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EDITORIAL COMMENTARY

The USPSTF call to inaction on blood pressure screening in children and adolescents

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In October 2020, JAMA published "Screening for high blood pressure in children and adolescents: U.S. Preventive Services Task Force (USPSTF) final recommendation Statement" [1]. This statement was intended to update the previous USPSTF statement on blood pressure (BP) screening in children published in 2013 [2], following a systematic review of available evidence [3]. Although the publication acknowledges that the prevalence of childhood hypertension (HTN) (both primary and secondary) in the US ranges from 3 to 4%, the USPSTF concludes that the current *evidence is insufficient (I) to assess the balance of benefits and harms of screening for high BP in children and adolescents.* Thus, the I statement is repeated once again by the USPSTF. Although this statement is disappointing, it is clearly in contrast with guidelines on BP measurement and management of abnormal BP in children and adolescents in the United States [4], Europe [5], Canada [6], and others.

The I statement for insufficient evidence appears to be based, in part, on accuracy of BP measurement in the clinical setting. However, BP is a vital sign, and BP is known to be variable in children and also in adults, due to responses to mental and physical stresses as well as to circadian rhythm. A diagnosis of HTN is never made on the basis of a single BP measurement. As detailed in the recent guidelines [4–6], BP must be measured appropriately and if abnormal should be repeated, within a clinical visit and subsequently over weeks or months to determine if a child has BP levels that meet criteria for HTN. Ambulatory BP monitoring is also recommended to confirm diagnosis of HTN.

The USPSTF statement is also based on insufficient evidence that BP screening in childhood decreases cardiovascular disease (CVD) in adulthood. However, prospective cohort studies that include BP measurements from childhood to early adulthood provide insights on a life-course connection of higher BP levels in childhood with intermediate markers of CVD in early adulthood [7, 8]. In a large cohort of almost 27,000 adolescents with follow-up to age 42 years, BP was stratified by baseline BP, adjusted for age and body mass index. The risk rate to develop HTN increased gradually across BP groups, even within the normotensive range at age 17 years, demonstrating that BP in adolescence linearly predicts progression to HTN in young adulthood [9]. A trajectory analysis of BP data from age 7 years to 38 years demonstrates clear separation by age 11 years of BP curves leading to prehypertension and HTN in adulthood [10]. The trajectory curves are notable in that adolescents who enter adulthood with a systolic BP < 120 mmHg remain normotensive in early adulthood.

A meta-analysis of twelve prospective cohort studies of elevated BP in children and adolescents with intermediate markers or hard outcomes in adulthood was recently reported by Yang et al. [11]. The investigators determined that elevated BP in childhood was significantly associated with intermediate markers of CVD in young adulthood as measured by pulse wave velocity (PWV) odds ratio (OR): 1.83 (95% CI 1.39–2.40), carotid intima-media thickness (cIMT), OR: 1.60 (95% CI 1.29–2.00), and left ventricular hypertrophy (LVH), OR: 1.40 (95% CI 1.20–1.64). Progression of elevated BP to HTN has also been demonstrated in primary care patients. An analysis of BP data in a community-based primary care population demonstrated that among adolescents aged 10 to 17 years with persistent elevated BP, progression to HTN occurred in 5.9% over a 2-year period [12]. Despite what should be convincing

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evidence from longitudinal cohort studies, the USPSTF appears to demand clinical trial evidence that BP screening in childhood decreases CVD outcomes in adulthood. Currently novel multicenter clinical trials in pediatric patients, similar to the adult TROPHY study [13], but with 20 to 30 years of follow-up, are unlikely to be supported.

The USPSTF statement dismisses the justification for BP screening in childhood to identify secondary HTN because it is "a relatively rare condition" and "HTN is unlikely to be the only clinical manifestation of the underlying disorder." However, in clinical pediatric practice, secondary HTN is not a rare condition, and secondary HTN conditions such as coarctation of the aorta, renal vascular lesions, and chronic kidney conditions are found in asymptomatic children. BP measurement is obtained by a noninvasive method that is highly available at all levels of health care and is economical. The harm in missing detection of these conditions in clinical practice clearly exceeds any harm or burden of BP screening.

It is interesting that the USPSTF even questions the definitions of pediatric HTN based on percentiles, stating "There is limited evidence about the clinical and epidemiologic significance of percentile thresholds used in children in terms of their association with adult CVD." There is an abundance of data from cross-sectional reports on significant associations of LVH, increased PWV, increased cIMT, and impaired cognitive function with HTN, defined as BP ≥ 95th percentile, in adolescents. Data in the Bogalusa cohort demonstrate that abnormal BP in childhood is predictive of LVH in adulthood [8]. In addition, recent reports from the multicenter cross-sectional Systolic Hypertension in Pediatrics: Adult Hypertension Onset in Youth (Ship Ahoy) study demonstrate that LVH can be detected in adolescents with BP levels below the 95th percentile. In this study, the 90th percentile for systolic BP resulted in the best balance between sensitivity and specificity for prediction of LVH [14]. Further analysis of cardiac function determined that subclinical changes in left ventricular systolic and diastolic function can be detected even at BP levels below the hypertensive range of ≥ 95th percentile [15]. These recent reports confirm that childhood HTN, as currently defined, is an adverse health burden that contributes to CVD in adolescence and if not managed appropriately, would likely advance to adult CVD.

There are two other items in the USPSTF recommendation on which we cannot resist making comments. Under "Practice Considerations" the authors state: "This recommendation applies to children and adolescents who are not known to have hypertension." How is it possible to know that children are not hypertensive without measuring BP? Having stated that the prevalence of childhood HTN is 3–4%, which is not uncommon, why is that prevalence itself not evidence that it is good practice to measure BP for something that is so common in childhood?

The other peculiar statements appear under "Potential Preventable Burden." In this paragraph, the risk factors for primary HTN in children and adolescents are provided. These risk factors are well known and would be an obvious indication for BP screening of asymptomatic children and adolescents. If this was a hint that BP screening would be appropriate in some asymptomatic children and adolescents, then the percentage of pediatric patients to screen for BP could be estimated. BP screening for children with high body mass index would include approximately 30% of US children; BP screening for low birth weight would add about 5%; BP screening for male sex would include 50% of all children; BP screening on African American or Hispanic/Latino race/ethnicity would include approximately 30% of US children; and BP screening for a positive family history could add more children. Essentially, the only asymptomatic children from age 3 to < 18 years to which this USPSTF statement could then apply would be normal weight white girls with a negative family history of hypertension, but only if they are also not known to be hypertensive.

Considerable advances have been made over the past few decades on the concept of childhood origins of adult diseases, including HTN. Abnormal BP in adolescents continues to rise and leads to HTN in early adulthood. Primary HTN in adolescents is frequently associated with target organ damage, and target organ damage can be detected even at BP levels < 95th percentile. Research is now needed on optimal methods to lower abnormal BP in children and adolescents and to determine if sustained lowering of BP can prevent or reverse target organ damage. This research is timely because the prevalence of BP control in adults has decreased since 2013–2014, especially among young adults aged 18 to 44 years [16], and the US Surgeon General has released a *call to action* to improve care of patients with HTN in the US [17]. Extending the call to action to childhood would be timely. The Ship Ahoy project is one model of multicenter collaboration that could be extended to clinical trials on interventions to lower BP and monitor outcomes from adolescence to young adulthood. Perhaps the repeat USPSTF statement of *insufficient* should serve as an incentive to mobilize pediatric HTN expertise to develop, obtain funding, and conduct clinical trials on BP reduction in youth with abnormal BP.

In the meantime, would it be ethical not to intervene until the final evidence is achieved? Given that children with high BP are likely to become hypertensive adults, with all the attendant HTN-related sequelae, the impact of *inaction* would be substantial. Prevention could assure a longer and better quality of life and lower costs for health care systems and promote a longer healthy and productive life. Action is required to address this issue in one of the most vulnerable and precious sectors of our society: the children who should be able to rely on us to provide the care they deserve. Inaction is not an acceptable solution.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict(s) of interest.

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