stage and visit stage of patient hypertension. The stage of hypertension known as "prehypertension" prior to the protocol change was renamed "elevated blood pressure" in post-protocol patients due to the change in national guidelines.

The two cohorts had similar demographics in terms of gender, age, ethnicity, race, and body mass index (see Table 1). In the pre-protocol cohort, 25.5% of patients displayed symptoms of hypertension at the time of the initial clinic visit, and 33.3% of patients in the post-protocol cohort displayed symptoms of hypertension at the time of the initial clinic visit. Frequencies of diagnostic tests were calculated and compared between the two cohorts; between the pre-protocol and post-protocol cohort, the rate of ambulatory blood pressure monitoring increased from 42.6% to 81%, the rate of echocardiograms decreased from 87.2% to 16.7%, the rate of renal ultrasounds decreased from 91.5% to 45.2%, and the rate of serum renin and aldosterone laboratory testing decreased from 87.2% to 50% (see Figure 1). Provider adherence to the updated hypertension protocol was also calculated; during the post-protocol period, providers adhered to the protocol 59.5% of the time. For every patient case in which the provider did not adhere to the protocol, the reason for non-adherence was documented; once every retrospective chart review was completed, the reasons for protocol non-adherence were assembled, analyzed, and then grouped into three broad categories. These categories were external factors such as patient circumstances, patient preferences, and decisions made by the

primary care provider; inappropriate timing of visits in regard to timing of referral, and incorrect diagnostic testing (both omission of testing and unnecessary addition of testing).

Throughout the protocol evaluation, several contextual elements were identified that impacted or may have impacted the ability of the providers at the nephrology clinic to adhere to the hypertension protocol. Clinic visits scheduled within two months of referral that should have been scheduled within one month of referral due to the patient's stage of hypertension may have been due to clinical scheduling processes or patient availability. Ordering correct diagnostic testing per the protocol was not rational in some patient cases due to primary care provider-driven interventions such as starting anti- hypertensive medications that affected hormone and electrolyte levels prior to the referral. Patient preferences impacted protocol adherence, as some patients refused or did not tolerate ambulatory blood pressure monitoring and thus the diagnostic test was not completed.

Table 2 shows associations between the nephrology clinic's hypertension protocol update and the frequency of diagnostic testing amongst adolescent patients being evaluated for hypertension. There were significant associations between the protocol update and frequencies of each of the four diagnostic tests: ambulatory blood pressure monitoring [OR= 0.174: 95% CI 0.067-0.457], echocardiograms [OR=34.167: 95% CI 10.498-111.95], renal ultrasounds [OR=13.013: 95% CI 3.954-42.826], and serum renin and aldosterone laboratory testing [OR=6.833: 95% CI 2.394-19.502]. These associations were still significant when non-adherence to the protocol was accounted for.

Table 1

Demographics as Percentages of the Cohort

Characteristic	Pre-Protocol (n= 47)	Post-Protocol (n= 42)

Gender		
Male	61.7	61.9
Female	38.3	38.1
Age (years)		
13	10.6	9.5
14	27.7	16.7
15	17.0	19.0
16	17.0	31.0
17	27.7	21.4
18	0.0	2.4
Ethnicity		
Non- Hispanic	66.0	64.3
Hispanic	34.0	28.6
Unknown	0.0	7.2
Race		
White	72.3	66.6
Black	6.4	2.4
Asian	8.5	0.0
American Indian	0.0	2.4
Native Hawaiian	0.0	2.4
Other Pacific Islander	0.0	2.4
Multiracial	6.4	4.8
Declined/Unknown	6.4	19.0
Body Mass Index		
Healthy weight	36.2	35.7
Overweight	6.4	11.9
Obese	57.4	52.4

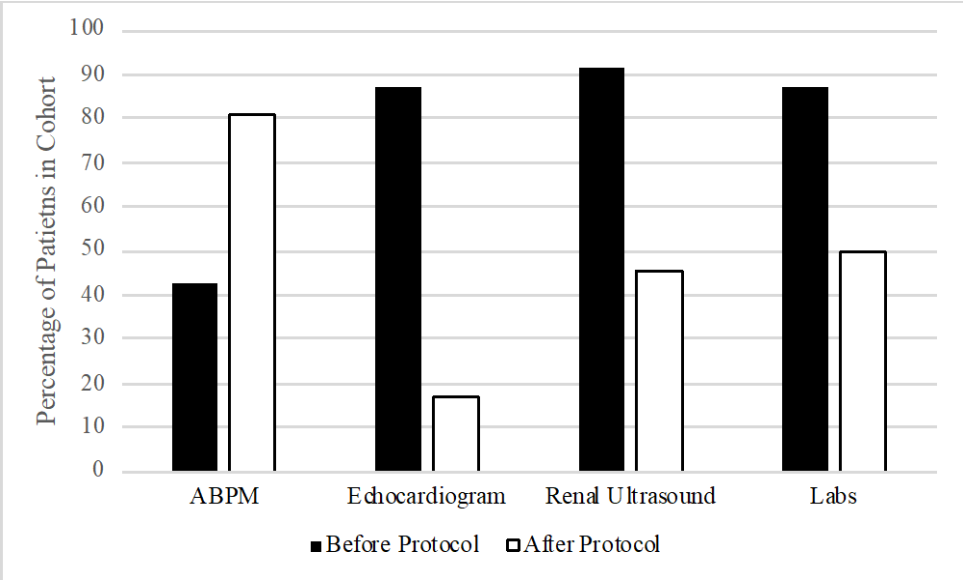

Figure 1. Protocol effect on diagnostic testing frequency

Table 2

Associations Between Protocol Change and Diagnostic Testing

Diagnostic Test	Pearson Chi-Square (χ^2) (1, *N*= 89)	Asymptotic Significance (2-sided)	Odds Ratio	95% Confidence Interval (CI)
Echocardiogram	44.46	p <.001	34.167	[10.498, 111.195]
ABPM	13.71	p <.001	0.174	[0.067, 0.457]
Renal ultrasound	22.45	p <.001	13.013	[3.954, 42.826]
Labs (serum renin/ aldosterone)	14.55	p <.001	6.833	[2.394, 19.502]

An unexpected result of this evaluation was the discrepancy between the stage of hypertension at the time of referral and the stage of hypertension determined by the pediatric nephrology provider. In the pre-protocol cohort, 80.8% of patients were referred to the clinic with Stage 1 or Stage 2 hypertension, yet only 23.4% of patients were determined to be in the Stage 1 or Stage 2 hypertension range after blood pressures were rechecked and the diagnostic workup was completed. In the post-protocol cohort, 90.5% of patients were referred to the clinic with Stage 1 or Stage 2 hypertension, yet only 38.1% of patients were determined to be in the Stage 1 or Stage 2 hypertension range. Due to the timing of when the data reporting tool was used to extract eligible patients from the electronic health record, two months of clinic data were initially missed and thus several eligible patients were not originally accounted for in the post-protocol cohort. To correct this, daily clinic schedules during the two-month time period were reviewed and eligible patients being seen for hypertension were identified and added to the appropriate cohort.

Discussion

Summary

The aims of this evaluation were to determine how updating a pediatric nephrology clinic's hypertension protocol to align with national guidelines impacted the care of referred adolescent patients, and to assess provider adherence to the updated protocol. The comparison of patient data from before and after the protocol update revealed that during the hypertension diagnostic process more patients were undergoing ambulatory blood pressure monitoring and less patients were undergoing echocardiograms, renal ultrasounds, and serum renin and aldosterone testing due to the protocol update. Adherence to the protocol was moderately consistent, though hindered by the timing of patient visits, incorrect diagnostic testing ordered by providers, and external factors. Strengths of this project include the breadth of evaluation and its generalizability to other pediatric clinical settings.

Interpretation

Due to the protocol update, there was a significant increase in the utilization of ambulatory blood pressure monitoring and significant decreases in the utilization of echocardiograms, renal ultrasounds, and serum renin and aldosterone testing during the nephrology clinic's hypertension diagnostic process. Incorporating the updated national pediatric blood pressure guidelines into the clinic's hypertension protocol significantly influenced patient care. This evaluation appears to be one of the first to look at provider adherence to the updated national pediatric blood pressure guidelines and how incorporation of the guidelines into a specialty clinic's hypertension protocol impacts diagnostic testing. The majority of studies evaluating the impact of the updated national pediatric blood pressure guidelines have focused on the more accurate identification of pediatric hypertension and how the guidelines have resulted in a greater prevalence of the condition (Dong et al., 2019; Khoury, Khoury, Dolan, Kimball & Urbina, 2018). While it was not the main aim of this evaluation, there were increases

in the prevalence of primary and secondary hypertension between the pre-protocol cohort and the post-protocol cohort. This evaluation impacts the care that the pediatric nephrology clinic provides to adolescents referred for hypertension, and can be used in the future as a guide as the clinic updates its hypertension protocol for children under the age of 13 years to also align with the national guidelines.

Upon completion of the evaluation, provider adherence to the updated hypertension protocol was not as high as had been anticipated at the beginning of the evaluation. While contextual factors such as patient availability and external care likely influenced this outcome, the PARIHS framework was utilized to better understand how the implementation of the updated protocol could have been more successful (Hill et al., 2017). The evidence behind the protocol was strong, as the protocol was based on national guidelines that emerged from systematic reviews (Flynn et al., 2017). Patient preferences could have been better incorporated, as some patients refused ambulatory blood pressure monitoring which in turn impacted protocol adherence. When considering the context of the implementation and the characteristics of the facilitators per the PARIHS framework, the nephrology staff and providers could have defined roles more clearly for the protocol implementation, allowed for more ongoing feedback, and facilitators of the change could have found ways to be more supportive, adaptive, consistent, and flexible. Another unexpected outcome was the discrepancy between the number of adolescents referred to the nephrology clinic for hypertension and the actual number of patients with hypertension. This finding could indicate a need for more accurate manual blood pressure measurement and monitoring in primary care settings, as well as better dissemination of the updated national pediatric blood pressure guidelines in primary care settings.

From a financial perspective, the clinic's updated hypertension protocol may lead to reduced healthcare costs. A study out of Texas Children's Hospital found that performing ambulatory blood pressure monitoring was about five times less expensive than performing an echocardiogram (Swartz, Srivaths, Croix & Feig, 2008). With the significant increase in ambulatory blood pressure monitoring and significant decrease in echocardiography, the updated hypertension protocol is likely contributing to more cost-effective care.

Limitations

This evaluation had several limitations. All data was collected and analyzed retrospectively, and the two cohorts consisted of different patients as opposed to the same group of patients being analyzed before and after the protocol update. While a validated data reporting tool was used to identify the two cohorts, eligible patients may have been missed if patient visits were coded incorrectly. Efforts to minimize limitations were taken, such as ensuring that the two cohorts were very similar in demographics and that both cohorts saw the same providers.

Conclusion

This evaluation found that updating a pediatric nephrology clinic's adolescent hypertension protocol to align with national guidelines led to significant changes in patient care. These findings, as well as what promoted and prevented provider adherence to the updated protocol, are useful for the clinic as they seek to improve delivery of evidence-based care and move towards creating an updated hypertension protocol for a younger age group. These findings are also useful for other pediatric nephrology or specialty practices seeking to implement the new blood pressure guidelines and to improve provider adherence to evidence-based practice. The updated protocol is likely sustainable for the clinic as it drives more efficient and cost-effective care. Practice evaluations of quality improvement changes such as this one are critical for not

only individual clinics but healthcare systems seeking to refine and sustain evidence-based practice. Further studies are needed on how the updated national guidelines affect hypertension diagnosis in younger children.

References

Dong, Y., Song, Y., Zhiyong, Z., Ma, J., Dong, B. & Prochaska, J.J. (2019). Updates to pediatric hypertension guidelines: Influence on classification of high blood pressure on children and adolescents. *Journal of Hypertension, 37*(2), 297-306. doi: 10.1097/HJH.0000000000001903

Flynn, J.T., Kaelber, D.C., Baker- Smith, C.M., Blowey, D., Carroll, A.E., Daniels, S.R., … Urbina, E.M. (2017). Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics, 140*(3), e20171904. doi: 10.1542/peds.2017-1904

Hill, J.N., Guihan, M., Hogan, T.P., Smith, B.M., LaVela, S.L., Weaver, F.M., … Evans, C.T. (2017). Use of the PARIHS framework for retrospective and prospective implementation evaluations. *Worldviews on Evidence-Based Nursing, 14*(2), 99-107. doi: 10.1111/wvn.12211

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. *Morbidity and Mortality Weekly Report, 67*(27), 758-762. doi: 10.15585/mmwr.mm6727a2.

Khoury, M., Khoury, P.R., Dolan, L.M., Kimball, T.R. & Urbina, E.M. (2018). Clinical implications of the revised AAP pediatric hypertension guidelines. *Pediatrics, 142*(2), e20180245. doi: 10.1542/peds.2018-0245

Mammen, C., Matsell, D.G. & Lemley, K.V. (2014). The importance of clinical pathways and protocols in pediatric nephrology. *Pediatric Nephrology, 29*(10), 1903-1914. doi: 10.1007/s00467-013-2577

Oregon Health Authority. (2019). *Oregon healthy teens 2019.* Retrieved from https://www.oregon.gov/oha/PH/DISEASESCONDITIONS/CHRONICDISEASE/DATAREPORTS/Documents/datatables/ORAnnualOHT_PAN.pdf

Rao, G. (2016). Diagnosis, epidemiology, and management of hypertension in children. (2016). *Pediatrics, 138*(2), e20153616. doi: 10.1542/peds.2015-3616

Shah, L., Hossain, J., Xie, S. & Zaritsky, J. (2019). Poor adherence to early childhood blood pressure measurement guidelines in a large pediatric healthcare system. *Pediatric Nephrology, 2019*(34), 697-701. doi: 10.1007/s00467-018-4132-y

Sharma, A.K., Metzger, D.L. & Rodd, C.J. (2018). Prevalence and severity of high blood pressure among children based on the 2017 American Academy of Pediatrics guidelines. *JAMA Pediatrics, 172*(6), 557-565. doi: 10.1001/jamapediatrics.2018.0223

Swartz, S.J., Srivaths, P.R., Croix, B. & Feig, D.I. (2008). Cost- effectiveness of ambulatory blood pressure monitoring in the initial evaluation of hypertension in children. *Pediatrics, 2008*(122), 1177-1181. doi: 10.1542/peds.2007-3432

Taylor-Zapata, P., Baker-Smith, C.M., Burckart, G., Daniels, S.R., Flynn, J.T., Giacoia, G., … Zajicek, A. (2019). Research gaps in primary pediatric hypertension. *Pediatrics, 143*(5), e20183517. doi: 10.1542/peds.2018-3517

Weaver, D.J. (2017). Hypertension in children and adolescents. *Pediatrics in Review, 38*(8), 369-382. doi: 10.1542/pir.2016-0106