Ambulatory Blood Pressure Monitoring Is Ready to Replace Clinic Blood Pressure in the Diagnosis of Hypertension

Con Side of the Argument
Josep Redon, Empar Lurbe

The San Francisco experience with Perloff and Sokolow was the starting point for the clinical application of ambulatory blood pressure (ABP) measurement. Using a semiautomatic device, the superiority of ABP to office measurement was demonstrated in the relationship with hypertension-induced organ damage and in the risk for cardiovascular events. This seminal study impelled an issue with the largest production and impact in the field of hypertension in recent decades, boosting research and having an enormous influence on daily clinical practice. Initially restricted to specialized clinics, ABP monitoring (ABPM) has largely expanded to primary care in many countries. Similarly, scientific production has increased extraordinarily. The number of articles that include 24-hour ABPM in the title or abstract has grown exponentially from the beginning of the 1990s to ≈600 articles per year.

Fifty years on from the pioneering work, ABPM is now considered a keystone in hypertension management. Several guidelines and consensus have been published with recommendations for the monitoring process, reference values, and clinical and research use. Recently, the ESH-ESC 2013 guidelines upgraded the importance of out-of-office BP measurement for hypertension management, and the NICE guidelines recommend that, “If the clinic BP is 140/90 mm Hg or higher, offer ABPM to confirm the diagnosis of HTN.” Likewise, the Canadian Education Program in Hypertension recommended, “At visit 2 for the assessment of hypertension, patients without macrovascular target organ damage, diabetes mellitus, or CKD but with BP lower than 180/110 mm Hg, should undergo further evaluation using repeated office BP, ABPM or home monitoring.” Moreover, a recent full document and a summary from the European Working Group on BP Monitoring updated the information available and emphasized fundamentals and recommendations. More recent guidelines in hypertension management from the American Heart Association and from the Joint National Committee did not include comments on ABPM, although the American Heart Association and the American Society of Hypertension had previously released specific documents about ABP.

Despite the advances and the extensive literature on the issue, as well as the widespread clinical use, the solution to relevant questions is still pending before ABP can replace office BP for the diagnosis and management of hypertension. Likewise, self-BP measurement allows for a wider use of out-of-office BP values at the time of diagnosis and even more for the follow-up of patients. The use of self-BP measurement, however, has the same shortage of relevant information as ABPM. In this article, we point out the limitations of ABP values and derived parameters in prognostic studies, the uncertainties in the classification of patients, and the relevant unmet needs. A final comment about the availability is also included.

Con 1: Limitation of ABP Values in Prognostic Studies

The average of 24-hour, awake or nocturnal BP measured with ABPM has a better relationship with the presence of hypertension-induced organ damage, left ventricular hypertrophy, urinary albumin excretion, estimated glomerular filtration rate, and signs of cerebral small vessel disease when compared with the office BP counterparts. Superiority
of these ABPM to office BP values is largely reduced or even disappears with automated/prolonged BP measurements. The superiority of ambulatory to office BP in assessing the risk to develop cardiovascular and renal events has been studied in a wide spectrum of conditions and populations. In the general population, hypertension, isolated systolic hypertension, resistant hypertension, diabetes mellitus, chronic kidney disease, hemodialysis, and post-transplant, a large number of studies are in agreement with the superiority of ABP. Likewise, a better prognostic value has been claimed for nocturnal BP in comparison with the active BP period or for 24 hours, with nocturnal BP being the value that best fits with the risk of cardiovascular and renal events. The better relationship with organ damage and the prognostic superiority of ABP is often inferred from the fact that mean BP values have a steeper relationship with cardiovascular events than BP values measured in the clinical setting, but this is in part a result of the narrower distribution of ambulatory values when compared with clinical BP values, even lower for nocturnal than for diurnal. Whether or not the reason for this apparent superiority can be explained by mathematical reasoning is a controversial issue.

All of these studies have obtained positive results with only 1 monitoring at the beginning of the study period, whereas the outcomes considered—total or cardiovascular mortality, myocardial infarction, stroke, end-stage renal disease—occur years later. No information on the BP values during the study period has been given. It is an important limitation to confirming that ambulatory BP is superior to its office counterpart, principally when the necessity for antihypertensive treatment and BP goals are guided by office BP values. Furthermore, the changes in office and ambulatory BP are not parallel and differ greatly.

Few studies have focused on the development of organ damage or on the occurrence of events that have been published with >1 monitoring. In all of them, BP goals were established for office BP and not for ambulatory. Mancia et al published the first evidence that ABP may be clinically superior to traditional BP measurements in 206 hypertensive subjects with left ventricular hypertrophy treated during 12 months in the Study on Ambulatory Monitoring of Blood Pressure and Lisinopril Evaluation (SAMPLE) study. The left ventricular mass index reduction was not related to the reduction in clinical BP, but it was to the reduction in the average of 24-hour BP. Treatment-induced reduction in average daytime and night-time BPs correlated with left ventricular mass index changes as strongly as 24-hour BP. Lurbe et al, in patients with type 1 diabetes mellitus, used ABPM to assess BP at the initial evaluation and about 2 years later, at which time all subjects had normal urinary albumin excretion. A persistent increase in systolic BP during sleep preceded the development of microalbuminuria. In those subjects whose BP during sleep decreased normally, the progression from normal albumin excretion to microalbuminuria appeared to be less likely. Zanchetti et al, in the European Lacidipine Study on Atherosclerosis, a randomized, double-blind 4-year trial of the effect of lacidipine or atenolol on echographic carotid intima-media thickness, performed ABPM yearly. In a multivariable linear regression model, mean on-treatment of both clinic and 24-hour systolic BP was associated with end-of-treatment carotid intima-media thickness and with cardiovascular outcomes, although it was unpowered.

Con 2: Derived Parameters Other Than the BP Averages Have Limited Value

In clinical practice, the average of 24-hour, diurnal, or nocturnal BPs is today the recommended parameter for defining hypertension status and for monitoring the BP-lowering effect of antihypertensive agents. Apart from the average of BP values, other derived parameters from ABPM have been considered to be relevant such as variability, day/night ratio, and early morning surge.

Increased short-term and long-term BP variability are associated with the development, progression, and severity of cardiac, vascular, and renal damage and with an increased risk of cardiovascular events and mortality. The potential clinical value of these derived parameters, however, are still to be confirmed because the value of stratifying risk has not been proven and are considered a matter for research until more evidence is obtained.

Abnormalities in the circadian profile, the so-called non-dipping pattern, have been described as being associated with different clinical conditions and produced by different mechanisms, which include baroreflex or autonomic dysfunction, relative nocturnal volume overload, and abnormal sodium handling. A blunted decline of the physiological BP reduction has been associated with the presence of organ damage and with a worse prognosis for cardiovascular and renal disease. A particular period of circadian variability is the early morning surge. This has also been linked to vascular damage throughout the circulation, which may involve the myocardium, large arteries, and other target organs. An increased risk for cardiovascular events, such as myocardial infarction and stroke, especially in the presence of the comorbidities of diabetes mellitus, as well as cardiac and renal disease, has also been described. The major drawbacks for these parameters, circadian variability and early morning surge, are the poor reproducibility and the fact that the day/night ratio and the early morning surge per se depend on both awake and sleep BP values. There is not enough evidence to support giving excessive relevance to the fact that changes in the patterns can influence the success of the antihypertensive treatment.

Besides the BP-derived parameters, monitors added modules to capture signals at the same time as BP. The beat-to-beat ECG, the assessment of pulse wave velocity, augmentation index, and central BP are some examples of this. The ECG signal allows for the assessment of the relationship between BP changes and myocardial ischemia or arrhythmia. The Qkd index to estimate pulse wave velocity, the augmentation index to estimate the reflecting wave, central BP, and pulse wave velocity are measured intermittently during 24 hours. Although it was claimed that these parameters correlate better with organ damage when measured for 24 hours, compared with office measurements, the potential clinical utility has not been tested yet.

Con 3: Uncertainties in Classification of Patients

It is worthy to mention here the discrepancies between office and ambulatory BP at the time to diagnose or to assess BP control in a given patient, the so-called white-coat or masked hypertension. Measurements of BP during regular living
Stratification of patients based on these discrepancies between office and ambulatory BP values, however, depends largely on the criteria used to define hypertension in ambulatory BP and on the day-to-day intradividual differences. First, classifying patients can differ not only if the criteria for defining hypertension in ambulatory BP use the average of 24-hour or the awake period, but also when different BP thresholds are used. The absence of grounded values for defining hypertension (see below) introduces uncertainties and potential bias when it comes to classifying subjects.

Con 4: Relevant Unmet Needs

Despite all the advances in ambulatory BP that have been made during the past 50 years, pivotal information not only remains unanswered but also, to our knowledge, a plan of action to obtain it is lacking. This is in sharp contrast with the large number of trials in which office BP provides evidence about a threshold to define hypertension as well as a goal to be achieved during antihypertensive treatment in the general hypertensive population as well as in specific conditions. The absence of a definition of hypertension, the lack of information about the appropriate goals, and, as a result, the lack of evidence that ambulatory BP-guided therapy can obtain greater reductions in morbidity and mortality than office BP-guided treatment are unmet needs in ambulatory BP.

Con 4a: Absence of Grounded BP Reference Values to Define Hypertension

Sir Geoffrey Rose defined hypertension in 1971 as “that BP level above which detection and treatment do more good than harm.” In agreement with this, thresholds to define hypertension have been reduced until the values that are accepted today, thanks to studies that support the new thresholds. In contrast, the definition of hypertension using ambulatory BP values has been made using different approaches, but never the gold standard defined by Rose. In fact, the thresholds for defining hypertension have been derived from the percentiles of the general population and from correspondence with the office BP counterpart defined by the generally accepted 140/90 mm Hg or by the values obtained in population-based studies. A clever approach to defining the threshold was made by the International Database on Ambulatory Blood Pressure Monitoring in Relation to Cardiovascular Outcomes Investigators research cooperation. From this database, ambulatory BP thresholds were determined as those that yielded a 10-year cardiovascular risk similar to those associated with optimal, normal, and hypertension in office measurements. That notwithstanding, it is important to remember that the BP values were measured only at the beginning of the studies and not during the follow-up.

If we assume that a definition using ambulatory BP gives a better risk stratification, this was not the case in the Pressioni Arteriose Monitorate e Loro Associazioni (PAMELA) study. The fitting of individual data to a Cox proportional hazard model used to quantify the 11-year risk of cardiovascular mortality was equally good for ambulatory and office systolic BP; there was no superiority of the ambulatory over the office values. Receiver operating curves for the prediction of cardiovascular events or all-cause mortality were largely superimposable for clinic and ambulatory BPs with only a small and not invariably significant increase in the area under the curve when office BP was used along with ABP. The PAMELA study does not support the contention that ABP adds substantially to the predictive value of clinic BP. Similar approaches to the PAMELA study to estimate the potential superiority of ambulatory values over the office values have not been made in other long-term outcome studies, although they should be encouraged. Other methods of statistical analysis, including net reclassification improvement and the integrative discrimination index, can better define the discriminative power of ambulatory BP as a diagnostic tool and should be applied in the future.

Con 4b: Absence of Grounded BP Goals

Likewise, the out-of-office BP goals during antihypertensive treatment have not been established up to now, because only 2 studies using them as a target have been conducted. The first one, Antihypertensive Treatment Based on Conventional or Ambulatory Blood Pressure measurement, which searched for differences in left ventricular mass, was conducted >15 years ago in 419 subjects who were followed up for 6 months. The study reported that the adjustment of antihypertensive treatment based on ambulatory monitoring and the average of daytime BP instead of conventional BP measurement at the physician’s office led to less intensive drug treatment with preservation of BP control, general well-being, and an inhibition of left ventricular enlargement, but it did not reduce the cost of antihypertensive treatment. An analysis of cost-effectiveness using a theoretical model concluded that the overall cost of treatment and years of drug treatment would be reduced.

The Effect of Strict Blood Pressure Control and ACE Inhibition on the Progression of CRF in Pediatric Patients trial examined the efficacy of intensified BP control in delaying the progression of renal disease among children with various types of underlying kidney disorders. In the trial, the BP goals were set by an average of 24-hour ABPM assessed at 6-month intervals. Subjects were randomly assigned to either a reduction in conventional BP between 50th to 90th percentiles, or to an intensified target below the 50th percentile. In the intensified BP control, with target 24-hour BP values in the low range of normal, the mean BP decreased 3 mm Hg more than those for the conventional group, which conferred a substantial benefit with respect to
renal function. When the differences in office BP were analyzed, the differences between the intensified and the conventional group were 2 mmHg for systolic and 1 mmHg for diastolic BP.

With the scarce information available now, it is impossible to make decisions or release recommendations other than that of reducing BP below the consensus-defined thresholds of hypertension.

Con 4c: Absence of Grounded Evidences of the Superiority to Target ABPM on Cardiovascular or Renal Outcomes

Whether or not ambulatory BP-guided therapy can obtain greater reductions in morbidity and mortality than office BP-guided treatment remains to be assessed. The studies that compared target ambulatory or office BP addressed the need for antihypertensive drugs and the achieved BP values, but not the impact on outcomes.72-73

Con 5: ABPM Is not Available Widespread

Finally, availability for routine use of ABPM has important constraints. From the initial semiautomatic monitors, which were operated by the patient, automatic devices were developed to measure BP in ambulatory conditions.74 Innovations reduced monitor size and noise, aiding portability and tolerability. In parallel, better algorithms in oscillometric devices75,76 contributed to improving the accuracy and reliability of BP readings. Validation protocols from the British Hypertension Society, Association for the Advancement of Medical Instrumentation, International Standards Organization, and European Society for Hypertension International Protocol (Version 2)77 facilitated the selection of the monitors with the best algorithms. Likewise, validation protocols identified differences in the degree of accuracy when used in adults, elderly, pregnant women, and children because of differences in vascular elasticity and pulse amplitude. Recommendations based on the results of the validation process were given to minimize erroneous BP values.78

Despite the existence of multiple validated monitors, their cost is still high, requiring computer assistance to preset the monitoring and to retrieve the information. In addition, the procedure is time-consuming and requires some level of expertise to analyze the report, despite there now being computer-generated reports that reduce the time needed for interpretation and allow for availability to a wider public even in pharmacies.79 Although the availability is increasing in developed countries, it is still low when compared with the high prevalence of hypertension mainly in developing countries, in which high BP accounts for a high burden of cardiovascular disease.

Conclusions

In conclusion, knowledge on ambulatory BP has provided a large weight of experience that seems to support the superiority of ambulatory to office BP. The real impact of this superiority, however, should be tested in the coming years. The combined efforts of health authorities and scientific organizations are required to plan studies that answer the following key question: Is time to replace office BP with ABP? The answer in our opinion is not yet, but it may be.

Disclosures

None.

References


Response to Ambulatory Blood Pressure Monitoring Is Ready to Replace Clinic Blood Pressure in the Diagnosis of Hypertension: Con Side of the Argument

Geoffrey A. Head

The superiority of ambulatory blood pressure measurements (ABPM) over clinic BP is undisputed and acknowledged by both articles in the debate. The criticism raised that outcome studies only obtained measurements at the beginning of the study is true but not actually relevant in a head-to-head comparison with techniques (Con 1). The value of ABPM is not only higher resolution from multiple measurements but also the inclusion of nocturnal period, which cannot be replicated in the clinic. Indeed, the recent study of Niiranen et al. found that neither clinic nor home measurements came close to matching ABPM for prognostic value and really ends this particular debate. The alleged limitations of derived ABPM parameters are not relevant to the discussion (Con 2). The uncertainty of patient classification (Con 3) actually lies in the poor ability of clinic BP to diagnose a large portion of the population correctly. This is largely eliminated by ABPM. There is widespread agreement on the definition of hypertension by ABPM (Con 4) as detailed in Table 2 of the Pro argument. These were defined by calculated equivalence to clinic BP2 and confirmed in large outcome studies.3 The clear benefits of guiding treatment with ABPM have been outlined in both articles as is the reduction in cost of treatment. This is not a negative (Con 4). Far more comprehensive cost benefit analysis now clearly favors ABPM. Finally, the availability of ABPM (Con 5) is rapidly increasing, costs are diminishing, and less training is required because of technological advances. Given the overwhelming evidence in favor of ABPM, we may well be negligent in not recommending it now for diagnosis and management of hypertension.

References

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Dynamic Blood Pressure Monitoring Is Ready to Replace Clinic Blood Pressure in the Diagnosis of Hypertension

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ABPM monitoring, ABPM最初局限应用于一些专科诊所，现在很多国家大部分已将其推广至基层医疗中，同样，学术成果也是大幅增加。从20世纪90年代开始，题目或摘要中包含24小时ABPM的论文数量以指数方式增长，到现在每年大约有600篇论文发表。


尽管针对ABPM的研究不断进展，文献非常丰富，临床应用也不断发展，但是，在用ABPM替代诊室外血压测量用于高血压的诊断和治疗之前，仍然有重要的问题没有解决。同样，自测血压使得诊断时的诊室外血压的使用范围更广，对患者的随访也是如此。然而，使用自测血压在有关方面与ABPM具有相同的缺点。本文中，我们将指出ABPM数差及相关参数在预后研究中的局限性，在患者分类中的不确定性，以及相关未被满足的需求。最后也包含对其可用性的评论。

反对理由1: ABPM数值在预后研究中的局限性

人群[29]、血液透析人群[30]、器官移植后人群[31]中，大量的研究也得出ABP具有优势的结论[32,33]。同样，与活动期血压或24小时血压相比，夜间血压的降低更佳，夜问血压Iterations用于心血管和肾脏事件的危险预测。

ABP与器官损害的相关性更佳，以及更具体验价值，通常来自以下事实：与临床情况下测得的血压数值相比，其平均血压数值与心肾事件的相关性更低，但是，这部分是由于，与正常血压数值相比，动态血压数值的分布更窄[34]，甚至夜间血压低于白天血压。这一明显优势的理由是，不管是否能够被数学模型所解释，仍然是一个颇具争议性的问题。

所有这些研究只在研究开始时进行过一次监测，均获得了阳性结果，然而，在之后几年中仍然出现了终点事件，包括死亡或心血管死亡、心肌梗死、卒中。研究期后，没有给出在研究期间的血压数值信息。要证实动态血压优于诊室血压，这是很重要的一个局限性，特别是，需要通过诊室血压数值来对抗高血压和心房纤维化危险的事件是否能达到目标。另外，诊室血压和动态血压的变化常常不是平行的，差异较大[35]。

已有发表的检测次数大于1次的研究中，对人员损害进展或事件发生的很少。有所有这些研究中，虽然没有研究正显示ABP是临床中具有优势的治疗方案。Mancia等[36]发表了第一项有关ABP可能临床优于传统血压测量的证据，即动态血压监测和赖诺普利评估研究（SAMPLE），入选206例伴有左心室肥厚的高血压患者，治疗12个月。左心室质量指数下降与诊室血压降低并不相关，而是与24小时血压降值相关。治疗导致的白天平均血压和夜间平均血压降低与左心室质量指数的变化密切相关。相关强度与24小时血压降低相当。Lurbe等[37]对I型糖尿病患者采用ABP评估血压情况，在初次评估和大约两年后使用ABPM，大约两年后所有受试者的尿白蛋白排泄率正常，夜间收缩压持续升高者仍高于出现微量白蛋白尿。在夜间血压降至正常的受试者中，从正常白蛋白排泄进展到微量白蛋白尿甚至超过可能。Zanchetti等[38]在欧洲拉西线平动脉粥样硬化研究中，每年进行一次ABP，该研究是一项随机、双盲、为期4年的试验，评价了拉西平或阿替洛尔对超声检测的颈动脉内膜中层厚度的影响。虽然该研究的统计学效能不足[39]，但一个多变量的线性回归模型发现，治疗中诊室和24小时收缩压的均值与治疗结束时的颈动脉内膜中层厚度、心房纤维化事件之间具有相关性。

### 反对理由2：除血压均值以外的其他参数价值有限

在临床实践中，平均的24小时血压、白天血压或夜间血压如今已被推荐作为主要的阅读材料，监测抗高血压药物降压效果的参数。除了这些平均的血压数值，其他一些ABPM参数也被认为是有意义的，如血压变异率[30]，白天/夜间血压比值[41]，以及血压峰[42]。短期和长期的血压变异性和升高与心房纤维化、血管及肾性损害的发生、发展及严重程度密切关系，与心房事件及死亡的危险升高密切相关的。然而，这些变量的潜在临床价值仍然需继续验证，因为其分层危险的价值还没有被证实[44]，仍然需要进一步研究，获得更多的证据[7]。

血压昼夜节律的异常，即所谓的非杓型模式，已被认为与不同的临床现象相关，并由不同的作用机制导致，后者包括baroreflex或自主神经调节异常。夜间量大相对超负荷，以及钠处理异常[45]。血压的生理学下降不因存在器官损害[46,47]，心血管疾病[48]和肾病[49]的预后较差之间具有相关性。血流昼夜节律异常的一个特殊时期是血压晨峰。这也与整个循环中的血管损害具有相关性，可能涉及到心肌、大血管和其他疾病的[50]。已有研究显示[51]，心血管事件的事件升高，如心肌梗死和卒中，特别是在合并糖尿病、心房纤维化和肾病的情况下，这些参数、血压昼夜节律变异和血压晨峰的主要缺陷是可重复性差[52]，白天/夜间血压比值和血压晨峰本身依赖于清醒和睡眠中的血压数值。目前尚没有充分的证据支持对其赋予更大的意义，即基于模式的变换可能影响抗高血压治疗的成功[7]。

除了这些血压参数外，监测仪也增加了可同时捕获信号的模块。逐拍心电图[53]、评估脉搏波传导速度、增强指数和中心血压就是这其中的一些举例。心电图信号[55]能够评估血压变化与心肌缺血或心律失常的关系。估算脉搏波传导速度的Qk指数[56]、估算射血比率的增强指数、中心血压和脉搏波传导速度[57,58]，均可以在24小时内间断性测量。尽管有研究宣称，与诊室测量相比[57,58]，24小时测量的这些参数与器官损害的相关性更佳，但是，其潜在的临床应用还没有得到验证。

### 反对理由3：在患者分类中的不确定性

这里值得一提的是，对于一例特定的患者，诊断时或评估血压控制时，诊室血压和动态血压之间的差异，即所谓的白大衣高血压或隐匿性高血压，在常规的生活条件下，夜间休息时，在临床环境之外测量血压，要避免应激反
应，或者白大衣反应[29,60]。诊断高血压及分层危险时，持久的应激反应可能引起偏倚。自我监测提出现应激反应以来，应激反应的诊断一直被讨论，但是，白大衣高血压的诊断增加，可以考虑从早期抗高血压治疗中获益的正常受试者。近年来得到公认的是观察的结果，即隐蔽性高血压，白天清醒时的动态血压升高，而诊断血压正常[61]。在这种情况下，在日常生活的常规活动中反应性高，似乎是进展至高血压的前驱表现，常常与器官损害的早期体征相关[62,63]。

然而，基于诊室血压和动态血压数值之间的这些差异对患者分层，主要依赖于用于定义高血压的动态血压标准，依赖于同一个体日常的血压差异。首先，如果动态血压中定义高血压的标准采用24小时血压均值或清醒期血压均值，而且使用不同的血压阈值时，则对患者的危险分类有所不同。在对受试者分类时，缺乏解释性的高血压的合理阈值（见下文）可引起对患者分类的不确定性，以及潜在的偏倚。

**反对理由4：相关未被满足的需求**

尽管在过去50年间动态血压已经取得了进步，但在一些关键问题中没有得到回答，而且，据我们所知，也依然缺乏要获得答案的行动计划。这与大量的诊室血压经验形成了鲜明的对照，这些试验中诊室血压仅提供了定义高血压的血压阈值证据，而且提供了普通高血压人群及其他特殊情况下抗高血压治疗要求达到的目标[67]。缺乏高血压定义，缺乏有关合适目标的信息，也因此缺乏动态血压可能诊室血压指导治疗可大幅度地降低发病率和死亡率的证据，以下是动态血压中未被满足的需求。

**反队理由4a：缺乏定义高血压的合理血压参考值**

Geoffrey Rose爵士1971年将高血压定义为“血压超过某一水平时，检测及治疗的获益将大于损害”[68]。与此一致的是，由于支持新建议的研究不断出现，高血压定义的阈值一直在下降，直到被广为接受的数值。由此形成对照的是，一直在采用不同的方法，采用动态血压的数值来定义高血压，但是，从来没有Rose定义那样的金标准。实际上，定义高血压的阈值一直来自于普通人群的血压百分位数，来源于被普遍接受的140/90 mm Hg的诊室血压数值，或者是从人群研究中获得的数值。确定阈值的一个聪明方法是依据动态血压监测与心血管病后研究者研究协作国际数据库来定。根据这一数据库，动态血压阈值被确定为与诊室血压测量中理想血压、正常血压和高血压相关的10年心血管危险相当的血压水平[69]。尽管如此，重要的一点是，记住血压数值是在研究开始时测得的，而是在随访中得到的。

如果我们假设，采用动态血压的定义可以得到更好的危险分层，那么这不是Pressioni Arteriose Monitorate e Loro Associazioni (PAMELA) 研究的情况，将个体数据合成为一个用来定量11年心血管死亡危险的Cox比例风险模型中，对动态和诊室收缩压可以得到同样的结果；动态血压相对于诊室血压数值没有优势[68]。在将诊室血压与ABP一起使用时，用于预测心血管事件或全因死亡的受试者工作曲线，两者在很大程度上是重合的，曲线下面积只有很小且并不一致的明显增加[67]。PAMELA研究并不支持以下论点：ABP极大地增加了诊室血压的预测值。尽管一直鼓励采用与PAMELA研究相似的方法来评估动态血压数值相对于诊室血压数值的潜在优势，但没有开展其他的长期预后研究。

其他统计学方法，包括分级改善和综合鉴别指数，可以更好地确定动态血压作为一种诊断工具的鉴别能力，应该在未来的研究中使用[68]。

**反对理由4b：缺乏合理的血压目标值**

同样，因为只开展过两项使用ABP作为目标的研究，故至今还没有建立起抗高血压治疗中的诊室外血压目标值。第一项研究是在传统或动态血压测量的抗高血压治疗试验[69]，是15年前开展的，对419例受试者随访观察了6个月，主要探讨左心室质量的差异。该研究报告称，根据动态血压监测和白天血压的均值，而非诊室诊室内的传统血压测量，来调整抗高血压治疗的方案，可使患者采用非强化的药物治疗，使血压得到控制，患者的整体健康状况较好，同时抑制左心室扩大，但是，该方法并没有降低抗高血压治疗的费用。采用一个理论模型进行成本-效益分析，得出结果，总的治疗费用和药物治疗的年数将下降[70]。

严格血压控制和ACE抑制剂对儿童患者慢性肾功能衰竭（CRF）进展影响的试验，在各种类型的肾病儿童中，研究了强化血压控制对延缓肾病进展的疗效。在这项试验中，根据6个月随访时的24小时ABPM均值设定血压目标值，受试者被随机分入传统降压组（第5至90百分位数），或者强化降压组（低于第50百分位数）。在强化降压组中，其24小时血压目标值在正常血压的低值范围内，比传统降压组的平均血压降低3 mm Hg。这对患者的肾功能有持久的获益。在分析诊室血压的差异时，强化和传统治疗组中的血压差值分别为：收缩压相差2 mm Hg，舒张压相差1 mm Hg。

由于数据缺乏，故几乎不可能做出决策或给出推荐，将
患者的血压降低至共识确定的高血压阈值以下。

反对理由4c: 缺乏ABPM目标对心血管或肾脏预后有优势的合理证据

与诊室血压指导的治疗相比，动态血压指导的治疗是否能够更大程度地降低发病率和死亡率，仍需要进一步评估。比较动态血压目标或诊室血压目标的研究应重点关注对抗高血压药物的需要，以及达到的血压数值，而不是对预后的研究[72,73]。

反对理由5: ABPM的应用不够广泛

最后，ABPM是否能够常规使用是一个重要的限制。从最初的半自动检测，由患者操作，到后来的全自动检测装置，可以在动态的情况下测量血压[74]。新改进的监测装置使得监测装置更容易，更自然，增强了便携性和可接受性，同时，示波装置的算法更佳[75,76]，提高了血压读数的准确性和可靠性。

来自英国高血压学会（British Hypertension Society）、医疗设备改进协会、国际标准化组织和欧洲高血压学会国际规则（第2版）[77]的校验规程，方便了对最佳算法的监测仪的选择。同样，由于血管弹性和弹性波速度的差异，校验规程确定了其用于成年人、老年人、孕妇及儿童患者时准确程度的差异。根据校验规程的证书给出的基准，可以将错误血压数值的影响降至最低[78]。

尽管现在已有多种经过校验的检测仪，但是，使用这些费用仍然很高，需要计算机辅助来解析监测，并获得数据。另外，尽管现在可以由计算机产生报告，缩短了解读报告所需的时间，允许大众的使用，甚至在药店使用，但是，该过程花费时间，仍然需要一定水平的专业人士来分析报告[79]。尽管在发达国家中药可性一直在提高，但是，与高血压的患病率相比，其应用率仍然较低，而血压升高主要是发展中国家心血管疾病的沉重负担。

结论

总之，有关动态血压方面的知识已经为我们提供了大量的经验，这些经验似乎支持动态血压优于诊室血压。然而，这一优势的真实影响，应该在未来几年内进行检验，需要卫生管理部门和学术组织一起努力来规划未来的研究，以便回答以下关键问题：ABP是时候替代诊室血压了吗？对于我们的观点，答案是还没有时候，但是，有这个可能。
Redon and Lurbe  ABPM Is Not Ready to Replace Clinic BP