Blood Pressure Measurement for the 21st Century

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The measurement of blood pressure (BP) is one of the most commonly performed assessments in clinical practice. An elevated BP is also one of the most powerful predictors of premature morbidity and mortality. It is remarkable that over 100 years since BP was first recorded, there is still debate about how to measure BP in routine clinical practice and the appropriate thresholds for BP treatment and BP control. BP is most commonly measured in the seated position in the doctor’s office. However, with the availability of automated BP measurement devices, attention has recently focused on the importance of "out of office" BP using home BP or ambulatory BP.

Home or ambulatory BP are now considered to be important by many guidelines to accurately define the presence of hypertension, by excluding “white coat” hypertension in people with spuriously high office BP and to diagnose masked hypertension in people with a normal office BP. There is also evidence that home and ambulatory BP are better predictors of hypertension-mediated organ damage and clinical outcomes when compared to office BP but it is still unclear if this is mainly due to the elimination of white coat hypertension and more accurate definition of sustained hypertension.

One of the challenges of home or ambulatory BP has been the practicality, tolerability and cost of these measurements, especially for ABPM. There have been exciting developments in home BP technology that will allow repeated measures of night-time BP and also watch-like devices that should make the routine measurement of home BP more practical. With advances in technology and digital medicine, one can easily envision a future in which such devices, linked to algorithms, will facilitate more effective BP measurement and potentially, self-management of BP. The latter is important because studies have shown that when patients engage with self-management using home BP, BP control rates are often better than those achieved with usual care.

Office BP measurement has also begun to change with the emergence of unattended automated BP measurements, recording a sequence of readings with pre-defined time intervals. The challenge is understanding the meaning of these values when compared to
standard office BP measurement, the unattended readings tend to be lower, which may reflect some elimination of the alerting reaction and white coat effect.

There is growing interest in qualitative aspects of BP profiles and their impact on cardiovascular risk, these include; BP variability, dipping status, morning surge, stiffness index etc. There is no doubt that many of these parameters refine risk prediction but there is no evidence so far, to show that specific types of treatment can modify the risk associated with these parameters. For example, how do you smooth BP variability? Is the timing of therapy, i.e. chronotherapy important in modifying night time BP and morning BP surge, and does this change outcomes?

Finally, there is also debate about whether non-invasively derived aortic pressure might provide more accurate determination of the BP load on the circulation when compared to office BP, because of the variable amplification of BP from the aortic root to brachial artery. To date, the evidence does not support any particular advantage of aortic BP in predicting risk and outcomes when compared to carefully measured brachial BP. There is a current interesting debate about how best to calibrate arterial wave-forms to enable the derivation of aortic pressure. This raises a more fundamental questions about how monitors interpret the derivation of systolic and diastolic BP from mean arterial pressure and the impact of variation in the form factor (k) of the arterial waveform in individual patients.

We are at a critical time. Few would have imagined we would still be discussing how to measure BP in routine practice. There have been important changes in practice, with guidelines are now recognising the potential advantages of home or ambulatory BP for the accurate diagnosis of hypertension. These recommendations have largely been based on epidemiology, rather than data from intervention trials which are still needed to drive a shift from office to home BP as the routine method for BP assessment for diagnosis and monitoring the effects of treatment. I think this shift is likely to happen as home BP monitors become easier and more practical to use.