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Improving hypertension recognition in adolescents, a small but important first step in cardiovascular disease prevention

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Blood pressure (BP) is routinely measured during pediatric primary care visits. It is estimated that 1–3% of youth in primary care settings meet clinical criteria for HT and an additional 5% to 10% have isolated BP measurements in the hypertensive range.^{1,2} Elevated BP and HT during childhood and adolescence, although generally asymptomatic, is associated with immediate adverse health effects, including left ventricular hypertrophy (LVH).³ More importantly, HT in youth tracks into adulthood, and predicts long-term cardiovascular morbidity and mortality.⁴

For children up to 12 years of age HT is defined as having BP recorded at three or more visits at or above the 95th percentile. Based on the updated, 2017 BP guidelines, for youth 13–17 years, the threshold for HT is 130/80 mmHg.⁵ As children average one to two primary care visits each year, over time there should be sufficient patient BP data stored in the electronic health record (EHR) to identify HT. However, our group and others have demonstrated that due to lack of familiarity with current pediatric BP guidelines, competing priorities at primary care visits, and the complexities of age, sex and height-based BP percentile calculations, elevated BP and HT are frequently not clinically recognized.

Clinical decision support (CDS), integrated within an existing electronic health record (EHR) platform and delivered at the point of care, is ideally suited to address barriers to elevated BP and HT recognition. Automated calculations of BP percentiles for current and prior visits can reduce the time needed to identify an incident or persistently elevated BP. Computer prompts regarding BP classification, recommended evaluations, and timing for follow-up can assist providers unfamiliar with pediatric BP guidelines.

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Clinical Trial Registration:

We previously developed, piloted, and refined an EHR-linked CDS to improve the recognition and initial management of elevated BP and HT in youth 10–17 years of age.⁶ The impact of this novel CDS on recognition and next steps in care was then formally assessed in a two-year cluster-randomized trial, conducted in 20 primary care clinics within our large integrated health system.⁶ As described in the Jan-Feb 2018 issue of *Academic Pediatrics*, using data from the first year of the trial, we identified approximately 1200 adolescents with an incident or a first elevated BP, evenly divided between intervention and usual care clinics. As compared to those attending usual care clinics, patients with elevated BP recorded at visits to CDS intervention clinics were more likely to have their elevated BP remeasured during the visit and were more likely to be diagnosed with elevated BP. Although pediatric BP guidelines recommend that patients with elevated BP return for an additional measurement in 1–2 weeks, rates for repeat BP measurement within 30 days were low and did not differ significantly among those at CDS intervention clinics.⁷

More recently we have described results from the full trial. Of 31,579 patients 10–17 years of age with one or more BPs measured over a two-year period at study clinics, 1.8% met clinical criteria for HT. Within 6 months of meeting criteria for incident HT, 54.9% of patients attending CDS clinics versus 21.3% of patients attending usual care clinics had their HT clinically recognized ($p < 0.001$).⁸ Using diagnosis codes alone to identify recognition, the rates were 47% and 14%, respectively. HT recognition was strongly associated with lifestyle referral or provider counseling regarding exercise and weight loss. A majority of providers surveyed at the end of the intervention thought that the CDS was useful in identifying patients with elevated BP or hypertension, 94% agreed that time using the CDS was “time well-spent” and 95% agreed that the CDS tool was useful for shared decision-making.⁸ In an accompanying 2018 editorial, our CDS tool was described as “the most comprehensive and well-integrated pediatric BP CDS described to date.”⁹ In a separate economic evaluation [*submitted to Academic Pediatrics concurrently with this submission*], we found that among patients with incident HT, availability of the CDS at their primary care clinical encounter was not associated with significant increases in medical expenditures over 12-months of follow-up.

Given the demonstrated effectiveness of the CDS in the initial trial, along with the positive feedback from providers using the tool, with support from our health system clinical leadership we have expanded the targeted age range to ages 6–17 years, updated algorithms to account for new definitions based on the 2017 pediatric BP guidelines⁵ and simplified the CDS, for use outside of a research study. In June 2018, following provider and staff training we implemented the CDS, now known as *Peds & TeenBP*, for use in 36 primary care clinics in Minnesota and Western Wisconsin (including 20 from the initial trial.) Over a 4-month period following this implementation, there were 29,028 visits among 6–17 year olds with a BP measured. Of these, 3305 (11.3%) had an elevated BP and 48% of elevated BPs were remeasured at the visit. Over the 4-month period, 171 patients (0.6%) newly met criteria for HT and about one-third were diagnosed with HT or elevated BP within 6 months of meeting criteria. (Table 1) Of note, there is no ongoing training or audit-feedback to further support CDS use. As of February 2019, the *Peds & TeenBPCDS* is live in all 55 primary care clinics and 19 subspecialty clinics serving children within our large integrated care system. Future directions include plans to implement this effective CDS in new health systems, with a focus

on rural and other settings where access to pediatricians and pediatric subspecialists may be limited.

The short term benefits of CDS such as the *Peds & TeenBP*, improving the quality of BP measurement through repeated measurement of an initial elevated BP and increasing clinical recognition of elevated BP and HT are clear. Identification or clinical recognition of HT is an important and necessary first step. Nevertheless, the long term benefits of diagnosing HT in youth, including the potential for early recognition to delay or prevent cardiovascular disease, has been identified as a gap in evidence and priority for ongoing pediatric hypertension research.¹⁰

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What's new

Electronic health record linked clinical decision support can help to increase clinical recognition of elevated blood pressure and hypertension in youth, improving the quality of blood pressure measurement and promoting guideline adherent care.

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Table 1.

Data on recognition of elevated BP and hypertension in 36 primary care clinics using Peds & TeenBP, July 1, 2018 – October 31, 2018

N=24,532 unique patients	
	N (%)
Male	12,294 (50.1)
Female	12,237 (49.9)
6–12 years	14,086 (57.4)
13–17 years	10,446 (42.6)
Asian	2202 (9.0)
African American	4958 (20.2)
Native American	328 (1.3)
White	14,268 (58.2)
Unknown / other	2776 (11.3)
Hispanic	1745 (7.1)
N=29,028 visits with BP measured	
	N (%)
Initial BP at visit elevated *	3305 (11.3)
<i>Of 3305 visits with initial BP elevated, BP repeated at visit</i>	<i>1587 (48.0)</i>
Lowest BP at visit elevated *	2402 (8.3)
Met criteria for incident hypertension **	171 (0.6)
<i>Of 171 patients meeting criteria for hypertension, hypertension or elevated BP diagnosed within 6 months</i>	<i>55 (32.1)</i>

* For youth 6–12 years, systolic BP or diastolic BP ≥95th percentile, using 2017 Guideline thresholds; for youth 13–17 years, systolic BP ≥130 mmHg or diastolic BP ≥80 mmHg

** Elevated BP at 3 or more visits, without prior hypertension diagnosis

BP = blood pressure