1. TITLE PAGE

Comprehensive Pediatric Hypertension Diagnosis and Management

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2. STRUCTURED ABSTRACT

Purpose: Determine concordance between pediatric practice and hypertension (HTN) guidelines. Identify whether a national quality improvement collaborative (QIC) in 60 pediatric practices is associated with increased guideline concordance. Understand whether pediatric home blood pressure (BP) monitoring (HBPM) is feasible and concordant with manual BP measurements.

Scope: Pediatric ambulatory patients.

Methods: We conducted a multisite, prospective, step-wedge, cluster-randomized trial, enrolling 64 pediatric practices who each collected prospective baseline data on pediatric HTN guideline compliance followed by 24 months of a QIC intervention. Practices were randomized based on practice group to begin the intervention immediately or after 6 months. Data were collected by practices semi-randomly, by identifying and then following the first 10-17 patients monthly who had an elevated BP measurement in their practice. The project was truncated by the SARS-CoV-2 pandemic after 12 months. Researchers enrolled six practices to offer HBPM to children with an elevated BP measurement and contacted families up to 10 times to receive HBPM measurements.

Results: In the baseline period, 2% of patients had all the BP measurement steps completed, 0.2% of the patients who required it received a three-extremity BP measurement, and 46% of patients received all counseling types recommended. Comparing the 12-month intervention phase to the baseline, the 'following the BP measurement algorithm' measure was the only of 10 measures that showed a significant although modest improvement (6.3%; 95 CI 4.5, 8.0). Only 26 patients (36%) returned HBPM measurements, and 50% of these 26 patients had discordant BP classification when compared to manual BP measurements.

Key Words: Ambulatory, hypertension, pediatric, guidelines

3. PURPOSE

The original specific aims and purpose of the Boosting Primary-Care Awareness and Treatment for Childhood Hypertension (BP-CATCH) grant were as follows:

Specific Aim 1: Determine whether a QIC in a national group of at least 60 pediatric practices, building on our prior elevated BP recognition work, is associated with reduction of errors in the broader outcomes of 1) HTN diagnosis, 2) initiation of management, and 3) time to diagnosis and management.

Specific Aim 2: Investigate whether a QIC with relevant, local pediatric HTN subspecialist involvement improves diagnosis and management for children with HTN.

Specific Aim 3: Determine whether pediatrician co-diagnosis and co-management of HTN, conducted via a 'hub and spoke' model in which one pediatric HTN subspecialist advises multiple primary care pediatricians, improves diagnosis and management for children with HTN.

Due to the SARS-CoV-2 pandemic in March 2020, the study was closed, as enrolled pediatric practices were no longer seeing patients in-person and did not have the availability to actively participate in a QIC, even as they started seeing patients again. Specific Aim 3 above was slated to begin testing in March 2020; therefore, it is not discussed below.

In conjunction with our AHRQ program officer, researchers developed two new aims that 1) stayed within the scope of the grant's original aims, 2) finished within the grant's timeline and budget, 3) aimed to improve pediatric HTN guideline compliance, and 4) used existing BP-CATCH data, practices, and patients:

Specific Aim 4: Investigate if HBPM correlates with in-person manual BP measurement and/or ambulatory blood pressure monitoring (ABPM) in pediatric primary care patients at higher risk for hypertension diagnosis but without diagnosed hypertension

Specific Aim 5: Determine if HBPM is feasible for pediatric primary care patients at higher risk for hypertension diagnosis but without diagnosed hypertension

4. SCOPE

Three to five percent of children have HTN, a prevalence that has risen by up to 2% in recent decades.[1-4] These rates are likely artificially low, as previous normative tables for pediatric BP included obese children, skewing the normative values higher than appropriate for most children.[5] HTN differs from the diagnosis of pediatric 'elevated BP' (EBP), previously known as 'prehypertension,' which is persistently elevated BP readings that do not meet criteria for stage 1 HTN.[6] The first step in making an HTN or EBP diagnosis is recognizing when pediatric BP is elevated. Though more straightforward in adults, BP measurement in children is challenging, as it requires specialized skills, including 1) preparing and calming a child, 2) choosing an appropriately sized cuff, and 3) interpreting the BP based on burdensome age, sex, and height tables.[7] A study by a member of this project's leadership team demonstrated that 39% of children have elevated BP readings at pediatric visits, but 87% of these elevations are not recognized by the PCP.[8] Other studies found that 74% of children with HTN or EBP were misdiagnosed by pediatricians[9] and that 47% of pediatricians classified one or more elevated BP readings as normal.[10] Misdiagnosed pediatric HTN has appreciable cardiovascular consequences for children, including increased rates of progression toward insulin resistance, atherosclerosis, and metabolic syndrome. Pediatric HTN is also associated with increased risk of adult HTN.[11-14] Additionally, studies demonstrate EBP and HTN cause irreversible cardiovascular damage in children,[15,16] suggesting that diagnosis and management occur too late in the disease process. Guidelines for pediatric HTN and EBP were recently updated.[6] To our knowledge this is the first proposal that will implement the new HTN guidelines[6] and improve pediatric HTN diagnosis and management.

This investigative team (Rinke, Bundy, Brady) was one of the first to perform a national, randomized trial on reducing missed diagnosis of pediatric elevated BP in primary care as part of an AHRQ grant (R01HS023608) on three different diagnostic errors. In this work, 30 pediatric practices from across the country were randomized to work as part of a QIC on one of the three diagnostic errors.[17] After 8 months, practices began working on a second error and sustaining their improvement on the first error. After another 8 months, practices worked to improve a third error, and sustained improvement on their first two errors. The first group to work on misdiagnosis of elevated BP reduced errors from 54% at baseline[17] to 28% during the 8-month intervention phase ($p<0.001$) using mixed-effects models controlling for clustering effect and adjusted for sex, age, and insurance type. This improvement was sustained for 13 months. Similar improvements were seen in the other two groups, who subsequently worked to reduce misdiagnosis of elevated BP. Although recognizing elevated BP is crucial, strategies to move from recognition to diagnosis and management were beyond the scope of that project.

QICs are defined as an organized, multifaceted approach to QI with 1) a specific topic for improvement with large variation in current practice, 2) clinical and QI experts sharing best practice knowledge, 3) multidisciplinary teams from multiple sites willing to improve care,

4) a model for improvement with measurable targets for improvement, data feedback to teams and small tests of change, and 5) a series of structured activities to advance improvement, exchange ideas, and share experiences of participating teams.[18] Most QICs include learning sessions, plan-do-study-act (PDSA) cycles, and robust data collection.[19] QICs improve care by using collective learning, data feedback, benchmarking, and open sharing of successes and failures to improve the entire group's performance. QICs sustainably reduce patient harm and improve quality of care.[18-23] Dr. Rinke, PI for this study, co-led a QIC to improve the ambulatory care of children with genetic diagnoses, resulting in a 42% improvement in the use of multigenerational family history tools and a 38% improvement in palliative care discussions.[24] Dr. Bundy, a co-investigator, co-led the Children's Hospital Association QIC that reduced pediatric central line infections by 22%.[25] Drs. Rinke, Bundy, and Brady led the national pediatric diagnostic error reduction QIC that demonstrated a reduction in elevated BP errors, as noted above.[26] QIC success is associated with performing collaborative activities, highlighting teamwork concepts, and long-term data collection, all of which were incorporated in this proposal.[23]

American Academy of Pediatrics' (AAP) guidelines for HTN diagnosis[6] specified that children demonstrate persistently EBP at three separate visits for diagnosis. Home blood pressure monitoring (HBPM) may reduce the number of in-person visits needed prior to receiving a HTN diagnosis.[27] HBPM is useful in adult HTN diagnosis[28] and is recommended by the European Society of Hypertension for evaluation of pediatric white coat HTN.[29] Given challenges associated with bringing children into offices and the rise of telehealth, it is imperative to understand whether HBPM offers a feasible and accurate adjunct in pediatric HTN diagnosis.

5. METHODS

Boosting Primary Care Awareness and Treatment of Hypertension (BP-CATCH) was a prospective, cluster-randomized, stepped wedge trial investigating the best methods to screen and manage children with elevated BP or HTN. The study was registered at ClinicalTrials.gov (NCT03783650).

Recruitment

Urban, suburban, and rural pediatric primary care practices from across the United States were recruited for participation into BP-CATCH starting in August 2018. Recruitment approaches included posting to pediatric QI listservs, emailing practices that participated in prior QI collaboratives with the research team, and direct referral. Participants had the opportunity to earn CME, MOC, and CEU credit by attending webinars and engaging in QI activities, and practices were given an incentive to offset costs related to data entry. In total, 61 practices were recruited, and 59 submitted baseline data. Practice groups underwent multivariate matching before randomization based on key demographics, including patient volume per practitioner, patient population, number of clinic sites, and prior work reducing hypertension diagnosis and management errors. They were then randomized to two cohorts. During Phase 1 of the intervention (defined below), three practices withdrew from Cohort 1; during Phase 2, two practices from Cohort 1 and four from Cohort 2 had incomplete data submission.

Data Collection

Prior to starting the intervention work, each practice completed a practice inventory survey that provided information about their patient population, practice characteristics, and procedures for obtaining BP measurements. Practices also collected baseline data from clinical encounters with measured high BPs documented between November 2018 and January 2019. Once practices identified a patient with high BP, they were instructed to determine how many high BP measurements that patient had during the prior 24 months and to enter data accordingly. Using a structured chart review tool, practices submitted clinical data from the first 17 of these patients each month (up to 51 unique patients total) into REDCap (Research Electronic Data Capture).[25]

Data included patient demographics, BP levels, anthropomorphic measurements, and actions taken, including weight or nutrition counseling, lifestyle modifications recommended, and imaging and lab work done. During months when fewer than 17 patient encounters were eligible, data were entered for all qualifying patients. Patient data were excluded if they were presenting for a sick visit; had known HTN or elevated BP; had a prior diagnosis of congenital heart disease, chronic kidney disease, or urologic disease; had an organ transplant; or had an extremely elevated BP or symptoms requiring emergency care. This data collection continued for the 12-months of the intervention period except with 10 patients.

Intervention

At the start of the intervention, both Cohort 1 and Cohort 2 were trained on appropriate BP measurement techniques that included a list of 10 key behaviors (e.g., back supported, feet on floor, no speaking, no watching a device, etc). Cohort 1, as the first intervention group, was provided with training on clinic-level BP diagnosis steps via a day-long training webinar, when they learned and practiced QI methodology and skills, identified local 30- to 60-day aims to improve local hypertension practices, and increased their understanding of the pediatric hypertension guidelines and requirements. Additionally, Cohort 1 participated in monthly video conferences, QI coaching with data feedback, and monthly mini root cause analyses (RCA: described below). Simultaneously, Cohort 2 continued usual care and submitted baseline data during their "extended baseline" phase.

Following these first 6 months, or Phase 1, Cohort 1 underwent an "elevated intervention" phase, when they incorporated a hypertension specialist into the QIC to emphasize issues in primary and specialty care to improve diagnosis, initial laboratory work-up, and standardized care for all patients. This was supplemented through a second day-long webinar that included topics specific to the issue of specialty care and that were emphasized in the monthly video conferences. Cohort 2 was assigned to improve hypertension practices via a PCP-only QIC, like Cohort 1's initial day-long webinar and monthly video conferences that they participated during their intervention phase. This was Phase 2. Although a third 6-month phase was planned, the study was stopped after 1 year due to the SARS-CoV-2 pandemic.

The mini root cause analysis (RCA) tool[30,31] was a QI tool that focused teams on learning from errors and helped identify opportunities for process improvement. Mini RCAs asked practices to identify which among the 25 patient, staff, and system factors contributed to the error and in which process step(s) the error occurred. The practices completed forms monthly via an online portal.[32]

Outcome Measures

Study outcomes were based on key steps required for the diagnosis, evaluation, and treatment of pediatric hypertension, as defined by the AAP Clinical Practice Guideline (CPG). The target population was patients ≥ 3 years old who had a high systolic or diastolic BP recorded at a well-child or non-sick visit. High BP was defined as systolic or diastolic BP ≥ 90th percentile for age, height, and sex or ≥ 120 mm Hg systolic or ≥ 80 mm Hg diastolic at any age.[22] BP categories were determined by the research team using actual BP values rather than using the categorization assigned by the practices.

BP Measurement

1. All screening BP measurement steps completed. According to the 2017 AAP CPG,[22] the initial screening BP measurement may be oscillometric or auscultatory. If the initial BP is elevated, two additional oscillometric or auscultatory BP measurements should be performed and averaged. If using auscultation, this averaged measurement is used to determine the child's BP category. If the averaged oscillometric reading is high, two auscultatory measurements should be taken and averaged, with that value used to

determine BP category. Patient encounters were reviewed to determine if all BP measurement steps were completed based on a chart review tool. All steps had to be completed correctly to fulfill criteria for this measure (Figure 1).

2. Three-limb BP measurements completed. A second measure identified if three-extremity BP was completed when indicated. Upper- and lower-extremity BPs should be performed on all patients presenting for the second time with an average BP in the elevated or Stage 1 BP range, or at the initial encounter when an average Stage 2 reading is obtained.[22] Again, the chart review tool included questions about this outcome if the patient met criteria for a three-extremity BP.
3. Ambulatory blood pressure monitoring (ABPM) completed. A final measure was whether 24-hour ABPM was completed when indicated. It is recommended that 24-hour ABPM be performed after a third encounter with an average BP in the elevated or Stage 1 category or after the second encounter with an average BP in the Stage 2 category.[22]

Counseling

It is recommended that patients with high BP receive nutrition counseling, with a specific emphasis on the Dietary Approaches to Stop Hypertension (DASH) diet, as well as counseling on physical activity, sleep, and weight loss, if appropriate. Practices were asked to indicate whether counseling regarding (1) weight, (2) nutrition, and/or (3) lifestyle modifications was documented. These items were tracked as separate measures and also in combination (all counseling, yes/no). If a patient did not have an elevated Body Mass Index (BMI), practices were given credit for completing all counseling if nutrition and lifestyle modification counseling alone were performed, as weight counseling would not be necessary.

Recognition and Work-Up

When a patient is noted to have high BP, it is recommended that they return within a certain time interval to have their BP rechecked. The specific interval depends on the degree of BP elevation and the number of prior high BPs. Study outcomes included (1) a follow-up appointment recommended or scheduled and (2) if follow-up appointment was scheduled, it was scheduled for the appropriate interval. The interval was considered to be appropriate for each stage based on the CPG, including a small buffer. For encounters in which the patient was presenting for the third time with an elevated BP, practices identified those in which a diagnosis of HTN or elevated BP was documented in some form (notes, billing, problem list). In addition, practices determined how many of these encounters documented completion of appropriate screening lab tests and renal ultrasound.

Analysis:

The primary outcome compared the baseline to Phase 1 and Phase 2 for primary care specific measures. Mixed-effects logistic regression models were used to compare phases on each measure, and the analysis was extended a priori to include baseline to elevated intervention comparisons. The most robust model included demographic variables that were statistically different between the phases and variables for cohort, time in months, and phase. If the primary model did not converge, the demographic variables were removed and the measure was remodeled. If the model still did not converge, time in months was removed. Data were analyzed using SAS 9.4 software (SAS Institute, Cary, NC). This study was approved by the Albert Einstein College of Medicine's Institutional Review Board and by local Institutional Review Boards, if required.

Home Blood Pressure Monitoring Study:

Six urban, pediatric primary care clinics associated with a tertiary care center and enrolled in the original study were recruited. After suspending in-person visits from mid-March 2020 through June 2020, clinics were open for all non-infectious, in-person visits. Visit volumes were approximately 20% lower than the comparable period in 2019, related to limiting infectious-type visits. Clinics maintained high performance on quality measures during the pandemic.

A research coordinator phoned English-speaking patients aged 3 to 22 years old, previously identified during the original study as having one prior EBP measurement. Patients had a visit between November 2018 and March 2020 and were contacted between November 2020 and May 2021. Following telephone consent, patients returned to clinic to obtain a HBPM device with appropriately sized cuff and receive education on its use, including recording three morning and three evening measurements for 7 consecutive days. Additionally, each patient underwent two manual BP measurements. Participants were asked to text, email, or fax pictures of HBPM measurements. Potential participants were contacted up to five times for consent, followed up with to reschedule missed appointments, and contacted up to 10 times to obtain HBPM data.

HBPM measurements were averaged and staged according to AAP guidelines.[6] Patients with HBPM measurements categorized in the same stage (normal, elevated, Stage 1, or Stage 2) as their average manual clinic BP were considered concordant. Patients with discordant measurements were referred to a pediatric nephrologist for “gold standard” BP staging, which included ambulatory blood pressure monitoring (ABPM) if older than 8 years old or clinical diagnosis via repeated BP measurements from experienced nephrology clinicians if younger.

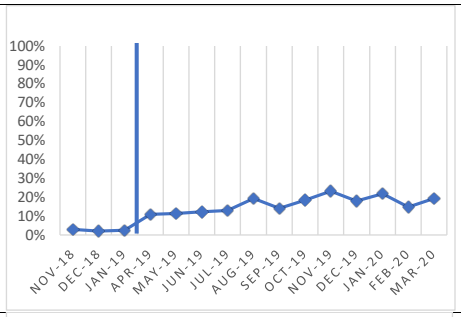
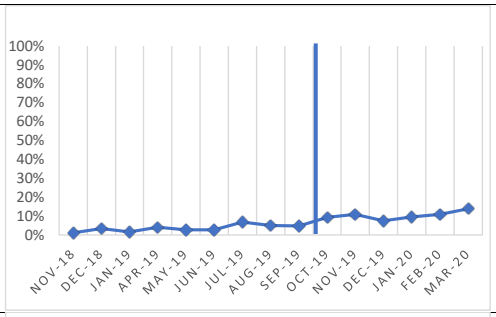
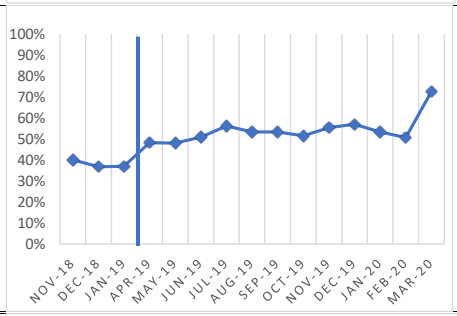
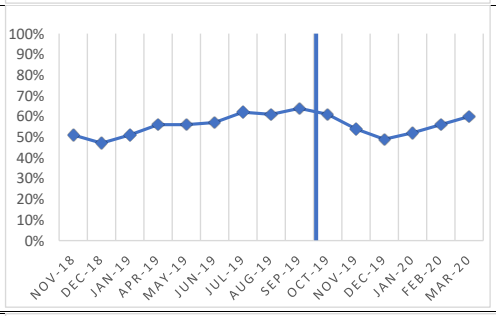
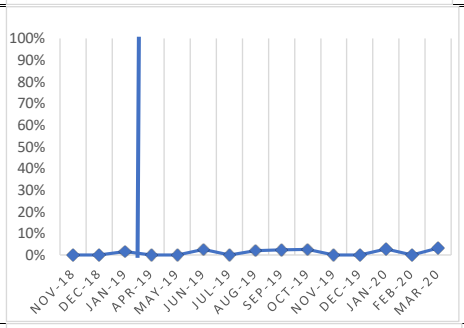
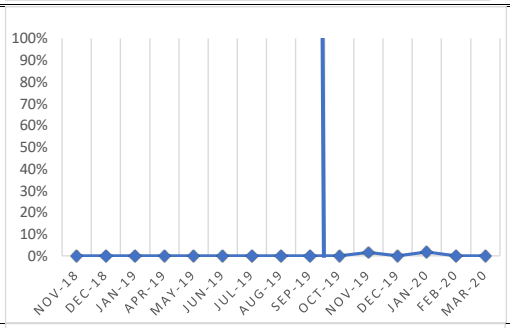
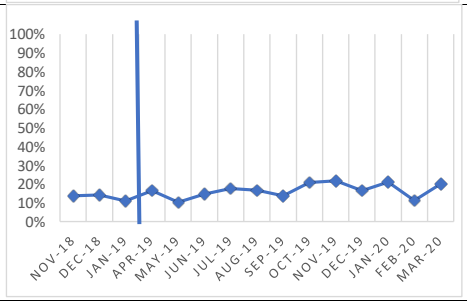
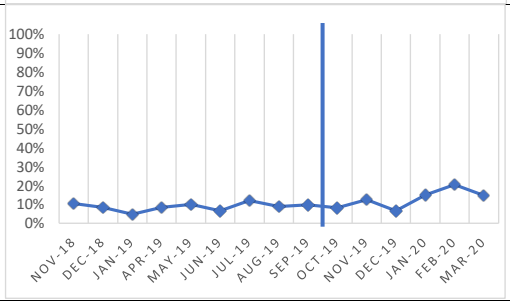
6. RESULTS

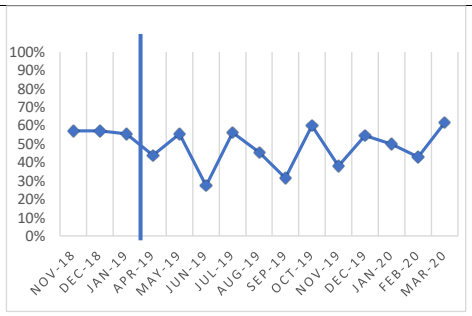
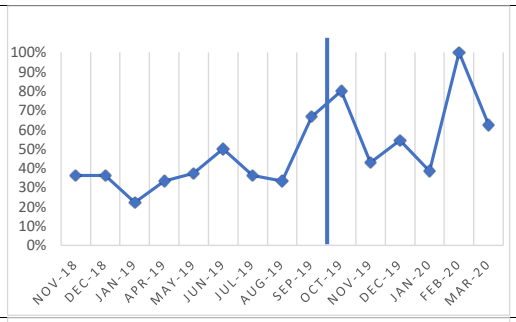
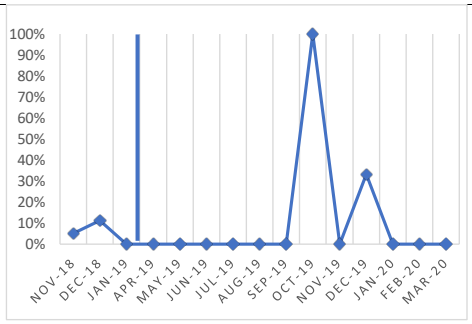
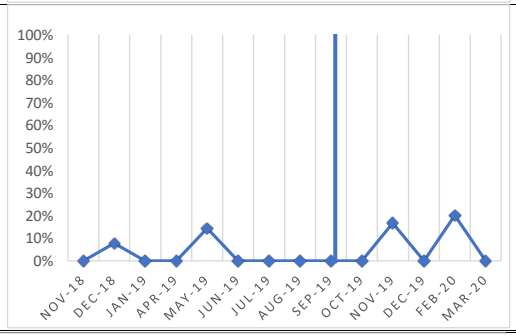
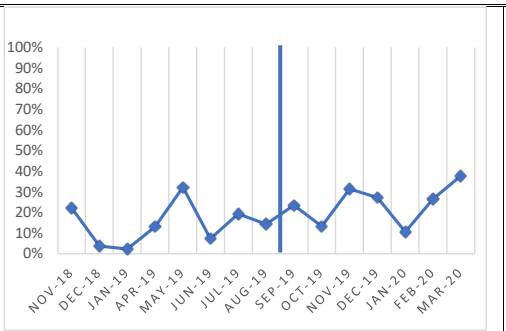
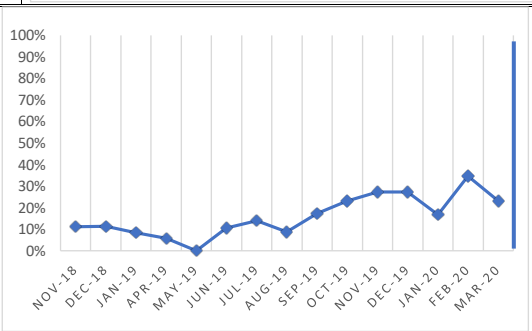
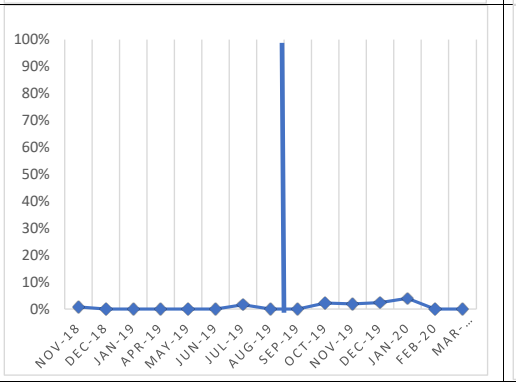
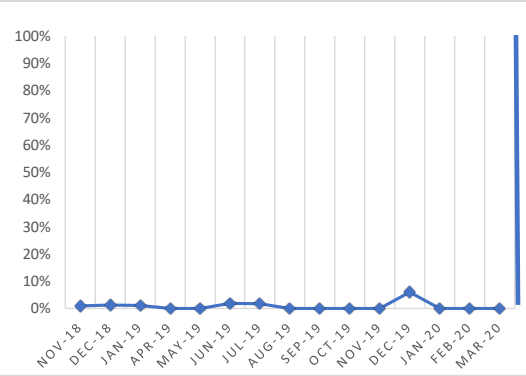
Of the 59 participating practices, 50% identified themselves as urban, 47% as suburban, and 3% as rural. Across the practices, 2677 patients were identified who had at least one high BP reading during the 3-month baseline period. Seventy-three percent were encounters with a first elevated BP, 18% with a second, and 8% with three or more elevated BPs. Across the practices, 9098 patients were identified who had at least one elevated BP measurement during the baseline and intervention periods combined and no missing demographic data. The mean age of these patients at study visit was 10.9 years (standard deviation (SD) 5.2); 57.2% of patients were male, 42% were White non-Hispanic, 22% were Black non-Hispanic, and 15% were Hispanic. Forty-six percent of patients had public insurance; 17% of patients had a BMI in the overweight category, and 31% had a BMI in the obese range.

Between November 2018 and January 2019, an average of 2% of patients had all the BP measurement steps completed correctly. Similarly, a three-extremity BP was measured in only 0.2% of the patients who required it, and fewer than 1% of patients had ABPM performed when indicated. An average of 64% patients had nutrition counseling documented during the baseline period. Fifty-eight percent had lifestyle counseling documented during the 3-month period, and 48% had documentation of weight management counseling for elevated BMI. In total, 46% of patients received all counseling types combined. In 10% of encounters with a high BP documented, a follow-up appointment was recommended or scheduled, and in 5% of encounters it was scheduled at the appropriate interval. For patients whose encounter was their third time presenting with a high BP, 10% had a diagnosis of elevated BP or HTN documented in the medical record or through billing, 2% had appropriate screening lab tests conducted, and none had a renal ultrasound done when indicated. Even among patients with a high BP documented, only 11% had appropriate lab testing done.

For the evaluation of the QIC intervention, the analysis plan had successful model convergence in four measures, with less robust models used for the other six measures.

Comparing the intervention phase to the baseline and extended baseline phases, the 'all the BP measurement steps completed correctly' measure was the only one that showed a significant, though modest, improvement (6.3%; 95 CI 4.5, 8.0). All other measures did not demonstrate significant improvement. Unadjusted run charts for each cohort for each measure are presented below, with the blue vertical line indicating when each cohort started intervening on that measure.

Measure	Cohort 1	Cohort 2
BP Measurement Algorithm Followed		
Recommended Counseling		
3 Extremity BP Performed		
PMD Follow up		

Stage 1 or EBP PMD Follow up		
Stage 2 PMD Follow Up		
Diagnosis of Stage 1 /Elevated Blood pressure		
Recommended lab test for all patients		

Home Blood Pressure Monitoring Study:

Overall, 294 patients who met inclusion criteria were identified at the six clinics; 92 (31%) consented to participate in the study and were scheduled for in-person visits (mean age 10.0, standard deviation 5.1). Of these, 72 (78%) presented to clinic for HBPM teaching and manual BP measurements. Despite up to 10 reminder phone calls, only 26 patients (36%) provided HBPM measurements, and 14 completed all 42 measurements as instructed. Thirteen (50%) of the 26 patients with HBPM data submitted had discordant BP classification when comparing HBPM to manual BP measurements. Of those discordant patients, nine subsequently presented for a pediatric nephrology referral and six received ABPM.

Of those, four had ABPM BP classifications concordant with manual BP classification and discordant with HBPM, whereas two had ABPM classifications discordant with manual BP classification. Of the three patients too young for ABPM, one had nephrologist classification concordant with manual BP and discordant with HBPM.

Discussion:

In this multi-site cohort of pediatric practices, we found that adherence to the 2017 AAP CPG for high BP was low. Very few patients had their BP measured correctly, and almost none had three-extremity BPs and ABPM performed when indicated. Practices did report higher rates of counseling, although fewer than half reported all three types of counseling. Follow-up was recommended or scheduled in only 10% of cases of high BP, and it was scheduled at an appropriate interval in only 5%. Only 10% of patients had their elevated BP or HTN documented in the medical record, and almost no patients had the recommended laboratory or imaging evaluation completed.

In one of the largest clustered, randomized, stepped wedge trials aiming to increase BP guideline compliance, a national QIC intervention was able to increase concordance with the BP measurement algorithm by only 6.3% but did not observe significant improvement in other guideline compliance measures, despite comprehensive QIC components employed by an experienced research team.

Finally, in a feasibility and concordance study of pediatric HBPM in an urban, majority minority population during the SARS-CoV-2 pandemic, only one third of consenting patients who appeared for an in-clinic BP measurement and HBPM training provided HBPM data, despite up to 10 contacts from a research coordinator. Of those who did provide HBPM, many did not complete all HBPM as instructed, and one half had HBPM classifications that were discordant from manual BPs obtained in clinic.

QICs are often assocaited with significant improvement in measured outcomes.[18,19,21-23,33] This reserch team, using similar methods and QIC components, successfully improved action taken on an elevated BP measurement by 90% in a prior QIC.[34] Although that project included sites working to improve three different measures sequentially over 8 months each, a major difference is that the current study attempted to improve over 10 guideline-related measures in 12 months. This study was stopped preamturely due to the SARS-CoV-2 pandemic, and it is unclear if the full planned 24-month timeline would have led to greater improvement. The improvement demonstrated on one measure was modest, and there were some measures for which practices anecdotally reported signficiant barriers to improve (e.g., three-extremity BP measurement required extra large adult cuffs for thigh BP measurements in obese adolescents). This lack of improvement could be due to variety of reasons, such as patient noncompliance, parent hesitation, and insufficient training or awareness by medical staff, and/or the perceived utility of this work in primary care.[35] Future guidelines may need to further consider real-world implementation challenges with key action steps.

Although willingness to return to clinic for follow up of EBP may be affected by the SARS-CoV-2 pandemic, HBPM data submission did not require in-person contact. It is unlikely that the multiple outreaches from the study team to obtain HBPM data could be replicated by primary care practitioners outside of a study environment, suggesting that even lower HBPM response rates could be observed in real-world HBPM implementation.

Limitations:

Our study has several limitations. Although this study included a national sample of pediatric practices, they may not represent every practice setting. Furthermore, practices that self-enrolled in a QIC to improve BP measurement and evaluation may perform differently from other practices in the United States. There may have been quality control issues, as each practice collected their own data, rather than having data collected by an independent research team.

The research team conducted multiple data collection and training webinars, answered questions on listservs, requested clarification for grossly abnormal data entry, and shared clarifications regarding data collection to minimize this bias. Practices were asked to collect data on the first 10 to 17 eligible patients each month, which is a no-randomized way to collect the data but which we hope minimized any sampling bias that could occur. The original planned timeline for the project was 24 months but, due to the SARS-CoV-2 pandemic, the project was stopped after 12 months, and it is unclear if additional time would have led to greater improvement. We cannot comment about practices that received the recruitment email, attended orientation webinars, or signed up and did not enter data and how this would change the results. Further research needs to be done to see if easier data collection would have reduced the attrition rate. Demographics data or patient measurements were not submitted by practices that dropped out; therefore, an intention-to-treat analysis or comparison between participating and non-participating practice demographics was not possible. Finally, it is unclear how the SARS-CoV-2 pandemic affected data collection for the HBPM study and whether this study would have increased data submission if done at a different time period.

In the third year of the award, Drs. Goilav and Rinke maintained their effort on the award but, due to administrative errors in carrying forward funding, the associated salaries were not fully applied.

Conclusions:

In conclusion, this study found low adherence to measurement, evaluation, and diagnosis recommendations from the 2017 AAP CPG in the baseline period of a national QIC. This national QIC aimed at increasing guideline compliant hypertension care in children, truncated because of the SARS-CoV-2 pandemic, was unable to significantly increase nine of 10 measures of guideline compliance. Given the long-term implications of high BP in childhood, it is imperative to improve PCP recognition and management of high BP. Further work is needed to understand how to best create compliance for complicated pediatric guidelines and sustainable approaches to guidelines.

As HBPM classifications were not consistently aligned with manual BP or ABPM classifications, it is unclear if this modality can reduce clinic visits, be used in telemedicine settings, or speed pediatric HTN diagnosis. More study is needed outside of the SARS-CoV-2 pandemic to confirm this finding with larger cohorts and in other contexts, such as in children with diagnosed hypertension or out-of-clinic BP measurements from other providers, such as school nurses or community health workers.

7. LIST OF PUBLICATIONS and PRODUCTS

1. Rea CJ, Brady T, Bundy DG, Heo M, Faro E, Giuliano K, Goilav B, Kelly P, Orringer K, Tarini B, Twombley K, Rinke ML. Pediatrician adherence to guidelines for diagnosis and management of high blood pressure. The Journal of Pediatrics. 2021 November. [Epub]. PMID: 34774574
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3. Rinke ML, Bundy DG, Heo M, Rea CJ, Giuliano K, Goilav B, Kelly P, Orringer K, Tarini B, Twombley K, Brady T. The effect of a quality improvement collaborative on pediatric hypertension guideline compliance. [Manuscript Prepared for Submission]

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