



Office and out-of-office blood pressure measurement using an all-in-one device

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Accurate blood pressure (BP) assessment is a prerequisite for the diagnosis and management of hypertension. Although BP measurement in the physician's office remains a commonly used method in clinical practice worldwide, out-of-office BP measurements, either ambulatory or home BP monitoring, have been increasingly recommended by various hypertension guidelines. Ambulatory BP monitoring usually captures diurnal BP levels and variation during daily life for 24 h, while home BP monitoring provides BP information when subjects have rested in the morning and evening at home for days, months or even years. Therefore, the two out-of-office BP measurement methods provide different but complementary BP information. There have been many investigations showing that either ambulatory or home BP level and variability can predict adverse outcomes independent of conventional risk factors and office BP [1]. However, which BP measurement is the best for the management of hypertension remains an issue of debate. Previous studies comparing ambulatory and home BP monitoring in their predictions of cardiovascular outcomes produced inconsistent results, partly because different devices and methodologies were used for the measurements [2].

In this issue of *Hypertension Research*, Kario and colleagues reported the concept, study design and baseline BP control status of the nationwide prospective HI-JAMP study, in which for the first time, an all-in-one device was used for office, ambulatory and home BP measurements [3]. The customised device can be preset in either automated or

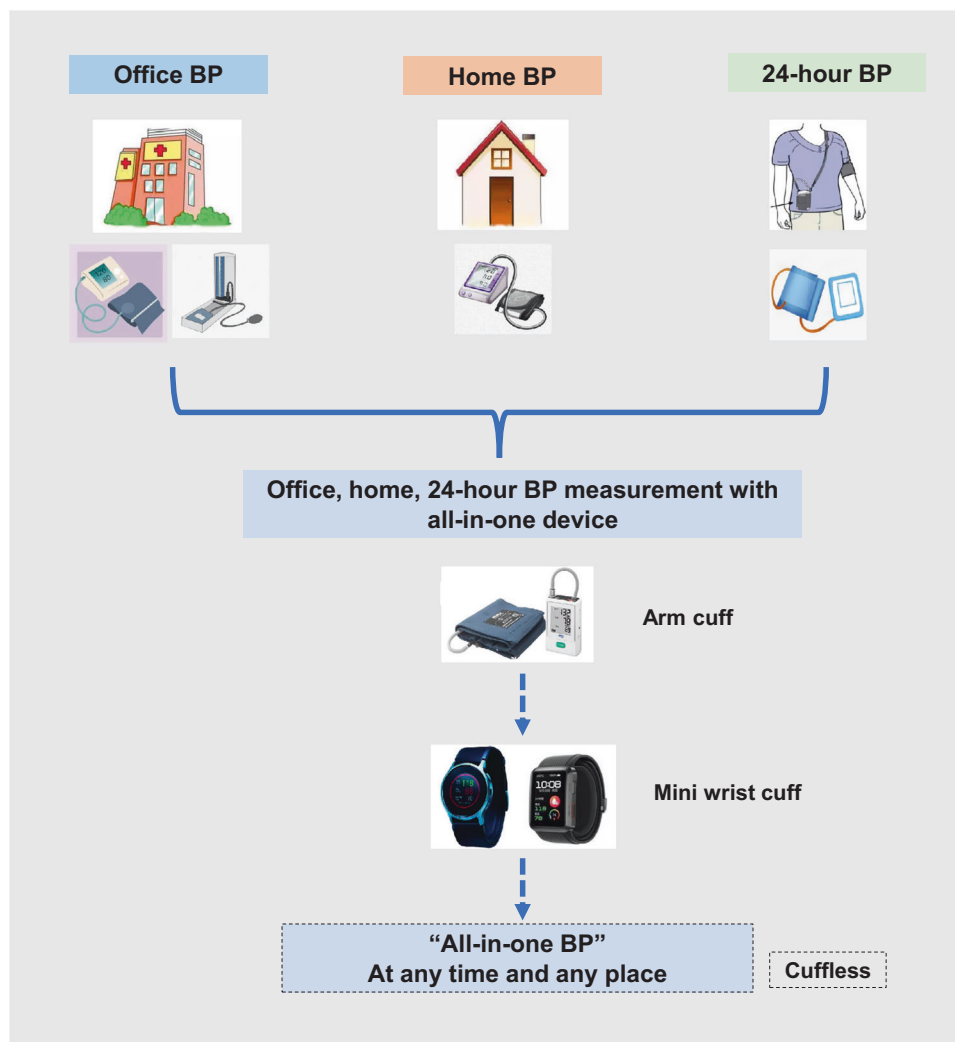
manual measurement mode so that it can fit the needs of BP measurement in various scenarios. The use of an all-in-one device may remove the confounding effect introduced by applying different algorithms of BP estimation in different devices on the comparison between BP measurement techniques. One of the goals of the HI-JAMP study is to clarify the impact of office, home, and ambulatory BPs on cardiovascular clinical outcomes. The prospective analyses of the HI-JAMP study are therefore worth looking forward to.

In the current baseline analyses of the HI-JAMP study [3], three important aspects of the results deserve attention. One is the mean BP difference between office, daytime ambulatory and home BP measurements. Among more than 2000 treated hypertensive patients, the mean office, daytime ambulatory, and morning, evening and average home BP levels were 131.8/80.8 mmHg, 127.9/77.6 mmHg, 134.3/81.1 mmHg, 126.1/75.7 mmHg, and 129.8/78.2 mmHg, respectively. As expected and consistent with previous observations, office BP was slightly higher than the daytime ambulatory and home BP levels. Impressively, morning home BP was the highest among the BPs taken during waking hours. The second aspect is the high prevalence of poorly controlled morning hypertension and nighttime hypertension, even among those taking two or more antihypertensive drugs. In the analyses stratified for the number of antihypertensive agents, combination therapy improved the BP control rates better than single-drug therapy. However, home morning and ambulatory nighttime BP levels remained uncontrolled in 54.4% and 46.5% of patients taking three or more drugs, respectively [3]. A large body of evidence has demonstrated that morning and nighttime hypertension are associated with adverse cardiovascular outcomes [4, 5]. The fact that the prevalence of morning and nighttime hypertension is high among Asians calls for special attention on the use of out-of-office BP measurement and the development of newer drugs and strategies to

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Fig. 1 Blood pressure (BP) measurement using an all-in-one device. The diagram illustrates the progression of BP assessment from the office, home and 24 h ambulatory BPs measured with various devices to measurements with the all-in-one device and hopefully to a new “all-in-one BP” that can be measured with validated wearable devices with mini cuffs or without cuffs in all scenarios of daily life for days, months and years



control morning and nighttime hypertension, as proposed by the HOPE Asia Network as one of the seven action approaches for the management of hypertension in Asia [6]. Third, even though BP was measured with the same device, the prevalence of masked hypertension and white coat hypertension defined based on home or ambulatory BP was different. In contrast to our previous findings [7], the prevalence of masked hypertension identified by home BP measurement was higher than that identified by ambulatory BP measurement in the HI-JAMP study, which might be due to the various prevalence rates of home morning hypertension and ambulatory nighttime hypertension in different study populations.

Finally, it is encouraging that in the HI-JAMP study, the all-in-one device was equipped with multiple sensors, including a high-sensitivity actigraph, a thermometer, and a barometer, which will allow future interesting investigations on BP response to physical activity and environmental factors and the development of new risk indicators of hypertension-mediated target organ damage and outcomes.

Currently, the all-in-one BP device is still dependent on arm cuff oscillometric estimations and to some extent less convenient for patients to carry the device all the time for days and months. Newly emerging wearable devices, especially watch-type devices with mini cuffs and validated accuracy [8, 9], might also be used as a kind of all-in-one device for BP measurement in the future. The “all-in-one BP” measured by using wearable devices with or without cuffs (Fig. 1) in all scenarios of daily life for days, months and years might greatly help the management of hypertension.

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Compliance with ethical standards

Conflict of interest YL reports having received research grants from A&D, Bayer, Omron, Salubris, and Shyndec and lecture fees from A&D, Omron, Servier, Salubris and Shyndec.

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