Hypertension Research (2023) 46:2124–2125
https://doi.org/10.1038/s41440-023-01345-4

COMMENT

Peak home blood pressure: new heights for SMBP

Stephen P. Juraschek[1,2] · Ruth-Alma N. Turkson-Ocran[1,2] · Jennifer L. Cluett[1,2]

Keywords Self-monitored blood pressure · Hypertension · Cardiovascular disease

Received: 11 May 2023 / Revised: 30 May 2023 / Accepted: 31 May 2023 / Published online: 9 June 2023

Historically the diagnosis and management of hypertension was based on blood pressure (BP) measurement in the medical office setting. Nevertheless, there is a growing body of literature in support of self-monitored blood pressure (SMBP) as a better predictor of end organ damage and cardiovascular events [1], especially stroke [2]. In addition, when combined with clinical supports (e.g., medication titration and lifestyle counseling) [3] and remote monitoring interventions like telehealth, SMBP can significantly reduce BP and improve access for patients. Indeed, SMBP is a promising tool to help reduce disparities in healthcare among low-income, rural, and some racial/ethnic minority populations as well as in scenarios of disrupted office-based healthcare such as the COVID-19 pandemic [4].

In light of this, SMBP has been endorsed by most major international hypertension guidelines to aid in the diagnosis and management of blood pressure disorders. Traditional approaches in the interpretation of SMBP are remarkably similar and rely on an average of readings preferably taken in duplicate, one minute apart, in the mornings and evenings, ranging over 3 to 7 days. These guidelines rely on averaging multiple measurements as a means of improving measurement accuracy and precision within and across several visits. Assuming that measures are unbiased, averaging is a tool to address random measurement error, which will trend toward zero with repeated measurements based on the central limit theorem. Moreover, a single visit BP based on the average of multiple measurements will have less random error, making the measurement more precise, which is important for tracking changes in BP over time [5].

✉ Stephen P. Juraschek
sjurasch@bidmc.harvard.edu

[1] General Medicine-Research, Beth Israel Deaconess Medical Center, Boston, MA, USA

[2] Harvard Medical School, Boston, MA, USA

However, the present report by Kario and colleagues [6], presents an alternative approach for assessing BP risk with SMBP. Using data from the well-known Japan Morning Surge Home Blood Pressure (J-HOP) study, the investigators examined a new high-risk phenotype, "average peak home systolic blood pressure", defined as the average of the highest three BP values out of a 2-week measurement period. Participants were followed for about 6 years for stroke and atherosclerotic disease events. Ultimately, the investigators found that a mean systolic BP over 175 mm Hg was strongly associated with stroke and CAD events. Moreover, the upper quintile of the mean of the maximum three measurements was more strongly associated with adverse events than the upper quintile of the mean average of all measurements.

These findings highlight SMBP's unique ability to trend "populations" of out-of-office BP measurements over time (Fig. 1) and have important implications for HTN management. Blood pressure varies substantially based on time of day, activity, and environmental exposure [7]. The confluence of these BP-raising factors can result in hypertensive extremes that could incite an adverse clinical event. These pathologic excursions may be masked in a more controlled clinic environment. This paper suggests that focusing on extreme, rather than mean, out-of-office BP elevations would better predict patients' risk for CVD events and thus enable more timely interventions. Moreover, it could safeguard against the well-described human tendency to focus on the lowest observed measurement, a form of downward measurement bias that causes clinical inertia [8].

This study has limitations. It did not focus on sequelae related to hypotensive events and is predicated on high quality, standardized SMBP. Patients with greater variability in BP or less reliable or inappropriate SMBP, could be at risk for complications of HTN overtreatment. Nevertheless, the study provides a compelling demonstration of yet another unique feature of SMBP. If replicated, this SMBP feature

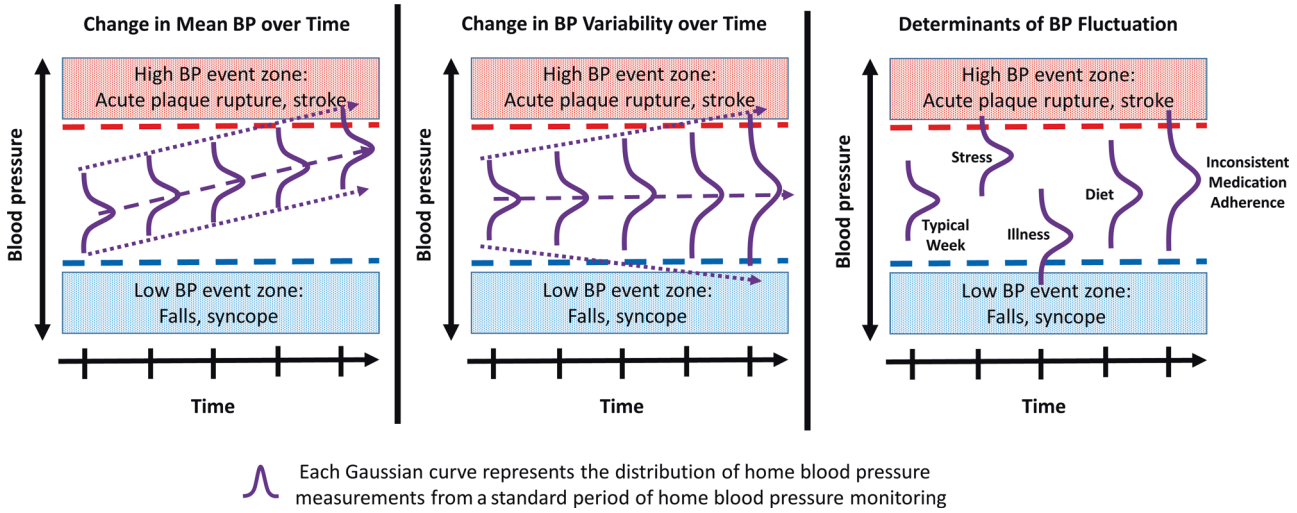

Fig. 1 This illustration depicts theoretical thresholds of high or low blood pressure (BP), contributing to adverse events related to hypertension (e.g., stroke, acute coronary syndrome) or hypotension (e.g., falls, syncope). Self-monitored blood pressure (or home blood pressure monitoring) makes it possible to obtain multiple measurements over time. Kario and colleagues demonstrate how a focus on the upper quintile of these measurements better classified patients at risk for cardiovascular disease events. This approach could result in more timely interventions

could be leveraged to enhance risk prediction and used to initiate timely preventive care.

Funding SPJ, RATO, and JLC are supported by R01HL158622.

Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

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