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Screening for Hypertension in Adults: An Updated Systematic Evidence Review for the U.S. Preventive Services Task Force

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The information in this report is intended to help healthcare decision makers—patients and clinicians, health system leaders, and policymakers, among others—make well-informed decisions and thereby improve the quality of healthcare services. This report is not intended to be a substitute for the application of clinical judgment. Anyone who makes decisions concerning the provision of clinical care should consider this report in the same way as any medical reference and in conjunction with all other pertinent information (i.e., in the context of available resources and circumstances presented by individual patients).

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Structured Abstract

Objective: We conducted this systematic review to support the U.S. Preventive Services Task Force (USPSTF) in updating its recommendation on screening for hypertension in adults. This systematic review addresses the benefits and harms of screening for hypertension in adults, including the accuracy of initial office-based screening measurements during a single encounter and confirmatory blood pressure measurements using various modalities in those who initially screen positive.

Data Sources: We performed a search of MEDLINE, PubMed (publisher-supplied records only), the Cochrane Collaboration Registry of Controlled Trials, and the Cumulative Index of Nursing and Allied Health for relevant English-language studies published between February 2014, and August 2019. Additionally, we re-evaluated all studies included in the 2014 USPSTF review. We supplemented searches by examining bibliographies from retrieved articles and consulting outside experts. We searched clinical trial registries for ongoing and/or unpublished trials. We conducted ongoing surveillance for relevant literature through March 26, 2021.

Study Selection: Two investigators independently reviewed 21,741 abstracts and 544 full-text articles against a set of *a priori* inclusion and quality criteria. Resolution of disagreements was achieved through discussion with a third reviewer. We included the following study designs: randomized controlled trials (RCTs) and clinical controlled trials (CCTs) for effectiveness of screening (KQ1); test accuracy studies for accuracy of initial office-based blood pressure screening (KQ2) and subsequent confirmatory blood pressure measurements (KQ3) using an ambulatory blood pressure measurement (ABPM) reference standard; and RCTs, CCTs, and cohort and cross-sectional studies for screening and confirmation harms (KQ4).

Data Analysis: One investigator abstracted data into evidence tables and a second investigator checked accuracy. We qualitatively synthesized data separately for each key question. We meta-analyzed study results for Key Questions 2 and 3. Our quantitative analyses utilized a bivariate model for sensitivity and specificity outcomes. We used visual inspection of forest plots arranged by various study, population, and test characteristics to explore heterogeneity.

Results: For KQ1, one community-based cluster RCT (N=140,642) of a multicomponent CVD health promotion program that included hypertension screening as the primary intervention for older adults reported a 9 percent relative reduction in composite CVD-related hospital admissions (rate ratio 0.91 [95% CI, 0.86 to 0.97]). For KQ2, meta-analysis of 15 studies (N=11,309) of office-based blood pressure measurement (OBPM) for screening at a single visit demonstrated a pooled sensitivity of 0.54 (95% CI, 0.37 to 0.70) and a pooled specificity of 0.90 (95% CI, 0.84 to 0.95) with considerable clinical and statistical heterogeneity. For KQ3, 18 studies (N=57,128) of various confirmatory blood pressure measurement modalities reported data that allowed accuracy calculations; these studies used confirmation modalities of: OBPM, home blood pressure measurement (HBPM), self-OBPM (measurement performed by a patient in the office setting), and truncated ABPM. Meta-analysis of eight OBPM confirmation studies (N=53,183) showed a pooled sensitivity of 0.80 (95% CI, 0.68 to 0.88) and a pooled specificity of 0.55 (95% CI, 0.42 to 0.66) with considerable clinical and statistical heterogeneity. Meta-analysis of four HBPM confirmation studies (N=1,001) showed a pooled sensitivity of 0.84

(95% CI, 0.76 to 0.90) and a pooled specificity of 0.60 (95% CI, 0.48 to 0.71) with considerable statistical heterogeneity. Two studies of self-OBPM (N=698) and one study of truncated ABPM (N=263) provided a limited evidence base for determination of accuracy for these modalities. There was limited information about the accuracy of protocol variations, precluding conclusions about the optimal protocol characteristics for screening and confirmatory blood pressure measurement in the included studies. For KQ4, 13 studies (N=5,150) suggest that screening is associated with no decrements in quality of life or psychological distress and scant evidence on screening's effect on absenteeism is mixed. ABPM followup testing is associated with minor adverse events including temporary sleep disturbance and bruising.

Limitations: The literature identified for blood pressure screening and confirmation accuracy represented a heterogeneous group of studies resulting in inconsistent and imprecise accuracy estimates. The included protocol characteristics for screening and confirmatory blood pressure measurements likely represent "research quality" measures not followed in current practice.

Conclusions: Blood pressure screening at a single visit has a low sensitivity and adequate specificity for detection of hypertension, leading to a substantial number of potentially missed cases. Confirmatory office or home blood pressure measurement applied to a population with a previously elevated blood pressure has adequate sensitivity and low specificity suggesting that these modalities may not be appropriate replacements for ABPM for diagnostic confirmation. Scant literature is available to inform best practices in blood pressure measurement to optimize test accuracy. Limited available evidence on the direct harms of screening and confirmatory blood pressure measurements suggest that the harms are minimal, and the most notable harm of blood pressure screening is likely misdiagnosis with ensuant under or over-treatment. Future research is needed to identify optimal blood pressure measurement protocols and confirmation algorithms—including blood pressure threshold values—to inform clinical practice.

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Chapter 1. Introduction

Purpose

The Agency for Healthcare Research and Quality (AHRQ) has requested an updated evidence report on screening for hypertension in adults. This report will be used by the United States Preventive Services Task Force (USPSTF) to update its 2015 recommendation on this topic.[1]

Topic Importance

Natural History

Blood pressure (BP) is the pressure the blood exerts against arterial walls as it circulates through the body. It is generally estimated by measuring systolic and diastolic components. Systolic blood pressure (SBP) is the maximal pressure in blood vessels during systole (heart contraction), and diastolic blood pressure (DBP) is the minimal pressure in blood vessels during diastole (heart relaxation between contractions).[2-6] BP is measured routinely as a "vital sign." Primary (or essential or idiopathic) hypertension is defined as high BP in the absence of a known secondary cause and accounts for 95 percent of all cases of hypertension.[7]

Hypertension is one of the most important risk factors for cardiovascular disease (CVD).[8] Although hypertension is often discussed as though it is a disease entity, it is more appropriately categorized as a continuous risk factor that is a strong predictor of poor health.[9, 10] The natural history of uncontrolled hypertension is progression to end-organ damage, including the heart, brain, kidneys, eyes and arteries with clinical sequelae including myocardial infarction, stroke, vascular dementia, renal failure, blindness, and peripheral artery disease.[11, 12] Long term uncontrolled hypertension can eventually lead to arterial and renal damage and eventually contribute to a treatment-resistant state of hypertension.[4]

Rationale for Screening

Hypertension is generally asymptomatic;[13] therefore, it is most commonly identified through screening. BP can be modified with lifestyle interventions,[14-16] and good-quality randomized, controlled trials (RCTs) demonstrate the effectiveness of antihypertensive pharmacological treatments to reduce CVD and total mortality.[17, 18]

Condition Background

Definition of Hypertension

The definition of hypertension has changed over time. Until recently, hypertension was most commonly defined as SBP 140 mm Hg or greater and/or DBP 90 mm Hg or greater (hereafter

referred to as ≥140/90 mm Hg).[2] Largely based on the results of the SPRINT trial,[19] the 2017 AHA/ACC guidelines redefined hypertension for adults as SBP ≥130 mm Hg or DBP ≥80 mm Hg, with treatment thresholds based on both blood pressure and 10-year CVD risk (**Table 1**).[20] Based on 2017 to 2018 data, the overall age-adjusted prevalence of hypertension among U.S. adults age 18 years or older was 45.4 percent when defined as BP ≥130/80 mm Hg by conventional measurement or use of antihypertensive medication.[21]

BP control rates remain low despite substantial improvements since the 1970s in the awareness and treatment of hypertension.[2] In 2017-2018, only 44.6 percent of men and 43.9 percent of women with hypertension and had their BP controlled to ≤140/90 mm Hg.[22] Disparities exist for the control of hypertension by race/ethnicity, as well as socioeconomic factors. The highest rates of BP control are among whites (45.2%) with the lowest control rates among Hispanics (36.8%). Control rates are higher among college graduates (47.1%), those with greater income (48.9% with annual household income ≥75,000), and health insurance. The BP control rate among those with no health insurance is exceedingly low at 22.2 percent.[22]

Robust data from both prospective cohort studies and contemporary clinical databases show a strong continuous relationship between blood pressure and cardiovascular disease spanning a wide range of blood pressures.[23, 24] A 2019 analysis of over 1.3 million adults in the United States using BP measurements obtained during routine clinical practice showed that both systolic and diastolic hypertension independently predict adverse outcomes, and that this relationship is not altered by choice of hypertension threshold (≥140/90 mm Hg vs. ≥130/80 mm Hg).[24] In the absence of a clear threshold, hypertension may be defined pragmatically as the level of BP at which there is either experimental or epidemiological evidence that therapeutic interventions reduce cardiovascular (CV) event rates.[25] On the other hand, since foundational evidence suggests no threshold effect and a continuous association between blood pressure and mortality down to 115/75 mm Hg, it could be argued that the definition could be based on the threshold at which this prognostic mortality association exists.[23]

Etiology and Risk Factors

The pathogenesis of primary hypertension is multifactorial and imprecisely understood. A number of risk factors for hypertension have been identified, including: age, African American race, family history of hypertension and genetic factors, excess weight and obesity, lifestyle habits (including lack of physical activity, stress, and tobacco use), and dietary factors (including dietary fats, higher sodium intake, lower potassium intake, and excessive alcohol intake).[26] Hypertension commonly coexists with other CVD risk factors, such as diabetes, dyslipidemia, and obesity. **Table 2** shows the odds ratios for prevalent hypertension for selected demographic and clinical characteristics.

As shown in **Table 3**, the prevalence of high BP is age-dependent. BP increases progressively with age[21] and hypertension develops in a high proportion of adults in the United States living into their 80s or 90s.[27] In a younger population, hypertension can develop over a relatively short period when BP is near the threshold for defining hypertension.[28] According to a recent analysis of 2017-2018 NHANES data, the overall prevalence of high BP was greater among men (51.0%) than women (39.7%), and disparities were also seen among different races and ethnicities.[21] High

BP was significantly more common in black adults (51.7%) than in whites (43.6%), and Hispanics (43.7%).[21] Data for BP were limited for Asians and Native Americans and Alaska Natives in the 2017-2018 survey period, but previous estimates from 2015-2016 NHANES survey data, which used a threshold of ≥140/90, reported that Asians had the lowest prevalence of high BP among any racial or ethnic group (25%).[29] The prevalence of high BP as defined by ambulatory blood pressure monitoring (ABPM)—the currently accepted reference standard—is unknown in the United States for the general population.

Blood Pressure Measurement

Office-Based Blood Pressure Measurement

Office-based measurement of BP is the standard of care for initial screening. Measurement methods include the *manual auscultatory method* using a stethoscope to detect Korotkoff sounds or the *oscillometric method* where a pressure transducer assesses the oscillations of the pressure in a cuff during gradual inflation or deflation. The diagnosis of hypertension typically involves a confirmatory measurement of an initial elevated office BP measurement.

During office-based measurement, measurement accuracy depends on a considerable number of patient-related, device-related, protocol-related, or observer-related factors.[30] Additionally, BP can increase substantially in the medical setting and in the presence of medical personnel.[30] "White coat hypertension" refers to BP of untreated individuals that is in the hypertensive range when measured in the clinic setting but not in that range when measured out of office.[31] Estimates from population-based samples of adults not treated for hypertension suggest that the prevalence of white coat hypertension is 7.9 percent when defined by 24-h ABPM.[32] In untreated populations with previous office BP elevation, the prevalence of white coat hypertension may be considerably higher (22.6% in an international registry of hypertension clinics).[33] One proposed approach is the use of automated office BP (AOBP) during which repeated measurements are taken while the patient is alone in a quiet room.[34-36]

The reverse phenomenon of white coat hypertension, sometimes called "masked hypertension," occurs in individuals whose BP levels are apparently nonhypertensive when measured at clinic visits but are elevated when measured outside of the medical setting.[6] Masked hypertension has clinical significance as it has been associated with increased CV risk.[37, 38] A 2017 analysis has estimated the prevalence of masked hypertension in the U.S. at 12.3 percent of the adult population, or over 17 million adults.[39] Masked hypertension is an important public health issue as it represents the failure to identify individuals with increased CVD risk.

Out-of-Office Measurements for Screening Confirmation

To confirm a diagnosis of hypertension, many health systems recommend several office-based blood pressure measurements performed on different days among patients with an initial elevated blood pressure. Repeat office measurements tend to be lower than initial measurements, but are subject to the same patient-related, device-related, protocol-related, and observer-related limitations as the initial measurement.[30] Office-based confirmation also does not capture BP

variations throughout the day or during the course of a person's normal activities. Major guideline bodies and health systems are increasingly recommending the use of AOBP or out-of-office measurement to overcome some of the limitations of conventional OBPM (**Table 4**).

Out-of-office methods for confirmation of hypertension include ambulatory BP monitoring (ABPM) and home BP monitoring (HBPM). Kiosk-based blood pressure measurements are another out-of-office measurement modality used for self-directed BP measurements in settings such as pharmacies, although concerns have been raised about the validity of these devices[40] (**Table 5**). ABPM is considered the gold standard noninvasive blood pressure measurement, providing the best predictive value for future CVD events.[28, 41] ABPM devices are small portable machines connected to an upper arm cuff that record BP at regular intervals over 12 to 48 hours while patients go about their normal activities, including sleep. Measurements are typically taken at 20- to 30-minute intervals during the daytime period.[5] Substantial variation exists in the level of specificity among guidelines for the protocols that should be used for ABPM and HBPM (**Table 4**). Screening intervals are increasingly addressed by guidelines, with a focus on risk-based screening intervals or rescreening of individuals with white coat hypertension. In addition to formal guidelines, national organizations have published policy and scientific statements regarding blood pressure measurement protocols and techniques.[31, 42]

Some concerns exist about the calibration and validation of measurement devices. Device manufacturers typically recommend regular calibration of oscillometric devices, including ABPM.[31] However, experts note that calibration rarely occurs; if at all, calibration may occur only at large academic medical centers with access to clinical engineering support.[43, 44] Standardized protocols are not in place for calibration of HBPM devices once they have left the manufacturer.[31] In addition, systematic reviews have found that BP devices frequently have not passed validation protocols, or have passed with protocol violations.[45, 46] The American Medical Association has developed a Validated Device Listing to help patients and providers easily identify validated BP measurement devices (https://www.validatebp.org/).[43]

Previous USPSTF Recommendation and Current Clinical Practice

2015 USPSTF Recommendation

In 2015, the USPSTF recommended screening for high blood pressure in adults age 18 years or older and procurement of measurements outside of the clinical setting for diagnostic confirmation before starting treatment.[1] This was an A recommendation, and the measurement accuracy and modality components were new to the 2015 consideration of this topic. The USPSTF found that elevated 24-hr ambulatory systolic blood pressure was consistently and significantly associated with stroke and other cardiovascular outcomes, independent of office blood pressure and with greater predictive value. Because of its large evidence base, ABPM was considered the best confirmatory test for hypertension. The USPSTF stated that HBPM may also be a reasonable confirmatory method but had less evidence to support its use.

Current Clinical Practice in the United States

Blood pressure measurement techniques in current clinical practice vary substantially from guideline-endorsed protocols. According to the 2016 National Ambulatory Medical Care Survey, BP was measured in 65.9 percent of clinic visits by patients age 18 years or older in the United States.[47] However, these measurements are often not taken in accordance with defined measurement protocols.[48-51] Several studies have found that when routine office measurements are repeated using recommended protocols, there are significant differences in BP values.[52, 53] The reasons for not following recommended BP measurement guidelines in the office are likely multifactorial and may include lack of information, training, and time.

Despite national guidelines recommending out-of-office confirmatory methods, survey data suggest that this is not common in current practice, with surveys showing that out-of-office measures are rarely ordered or available to clinicians.[49, 51] Physicians have described a number of barriers to ABPM, including challenges in accessing testing, costs of testing, concerns about patient willingness to complete ABPM, and concerns about accuracy and benefit of ABPM.[54] Physician concerns regarding HBPM include: patient compliance with protocols, accuracy of HBPM, out-of-pocket cost, and time to instruct patients on HBPM protocols.[54]

The Centers for Medicare & Medicaid Services (CMS) has covered ABPM since 2001 for patients with suspected white coat hypertension.[55] Research has shown, however, that utilization of the coverage was exceedingly low, with an estimated 0.1 percent of Medicare beneficiaries having ABPM claims between 2007 and 2010, with some hypothesizing that the reimbursement rate may be too low to encourage its use.[56, 57] In July 2019, CMS expanded coverage of ABPM to once per year in eligible beneficiaries with suspected masked hypertension, defined as those with average OBPM between 120 mm Hg and 129 mm Hg for SBP or between 75 mm Hg and 79 mm Hg for DBP on two separate office visits, with at least two separate measurements made at each visit, and with at least two measurements taken outside the office that are ≥130/80 mm Hg.[58] This coverage decision is consistent with ACC/AHA guidelines and the AHA Scientific Statement for screening for masked hypertension.[20, 31]

Chapter 2. Methods

Scope and Purpose

Screening for hypertension in adults has been standard of care in the United States for decades,[59] and the USPSTF has maintained an A recommendation for the service from its 1996 inception.[1, 60-63] Beginning with the 2015 evidence review,[64] the test accuracy of initial screening and confirmatory measurements has been systematically reviewed as part of the USPSTF process due to growing interest and availability of out-of-office blood pressure measurement modalities. The USPSTF will use this review to update its 2015 recommendation statement on screening for hypertension in adults, with a focus on test accuracy and identification of the best methods for screening and confirmation of hypertension.[1]

Key Questions and Analytic Framework

In consultation with members of the USPSTF, we developed an analytic framework (**Figure 1**) and four Key Questions (KQs) to guide our review.

1. Does screening for hypertension in adults improve health outcomes?
2. What is the accuracy of office-based blood pressure measurement (OBPM) during a single encounter as initial screening for hypertension compared with the reference standard, ambulatory blood pressure measurement (ABPM)?
   a. What screening protocol characteristics define the best test accuracy?
3. What is the accuracy of confirmatory blood pressure measurement in adults who initially screen positive for hypertension compared with the reference standard (ABPM)?
   a. What confirmation protocol characteristics define the best test accuracy?
4. What are the harms of screening for hypertension in adults?

Changes in Scope From the Previous Review

Consistent with the previous review, we evaluated the test accuracy of initial screening for hypertension and the test accuracy of confirmatory measurement in separate KQs. However, some scope changes were made for the test accuracy questions in this update. For both initial screening and confirmation questions, we required ABPM to serve as the reference standard. Based on a finding from a systematically reviewed question in the last review that ABPM predicts long-term cardiovascular outcomes independently of OBPM, the USPSTF determined that ABPM should serve as the reference standard for blood pressure measurement.[1] This prognosis question was not updated in the present review. Additionally, the previous review systematically evaluated evidence on the appropriate rescreening interval for patients who had been found to have normal blood pressure in previous screening. This question was also not updated in the present review, but rescreening is addressed contextually in the Discussion section.

For the accuracy of confirmation question, we required studies to have a population whose selection was based upon having elevated blood pressure previously, then had that entire pre-selected population undergo another confirmation measurement and ABPM. The scope of all questions was expanded to include individuals with diabetes as they comprise a substantial proportion of patients seen in the primary care setting.

Data Sources and Searches

We conducted a search to identify literature published since the previous review for the USPSTF through August 2019. We worked with a research librarian to develop our search strategy, which included the following databases: MEDLINE, PubMed (published-supplied records only), the Cochrane Central Register of Controlled Trials (CENTRAL), and the Cumulative Index of Nursing and Allied Health (CINAHL) (**Appendix A**). Additionally, due to an expansion in the scope of the current review to include individuals with diabetes, we performed a targeted search of the bibliographic database for the previous review for terms related to this condition; this database included results of a comprehensive literature search from 1992 through February 2014.

We evaluated all previously included studies from the prior review for the USPSTF as well as studies that were previously excluded based on their reference standard or because the populations included a large proportion with diabetes; these reflected areas of scope change in this update. Additionally, we reviewed reference lists of other systematic reviews,[65, 66] individual patient-data meta analyses,[67] recent guidelines[31, 68] and table-of-content alerts such as those produced by the USPSTF Scientific Resource Center LitWatch activity to identify additional studies not identified in our literature searches. We conducted ongoing surveillance through March 26, 2021. We also searched ClinicalTrials.gov and WHO International Clinical Trials Registry Platform (ICTRP), for relevant ongoing trials. We managed all literature search results using EndNote™ version 7.3.1 (Thomson Reuters, New York, NY).

Study Selection

One investigator independently prescreened titles and abstracts of a subset of studies with keywords (identified electronically) pertaining to an excluded setting, population, or condition in the title, abstract, or keyword fields of EndNote (**Appendix A Table 1**). Abstracts deemed potentially relevant during single review were advanced for dual review. Of the 21,741 citations screened, 10,473 were prescreened by a single reviewer; of these, 297 were identified as potentially relevant and moved forward for dual review. Two investigators independently reviewed 544 full-text articles against prespecified inclusion criteria (**Appendix A Table 2**). We used DistillerSR (Evidence Partners, Ottawa, Canada) to conduct abstract and full-text review.

Population

For all KQs, we required studies to be conducted in adults who were not already taking antihypertensive medications, the reason being that treatment with antihypertensive medication has been shown to reduce blood pressure variability, which would limit the generalizability of

accuracy results in a screening population.[69, 70] We accepted studies in which less than 20 percent of the population was treated for hypertension; otherwise we required analyses to be stratified by treatment status or when we were able to isolate results based on the untreated population. We excluded populations derived from treatment trials or ABPM centers in which the population was previously treated with subsequent wash-out period and the aim of the study was other than test accuracy. We excluded studies specifically recruiting pregnant individuals, institutionalized persons, inpatients, and persons with secondary hypertension. We excluded studies that enrolled a highly selected group of participants, such as renal transplant recipients or those with chronic kidney disease.

Eligible populations for KQ2 (initial screening) were unselected, whereas KQ3 populations (confirmatory screening) were preselected, with a criterion of at least one elevated BP measurement identified by clinic-based screening. If a KQ3 population was described as being "referred for ABPM," we accepted this as relevant as long as no more than 20 percent of the population was treated or results were stratified by treatment status. Unless an APBM registry had the specific aim of screening, we considered an ABPM registry to be a preselected population and thus appropriate for KQ3 (and not KQ2). We acknowledge that there is a wide range of potential indications for ABPM and considered a lack of treatment a proxy for an ABPM indication of confirmation of diagnosis.

Intervention and Comparators

For all KQs, we required BP measurements to be taken on the upper arm. Consistent with the previous review, we excluded forearm cuffing as well as wrist, ankle, finger, and toe BP monitors and measurements due to limitations in their accuracy.[31] We also excluded any BP measurement methods not commonly used in routine screening, such as invasive methods (e.g., intra-arterial measures) or noninvasive central BP measurements. For all KQs, we accepted any SBP/DBP threshold (where either SBP or DBP or both are elevated), SBP-alone, or DBP-alone threshold to diagnose hypertension (HTN) in order to be as inclusive as possible; however, SBP/DBP thresholds were preferred because of their relevance to current clinical practice. We also accepted any threshold for "elevated BP" to qualify for a confirmation study and abstracted the threshold values as reported in these studies. However, for test accuracy questions, we did not accept hypertension defined as use of anti-hypertension medication. AOBP was an eligible type of OBPM for all KQs; descriptions of the conduct of AOBP were closely evaluated to confirm whether the measurements were unattended by a clinician or other staff. When the presence or absence of personnel during blood pressure measurement was unclear from the study publication, we contacted the study's corresponding author. Because of variation in the reporting of AOBP protocols and device characteristics, we sought to consistently define measurement methods by distinguishing who triggered the device and whether or not the measurement was attended or unattended. For cases where serial measurements are triggered by the patient, this is categorized as self-OBPM. If serial measurements are automated, we have categorized as AOBP.

For KQ1, we included RCTs that reported changes in health outcomes as a result of screening for hypertension compared with no screening. Screening had to occur during a single encounter and be performed by trained personnel. Screening could have been conducted as part of a

multicomponent CVD risk assessment as long as the blood pressure measurement was the primary intervention.

For KQ2, we included test accuracy studies that compared OBPM to an ABPM reference standard for initial screening for hypertension using any common device or screening protocol as long as it was office-based. We initially accepted only screening measurement(s) occurring at a single encounter and then conducted a sensitivity analysis to include screening over multiple visits based on practice guidelines.[20] We accepted any ABPM method for the reference standard, including 24-hr, daytime, and nighttime. We then conducted an exploratory analysis restricted to the 24-hr ABPM reference standard. For KQ2a, we included studies reporting accuracy of different OBPM protocol characteristics compared with an ABPM reference standard (e.g., more vs. fewer OBPM measures, shorter vs. longer resting time or time between measures, different sitting positions, attended vs. unattended measures).

For KQ3, we included test accuracy studies of clinic-based or out-of-office noninvasive blood pressure measurement modalities to confirm an initial elevated blood pressure result compared with any ABPM reference standard. As with KQ2, we conducted an exploratory analysis restricted to 24-hr ABPM reference standards only. Eligible confirmatory methods included repeated OBPM, HBPM, or kiosk (public use blood pressure stations). Eligible studies needed to report a confirmatory measure and ABPM for participants with a previous elevated OBPM in order to create a 2x2 table; studies only conducting ABPM in these participants were not eligible as only a 1x2 table could be generated. For KQ3a, we included studies reporting accuracy of different confirmation protocol characteristics compared with an ABPM reference standard (e.g., more vs. fewer days of HBPM).

For KQ4, we included RCTs comparing harms in screened versus unscreened groups as well as RCTs and cohort studies that reported on the harms of screening, including absenteeism or any psychological effects or changes in quality of life as a result of being labeled hypertensive. We also included studies that examined the adverse effects of subsequent BP measurement methods to confirm the initial diagnosis (i.e., ABPM or HBPM), such as sleep disturbance or discomfort in continuously wearing a BP monitor.

Outcomes

For KQ1, eligible outcomes were: all-cause and cardiovascular mortality; cardiovascular disease events, including myocardial infarction, sudden cardiac death, stroke, heart failure, and hospitalization for coronary heart disease; symptomatic PAD; vascular dementia; end-stage renal disease; and quality of life. For KQs 2 and 3, we required sensitivity, specificity, positive and negative predictive values, or enough data to create 2x2 tables so sensitivity and specificity could then be calculated. We excluded test accuracy studies only reporting kappas or other measures of concordance but not sensitivity and specificity. KQ4 studies needed to report outcomes on the harms of screening, which could include psychological effects of labeling, absenteeism, quality of life, or tolerability of ABPM devices. For ABPM tolerability outcomes pertaining to sleep disturbance, we required that measures use some type of comparator, such as a comparison to usual sleep, to avoid bias from any poor general sleep outcome being attributed to ABPM.

Setting

For KQs 1 and 2, to be included, studies must have been conducted in eligible primary care settings, which we defined as sites with personnel trained in BP measurement, established BP measurement protocols, and ongoing documentation procedures for each. For KQ2, studies that recruited from workplace settings were eligible as long as OBPMs were conducted in an eligible primary care setting. For KQ3, allowable settings also included those for out-of-office BP measurement.

For all KQs, we excluded inpatient and residential facilities and restricted studies to those conducted in countries rated as "Very High" on the 2015 Human Development Index.[71]

Study Design

For KQ1, we included RCTs and CCTs of screening compared with no screening. For KQs 2 and 3, we accepted test accuracy studies comparing an initial or confirmatory BP measurement modality compared with an ABPM reference standard. For KQ4, we accepted RCTs, CCTs, and cohort studies for the outcomes of quality of life, physiological effects of labeling, and absenteeism; for the outcome of ABPM tolerability we additionally allowed cross-sectional studies given that tolerability was measured at one point in time.

Individual patient-data meta-analyses and registries were evaluated for inclusion. We required contributing populations to these studies to meet our other inclusion criteria, and we carefully evaluated their source populations to ensure that they did not overlap with populations in other included studies to avoid duplication. Publications from the International Database on Ambulatory Blood Pressure in Relation to Cardiovascular Outcomes (IDACO) were ultimately excluded because several contributing cohorts conducted OBPM during home visits, which did not meet our setting criteria.[32, 37, 67, 72] Additionally, several cohorts were from non-very-High HDI countries. Similarly, the Ambulatory blood pressure Registry TEleMonitoring of hypertension and cardiovascular rISk (ARTEMIS) was excluded because contributing hypertension clinics included those from non-very-High HDI countries, and furthermore, we concluded that there was overlap with already included populations based on the author list.[33] We prioritized the individual primary publications which reported additional protocol details which could be used for critical appraisal and data abstraction. Two other registries met inclusion criteria for KQ3—the Spanish ABPM Registry and the Korean ABPM Registry for Evaluation of the Prognostic Threshold in Hypertension (Kor-ABP).[73, 74]

Quality Assessment

Two reviewers critically appraised articles meeting inclusion criteria. We assigned each study a quality rating of "good," "fair," or "poor" according to the USPSTF's study design-specific criteria.[75] We supplemented these criteria with items from the Newcastle-Ottawa Scale for cohort studies[76] and the Quality Assessment of Diagnostic Accuracy Studies for studies of test accuracy[77, 78] (**Appendix A Table 3**). Disagreements were resolved by consensus and, if needed, consultation with a third independent reviewer. Because of several important changes to the

scope of test accuracy KQs in this update (KQ2 and KQ3), we repeated critical appraisal of previously included test accuracy studies. Critical appraisal of previously included studies was carried forward from the previous review for KQ1 and KQ4 because there were no changes to the scope of these questions and this was an update of our own work. Detailed methods for quality rating of test accuracy studies are available in **Appendix A**.

Data Abstraction

For studies about the benefits and harms of screening (KQs 1 and 4), we extracted details about each study's design (e.g., recruitment and inclusion criteria, number of participants recruited and analyzed); patient characteristics (e.g., age, sex, race/ethnicity, comorbidities and CVD history, baseline blood pressure); and intervention characteristics and control groups. Outcomes specified in inclusion criteria were abstracted.

For test accuracy studies (KQs 2 and 3), we extracted details about each study's screening test (e.g., device, number of blood pressure measurements, other protocol characteristics); recruitment and inclusion criteria; number of participants approached and analyzed; patient characteristics (i.e., age, sex, race/ethnicity, comorbidities and CVD history, and baseline blood pressure); reference standard details; and diagnostic outcomes (i.e., contingency table, sensitivity, specificity, positive and negative predictive values, and area under the curve). Outcomes from multiple clinically relevant diagnostic thresholds were abstracted if reported. We contacted authors for additional information about protocol characteristics or diagnostic thresholds if information was missing or unclear.

Data Synthesis and Analysis

KQs 1 and 4 (Benefits and Harms of Screening)

For KQs 1 and 4, we described results qualitatively because of the small number of included studies.

KQ2 (Test Accuracy of Initial Screening Using OBPM)

Our primary outcomes of interest were sensitivity, specificity, positive predictive value, and negative predictive value. We synthesized results in summary tables and figures organized by ABPM method and OBPM and ABPM diagnostic threshold. Test performance was either directly extracted from individual study results or calculated using study-reported contingency tables compiled from study-reported data.

For KQ2, our main analysis was a quantitative synthesis of test performance of OBPM using any ABPM modality as the reference standard. We pooled reference standards using 24-hr, daytime, and combinations of 24-hr and daytime ABPM together based on findings from the previous review that the prognostic value of different ABPM time periods to predict CVD events is similar, after adjusting for OBPM.[28] That finding was also the basis for allowing all ABPM

reference standards in our review's inclusion criteria. When a study reported both 24-h and daytime ABPM as the reference standard, we preferentially included 24-h ABPM in our meta-analysis because this method includes more measures. Studies using nighttime ABPM as a reference standard were eligible, but no study exclusively used this method. We conducted exploratory analyses restricting to studies using a 24-h ABPM reference standard.

In our quantitative pooling, we only included studies that used both SBP and DBP in their definition of hypertension because of relevance to current clinical practice. Studies using thresholds based on SBP alone or DBP alone are discussed separately in the results. While we extracted data from multiple thresholds if reported, we preferentially selected those for pooling that are based on international guidelines,[31, 34, 68, 79] which include 140/90 mm Hg for OBPM, 135/85 mm Hg for daytime ABPM, and 130/80 for 24-h ABPM. Because there was some variability of thresholds, we established *a priori* that we would pool thresholds within 0.5 standard deviation of the preferred threshold. We established the standard deviation of blood pressure using results from a large individual patient-data meta-analysis of population-based studies conducting both OBPM and ABPM in untreated populations (**Appendix A Table 4**).[37] No studies were excluded from quantitative synthesis on this basis. We acknowledge that the ACC/AHA currently recommends OBPM of 130/80 mm Hg as a threshold to diagnose hypertension.[20] We planned to include and discuss test accuracy studies using this threshold; however, none were reported in the primary literature for KQ2.

In our quantitative analysis, we included studies measuring OBPM at one visit only. Two studies measuring blood pressure at multiple visits were included in a sensitivity analysis.[80, 81] KQ2a examines differences in accuracy within studies when multiple protocols are reported. This question was synthesized qualitatively due to a small number of studies and heterogeneity in the types of protocol differences evaluated.

We used a bivariate model for quantitative synthesis, which modeled sensitivity and specificity simultaneously, thus accounting for the correlation between these variables. One study reported insufficient data for this approach and was not included in pooled analyses.[82] We used visual inspection of forest plots arranged by various study, population, and test characteristics to explore heterogeneity. No discernible patterns were identified. The I^2 statistic and accepted thresholds (which purposefully overlap) were used to interpret statistical heterogeneity, where 30 to 60 percent may represent moderate heterogeneity, 50 to 90 percent may represent substantial heterogeneity, and 75 to 100 percent shows considerable heterogeneity.[83]

In our Discussion section, we present a hypothetical population of 1,000 individuals to illustrate the flow and clinical consequences of screening using our pooled sensitivity and specificity for initial and confirmatory screening. We additionally estimated how confidence interval upper and lower bounds would alter positive and negative predictive values (PPV and NPV). PPV and NPV were calculated by applying pooled sensitivity and specificity point estimates to the prevalence of hypertension as defined by 24-h ABPM in three age strata from the International Database on Ambulatory blood pressure in relation to Cardiovascular Outcomes (IDACO).[32] These international prevalence estimates were used because U.S. population-based prevalence estimates of hypertension as defined by ABPM are not available. Additional limitations of U.S. epidemiologic data on the prevalence of hypertension include condition definitions that also

include treatment and would thus not reflect a screening-relevant population, and use of self-report instead of measured blood pressure.[84-86]

KQ3 (Test Accuracy of Confirmatory BP Measurement)

Analyses were stratified by type of confirmatory measure: repeat OBPM, HBPM, "self-OBPM," AOBP, and kiosk. Data were sufficient for quantitative syntheses for OBPM and HBPM modalities only; other modalities were qualitatively synthesized. Decisions regarding preferred thresholds for OBPM and ABPM are the same as for KQ2. For HBPM, our preferred threshold was ≥135/85 mm Hg, based on its correspondence to the most commonly reported OBPM threshold of 140/90 mm Hg.[20]

We used Stata version 15.1 (StataCorp LP, College Station, TX) for all analyses. All significance testing was two-sided, and results were considered statistically significant if the p-value was 0.05 or less.

Grading the Strength of the Body of Evidence

We graded the strength of the overall body of evidence for each KQ. We adapted the Evidence-based Practice Center approach,[87] which is based on a system developed by the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group.[88] Our method explicitly addresses four of the five Evidence-based Practice Center-required domains: consistency (similarity of effect direction and size), precision (degree of certainty around an estimate), reporting bias (potential for bias related to publication, selective outcome reporting, or selective analysis reporting), and study quality (i.e., study limitations). We did not address the fifth required domain—directness—as it is implied in the structure of the KQs (i.e., pertains to whether the evidence links the interventions directly to a health outcome).

Consistency was rated as reasonably consistent, inconsistent, or not applicable (e.g., single study). Precision was rated as reasonably precise, imprecise, or not applicable (e.g., no evidence). Reporting bias was rated as suspected, undetected, or not applicable (e.g., when there is insufficient evidence for a particular outcome). Study quality reflects the quality ratings of the individual studies and indicates the degree to which the included studies for a given outcome have a high likelihood of adequate protection against bias. The body-of-evidence limitations field highlights important restrictions in answering the overall KQ.

We graded the overall strength of evidence as high, moderate, or low. "High" indicates high confidence that the evidence reflects the true effect and that further research is very unlikely to change our confidence in the estimate of effects. "Moderate" suggests moderate confidence that the evidence reflects the true effect and that further research may change our confidence in the estimate of effect and may change the estimate. "Low" indicates low confidence that the evidence reflects the true effect and that further research is likely to change our confidence in the estimate of effect and is likely to change the estimate. A grade of "insufficient" indicates that evidence is either unavailable or does not permit estimate of an effect. Two independent reviewers rated each KQ according to consistency, precision, reporting bias, and overall strength

of evidence grade. We resolved discrepancies through consensus discussion involving more reviewers.

Expert Review and Public Comment

The draft Research Plan was posted for public comment on the USPSTF Web site from June 7, 2018, to July 5, 2018. The USPSTF received comments regarding the selection of outcomes, the importance of addressing the prevalence and prognosis of both masked and white coat hypertension, and the categories of blood pressure identified in the Analytic Framework. In response, the USPSTF added symptomatic peripheral artery disease and vascular dementia as health outcomes and retained end-stage renal disease as the renal outcome. The USPSTF also added a contextual question about the prevalence and prognosis of white coat hypertension. One organization suggested adding more blood-pressure classification categories to the Analytic Framework. The USPSTF kept the dichotomous classifications of "normal" and "elevated blood pressure," referring to the initial office-based screening step, without limiting included studies to specific thresholds. A draft version of this report was reviewed by five invited experts and two 2 USPSTF Federal Partners. Experts were selected based on their expertise in fundamental methodologic and content aspects of the review (i.e., blood pressure measurement modalities, test accuracy, CVD epidemiology and population health) and were selected to obtain diverse informed perspectives, including those of professional organizations. Reviewer comments were presented to the USPSTF during its deliberations and subsequently addressed in revisions of this report. Based on reviewer comments, methods and discussion text around AOBP were extended, selected Introduction text was edited for clarity, and additional assumptions and clarifications related to figures were added. Additionally, a draft version of this report was posted for public comment on the USPSTF Web site from May 26, 2020 to June 23, 2020. All comments were reviewed and considered for inclusion. Text was updated or clarified in the introduction section but no changes were made to the results or overall conclusions.

USPSTF Involvement

We worked with four USPSTF members at key points throughout this review, particularly when determining the scope and methods and developing the Analytic Framework and KQs. The USPSTF members approved the final Analytic Framework, KQs, and inclusion and exclusion criteria after revisions were made that reflected responses to the public comments. AHRQ funded this review under a contract to support the work of the USPSTF. An AHRQ Medical Officer provided project oversight, reviewed the draft report, and assisted in the external review of the report.

Chapter 3. Results

Literature Search

We reviewed 21,741 abstracts and assessed 544 full-text articles for inclusion (**Appendix B Figure 1**). Overall, we included 52 studies (reported in 81 articles), representing over 215,000 adults. For KQ 1, we included one study (4 articles); for KQ 2, 20 studies (34 articles); for KQ 3, 18 studies (28 articles); and for KQ 4, 13 studies (16 articles). Thirty-five studies were newly identified in this update, and 18 were carried forward from the preview review.

The lists of included studies and excluded studies (with reasons for exclusion) are available in **Appendix C** and **Appendix D**, respectively. Among all KQs, seven studies (reported in 14 articles) were excluded for poor quality and these were all studies of test accuracy. In brief, major risks of bias included a lack of independence between index and reference standards, inappropriate exclusions of participants that would bias accuracy, and unclear or potentially biased participant recruitment methods (**Appendix A Table 3**).

KQ1. Does Screening for Hypertension in Adults Improve Health Outcomes?

Summary of Results

There were no population-based hypertension screening trials. One community-based cluster RCT included in the previous review reported that a multicomponent CVD health promotion program was associated with a reduction in the trial's primary composite outcome (hospital admissions for acute MI, CHF, or stroke) at one year follow up.

Detailed Results

There were no population-based screening trials examining the effectiveness of hypertension screening compared with no screening. We identified one good-quality community-based cluster RCT (reported in 4 articles) conducted in Canada examining the effectiveness of a multicomponent CVD health promotion program on CVD health outcomes when hypertension screening was the primary intervention (**Appendix E Tables 1 and 2)**.[89] The trial comprised 39 clusters and evaluated 140,642 community members; 15,889 unique participants received a total of 27,358 assessments in the intervention group. This study was also included in the previous review. The community clusters received either the CHAP Cardiovascular Health Awareness Program (CHAP) intervention or no intervention. In the CHAP communities, residents age 65 and older were invited to participate in community pharmacy-based BP screenings using an automated instrument (BpTRU®, VSM MedTech, Coquitlam, BC) and complete a standardized risk profile. Blood pressure measurement in this trial could be categorized as an attended AOBP measurement. Intervention participants received their risk profile, risk-specific educational materials, and information about local community resources. An on-call nurse reassessed

participants with very high blood pressures (i.e., SBP of 180 or DBP of 110 mm Hg). Blood pressure and risk assessment results were communicated with the participants' family physicians. The entire program duration was 10 weeks. The mean age of participants was 74.8 years, and 57.2 percent were women. Twelve percent of the participants had a previous history of congestive heart failure (CHF), and 22 percent had diabetes. The primary composite outcome was the relative change in the mean annual rate of hospital admissions for acute MI, CHF, or stroke in all community residents age 65 years or older in the year before compared with the year after CHAP implementation. The intervention communities had a 9 percent relative reduction in the number of hospital admissions per 1,000 for composite events (rate ratio 0.91 [95% CI, 0.86 to 0.97]). There were 3.02 fewer annual hospital admissions for CVD per 1,000 people in the intervention group compared with the control group. For hospitalizations due to individual components of the composite outcome (MI, CHF, stroke), there was a statistically significant reduction seen in admissions due to MI (rate ratio 0.87 [95% CI, 0.79 to 0.97]) and CHF (rate ratio 0.90 [95% CI, 0.81 to 0.99]). When analyzed by number of residents (instead of by number of hospital admissions), the composite outcome did not have a statistically significant difference (rate ratio 0.95 [95% CI, 0.89 to 1.02]), and MI was the only component of the composite that showed statistically significant benefit (rate ratio 0.89 [95% CI, 0.79 to 0.99]). There were no statistically significant differences in all-cause mortality (rate ratio 0.98 [95% CI, 0.92 to 1.03])) or in-hospital CV mortality (rate ratio 0.86 [95% CI, 0.73 to 1.01]). Initiation of antihypertensive treatment was 10 percent higher in the intervention group compared with the control group (rate ratio 1.10 [95% CI, 1.02 to 1.20]).

This large cluster RCT was rated good quality.[89] While the intervention primarily included systematic hypertension screening, other interventions including risk assessments, education, and self-management likely contributed to the health benefits achieved in the trial. Overall, risk of bias was low for all domains of critical appraisal: randomization, intervention fidelity, attrition, and outcome reporting. Trial limitations included short 10-week intervention and 1-year followup times; furthermore, the outcome measures were derived from administrative records which inherently present some validity concerns although would not have systematically biased results in favor of either study group.

KQ2. What Is the Accuracy of OBPM During a Single Encounter as Initial Screening for Hypertension Compared With the Reference Standard, ABPM?

Summary of Results

We identified 20 fair- to good-quality studies (reported in 34 articles) (N=12,614) examining the test accuracy of office-based blood pressure measurement (OBPM) for initial screening for hypertension compared with an ambulatory blood pressure measurement (ABPM) reference standard.[80-82, 90-120] All studies are newly included in this update because of the new requirement in this review to have an ABPM reference standard.

Meta-analysis of 15 studies using SBP/DBP thresholds and measuring blood pressure at one visit (N=11,309) showed a pooled sensitivity of 0.54 (95% CI, 0.37to 0.70) and a pooled specificity of 0.90 (95% CI, 0.84 to 0.95). Substantial clinical and methodologic heterogeneity among the included studies contributed to considerable statistical heterogeneity not explained by any single participant or test characteristic (**Figure 2**). Among this set of studies, positive predictive values ranged widely, from 0.35 to 0.97, and negative predictive values ranged from 0.25 to 0.97. False positive and false negative rates likewise ranged widely and were as high as 30 percent for false positive rates and 100 percent for false negative rates (FPR 0 to 30%; FNR 8 to 100%). Evidence for this key question is derived primarily from population-based samples in which participants represent a wide range of demographic and clinical characteristics, including a large range of blood pressures. Index test measurement protocols were heterogeneous and deviated somewhat from commonly performed protocols in U.S. practice in that studies mostly used a mercury sphygmomanometer, had participants rest for 5 minutes prior to measurement, and used the average of multiple measurements.

Study and Population Characteristics

Included studies were most commonly community-based samples and were conducted in a variety of countries (**Table 6; Appendix E Table 3**). Five studies were conducted in the U.S.,[80, 90, 100, 103, 104] two studies each were conducted in Belgium,[91, 105] Italy,[98, 101] and Japan,[95, 96] and one study each was conducted in Australia,[93] Canada,[102] Denmark,[94] Finland,[81] France,[92] Ireland,[99] Poland,[106] Russia,[97] and the United Kingdom.[82] Fourteen studies recruited participants from the community;[81, 90, 92-96, 98, 100-102, 104-106] three studies recruited from primary care;[82, 91, 99] one recruited from both the community and primary care;[80] one recruited participants from local businesses and colleges;[97] and one recruited employees from multiple organizations.[103]

Participants in included studies exhibited a wide range of demographic and clinical characteristics (**Table 6**). The number of participants in the studies used for this analysis, which focused on untreated populations, ranged from 65[80] to 2,955.[101] Participant ages ranged from 14 years to 102 years, with mean age ranging from 25.6 years[97] to 70 years.[91] Percent female ranged from 37.9 percent[93] to 72.3 percent.[96] Only nine of 19 studies reported race/ethnicity. Of those, four studies were conducted with 100 percent white populations[80, 94, 105, 106] and one study, the Jackson Heart Study, had a 100 percent black population.[104] Less than 10 percent of participants reported history of MI, CVA or previous CVD at baseline in the 11 studies reporting this characteristic.[81, 82, 91, 92, 94-97, 99, 103, 104]

Mean sitting office SBP ranged from 109.1 mm Hg[115] to 136.7 mm Hg[91] and mean office DBP ranged from 68.8 mm Hg[102] to 84.3 mm Hg.[106] For both SBP and DBP, the lowest values were from young populations with mean ages of 30 or less years;[102, 115] the highest blood pressures were from a French sample of 65-year-old people in whom the measurement was taken in the supine position.[92]

Index Test Characteristics

Included index tests applied a wide range of protocols and devices (**Table 7**). The office-based blood pressure measurement devices in the majority of the studies (14 of 20) used the auscultatory method,[80, 81, 90-94, 96-98, 101, 103-105] while a few studies used the oscillatory method.[82, 95, 99, 100, 102, 106] All devices using the auscultatory method were manual, with the exception of an automatic device using the microphone method in one study.[96] Other manual devices were mercury sphygmomanometers, used in 11 studies,[80, 81, 90-93, 97, 98, 101, 103, 105] and random-zero mercury sphygmomanometers, used in two studies.[94, 104] The remaining seven studies used automated devices.[82, 95, 96, 99, 100, 102, 106] All included studies had attended measurements. One study by Gill and colleagues[82] could be considered attended AOBP as it used a fully automated BPTru device with a preprogrammed set of 6 measurements.

Per inclusion criteria, all initial blood pressure screening measurements occurred in office-based settings. We initially included only screening protocols occurring at one clinical encounter; however, we later expanded our criteria to include studies measuring blood pressure over multiple visits to be consistent with guidelines.[20, 121] Two additional studies were included based on this expansion; these were included in the sensitivity analysis. One measured blood pressure over three visits occurring at 1-week intervals,[80] and the other measured blood pressure at four visits occurring over a 3-week period.[81] Several studies measured blood pressure over several visits but reported accuracy for protocols using measures from just the first visit as well as multiple visits;[82, 102, 103] the comparative accuracy of different protocols is discussed further in KQ2a. The number of measurements used to calculate blood pressure ranged from one[82] to nine[80, 103] but was most commonly two (9 studies).[92-97, 99, 100, 104] Typically, all measures were averaged to calculate the blood pressure value, but in some studies the first measurement was dropped before calculating the mean.[82, 99-101]

For most protocol characteristics, there was wide variation in the specificity of the index test-protocol description (**Table 7**). More than half of studies did not report which arm was used for blood pressure measurement,[81, 90, 92-96, 102, 103, 105, 106] and arm position was rarely noted. None of the studies reported whether the cuff was placed over clothing or bare skin. Eight studies reported no information about cuff size,[82, 92, 95-97, 99, 102, 106] while the remaining studies provided some variable detail on cuff-size[80, 81, 90, 91, 93, 94, 98, 100, 101, 103-105] Only two studies reported leg position; both reported leg position as flat feet on the floor[100, 104] and one further specified uncrossed legs.[104] The protocol characteristics of body position, resting time, and attendance of measurements (i.e. presence of personnel during measurement) were well reported and showed similarities spanning all studies, including use of the seated position and resting time that was most commonly 5 minutes or at least 5 minutes.[82, 90, 91, 94, 95, 98-101, 103-105] Avoidance of distraction was mentioned in a few studies; two studies noted that the rest period was quiet,[80, 101] and one study specifically instructed observers not to speak during blood pressure measurements.[102] Blood pressure measurements in all studies were attended by the personnel performing measurements, but there was a wide variety of personnel taking measurements, including physicians,[92, 95, 98] participants' usual primary care physicians,[91] cardiologists,[97] nurses or research nurses,[81, 82, 90, 93, 105] nurses or technicians,[96, 103] research assistants,[80] or trained and certified staff without further specification.[100, 106] Most commonly, studies did not report how personnel were trained or noted only that personnel were trained.

Studies most commonly used an office BP of ≥140/90 mm Hg as the diagnostic threshold for the index test (15 of 20 studies).[81, 90, 91, 94-101, 103-106] An additional two studies used a threshold of 140/90 mm Hg; however, it was not reported whether the threshold was operationalized as greater than or equal to 140/90 mm Hg or greater than this value.[80, 82] Of the studies using a combination SBP/DBP threshold, only one did not use a cutpoint of 140/90 mm Hg; instead it used thresholds of ≥150/90 mm Hg and ≥160/95 mm Hg.[93] Several studies also reported accuracy for other thresholds in addition to ≥140/90 mm Hg (i.e., ≥ or >120/80 mm Hg[97, 103] and ≥130/85 mm Hg[103]). Two studies used SBP-alone or DBP-alone thresholds.[92, 102] One study[100] reported accuracy for an OBPM threshold of ≥130/80 mm Hg, the diagnostic threshold recommended in the 2017 ACC/AHA guideline.[20] However, because this study reported accuracy compared to a reference standard threshold that was also lowered, no information is available about the comparative accuracy of ≥130/80 mm Hg vs ≥140/90 mm Hg using the same reference standard threshold.

Reference Test Characteristics

While all but one study[102] reported that 24-h ABPM was conducted, most studies (k=13) used daytime ABPM as their reference standard (**Table 7**). Seven studies used 24-h ABPM as the reference standard,[80, 94-96, 98, 99, 101] and five studies used combination thresholds for 24-h, daytime, and/or nighttime, and required one period to be abnormal to diagnose hypertension.[80, 90, 97, 99, 106] Four studies reported results for multiple reference standard tests (e.g., daytime and 24-h ABPM).[80, 94, 96, 99]

Consistent with guidelines,[31, 34, 68, 79] the diagnostic threshold most commonly used for daytime ABPM was ≥135/85 mm Hg.[82, 90, 91, 93, 94, 99, 100, 102-105] Two studies used a daytime ABPM cutpoint of ≥140/85 mm Hg,[81, 96] while another used a daytime ABPM cutpoint using systolic blood pressure only (SBP ≥135 mm Hg).[92] The 24-hr ABPM threshold values showed more variation, with thresholds ranging from ≥125/79 mm Hg[98, 101] to ≥140/90 mm Hg.[80] The remaining studies used combination definitions for hypertension involving blood pressure elevation for 24-hr, daytime, and/or nighttime with various thresholds.[80, 97, 99, 106] Three studies reported multiple thresholds for the same type of ABPM.[80, 100, 101]

Timing to start daytime ABPM measurement varied, but nearly all studies reported beginning times of 0600 to 1000 and ending times ranging from 2000 to 2300.[81, 82, 91, 93, 101, 104-106] Measurements occurred every 15 to 30 minutes during the daytime period and 15 to 60 minutes during the nighttime period. Most studies (k=13) required a minimum number of measurements to consider the ABPM complete.[80, 82, 90, 92, 94, 96, 98-101, 104-106] Most commonly, ABPM values were determined by calculating simple means,[80-82, 90, 92, 95-98, 101-104, 106] but in some cases, means were weighted.[91, 93, 94, 100, 105]

Other protocol details about the arm measured, cuff size, and instructions provided to participants were sparsely reported.

Quality

Only one of the included studies was rated as good quality.[98] This study was a random population-based sample of residents of an Italian town with low risk of bias for all four domains evaluated during critical appraisal. Several studies had at least medium risk of bias for patient selection, conduct of the index test, and conduct of the reference test. Fifteen of the 20 included studies had medium risk of bias in the domain of patient selection.[80, 82, 90, 93, 97, 103, 106] to high[94-96, 99-102, 104] Potential for bias for the patient selection domain was introduced because of lack of reporting of initial recruitment strategy[80, 90, 97, 103, 106] or self- or clinician-selected volunteers,[80, 82, 99, 100] or because the sample was a subset of a larger population without details of how the subset was achieved or without assurance that the subsample was representative of larger population.[93-95, 101, 104] Some studies excluded participants with higher blood pressures[103] or those on cardiovascular medications,[102] which may have removed higher risk participants from samples, potentially underestimating accuracy. Studies rarely provided details on all relevant OBPM protocol characteristics; however, most studies reported sufficient detail to achieve a low risk of bias for this domain. Six studies had medium risk of bias for conduct of the reference test because they did not report fidelity to the gold-standard ABPM measurements (e.g., there were no reports of minimum required ABPM measurements or mean number of ABPM values obtained)[81, 91, 93, 95, 97, 102] or issues with calibration and use of visual inspection of ABPM reports.[80] Five studies had medium risk of bias for the patient flow domain due to lack of reporting about the nature of missing data or disproportionate exclusions from data analysis.[82, 90, 93, 94, 105]

Detailed Results

Prevalence and Screen Positivity

The prevalence of hypertension as defined by ABPM in the included studies reflected population heterogeneity and ranged from 12.6 percent[97] to 88.9 percent.[100] Percent positive screens defined by elevated OBPM ranged from 0 percent[97] in the cardiology outpatient setting with young participants (mean age 25.6 years) to as high as 62.5 percent[100] in a study of African-American and white men and women (aged 48 to 60 years old) (**Table 8**).

Sensitivity/Specificity

Meta-analysis of 15 studies reporting SBP/DBP thresholds (N=11,309) showed a pooled sensitivity of 0.54 (95% CI, 0.37 to 0.70) and a pooled specificity of 0.90 (95% CI, 0.84 to 0.95) with considerable heterogeneity (I^2 sensitivity=97.8%; I^2 specificity=96.7%) (**Figure 2; Table 8**). Sensitivity varied widely among pooled studies. The lowest sensitivity was 0.00 in a sample of young participants (mean age 25.6 years) where 0 percent had a positive screen by OBPM, but 12.6 percent had hypertension by daytime or nighttime ABPM.[97] The highest sensitivity was 0.92 reported in a large population-based study conducted in an Italian town with mean age of 49 years.[101] Specificity varied less among pooled studies. The lowest specificity of 0.70 was reported in a study of adults 60 years or older recruited from primary care in Belgium, of whom 42.8 percent had a positive screen by OBPM.[91] The highest specificity of 1.00 occurred in a

sample of young adults of whom 0 percent had a positive screen by OBPM—this is the same study that reported a sensitivity of 0.00.[97]

Five studies did not contribute to the meta-analysis. The study by Gill and colleagues[82] could not be included due to insufficient reporting; results for sensitivity were within the confidence intervals of the pooled analysis, but specificity was lower [0.74 (95% CI, 0.66 to 0.82)]. Two studies reported SBP-only or DBP-only thresholds that are not relevant to current clinical practice and showed widely varying accuracy.[92, 102] Based on recommendations from ACC/AHA to average measurements obtained on at least two visits,[20, 31] we conducted a sensitivity analysis to add two studies measuring blood pressure at three or four visits.[80, 81] This sensitivity analysis rendered the same point estimate, but with slightly narrower confidence intervals (sensitivity: 0.53 [95% CI, 0.37 to 0.68]; specificity: 0.91 [95% CI, 0.85 to 0.95]) (I^2 sensitivity=97.5%; I^2 specificity=96.8%)]. Exploration of heterogeneity using visual inspection of forest plots did not yield any decisive trends regarding participant or index test characteristics.

We conducted an exploratory analysis restricted to the preferred 24-h ABPM modality. Meta-analysis of 6 studies with a 24-hr ABPM reference standard (N=7,845) showed a pooled sensitivity of 0.72 (95% CI, 0.58 to 0.84) and specificity of 0.83 (95% CI, 0.78 to 0.88), again with considerable statistical heterogeneity (I^2 sensitivity=98.2%; I^2 specificity=96.9%) (**Appendix F Figure 1**). While the point estimate for sensitivity of OBPM compared to the 24-h ABPM reference standard was higher when compared to the sensitivity against all ABPM reference standards (0.72 vs 0.53), confidence intervals did overlap, as they did for specificity. Furthermore, we consider this analysis exploratory as there exists population heterogeneity in addition to reference standard heterogeneity in these studies, and this represents a subset of less than half of the studies included in our main analysis. Three studies reported results for the accuracy of OBPM versus both 24-h and daytime ABPM reference standards.[94, 96, 99] Differences in accuracy of OBPM when compared with 24-hr and daytime ABPM reference standard showed no consistent pattern.

Four studies reported results for multiple OBPM thresholds.[93, 97, 102, 103] These studies consistently showed increased sensitivity and decreased specificity as thresholds are lowered. For example, in the study by Shimbo and colleagues,[103] which reported OBPM thresholds of ≥140/90 mm Hg, ≥130/85 mm Hg, and ≥120/80 mm Hg, the respective sensitivities and specificities were: 0.33 and 0.97, 0.56 and 0.87, and 0.84 and 0.63. One study[100] reported accuracy for an OPBM threshold of ≥130/80 mm Hg but also lowered the reference standard (daytime ABPM) to ≥130/80 mm Hg with a resulting sensitivity of 0.56 (95% CI, 0.50 to 0.61) and specificity of 0.89 (95% CI, 0.83 to 0.93).

No studies reported the area under the curve.

Positive Predictive Value/Negative Predictive Value (PPV/NPV)

For studies using SBP/DBP thresholds and in which measurement occurred at one visit, PPV ranged widely from 0.35 to 0.97. The lowest PPV of 0.35 is from a community-based study in Japan where 19.4 percent screened positive by OBPM and 13.9 percent were hypertensive based on 24-h ABPM.[96] The highest PPV of 0.97 is from a subset of the CARDIA study (n=432),[100] a

U.S. community-based trial where 62.5 percent screened positive by OBPM and 88.9 percent were hypertensive based on Daytime ABPM. NPVs were less variable and ranged from 0.25 to 0.97 among studies using SBP/DBP thresholds and where measurement occurred at 1 visit. The NPV of 0.25 was from a community-based study in the U.S. where 62.5 percent screened positive on OBPM and 88.9 percent were hypertensive based on a 24-h ABPM threshold of ≥135/85 mm Hg. The NPV of 0.97 was from a large community-based study conducted in Italy where 34.6 percent screened positive on OBPM and 27.7 percent had hypertension based on a 24-h ABPM threshold of ≥130/80 mm Hg.[101]

False Positive Rates/False Negative Rates (FPR/FNR)

For studies using SBP/DBP thresholds and in which measurement occurred at a single visit, false positive rates had a wide range among studies. The lowest occurrence of false positives, 0 percent, occurred in a study of young participants (mean age 25.6 years) in which no one screened positive by OBPM ≥140/90 mm Hg and the protocol involved 2 measurements after a 20 minute rest period.[97] The highest false positive rate, 30 percent, occurred in a cohort recruited from primary care in Belgium; the mean age was 70 years and the mean OBPM was 136.7/76.2 mm Hg.[91] The protocol in this study averaged three readings after a rest period of at least 5 minutes.

False negative rates showed a similar wide range among included studies. The lowest false negative rate of 8 percent was reported in a large, Italian, community-based study in which the mean age was 49.0 years and the mean OBPM was 124.3/77.3 mm Hg.[101] The protocol in this study used the mean of second and third measurements on both arms after 5 minutes rest. The highest false negative rate, 100 percent, occurred in the study with young participants described above where no one screened positive by OBPM ≥140/90 mm Hg.[97]

KQ2a. What Screening Protocol Characteristics Define the Best Test Accuracy?

Summary of Results

Only four of the 20 included KQ2 studies compared the accuracy of different protocols in a single study.[82, 97, 102, 103] Three studies reported accuracy for protocol variations using different numbers of measures and visits and showed mixed results: two studies showed no difference in accuracy,[102, 103] while one study showed a higher sensitivity and lower specificity with single compared with multiple measurements.[82] One unique study reported that adding a breath-holding maneuver to a blood pressure measurement protocol improves overall accuracy of screening in a young population, with substantially higher sensitivity and slightly lower specificity, but these results have not been replicated.[97]

Detailed Results

Substantial clinical and methodological heterogeneity among the 20 included studies precluded analysis of protocol differences among studies as explanations for differences in accuracy. Four of the 20 included KQ2 studies reported within-study comparisons of protocol characteristics on accuracy[82, 97, 102, 103] (**Table 7**; **Appendix E Table 4**). Overall, results of the three studies that evaluated the effect of additional measurements from additional visits were mixed, showing either no difference in accuracy or higher sensitivity and lower specificity with single compared with multiple measurements.[82, 102, 103]

Three studies reported accuracy for protocol variations using different numbers of measures and visits. One study by Selenta et al reported nearly identical accuracy for a primary analysis using an average of five OBPMs from a single visit for the index test, to a sensitivity analysis using the average of two OBPMs from a single visit.[102] A second study by Shimbo et al reported accuracy for an index test of a mean of three readings from a single visit and an index test of a mean of nine readings from three visits and found similar results with overlapping confidence intervals.[103] For OBPM ≥140/90 mm Hg with a reference standard of daytime ABPM of ≥135/85 mm Hg, sensitivity for three readings and nine readings, respectively, were 0.33 (95% CI, 0.26 to 0.40) and 0.24 (95% CI, 0.18 to 0.31), and specificity was 0.97 (95% CI, 0.95 to 0.98) and 0.99 (95% CI, 0.98 to 0.99). A third study by Gill et al reported accuracy for three variations of an attended AOBP index test: the first reading on the first visit (1 measurement), the mean of second and third readings from three visits (6 measurements), and the mean of second and sixth readings from three visits (6 measurements).[82] The first reading from the first visit showed the highest sensitivity and lowest specificity of all three protocols. The sensitivity of the single reading was 0.65 (95% CI, 0.54 to 0.75), while the sensitivity from the mean of the second and third BPs from three visits was 0.40 (95% CI, 0.29 to 0.51). The specificity from the single visit was 0.74 (95% CI, 0.66 to 0.82), while the specificity from the mean of the second and third BPs from 3 visits was 0.90 (95% CI, 0.84 to 0.95). The mean of second and sixth readings from 3 visits had sensitivity and specificities that overlapped with the other 2 protocols.

One study evaluated whether adding a breath-hold to a blood pressure measurement protocol could serve as a simple test for masked hypertension. This Russian study by Lyamina and colleagues[97] (N=269) recruited young participants with a mean age of 25.6 years from local colleges and businesses and compared the mean of two BP measurements in a single visit measured with and without a breath-hold. The index test had a threshold of ≥140/90 mm Hg and the reference test used a combined day and nighttime ABPM threshold. Sensitivity and specificity with breath-holding were 1.00 (95% CI, 0.90 to 1.00) and 0.92 (95% CI, 0.88 to 0.95), respectively. Sensitivity and specificity without breath-holding were 0 (95% CI, 0 to 0.10) and 1.00 (95% CI, 0.98 to 1.00), respectively. Such results suggest that breath-holding may improve accuracy; however, such results would need to be replicated in a larger, more generalizable, and older target population with a higher prevalence of hypertension as no participant in this study screened positive by OBPM without breath-holding.

KQ3. What Is the Accuracy of Confirmatory Blood Pressure Measurement in Adults Who Initially Screen Positive for Hypertension Compared With the Reference Standard (ABPM)?

Summary of Results

We identified 18 fair- to good-quality studies (reported in 27 articles) (N=57,128) examining the test accuracy of confirmatory blood pressure measurements (office, home, self-OBPM, truncated ABPM) compared with an ambulatory blood pressure measurement (ABPM) reference standard in adults with a previous elevated OBPM.[73, 74, 122-146] Twelve of these studies are new since the previous review.[73, 74, 122, 124, 130-133, 135, 136, 139, 142]

In contrast to KQ2 results, which showed that initial screening with OBPM is not sensitive but is specific in an unselected population, KQ3 showed that confirmatory modalities, when applied to a preselected population, are generally sensitive but not specific. All results showed considerable heterogeneity without apparent explanation based on any patient or test characteristics.

OBPM

Meta-analysis of eight OBPM confirmation studies (N=53,183) reporting SBP/DBP thresholds showed a pooled sensitivity of 0.80 (95% CI, 0.68 to 0.88) and a pooled specificity of 0.55 (95% CI, 0.42 to 0.66), with considerable heterogeneity (I^2 sensitivity=99.2%; I^2 specificity=98.6%). Among this set of studies, positive predictive values ranged from 0.59 to 0.88 and negative predictive values ranged from 0.30 to 0.82. False positive rates ranged from 15 to 65 percent. False negative rates ranged from 10 to 65 percent.

HBPM

Meta-analysis of four HBPM confirmation studies with threshold of ≥135/85 mm Hg (N=1,001) showed a pooled sensitivity of 0.84 (95% CI, 0.76 to 0.90), and pooled specificity of 0.60 (95% CI, 0.48 to 0.71), with considerable heterogeneity (I^2 sensitivity=85.1%; I^2 specificity=77.8%). Among this set of studies, positive predictive values ranged from 0.68 to 0.94 and negative predictive values ranged from 0.46 to 0.86. False positive rates ranged from 22 to 50 percent, and false negative rates ranged from 7 to 24 percent.

Self-OBPM

Two studies (N=698) examined self-OBPM as a confirmation method.[135, 139] Only one of these studies used SBP/DBP thresholds relevant to current clinical practice; it found high sensitivity and low specificity (0.92 [95% CI, 0.85 to 0.96]; 0.25 [95% CI, 0.16 to 0.35]).[135] The PPV and NPV in this study were 0.59 and 0.72, respectively. The false positive rates in the two self-OBPM studies were 43 and 75 percent, and false negative rates were 8 and 14 percent.

Truncated ABPM

One study reported accuracy for a truncated ABPM (6-h ABPM) and results were reported separately based on ABPM indication.[124] Sensitivity and specificity were 0.94 and 0.76, respectively, in a population (N=126) for whom the ABPM indication was borderline hypertension. The sensitivity and specificity were 0.89 and 0.70, respectively, for the population (N=137) with suspected white coat hypertension. Confidence intervals in this study were not calculable.

Study and Population Characteristics

Included studies were conducted in a variety of countries among participants from several different population sources (**Table 9; Appendix E Table 5**). Two studies were conducted in the United States,[124, 130] three studies each were conducted in Italy,[126, 142, 143] Greece,[132-134] and Korea;[73, 131, 136] two studies were conducted in Spain;[74, 122] and one study each was conducted in Argentina,[139] Denmark,[128] Israel,[145] Switzerland,[127] and the United Kingdom.[135] Three studies recruited participants solely from primary care,[122, 127, 135] and an additional five studies recruited at least partly from primary care.[74, 126, 130, 132, 139] Eight studies recruited patients solely from a cardiology and/or blood pressure clinic.[73, 128, 133, 134, 136, 142, 143, 145] One study recruited participants from an ABPM referral service of a university-affiliated primary care center.[124] Finally, two studies were ABPM registries: Kor-ABP[73] and the Spanish ABPM Registry.[74] While the Kor-ABP registry, conducted in Korea, was of modest size (N=1,262), the Spanish ABPM Registry analysis used for our review included 45,020 untreated individuals, which makes up much of the included evidence for this question.[74]

Eligible populations for KQ3 were preselected, with at least one elevated BP measurement identified by clinic-based screening. As such, included studies are samples of patients referred by primary care physicians to blood pressure clinics because of borderline or elevated blood pressures, consecutive patients referred to ABPM or hypertension clinics, or individuals who were newly diagnosed as hypertensive by OBPM and not yet treated.

Participants in the included studies exhibited a wide range of demographic and clinical characteristics (**Table 9**). The number of untreated participants analyzed ranged from 159[128] to 45,020 participants in a registry.[74] Participant ages ranged from 13 to 95 years, with mean age ranging from 46.9[127] to 60 years. Percent female ranged from 0[126] to 66.7 percent.[145] Only three studies reported race/ethnicity, and of those, participants were largely white.[130, 135, 147] One U.S. study conducted in the Southeast included 22.3 percent black participants.[130]

Mean blood pressures showed a substantial range across all measurement modalities with the exception of HBPM which showed a tighter clustering in the high-normal range (**Table 9**). For example, mean OBPM values ranged from 129.6/81.0 mm Hg[130] to 164.1/103.5 mm Hg.[126] Mean HBPMs for SBP ranged from 134.6 mm Hg[136] to 141.1 mm Hg[135] and 82.1 mm Hg[122] to 88 mm Hg[134] for DBP.

Quality

Two of the included studies were rated as good quality, with low risk of bias for all domains.[134, 143] Both good-quality studies evaluated repeat OBPM as a confirmation method and studied consecutive patients referred to outpatient hypertension clinics for evaluation of elevated blood pressure. The protocols in these studies were well-described, reporting the fidelity of measurement and accounting for all participants in the analysis. Eleven of the 18 included studies had medium risk of bias for the domain of patient selection.[73, 74, 122, 124, 126, 127, 132, 133, 135, 136, 145] Potential for bias for the patient selection domain was introduced because some were studies convenience samples from ABPM or hypertension clinics,[73, 124, 127, 132, 133, 145] involved self- or clinician referral,[135] had exclusions threatening spectrum of disease representativeness,[122, 126] or reported limited detail on enrollment.[74, 136] One study had high risk of bias for patient selection because it specified a narrow range of eligible blood pressures, was not a consecutive or random sample, and lacked details on the process of patient selection; however, all other domains were rated as low risk of bias.[130] One study had medium risk for the conduct or interpretation of index test domain because of multiple exploratory thresholds.[139] Four studies had a medium risk of bias for the reference standard domain because of unusual adjustments to office and ambulatory devices, which may have influenced independence of measures in one study,[128] and three studies did not report the required minimum or average number of ABPM measurements.[131, 142, 145] It was extremely rare for studies to report any details about quality assurance for the index or reference standard device, such as calibration or maintenance.[122, 133] Four studies had a medium risk of bias for the patient flow domain due to lack of reporting of details about which recruited patients were not analyzed.[73, 74, 133, 145]

OBPM Confirmatory Studies: Index Text Characteristics

Thirteen studies examined OBPM measured by medical personnel as the index test against the ABPM reference standard.[73, 74, 126-128, 130-134, 142, 143, 145] In most studies, the OBPM confirmations were performed in different locations with different personnel and possibly different protocols than the initial OBPM screening (that often occurred in primary care clinics) triggering the referral for this further confirmatory testing. Most OBPM confirmatory measurements were taken with patients seated for at least 5 minutes of rest and attended by personnel, were taken with a mercury sphygmomanometer, had a diagnostic threshold of ≥140/90 mm Hg, and were conducted at one visit; however, other protocol details varied widely (**Table 10**). The office-based blood pressure measurement devices in most studies (9 studies) used the auscultatory method with manual technique;[126-128, 131-134, 143, 145] all but one[145] were mercury sphygmomanometers. One of the mercury sphygmomanometers was a Hawksley random zero device which is an older device that intends to eliminate digit preference by masking values during measurment.[128] Four studies used the oscillatory method with automated technique.[73, 74, 130, 142]

The number of office measurements used to calculate blood pressure ranged from 1[131] to 12,[143] with most studies (9 of 13) conducting OBPM at one visit. The remaining studies measured office BP at different visits separated by 1 day,[132, 143] 6 weeks,[134] or 8 weeks.[126] The time between measurements on single occasions was only reported in four studies and in all cases was 1 minute.[73, 126, 134, 142]

Protocol details relating to the arm and arm position, cuff, and timing of measurement were sparsely reported. Three studies reported the arm used for the measurement as the nondominant arm.[130, 132, 133] Three studies reported arm positioning as supported at heart level, and no studies mentioned whether the cuff was applied under or over clothing.[132, 133, 143] Cuff-size was rarely described with any detail.[126, 130, 132-134, 143] Only two studies mentioned the time of day when these office measurements were taken: between 0800 and 1000 in one study[142] and morning in the other.[126]

Body position and resting time were commonly reported and generally consistent among studies. All studies reported that measurements were taken in the seated position except two studies in which body position was not reported.[73, 130] Leg position was not reported in any study. All but two studies[127, 133] reported resting time before the initial measurement; this rest time was most commonly 5 minutes.[73, 74, 130, 131, 134, 145] Less commonly reported rest times were 10 or ≥10 minutes[132, 142, 143] and as long as ≥15 minutes in one study.[128] Only three studies reported avoidance of distraction.[130, 142, 145]

Nine studies specified the personnel taking the measurement. These were nurses,[127] nurses or physicians,[145] physicians,[126, 128, 132-134, 143] or hypertension specialists.[142] Another study reported that the measurement was attended but did not identify the type of personnel.[131] In three studies, neither the interventionist nor attendance of the measurement was reported.[73, 74, 130]

Studies most commonly used an office BP of ≥ or >140/90 mm Hg as the diagnostic threshold for the index test.[73, 74, 127, 130, 132-134, 142, 143] One study reported accuracy data for other thresholds in addition to >140/90 mm Hg. These included: >135/85 mm Hg, >160/95 mm Hg, and >160/100 mm Hg.[127] An additional four studies used SBP-only or DBP-only thresholds.[126, 128, 131, 145]

OBPM Confirmatory Studies: Reference Test Characteristics

While all but two of the 13 OBPM confirmation studies[73, 127] reported that 24-h ABPM was conducted, most studies (k=9) used daytime ABPM as their reference standard (**Table 10**).[73, 74, 126-128, 133, 134, 143, 145] Five studies used 24-h ABPM as the reference standard,[74, 130-132, 142] and one study reported multiple reference standards, including daytime, 24-h, and a combination threshold requiring one period (24-h, daytime, or nighttime) to be abnormal in order for a hypertension diagnosis to be made.[74]

While ABPM cutoffs varied, the diagnostic threshold most commonly used for daytime ABPM was ≥135/85 mm Hg,[73, 133, 134, 143] which is consistent with guidelines.[31, 34, 68, 79] One study each used thresholds of ≥134/90 mm Hg[126] and >140/90 mm Hg.[127] Two studies used the diastolic-only threshold of >90 mm Hg.[128, 145] The studies using a 24-hr ABPM reference standard reported thresholds ranging from ≥125/80 mm Hg[132] to ≥135/85 mm Hg,[130] with one study using a SBP-only threshold.[131] The very large Spanish ABPM registry reported accuracy using multiple reference standards including daytime ABPM alone, 24-hr ABPM alone, and a combination definition involving blood pressure elevation for 24-hr, daytime, or nighttime periods.[74]

Most studies used a fixed time period to define the daytime ABPM period.[73, 126, 128, 132, 133, 142, 143, 145] Most studies (9 of 13) required a minimum number of ABPM measurements.[73, 74, 127, 128, 130, 132-134, 143] The minimum required number of measures were variable but were usually at least 10 measures or greater than 75 percent of planned measures. The range of reported maximum measurements for 24-hr ABPM reference was 40-96 measurements[74, 130, 132, 142] and for daytime ABPM was 36-72 measurements.[73, 126-128, 133, 143, 145] Most commonly, ABPM values were determined by calculating simple means.

Other protocol details about the arm measured, cuff size, and instructions provided to participants were sparsely reported.

OBPM Confirmatory Studies: Detailed Results

Prevalence and Screen Positivity

The prevalence of hypertension in the 13 OBPM confirmation studies ranged from 47 percent[145] to 77 percent[134] using a variety of ABPM definitions for hypertension. The lowest prevalence was reported in a study using a DBP-only diagnostic threshold of >90 mm Hg for the daytime ABPM reference standard.[145] The highest prevalence was reported in a population with a similar mean age and recruitment from primary care as the study with the lowest prevalence, but daytime ABPM reference threshold was ≥135/85 mm Hg[134] (**Table 11**).

The percent of individuals with a positive confirmatory OBPM ranged from 29 percent[130] to 82 percent.[126, 128, 143] The lowest rate of positive screens was in a population with a mean age of 47.9 years who were volunteers or recruited from primary care.[130] This study used an OBPM threshold of ≥140/90 mm Hg. The highest rate of positive screens was 82 percent; this prevalence was reported in three studies. The populations in these studies were also referred from primary care and represented a wide range of ages.[126, 128, 143] Two of these studies had DBP-only diagnostic thresholds of >90 mm Hg[126, 128] and the third used a ≥140/90 mm Hg threshold.

Sensitivity/Specificity

Meta-analysis of eight OBPM confirmation studies (N=53,183) reporting SBP/DBP thresholds showed a pooled sensitivity of 0.80 (95% CI, 0.68 to 0.88) and a pooled specificity of 0.55 (95% CI, 0.42 to 0.66) with considerable heterogeneity (I^2 sensitivity=99.2%; I^2 specificity=98.6%) (**Figure 3; Table 11**). Most commonly, these studies averaged two or three blood pressure measurements during a single visit.[73, 74, 130, 133, 142] Other studies averaged six to 12 measures taken over two to three visits.[132, 134, 143] Sensitivity and specificity varied widely among pooled studies; sensitivity ranged from 0.35[130] to 0.90[142] and specificity ranged from 0.35[143] to 0.85.[130] The Spanish ABPM registry, with a sample size of 45,020, makes up most of the body of evidence for OBPM confirmation, which had a total sample size of 57,128.[74] When this study is removed from the pooled result in a sensitivity analysis, results are similar (sensitivity: 0.79 [95% CI, 0.65 to 0.89], specificity: 0.57 [95% CI, 0.45 to 0.69]). No patient or index test characteristics explaining heterogeneity were revealed upon visual inspection of the forest plots.

We conducted an exploratory analysis of studies using only the preferred 24-h ABPM reference standard. Meta-analysis of 4 studies with a 24-hr ABPM reference standard (N=49,168) showed a pooled sensitivity of 0.74 (95% CI, 0.50 to 0.89) and specificity of 0.62 (95% CI, 0.42 to 0.79), again with considerable statistical heterogeneity (I^2 sensitivity=99.6%; I^2 specificity=99.4%) (**Appendix F Figure 2**). The point estimate for sensitivity showed a small decrement compared to the main analysis, and specificity showed a small improvement, however, confidence intervals overlapped. Furthermore, we consider this analysis exploratory as there exists population heterogeneity in addition to reference standard heterogeneity in these studies and these studies represent a subset of only half of studies from the main analysis. The Spanish ABPM registry was the only study that reported accuracy results for OBPM against multiple ABPM reference standards, including 24-hr ABPM, daytime ABPM, and a combination of daytime, nighttime, and 24-hr ABPM showing similar accuracy results. One study reported accuracy for multiple OBPM thresholds against the same daytime ABPM reference standard.[127] This study showed increased sensitivity and decreased specificity as thresholds are lowered. No included study reported accuracy for an OBPM threshold of ≥130/80 mm Hg.

Five studies did not contribute to the meta-analysis; these studies similarly reported large variations in accuracy (**Table 11**).[126-128, 131, 145] Four of these studies had SBP-only or DBP-only index and/or reference test thresholds that are not relevant to current clinical practice.[126, 128, 131, 145] One study did not provide sufficient data for pooling.[127] The sensitivity point estimate in this study of 0.80 was identical to our pooled result, and the specificity point estimate of 0.68 was slightly higher than the upper confidence limit in our pooled analysis.

No studies of OBPM confirmation reported area under the curve.

PPV/NPV

Among the eight studies using SBP/DBP thresholds from the pooled analysis, the PPVs ranged from 0.61[133] to 0.88.[130] The lowest PPV was in a Greek study of patients referred to a hypertension clinic from primary care who had a 49 percent prevalence by daytime ABPM and 72 percent OBPM positivity.[133] The highest PPV, along with the lowest sensitivity and lowest index test positivity, was in the Husain et al study which recruited participants with recent office BPs between 120-149/80-95 mm Hg from primary care and who had a 75 percent prevalence by 24-hr ABPM and a 30 percent OBPM positivity.[130] The NPVs were more variable than the PPVs and ranged from 0.30[130] to 0.82.[133] The lowest NPV was in the study with the highest PPV[130] and the highest NPV was in the study with the lowest PPV.[133] The ranges of PPVs and NPVs in the five studies not included in the pooled analysis[126-128, 131, 145] were similar to the ranges of those in the pooled analysis.

FPR/FNR

Among the eight studies using SBP/DBP thresholds from the pooled analysis, false positive rates had a wide range among studies. Point estimates from the studies ranged from 15 percent[130] to 65 percent.[74] The lowest occurrence of false positives, 15 percent, occurred in the study with the highest PPV (and lowest NPV); participants were self-selected or recruited from primary care, with a young mean age (47.9 years) and the lowest index test positivity (30%).[130] The highest

occurrence of false positives, 65 percent, was seen in an Italian study of individuals referred to an outpatient hypertension clinic and 82.5 percent, screened positive on OBPM.[143] False negative rates were likewise variable, with estimates ranging from 10 percent[142] to as high as 65 percent.[130] The occurrence of false negatives was as low as 10 percent in an Italian study where 24 percent screened negative on OBPM[142] to as high as 65 percent in a study where 70 percent screened negative on OBPM.[130] The range of false positivity in the non-pooled studies was generally similar to that seen in the pooled studies.

Home-Based Blood Pressure: Index Test Characteristics

Four studies examined the accuracy of HBPM against the ABPM reference standard (**Table 12**).[122, 134-136] These studies represent a reasonably homogeneous index test wherein studies used the same diagnostic threshold, similar automated, oscillometric HBPM devices, and comparable basic protocol characteristics. In these studies, participants were instructed to measure blood pressure for 3 to 7 days in the morning and evening in the seated position after a rest period of usually 5 minutes.

All HBPM devices applied an automated oscillometric technique. Three studies explicitly reported that devices had printing capabilities for recording blood pressures or that data could be electronically transmitted to researchers.[122, 134, 135] The method of recording BP was unclear in the other study.[136] Only one study reported calibration, which was done annually.[122] Another study reported that the accuracy of the HBPM device was tested in each individual against a standard mercury sphygmomanometer.[134]

The monitoring period ranged from 3 days[122] to 7 days.[135, 136] All studies instructed participants to measure BP in two sittings per day, occurring in the morning and evening, taking two to three measurements at each sitting with 1 to 2 minutes between measurements. Three of the four studies explicitly reported training participants how to perform the blood pressure measurement.[122, 134, 136] The total maximum number of measurements ranged from 18[122] to 42,[136] and the number of measurements used to calculate the mean HBPM ranged from 8[122] to 28.[135, 136] Two studies excluded initial measurements as follows: one study excluded first-day readings and the first and second readings of each morning[122] and one study discarded the first morning and evening BPs.[136] Three studies required a minimum number of readings, which ranged from eight[134] to 30.[136]

Three of four studies reported that measurements were taken seated and after a 5-minute rest;[134-136] however, only one study mentioned the provision of a quiet place for measurement.[136] Protocol details relating to the arm, arm position, and cuff were sparsely reported. No study mentioned arm position, leg position, or whether the cuff was placed under or over clothing. Only one study reported that the nondominant arm was used.[135] Half of the studies mentioned that different-sized cuffs could be used based on patient size.[122, 134]

All four studies used an HBPM diagnostic threshold of ≥135/85 mm Hg,[122, 134-136] and two of these studies additionally reported test accuracy of other thresholds, including ≥130/85 mm Hg and ≥130/80 mm Hg.[122, 136]

Home-Based Blood Pressure: Reference Test Characteristics

While all four HBPM confirmation studies performed 24-h ABPM, daytime ABPM was used as the reference standard and the daytime ABPM threshold was ≥135/85 mm Hg (**Table 12**).[122, 134-136] One study additionally reported test accuracy of HBPM using 24-hr and nighttime ABPM as reference standards.[136] Three studies used a fixed time period to define the daytime ABPM period,[122, 135, 136] and one study used participant diaries to determine awake hours.[134] Blood pressures were measured every 20 to 30 minutes. All studies required a minimum number of measurements: at least 14 measures or greater than 70 percent of planned readings. The maximum number of daytime measurements ranged from 20[136] to 48 measurements.[122] Where reported, daytime blood pressures were calculated as the mean of valid measurements. Other protocol details about the arm measured, cuff size, and instructions provided to participants were sparsely reported.

Home-Based Blood Pressure: Detailed Results

Prevalence and Screen Positivity

The prevalence of hypertension as defined by daytime ABPM of ≥135/85 mm Hg or 24-hr ABPM ≥130/80 mm Hg in the four HBPM confirmation studies ranged from 54 percent[135] to 80 percent.[136] The study with the lowest prevalence of 54 percent was set in U.K. primary care clinics.[135] The study with the highest hypertension prevalence of 80 percent was a Korean study set in an outpatient cardiology clinic[136] (**Table 13**).

Percent positive screens on HBPM ranged from 65 percent[122] to 76 percent.[134] The study with the lowest positive HBPM prevalence recruited participants from Spanish primary care health care centers.[122] The highest HBPM test positivity of 76 percent occurred in a Greek study in which participants were recruited from a hospital blood pressure clinic.[134]

Sensitivity/Specificity

All four HBPM confirmation studies could be pooled, and meta-analysis of an HBPM threshold of ≥135/85 mm Hg (N=1,001) showed a pooled sensitivity of 0.84 (95% CI, 0.76 to 0.90) and pooled specificity of 0.60 (95% CI, 0.48 to 0.71) with considerable heterogeneity (I^2 sensitivity=85.1%; I^2 specificity=77.8%) (**Figure 4; Table 13**). The range of sensitivities was 0.76[122] to 0.93.[135] The range of specificities was 0.50[122, 135] to 0.78.[136] Exploration of heterogeneity via visual inspection of forest plots sorted by participant and test characteristics showed no pattern.

One study reported the accuracy of the HBPM threshold of ≥135/85 mm Hg against 24-h, daytime, and nighttime ABPM reference standards.[136] Accuracy was reasonably similar across all reference standard comparisons, with sensitivity ranging from 0.77 to 0.79 and specificity ranging from 0.69 to 0.85. Two studies reported accuracy for multiple HBPM thresholds.[122, 136] These studies consistently showed increased sensitivity and decreased specificity as thresholds are lowered.

One study reported AUC. The U.K. primary care practice study reported an AUC of 0.71 (95% CI, 0.66 to 0.77) for HBPM confirmation conducted over 7 days.[135]

PPV/NPV

The PPV for individual studies ranged from 0.68[135] to 0.94[136] (**Table 13**). The lowest PPV was in a population recruited from primary care in the United Kingdom,[135] and the highest PPV was in a Korean study that recruited participants from cardiology clinics.[136] The NPV ranged from 0.46[136] to 0.86.[135] The lowest NPV was in the aforementioned Korean study with the highest PPV.[136] The highest NPV was in the aforementioned U.K. primary care study with the lowest PPV.[135]

FPR/FNR

False positive rates in analyses using the preferred 135/85 mm Hg HBPM threshold ranged from 22 percent[136] to 50 percent.[122, 135] False negative rates ranged from 7 percent[135] to 24 percent.[122]

Self-OBPM: Index Test Characteristics

Two studies evaluated an index test for which participants used an HBPM device to take their own blood pressure in an office setting, which we refer to as "self-OBPM"[135, 139] (**Table 14**). While many fundamental device and protocol characteristics were similar in these two studies, thresholds were not comparable and measurements were unattended by staff in one of the studies.[139]

Both studies used automated oscillometric HBPM devices. One of the two self-OBPM studies also evaluated the accuracy of the HBPM device in the home environment.[135] While the two studies shared some protocol characteristics, they differed with respect to attendance of staff during measurements. In both studies, participants were seated and took multiple measurements (5[139] or 6[135]) in one sitting with at least 1 minute between measurements. One study averaged the first three measurements to determine the self-OBPM[139] while the second study averaged five of the six measurements.[135] In one study, a nurse performed a training measurement for the participant before they left the room and the participant then triggered five measurements to perform alone; training measurement data were discarded. In the other study, clinic staff took measurements after a 5-minute seated rest with the same device before the patients took their own measurement; patient measurements were attended by a member of the practice administrative staff.[135]

Other protocol details such as cuff size and arm position were sparsely or inconsistently reported in the two studies. Cuff size was not reported in either study. One study reported that the nondominant arm was measured unless the difference between arms was ≥10 mm Hg, then the highest reading was used.[135] The other study that had the fully unattended measurement reported that the participant was in an isolated room not speaking, with the arm supported at the heart level, the cuff applied to an uncovered arm, legs uncrossed with feet on the floor, and the back supported.[139]

The diagnostic thresholds were heterogeneous, with one using ≥135/85 mm Hg[135] and the other reporting accuracy for various SBP-only and DBP-only thresholds that are not currently used in practice (SBP ≥130 mm Hg, SBP ≥160 mm Hg, DBP ≥80 mm Hg, and DBP ≥90 mm Hg).[139]

Self-OBPM: Reference Test Characteristics

The two studies of confirmatory self-OBPM conducted 24-h ABPM but used daytime ABPM of ≥135/85 mm Hg as the reference standard for hypertension diagnosis[135, 139] (**Table 14**). One study specified the daytime monitoring period,[135] while the other defined daytime per patient report.[139] Blood pressures were measured every 15 minutes[139] and 30 minutes.[135] One study required at least 70 percent of planned measures and one record per hour to be considered valid, and the other did not report minimum measures needed. One study reported a maximum number of measurements of 32 and specified that the ABPM values were calculated based on a simple mean.[135] The other study did not report how ABPM values were calculated, and maximum measures varied.[139] Neither study reported information on arm position, leg position, cuff size, or instructions provided to participants.

Two studies used self-OBPM as a confirmation method (N=698). The prevalence of hypertension by ABPM in these studies were 47 percent[139] and 54 percent.[135] The percent with positive screens by self-OBPM was 84 percent in the one study that applied an SBP/DBP threshold.[135]

Self-OBPM: Detailed Results

Prevalence/Test Positivity

The two studies reported prevalence rates 47 percent[139] and 54 percent[135] for hypertension based on the daytime ABPM of ≥135/85 mm Hg. The index test positivity was 63 percent[139] and 84 percent,[135] respectively.

Sensitivity/Specificity

Sensitivity and specificity were 0.92 (95% CI, 0.85 to 0.96) and 0.25 (95% CI, 0.16 to 0.35), respectively, in the study using an SBP/DBP threshold (≥135/85 mm Hg).[135] This study recruited participants from primary care practices in the United Kingdom. The other study reported accuracy for various SBP-only and DBP-only thresholds that are not relevant to current clinical practice, and because results ranged widely, results are not discussed in detail here (see **Table 15**).

AUC for the U.K. primary care practice study with an SBP/DBP threshold was 0.58 (95% CI, 0.53 to 0.63).[135]

PPV/NPV

The PPV for the U.K. primary care practice study using an SBP/DBP threshold was 0.59 and the NPV was 0.72.[135] PPVs and NPVs were variable in the study reporting SBP-only and DBP-only thresholds. False positive rates were 43[139] and 75[135] percent and false negative rates were 8[135] and 14[139] percent.

Truncated ABPM: Index Test Characteristics

One study reported the accuracy of a truncated (6-hour) ABPM compared with 24-h ABPM (**Table 16**).[124] In this study, just one ABPM test was conducted and results from the first 6 hours (minus a 1-hour "white coat window") were compared with the full 24-h reference standard (minus a 1-hour white coat window). The ABPM test was initiated in the morning for almost all participants. Measurements were taken every 20 minutes during the day for a maximum of 18 measurements, 15 of which were used to calculate BP because of the white coat window. Participants received standardized education about the ABPM session and were fit with appropriately sized cuffs based on AHA standards.

The diagnostic threshold for this 6-hour ABPM was SBP >130 mm Hg.

Truncated ABPM: Reference Test Characteristics

The single study (N=263) of a truncated ABPM index test evaluated a 6-hour ABPM compared with a 24-hr ABPM reference standard with an SBP-only threshold of >130 mm Hg for hypertension diagnosis (**Table 16**).[124] The device obtained measurements every 20 minutes during the daytime and every 30 minutes during the nighttime. The total number of measurements over 24 hours ranged from 57 to 61. The reference value was calculated as the average of measurements with the first hour excluded as the white coat window. The study reports that staff met with the patient to provide standardized education about the session and to fit the patient with the appropriately sized cuff, which was determined by arm circumference according to AHA guidelines; no other details were reported.

Truncated ABPM: Detailed Results

Sensitivity/Specificity

The sensitivity and specificity were 0.94 (CIs not reported) and 0.76 (CIs not reported), respectively, in a population (N=126) for whom the ABPM indication was borderline hypertension (**Table 17**). The sensitivity and specificity were 0.89 and 0.70, respectively, for the population (N=137) with suspected white coat hypertension.

FPR/FNR

Sparse data were reported in this study, precluding calculations of prevalence, percent positivity, FPR, FNR, PPV, and NPV. AUCs were high in both populations, with values of 0.932 in those with borderline hypertension and 0.901 in those with suspected white coat hypertension.

Comparative Accuracy

Two studies reported the accuracy of multiple confirmation methods against the same ABPM reference standard. Nasothimiou et al reported the accuracy of repeat OPBM and HBPM compared with a daytime ABPM reference standard.[134] Sensitivity was high and similar for both index tests (0.85 [95% CI, 0.80 to 0.88] for OBPM and 0.87 [95% CI, 0.83 to 0.91] for HBPM). Specificity was much lower for both modalities. Specificity trended higher for HBPM, but there was some overlap of confidence intervals (0.43 [95% CI, 0.33 to 0.54] for OBPM and 0.61 [95% CI, 0.51 to 0.71] for HBPM). Nunan et al reported the accuracy of HBPM and self-OBPM compared with a daytime ABPM reference standard.[135] Sensitivity was high and similar for both index tests (0.93 [95% CI, 0.86 to 0.97] for HBPM and 0.92 [95% CI, 0.85 to 0.96] for self-OBPM). Specificity was much lower for both modalities, with self-OBPM being significantly worse (0.50 [95% CI, 0.40 to 0.61] for HBPM and 0.25 [95% CI, 0.16 to 0.35] for self-OBPM).

KQ3a. What Confirmation Protocol Characteristics Define the Best Test Accuracy?

Summary of Results

Five of 18 confirmation studies reported within-study comparisons of protocol characteristics on accuracy.[126, 130, 135, 136, 139] Evidence on protocol variations for any one confirmation modality was sparse, but very limited evidence may suggest that for HBPM, additional days of measurement beyond 5 do not improve accuracy. Two studies reported accuracy for confirmatory OBPM protocols using multiple visits, but each study had a different design and aim. While one study exploring whether the prevalence of white coat hypertension would decrease over a series of measurements found some evidence to support that hypothesis,[126] another study found that ABPM phenotypes had fair reproducibility when taken one week apart.[130] Two studies of confirmatory HBPM found no improvement in accuracy for a 7-day protocol compared with a 5-day protocol.[135, 136] Similarly, one study of self-OBPM reported similar accuracy for the average of five and the average of three measurements taken on a single visit compared with ABPM.[139]

Detailed Results

OBPM

Two studies reported accuracy for confirmatory OBPM protocols based on measurements performed at multiple visits but had different aims (**Appendix E Table 6**).[126, 130] The study by Fogari et al explored whether repeated OBPMs taken at several visits would reduce the prevalence of white coat hypertension. OBPMs were taken at office visits occurring every 2 weeks for a total of five visits. Complete accuracy results are only reported at week 8; however, results suggested that there are fewer screen positives over time with repeated visits. The other study, by Husain et al, examined the reproducibility of ABPM phenotypes (sustained, masked, white coat, normotensive), which were evaluated by comparing repeated sets of OBPMs and ABPMs taken 1 week apart. Sensitivity and specificity were nearly identical in the first and second comparisons, and short-term reproducibility was characterized as fair.[144]

HBPM

Two studies of confirmatory HBPM evaluated protocol variations involving a different number of days of HBPM (**Appendix E Table 6**).[135, 136] The U.K. primary care practice study by Nunan et al compared HBPM protocols, averaging measures taken in the morning and evening on days 1-7 (28 measures), days 2-7 (24 measures), days 1-5 (20 measures), and days 2-5 (16 measures). Sensitivities and specificities for the various protocols were similar: sensitivity point estimates ranged from 0.93 to 0.94, specificity point estimates ranged from 0.50 to 0.53, and confidence intervals were nearly identical. Another study by Park tested protocol variations involving the number of days of measured and which measures, out of three taken each in the morning and evening, to include in the averaged value.[136, 138] This study found similar accuracy for HBPM taken over 5 days versus 6 or 7 days, with sensitivity ranging from 0.74 to 0.75 and specificity ranging from 0.75 to 0.78, each with overlapping confidence intervals. Similar accuracy was found for each averaging method.

Self-OBPM

One study by Salazar et al of self-OBPM using SBP-only or DBP-only index test thresholds reported accuracy for an average of three compared with 5 measures in one sitting separated by 1 or more minutes (**Appendix E Table 6**).[139] Authors reported that the use of five measures instead of three did not significantly improve correlations or AUCs of self-OBPM compared with the ABPM reference standard.

KQ4. What Are the Harms of Screening for Hypertension in Adults?

Summary of Results

We identified 13 fair- to good-quality studies (reported in 16 articles) (N=5,150) examining the harms of screening and diagnosis of hypertension.[148-161] Most of these studies were performed 2 or more decades ago. Four studies addressing absenteeism,[151] ABPM tolerability,[161, 162] and sleep quality[163] are newly included since the previous review. Evidence for KQ4 is derived from heterogeneous populations and studies of limited quality. The limited existing evidence suggests that screening is associated with no decrement in quality of life or psychological distress, and the scant evidence on screening's effect on absenteeism is mixed. ABPM followup testing is associated with minor adverse events including temporary sleep disturbance and bruising.

Inaccurate diagnoses (false positives and false negatives) are considered harms of screening and confirmation and have been discussed in detail under the KQ2 and KQ3 results. In brief, false positive and false negative rates varied widely for OBPM screening (KQ2) and for various confirmation modalities (KQ3). For screening OBPM (KQ2), false positive rates ranged from 0 to 30 percent and false negative rates ranged from 8 to 100 percent among studies included in the main pooled analysis. For confirmatory OBPM in KQ3, false positive rates ranged from 15 to 65 percent and false negative rates ranged from 10 to 65 percent. For confirmatory HBPM, false positive rates ranged from 22 to 50 percent and false negative rates ranged from 7 to 24 percent.

Study and Population Characteristics

The 13 harms studies had heterogenous designs and measured various outcomes in different populations (**Table 18**). The included analyses for harms are embedded within studies originally designed to address various aims; however, for the purpose of addressing harms, the data are derived from analyses consisting of two RCTs,[155, 157] two prospective cohorts,[162, 163] four cohorts derived from RCTs,[148-151] and five cross-sectional analyses.[156, 158-161] Nearly half of the studies were conducted in North America: five in the United States,[151, 155, 157, 158, 163] and one in Canada.[149] Three studies were conducted in the United Kingdom,[150, 159, 162] and one study each in Italy,[156] Greece (297), Japan,[161] and the Netherlands.[148] The study sizes ranged from a small Japanese study by Kuwajima et al with 24 participants[161] to the largest Italian study by Verdecchia with 2,934 participants.[156] The studies recruited participants from heterogenous settings, including hypertension treatment trials,[150] medical clinics or academic research centers,[148, 155, 157, 158, 160, 162] hospital-based registry,[156] and occupational settings,[149, 151] and in some studies was not reported.[159, 161]

The mean participant age ranged from 37.9 years[151] to 74 years.[161] One study[149] solely recruited men, while the remaining recruited 38 percent[151] to 57 percent[159] women. Other participant characteristics were rarely reported. Mean office SBP/DBP was reported in six of the studies and ranged from 126.4/79.9 mm Hg[155] to as high as 167.4/104.7 mm Hg.[148]

Quality

In general, this literature is limited by heterogeneous populations, comparators, and outcomes. Only one study was rated as good quality; the remaining studies were rated as fair. The single good-quality study was an RCT reporting adequate randomization and allocation concealment; there was similar attrition between the groups; and validated scales were used to assess outcomes with adjustment for confounding.[155] For the remaining fair quality studies, quality issues included pre-post cohort designs or cross sectional designs with lack of comparators and use of unvalidated measures. These design flaws contribute to a body of evidence on screening and confirmation harms with limited internal and external validity.

Detailed Results

There were no population-based RCTs of harms of screening for hypertension compared with no screening.

Screening Effects on Quality of Life and Psychological Outcomes

The two included RCTs (N=197), one prospective cohort (N=139), and two cohorts derived from RCTs (N=985) examined the effects of screening on various measures of quality of life, mood, and psychological distress; the validated QOL scales included GHQ,[150] SF-12,[155] and SF-36,[157] and the validated mood scale used was the Amsterdam Mood List[148] and the hospital anxiety and depression scale (HADS)[162] (**Appendix E Table 7**). The two RCTs compared the effects of labeling individuals as prehypertensive versus generic counseling without reference to their prehypertensive status.[155, 157] In both trials, labeling individuals as prehypertensive was not found to have any adverse effects on physical or mental health after 3 months. Two prospective cohort studies of individuals being evaluated for inclusion in hypertension treatment trials examined the short-term quality-of-life impact of the identification of hypertensive status.[148, 150] One of these cohorts evaluated a validated mood scale and unvalidated QOL-related item results comparing scores before and after hypertension diagnosis,[148] while the second cohort compared validated QOL scale results before and after screening.[150] Similar to the results of the RCTs, these studies found no effects of screening or labeling on participant quality of life. One cohort assessed the psychological impact of 28 days of self-monitoring, followed by 24-hr ABPM using the HADS. This study found that the proportion of participants anxious or depressed at baseline decreased after monitoring. The authors concluded that out-of-office BP monitoring may induce feelings of anxiety in some patients but does not appear to be harmful.[162] (**Appendix E Table 7**)

Absenteeism

The two studies report mixed results on hypertension diagnosis on absenteeism (**Appendix E Table 8**). One industrial worksite-based cohort study by Haynes et al (N=208) compared the rates of absenteeism among individuals with hypertension with their absenteeism during the year prior to screening and then stratified results by previously aware and previously unaware subgroups. Overall, compared with the year before screening, days of absenteeism increased 80

percent, with the largest rise among individuals who reported being previously unaware of their hypertensive status.[149] This increase in absenteeism continued over 4 years for previously unaware individuals, while those who reported being aware of their hypertension previously remained relatively stable.[152] A second worksite study by Rudd et al (N=294) reported no statistically significant differences in absenteeism due to illness (days/year) in the sustained hypertensive group between the previously aware and previously unaware participants after correction for matched controls[151] (**Appendix E Table 8**).

Sleep Disturbance and Tolerability Associated With ABPM

Six cross-sectional studies[156, 158-162] and one prospective cohort study[163] reported ABPM tolerability or sleep disturbance in different populations (**Appendix E Table 9**). Four studies addressed sleep disturbance attributed to the ABPM through the use of unvalidated participant questionnaires[156, 158, 159, 161] and one study assessed sleep efficiency objectively in men and women with untreated hypertension using wrist actigraphy[163] (**Appendix E Table 9**). The definitions of sleep disturbance varied among studies, with self-reported rates ranging from 14 percent[156] in the largest study (N=2934) (defined as sleep deprivation ≥2 hours) to 70 percent[158] (defined as being awoken by the monitor). In one study, 9 percent of individuals reported their sleep was disrupted enough that they removed the monitor during the night.[158] A prospective cohort study (N=121) measured sleep efficiency and total sleep time on seven days of non-ABPM days and three subsequent days of ABPM-monitoring.[163] This study found no evidence that ABPM had an adverse effect on sleep quality (**Appendix E Table 9**).[163]
Three studies reported other adverse effects of ABPM, with mixed results.[158, 160, 161] Reported adverse events included pain/discomfort, bruising, and skin irritation (**Appendix E Table 9**). In one study comparing tolerability of HBPM and ABPM, participants reported moderate to severe daily restriction in the ABPM group compared with the HBPM group; HBPM was viewed more favorably than ABPM by participants (82% vs. 63%) due to ease of use, comfort, and less activity restriction.[160]

One study (N=183) used an unvalidated questionnaire to measure the acceptability of self-monitoring and ABPM and found that self-monitoring was preferable to ABPM (**Appendix E Table 9**).[162]

Chapter 4. Discussion

Summary of Evidence

The summary of evidence and context for this update can be found in **Tables 19 and 20**. There were no population-based trials strictly evaluating screening for hypertension versus no screening. We did include one trial of a community-based, multicomponent, CVD health-promotion program on CVD health outcomes where hypertension screening was the primary intervention. This trial showed a 9 percent relative reduction in the number of CVD-related hospital admissions (KQ1). Given that hypertension screening is considered standard of care in developed countries and there is an established evidence base linking asymptomatic hypertension treatment to improved CVD outcomes,[164-169] we would not expect to find contemporary population-based trials of hypertension screening. Thus, the focus of this review was on the accuracy of screening (KQ2) and confirmatory blood pressure (KQ3) measurements, protocol variations that may influence accuracy (KQ2a/KQ3a), and the harms of screening and confirmation of hypertension (KQ4).

Our meta-analysis of 15 screening studies (N=11,309) using SBP/DBP thresholds and measuring blood pressure at a single visit showed a pooled sensitivity of 0.54 (95% CI, 0.37 to 0.70) and a pooled specificity of 0.90 (95% CI, 0.84 to 0.95) with considerable heterogeneity not explained by participant or test characteristics (I^2 sensitivity=97.8%; I^2 specificity=97.1%). Evidence for this key question is derived primarily from heterogeneous population-based samples and heterogeneous measurement protocols deviating somewhat from commonly performed protocols in current U.S. practice. These studies mostly used a mercury sphygmomanometer, had participants rest for 5 minutes prior to measurement, and used the average of multiple measurements, which is not standard in current clinical practice where single measurements are performed immediately upon rooming patients. Studies comparing protocol variations showed mixed results, making it difficult to arrive at conclusions about the ideal protocol to maximize screening accuracy.

In contrast to KQ2 results, which showed that initial screening with OBPM is not sensitive but is specific in an unselected population, KQ3 showed that confirmatory modalities, when applied to a preselected population with an initially elevated OBPM, are generally sensitive but not specific. The only two confirmation modalities with sufficient data for quantitative pooling, OBPM and HBPM, showed roughly similar test accuracy with overlapping confidence intervals. Meta-analysis of eight OBPM confirmation studies (N=53,183) reporting SBP/DBP thresholds showed a pooled sensitivity of 0.80 (95% CI, 0.68 to 0.88) and a pooled specificity of 0.55 (95% CI, 0.42 to 0.66) with considerable heterogeneity (I^2 sensitivity=99.2%; I^2 specificity=98.6%). Meta-analysis of four HBPM confirmation studies (N=1,001) showed a pooled sensitivity of 0.84 (95% CI, 0.76 to 0.90), and pooled specificity of 0.60 (95% CI, 0.48 to 0.71), also with considerable heterogeneity (I^2 sensitivity=85.1%; I^2 specificity=77.8%). Only one study each examined the accuracy of self-OBPM or truncated ABPM using SBP/DBP thresholds; the self-OBPM study (N=698) showed high sensitivity and low specificity (0.92 and 0.25), while the truncated ABPM study (N=126) showed a high sensitivity and moderate specificity (0.94 and 0.76, respectively), in a population for whom the ABPM indication was borderline hypertension.

There is scant evidence on how protocol variations influence accuracy for confirmatory OBPM or HBPM. Again, the research protocols in these studies are different than those followed in common clinical practice where a single repeated measurement is often used for confirmation and multiple values are rarely averaged; when home blood pressure measurement is used for confirmation in practice, patient instructions for measurement and result interpretation are variable.

Evidence on harms of screening and confirmation is limited but generally suggests that direct harms of screening and confirmation are minimal. The more important potential indirect harm of screening is misdiagnosis (missed cases or overdiagnosis and overtreatment). Some have argued that the 2017 ACC/AHA guideline[2] advocating more aggressive treatment targets did not consider the totality of evidence, such as a systematic assessment of harms of more intensive treatment goals.[10, 170] The downstream adverse events of treatment may be greater in magnitude with more intensive treatment.[166, 171-176]

Comparison to Results of Other Systematic Reviews

To our knowledge, this is the only systematic review comparing the accuracy of office-based screening with the ABPM gold standard. A large, international, individual patient data meta-analysis of population-based cohorts, the International Database of Ambulatory Blood Pressure in relation to Cardiovascular Outcome (IDACO) (N=4997), reported data that allowed us to calculate accuracy for office blood pressure measurements. Sensitivity is reasonably consistent with our results (0.66 [95% CI, 0.64 to 0.68]), while specificity is slightly lower than our pooled estimates for KQ2 (0.82 [95% CI, 0.81 to 0.83]).[67] Given the high prevalence and clinical importance of hypertension, it is surprising that there are not more reviews examining the accuracy of screening office blood pressure measured on one or more occasions, as is performed in current practice. Other systematic reviews have estimated test accuracy for confirmatory office or home measurements, but these studies include mixed populations (treated and untreated individuals, and populations with and without a previous elevated blood pressure).[33, 66, 177, 178] Reported pooled point estimates for sensitivity and specificity for OBPM in these reviews ranged from 0.75 to 0.82 and 0.41 to 0.76, respectively, and for HBPM ranged from 0.86 to 0.90 and 0.62 to 0.84. These reviews have overlapping confidence intervals with our pooled sensitivity for KQ3, however, reported specificities are quite variable and likely reflect heterogeneity in populations and measurement protocols.

Although mm Hg difference in blood pressure between modalities was not a prespecified outcome in our review, we performed an exploratory analysis of this outcome in our included studies. The relationship between OPBM and ABPM values was inconsistent in our included studies of OBPM screening accuracy (KQ2). Within-study differences for SBP ranged from -9.3 mm Hg (ABPM>OBPM)[115] to 12.6 mm Hg (OBPM>ABPM);[98] within-study differences for DBP ranged from -3.6 (ABPM>OBPM)[104] to 11.0 (OBPM>ABPM).[99] Between-study heterogeneity and large standard deviations in screening blood pressures within individual studies preclude identification of characteristics associated with higher or lower OBPM relative to ABPM from this body of literature. An analysis of IDACO by Conen and colleagues,[32] which has the advantage of including individual patient data, suggests that on average, OBPM may be

lower than ABPM in younger age strata (-6.0 mm Hg in ages 18-30 years) compared with the reverse phenomenon in the oldest age strata (13.1 mm Hg in ages ≥70 years). However, screening blood pressures similarly exhibit wide variation in these data, particularly at older ages, so the influence of age on OBPM-ABPM differences should be interpreted cautiously. We were unable to further analyze how age may influence this association because of lack of outcome reporting by age. In contrast to the inconsistent association we found between OBPM and ABPM in screening studies (KQ2), OBPM appears to be consistently higher than ABPM in the included studies that examined populations with a previous elevated screen (KQ3). Within included KQ3 studies, SBP from OBPM was 3.0 to 17.2 mm Hg higher than ABPM and DBP from OBPM was 1.8 to 12.8 mm Hg higher than ABPM. This more consistent association between OBPM and ABPM in studies of confirmation measurement may be an expected finding, given that individuals with masked hypertension would not be included in this population.

Understanding the Clinical Relevance of Test Accuracy of Screening and Confirmatory Testing

Applying our pooled accuracies to a hypothetical cohort, it is apparent that screening for hypertension with OBPM misses a substantial number of masked hypertension cases and to a lesser extent, leads to treatment of white coat hypertension cases (**Figure 5, Figure 6 and Table 20**). The clinical significance of delays in the identification and treatment of masked hypertension and in the treatment of white coat hypertension are not fully understood (as discussed in the next section). Nonetheless, the evidence supporting hypertension screening and treatment have historically been based solely on OBPM.

In a hypothetical population of 1,000 individuals age 40-60 years, using our pooled screening accuracy of a single-occasion blood pressure measurement (0.54 sensitivity, 0.90 specificity) and a prevalence of sustained hypertension of 30.6 percent based on ABPM,[32] the PPV would be 70 percent and the NPV would be 82 percent. This translates to 165 true positives, 625 true negatives, 141 masked hypertension cases (false negatives), and 69 treated white coat hypertension cases (false positives) (**Table 21**). In clinical practice, patients rarely go on to treatment based on a single office blood pressure measurement. A more likely clinical scenario would be that those who screened positive on initial office blood pressure would return for at least one additional office measurement, and treatment would be based on the repeat office measurement. In this more realistic scenario, 132 sustained hypertension cases would be detected; 174 with ABPM-defined HTN would be missed (masked hypertension) and would not receive treatment, and 31 without ABPM-defined HTN (white coat hypertension) would receive treatment (**Figure 5**). In a third clinical scenario in which only those who screened positive on an initial office BP received repeat OBPM, then only those with positive repeat OBPM went on to ABPM for confirmation and treatment decisions, 132 true cases would be detected and 174 would still be missed (masked hypertension), but none would receive potentially unnecessary treatment (**Figure 6**). Therefore, treatment based on confirmatory ABPM (compared to treatment based on confirmatory OBPM) does not change the masked hypertensive cases as these false negatives occurred during the low-sensitivity initial screen, however, the ABPM confirmation does avoid treating a small number of white coat hypertensives with lifelong antihypertensive treatment.

While exceedingly few of our included studies reported direct comparative accuracy data, we can apply the accuracy point estimates for each modality to our hypothetical population (**Table 22**) Not surprisingly, the most accurate strategy for identifying sustained and masked hypertension based on an ABPM-based hypertension definition is to screen the entire population with ABPM. Clearly, this is a resource intensive strategy with feasibility challenges given the OBPM standard of care and limited ABPM accessibility.[54] The next most accurate strategy is to apply ABPM confirmation for all of those with elevated screening OBPM. The remaining confirmation strategies correctly classify a similar percentage of the population but any strategy that does not use ABPM for confirmation and treatment decisions introduces treatment of a number of white coat hypertension cases. This hypothetical cohort example should be interpreted with caution. First, very few of these studies were designed as direct comparative studies and measured the same participants with different modalities.[134, 135] Moreover, these are based on pooled estimates with considerable statistical, clinical and methodologic heterogeneity, and the strength of evidence was rated as low. Regardless, in every screening and confirmation strategy except that using ABPM alone, there are a considerable number of missed cases.

In the traditional screening paradigm, high sensitivity is valued at the first step to detect as many potential cases as possible, and high specificity is valued for confirmatory testing to rule out the false positives detected during highly sensitive initial screening. Screening for hypertension currently shows the opposite pattern, with a lower sensitivity/higher specificity at initial screening—leading to missed cases—and a higher specificity/lower sensitivity at the confirmatory step—leading to possible overtreatment in normotensive adults. This may be because those patients who screen positive could have blood pressures that are closer to borderline thresholds and their cases could be more difficult to diagnose. While missing cases (low sensitivity) will leave patients at risk for CVD events without treatment, rescreening is common in clinical practice, so in those populations with adequate access to healthcare, there may be ample opportunity to identify these individuals at another healthcare visit. The clinical significance of the delay in identification and treatment of masked hypertension is incompletely understood but would presumably depend on its duration. An analysis of data from the Spanish ABPM registry (a preselected population with previous elevated screen that was included for KQ3) found that among untreated individuals, masked hypertension status was maintained by 47 percent with a median followup of 3 months (interquartile range 0-13), and 33 percent of those with masked hypertension transitioned to sustained hypertension during this period.[123] A longer-term study in a different population suggests that delays may persist. In a workplace-based study of adults not selected based on blood pressure, which may be the more germane population, masked hypertension status persisted in 38 and 18.5 percent, respectively, after 3 and 5 years and 26 and 37 percent of masked hypertensives progressed to sustained hypertension after 3 and 5 years, respectively.[179] Some researchers have posited that age is the mechanism by which masked hypertension is unmasked. Shimbo and colleagues[103] have hypothesized that as both OBPM and ABPM increase with age, ABPM first exceeds the diagnostic threshold while OBPM remains normotensive—and that OBPM will eventually cross the diagnostic threshold, resulting in sustained hypertension. With respect to white coat hypertension, adhering to a do-no-harm philosophy, potential overtreatment and ensuing lifelong treatment with possible side effects may be important to avoid.[177]

White Coat and Masked Hypertension

As discussed above, white coat and masked hypertension are both common with clinical significance and management that remain highly debated.[180, 181] In the IDACO individual patient data meta-analysis of population-based studies, the prevalence of white coat hypertension in untreated adults defined by a 24-h ABPM reference standard was 7.9 percent and the prevalence of masked hypertension was 14.3 percent.[32] These reported prevalences are consistent with those in our included studies, in which white coat hypertension ranged from 0 to 22 percent (weighted mean 9.6 percent) and masked hypertension ranged from 2 to 31 percent (weighted mean 11.0 percent). Existing meta-analyses suggest that for untreated individuals generally recruited from population-based cohorts, cardiovascular risk progressively increases in ABPM phenotypes, in the order of normotension, white coat hypertension, masked hypertension, and sustained hypertension (**Table 23**).[37, 38, 182-185] Most of the prognostic literature addresses white coat hypertension compared to a normotensive reference group and synthesized literature shows mixed results. A 2019 study-level meta-analysis by Cohen and colleagues[184] reported a hazard ratio of 1.36 (95% CI, 1.03 to 2.00) for untreated white coat hypertension compared to normotension, where adjustments for cardiovascular risk factors from the primary studies were used. In contrast, an individual patient-data meta-analysis by Asayama and colleagues[37] found that the risk for white coat hypertension was not statistically significantly increased compared to normotension (1.21 [95% CI, 0.91 to 1.61) in untreated individuals when using a 24-h ABPM reference standard (adjusting for age, sex, BMI, smoking, drinking, total cholesterol, diabetes, CVD history and cohort). Adjustment for blood pressure values is not common in the primary studies that contribute to the Cohen analysis and the Asayama analysis does not control for blood pressure values, thus, some have argued that residual confounding remains since out-of-office blood pressure has been higher in white coat hypertensives compared to normotensives, which may partially explain increased CVD risk.**[185]** Shimbo and Muntner extend the Cohen analysis to compare the risk of CVD events for sustained hypertension compared to normotension (HR 2.31 [95% CI, 1.91 to 3.15]) and conclude that the risk associated with untreated white coat hypertension is only moderately increased.**[185]** In a smaller number of systematic reviews evaluating prognosis of masked hypertension, evidence consistently shows that masked hypertension confers an increased risk of cardiovascular events compared with normotension.[37, 38] We identified only one source reporting the prognosis of masked hypertension compared with a sustained hypertension reference group; it showed that masked hypertension has a more favorable prognosis (for fewer) CVD events (adjusted HR 0.70 [95% CI, 0.54 to 0.91]).[37] This same analysis reports an adjusted hazard ratio of 0.51 (95% CI, 0.40 to 0.64) for the risk of CVD events in those with white coat hypertension compared to a sustained hypertension reference group.

Masked hypertension is not detectable within the current paradigm of office-based screening. Given the barriers to routine use of ABPM, multivariate risk prediction models or single risk factors could be an efficient strategy to identify a targeted population for whom out-of-office measurement might be most useful. One such risk prediction model is PROOF-BP, an externally validated triage approach that uses basic clinical characteristics (age, sex, BMI, previous diagnosis of hypertension, and history of CVD) and a set of 3 OBPM measures taken at one visit to identify those with definitively normal blood pressure, those with definitively high blood pressure, and those requiring further testing with ABPM.[186] PROOF-BP is intended to be used in

patients with suspected hypertension. In the validation subset limited to those with no previous history of hypertension, the use of the triage protocol correctly classified 91 percent of people against a daytime ABPM reference standard (244/268 people). The sensitivity of the protocol was 0.95 (95% CI, 0.92 to 0.98), and the specificity was 0.85 (95% CI, 0.78 to 0.92). In this population, 62 percent of participants were referred for ABPM, suggesting that the triage protocol can result in meaningful reductions in the need for ABPM referrals while maintaining good accuracy. Use of a triage tool may represent an intermediate approach between the ABPM everyone strategy and the office to ABPM strategy (**Table 22**). However, to avoid missed cases that are introduced from the initial screen, a triage approach for an unselected population would be helpful. A free, web-based version of BP-PROOF is available online at https://sentry.phc.ox.ac.uk/proof-bp/.

Because of the diagnostic overlap between prehypertension and masked hypertension, several investigators have examined whether an OBPM level alone can be established that would effectively identify a population for whom ABPM should be used to detect masked hypertension. Additionally, AHA guidelines suggest screening for masked hypertension in adults with untreated office blood pressures that are consistently between 120 mm Hg and 129 mm Hg for SBP or between 75 mm Hg and 79 mm Hg for DBP.[20] In a population not selected for previous OBPM elevation, Shimbo and colleagues[103] found that masked hypertension was rare (3.9%) when OBPM was <120/80 mm Hg. However, other analyses have found that this threshold may result in an excess number of ABPM tests being conducted.[187] Using NHANES data, Booth and colleagues found that a cutpoint of ≥120/80 mm Hg has high sensitivity (0.825) and lower specificity (0.615) and would refer 59.3 million U.S. adults to ABPM. A higher threshold of ≥130/85 mm Hg has lower sensitivity (0.423) and higher specificity (0.866) and would result in fewer adults—20.3 million—being referred for ABPM. As a means to balance sensitivity and specificity, these researchers developed and validated an OBPM index (clinic SBP+1.3*clinic DBP) that could be used to refer adults to ABPM.

Estimated 10-year CVD risk could also be used to identify subpopulations that may benefit from ABPM to identify masked hypertension. An analysis of the Jackson Heart Study found that increased 10-year risk is associated with a higher prevalence of masked hypertension and that as many as two-thirds of those with ≥10 percent 10-year CVD risk have masked hypertension. However, the discrimination of CVD risk was not better than using clinic BP alone.[188] A recent analysis examining the comparative effectiveness of different blood pressure treatment approaches demonstrated that strategies based on CVD risk alone or a combination of both blood pressure threshold and CVD risk prevented more events than treatment strategies based on blood pressure threshold alone.[189]

The most recent ACC/AHA guidelines use both BP level and CVD risk to guide treatment, and recommend initiation of pharmacological treatment based on ABPM or HBPM, thus calling for treatment of masked hypertension but not white coat hypertension.[20] Historically and in current clinical practice, treatment decisions have been made based on office measurements, reflecting the treatment literature showing CVD benefit based on trials using OBPM inclusion criteria and OBPM treatment targets. Assuming that the accuracy of blood pressure eligibility screens for trial inclusion is similar to our confirmation populations in KQ3, these treatment trials include white coat hypertensives who are presumably receiving some of the reported treatment benefit,

unless there is unknown heterogeneity of treatment benefit by ABPM phenotype. An ABPM substudy of the Systolic Hypertension in Europe (Syst-Eur) trial found that treatment did not reduce cardiovascular events in those with white coat hypertension, which comprised about one-quarter of the subsample.[190] However, this study was limited to adults age 60 or older with isolated systolic hypertension, defined by SBP 160-219 mm Hg, and was conducted in a subsample of the larger trial so this analysis was not adequately powered. On the other hand, the Hypertension in the Very Elderly (HYVET) trial of patients 80 years and older with SBP ≥160 mm Hg reported reduction in CVD mortality and all-cause mortality as well as stroke and heart failure in the active treatment group; an estimated 40 to 60 percent of the participants may have had white coat hypertension according to the ABPM substudy.[191, 192] HYVET authors posited that it would be surprising if the substantial treatment benefits did not apply to those with white coat hypertension since they comprised such a large proportion of participants. Contemporary trial data using clinically relevant treatment thresholds are needed to clarify the potential benefit of treatment in white coat hypertension. Additionally, research is urgently needed to identify whether there is a benefit of treating masked hypertension. Any potential treatment benefit of masked hypertension is not being realized in clinical practice because screening office blood pressure measurement is missing a large subpopulation of patients with masked hypertension. A large Italian study is underway to compare intermediate cardiovascular outcomes in antihypertensive treatment guided by OBPM versus 24-hr ABPM; however, this study is being conducted in masked uncontrolled hypertensives (e,g., those already on treatment and with OBPM <140/90 mm Hg, but elevated ABPM) (NCT02804074). A trial of treatment versus placebo in treatment-naïve and newly screen-detected masked hypertensives would most directly answer this question; however, this is unlikely given ethical issues around withholding treatment from a group with research for adverse prognosis (**Table 23**). A counterpoint to a call for trials in individuals with white coat and masked hypertension would be a redoubled effort for blood pressure to be measured in clinical practice in the same way that it is measured in the treatment trials showing benefit.[193, 194] Limited evidence on routine methods for measurement in current practice suggests that these fall short of "research quality" protocols used in treatment trials, including use of a validated and calibrated device, multiple measurements taken in one sitting, measurement in both arms, and appropriate cuff size.

Rescreening

Professional organizations endorse rescreening intervals based on expert opinion and these intervals range from every 1-5 years or according to clinician discretion.[1, 2, 68, 195] There are surprisingly few studies, and no randomized trials, designed to compare screening intervals for blood pressure measurement.[28, 196] One small retrospective case-control study (N=372) compared annual screening to current practice suggesting that annual screening can improve specificity (0.820 vs. 0.704) without substantially changing sensitivity (1.00 versus 0.926).[197]

The most recent systematic review (k=39; mean age 23.6 to 64.6 years; N's ranging from 275 to 115,736) addressing rescreening interval was the previous 2014 report for the USPSTF, which evaluated incident hypertension rates from a variety of cohort studies that concluded that hypertension incidence following a normal blood pressure screen was highly variable, ranging from 2.5 to 4.4 percent at 1 year, 1.2 to 12.3 percent at 2 years, and 6.6 to 24.9 percent at 3

years.[28] Subpopulations identified to be at higher risk for incident HTN in that review included older adults, persons with elevated BMI, African Americans, and persons with blood pressure in the high-normal range. Thus, the USPSTF recommended a shorter rescreening interval of 1 year in those with these risk factors, and an rescreening interval of 3 to 5 years in those without.[1] Since the publication of the previous review, analyses from large, U.S. population-based cardiovascular cohorts as well as risk models confirm that these patient characteristics identified in the last review are associated with higher incident hypertension rates, suggesting a more tailored approach to screening interval may be warranted.[198-202]

Analyses of the broader outcome of CVD risk progression reinforce that individualized rescreening intervals by risk may be appropriate. A retrospective analysis from the British Whitehall II cohort study of 6,964 individuals followed for mean of 22 years with repeated biomedical screenings every 5 years to calculate 10-year ASCVD risk concluded that 5-year intervals may be too frequent for low risk individuals to progress to the high risk category and not frequent enough for intermediate and high risk individuals. Based on this analysis, authors suggested 7-year interval, 4-year interval, and 1- year interval for low, intermediate, and high risk individuals, respectively.[203]

AOBP

Many have suggested that there is a potential role for AOBP in replacing traditional office screening and out of office confirmation modalities.[204] However, we found no studies of unattended AOBP and only one study of attended AOBP reporting test accuracy (sensitivity and specificity) against an ABPM reference standard. The single included KQ1 screening study (CHAP) used attended AOBP but applicability issues regarding the setting of measurements, which occurred in a community pharmacy, reduce relevance to U.S.-based primary care setting.[89] The one attended AOBP study for KQ2 showed a sensitivity of 0.65 (95% CI, 0.54 to 0.75), which is higher than our overall pooled estimate of OBPM but confidence intervals overlap; the specificity of 0.74 (95% CI, 0.66 to 0.82) was lower than our pooled estimate and confidence intervals did not overlap.[82] This one study is insufficient for drawing conclusions about the accuracy of attended AOBP, particularly in the context of a body of evidence with notable methodologic and population heterogeneity.

While there are a dearth of studies reporting test accuracy of AOBP, many studies evaluate mean BP differences between AOBP and other modalities. A 2019 systematic review and meta-analysis by Roerecke et al[65] (31 articles, N=9279) evaluated the mean differences between AOBP and other methods of BP measurement in treated and untreated individuals with systolic AOBP of 130 mm Hg or more. They estimated a pooled mean difference of 14.5 mm Hg (95% CI, 11.8 to 17.2 mm Hg; n = 9; I^2 = 94.3%) between systolic OBPM readings and AOBP but similar awake ambulatory BP and AOBP readings, with a pooled mean difference of 0.3 mm Hg (95% CI, −1.1 to 1.7 mm Hg; n = 19; I^2 = 90%). While the results from this and other systematic reviews may suggest that, on average, there are no statistical differences in pooled AOBP and ABPM values, study-level AOBP and ABPM differences show substantial heterogeneity.[205, 206] More importantly, without analysis of test accuracy outcomes (e.g., sensitivity, specificity), it is not possible to conclude whether AOBP would result in similar clinical screening and diagnostic

results as ABPM or HBPM. Complicating this issue is conflicting literature questioning the equivalence of different AOBP models.[207, 208] Future studies recruiting untreated individuals reporting accuracy outcomes for AOBP in the setting of screening and confirmation are needed. At least one AOBP test accuracy study is underway (**Appendix G**).

Limitations of Our Approach

For KQ1, we included a trial from the previous review[28] that tested a CVD health promotion intervention in a community-based setting; however, this intervention was largely a hypertension screening intervention and was the only available trial carried forward from the last review. Another multicomponent screening trial, VIVA, was not included because the independent benefit of the hypertension screening component could not be evaluated separately from the trial's abdominal aortic aneurysm and peripheral artery disease screening interventions and other CVD preventive interventions.[209] For all key questions, we sought to approximate screening populations so excluded screening studies in which 20 percent or more of participants were treated. While this limited the included studies, as mentioned above, the accuracy of blood pressure measurements may be influenced by blood pressure variability and hypertension medications may reduce such variations. As such, this limitation precludes extrapolating the accuracy results from this review to treated populations. For KQ3, if a population was described as being "referred for ABPM," we accepted this to be relevant for KQ3. Although there are a number of indications for ABPM, we considered the lack of treatment a proxy for an ABPM indication of diagnostic confirmation. There are other indications for ABPM, so our included populations may not strictly represent those referred for confirmation of diagnosis. Additionally, we did not examine how subpopulation characteristics may have influenced accuracy, but given the heterogeneity in study design for the set of accuracy studies (KQ2 and KQ3), it is unlikely that such a subanalysis would have yielded credible results.

Our pooled analyses yielded considerable statistical heterogeneity which was not explained by any single population or test characteristic, thereby limiting the precision of the point estimates. Furthermore, included studies used heterogeneous reference standards (24-h, daytime, and combination ABPM). Indeed, many studies reported that they conducted a 24-h ABPM test, but they used a daytime reference standard to define true hypertension. Our hypothesis is that this was done to achieve comparable measurement intervals among participants. In our main analysis, we pooled all ABPM reference standards for inclusivity. We conducted exploratory analyses limiting to studies using a 24-h reference standard and found higher sensitivity and lower specificity for single visit OBPM screening accuracy (KQ2), and the opposite for the OBPM confirmation modality (KQ3)—although confidence intervals overlapped between the main analyses and exploratory analyses. Because there was additional population heterogeneity in these studies that might confound results of pooling by reference standard modality, we consider these analyses to be exploratory. Moreover, because of the rarity of studies reporting accuracy using both a 24-h and daytime reference standard, we have little direct evidence for comparative accuracy based on different reference standards. Very recent analyses from IDACO have shown that 24-h and nighttime ABPM have prognostic value over and above daytime ABPM and perhaps serve as a superior reference standard.[41] However, most included studies use daytime ABPM as the reference standard (e.g., 13/20 studies in KQ2).

We did not include accuracy studies that only reported mm Hg differences between measurement modalities or studies that only included kappas as a measure of agreement. While our review defined hypertension as a dichotomous outcome in order to calculate sensitivity and specificity, we acknowledge that blood pressure is a continuous variable associated with CVD risk. Nonetheless, clinical decision-making to start treatment is almost entirely based on blood pressures exceeding a defined threshold.

The previous review addressed the prognostic value of office, ambulatory and home blood pressure measurements in predicting future CVD events.[28] Based on that review, we solely accepted ABPM as the gold standard for hypertension diagnosis and did not re-review the evidence on the prognostic value of various blood pressure measurement modalities. That review noted that the body of evidence for HBPM to independently predict CVD outcomes is smaller than the evidence for ABPM, and that direct evidence for the prognostic value of HBPM compared to ABPM is sparse. However, this smaller body of evidence suggests but does not confirm that HBPM may serve as a similar predictor of outcomes. HBPM was not an eligible reference standard in the current review but could be considered an alternate reference standard.[210]

We did not systematically address the prognosis of white coat hypertension or masked hypertension in our review, but we have discussed these clinically important issues in the Discussion section to provide context. We did not address circadian blood pressure patterns and screening for nighttime dipping. There is prognostic data to suggest that this is important.[211] Finally, we did not address treatment benefit and harms. We acknowledge that there is a robust literature supporting cardiovascular benefits of treatment,[164-169] and there are also important harms of treatment, but they are beyond the scope of this review and screening framework.

Limitations of the Studies, Ongoing Research, and Future Research Needs

Hypertension screening is a long-standing routine clinical practice based on treatment effectiveness literature, so the lack of direct evidence (KQ1) from clinical settings would be anticipated. Indeed, we are aware of no in-progress trials evaluating the effectiveness of blood pressure screening alone versus no screening.[212] Given the clinical importance of hypertension as a CVD risk factor, however, it is surprising that existing blood pressure screening and confirmation accuracy literature is not more robust. Instead, this evidence base comprises a heterogeneous group of studies with various populations and blood pressure measurement protocols, resulting in inconsistent and imprecise accuracy estimates. Moreover, the included protocol characteristics likely represent “research quality” measures not found in current practice. Moreover, because many of the studies utilized older devices not currently available, there remains some uncertainty about extrapolation of studies’ accuracy data to contemporary clincal practice. The US Blood Pressure Validated Device Listing is a recent resource that catalogues contemporary blood pressure measurement devices that have been validated for clinical accuracy as determined through an independent review process (https://www.validatebp.org/). Despite current interest in unattended AOBP, there is a lack of accuracy studies of AOBP for screening or confirmation in an untreated, screening-relevant

population. There are limited data to compare the accuracy among the various confirmation modalities or to identify optimal protocol characteristics for blood pressure measurement. A few ongoing studies are particularly relevant in addressing the accuracy and feasibility of various screening and confirmation algorithms in clinical practice[213-216] (**Appendix G**).

Future research needs include:

- AOBP and kiosk-based accuracy studies for screening and confirmation in an untreated population
- Accuracy studies with direct comparisons of different protocol characteristics (e.g., rest times, number of repeated measurements over number of separate days, attendance of measurement by medical personnel)
- Accuracy studies using the most recent ACC/AHA office threshold of 130/80 mm Hg compared with the ABPM gold standard and accuracy studies with direct comparisons of ≥130/80 mm Hg vs ≥140/90 mm Hg using the same ABPM reference standard threshold.
- Comparative accuracy of different screening and confirmation modalities in nationally representative samples including diverse populations (by age, race/ethnicity, CVD risk status)
- More studies evaluating the accuracy of truncated ABPM versus 24-h ABPM to determine if a limited number of hours of ABPM is acceptable, thereby reducing a barrier to confirmation with 24-h ABPM
- More long-term prognostic studies comparing the value of OBPM, ABPM and HBPM in predicting future CVD events
- Externally validated risk models from large U.S. cohorts to identify higher risk adults for whom more frequent screening may be appropriate
- Studies examining validated risk models to identify patients for masked hypertension screening
- Clinical effectiveness trials examining the benefits and harms of treatment of white coat and masked hypertension.
- Systems approaches to improve ABPM use for hypertension confirmation

Conclusions

Our meta-analysis demonstrated that blood pressure screening administered at a single visit has a low sensitivity and adequate specificity for detection of hypertension, leading to a substantial number of potentially missed cases. In contrast, we found that confirmatory office or home blood pressure measurements, when applied to a preselected population, are generally more sensitive but not specific. We did not identify any studies meeting inclusion criteria for unattended AOBP or kiosk blood pressure measurements for screening or diagnostic confirmation. Scant literature is available to inform best practices in blood pressure measurement protocols. Available literature with design limitations suggests that the direct harms of screening and confirmatory blood pressure measurements are minimal and the most notable harm of blood pressure screening is likely misdiagnosis. Future research is needed to determine the best screening and confirmatory algorithms including details on measurement protocols and blood pressure

thresholds for clinical practice and to clarify the benefits of treating white coat and masked hypertension.

References

1. Siu AL, USPSTF. Screening for high blood pressure in adults: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med. 2015;163(10):778-86. PMID: 26458123. https://doi.org/10.7326/M15-2223
2. National High Blood Pressure Education Program. The Seventh Report on the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. Washington, DC: National Institutes of Health; 2004.
3. Beevers G, Lip GY, O'Brien E. ABC of hypertension. Blood pressure measurement. Part I-sphygmomanometry: factors common to all techniques. BMJ. 2001;322(7292):981-5. PMID: 11312235. https://doi.org/10.1136/bmj.322.7292.981
4. National Institute for Health and Clinical Excellence. Hypertension: The Clinical Management of Primary Hypertension in Adults. Clinical Guideline 127 London, England National Institute for Health and Clinical Excellence, ; 2011. PMID: 22855971.
5. Ogedegbe G, Pickering T. Principles and techniques of blood pressure measurement. Cardiology clinics. 2010;28(4):571-86. PMID: 20937442. https://doi.org/10.1016/j.ccl.2010.07.006
6. Pickering TG, Miller NH, Ogedegbe G, et al. Call to action on use and reimbursement for home blood pressure monitoring: a joint scientific statement from the American Heart Association, American Society Of Hypertension, and Preventive Cardiovascular Nurses Association. Hypertension. 2008;52(1):10-29. PMID: 18596492. https://doi.org/10.1097/01.jcn.0000317429.98844.04
7. Carretero OA, Oparil S. Essential hypertension. Part I: definition and etiology. Circulation. 2000;101(3):329-35. PMID: 10645931. https://doi.org/10.1161/01.cir.101.3.329
8. Patel SA, Winkel M, Ali MK, et al. Cardiovascular mortality associated with 5 leading risk factors: national and state preventable fractions estimated from survey data. Ann Intern Med. 2015;163(4):245-53. PMID: 26121190. https://doi.org/10.7326/m14-1753
9. Harris R, Sawaya GF, Moyer VA, et al. Reconsidering the criteria for evaluating proposed screening programs: reflections from 4 current and former members of the U.S. Preventive services task force. Epidemiol Rev. 2011;33:20-35. PMID: 21666224. https://doi.org/10.1093/epirev/mxr005
10. LeFevre ML. ACC/AHA Hypertension Guideline: What Is New? What Do We Do? American family physician. 2018;97(6):372-3. PMID: 29671534.
11. Korhonen PE, Kautiainen H, Jarvenpaa S, et al. Target organ damage and cardiovascular risk factors among subjects with previously undiagnosed hypertension. European journal of preventive cardiology. 2014;21(8):980-8. PMID: 23335655. https://doi.org/10.1177/2047487312474530
12. Nadar SK, Tayebjee MH, Messerli F, et al. Target organ damage in hypertension: pathophysiology and implications for drug therapy. Current pharmaceutical design. 2006;12(13):1581-92. PMID: 16729871. https://doi.org/10.2174/138161206776843368
13. Institute of Medicine. A Population-Based Policy and Systems Change Approach to Prevent and Control Hypertension. Washington, DC: The National Academies Press; 2010.

14. Patnode CD, Evans CV, Senger CA, et al. Behavioral Counseling to Promote a Healthful Diet and Physical Activity for Cardiovascular Disease Prevention in Adults Without Known Cardiovascular Disease Risk Factors: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force. JAMA. 2017;318(2):175-93. PMID: 28697259. https://doi.org/10.1001/jama.2017.3303
15. Graudal NA, Hubeck-Graudal T, Jurgens G. Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride. The Cochrane database of systematic reviews. 2017;4:CD004022. https://doi.org/10.1002/14651858.CD004022.pub4
16. Rees K, Dyakova M, Wilson N, et al. Dietary advice for reducing cardiovascular risk. The Cochrane database of systematic reviews. 2013(12):CD002128. https://doi.org/10.1002/14651858.CD002128.pub5
17. Musini VM, Gueyffier F, Puil L, et al. Pharmacotherapy for hypertension in adults aged 18 to 59 years. The Cochrane database of systematic reviews. 2017;8:Cd008276. PMID: 28813123. https://doi.org/10.1002/14651858.cd008276.pub2
18. Musini VM, Tejani AM, Bassett K, et al. Pharmacotherapy for hypertension in the elderly. The Cochrane database of systematic reviews. 2009(4):Cd000028. PMID: 19821263. https://doi.org/10.1002/14651858.cd000028.pub2
19. Sprint Research Group, Wright JT, Jr., Williamson JD, et al. A Randomized Trial of Intensive versus Standard Blood-Pressure Control. N Engl J Med. 2015;373(22):2103-16. PMID: 26551272. https://doi.org/10.1056/nejmoa1511939
20. Whelton PK, Carey RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Hypertension. 2017;71(6):e13-e115. PMID: 29133356. https://doi.org/10.1161/hyp.0000000000000065
21. Ostchega Y, Fryar CD, Nwankwo T, et al. Hypertension Prevalence Among Adults Aged 18 and Over: United States, 2017-2018. NCHS Data Brief. 2020(364):1-8. PMID: 32487290.
22. Muntner P, Hardy ST, Fine LJ, et al. Trends in Blood Pressure Control Among US Adults With Hypertension, 1999-2000 to 2017-2018. JAMA. 2020;324(12):1190-200. PMID: 32902588. https://doi.org/10.1001/jama.2020.14545
23. Lewington S, Clarke R, Qizilbash N, et al. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. Lancet. 2002;360(9349):1903-13. PMID: 12493255. https://doi.org/10.1016/s0140-6736(02)11911-8
24. Flint AC, Conell C, Ren X, et al. Effect of Systolic and Diastolic Blood Pressure on Cardiovascular Outcomes. N Engl J Med. 2019;381(3):243-51. PMID: 31314968. https://doi.org/10.1056/NEJMoa1803180
25. Weber MA, Townsend RR. Building the case for central blood pressure. Journal of the American College of Cardiology. 2013;62(19):1788-90. PMID: 23850920. https://doi.org/10.1016/j.jacc.2013.06.028
26. Benjamin EJ, Blaha MJ, Chiuve SE, et al. Heart Disease and Stroke Statistics-2017 Update: A Report From the American Heart Association. Circulation.

2017;135(10):e146-e603. PMID: 28122885. https://doi.org/10.1161/CIR.0000000000000485
27. Vasan RS, Beiser A, Seshadri S, et al. Residual lifetime risk for developing hypertension in middle-aged women and men: The Framingham Heart Study. JAMA. 2002;287(8):1003-10. PMID: 11866648. https://doi.org/10.1001/jama.287.8.1003
28. Piper MA, Evans CV, Burda BU, et al. Screening for High Blood Pressure in Adults: A Systematic Evidence Review for the U.S. Preventive Services Task Force. Rockville (MD): 2014.
29. Fryar CD, Ostchega Y, Hales CM, et al. Hypertension Prevalence and Control Among Adults: United States, 2015-2016. NCHS Data Brief. 2017(289):1-8. PMID: 29155682.
30. Kallioinen N, Hill A, Horswill MS, et al. Sources of inaccuracy in the measurement of adult patients' resting blood pressure in clinical settings: a systematic review. Journal of hypertension. 2017;35(3):421-41. PMID: 27977471. https://doi.org/10.1097/HJH.0000000000001197
31. Muntner P, Shimbo D, Carey RM, et al. Measurement of Blood Pressure in Humans: A Scientific Statement From the American Heart Association. Hypertension. 2019;73(5):e35-e66. PMID: 30827125. http://doi.org/10.1161/HYP.0000000000000087
32. Conen D, Aeschbacher S, Thijs L, et al. Age-specific differences between conventional and ambulatory daytime blood pressure values. Hypertension. 2014;64(5):1073-9. PMID: 25185130. https://dx.doi.org/10.1161/HYPERTENSIONAHA.114.03957
33. Omboni S, Aristizabal D, De la Sierra A, et al. Hypertension types defined by clinic and ambulatory blood pressure in 14 143 patients referred to hypertension clinics worldwide. Data from the ARTEMIS study. Journal of hypertension. 2016;34(11):2187-98. PMID: 27512964. https://dx.doi.org/10.1097/HJH.0000000000001074
34. Leung AA, Daskalopoulou SS, Dasgupta K, et al. Hypertension Canada's 2017 Guidelines for Diagnosis, Risk Assessment, Prevention, and Treatment of Hypertension in Adults. The Canadian journal of cardiology. 2017;33(5):557-76. PMID: 28449828. https://doi.org/10.1016/j.cjca.2017.03.005
35. Myers MG, Godwin M, Dawes M, et al. Measurement of blood pressure in the office: recognizing the problem and proposing the solution. Hypertension. 2010;55(2):195-200. PMID: 20038756. https://doi.org/10.1161/HYPERTENSIONAHA.109.141879
36. Pickering TG, Hall JE, Appel LJ, et al. Recommendations for blood pressure measurement in humans and experimental animals: part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. Circulation. 2005;111(5):697-716. PMID: 15699287. https://doi.org/10.1161/01.cir.0000154900.76284.f6
37. Asayama K, Thijs L, Li Y, et al. Setting thresholds to varying blood pressure monitoring intervals differentially affects risk estimates associated with white-coat and masked hypertension in the population. Hypertension. 2014;64(5):935-42. PMID: 25135185. https://dx.doi.org/10.1161/HYPERTENSIONAHA.114.03614
38. Pierdomenico SD, Cuccurullo F. Prognostic value of white-coat and masked hypertension diagnosed by ambulatory monitoring in initially untreated subjects: an updated meta analysis. American journal of hypertension. 2011;24(1):52-8. PMID: 20847724. https://doi.org/10.1038/ajh.2010.203

39. Wang YC, Shimbo D, Muntner P, et al. Prevalence of Masked Hypertension Among US Adults With Nonelevated Clinic Blood Pressure. American journal of epidemiology. 2017;185(3):194-202. PMID: 28100465. https://doi.org/10.1093/aje/kww237
40. Al Hamarneh YN, Houle SK, Chatterley P, et al. The validity of blood pressure kiosk validation studies: a systematic review. [Review]. Blood pressure monitoring. 2013;18(3):167-72. PMID: 23635486. https://doi.org/10.1097/mbp.0b013e328360fb85
41. Yang WY, Melgarejo JD, Thijs L, et al. Association of Office and Ambulatory Blood Pressure With Mortality and Cardiovascular Outcomes. JAMA. 2019;322(5):409-20. PMID: 31386134. https://doi.org/10.1001/jama.2019.9811
42. Shimbo D, Artinian NT, Basile JN, et al. Self-Measured Blood Pressure Monitoring at Home: A Joint Policy Statement From the American Heart Association and American Medical Association. Circulation. 2020;142(4):e42-e63. PMID: 32567342. https://doi.org/10.1161/cir.0000000000000803
43. Cohen JB, Padwal RS, Gutkin M, et al. History and Justification of a National Blood Pressure Measurement Validated Device Listing. Hypertension. 2019;73(2):258-64. PMID: 30580681. https://doi.org/10.1161/HYPERTENSIONAHA.118.11990
44. Shimbo D. Daichi Shimbo personal communication (Sep 23, 2019). 2019. PMID.
45. Hodgkinson JA, Sheppard JP, Heneghan C, et al. Accuracy of ambulatory blood pressure monitors: a systematic review of validation studies. Journal of hypertension. 2013;31(2):239-50. PMID: 23303347. https://doi.org/10.1097/hjh.0b013e32835b8d8b
46. Bello NA, Woolley JJ, Cleary KL, et al. Accuracy of Blood Pressure Measurement Devices in Pregnancy: A Systematic Review of Validation Studies. Hypertension. 2018;71(2):326-35. PMID: 29229741. https://dx.doi.org/10.1161/HYPERTENSIONAHA.117.10295
47. Rui P, Okeyode T. National Ambulatory Medical Care Survey: 2016 National Summary Tables. https://www.cdc.gov/nchs/data/ahcd/namcs_summary/2016_namcs_ web_tables.pdf. Accessed.
48. Woolsey S, Brown B, Ralls B, et al. Diagnosing Hypertension in Primary Care Clinics According to Current Guidelines. J Am Board Fam Med. 2017;30(2):170-7. PMID: 28379823. https://doi.org/10.3122/jabfm.2017.02.160111
49. Carter BU, Kaylor MB. The use of ambulatory blood pressure monitoring to confirm a diagnosis of high blood pressure by primary-care physicians in Oregon. Blood pressure monitoring. 2016;21(2):95-102. PMID: 26683382. https://doi.org/10.1097/MBP.0000000000000166
50. Ray GM, Nawarskas JJ, Anderson JR. Blood pressure monitoring technique impacts hypertension treatment. Journal of general internal medicine. 2012;27(6):623-9. PMID: 22160847. https://doi.org/10.1007/s11606-011-1937-9
51. Levy J, Gerber LM, Wu X, et al. Nonadherence to Recommended Guidelines for Blood Pressure Measurement. Journal of Clinical Hypertension. 2016;18(11):1157-61. https://dx.doi.org/10.1111/jch.12846
52. Burgess SE, MacLaughlin EJ, Smith PA, et al. Blood pressure rising: differences between current clinical and recommended measurement techniques. Journal of the American Society of Hypertension. 2011;5(6):484-8. PMID: 22015319. https://doi.org/10.1016/j.jash.2011.08.007
53. Minor DS, Butler KR, Jr., Artman KL, et al. Evaluation of blood pressure measurement and agreement in an academic health sciences center. Journal of clinical hypertension

(Greenwich, Conn). 2012;14(4):222-7. PMID: 22458743. https://doi.org/10.1111/j.1751-7176.2012.00599.x
54. Kronish IM, Kent S, Moise N, et al. Barriers to conducting ambulatory and home blood pressure monitoring during hypertension screening in the United States. Journal of the American Society of Hypertension. 2017;11(9):573-80. PMID: 28734798. https://dx.doi.org/10.1016/j.jash.2017.06.012
55. Tunis S, Kendall P, Londner M, et al. National Coverage Decision: Decision Memo for Ambulatory Blood Pressure Monitoring (CAG-00067N). Baltimore, MD: Centers for Medicare and Medicaid Services; 2001.
56. Shimbo D, Kent ST, Diaz KM, et al. The use of ambulatory blood pressure monitoring among Medicare beneficiaries in 2007-2010. Journal of the American Society of Hypertension. 2014;8(12):891-7. PMID: 25492832. https://dx.doi.org/10.1016/j.jash.2014.09.015
57. Kent ST, Shimbo D, Huang L, et al. Rates, amounts, and determinants of ambulatory blood pressure monitoring claim reimbursements among Medicare beneficiaries. Journal of the American Society of Hypertension. 2014;8(12):898-908. PMID: 25492833. https://doi.org/10.1016/j.jash.2014.09.020
58. Syrek Jensen T, Chin J, Ashby L, et al. National Coverage Determination: Decision Memo for Ambulatory Blood Pressure Monitoring (ABPM) (CAG-00067R2). Baltimore, MD: Centers for Medicare and Medicaid Services; 2019.
59. Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure. A cooperative study. JAMA. 1977;237(3):255-61. PMID: 276159.
60. Gueyffier F, Froment A, Gouton M. New meta-analysis of treatment trials of hypertension: improving the estimate of therapeutic benefit. Journal of human hypertension. 1996;10(1):1-8. PMID: 8642184.
61. U.S. Preventive Services Task Force. Guide to Clinical Preventive Services, 2nd ed. Baltimore, MD: Williams & Wilkins; 1996.
62. U.S. Preventive Services Task Force. Screening for high blood pressure: recommendations and rationale. American Journal of Preventive Medicine. 2003;25(2):159-64. PMID: 12880885. https://doi.org/10.1016/s0749-3797(03)00122-3
63. U.S. Preventive Services Task Force. Screening for high blood pressure: U.S. Preventive Services Task Force reaffirmation recommendation statement. Ann Intern Med. 2007;147(11):783-6. PMID: 18056662. https://doi.org/10.7326/0003-4819-147-11-200712040-00009
64. Piper MA, Evans CV, Burda BU, et al. Diagnostic and predictive accuracy of blood pressure screening methods with consideration of rescreening intervals: a systematic review for the U.S. Preventive Services Task Force. Annals of Internal Medicine. 2015;162(3):192-204. PMID: 25531400. https://dx.doi.org/10.7326/M14-1539
65. Roerecke M, Kaczorowski J, Myers MG. Comparing Automated Office Blood Pressure Readings With Other Methods of Blood Pressure Measurement for Identifying Patients With Possible Hypertension: A Systematic Review and Meta-analysis. JAMA internal medicine. 2019;179(3):351-62. PMID: 30715088. https://dx.doi.org/10.1001/jamainternmed.2018.6551
66. Hodgkinson J, Mant J, Martin U, et al. Relative effectiveness of clinic and home blood pressure monitoring compared with ambulatory blood pressure monitoring in diagnosis of

hypertension: systematic review. BMJ. 2011;342:d3621. PMID: 21705406. https://doi.org/10.1136/bmj.d3621
67. Melgarejo JD, Maestre GE, Thijs L, et al. Prevalence, Treatment, and Control Rates of Conventional and Ambulatory Hypertension Across 10 Populations in 3 Continents. Hypertension. 2017;70(1):50-8. PMID: 28483916. https://dx.doi.org/10.1161/HYPERTENSIONAHA.117.09188
68. National Institute for Health and Care Excellence. Hypertension in adults: diagnosis and managment, draft for consultation. Mar 2019.
69. Omboni S, Kario K, Bakris G, et al. Effect of antihypertensive treatment on 24-h blood pressure variability: pooled individual data analysis of ambulatory blood pressure monitoring studies based on olmesartan mono or combination treatment. Journal of hypertension. 2018;36(4):720-33. https://dx.doi.org/10.1097/HJH.0000000000001608
70. Webb AJ, Fischer U, Mehta Z, et al. Effects of antihypertensive-drug class on interindividual variation in blood pressure and risk of stroke: a systematic review and meta-analysis. Lancet. 2010;375(9718):906-15. PMID: 20226989. https://doi.org/10.1016/S0140-6736(10)60235-8
71. United Nations Development Programme. Human Development Report 2016: Human Development Everyone. New York, NY: United Nations Development Programme; 2016.
72. Hansen TW, Kikuya M, Thijs L, et al. Prognostic superiority of daytime ambulatory over conventional blood pressure in four populations: a meta-analysis of 7,030 individuals. Journal of hypertension. 2007;25(8):1554-64. PMID: 17620947. https://doi.org/10.1097/hjh.0b013e3281c49da5
73. Shin J, Park SH, Kim JH, et al. Discordance between ambulatory versus clinic blood pressure according to global cardiovascular risk group. The Korean journal of internal medicine. 2015;30(5):610-9. PMID: 26354055. https://doi.org/10.3904/kjim.2015.30.5.610
74. de la Sierra A, Vinyoles E, Banegas JR, et al. Prevalence and clinical characteristics of white-coat hypertension based on different definition criteria in untreated and treated patients. Journal of hypertension. 2017;35(12):2388-94. PMID: 28723880. https://dx.doi.org/10.1097/HJH.0000000000001493
75. U.S. Preventive Services Task Force. U.S. Preventive Services Task Force Procedure Manual. Rockville, MD: U.S. Preventive Services Task Force; 2015.
76. Wells G, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp. Accessed: December 3, 2018.
77. Whiting P, Rutjes AW, Reitsma JB, et al. The development of QUADAS: a tool for the quality assessment of studies of diagnostic accuracy included in systematic reviews. BMC Med Res Methodol. 2003;3:25. PMID: 14606960. https://doi.org/10.1186/1471-2288-3-25
78. Whiting PF, Rutjes AW, Westwood ME, et al. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. Ann Intern Med. 2011;155(8):529-36. PMID: 22007046. https://doi.org/10.7326/0003-4819-155-8-201110180-00009

79. Williams B, Mancia G, Spiering W, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension. Eur Heart J. 2018;39(33):3021-104. PMID: 30165516. https://doi.org/10.1093/eurheartj/ehy339
80. Larkin KT, Schauss SL, Elnicki DM. Isolated clinic hypertension and normotension: false positives and false negatives in the assessment of hypertension. Blood pressure monitoring. 1998;3:247-54.
81. Hanninen MR, Niiranen TJ, Puukka PJ, et al. Comparison of home and ambulatory blood pressure measurement in the diagnosis of masked hypertension. Journal of hypertension. 2010;28(4):709-14. PMID: 20061982. https://doi.org/10.1097/HJH.0b013e3283369faa
82. Gill P, Haque MS, Martin U, et al. Measurement of blood pressure for the diagnosis and management of hypertension in different ethnic groups: one size fits all. BMC Cardiovasc Disord. 2017;17(1):55. PMID: 28178928. https://dx.doi.org/10.1186/s12872-017-0491-8
83. Higgins J, Green S. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011.
84. Centers for Disease Control and Prevention, National Center for Health Statistics. Health, United States, 2017 - Data Finder. https://www.cdc.gov/nchs/hus/contents2017.htm#054. Accessed: 06/15/2019, 2019.
85. Centers for Disease Control and Prevention, National Center for Health Statistics. National Health Interview Survey: Tables of Summary Health Statistics. https://www.cdc.gov/nchs/nhis/SHS/tables.htm. Accessed: 06/15/2019, 2019.
86. Centers for Disease Control and Prevention, National Center for Health Statistics. Summary Health Statistics: National Health Interview Survey, 2017. Table A-1. https://ftp.cdc.gov/pub/Health_Statistics/NCHS/NHIS/SHS/2017_SHS_Table_A-1.pdf. Accessed: 06/15/2019.
87. Berkman N, Lohr K, Ansari M, et al. Grading the Strength of a Body of Evidence When Assessing Health Care Interventions for the Effective Health Care Program of the Agency for Healthcare Research and Quality: An Update. Methods Guide for Effectiveness and Comparative Effectiveness Reviews. AHRQ Publication No. 10(14)-EHC063-EF. Rockville, MD: Agency for Healthcare Research and Quality; 2014. p. 314-49.
88. Atkins D, Eccles M, Flottorp S, et al. Systems for grading the quality of evidence and the strength of recommendations I: critical appraisal of existing approaches The GRADE Working Group. BMC Health Serv Res. 2004;4(1):38. PMID: 15615589. http://dx.doi.org/10.1186/1472-6963-4-38
89. Kaczorowski J, Chambers LW, Dolovich L, et al. Improving cardiovascular health at population level: 39 community cluster randomised trial of Cardiovascular Health Awareness Program (CHAP). BMJ. 2011;342:d442. PMID: 21300712. https://doi.org/10.1136/bmj.d442
90. Abdalla M, Goldsmith J, Muntner P, et al. Is Isolated Nocturnal Hypertension A Reproducible Phenotype? American journal of hypertension. 2016;29(1):33-8. PMID: 25904648. https://dx.doi.org/10.1093/ajh/hpv058
91. Fagard RH, van den Broeke C, de Cort P. Prognostic significance of blood pressure measured in the office, at home and during ambulatory monitoring in older patients in general practice. Journal of human hypertension. 2005;19(10):801-7. PMID: 15959536. https://doi.org/10.1038/sj.jhh.1001903

92. Gosse P, Dauphinot V, Roche F, et al. Prevalence of clinical and ambulatory hypertension in a population of 65-year-olds: the PROOF study. Journal of clinical hypertension (Greenwich, Conn). 2010;12(3):160-5. PMID: 20433528. https://doi.org/10.1111/j.1751-7176.2009.00235.x
93. Gourlay SG, McNeil JJ, Marriner T, et al. Discordance of mercury sphygmomanometer and ambulatory blood pressure measurements for the detection of untreated hypertension in a population study. Journal of human hypertension. 1993;7(5):467-72. PMID: 8263887.
94. Hansen TW, Jeppesen J, Rasmussen S, et al. Ambulatory blood pressure monitoring and risk of cardiovascular disease: a population based study. American journal of hypertension. 2006;19(3):243-50. PMID: 16500508. https://doi.org/10.1016/j.amjhyper.2005.09.018
95. Ishikawa J, Hoshide S, Eguchi K, et al. Masked hypertension defined by ambulatory blood pressure monitoring is associated with an increased serum glucose level and urinary albumin-creatinine ratio. Journal of clinical hypertension (Greenwich, Conn). 2010;12(8):578-87. PMID: 20695934. https://doi.org/10.1111/j.1751-7176.2010.00286.x
96. Kanno A, Metoki H, Kikuya M, et al. Usefulness of assessing masked and white-coat hypertension by ambulatory blood pressure monitoring for determining prevalent risk of chronic kidney disease: the Ohasama study. Hypertension research. 2010;33(11):1192-8. PMID: 20703228. https://doi.org/10.1038/hr.2010.139
97. Lyamina NP, Smith ML, Lyamina SV, et al. Pressor response to 30-s breathhold: a predictor of masked hypertension. Blood Press. 2012;21(6):372-6. PMID: 22725829. https://doi.org/10.3109/08037051.2012.694213
98. Mancia G, Facchetti R, Bombelli M, et al. Long-term risk of mortality associated with selective and combined elevation in office, home, and ambulatory blood pressure. Hypertension. 2006;47(5):846-53. PMID: 16567588. https://doi.org/10.1161/01.HYP.0000215363.69793.bb
99. O'Flynn AM, Curtin RJ, Perry IJ, et al. Hypertension Prevalence, Awareness, Treatment, and Control: Should 24-Hour Ambulatory Blood Pressure Monitoring be the Tool of Choice? J Clin Hypertens. 2016;18(7):697-702. PMID: 26611695. https://dx.doi.org/10.1111/jch.12737
100. Poudel B, Booth JN, 3rd, Sakhuja S, et al. Prevalence of ambulatory blood pressure phenotypes using the 2017 American College of Cardiology/American Heart Association blood pressure guideline thresholds: data from the Coronary Artery Risk Development in Young Adults study. Journal of hypertension. 2019;37(7):1401-10. PMID: 31145711. https://dx.doi.org/10.1097/HJH.0000000000002055
101. Scuteri A, Morrell CH, Orru M, et al. Gender specific profiles of white coat and masked hypertension impacts on arterial structure and function in the SardiNIA study. International journal of cardiology. 2016;217:92-8. PMID: 27179214. https://dx.doi.org/10.1016/j.ijcard.2016.04.172
102. Selenta C, Hogan BE, Linden W. How often do office blood pressure measurements fail to identify true hypertension? An exploration of white-coat normotension. Arch Fam Med. 2000;9(6):533-40. PMID: 10862216. https://doi.org/10.1001/archfami.9.6.533
103. Shimbo D, Newman JD, Schwartz JE. Masked hypertension and prehypertension: diagnostic overlap and interrelationships with left ventricular mass: the Masked

Hypertension Study. American journal of hypertension. 2012;25(6):664-71. PMID: 22378035. https://doi.org/10.1038/ajh.2012.15
104. Thomas SJ, Booth JN, 3rd, Bromfield SG, et al. Clinic and ambulatory blood pressure in a population-based sample of African Americans: the Jackson Heart Study. Journal of the American Society of Hypertension. 2017;11(4):204-12.e5. PMID: 28285829. https://dx.doi.org/10.1016/j.jash.2017.02.001
105. Wei FF, Zhang ZY, Thijs L, et al. Conventional and Ambulatory Blood Pressure as Predictors of Retinal Arteriolar Narrowing. Hypertension. 2016;68(2):511-20. PMID: 27324224. https://dx.doi.org/10.1161/HYPERTENSIONAHA.116.07523
106. Wojciechowska W, Stolarz-Skrzypek K, Olszanecka A, et al. Subclinical arterial and cardiac damage in white-coat and masked hypertension. Blood Press. 2016;25(4):249-56. PMID: 26953075. https://dx.doi.org/10.3109/08037051.2016.1150563
107. Wood S, Martin U, Gill P, et al. Blood pressure in different ethnic groups (BP-Eth): a mixed methods study. BMJ Open. 2012;2(6):2012. PMID: 23129572. https://doi.org/10.1136/bmjopen-2012-001598
108. Martin U, Haque MS, Wood S, et al. Ethnicity and differences between clinic and ambulatory blood pressure measurements. American journal of hypertension. 2015;28(6):729-38. PMID: 25398890. https://doi.org/10.1093/ajh/hpu211
109. Sehestedt T, Jeppesen J, Hansen TW, et al. Can ambulatory blood pressure measurements substitute assessment of subclinical cardiovascular damage? Journal of hypertension. 2012;30(3):513-21. PMID: 22241138. https://doi.org/10.1097/HJH.0b013e32834f6f60
110. Hoshide S, Ishikawa J, Eguchi K, et al. Masked nocturnal hypertension and target organ damage in hypertensives with well-controlled self-measured home blood pressure. Hypertension research. 2007;30(2):143-9. PMID: 17460384. https://doi.org/10.1291/hypres.30.143
111. Hozawa A, Ohkubo T, Kikuya M, et al. Blood pressure control assessed by home, ambulatory and conventional blood pressure measurements in the Japanese general population: the Ohasama study. Hypertension research. 2002;25(1):57-63. PMID: 11924727. https://doi.org/10.1291/hypres.25.57
112. Imai Y, Tsuji I, Nagai K, et al. Ambulatory blood pressure monitoring in evaluating the prevalence of hypertension in adults in Ohasama, a rural Japanese community. Hypertension research. 1996;19(3):207-12. PMID: 8891750. https://doi.org/10.1291/hypres.19.207
113. Cuspidi C, Facchetti R, Bombelli M, et al. Risk of new-onset metabolic syndrome associated with white-coat and masked hypertension: data from a general population. Journal of hypertension. 2018;36(9):1833-9. PMID: 29965885. https://doi.org/10.1097/hjh.0000000000001767
114. Mancia G, Sega R, Bravi C, et al. Ambulatory blood pressure normality: results from the PAMELA study. Journal of hypertension. 1995;13(12 Pt 1):1377-90. PMID: 8866899.
115. Muntner P, Lewis CE, Diaz KM, et al. Racial differences in abnormal ambulatory blood pressure monitoring measures: Results from the Coronary Artery Risk Development in Young Adults (CARDIA) study. American journal of hypertension. 2015;28(5):640-8. PMID: 25376639. https://dx.doi.org/10.1093/ajh/hpu193
116. Scuteri A, Najjar SS, Orru M, et al. Age- and gender-specific awareness, treatment, and control of cardiovascular risk factors and subclinical vascular lesions in a founder

population: the SardiNIA Study. Nutr Metab Cardiovasc Dis. 2009;19(8):532-41. PMID: 19321325. https://doi.org/10.1016/j.numecd.2008.11.004
117. Terracciano A, Scuteri A, Strait J, et al. Are personality traits associated with white-coat and masked hypertension? Journal of hypertension. 2014;32(10):1987-92; discussion 92. PMID: 25186529. https://dx.doi.org/10.1097/HJH.0000000000000289
118. Oe Y, Shimbo D, Ishikawa J, et al. Alterations in diastolic function in masked hypertension: findings from the masked hypertension study. American journal of hypertension. 2013;26(6):808-15. PMID: 23446956. https://doi.org/10.1093/ajh/hpt021
119. Diaz KM, Veerabhadrappa P, Brown MD, et al. Prevalence, Determinants, and Clinical Significance of Masked Hypertension in a Population-Based Sample of African Americans: The Jackson Heart Study. American journal of hypertension. 2015;28(7):900-8. PMID: 25499058. https://dx.doi.org/10.1093/ajh/hpu241
120. McMullan CJ, Hickson DA, Taylor HA, et al. Prospective analysis of the association of ambulatory blood pressure characteristics with incident chronic kidney disease. Journal of hypertension. 2015;33(9):1939-46; discussion 46. PMID: 26066645. https://dx.doi.org/10.1097/HJH.0000000000000638
121. Mancia G, Fagard R, Narkiewicz K, et al. 2013 ESH/ESC Guidelines for the management of arterial hypertension: the Task Force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). Journal of hypertension. 2013;31(7):1281-357. PMID: 23817082. https://doi.org/10.1097/01.hjh.0000431740.32696.cc
122. Bayo J, Cos FX, Roca C, et al. Home blood pressure self-monitoring: diagnostic performance in white-coat hypertension. Blood pressure monitoring. 2006;11(2):47-52. PMID: 16534404. https://doi.org/10.1097/01.mbp.0000200479.19046.94
123. de la Sierra A, Vinyoles E, Banegas JR, et al. Short-Term and Long-Term Reproducibility of Hypertension Phenotypes Obtained by Office and Ambulatory Blood Pressure Measurements. J Clin Hypertens. 2016;18(9):927-33. PMID: 26890293. https://dx.doi.org/10.1111/jch.12792
124. Ernst ME, Sezate GS, Lin W, et al. Indication-specific 6-h systolic blood pressure thresholds can approximate 24-h determination of blood pressure control. Journal of human hypertension. 2011;25(4):250-5. PMID: 20574446. https://doi.org/10.1038/jhh.2010.66
125. Ernst ME, Weber CA, Dawson JD, et al. How well does a shortened time interval characterize results of a full ambulatory blood pressure monitoring session? Journal of clinical hypertension (Greenwich, Conn). 2008;10(6):431-5. PMID: 18550932. https://doi.org/10.1111/j.1751-7176.2008.07784.x
126. Fogari R, Corradi L, Zoppi A, et al. Repeated office blood pressure controls reduce the prevalence of white-coat hypertension and detect a group of white-coat normotensive patients. Blood pressure monitoring. 1996;1(1):51-4. PMID: 10226202.
127. Gerc V, Favrat B, Brunner HR, et al. Is nurse-measured blood pressure a valid substitute for ambulatory blood pressure monitoring? Blood pressure monitoring. 2000;5(4):203-9. PMID: 11035861. https://doi.org/10.1097/00126097-200008000-00002
128. Hoegholm A, Kristensen KS, Madsen NH, et al. White coat hypertension diagnosed by 24-h ambulatory monitoring. Examination of 159 newly diagnosed hypertensive patients. American journal of hypertension. 1992;5(2):64-70. PMID: 1550667. https://doi.org/10.1093/ajh/5.2.64

129. Hoegholm A, Kristensen KS, Madsen NH, et al. The frequency of white coat hypertension among patients with newly diagnosed hypertension. Cardiovasc Rev Rep. 1994;15:55-61. PMID: None.
130. Husain A, Lin FC, Tuttle LA, et al. The Reproducibility of Racial Differences in Ambulatory Blood Pressure Phenotypes and Measurements. American journal of hypertension. 2017;30(10):961-7. PMID: 28531258. https://dx.doi.org/10.1093/ajh/hpx079
131. Kim S, Park JJ, Lee SA, et al. Diagnostic accuracy of manual office blood pressure measurement in ambulatory hypertensive patients in Korea. The Korean journal of internal medicine. 2018;33(1):113-20. PMID: 28602060. https://dx.doi.org/10.3904/kjim.2016.161
132. Kotsis V, Stabouli S, Toumanidis S, et al. Target organ damage in "white coat hypertension" and "masked hypertension". American journal of hypertension. 2008;21(4):393-9. PMID: 18292757. https://doi.org/10.1038/ajh.2008.15
133. Manios ED, Koroboki EA, Tsivgoulis GK, et al. Factors influencing white-coat effect. American journal of hypertension. 2008;21(2):153-8. PMID: 18174883. https://doi.org/10.1038/ajh.2007.43
134. Nasothimiou EG, Tzamouranis D, Rarra V, et al. Diagnostic accuracy of home vs. ambulatory blood pressure monitoring in untreated and treated hypertension. Hypertension research. 2012;35(7):750-5. PMID: 22357523. https://doi.org/10.1038/hr.2012.19
135. Nunan D, Thompson M, Heneghan CJ, et al. Accuracy of self-monitored blood pressure for diagnosing hypertension in primary care. Journal of hypertension. 2015;33(4):755-62; discussion 62. PMID: 25915880. https://doi.org/10.1097/HJH.0000000000000489
136. Park JS, Rhee MY, Namgung J, et al. Comparison of Optimal Diagnostic Thresholds of Hypertension With Home Blood Pressure Monitoring and 24-Hour Ambulatory Blood Pressure Monitoring. American journal of hypertension. 2017;30(12):1170-6. PMID: 28992112. https://dx.doi.org/10.1093/ajh/hpx115
137. Presta V, Figliuzzi I, D'Agostino M, et al. Nocturnal blood pressure patterns and cardiovascular outcomes in patients with masked hypertension. J Clin Hypertens. 2018;20(9). PMID: 30058135. https://doi.org/10.1111/jch.13361
138. Rhee MY, Kim JY, Kim JH, et al. Optimal schedule of home blood-pressure measurements for the diagnosis of hypertension. Hypertension research. 2018;41(9):738-47. PMID: 29977083. https://doi.org/10.1038/s41440-018-0069-6
139. Salazar MR, Espeche WG, Stavile RN, et al. Could self-measured office blood pressure be a hypertension screening tool for limited-resources settings? Journal of human hypertension. 2018;32(6):415-22. PMID: 29713048. https://dx.doi.org/10.1038/s41371-018-0057-y
140. Stergiou GS, Salgami EV, Tzamouranis DG, et al. Masked hypertension assessed by ambulatory blood pressure versus home blood pressure monitoring: is it the same phenomenon? American journal of hypertension. 2005;18(6):772-8. PMID: 15925734. https://doi.org/10.1016/j.amjhyper.2005.01.003
141. Stergiou GS, Skeva II, Baibas NM, et al. Diagnosis of hypertension using home or ambulatory blood pressure monitoring: comparison with the conventional strategy based on repeated clinic blood pressure measurements. Journal of hypertension.

2000;18(12):1745-51. PMID: 11132597. https://doi.org/10.1097/00004872-200018120-00007
142. Tocci G, Presta V, Figliuzzi I, et al. Prevalence and clinical outcomes of white-coat and masked hypertension: Analysis of a large ambulatory blood pressure database. J Clin Hypertens. 2018;20(2):297-305. PMID: 29370477. https://dx.doi.org/10.1111/jch.13181
143. Ungar A, Pepe G, Monami M, et al. Isolated ambulatory hypertension is common in outpatients referred to a hypertension centre. Journal of human hypertension. 2004;18(12):897-903. PMID: 15241442. https://doi.org/10.1038/sj.jhh.1001756
144. Viera AJ, Lin FC, Tuttle LA, et al. Reproducibility of masked hypertension among adults 30 years or older. Blood pressure monitoring. 2014;19(4):208-15. PMID: 24842491. https://dx.doi.org/10.1097/MBP.0000000000000054
145. Zabludowski JR, Rosenfeld JB. Evaluation of clinic blood pressure measurements: assessment by daytime ambulatory blood pressure monitoring. Isr J Med Sci. 1992;28(6):345-8. PMID: 1607269.
146. Zakopoulos NA, Kotsis VT, Pitiriga V, et al. White-coat effect in normotension and hypertension. Blood pressure monitoring. 2002;7(5):271-6. PMID: 12409886. https://doi.org/10.1097/00126097-200210000-00004
147. de la Sierra A. Alejandro de la Sierra personal communication (Mar 11, 2019). 2019.
148. Ameling EH, de Korte DF, Man it, V. Impact of diagnosis and treatment of hypertension on quality of life: a double-blind, randomized, placebo-controlled, cross-over study of betaxolol. J Cardiovasc Pharmacol. 1991;18(5):752-60. PMID: 1723773. https://doi.org/10.1097/00005344-199111000-00014
149. Haynes RB, Sackett DL, Taylor DW, et al. Increased absenteeism from work after detection and labeling of hypertensive patients. N Engl J Med. 1978;299(14):741-4. PMID: 692548. https://doi.org/10.1056/NEJM197810052991403
150. Mann AH. The psychological effect of a screening programme and clinical trial for hypertension upon the participants. Psychol Med. 1977;7(3):431-8. PMID: 905459.
151. Rudd P, Price MG, Graham LE, et al. Consequences of worksite hypertension screening. Changes in absenteeism. Hypertension. 1987;10(4):425-36. PMID: 3653971. https://doi.org/10.1161/01.hyp.10.4.425
152. Taylor DW, Haynes RB, Sackett DL, et al. Longterm follow-up of absenteeism among working men following the detection and treatment of their hypertension. Clin Invest Med. 1981;4(3-4):173-7. PMID: 7337988.
153. [No author listed]. Randomised controlled trial of treatment for mild hypertension: design and pilot trial. Report of Medical Research Council Working Party on Mild to Moderate Hypertension. Br Med J. 1977;1(6074):1437-40. PMID: 324577. https://doi.org/10.1136/bmj.1.6074.1437
154. Manning G, Vijan SG, Millar-Craig MW. [80] Does perception of sleep quality affect diurnal variation of blood pressure and heart rate during 24Hr blood pressure monitoring? Clin Sci. 1992;83(Suppl 27):22P-3P. PMID: None.
155. Spruill TM, Feltheimer SD, Harlapur M, et al. Are there consequences of labeling patients with prehypertension? An experimental study of effects on blood pressure and quality of life. J Psychosom Res. 2013;74(5):433-8. PMID: 23597332. https://doi.org/10.1016/j.jpsychores.2013.01.009

156. Verdecchia P, Angeli F, Borgioni C, et al. Ambulatory blood pressure and cardiovascular outcome in relation to perceived sleep deprivation. Hypertension. 2007;49(4):777-83. PMID: 17261645. https://doi.org/10.1161/01.HYP.0000258215.26755.20
157. Viera AJ, Lingley K, Esserman D. Effects of labeling patients as prehypertensive. J Am Board Fam Med. 2010;23(5):571-83. PMID: 20823351. https://doi.org/10.3122/jabfm.2010.05.100047
158. Viera AJ, Lingley K, Hinderliter AL. Tolerability of the Oscar 2 ambulatory blood pressure monitor among research participants: a cross-sectional repeated measures study. BMC Med Res Methodol. 2011;11:59. PMID: 21524301. https://doi.org/10.1186/1471-2288-11-59
159. Manning G, Rushton L, Donnelly R, et al. Variability of diurnal changes in ambulatory blood pressure and nocturnal dipping status in untreated hypertensive and normotensive subjects. American journal of hypertension. 2000;13(9):1035-8. PMID: 10981556. https://doi.org/10.1016/s0895-7061(00)00261-2
160. Nasothimiou EG, Karpettas N, Dafni MG, et al. Patients' preference for ambulatory versus home blood pressure monitoring. Journal of human hypertension. 2013;28(4):224-9. PMID: 24152822. https://doi.org/10.1038/jhh.2013.104
161. Kuwajima I, Nishinaga M, Kanamaru A. The accuracy and clinical performance of a new compact ambulatory blood pressure monitoring device, the ES-H531. American journal of hypertension. 1998;11(11:Pt 1):t-33. PMID: 9832176. https://doi.org/10.1016/s0895-7061(98)00155-1
162. Tompson AC, Ward AM, McManus RJ, et al. Acceptability and psychological impact of out-of-office monitoring to diagnose hypertension: an evaluation of survey data from primary care patients. British Journal of General Practice. 2019;69(683):e389-e97. PMID: 30910876. https://dx.doi.org/10.3399/bjgp19X702221
163. Sherwood A, Hill LK, Blumenthal JA, et al. The Effects of Ambulatory Blood Pressure Monitoring on Sleep Quality in Men and Women With Hypertension: Dipper vs. Nondipper and Race Differences. American journal of hypertension. 2019;32(1):54-60. PMID: 30204833. https://dx.doi.org/10.1093/ajh/hpy138
164. Czernichow S, Zanchetti A, Turnbull F, et al. The effects of blood pressure reduction and of different blood pressure-lowering regimens on major cardiovascular events according to baseline blood pressure: meta-analysis of randomized trials. Journal of hypertension. 2011;29(1):4-16. PMID: 20881867. https://doi.org/10.1097/HJH.0b013e32834000be
165. Blood Pressure Lowering Treatment Trialists Collaboration. Blood pressure-lowering treatment based on cardiovascular risk: a meta-analysis of individual patient data. Lancet. 2014;384(9943):591-8. PMID: 25131978. https://doi.org/10.1016/S0140-6736(14)61212-5
166. Xie X, Atkins E, Lv J, et al. Effects of intensive blood pressure lowering on cardiovascular and renal outcomes: updated systematic review and meta-analysis. Lancet. 2016;387(10017):435-43. PMID: 26559744. https://doi.org/10.1016/S0140-6736(15)00805-3
167. Ettehad D, Emdin CA, Kiran A, et al. Blood pressure lowering for prevention of cardiovascular disease and death: a systematic review and meta-analysis. Lancet. 2016;387(10022):957-67. PMID: 26724178. https://doi.org/10.1016/S0140-6736(15)01225-8

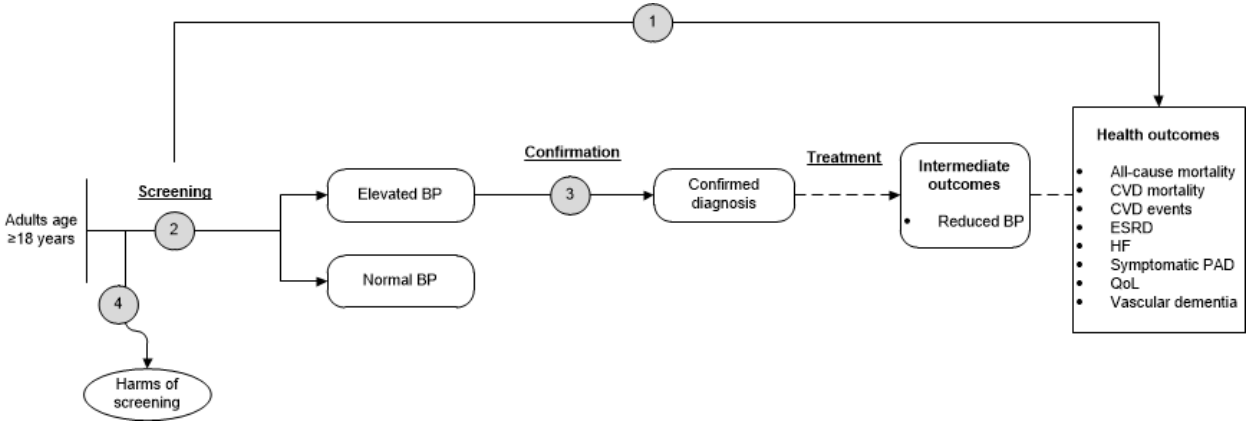
168. Bundy JD, Li C, Stuchlik P, et al. Systolic Blood Pressure Reduction and Risk of Cardiovascular Disease and Mortality: A Systematic Review and Network Meta-analysis. JAMA Cardiol. 2017;2(7):775-81. PMID: 28564682. https://doi.org/10.1001/jamacardio.2017.1421
169. Brunstrom M, Carlberg B. Association of Blood Pressure Lowering With Mortality and Cardiovascular Disease Across Blood Pressure Levels: A Systematic Review and Meta-analysis. JAMA internal medicine. 2018;178(1):28-36. PMID: 29131895. https://doi.org/10.1001/jamainternmed.2017.6015
170. Moran AE, Pletcher MJ, Bibbins-Domingo K. Whom to Treat for High Blood Pressure-Time for a Precision Approach. JAMA internal medicine. 2018;178(1):37-8. PMID: 29297011. https://doi.org/10.1001/jamainternmed.2017.7853
171. Wilt TJ, Kansagara D, Qaseem A. Hypertension Limbo: Balancing Benefits, Harms, and Patient Preferences Before We Lower the Bar on Blood Pressure. Ann Intern Med. 2018;168(5):369-70. PMID: 29357397. https://doi.org/10.7326/M17-3293
172. National Institute for Health and Care Excellence. Hypertension in adults: diagnosis and managment. D. Evidence review for targets. 2019.
173. Weiss J, Kerfoot A, Freeman M, et al. Benefits and Harms of Treating Blood Pressure in Older Adults: A Systematic Review and Meta-analysis Department of Veterans Affairs, Health Services Research and Development Service; 2015.
174. Garrison SR, Kolber MR, Korownyk CS, et al. Blood pressure targets for hypertension in older adults. The Cochrane database of systematic reviews. 2017;8:CD011575. PMID: 28787537. https://dx.doi.org/10.1002/14651858.CD011575.pub2
175. Sundstrom J, Arima H, Jackson R, et al. Effects of blood pressure reduction in mild hypertension: a systematic review and meta-analysis. Ann Intern Med. 2015;162(3):184-91. PMID: 25531552. https://doi.org/10.7326/M14-0773
176. Bress AP, Colantonio LD, Cooper RS, et al. Potential Cardiovascular Disease Events Prevented with Adoption of the 2017 American College of Cardiology/American Heart Association Blood Pressure Guideline. Circulation. 2019;139(1):24-36. PMID: 30586736. https://doi.org/10.1161/CIRCULATIONAHA.118.035640
177. National Institute for Health and Care Excellence. Hypertension in adults: diagnosis and managment. A. Evidence review for diagnosis. 2019.
178. Reino-Gonzalez S, Pita-Fernandez S, Seoane-Pillado T, et al. How in-office and ambulatory BP monitoring compare: A systematic review and meta-analysis. Journal of Family Practice. 2017;66(1):E5-E12. PMID: 28188315.
179. Trudel X, Milot A, Brisson C. Persistence and progression of masked hypertension: a 5-year prospective study. International Journal of Hypertension. 2013;2013:836387. PMID: 24455208. https://doi.org/10.1155/2013/836387
180. Stergiou GS, Ntineri A, Kollias A. Management of Masked Hypertension: Why Are We Still Sitting on the Fence? Hypertension. 2016;68(6):1344-5. PMID: 27777358. https://doi.org/10.1161/HYPERTENSIONAHA.116.08393
181. Cuspidi C, Tadic M, Mancia G, et al. White-Coat Hypertension: the Neglected Subgroup in Hypertension. Sunhwangi. 2018;48(7):552-64. PMID: 29938429. https://dx.doi.org/10.4070/kcj.2018.0167
182. Briasoulis A, Androulakis E, Palla M, et al. White-coat hypertension and cardiovascular events: a meta-analysis. Journal of hypertension. 2016;34(4):593-9. PMID: 26734955. https://dx.doi.org/10.1097/HJH.0000000000000832

183. Huang Y, Huang W, Mai W, et al. White-coat hypertension is a risk factor for cardiovascular diseases and total mortality. Journal of hypertension. 2017;35(4):677-88. PMID: 28253216. https://dx.doi.org/10.1097/HJH.0000000000001226
184. Cohen JB, Lotito MJ, Trivedi UK, et al. Cardiovascular Events and Mortality in White Coat Hypertension: A Systematic Review and Meta-analysis. Ann Intern Med. 2019;170(12):853-62. PMID: 31181575. https://doi.org/10.7326/m19-0223
185. Shimbo D, Muntner P. Should Out-of-Office Monitoring Be Performed for Detecting White Coat Hypertension? Ann Intern Med. 2019;170(12):890-2. PMID: 31181573. https://doi.org/10.7326/m19-1134
186. Sheppard JP, Martin U, Gill P, et al. Prospective external validation of the Predicting Out-of-OFfice Blood Pressure (PROOF-BP) strategy for triaging ambulatory monitoring in the diagnosis and management of hypertension: observational cohort study. BMJ. 2018;361:k2478. PMID: 29950396. https://dx.doi.org/10.1136/bmj.k2478
187. Booth JN, 3rd, Muntner P, Diaz KM, et al. Evaluation of Criteria to Detect Masked Hypertension. J Clin Hypertens. 2016;18(11):1086-94. https://dx.doi.org/10.1111/jch.12830
188. Anstey DE, Booth JN, 3rd, Abdalla M, et al. Predicted Atherosclerotic Cardiovascular Disease Risk and Masked Hypertension Among Blacks in the Jackson Heart Study. Circ Cardiovasc Qual Outcomes. 2017;10(7). PMID: 28698190. https://dx.doi.org/10.1161/CIRCOUTCOMES.116.003421
189. Herrett E, Gadd S, Jackson R, et al. Eligibility and subsequent burden of cardiovascular disease of four strategies for blood pressure-lowering treatment: a retrospective cohort study. Lancet. 2019;394(10199):663-71. PMID: 31353050. https://doi.org/10.1016/S0140-6736(19)31359-5
190. Fagard RH, Staessen JA, Thijs L, et al. Response to antihypertensive therapy in older patients with sustained and nonsustained systolic hypertension. Systolic Hypertension in Europe (Syst-Eur) Trial Investigators. Circulation. 2000;102:1139-44. PMID: 10973843. https://doi.org/10.1161/01.cir.102.10.1139
191. Beckett NS, Peters R, Fletcher AE, et al. Treatment of hypertension in patients 80 years of age or older. N Engl J Med. 2008;358(18):1887-98. PMID: 18378519. https://doi.org/10.1056/NEJMoa0801369
192. Bulpitt CJ, Beckett N, Peters R, et al. Does white coat hypertension require treatment over age 80?: Results of the hypertension in the very elderly trial ambulatory blood pressure side project. Hypertension. 2013;61(1):89-94. PMID: 23172934. https://doi.org/10.1161/hypertensionaha.112.191791
193. Giorgini P, Weder AB, Jackson EA, et al. A review of blood pressure measurement protocols among hypertension trials: implications for "evidence-based" clinical practice. Journal of the American Society of Hypertension. 2014;8(9):670-6. PMID: 25224868. https://dx.doi.org/10.1016/j.jash.2014.07.024
194. Chen Y, Lei L, Wang JG. Methods of Blood Pressure Assessment Used in Milestone Hypertension Trials. Pulse. 2018;6(1-2):112-23. PMID: 30283753. https://dx.doi.org/10.1159/000489855
195. Nerenberg KA, Zarnke KB, Leung AA, et al. Hypertension Canada's 2018 Guidelines for Diagnosis, Risk Assessment, Prevention, and Treatment of Hypertension in Adults and Children. The Canadian journal of cardiology. 2018;34(5):506-25. PMID: 29731013. https://doi.org/10.1016/j.cjca.2018.02.022

196. Chiolero A, Anker D. Screening interval: a public health blind spot. Lancet Public Health. 2019;4(4):e171-e2. PMID: 30954137. https://doi.org/10.1016/S2468-2667(19)30041-6
197. Garrison GM, Oberhelman S. Screening for hypertension annually compared with current practice. Ann Fam Med. 2013;11(2):116-21. PMID: 23508597. https://doi.org/10.1370/afm.1467
198. Niiranen TJ, Henglin M, Claggett B, et al. Trajectories of Blood Pressure Elevation Preceding Hypertension Onset: An Analysis of the Framingham Heart Study Original Cohort. JAMA Cardiol. 2018;3(5):427-31. PMID: 29562081. https://doi.org/10.1001/jamacardio.2018.0250
199. Ye C, Fu T, Hao S, et al. Prediction of Incident Hypertension Within the Next Year: Prospective Study Using Statewide Electronic Health Records and Machine Learning. J Med Internet Res. 2018;20(1):e22. PMID: 29382633. https://doi.org/10.2196/jmir.9268
200. Selassie A, Wagner CS, Laken ML, et al. Progression is accelerated from prehypertension to hypertension in blacks. Hypertension. 2011;58(4):579-87. PMID: 21911708. https://doi.org/10.1161/hypertensionaha.111.177410
201. Thomas SJ, Booth JN, 3rd, Dai C, et al. Cumulative Incidence of Hypertension by 55 Years of Age in Blacks and Whites: The CARDIA Study. J Am Heart Assoc. 2018;7(14). PMID: 29997132. https://doi.org/10.1161/JAHA.117.007988
202. Pannarale G, Moroni C, Acconcia MC, et al. The natural history of prehypertension. A 20-year follow-up. Eur Rev Med Pharmacol Sci. 2017;21(6):1329-34. PMID: 28387894.
203. Lindbohm JV, Sipila PN, Mars NJ, et al. 5-year versus risk-category-specific screening intervals for cardiovascular disease prevention: a cohort study. Lancet Public Health. 2019;4(4):e189-e99. PMID: 30954144. https://doi.org/10.1016/S2468-2667(19)30023-4
204. Myers MG, Cloutier L, Gelfer M, et al. Blood Pressure Measurement in the Post-SPRINT Era: A Canadian Perspective. Hypertension. 2016;68(1):e1-3. PMID: 27185747. https://doi.org/10.1161/hypertensionaha.116.07598
205. Jegatheswaran J, Ruzicka M, Hiremath S, et al. Are Automated Blood Pressure Monitors Comparable to Ambulatory Blood Pressure Monitors? A Systematic Review and Meta-analysis. The Canadian journal of cardiology. 2017;33(5):644-52. PMID: 28449834. https://doi.org/10.1016/j.cjca.2017.01.020
206. Pappaccogli M, Di Monaco S, Perlo E, et al. Comparison of Automated Office Blood Pressure With Office and Out-Off-Office Measurement Techniques. Hypertension. 2019;73(2):481-90. PMID: 30624994. https://doi.org/10.1161/hypertensionaha.118.12079
207. Rinfret F, Cloutier L, Wistaff R, et al. Comparison of Different Automated Office Blood Pressure Measurement Devices: Evidence of Nonequivalence and Clinical Implications. Canadian Journal of Cardiology. 2017;33(12):1639-44. PMID: 29173603. https://dx.doi.org/10.1016/j.cjca.2017.09.011
208. Myers MG, Valdivieso M, Kiss A, et al. Comparison of two automated sphygmomanometers for use in the office setting. Blood pressure monitoring. 2009;14(1):45-7. PMID: 19190490. https://doi.org/10.1097/MBP.0b013e32831e314f
209. Lindholt JS, Sogaard R. Population screening and intervention for vascular disease in Danish men (VIVA): a randomised controlled trial. Lancet. 2017;390(10109):2256-65. PMID: 28859943. https://doi.org/10.1016/S0140-6736(17)32250-X

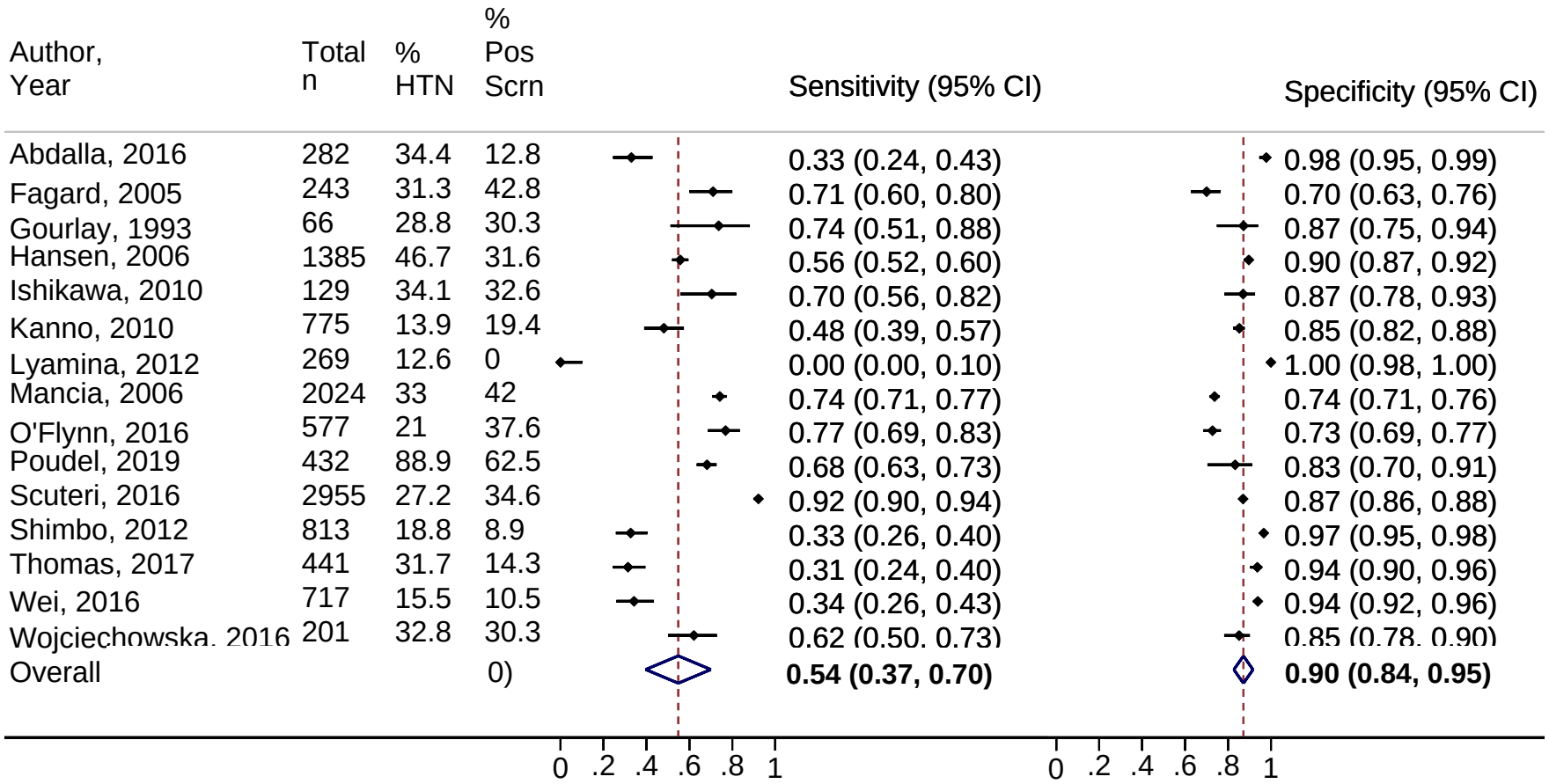
210. Shimbo D, Abdalla M, Falzon L, et al. Studies comparing ambulatory blood pressure and home blood pressure on cardiovascular disease and mortality outcomes: a systematic review. Journal of the American Society of Hypertension. 2016;10(3):224-34 e17. PMID: 26822864. https://doi.org/10.1016/j.jash.2015.12.013
211. Salles GF, Reboldi G, Fagard RH, et al. Prognostic Effect of the Nocturnal Blood Pressure Fall in Hypertensive Patients: The Ambulatory Blood Pressure Collaboration in Patients With Hypertension (ABC-H) Meta-Analysis. Hypertension. 2016;67(4):693-700. https://dx.doi.org/10.1161/HYPERTENSIONAHA.115.06981
212. Schmidt BM, Durao S, Toews I, et al. Screening strategies for hypertension: a systematic review protocol. BMJ Open. 2019;9(1):e025043. PMID: 30647046. https://dx.doi.org/10.1136/bmjopen-2018-025043
213. Green B. Blood Pressure Checks for Diagnosing Hypertension (BP-CHECK). NCT03130257. https://clinicaltrials.gov/ct2/show/NCT03130257?term=BP-CHECK&rank=1. Accessed.
214. Rhee M. Diagnosis of Hypertension by Home Blood Pressure Monitoring: NCT03855605. https://clinicaltrials.gov/ct2/show/NCT03855605. Accessed.
215. Kronish I. Implementing Hypertension Screening Guidelines in Primary Care: NCT03480217. https://clinicaltrials.gov/show/nct03480217. Accessed.
216. Siso Almairall A. Validity of 1BPM for Diagnosis of Hypertension: NCT03147573. https://clinicaltrials.gov/ct2/show/NCT03147573. Accessed.
217. Egan BM, Li J, Hutchison FN, et al. Hypertension in the United States, 1999 to 2012: progress toward Healthy People 2020 goals. Circulation. 2014;130(19):1692-9. PMID: 25332288. https://doi.org/10.1161/CIRCULATIONAHA.114.010676
218. Department of Veterans Affairs, Department of Defense. VA/DoD clinical practice guideline for the diagnosis and management of hypertension in the primary care setting. https://www.healthquality.va.gov/guidelines/CD/htn/VADoDHypertensionCPG508Corrected792020.pdf. Accessed.
219. American Academy of Family Physicians. Summary of Recommendations for Clinical Preventive Services. Leawood, KS: 2017.
220. James PA, Oparil S, Carter BL, et al. 2014 Evidence-based guideline for the management of high blood pressure in adults: Report from the panel members appointed to the Eighth Joint National Committee (JNC 8). JAMA. 2014;311(5):507-20. PMID: 24352797. https://doi.org/10.1001/jama.2013.284427

Figure 1. Analytic Framework



Abbreviations: BP = blood pressure; CVD = cardiovascular disease; ESRD = end-stage renal disease; HF = heart failure; QoL = quality of life; PAD = peripheral artery disease.

Figure 2. KQ2: Test Accuracy of Screening Office Blood Pressure Monitoring at a Threshold of ≥140/90 mm Hg* to Identify Hypertension Detected by Ambulatory Blood Pressure Monitoring, by Author



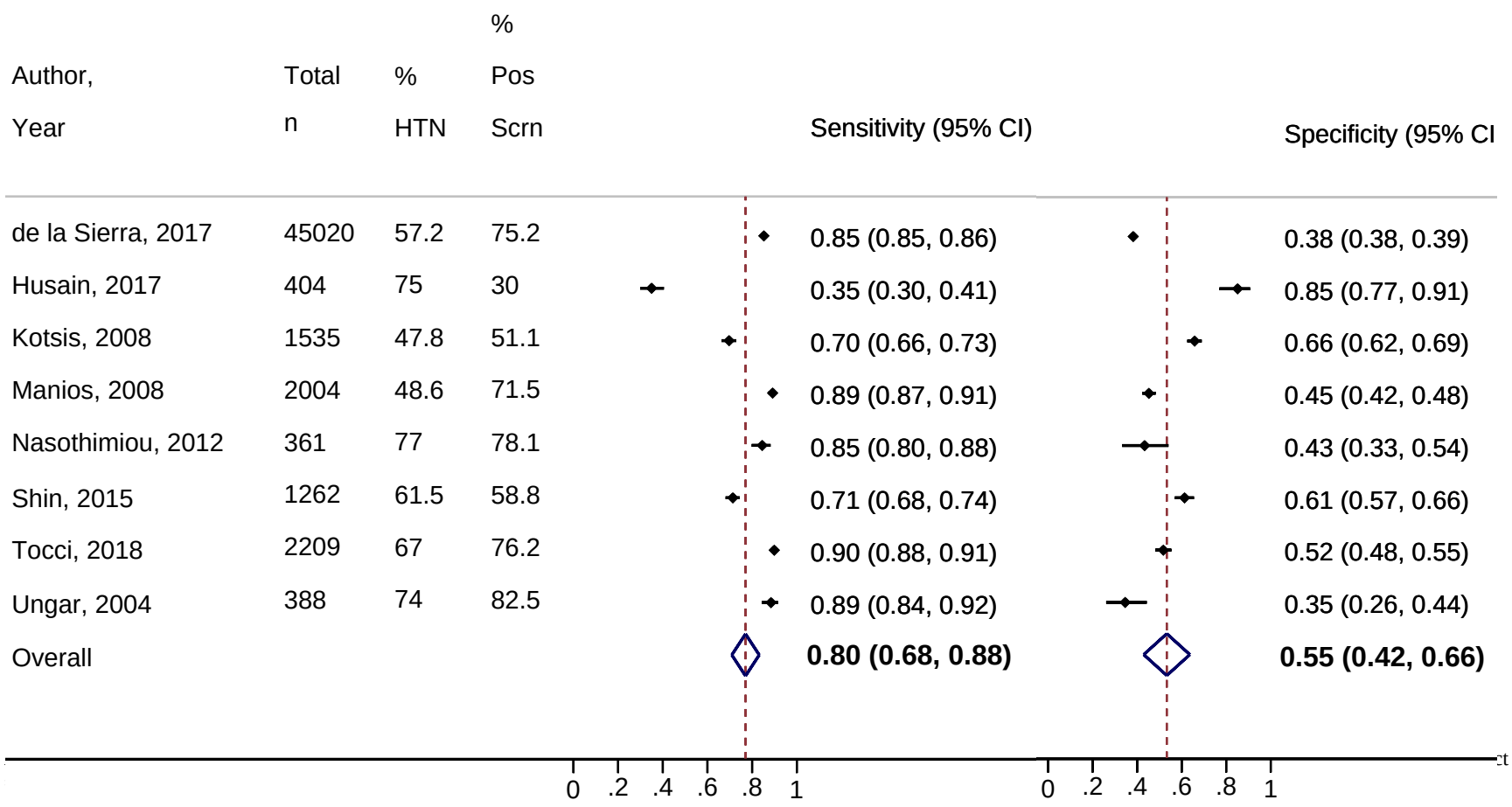
Abbreviations: ABPM = ambulatory blood pressure measurement; AM = daytime; CI = confidence interval; combo = combination; Dx TH = diagnostic threshold; HTN = hypertension; n = number; PM = nighttime; pct = percent; pos scrn = positive screen; 24 = 24-hour

Notes: The ABPM diagnostic threshold for Wojciechowska is ≥130/80 mm Hg for 24 ABPM, ≥135/85 mm Hg for daytime ABPM, and ≥120/70 mm Hg for nighttime ABPM. For Lyamina the diagnostic threshold is ≥135/85mm Hg for daytime ABPM, and ≥120/70 mm Hg for nighttime ABPM.

Sensitivity I^2=97.8; Specificity I^2=96.7

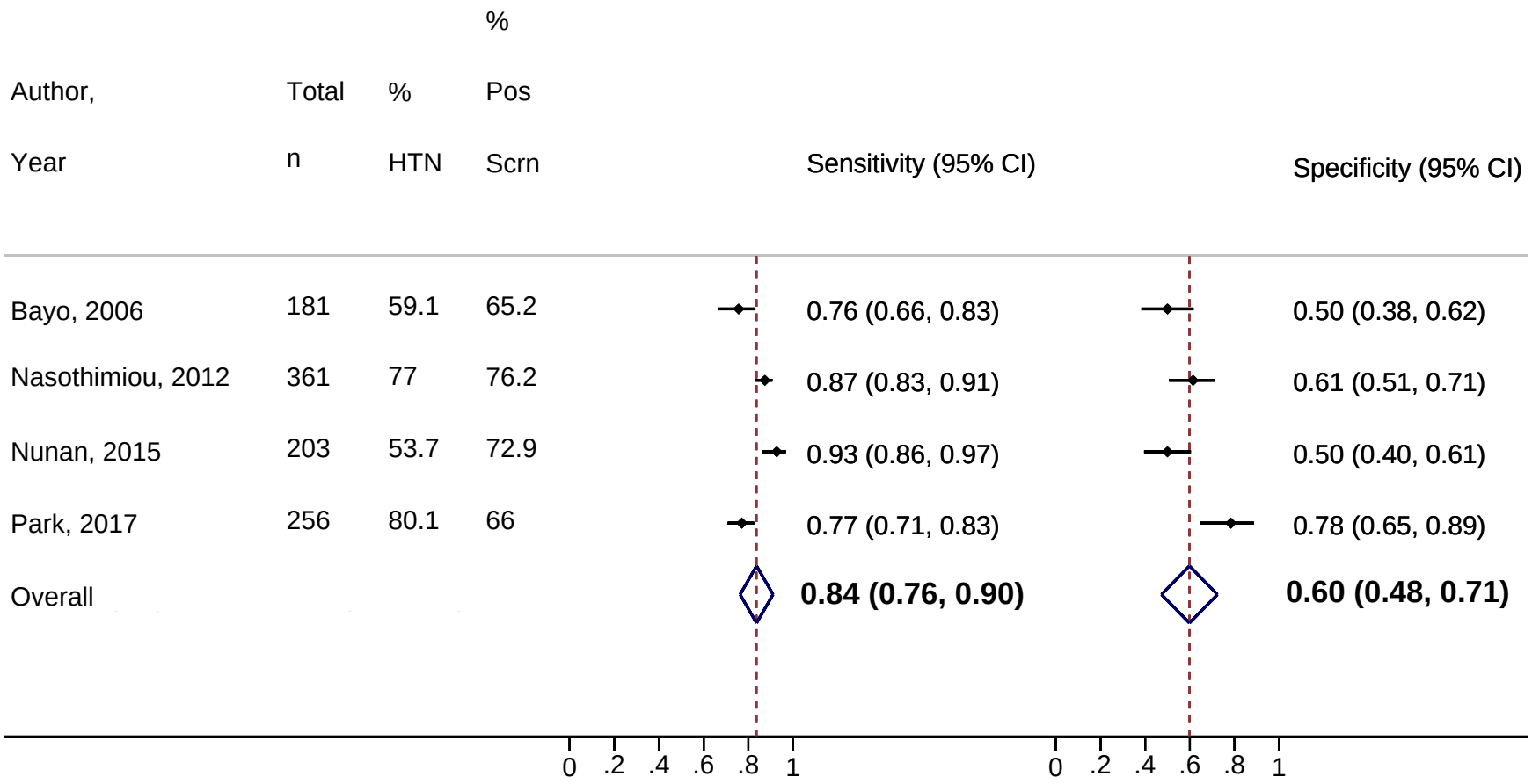
*Gourlay used a threshold of ≥150/90 for OBPM.

Figure 3. KQ3: Test Accuracy of Confirmatory Office Blood Pressure Monitoring at a Threshold of ≥140/90 mm Hg to Identify Hypertension Detected by Ambulatory Blood Pressure Monitoring, by Author



Note: Sensitivity I^2=99.2; Specificity I^2=98.6

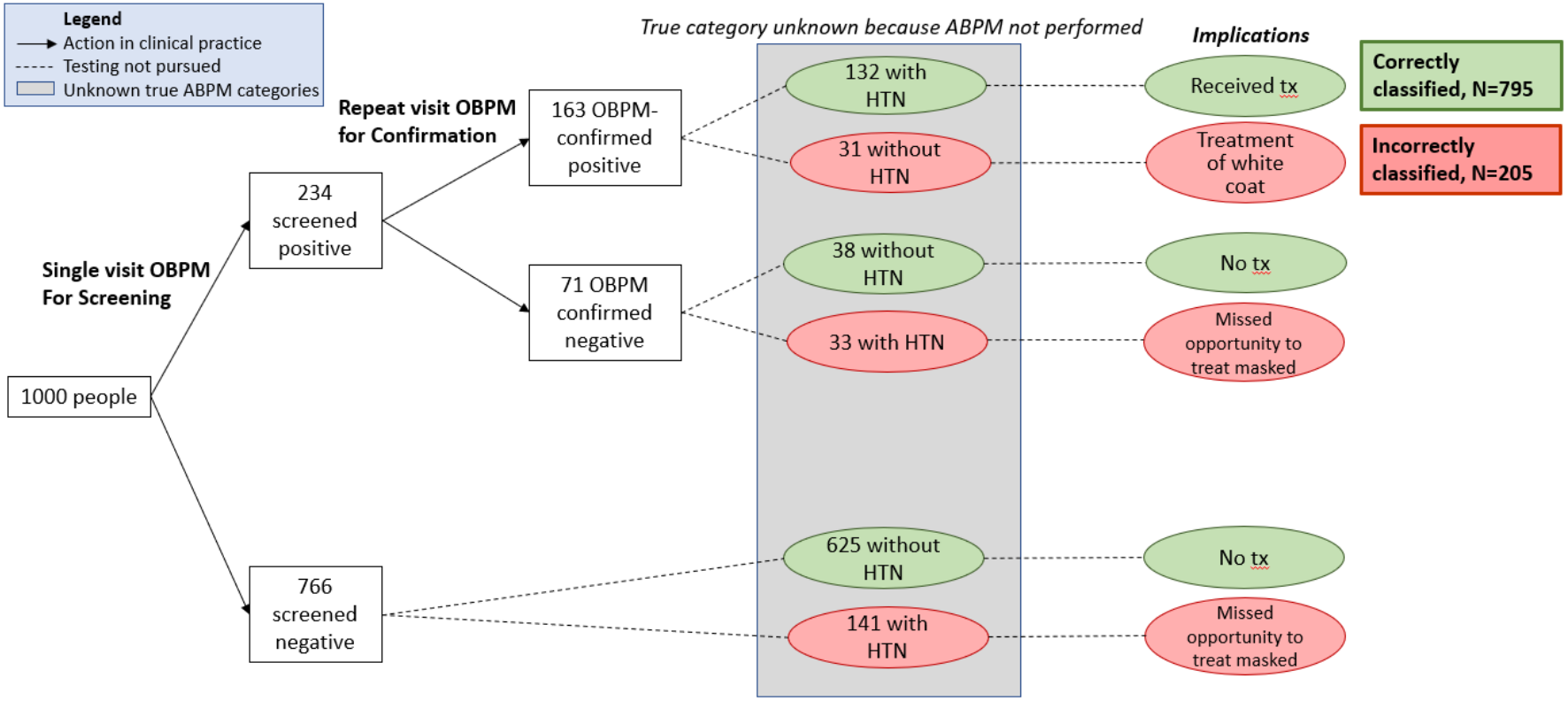
Figure 4. KQ3: Test Accuracy of Confirmatory Home Blood Pressure Monitoring at a Threshold of ≥135/85 mm Hg to Identify Hypertension Detected by Ambulatory Blood Pressure Monitoring, by Author



Abbreviations: ABPM = ambulatory blood pressure measurement; AM = daytime; CI = confidence interval; Dx TH = diagnostic threshold; HTN = hypertension; n = number; pct = percent; pos scrn = positive screen; 24 = 24-hour

Notes: Sensitivity I^2=85.1; Specificity I^2=77.8
The pooled analysis for Nunan, 2015 used accuracy for HBPM measured over 1-7 days; analyses for alternate intervals reported in KQ3a

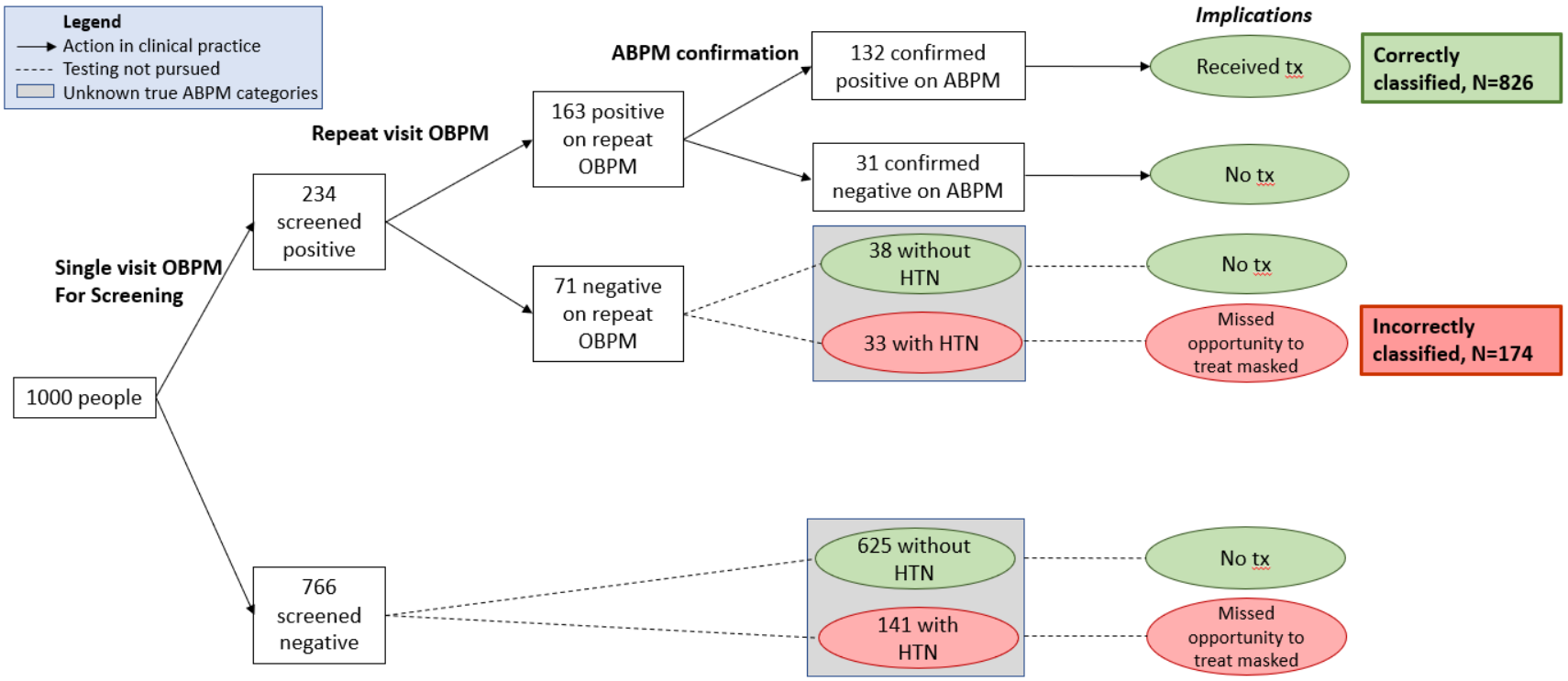
Figure 5. Hypothetical Screening With Confirmation Testing Done in Office, Treatment Based on Repeat OBPM Confirmation



Assumptions: Prevalence of 30.6% based on 24-h ABPM in untreated population 40-60 years old based on IDACO IPD-MA.[32] Screening OBPM sensitivity 0.54, specificity 0.90 based on KQ2 pooled estimates; for confirmatory testing with OBPM, sensitivity 0.80, specificity 0.55 based on KQ3 pooled estimates.

Abbreviations: ABPM = ambulatory blood pressure measurement; OBPM = office blood pressure measurement; HTN = hypertension; N = number; tx = treatment

Figure 6. Hypothetical Screening and Repeat Office Testing With ABPM Confirmation, Treatment Based on ABPM Confirmation



Assumptions: Prevalence of 30.6% based on 24-h ABPM in untreated population 40-60 years old based on IDACO IPD-MA.[32] Screening OBPM sensitivity 0.54, specificity 0.90 based on KQ2 pooled estimates; for confirmatory testing with OBPM, sensitivity 0.80, specificity 0.55 based on KQ3 pooled estimates.

Abbreviations: ABPM = ambulatory blood pressure measurement; OBPM = office blood pressure measurement; HTN = hypertension; N = number; tx = treatment

Table 1. Blood Pressure Classifications

JNC7 Blood Pressure Classification[2]	SBP (mm Hg)	DBP (mm Hg)	ACC/AHA HTN categories[20]†	SBP (mm Hg)	DBP (mm Hg)
Normal	<120	and <80	Normal	<120	and <80
Prehypertension	120-139	or 80-89	Elevated	120-129	and <80
Stage 1 hypertension	140-159	or 90-99	Stage 1 hypertension	130-139	or 80-89
Stage 2 hypertension*	≥160	or ≥100	Stage 2 hypertension	≥140	≥90

*Previous definitions of Stage 2 and Stage 3 hypertension have been combined under Stage 2 hypertension
† Individuals with SBP and DBP in 2 categories should be designated to the higher BP category. BP indicates blood pressure (based on an average of ≥2 careful readings obtained on ≥2 occasions, as detailed in Section 4); DBP, diastolic blood pressure; and SBP systolic blood pressure.
Abbreviations: ACC = American College of Cardiology; AHA = American Heart Association; DBP = diastolic blood pressure; HTN = hypertension; JNC 7 = Seventh report of the Joint National Committee on Prevention on Detection, Evaluation, and Treatment of High Blood Pressure; mm Hg = millimeters of Mercury; SBP = systolic blood pressure

Table 2. Risk of Hypertension by Selected Demographic and Clinical Characteristics, NHANES 1999-2012[217]

Demographic or Clinical Characteristic	Odds Ratio (95% CI) for Prevalent Hypertension
Age <45 vs ≥65	0.08 (0.07–0.10)
Age 45-64 vs ≥65	0.35 (0.32–0.39)
Black vs white	1.86 (1.64–2.12)
Hispanic vs white	0.87 (0.74–1.03)
Male vs female	1.10 (1.01–1.22)
Diabetes vs no diabetes	1.58 (1.38–1.79)
Increase of BMI by 5 kg/m^2	1.44 (1.38–1.49)
Smoker vs nonsmoker	0.96 (0.85–1.08)
Treated vs untreated for cholesterol	2.29 (2.00–2.63)

Abbreviations: CI = confidence interval; kg/m^2 = kilogram per square meter; NHANES = National Health and Nutrition Examination Survey; vs = versus

Table 3. Prevalence of Hypertension (≥130/80 mm Hg or Taking Anti-Hypertensive Medication) Among Adults Aged 18 Years and Older in the United States, 2017-2018[21]

Demographic	Characteristic	Men, %	Women, %
Overall	All individuals	51.0	39.7
Age (years)	18-39	31.2	13.0
	40-59	59.4	49.9
	≥60	75.2	73.9
Race	Non-Hispanic White	50.2	36.7
	Non-Hispanic Black	57.2	56.7
	Hispanic	50.1	36.8
	Asian	NR	NR
	American Indian/Alaska Native	NR	NR

Since 1999, BP in NHANES has been measured in a mobile examination center by a physician by taking 3 consecutive blood pressure readings in the same arm which are then averaged.
Abbreviations: BP = blood pressure; mm Hg = millimeters of mercury; NHANES = National Health and Nutrition Examination Survey; NR = not reported

Table 4. Recommendations of Others for Screening and Confirmation of a Hypertension Diagnosis

Organization,	Frequency	Initial Screening	Confirmation
2017 American College of Cardiology/ American Heart Association (ACC/AHA) Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure and Adults[20]	In adults with white coat HTN, annual monitoring with either ABPM or HBPM is reasonable to detect transition to sustained hypertension	Proper methods are recommended for accurate measurement and documentation of BP in the office, including: having the patients sit in a chair with feet on the floor and back supported for >5 mins ; no caffeine, exercise, or smoking for at least 30 minutes before measurement; ensure patient has emptied bladder; no talking during the rest period or measurement; remove all clothing in location of cuff placement; using a validated and calibrated device; supporting the patient's arm; positioning cuff at the midpoint of the sternum; using the correct size cuff; record BP in both arms during first visit, using the arm with the higher reading for subsequent readings; separate repeated measurements by 1-2 minutes; use proper deflation speed for auscultatory readings; properly document the readings; average at least 2 readings obtained on at least 2 occasions to estimate BP; and provide patient SBP and DBP both verbally and in writing	Out-of-office BP measurements are recommended to confirm the diagnosis of hypertension In adults with an untreated SBP 130-160 mm Hg or DBP 80-100 mm Hg it is reasonable to screen for the presence of white coat hypertension by using either daytime ABPM or HBPM before diagnosis of hypertension In adults with untreated office BPs that are consistently between 120-129 mm Hg SBP or between 75-79 mm Hg DBP, screening for masked hypertension with daytime ABPM or HBPM is reasonable
VA/DoD, 2020[218]	Periodic (not further specified)	Use attended or unattended, fully automated office blood pressure measurement (programmed to wait five minutes and record the average of three measurements separated by at least 30 seconds). When fully automated blood pressure measurement is not available, measure blood pressure using a standard technique and a properly calibrated and validated sphygmomanometer.	If BP is ≥130/80 mm Hg, measure again after 1-4 weeks Use out-of-office blood pressure monitoring methods (ambulatory 24-hour monitoring or home blood pressure measurements) to inform the diagnosis and management of hypertension in select patients (masked HTN should be suspected in individuals with normal or controlled OBPM if they report higher HBPM, and in the presence of target organ damage and certain chronic conditions such as CKD)
2019 National Institute for Health and Clinical Excellence[68]*	Recheck every 5 years for adults with normal BP and consider rechecking more frequently for adults with BP close to 140/90 mm Hg Measure BP at least annually in adults with DM without previously diagnosed HTN or renal disease	Ensure that healthcare professionals taking blood pressure measurements have adequate initial training and periodic review of their performance. Because automated devices may not measure BP accurately if there is pulse irregularity (for example, due to atrial fibrillation), palpate the radial or brachial pulse before measuring BP. If pulse irregularity is present, measure blood pressure manually using direct auscultation over the brachial artery. Healthcare providers must ensure that devices for measuring BP are properly validated, maintained and regularly recalibrated according to manufacturers' instructions.	If the clinic blood pressure is between 140/90 and180/110 mm Hg, offer ABPM to confirm the diagnosis of hypertension (use average of ≥14 measurement taken during the person's usual waking hours). ABPM diagnostic threshold: ≥135/85 (daytime) If a person is unable to tolerate ABPM, HBPM is a suitable alternative to confirm the diagnosis of hypertension (twice in morning and evening for at least 4 days, ideally 7 days and discard first day measurements to obtain average value). HBPM diagnostic threshold: ≥135/85

Table 4. Recommendations of Others for Screening and Confirmation of a Hypertension Diagnosis

Organization,	Frequency	Initial Screening	Confirmation
		When measuring blood pressure in the clinic or in the home, standardize the environment and provide a relaxed, temperate setting, with the person quiet and seated, and their arm outstretched and supported. Use an appropriate cuff size for the person's arm. When considering a diagnosis of hypertension, measure BP in both arms. If the difference in readings between arms is >15 mm Hg, repeat the measurements. If the difference in readings between arms remains >15 mm Hg on the second measurement, measure subsequent BPs in the arm with the higher reading. If blood pressure measured in the clinic is ≥140/90 mm Hg, take a second measurement. If the second measurement is substantially different from the first, take a third measurement. Record the lower of the last two measurements as the clinic blood pressure	If the person has severe hypertension and target organ damage is identified, consider starting antihypertensive drug treatment immediately, without waiting for the results of ABPM or HBPM. If no target organ damage is identified, repeat clinic blood pressure measurement within 7 days.
Hypertension Canada (formerly the Canadian Hypertension Education Program [CHEP])[195]	At all appropriate visits, which is left to the discretion of each practitioner	Measurement should be taken by health care professionals who have been specifically trained to measure blood pressure accurately using standardized measurement techniques and validated equipment for all methods. AOBP is the preferred method of performing in-office measurement. When using AOBP, a displayed mean SBP ≥135 or DBP ≥85 mm Hg is considered high. When using non-AOBP, a mean SBP ≥140 or DBP ≥90 mm Hg is considered high. SBP between 130-139 and DBP 85-89 is considered high-normal. If non-AOBP used, at least 3 readings should be taken, and the mean calculated after discarding the first measurement.	Diagnosis should be confirmed by performing out-of-office measurement, if possible. ABPM is the recommended measurement method; HBPM is recommended if ABPM is not tolerated, not readily available, or because of patient preference. Using ABPM, patients can be diagnosed as hypertensive if mean awake SBP is ≥135 or DBP is ≥85 mm Hg or if the mean 24-hr SBP is ≥130 mm Hg or DBP ≥80 mm Hg Using HBPM, patients can be diagnosed as hypertensive if mean awake SBP is ≥135 or DBP is ≥85 mm Hg. Duplicate measurement should be done in the morning and evening for 7 days, and results should be averaged after excluding the first day's readings. If OBPM is high and mean HBPM is <135/85 mm Hg, either repeat HBPM to confirm that HBPM is <135/85 mm Hg or perform 24-hr ABPM to confirm that mean 24-hr ABPM is <130/80 and mean awake ABPM is <135/95 before diagnosing white coat hypertension. If white coat hypertension is diagnosed, annual BP measurement is recommended to monitor progression.

Table 4. Recommendations of Others for Screening and Confirmation of a Hypertension Diagnosis

Organization,	Frequency	Initial Screening	Confirmation
			Serial office measurements over 3-5 visits can be used if ABPM or HBPM is not available.
2018 European Society of Hypertension/European Society of Cardiology Guidelines for the Management of Arterial Hypertension[79]	Screening programs for HTN are recommended and all adults should have their office BP measured and recorded in their medical file and be aware of their BP. Rescreen BP every 5 years if BP remains optimal, rescreen every 3 years if BP remains normal, and rescreen at least annually if BP is high-normal. Consider screening more frequently in patients >50 years.	Auscultatory or oscillometric semiautomatic or automatic sphygmomanometers are the preferred method for measure BP in the doctor's office. BP measurement devices should be validated according to standard protocols. The following techniques should be used: allow patient to sit in a quiet environment for 5 minutes before beginning BP measurements; take at least three BP measurements, in the sitting position, spaced 1–2 min apart, and additional measurements if the first two differ by >10 mm Hg and consider the average of the last two BP readings; use a standard bladder (12–13 cm wide and 35 cm long), but have a larger and a smaller bladder available for large (arm circumference >32 cm) and thin arms, respectively; have the cuff at the heart level, whatever the position of the patient; measure BP in both arms at first visit to detect possible differences.	The diagnosis of hypertension (mean ≥140/90 mm Hg) should be based on repeated office BP measurements on more than one visit, except when HTN is severe, or out-of-office BP measurement with ABPM and/or HBPM provided that these measurements are logistically and economically feasible. Out-of-office BP is specifically recommended for a number of clinical indications, including identifying white-coast and masked hypertension. Diagnostic threshold for HBPM is ≥135/85 mm Hg. For diagnostic evaluation BP, HBPM should be measured daily on at least 3 days and preferably on 6-7 consecutive days; in the mornings as well as in the evenings. BP should be measured in a quiet room, with the patient in the seated position, back and arm supported, after 5 min of rest and with two measurements per occasion taken 1–2 min apart. Home BP is the average of these readings. Diagnostic threshold for daytime or awake ABPM is mean ≥135/85 mm Hg, mean ≥120/70 mm Hg for nighttime or asleep ABPM, or ≥130/80 mm Hg for 24-hr ABPM. 70% usable BP recordings are required for a valid ABPM measurement session.
American Academy of Family Physicians (AAFP), 2015[219]	Not specified	Screen for high blood pressure in adults aged 18 years or older. No additional details provided, but a link is provided to the USPSTF recommendation with an endorsement.	Obtain measurements outside of the clinical setting for diagnostic confirmation before starting treatment. No additional details provided, but a link is provided to the USPSTF recommendation.
Joint National Committee on Prevention, Detection, Evaluation and Treatment of Blood Pressure (JNC 7),† 2004[2]	Recheck in 2 years for adults with normal BP; recheck in 1 year for adults with high-normal BP	Measurements should be made by an operator who is trained and regularly retrained in the standardized technique, and the patient must be properly prepared and positioned. Persons should be seated quietly for at least 5 minutes in a chair, with feet on the floor, and arm supported at heart level. Caffeine, exercise, and smoking should be avoided for at least 30 minutes prior to measurement. An appropriately sized cuff (cuff bladder encircling at least 80 percent of the arm) should be used to ensure accuracy. At least two	Stage 1 hypertension diagnosis (140-159/90-99 mm Hg) should be confirmed within 2 months after initial elevated OBPM; the measurement method for confirmation is not specified Stage 2 hypertension (≥160/≥100 mm Hg) should be confirmed within 1 month; those with ≥180/110 mm Hg evaluate and treat immediately. Indications for the use of ABPM are: suspected white-coat hypertension in patients with hypertension and no

Table 4. Recommendations of Others for Screening and Confirmation of a Hypertension Diagnosis

Organization,	Frequency	Initial Screening	Confirmation
		measurements should be made and the average recorded.	target organ damage, apparent drug resistance, hypotensive symptoms with antihypertensive medication, episodic hypertension or autonomic dysfunction. The ABPM diagnostic threshold is mean ≥135/85 mm Hg (awake) or mean ≥120/75 mm Hg (sleep). HBPM can be used prior to consideration of ABPM. For those whose out-of-office BPs are consistently <130/80 mm Hg despite an elevated office BP, and who lack evidence of target organ disease, ABPM or drug therapy can be avoided. A protocol for HBPM is not reported.

* Update currently in progress with expected publication August 2019; the update will include the following systematically reviewed question on confirmation: In adults with suspected primary hypertension, what is the best method of measuring blood pressure (HBPM, ABOM, or OBPM) to establish the diagnosis and predict cardiovascular events?
† The JNC 8 Panel did not address diagnosis of hypertension in its 2014 guidelines. The Supplement to the guidelines includes additional content not supported by a systematic review but that is intended to aid in implementing the main guidelines. In the Supplement the JNC 8 Panel recommends averaging 2-3 measurements at each visit to establish a diagnosis of hypertension. Definitions of hypertension were not addressed but thresholds for pharmacologic treatment were defined. HBPM and ABPM were not addressed[220]

Abbreviations: AAFP = American Academy of Family Physicians; ABPM = ambulatory blood pressure measurement; ACC = American College of Cardiology; ACP = American College of Physicians; AHA = American Heart Association; AOBP = automated office blood pressure; BP = blood pressure; CHEP = Canadian Hypertension Education Program; HBPM = home blood pressure monitoring; JNC = Joint National Committee on Prevention, Detection, Evaluation and Treatment of Blood Pressure; mm Hg = millimeters of mercury; NR = not reported; OBPM = office blood pressure measurement; USPSTF = United States Preventive Services Task Force

Table 5. Blood Pressure Measurement Modalities

Method	Brief Description
OBPM	Office based BP measurement (OBPM) can be performed using the *manual auscultatory** method or with an *oscillometric†* sphygmomanometer.
AOBP	Automated office BP (AOBP) is a specific type of OBPM where multiple pre-programmed measurements, usually spaced one minute apart over 4-7 minutes, are taken while the patient is in a quiet room; may be attended or unattended.
HBPM	Home blood pressure measurement (HBPM) is when an individual uses an automated oscillometric device to measure BP while seated and resting at home; measurements are taken at one or more times per day over days to weeks, but protocols vary.
ABPM	Ambulatory blood pressure measurement (ABPM) is the use of a preprogrammed device typically worn by patient for 12 or 24 hours during their normal activities (including sleep) in and outside of the home; automated to take BPs at 20-30 minute intervals.
Kiosk	A kiosk is a station where BP is automatically assessed by a device that is triggered by the individual having their BP measured; kiosks are designed to operate without the assistance of medical staff and are often located in pharmacies or other public or private settings.

* The manual auscultatory method involves a trained observer using a stethoscope to detect Korotkoff sounds, which are made by the turbulent flow of blood past the restricted area created by the inflated cuff. The readings are made using a mercury or aneroid sphygmomanometer at the brachial artery.

† Oscillometric sphygmomanometers use a pressure transducer to assess the oscillations of pressure in a cuff during gradual deflation. The point of maximum oscillation corresponds to the mean intra-arterial pressure. Systolic and diastolic measurements are then calculated based on an empirically derived algorithm.

Table 6. Study and Baseline Population Characteristics of Included Studies for KQ2, by Author

Author, Year Study name Quality	Country	Brief population description	Recruitment setting	N analyzed	Mean, OBPM, SBP/DBP (mmHg)	Mean ABPM, SBP/DBP (mmHg)	Age, mean (range)	% female	% white	% DM	Mean BMI, kg/m^2
Abdalla, 2016[90] The Improving the Detection of HTN study Fair	US	Community-based sample of adults aged 20 to 81	Community-based	282	116.0/75.6	124.5/77.7*	34.9 (20-81)	58.0	NR‡	5.0	27.0
Fagard, 2005[91] Fair	Belgium	Adults ≥60 years from primary care practice	Primary care	243	136.7/76.2	128.0/76.6*	70 (≥60)	52.4	NR	7.2	26.7
Gill, 2017[82] BP-Eth Fair	UK	Adults 40-75 years not previously identified as hypertensive	Primary care	211	NR	NR	55.8 (40-75)	53.1	46.4	5.7	28.1
Gosse, 2010[92] PROOF Fair	France	Adults ≥65 years	Community-based	738	141.4/87.1	122.7/78.8* 118.0/75.8†	65 (65-65)	60.0	NR	4.3	24.9
Gourlay, 1993[93] Fair	Australia	Untreated adults agreeing to wear ABPM recorder	Community-based	66	133/82.7	130.8/75.7*	45 (21-67)	37.9	NR	NR	25.9
Hanninen, 2010[81] Fair	Finland	Adults 35-64 years	Community-based	254	121.7/76.6	127.2/77.8*	49.1 (35-64)	52.1	NR	NR	26.5
Hansen, 2006[94] MONICA Fair	Denmark	Adults aged 41 to 72 years, without major CVD	Community-based	1385	127.6/81.5	130.5/77.7*	61.3 (41-72)	52.9	100	2.4	25.6
Ishikawa, 2010[95] Fair	Japan	Residents ≥20 years	Community-based	129	132/82	121/74†	59.9 (≥20)	52.7	NR	15.5	24.0
Kanno, 2010[96] Ohasama Study Fair	Japan	Adults ≥40 years	Community-based	775	128.9/71.6	130.5/76.2* 124.872.1†	66.8 (NR)	72.3	NR	12.6	23.2
Larkin, 1998[80] Fair	US	Pts without serious medical disorders (except HTN), psychiatric	Community-based Primary care	65	127.8/82.7	132.8/81.9†	45.1 (20-69)	47.7	100	NR	NR

Table 6. Study and Baseline Population Characteristics of Included Studies for KQ2, by Author

Author, Year Study name Quality	Country	Brief population description	Recruitment setting	N analyzed	Mean, OBPM, SBP/DBP (mmHg)	Mean ABPM, SBP/DBP (mmHg)	Age, mean (range)	% female	% white	% DM	Mean BMI, kg/m^2
		disorders and those taking antihypertension meds									
Lyamina, 2012[97] Fair	Russia	Young subjects free of CVD, DM or other comorbidities	Cardiology outpatient§	269	NR	NR	25.6 (18-36)	62.4	NR	0	25.6
Mancia, 2006[98] PAMELA Good	Italy	Adults 25-74 years	Community-based	2024	132.8/83.8	120.2/74.4†	50.9 (25-74)	49.4	NR	NR	25.6
O'Flynn, 2016[99] Mitchelstown cohort Fair	Ireland	Adults, aged 50 to 69 years	Primary care	577	134/83	131/77* 124/72†	60 (50-69)	53	NR	9	29
Poudel, 2019[100] CARDIA Fair	US	African American and White men and women aged 48-60	Community-based	432	120/73	128/81* 123/76†	54.5 (48-60)	56	48.4	7.4	29.3
Scuteri, 2016[101] SardiNIA Fair	Italy	Residents aged ≥14 years	Community-based	2955	124.3/77.3	119.3/74.6†	49.0 (14-102)	60.1	NR	6.5	25.7
Selenta, 2000[102] Fair	Canada	Presumably healthy students and community members aged 17-68 years not taking cardioactive medications	Community-based	319	117.1/68.8	129.2/80.0*	27 (17-68)	51.7	70	NR	NR
Shimbo, 2012[103] Masked Hypertension Study Fair	US	Untreated adults ≥18 years with screening BP ≤160/105 mm Hg	Employment-based	813	116.3/76.0 (Mean of 3 readings)	123.1/77.4*	45.1 (NR)	58.4	NR	3.6	27.6

Table 6. Study and Baseline Population Characteristics of Included Studies for KQ2, by Author

Author, Year Study name Quality	Country	Brief population description	Recruitment setting	N analyzed	Mean, OBPM, SBP/DBP (mmHg)	Mean ABPM, SBP/DBP (mmHg)	Age, mean (range)	% female	% white	% DM	Mean BMI, kg/m^2
Thomas, 2017[104] Jackson Heart Study Fair	US	African American adults aged 20 to 95 years	Community-based	441	124.5/74.6	127.1/78.2*	NR (NR)	63.3	0	12.1	30.0
Wei, 2016[105] FLEMENGHO Fair	Belgium	Teen-aged and older household members with a records of ABPM and retinal photography	Community-based	717	120.7/74.8	122.8/76.1*	38.2 (NR)	51.3	100	1.0	24.7
Wojciechowska, 2016[106] Fair	Poland	Adults ≥18 years	Community-based	201	125.0/84.3	122.9/76.8* 118.9/73.4†	41.1 (NR)	53.2	100	NR	25.0

*Daytime ABPM. Nighttime ABPM: 109/63.7
†24-hr ABPM
‡ Reported 22% Black
§ Participants were recruited from local colleges and businesses when they presented for annual examinations in an outpatient cardiology clinic.

Abbreviations: ABPM = ambulatory blood pressure measurement; BMI = body mass index; CARDIA = the Coronary Artery Risk Development in Young Adults study; CVD = cardiovascular; DBP = diastolic blood pressure; DM = diabetes mellites; FLEMENGHO = the Flemish Study on Environment, Genes and Health Outcomes; HTN = hypertension; kg/m^2 = kilograms per meter squared; NR = not reported; MONICA = MONItoring of trends and determinants in Cardiovascular Disease study; mm HG = millimeter of mercury; OBPM = office-based BP measurement; PAMELA = Pressioni Arteriose Monitorate e Loro Associazioni study; PROOF = The Prognostic Indicator of Cardiovascular and Cerebrovascular Events study; SBP = systolic blood pressure; UK = United Kingdom; US = United States; yr(s) = year(s)

Table 7. Test Characteristics of Included Studies for KQ2, by Author

Author, Year Trial name Quality	OBPM threshold(s), mm Hg	OBPM Device (A or M)	Total # of office measurements in single visit	Method of determination	Interventionist attending	Resting time (min)	ABPM modality reference	Reference threshold, mm Hg
Abdalla, 2016[90] The Improving the Detection of HTN study Fair	≥140/90	Mercury sphyg (M)	3	Mean of 3	Research nurse/technician	1	Combined day and night	≥135/85 (day) or ≥120/70 (night)
Fagard, 2005[91] Fair	≥140/90	Mercury sphyg (M)	3	Mean of 3	Participants' usual PCP or assistant physician	5	Daytime	≥135/85
Gill, 2017[82] BP-Eth Fair	140/90*	BpTru (A)‡	18	Mean of second and third readings from the 3 visits	Research nurse	5	Daytime	135/85*
	135/85*	BpTru (A)‡	18	Mean of second and sixth readings from the 3 visits	Research nurse	5	Daytime	135/85*
	140/90*	BpTru (A)‡	18	First reading on the first visit	Research nurse	5	Daytime	135/85*
Gosse, 2010[92] Proof Fair	SBP ≥140	Mercury sphyg (M)	2	Mean of 2 SBPs while lying down	Physician	15	Daytime	SBP ≥135
Gourlay, 1993[93] Fair	≥150/90	Mercury sphyg (M)	2	Mean of 2	Nurse	NR	Daytime	≥135/85
	≥160/95	Mercury sphyg (M)	2	Mean of 2	Nurse	NR	Daytime	≥135/85
Hanninen, 2010[81] Fair	≥140/90	Mercury sphyg (M)	8	Mean of 8	Nurse	15	Daytime	≥140/85
Hansen, 2006[94] MONICA Fair	≥140/90	Random zero mercury sphyg (M)	2	Mean of 8	NR	5	24-hr Daytime	24-hr: ≥125/80 Daytime: ≥135/85
Ishikawa, 2010[95] Fair	≥140/90	UA-631; A&D Company, Ltd, Tokyo, Japan (A)	2	Mean of 2	Physician	5	24-hr	≥130/80
Kanno, 2010[96] Ohasama Study	≥140/90	USM700F; Ueda Electronic	2	Mean of 2	Nurses or technicians	2	24-hr Daytime	24-hr: ≥135/85 Daytime: ≥140/85

Table 7. Test Characteristics of Included Studies for KQ2, by Author

Author, Year Trial name Quality	OBPM threshold(s), mm Hg	OBPM Device (A or M)	Total # of office measurements in single visit	Method of determination	Interventionist attending	Resting time (min)	ABPM modality reference	Reference threshold, mm Hg
Fair		Work Co., Ltd., Tokyo, Japan (A)†						
Larkin, 1998[80] Fair	140/90	Mercury sphyg (M)	9	Mean of 9	Research assistant	10	24-hr Combined 24-hr, daytime, nighttime ABPM	24hr: ≥135/85 AND ≥140/90 Combined: ≥139/87 (24-hr) OR ≥143/91 (day) OR ≥127/79 (night)
Lyamina, 2012[97] Fair	≥140/90 with breath-hold	Mercury sphyg (M)	2	NR	Cardiologist	20	Combined day and night	≥135/85 (day) OR ≥120/70 (night)
	>120/80	Mercury sphyg (M)	2	NR	Cardiologist	20	Combined day and night	≥135/85 (day) OR ≥120/70 (night)
	≥140/90	Mercury sphyg (M)	2	NR	Cardiologist	20	Combined day and night	≥135/85 (day) OR ≥120/70 (night)
Mancia, 2006[98] PAMELA Good	≥140/90	Mercury sphyg (M)	3	Mean of 3	Physician	10	24-hr	≥125/79
O'Flynn, 2016[99] Mitchelstown cohort Fair	≥140/90	Omron Model M7 (A)	3	Mean of second and third	NR	≥5	24-hr Daytime Nighttime Combined day and night	24-hr: ≥130/80 Daytime: ≥135/85 Nighttime: ≥120/70 Combined day and night: ≥135/85 (day) OR ≥120/70 (night)

Table 7. Test Characteristics of Included Studies for KQ2, by Author

Author, Year Trial name Quality	OBPM threshold(s), mm Hg	OBPM Device (A or M)	Total # of office measurements in single visit	Method of determination	Interventionist attending	Resting time (min)	ABPM modality reference	Reference threshold, mm Hg
Poudel, 2019[100] CARDIA Fair	≥130/80	Omron HEM907XL (A)	3	Average of 2nd and 3rd measurements	Trained and certified staff	NR	Daytime	≥130/80 AND ≥135/85
	≥140/90	Omron HEM907XL (A)	3	Average of 2nd and 3rd measurements	Trained and certified staff	NR	Daytime	≥130/80 AND ≥135/85
Scuteri, 2016[101] SardiNIA Fair	≥140/90	Mercury sphyg (M)	6	Mean of second and third of both the right and left arm	NR	5	24-hr ABPM	≥125/79 AND ≥130/80
Selenta, 2000[102] Fair	SBP ≥140	Dinamap 845 Vital Signs Monitor; Critikon Corporation (A)	5	Mean of 5	NR	NR	Daytime	≥135/85
	DBP ≥90	Dinamap 845 Vital Signs Monitor; Critikon Corporation (A)	5	Mean of 5	NR	NR	Daytime	≥135/85
	SBP ≥130	Dinamap 845 Vital Signs Monitor; Critikon Corporation (A)	5	Mean of 5	NR	NR	Daytime	≥135/85
	SBP ≥160	Dinamap 845 Vital Signs Monitor; Critikon Corporation (A)	5	Mean of 5	NR	NR	Daytime	≥135/85
	DBP ≥80	Dinamap 845 Vital Signs Monitor; Critikon Corporation (A)	5	Mean of 5	NR	NR	Daytime	≥135/85
	DBP ≥100	Dinamap 845 Vital Signs Monitor; Critikon Corporation (A)	5	Mean of 5	NR	NR	Daytime	≥135/85

Table 7. Test Characteristics of Included Studies for KQ2, by Author

Author, Year Trial name Quality	OBPM threshold(s), mm Hg	OBPM Device (A or M)	Total # of office measurements in single visit	Method of determination	Interventionist attending	Resting time (min)	ABPM modality reference	Reference threshold, mm Hg
Shimbo, 2012[103] Masked Hypertension Study Fair	≥120/80	Mercury sphyg (M)	9	Mean of 9	Research nurse/ technician	≥5	Daytime	≥135/85
	≥130/85	Mercury sphyg (M)	9	Mean of 9	Research nurse/ technician	≥5	Daytime	≥135/85
	≥120/80	Mercury sphyg (M)	3	Mean of 3 from single visit	Research nurse/ technician	≥5	Daytime	≥135/85
	≥130/85	Mercury sphyg (M)	3	Mean of 3 from single visit	Research nurse/ technician	≥5	Daytime	≥135/85
	≥140/90	Mercury sphyg (M)	9	Mean of 9	Research nurse/ technician	≥5	Daytime	≥135/85
	≥140/90	Mercury sphyg (M)	3	Mean of 3 from single visit	Research nurse/ technician	≥5	Daytime	≥135/85
Thomas, 2017[104] Jackson Heart Study Fair	≥140/90	Hawksley random zero sphyg (M)	2	Mean of 2	NR	5	Daytime	≥135/85
Wei, 2016[105] FLEMENGHO Fair	≥140/90	Mercury sphyg (M)	5	Mean of 5	Nurse	5	Daytime	≥135/85
Wojciechowska, 2016[106] Fair	≥140/90	OMRON 705CP (A)	5	Mean of 5	Observer (not further specified)	15	Combined 24-hr, daytime, nighttime ABPM	≥130/80 (24-hr) OR ≥135/85 (day) OR ≥120/70 (night)

*(NR > or ≥)
† Semiautomatic BP measuring device based on the microphone method
‡ Attended AOBP

Abbreviations: A = automated; ABPM = ambulatory blood pressure measurement; CARDIA = the Coronary Artery Risk Development in Young Adults study; DBP = diastolic blood pressure; FLEMENGHO = the Flemish Study on Environment, Genes and Health Outcomes; HTN = hypertension; hr = hour; M = manual; MONICA = MONItoring of trends and determinants in Cardiovascular Disease study; mm HG = millimeter of mercury; NR = not reported; OBPM = office-based BP measurement; PAMELA = Pressioni Arteriose Monitorate e Loro Associazioni study; PCP = primary care provider; PROOF = The Prognostic Indicator of Cardiovascular and Cerebrovascular Events study; SBP = systolic blood pressure; sphyg = sphygmomanometer

Table 8. Test Accuracy Results of Included Studies for KQ2, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	OPBM threshold, mm Hg	Positive index test	Prev HTN (%)	Se (95% CI)	Sp (95% CI)	FPR (95% CI)	FNR (95%CI)	In MA
Abdalla, 2016[90] The Improving the Detection of HTN study	282	Combined day and night	≥135/85 (day) or ≥120/70 (night)	≥140/90	12.8	34.4	0.33 (0.24, 0.43)	0.98 (0.95, 0.99)	0.02 (0.01, 0.05)	0.67 (0.57, 0.76)	X
Fagard, 2005[91]	243	Daytime	≥135/85	≥140/90	42.8	31.3	0.71 (0.60, 0.80)	0.70 (0.63, 0.76)	0.30 (0.24, 0.37)	0.29 (0.20, 0.40)	X
Gill, 2017[82]	211	Daytime	135/85	140/90 (Clinic23)*,§	NR	NR	0.40 (0.29, 0.51)	0.90 (0.84, 0.95)	NR	NR	
		Daytime	135/85	135/85 (Clinic26)†,§	NR	NR	0.58 (0.47, 0.69)	0.83 (0.76, 0.89)	NR	NR	
		Daytime	135/85	140/90 (ClinicD1R1)‡,§	NR	NR	0.65 (0.54, 0.75)	0.74 (0.66, 0.82)	NR	NR	
Gosse, 2010[92]	738	Daytime SBP	SBP ≥135	SBP ≥140	57.7	20.2	0.85 (0.79, 0.90)	0.49 (0.45, 0.53)	0.51 (0.47, 0.55)	0.15 (0.10, 0.21)	
Gourlay, 1993[93]	66	Daytime	≥135/85	≥150/90	30.3	28.8	0.74 (0.51, 0.88)	0.87 (0.75, 0.94)	0.13 (0.06, 0.25)	0.26 (0.14, 0.49)	X
		Daytime	≥135/85	≥160/95	18.2	28.8	0.47 (0.28, 0.68)	0.94 (0.93, 0.98)	0.06 (0.02, 0.17)	0.53 (0.32, 0.73)	
Hanninen, 2010[81]	254	Daytime	≥140/85	≥140/90	22.0	13.4	0.48 (0.36, 0.61)	0.96 (0.93, 0.98)	0.04 (0.02, 0.07)	0.52 (0.39, 0.64)	
Hansen, 2006[94]	1385	24-hr	≥125/80	≥140/90	31.6	46.7	0.56 (0.52, 0.60)	0.90 (0.87, 0.92)	0.10 (0.08, 0.13)	0.44 (0.40, 0.48)	X
		Daytime	≥135/85	≥140/90	32.9	36.8	0.66 (0.62, 0.69)	0.86 (0.84, 0.88)	0.14 (0.12, 0.16)	0.34 (0.31, 0.38)	
Ishikawa, 2010[95]	129	24-hr	≥130/80	≥140/90	32.6	34.1	0.70 (0.56, 0.82)	0.87 (0.78, 0.93)	0.13 (0.07, 0.22)	0.30 (0.18, 0.44)	X
Kanno, 2010[96]	775	24-hr	≥135/85	≥140/90	19.4	13.9	0.48 (0.39, 0.57)	0.85 (0.82, 0.88)	0.15 (0.12, 0.18)	0.52 (0.43, 0.61)	X

Table 8. Test Accuracy Results of Included Studies for KQ2, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	OPBM threshold, mm Hg	Positive index test	Prev HTN (%)	Se (95% CI)	Sp (95% CI)	FPR (95% CI)	FNR (95%CI)	In MA
		Daytime	≥140/85	≥140/90	22.3	21.3	0.40 (0.33, 0.47)	0.82 (0.79, 0.85)	0.18 (0.15, 0.21)	0.60 (0.53, 0.67)	
Larkin, 1998[80]	65	24-hr	≥135/85	≥140/90	33.8	55.4	0.50 (0.34, 0.66)	0.86 (0.69, 0.95)	0.14 (0.05, 0.31)	0.50 (0.34, 0.66)	
		24, Daytime, Nighttime	≥139/87 24, ≥143/91 AM, ≥127/79 PM	≥140/90	33.8	49.2	0.53 (0.36, 0.69)	0.85 (0.69, 0.93)	0.15 (0.07, 0.31)	0.47 (0.31, 0.64)	
		24-hr	≥140/90	≥140/90	33.8	38.5	0.52 (0.33, 0.70)	0.78 (0.62, 0.88)	0.22 (0.12, 0.38)	0.48 (0.30, 0.67)	
Lyamina, 2012[97]	269	Daytime, Nighttime	≥135/85 AM, ≥120/70 PM	>120/80	16.0	12.6	0.65 (0.48, 0.79)	0.91 (0.87, 0.94)	0.09 (0.06, 0.13)	0.35 (0.21, 0.52)	
		Daytime, Nighttime	≥135/85 AM, ≥120/70 PM	≥140/90 with BH	19.7	12.6	1.00 (0.90, 1.00)	0.92 (0.88, 0.95)	0.08 (0.05, 0.12)	0.00 (0.00, 0.10)	
		Daytime, Nighttime	≥135/85 AM, ≥120/70 PM	≥140/90	0.0	12.6	0.00 (0.00, 0.10)	1.00 (0.98, 1.00)	0.00 (0.00, 0.02)	1.00 (0.90, 1.00)	X
Mancia, 2006[98]	2024	24-hr	≥125/79	≥140/90	42.0	33.0	0.74 (0.71, 0.77)	0.74 (0.71, 0.76)	0.26 (0.24, 0.29)	0.26 (0.23, 0.29)	X
O'Flynn, 2016[99]	577	Daytime, Nighttime	≥135/85 AM, ≥120/70 PM	≥140/90	37.6	42.5	0.67 (0.61, 0.73)	0.84 (0.80, 0.88)	0.16 (0.12, 0.20)	0.33 (0.27, 0.39)	
		24-hr	≥130/80	≥140/90	37.6	21.0	0.77 (0.69, 0.83)	0.73 (0.69, 0.77)	0.27 (0.23, 0.31)	0.23 (0.17, 0.31)	X
		Daytime	≥135/85	≥140/90	37.6	39.9	0.68 (0.62, 0.74)	0.82 (0.78, 0.86)	0.18 (0.14, 0.22)	0.32 (0.26, 0.38)	

Table 8. Test Accuracy Results of Included Studies for KQ2, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	OPBM threshold, mm Hg	Positive index test	Prev HTN (%)	Se (95% CI)	Sp (95% CI)	FPR (95% CI)	FNR (95%CI)	In MA
	577	Nighttime	≥120/70	≥140/90	37.6	24.4	0.69 (0.61, 0.76)	0.72 (0.68, 0.76)	0.28 (0.24, 0.32)	0.31 (0.24, 0.39)	
Poudel, 2019[100] CARDIA	432	Daytime	≥130/80	≥130/80	42.1	69.9	0.56 (0.50, 0.61)	0.89 (0.83, 0.93)	0.11 (0.07, 0.17)	0.44 (0.39, 0.50)	
			≥135/85	≥140/90	62.5	88.9	0.68 (0.63, 0.73)	0.83 (0.70, 0.91)	0.17 (0.09, 0.30)	0.32 (0.27, 0.37)	X
Scuteri, 2016[101]	2955	24-hr	≥130/80	≥140/90	34.6	27.2	0.92 (0.90, 0.94)	0.87 (0.86, 0.88)	0.13 (0.12, 0.14)	0.08 (0.06, 0.10)	X
			≥125/79	≥140/90	36.9	35.6	0.86 (0.84, 0.88)	0.90 (0.89, 0.91)	0.10 (0.09, 0.11)	0.14 (0.12, 0.16)	
Selenta, 2000[102]	319	Daytime	≥135/85	SBP ≥140	4.4	26.6	0.14 (0.08, 0.23)	0.99 (0.97, 1.00)	0.01 (0.00, 0.03)	0.86 (0.77, 0.92)	
			≥135/85	DBP ≥90	3.1	27.6	0.11 (0.06, 0.20)	1.00 (0.98, 1.00)	0.00 (0.00, 0.02)	0.89 (0.80, 0.94)	
			≥135/85	SBP ≥130	10.7	26.6	0.28 (0.20, 0.39)	0.96 (0.92, 0.98)	0.04 (0.02, 0.08)	0.72 (0.61, 0.80)	
			≥135/85	DBP ≥80	11.9	27.6	0.38 (0.28, 0.48)	0.98 (0.95, 0.99)	0.02 (0.01, 0.05)	0.63 (0.52, 0.72)	
			≥135/85	DBP ≥100	0.9	27.6	0.03 (0.01, 0.10)	1.00 (0.98, 1.00)	0.00 (0.00, 0.02)	0.97 (0.90, 0.99)	
			≥135/85	SBP ≥160	0.3	26.6	0.01 (0.00, 0.06)	1.00 (0.98, 1.00)	0.00 (0.00, 0.02)	0.99 (0.94,1.00)	
Shimbo, 2012[103]	813	Daytime	≥135/85	≥140/90 (Mean of 3 readings)	8.9	18.8	0.33 (0.26, 0.40)	0.97 (0.95, 0.98)	0.03 (0.02, 0.05)	0.67 (0.60, 0.74)	X
			≥135/85	≥120/80 (Mean of 3 readings)	45.9	18.8	0.84 (0.77, 0.89)	0.63 (0.59, 0.66)	0.37 (0.34, 0.41)	0.16 (0.11, 0.23)	

Table 8. Test Accuracy Results of Included Studies for KQ2, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	OPBM threshold, mm Hg	Positive index test	Prev HTN (%)	Se (95% CI)	Sp (95% CI)	FPR (95% CI)	FNR (95%CI)	In MA
			≥135/85	≥130/85 (Mean of 3 readings)	21.2	18.8	0.56 (0.48, 0.64)	0.87 (0.84, 0.89)	0.13 (0.11, 0.16)	0.44 (0.36, 0.52)	
			≥135/85	≥140/90 (Mean of 9 readings)	5.4	18.8	0.24 (0.18, 0.31)	0.99 (0.98, 0.99)	0.01 (0.01, 0.02)	0.76 (0.69, 0.82)	
	813	Daytime	≥135/85	≥120/80 (Mean of 9 readings)	40.7	18.8	0.88 (0.81, 0.92)	0.70 (0.67, 0.74)	0.30 (0.26, 0.33)	0.12 (0.08, 0.19)	
			≥135/85	≥130/85 (Mean of 9 readings)	16.1	18.8	0.53 (0.45, 0.61)	0.92 (0.90, 0.94)	0.08 (0.06, 0.10)	0.47 (0.39, 0.55)	
Thomas, 2017[104]	441	Daytime	≥135/85	≥140/90	14.3	31.7	0.31 (0.24, 0.40)	0.94 (0.90, 0.96)	0.06 (0.04, 0.10)	0.69 (0.60, 0.76)	X
Wei, 2016[105]	717	Daytime	≥135/85	≥140/90	10.5	15.5	0.34 (0.26, 0.43)	0.94 (0.92, 0.96)	0.06 (0.04, 0.08)	0.66 (0.57, 0.74)	X
Wojciechowska, 2016[106]	201	24-hr, Daytime, Nighttime	≥130/80 24, ≥135/85 AM, ≥120/70 PM	>140/90	30.3	32.8	0.62 (0.50, 0.73)	0.85 (0.78, 0.90)	0.15 (0.10, 0.22)	0.38 (0.27, 0.50)	X

* Mean of second and third readings from the three visits
† Mean of second and sixth readings from the 3 visits
‡ First reading of the first visit
§ Attended AOBP

Abbreviations: ABPM = ambulatory blood pressure measurement; BH = breath hold; CI = confidence interval; DBP = diastolic blood pressure; FNR = false negative rate; FPR = false positive rate; hr = hour; HTN = hypertension; MA = meta-analysis; mm HG = millimeter of mercury; NR = not reported; OBPM = office-based BP measurement; Prev = prevalence; Se = sensitivity; Sp = specificity

Table 9. Study and Baseline Population Characteristics of Included Studies for KQ 3, by Author

Author, Year Study name Quality	Country	Brief population description	Recruitment setting	N analyzed (Untx)	Mean OBPM, SBP/DBP (mm, Hg)	Mean ABPM, SBP/DBP (mm, Hg)	Age, mean (range)	% female	% white	% DM	Mean BMI, kg/m^2
Bayo, 2006[122] Fair	Spain	Patients aged 18 to 80 years with mild–moderate HTN, without previous antihypertensive tx	Primary care	181	152.3/89.2	134.8/81.3* 137.4/82.1†	58.4 (18-80)	58.9	NR	9.5	28.2
de la Sierra, 2017[74] Spanish ABPM Registry Fair	Spain	Participants from an ongoing ABPM registry	BP Clinic, Primary care	45020	145.9/88.2	132.3/81.6* 128.7/78.4†	53.5 (NR)	45.9	>99	12.7	28.8
Ernst, 2011[124] Fair	US	Pts referred for ABPM for evaluation of (1) borderline HTN (not currently treated but with a series of variable office BPs in both the normal and elevated range), (2) evaluation of BP control on therapy, (3) suspected WCH, or (4) treatment resistance	ABPM Referral Service	263	NR	6-hr: NR	52.7 (NR)	50	NR	NR	29.5
Fogari, 1996[126] Fair	Italy	Pts with newly diagnosed new-treated essential HTN (DBP>90 mm Hg)	Cardiology outpatient	221	164.1/103.5	144.0/94.5*	NR (31-60)	0	NR	0	NR
Gerc, 2000[127] Fair	Switzerland	Pts with an elevated office BP referred to hypertension clinic for confirmation of hypertension diagnosis	Primary care	1466	140.6/91.4	142.2/90.7*	46.9 (13-85)	41.6	NR	NR	NR
Hoegholm, 1992[128] Fair	Denmark	Untreated pts with newly diagnosed essential HTN (with BP under observation for a median of 4 months prior to diagnosis)	Primary care	153	156.8/99.8	145.2/95.9*	47¶ (17-76)	54.1	NR	NR	NR
Husain, 2017[130] Fair	US	Participants with recent office BP measurements between SBP 120-149 and/or DBP 80-95, and not greater than 149/95.	BP Clinic	404	Visit 1: 129.6/81.0 Visit 2: 128.7/80.7	NR	47.9 (NR)	56.8	77.7	NR	29.3

Table 9. Study and Baseline Population Characteristics of Included Studies for KQ 3, by Author

Author, Year Study name Quality	Country	Brief population description	Recruitment setting	N analyzed (Untx)	Mean OBPM, SBP/DBP (mm, Hg)	Mean ABPM, SBP/DBP (mm, Hg)	Age, mean (range)	% female	% white	% DM	Mean BMI, kg/m^2
Kim, 2018[131] Fair	Korea	All ambulatory pts who underwent OBP and ABP measurements during 2013	Primary care	565	138.3/84.1	124.3/79.1†	56.7 (NR)	49.9	NR	11.5	NR
Kotsis, 2008[132] Fair	Greece	Pts referred to participating HTN clinics for possible hypertension from either primary health care providers, or from a hospital outpatient clinic for a routine BP check up between 2000-2006	Self-selected	1535	141.4/88.5	128.1/77.6†	51.1 (NR)	50.5	NR	9.1	27.4
Manios, 2008[133] Fair	Greece	Pts referred from primary physician to outpatient HTN unit for conventional clinical indications during specified time	NR	2004	141/89	132/82*	50.9 (NR)	53.4	NR	10.6	24.8
Nasothimiou, 2012[134] Good	Greece	Pts referred for elevated BP and assessed with clinic BP, ABP and HBP	Cardiology outpatient	361	143/94	140/90* 138/88‡	49 (NR)	41	NR	2.9	28
Nunan, 2015[135] Fair	United Kingdom	Untreated adults aged 40-85 years with an SBP between 130-179 mm Hg who were willing to perform 24h ABPM	Primary care	203	Self-monitored OBPM: 145.0/14.4 HBPM: 141.1/87.0§	133.6/82.6*	56.4 (40-85)	47.3	90.4	5.4	28.2
Park, 2017[136] Fair	Korea	Untreated pts with high OBPM (≥140/90mm Hg)	BP Clinic	256	141.0/91.6	132.8/88.5† Combo: 134.6/87.8‖	51.8 (NR)	53.5	NR	NR	25.4
Salazar, 2018[139] Fair	Argentina	Consecutive pts referred from clinics, cardiologists and general practices in order to perform an ABPM for diagnostic or therapeutic purposes during a specified time period.	BP Clinic	466	138/82	135/84*	51 (NR)	61.0	NR	9.2	29.7

Table 9. Study and Baseline Population Characteristics of Included Studies for KQ 3, by Author

Author, Year Study name Quality	Country	Brief population description	Recruitment setting	N analyzed (Untx)	Mean OBPM, SBP/DBP (mm, Hg)	Mean ABPM, SBP/DBP (mm, Hg)	Age, mean (range)	% female	% white	% DM	Mean BMI, kg/m^2
Shin, 2015[73] Kor-ABP Fair	Korea	Pts undergoing ABPM for the evaluation of high BP	Primary care	1262	141.6/88.2	135.4/86.4*	52.1 (NR)	48	NR	NR	24.5
Tocci, 2018[142] Fair	Italy	Untreated pts, aged ≥18 years, referred to HTN outpatient clinic.	Cardiology outpatient	2209	144.3/93.9	130.7/81.1†	52.5 (NR)	47.5	NR	5.1	26.1
Ungar, 2004[143] Good	Italy	Consecutive pts that were referred to HTN clinic during a designated time period.	Cardiology outpatient	388	151/93	141/86* 137/83†	60 (20-95)	51.2%	NR	NR	26
Zabludowski, 1992[145] Fair	Israel	Patients with untreated borderline hypertension referred for ABPM	Primary care	171	158.9/90.7	150.5/85.4*	48.0 (NR)	66.7	NR	NR	NR

* Daytime ABPM
† 24-hr ABPM
‡ Home monitoring on 6 working days within 2 weeks; measurements taking twice in the AM and in the PM; average of all readings
§ Mean of days 2-7 of self-monitored BP (2 measures taken in the AM and 2 in the PM)
‖ Automated measurement; average of 42 measurements (6 per day; 3AM, 3PM) for 7 days
¶ Median

Abbreviations: ABPM = ambulatory blood pressure measurement; BMI = body mass index; BP = blood pressure; DBP = diastolic blood pressure; DM = diabetes mellites; HBPM = home blood pressure measurement; HTN = hypertension; kg/m^2 = kilograms per meter squared; mm HG = millimeter of mercury; NR = not reported; OBPM = office-based blood pressure measurement; Pts = patients; SBP = systolic blood pressure; tx = treatment; Untx = untreated; US = United States; WCH = white coat hypertension

Table 10. OBPM Test Characteristics of Included Studies for KQ 3, by Author

Author, Year Trial name Quality	OBPM threshold(s), mm Hg	Index Device (A or M)	Total # of OBPM measurements	Method of determination	Interventionist attending	Resting time (min)	ABPM reference	Reference threshold, mm Hg
de la Sierra, 2017[74] Spanish ABPM Registry Fair	≥140/90	NR (validated oscillometric device) (A)	2	Mean of 2	NR	5	24-hr Daytime Combined	24-hr: ≥130/80 Daytime: ≥135/85 Combined: Daytime ≥135/85 OR nighttime ≥120/70 OR 24-hr ≥130/80
Fogari, 1996[126] Fair	DBP >90	Standard mercury sphyg (M)	14	Average of measurements	Physician	2	Daytime	≥134/90
Gerc, 2000[127] Fair	>160/95	Mercury sphyg (M)	3	Average of measurement	Nurse	NR	Daytime	>140/90
	>135/85	Mercury sphyg (M)	3	Average of measurement	Nurse	NR	Daytime	>140/90
	>140/90	Mercury sphyg (M)	3	Average of measurement	Nurse	NR	Daytime	>140/90
	>160/100	Mercury sphyg (M)	3	Average of measurement	Nurse	NR	Daytime	>140/90
Hoegholm, 1992[128] Fair	DBP >90	Hawksley random zero sphyg (M)	5	Average of measurements	Physician (male)	≥15	Daytime	DBP >90
Husain, 2017[130] Fair	≥140/90 (Visit 1)	Welch Allyn Vital Signs (A)	3	Average of the second and third measurement	NR	5	24-hr	≥135/85
	≥140/90 (Visit 2)	Welch Allyn Vital Signs (A)	3	Average of the second and third measurement	NR	5	24-hr	≥135/85
Kim, 2018[131] Fair	SBP ≥140	Mercury sphyg (Baumanometer Desk model, W.A. Baum Co. Inc.,	1	NA	NR	5	24-hr	SBP ≥130

Table 10. OBPM Test Characteristics of Included Studies for KQ 3, by Author

Author, Year Trial name Quality	OBPM threshold(s), mm Hg	Index Device (A or M)	Total # of OBPM measurements	Method of determination	Interventionist attending	Resting time (min)	ABPM reference	Reference threshold, mm Hg
		Copiague, NY, USA) (M)						
Kotsis, 2008[132] Fair	≥140/90	Mercury sphyg (M)	6	Average of the six BP measurements (from 2 visits)	Physician	10	24-hr	≥135/85
Manios, 2008[133] Fair	≥140/90	Mercury sphyg (M)	6	Average of 3 BP values; unclear which 3 measures are being used. Assuming that measures from dominant arm are dropped.	Physician	NR	Daytime	≥135/85
Nasothimiou, 2012[134] Good	≥140/90	Standard mercury sphyg (M)	9	Average of the second and third clinic BP reading of the three study visits	Physician	5	Daytime	≥135/85
Shin, 2015[73] Kor-ABP Fair	≥140/90	A&D UA-767 (A&D Co., Ltd., Tokyo, Japan) (A)	2	Average of measurements	NR	5	Daytime	≥135/85
Tocci, 2018[142] Fair	≥ 140/90	Omron 705 IT (Omron Healthcare Europe BV, Hoofddorp, The Netherlands) (A)	3	Average of 3 consecutive BP measurements	ESH HTN specialist	10	24-hr	≥130/80
Ungar, 2004[143] Good	≥140/90	Mercury sphyg (M)	8-12	All measurements averaged	Physician	≥10	Daytime	≥135/85
Zabludowski, 1992[145] Fair	DBP >90	Accutracker I (Suntech Medical Instruments) (A)	3	Average of measurements	Physician or nurse	5	Daytime	DBP >90

Abbreviations: A = automated; ABPM = ambulatory blood pressure measurement; BP = blood pressure; DBP = diastolic blood pressure; HTN = hypertension; hr = hour; M = manual; mm HG = millimeter of mercury; NA = not applicable; NR = not reported; OBPM = office-based blood pressure measurement; PCP = primary care provider; SBP = systolic blood pressure; sphyg = sphygmomanometer; USA = United States of America

Table 11. OBPM Test Accuracy Results of Included Studies for KQ 3, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	Index threshold, mm Hg	Positive index test	Prev HTN	Se (95% CI)*	Sp (95% CI)*	FPR (95% CIs)*	FNR (95%CIs)*	In MA
de la Sierra, 2017[74]	45020	24-hr	≥130/80	≥140/90	75.2	57.2	0.85 (0.85, 0.86)	0.38 (0.38, 0.39)	0.62 (0.61, 0.62)	0.15 (0.14, 0.15)	X
		Daytime	≥135/85	≥140/90	75.2	51.0	0.87 (0.86, 0.87)	0.37 (0.36 0.37)	0.63 (0.63, 0.64)	0.13 (0.13, 0.14)	-
		24, Daytime, Nighttime	Daytime ≥135/85 OR nighttime ≥120/70 OR 24-h ≥130/80	≥140/90	75.2	67.3	0.83 (0.82, 0.83)	0.40 (0.39, 0.41)	0.60 (0.59, 0.61)	0.17 (0.17, 0.18)	-
Fogari, 1996[126]	221	Daytime	≥134/90	DBP >90	82.4	76.0	0.95 (0.90, 0.97)	0.57 (0.43, 0.69)	0.43 (0.31, 0.57)	0.05 (0.03, 0.10)	-
Gerc, 2000[127]	1466	Daytime	> 140/90	>140/90	NR†	NR	0.80 (NR)	0.68 (NR)	NR†	NR†	-
		Daytime	> 140/90	>135/85	NR	NR	0.87 (NR)	0.59 (NR)	NR†	NR†	-
		Daytime	> 140/90	>160/95	NR	NR	0.74 (NR)	0.79 (NR)	NR†	NR†	-
		Daytime	> 140/90	>160/100	NR	NR	0.67 (NR)	0.84 (NR)	NR†	NR†	-
Hoegholm, 1992[128]	153	Daytime	DBP >90	DBP >90	81.7	64.7	0.95 (0.89, 0.98)	0.43 (0.30, 0.56)	0.57 (0.44, 0.70)	0.05 (0.02, 0.11)	-
Husain, 2017[130]	404	24-hr V1‡	≥135/85	≥140/90	30.0	75.0	0.35 (0.30, 0.41)	0.85 (0.77, 0.91)	0.15 (0.09, 0.23)	0.65 (0.59, 0.70)	X
		24-hr V2‡	≥135/85	≥140/90	29.2	71.5	0.35 (0.30, 0.41)	0.86 (0.79, 0.91)	0.14 (0.09, 0.21)	0.65 (0.59, 0.70)	-
Kim, 2018[131]	565	24-hr	SBP≥ 130	SBP ≥140	45.8	49.0	0.52 (0.46, 0.58)	0.60 (0.55,0.66)	0.40 (0.34, 0.45)	0.48 (0.42, 0.54)	-
Kotsis, 2008[132]	1535	24-hr	≥ 125/80	≥140/90	51.1	47.8	0.70 (0.66, 0.73)	0.66 (0.62, 0.69)	0.34 (0.31, 0.38)	0.30 (0.27, 0.34)	X

Table 11. OBPM Test Accuracy Results of Included Studies for KQ 3, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	Index threshold, mm Hg	Positive index test	Prev HTN	Se (95% CI)*	Sp (95% CI)*	FPR (95% CIs)*	FNR (95%CIs)*	In MA
Manios, 2008[133]	2004	Daytime	≥135/85	≥140/90	71.5	48.6	0.89 (0.87, 0.91)	0.45 (0.42, 0.48)	0.55 (0.52, 0.58)	0.11 (0.09, 0.13)	X
Nasothimiou, 2012[134]	361	Daytime	≥135/85	≥140/90	78.1	77.0	0.85 (0.80, 0.88)	0.43 (0.33, 0.54)	0.57 (0.46, 0.67)	0.15 (0.12, 0.20)	X
Shin, 2015[73] Kor-ABP	1262	Daytime	≥135/85	140/90	58.8	61.5	0.71 (0.68, 0.74)	0.61 (0.57, 0.66)	0.39 (0.34, 0.43)	0.29 (0.26, 0.32)	X
Tocci, 2018[142]	2209	24-hr	≥ 130/80	≥ 140/90	76.2	67.0	0.90 (0.88, 0.91)	0.52 (0.48, 0.55)	0.48 (0.45, 0.52)	0.10 (0.09, 0.12)	X
Ungar, 2004[143]	388	Daytime	≥135/85	≥140/90	82.5	74.0	0.89 (0.84, 0.92)	0.35 (0.26, 0.44)	0.65 (0.56, 0.74)	0.11 (0.08, 0.16)	X
Zabludowski, 1992[145]	171	Daytime DBP	DBP >90	DBP >90	66.7	47.4	0.81 (0.72, 0.88)	0.47 (0.37, 0.57)	0.53 (0.43, 0.63)	0.19 (0.12, 0.28)	-

* Calculated
† 2x2 data unavailable, unable to calculated CIs or FPR and FNR
‡ ABPM taken at the conclusion of the initial visit (V1) and one week later (V2)

Abbreviations: ABPM = ambulatory blood pressure measurement; CI = confidence interval; DBP = diastolic blood pressure; FNR = false negative rate; FPR = false positive rate; hr = hour; HTN = hypertension; MA = meta-analysis; mm HG = millimeter of mercury; NR = not reported; OBPM = office-based BP measurement; Prev = prevalence; Se = sensitivity; sp = specificity

Table 12. HBPM Test Characteristics of Included Studies for KQ 3, by Author

Author, Year Trial name Quality	HBPM threshold(s), mm Hg	HBPM Device (A or M)	Measurement time	Number of screens	Total # of measurements	Method of determination	Pt training	Body position	ABPM modality reference	Reference threshold, mm Hg
Bayo, 2006[122] Fair	≥130/80	Omron HEM-705CP (Tokyo, Japan) (A)	Morning (0600 to 1000) and evening (2000 to 0000)	6 (3 days x 2 per day)	18 (max)	Readings of first day excluded; first and second readings of each morning–night period of second and third days used	Instructed by his physician or nurse on the working of the units and the BP measuring technique and provided with written information.	NR	Daytime	≥135/85
	≥135/85	Omron HEM-705CP (Tokyo, Japan)	Morning (0600 to 1000) and evening (2000 to 0000)	6 (3 days x 2 per day)	18 (max)	Readings of first day excluded; first and second readings of each morning–night period of second and third days used	Instructed by his physician or nurse on the working of the units and the BP measuring technique and provided with written information.	NR	Daytime	≥135/85
Nasothimiou, 2012[134] Good	≥135/85	Omrom HEM-705CP, IC, or 705IT (Omron Healthcare, The Netherlands)	Morning (0600-1000h) and evening (1800-2200h)	12 (6 days x 2 per day)	24	Average of all measurements	Trained in the conditions of HBP measurement and the use of the devices	Seated	Daytime	≥135/85
Nunan, 2015[135] Fair	≥135/85	Stabliograph bluetooth-enabled automated sphyg (Stabilograph; I.E.M,	Morning (preferably upon waking) and evening (before going to bed)	10 (5 days x 2 per day)	20	Average of days 2-5	NR	Seated	Daytime	≥135/85
				10 (5 days x 2 per day)	20	Average of days 1-5	NR	Seated	Daytime	≥135/85

Table 12. HBPM Test Characteristics of Included Studies for KQ 3, by Author

Author, Year Trial name Quality	HBPM threshold(s), mm Hg	HBPM Device (A or M)	Measurement time	Number of screens	Total # of measurements	Method of determination	Pt training	Body position	ABPM modality reference	Reference threshold, mm Hg
		Stolberg, Germany)		14 (7 days x 2 per day)	28	Readings from a minimum of 4 (preferably 7) consecutive days with readings from the first day dropped	NR	Seated	Daytime	≥135/85
				14 (7 days x 2 per day)	28	Readings from a minimum of 4 (preferably 7) consecutive days with readings from the first day dropped	NR	Seated	Daytime	≥135/85
Park, 2017[136] Fair	≥130/85	WatchBP Home (Microlife, Taiwan)	Morning (betwen 0700/waking and 0900) and evening (2100-2300/bedtime)	14 (7 days x 2 per day)	42 (max); 40.1 (2.7) (mean)	Avg of valid measurements; First evening and morning BP measurements were discarded, first and second reading of the morning and evening were averaged	Received instructions from study nurse on first visit day	Seated	24-hr	≥130/80
	≥130/80	WatchBP Home (Microlife, Taiwan)	Morning (betwen 0700/waking and 0900) and evening (2100-2300/bedtime)	14 (7 days x 2 per day)	42 (max); 40.1 (2.7) (mean)	Avg of valid measurements; First evening and morning BP measurements were discarded, first and second reading of the	Received instructions from study nurse on first visit day	Seated	24-hr	≥130/80

Table 12. HBPM Test Characteristics of Included Studies for KQ 3, by Author

Author, Year Trial name Quality	HBPM threshold(s), mm Hg	HBPM Device (A or M)	Measurement time	Number of screens	Total # of measurements	Method of determination	Pt training	Body position	ABPM modality reference	Reference threshold, mm Hg
						morning and evening were averaged				
	≥135/85	WatchBP Home (Microlife, Taiwan)	Morning (betwen 0700/waking and 0900) and evening (2100-2300/bedtime)	14 (7 days x 2 per day)	42 (max); 40.1 (2.7) (mean)	Avg of valid measurements; First evening and morning BP measurements were discarded, first and second reading of the morning and evening were averaged	Received instructions from study nurse on first visit day	Seated	24-hr	≥130/80

Abbreviations: A = automated; ABPM = ambulatory blood pressure measurement; BP = blood pressure; DBP = diastolic blood pressure; HBPM = home blood pressure measurement; HTN = hypertension; hr = hour; M = manual; mm HG = millimeter of mercury; NA = not applicable; NR = not reported; OBPM = office-based blood pressure measurement; PCP = primary care provider; SBP = systolic blood pressure; sphyg = sphygmomanometer; USA = United States of America

Table 13. HBPM Test Accuracy Results of Included Studies for KQ 3, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	Index threshold, mm Hg	Positive index test*	Prev HTN*	Se (95% CI)*	Sp (95% CI)*	FPR (95% CIs)*	FNR (95%CIs)*	In MA
Bayo, 2006[122]	181	Daytime	≥135/85	≥130/80	79.0	59.1	0.88 (0.80, 0.93)	0.34 (0.24, 0.45)	0.66 (0.55, 0.76)	0.12 (0.07, 0.20)	-
		Daytime	≥135/85	≥135/85	65.2	59.1	0.76 (0.66, 0.83)	0.50 (0.38, 0.62)	0.50 (0.39, 0.61)	0.24 (0.17, 0.33)	X
Nasothimiou, 2012[134]	361	Daytime	≥135/85	≥135/85	76.2	77.0	0.87 (0.83, 0.91)	0.61 (0.51, 0.71)	0.39 (0.29, 0.49)	0.13 (0.09, 0.17)	X
Nunan, 2015[135]	203	Daytime (Days 1-7)	≥135/85	≥135/85	73.0	53.7	0.93 (0.86, 0.97)	0.50 (0.40, 0.61)	0.50 (0.40, 0.60)	0.07 (0.04, 0.14)	X
		Daytime (Days 1-5)	≥135/85	≥135/85	NR	53.7	0.93 (0.86, 0.97)	0.53 (0.43, 0.64)	NR†	NR†	-
		Daytime (Days 2-7)	≥135/85	135/85	72.9	53.7	0.94 (0.87, 0.97)	0.51 (0.41, 0.62)	NR†	NR†	-
		Daytime (Days 2-5)	≥135/85	≥135/85	NR	53.7	0.94 (0.87, 0.97)	0.53 (0.43, 0.64)	NR†	NR†	-
Park, 2017[136]	256	Daytime	≥135/85	≥130/80	79.7	73.4	0.92 (0.87, 0.95)	0.53 (0.40, 0.65)	0.47 (0.36, 0.59)	0.09 (0.05, 0.13)	-
		24-hr	≥130/80	≥130/80	79.7	80.1	0.90 (0.85. 0.94)	0.63 (0.48, 0.76)	0.37 (0.25, 0.51)	0.10 (0.03, 0.15)	-
		Nighttime	≥120/70	≥130/80	79.7	87.1	0.85 (0.90, 0.90)	0.58 (0.39, 0.75)	0.42 (0.27, 0.59)	0.15 (0.11, 0.20)	-
		Daytime	≥135/85	≥130/85	70.7	73.4	0.82 (0.76, 0.88)	0.62 (0.49, 0.73)	0.38 (0.28, 0.50)	0.18 (0.13, 0.24)	-
		24-hr	≥130/80	≥130/85	70.7	80.1	0.81 (0.75, 0.86)	0.71 (0.56, 0.83)	0.29 (0.19, 0.43)	0.19 (0.14, 0.25)	-
		Nighttime	≥120/70	≥130/85	70.7	87.1	0.77 (0.71, 0.82)	0.70 (0.51, 0.84)	0.30 (0.17, 0.47)	0.23 (0.18, 0.29)	-
		Daytime	≥135/85	≥135/85	66.0	73.4	0.79 (0.72, 0.84)	0.69 (0.57, 0.80)	0.31 (0.21, 0.43)	0.21 (0.16, 0.28)	-

Table 13. HBPM Test Accuracy Results of Included Studies for KQ 3, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	Index threshold, mm Hg	Positive index test*	Prev HTN*	Se (95% CI)*	Sp (95% CI)*	FPR (95% CIs)*	FNR (95%CIs)*	In MA
		24-hr	≥130/80	≥135/85	66.0	80.1	0.77 (0.71, 0.83)	0.78 (0.65, 0.89)	0.22 (0.12 (0.35)	0.23 (0.18, 0.29)	X
		Nighttime	≥120/70	≥135/85	66.0	87.1	0.74 (0.67, 0.79)	0.85 (0.68, 0.95)	0.15 (0.07, 0.31)	0.26 (0.21, 0.33)	-

*Calculated

† 2x2 data unavailable, unable to calculated CIs or FPR and FNR

Abbreviations: ABPM = ambulatory blood pressure measurement; CI = confidence interval; DBP = diastolic blood pressure; FNR = false negative rate; FPR = false positive rate; HBPM = home blood pressure measurement; hr = hour; HTN = hypertension; MA = meta-analysis; mm HG = millimeter of mercury; NR = not reported; OBPM = office-based BP measurement; Prev = prevalence; Se = sensitivity; sp = specificity

Table 14. Self-OBPM Test Characteristics of Included Studies for KQ 3, by Author

Author, Year Trial name Quality	OBPM threshold(s), mm Hg	Index Device (A or M)	Total # of OBPM measurements	Method of determination	Interventionist attending	Resting time (min)	ABPM reference	Reference threshold, mm Hg
Nunan, 2015[135] Fair	≥135/85	Stabliograph bluetooth-enabled automated sphyg	6	Average of 5 (unclear which measure is being dropped as 6 measures are taken)	Self-monitored (Attended)	≥5	Daytime	≥135/85
Salazar, 2018[139] Fair	SBP ≥160	OMRON HEM 705 CP (A)	5	Average of the first three measurements	Self-monitored (Unattended): A nurse performed a training measurement for the patient; these data were discarded. Then the nurse retired and the patient triggered five measurements.	NR	Daytime	≥135/85
	DBP ≥80	OMRON HEM 705 CP (A)	5	Average of the first three measurements	Self-monitored (Unattended): A nurse performed a training measurement for the patient; these data were discarded. Then the nurse retired and the patient triggered five measurements.	NR	Daytime	≥135/85
	DBP ≥90	OMRON HEM 705 CP (A)	5	Average of the first three measurements	Self-monitored (Unattended): A nurse performed a training measurement for the patient; these data were discarded. Then the nurse retired and the patient triggered five measurements.	NR	Daytime	≥135/85
	SBP ≥130	OMRON HEM 705 CP (A)	5	Average of the first three measurements	Self-monitored (Unattended): A nurse performed a training measurement	NR	Daytime	≥135/85

Table 14. Self-OBPM Test Characteristics of Included Studies for KQ 3, by Author

Author, Year Trial name Quality	OBPM threshold(s), mm Hg	Index Device (A or M)	Total # of OBPM measurements	Method of determination	Interventionist attending	Resting time (min)	ABPM reference	Reference threshold, mm Hg
					for the patient; these data were discarded. Then the nurse retired and the patient triggered five measurements.			

Abbreviations: A = automated; ABPM = ambulatory blood pressure measurement; BP = blood pressure; DBP = diastolic blood pressure; HTN = hypertension; hr = hour; M = manual; mm HG = millimeter of mercury; NA = not applicable; NR = not reported; OBPM = office-based blood pressure measurement; SBP = systolic blood pressure; sphyg = sphygmomanometer

Table 15. Self-OBPM Test Accuracy Results of Included Studies for KQ 3, by Author

Author, Year	N analyzed	ABPM method	ABPM threshold, mm Hg	Index threshold, mm Hg	Positive index test*	Prev HTN*	Se (95% CI)*	Sp (95% CI)*	FPR (95% CIs)*	FNR (95% CIs)*	In MA
Nunan, 2015[135]	203	Daytime	≥135/85	≥135/85	84.2	54.0	0.92 (0.85, 0.96)	0.25 (0.16, 0.35)	0.75 (0.66, 0.83)	0.08 (0.04, 0.15)	-
Salazar, 2018[139]	466	Daytime	≥135/85	SBP ≥130	63.0	47.0	0.86 (0.81, 0.90)	0.57 (0.51, 0.63)	0.43 (0.37, 0.49)	0.14 (0.10, 0.19)	-
	NR	Daytime	≥135/85	SBP ≥160	63.0	47.0	0.20 (NR)†	0.97 (NR)†	NR†	NR†	-
	NR	Daytime	≥135/85	DBP ≥80	63.0	47.0	0.84 (NR)†	0.65 (NR)†	NR†	NR†	-
	NR	Daytime	≥135/85	DBP ≥90	63.0	47.0	0.46 (NR)†	0.95 (NR)†	NR†	NR†	-

*Calculated
†2x2 data unavailable, unable to calculate CIs or FPR and FNR

Abbreviations: ABPM = ambulatory blood pressure measurement; CI = confidence interval; DBP = diastolic blood pressure; FNR = false negative rate; FPR = false positive rate; hr = hour; HTN = hypertension; MA = meta-analysis; mm HG = millimeter of mercury; NR = not reported; OBPM = office-based BP measurement; Prev = prevalence; Se = sensitivity; sp = specificity

Table 16. Truncated ABPM Test Characteristics of Included Studies for KQ 3, by Author

Author, Year Trial name Quality	ABPM Index threshold(s), mm Hg	Index Device (A or M)	Total # of measurements	Method of determination	Interventionist (attended)	Resting time (min)	ABPM modality reference	Reference threshold, mm Hg
Ernst, 2011[124] Fair	6-hr ABPM SBP >130	SpaceLabs 90217	18 (max, daytime-only window)	6 hours, initiated in morning for almost all participants	NA	NA	24-hr	SBP >130

Abbreviations: A = automated; ABPM = ambulatory blood pressure measurement; hr = hour; M = manual; min = minute; mm Hg = millimeters of mercury; NA = not applicable; SBP = systolic blood pressure

Table 17. Truncated ABPM Test Accuracy Results of Included Studies for KQ 3, by Author

Author, Year	Group	N analyzed	ABPM method	ABPM threshold, mm Hg	Index threshold, mm Hg	Positive index test	Prev HTN	Se (95% CI)*	Sp (95% CI)*	FPR (95% CIs)*	FNR (95%CIs)*	In MA
Ernst, 2011[124]	Borderline HTN	126	24-hr	SBP >130	SBP >135	NR	NR	0.94 (NR)	0.76 (NR)	NR†	NR†	-
	Suspected WC	137	24-hr	SBP >130	SBP >135	NR	NR	0.89 (NR)	0.70 (NR)	NR†	NR†	-

*Calculated
† 2x2 data unavailable, unable to calculated CIs or FPR and FNR

Abbreviations: ABPM = ambulatory blood pressure measurement; CI = confidence interval; FNR = false negative rate; FPR = false positive rate; HTN = hypertension; hr = hour; MA = meta-analysis; NR = not reported; Prev = prevalence; SBP = systolic blood pressure; WC = white coat

Table 18. High-Level Summary of Included Studies for KQ 4, by Outcome

Category (number of studies)	Author, Year Quality	Country	Study Design	N analyzed	Sample	Comparison	Outcome measurement	Study conclusions
QoL /psychological outcomes(k=4)	Ameling, 1991[148] Fair	NL	Prospective Cohort (prior to randomization into treatment trial)	331	Newly diagnosed hypertensives identified via case-finding in general practice	Pre-post labeling as hypertensive (1 week follow up)	Unvalidated set of QOL-related items on physical symptoms, sexual functioning, and sleep. Also reported validated Amsterdam Mood List.	No effects of labeling hypertension on quality of life.
	Mann, 1977[150] Fair	UK	Prospective Cohort (prior to randomization into treatment trial)	654	Participants screened for hypertension for eligibility for the MRC trial	Pre-post screening (timing NR)	GHQ	Informing asymptomatic people about their raised blood pressure and enrollment in a trial caused no undue psychological response.
	Spruill, 2013[155] Good	US	RCT	100	Adults previously unaware of prehypertensive status identified in internal medicine practices and advertised BP screenings	No label (informed of BP only) vs. labeled (discussed prehypertension) 3 months post labeling	SF-12 (physical and mental health)	Prehypertension labeling did not significantly influence self-reported physical or mental health
	Tompson, 2019[162] Fair	UK	Prospective Cohort	140	Consecutive pts, aged 40-85, presenting with a single office SBP between 130 and 179 mmHg	Pre-post evaluation assessing psychological impact of 28 days of self-monitoring followed by 24-hr ABPM	HADS scores	Out-of-office BP monitoring does not appear to be harmful though it may induce feelings of anxiety in some pts.

Table 18. High-Level Summary of Included Studies for KQ 4, by Outcome

Category (number of studies)	Author, Year Quality	Country	Study Design	N analyzed	Sample	Comparison	Outcome measurement	Study conclusions
	Viera, 2010[157] Fair	US	RCT	97	Adults with prehypertension recruited via flyers in examination rooms	No label (standard lifestyle counseling only) vs. labeled (discussed prehypertension) 3 months post labeling	SF-36 (physical and mental health); self-rated health questions of improvement or no-change	Being labeled as prehypertensive seems to exert neither harmful or helpful effects.
Absenteeism after labeling (k=2)	Haynes, 1978[149] Fair	Can	Prospective cohort derived from treatment trials	208	Male employees with screen-detected untreated hypertension recruited via the workplace	Pre-post labeling (12 months before labeling versus 12-48 months after labeling); results stratified by previously aware (known hypertensive subgroup) versus previously unaware (screened subgroup)	Work absenteeism	Men previously unaware of their hypertension had a statistically significant rise in absenteeism which persisted to the end of 4 years of followup.
	Rudd, 1987[151] Fair	US	Prospective cohort derived from randomized trial	294	Employees with screen-detected untreated hypertension recruited via the workplace	Pre-post labeling (12 months before labeling versus 12 months after labeling)	Work absenteeism	No significant increase in absenteeism in aware and previous unaware hypertensives after statistical correction.
ABPM tolerability and ABPM-attributed sleep	Kuwajima, 1998[161] Fair	Japan	Cross-sectional	24	Volunteers aged 22-96; recruitment setting not reported	24-hour ABPM with no comparator	Unvalidated questionnaire: Tolerability (including sleep disturbance)	Sleep disturbance reported in 29% of individuals and was associated with

Table 18. High-Level Summary of Included Studies for KQ 4, by Outcome

Category (number of studies)	Author, Year Quality	Country	Study Design	N analyzed	Sample	Comparison	Outcome measurement	Study conclusions
disturbance (k=6)								some upper arm pain.
	Manning, 2000[159] Fair	UK	Cross-sectional	79	Borderline hypertensives and normotensives, aged 18 to 70; recruitment setting not reported	24-hour ABPM with no comparator	Unvalidated questionnaire: Perception of sleep quality	Sleep disturbance reported in 37% of individuals.
	Nasothimiou, 2013[134] Fair	Greece	Cross-sectional data from within a prospective cohort study	104	Consecutive untreated adults referred for evaluation at an outpatient hypertension clinic	7 days of HBPM vs 24-hour ABPM	Unvalidated questionnaire: Tolerability of using both ABPM and HBPM	HBPM was viewed more favorably than ABPM by participants (82% vs 63%) due to ease, discomfort, and restriction of activities.
	Sherwood, 2019[163]	US	Prospective cohort	121	Volunteersaged30-60, with untreated stage 1 or 2 hypertension*	BL (average of 7 non-ABPM nights) vs three 24-hr ABPM sessions	Wrist actigraphy (Mini-Mitter Actiwatch): sleep efficiency and total sleep duration	Found no evidence that ABPM had an adverse effect on sleep quality
	Tompson, 2019[162] Fair	UK	Cross-sectional data within a prospective Cohort	183	Consecutive pts, aged 40-85, presenting with a single office SBP between 130 and 179 mmHg	28 days of HBPM vs 24-hour ABPM	Unvalidated questionnaire: acceptability of self-monitoring and ABPM	Self-monitoring may be preferable to ABPM
	Verdecchia, 2007[156] Fair	Italy	Cross-sectional data from within a prospective registry	2934 (rand)	Untreated subjects with hypertension from hospital-based registry.	24-hour ABPM with no comparator	Unvalidated questionnaire: Perceived sleep duration	Sleep deprivation of ≥2 hours was reported by 14% of individuals.
	Viera, 2011[158] Fair	US	Cross-sectional	60	Adults with borderline hypertension recruited via flyers in primary care	24-hour ABPM with no comparator	Unvalidated questionnaire: AEs of monitor wear	20% reported the monitor stopped them from falling asleep and 70%

Table 18. High-Level Summary of Included Studies for KQ 4, by Outcome

Category (number of studies)	Author, Year Quality	Country	Study Design	N analyzed	Sample	Comparison	Outcome measurement	Study conclusions
					clinics and a clinical research center.			reported being awoken by the monitor. Commonly reported adverse events included pain, skin irritation, and bruising.

* Clinic SBP between 130-159 and/or DBP of 85-99 mmHg

Abbreviations: ABPM = ambulatory blood pressure measurement; Can = Canada; GHQ = General Health Questionnaire; HADS = hospital anxiety and depression scale; HBPM = home blood pressure measurement; NL = the Netherlands; QoL = quality of life; RCT = randomized controlled trial; SF = short form; UK = United Kingdom; US = United States

Table 19. Summary of Evidence

Key question	Studies (k) Study designs Observations (n)	Summary of findings	Consistency and precision	Other limitations	Strength of evidence	Applicability
KQ 1 Screening	k=1 Cluster RCT (0 new) n=140,642	No trials examined the effectiveness of HTN screening alone vs no screening 1 community-based cluster RCT of a multicomponent CVD health promotion trial reported a 9% reduction in the number of CVD-related hospital admissions (rate ratio, 0.91 [95% CI, 0.86 to 0.97]) but no difference in all-cause mortality.	Consistency NA, reasonably precise	Confounding from multicomponent intervention Short 10-week intervention and 1year followup duration. Administrative records used for outcomes.	MODERATE for small benefit	Population: Older adults ≥65 years Intervention: Community-based intervention (community pharmacy)
KQ 2 Diagnostic accuracy of initial OBPM	k=20 cross sectional studies (20 new) n=12,614	Meta-analysis of 15 studies using SBP/DBP thresholds and measuring blood pressure at 1 visit (N=11,309) showed a pooled sensitivity of 0.54 (95% CI, 0.37 to 0.70) and a pooled specificity of 0.90 (95% CI, 0.84 to 0.95) with considerable heterogeneity.	Inconsistent, imprecise	Heterogeneous group of studies in terms of population, measurement protocols, BP thresholds.	LOW evidence for low sensitivity and adequate specificity	Population: General adult population Intervention: Index test measurement protocols deviated somewhat from commonly performed protocols in U.S. practice in that studies mostly used a mercury sphygmomanometer, had participants rest for 5 minutes prior to measurement, and used the average of multiple measurements. No studies report accuracy for ≥130/80 mm Hg threshold

Table 19. Summary of Evidence

Key question	Studies (k) Study designs Observations (n)	Summary of findings	Consistency and precision	Other limitations	Strength of evidence	Applicability
KQ 2a Diagnostic accuracy of different OBPM protocol characteristics	K=4 cross sectional studies (4 new) N=1,612	3 studies addressed how number of measurements and visits influences accuracy and showed mixed results.	Inconsistent, imprecise	Few studies overall; single studies evaluating different comparisons of comparative accuracy of number of visits and measurements making conclusions difficult.	INSUFFICIENT to evaluate any single protocol characteristic	Population: General adult population Intervention: variations in number of office measurements and visits
KQ 3 Diagnostic Accuracy of Confirmatory Screen	k=18 cross sectional studies (12 new) n=57,128 Repeat OBPM: 13 studies (n=55,759) HBPM: 4 studies (n=1,001) Self-administered OBPM: 2 studies (n=698) Truncated vs 24-h ABPM: 1 study (n=263)	**Repeat OBPM:** Meta-analysis of 8 OBPM confirmation studies (N=53,183) reporting SBP/DBP thresholds showed a pooled sensitivity of 0.80 (95% CI, 0.68 to 0.88) and a pooled specificity of 0.55 (95% CI, 0.42 to 0.66) with considerable heterogeneity. **HBPM:** Meta-analysis of 4 HBPM confirmation studies (N=1,001) showed a pooled sensitivity of 0.84 (95% CI, 0.76 to 0.90), and pooled specificity of 0.60 (95% CI, 0.48 to 0.71) with considerable heterogeneity. **Self-OBPM:** 2 studies reported wide ranging sensitivities (0.20 to 0.92) and specificities (0.25 to 0.97). **Truncated vs 24-h ABPM:** 1 study reporting separate analyses by indication. Sensitivity and specificity were 0.94 and 0.76, respectively, for ABPM indication of borderline HTN (N=126) and 0.89 and 0.70 for the ABPM indication of suspected white coat HTN (N=137).	**Repeat OBPM**: inconsistent and imprecise **HBPM**: inconsistent and imprecise **Self-OPBM**: inconsistent and imprecise **Truncated ABPM:** NA for consistency, precision	Repeat office: heterogeneity in population recruitment, blood pressure measurement protocols, thresholds Self OBPM and truncated ABPM; too few studies AOBP: no studies	**Repeat OBPM:** LOW for adequate sensitivity and low specificity **HBPM**: LOW for adequate sensitivity and low specificity **Self-OPBM**: INSUFFICIENT **Truncated ABPM**: INSUFFICIENT	Population: Adults referred for ABPM due to elevated office blood pressures or suspicious for white coat hypertension. Intervention: **Repeat OBPM**: Most index test protocols had 5 minutes rest and used mercury sphygmomanometer **HBPM**: Diagnostic threshold, devices, and protocol characteristics similar to those in current practice **Self OBPM and truncated ABPM**; Neither intervention commonly used in

Table 19. Summary of Evidence

Key question	Studies (k) Study designs Observations (n)	Summary of findings	Consistency and precision	Other limitations	Strength of evidence	Applicability
						clinical practice for confirmation.
KQ 3a Diagnostic accuracy of different confirmatory protocol characteristics	k=5 cross-sectional studies (4 new) n=1,550	Evidence on accuracy of protocol variations was sparse. **Repeat OBPM:** Two studies examined different office protocols with mixed results **HBPM:** Two studies reported similar accuracies with home protocols based on 7 compared to 5 days of measurement **Self-OPBM:** One study reported similar accuracy for 3 compared to 5 measurements in a single sitting	Office: inconsistent, imprecise Home: consistent, imprecise Self: NA single study	The only protocol variations examined were number of measurements and days of measurements. No studies looked at rest time, patient positioning, timing of measurements during the day or any other variations.	INSUFFICIENT to evaluate any single protocol characteristic for any modality	Population: Referred for ABPM due to elevated office blood pressures or suspicious for white coat hypertension. Intervention: office and home BP variations in protocol could be applicable to current practice.
KQ 4 Harms	k=13 studies [2 RCTs, 6 cohort, 5 cross sectional] (4 newly included) n=5,150	Limited evidence suggests that screening is not associated with any substantial short term QOL changes. Scant evidence on absenteeism is mixed. ABPM is associated with minor adverse events including temporary sleep disturbance, arm discomfort, and bruising.	QOL: consistent, imprecise Absenteeism: Inconsistent, imprecise Tolerability/ sleep disturbance: consistent, imprecise	Heterogenous group of dated studies, generally small in size and of limited quality. QOL studies and absenteeism studies did not control for confounders. Sleep disturbance and tolerability studies limited by cross sectional design without	LOW for minor harms	Population: Employment based and clinic-based studies in very high HDI countries.

Table 19. Summary of Evidence

Key question	Studies (k) Study designs Observations (n)	Summary of findings	Consistency and precision	Other limitations	Strength of evidence	Applicability
				comparators and lack of validated measures.		

Abbreviations: ABPM = ambulatory blood pressure measurement; BP = blood pressure; CI = confidence interval; DBP = diastolic blood pressure; HBPM = home blood pressure measurement; HDI = Human Development Index; HTN = hypertension; k = number of studies; mm Hg = millimeter of mercury; NA = not applicable; OBPM = office-based blood pressure measurement; QoL = quality of life; RCT = randomized clinical trial; SBP = systolic blood pressure

Table 20. Summary of Existing and New Evidence

Key Question	Rationale for existing 2015 recommendation	Limitations of foundational evidence	New evidence	Limitations of new evidence	Consistency of new evidence with prior recommendation
Benefits of screening and treatment	Screening and treatment substantially reduce CVD events based on: • Direct evidence: 1 large cluster RCT (CHAP) • Indirect evidence: IPD MA and MA of treatment benefit	CHAP study: conducted in participants ≥65 years, community pharmacy setting, multicomponent intervention Identification of HTN in treatment trials based on OBPM alone; thus, treatment evidence includes white coat HTN in addition to sustained HTN. Treatment benefit of white coat and masked HTN unknown	No new KQ1 evidence; MAs and IPD MAs of treatment continue to accrue with focus on risk stratification and attention to BP goals	NA	Consistent. Despite low sensitivity of OBPM for initial screening, treatment benefit based on OBPM-based trials is substantial Clinical uncertainty remains as to how to integrate accuracy results with foundational treatment evidence because effectiveness of WCH and MH treatment remain a research gap
Diagnostic accuracy of screening and confirmation	NA	Much of 2015 review focused on establishing ABPM as reference standard based on prognostic value in predicting future CVD events Did not address diagnostic accuracy of screening/confirmatory BP modalities against ABPM reference standard	Initial OBPM screening accuracy: Low sensitivity, adequate specificity Confirmation accuracy: Adequate sensitivity, low specificity for OBPM, HBPM modalities	Accuracy evidence with clinical heterogeneity Index test protocols are "research quality" and deviate from current practice No studies of 130/80 mm Hg threshold, limited data for AOBP	
Harms of screening	Few major harms of screening	Heterogeneous group of small, older studies of varied design and limited quality	Few major harms of screening	Same limitations	Consistent

Abbreviations: AOBP = automated office-based blood pressure; BP = blood pressure; CVD = cardiovascular disease; CHAP = Cardiovascular Health Awareness Program; IPD MA = individual-patient data meta-analysis; KQ = key question; MA = meta-analysis; MH = masked hypertension; NA = not applicable; OBPM = office-based blood pressure measurement; RCT = randomized control trial; WCH = white coat hypertension

Table 21. Estimated Positive and Negative Predictive Values in a Hypothetical Population (n=1,000), Based on KQ2 Meta-Analysis, by Age Group

Pooled estimate	Age group, years	Prevalence of hypertension, percent	Sensitivity	Specificity	TP, n	TN, n	FN, n	FP, n	PPV	NPV
Lower bound of sensitivity CI and upper bound of specificity CI	18-40	22.6	0.37	0.95	84	735	142	39	0.68	0.84
	40-60	30.6	0.37	0.95	113	659	193	35	0.77	0.77
	≥60	41.6	0.37	0.95	154	555	262	29	0.84	0.68
Pooled point estimates	18-40	22.6	0.54	0.90	122	697	104	77	0.61	0.87
	40-60	**30.6**	**0.54**	**0.90**	**165**	**625**	**141**	**69**	**0.70**	**0.82**
	≥60	41.6	0.54	0.90	225	526	191	58	0.79	0.73
Upper bound of sensitivity CI and lower bound of specificity CI	18-40	22.6	0.70	0.84	158	650	68	124	0.56	0.91
	40-60	30.6	0.70	0.84	214	583	92	111	0.66	0.86
	≥60	41.6	0.70	0.84	291	491	125	93	0.76	0.80
Lower bound of sensitivity CI and lower bound of specificity CI	18-40	22.6	0.37	0.84	84	650	142	124	0.40	0.82
	40-60	30.6	0.37	0.84	113	583	193	111	0.50	0.75
	≥60	41.6	0.37	0.84	154	491	262	93	0.62	0.65
Upper bound of sensitivity CI and upper bound of specificity CI	18-40	22.6	0.70	0.95	158	735	68	39	0.80	0.92
	40-60	30.6	0.70	0.95	214	659	92	35	0.86	0.88
	≥60	41.6	0.70	0.95	291	555	125	29	0.91	0.82

Abbreviations: CI = confidence interval; FN = false negative; FP = false positive; NPV = negative predictive value; PPV = positive predictive value; TN = true negative; TP = true positive

Table 22. Comparative Screening and Confirmation Strategies Using a Hypothetical Population of 1,000 With a Hypertension Prevalence of 30.6%

Screening	Confirmation (Tx based on final modality)	Identified HTN cases	WCH treated	Missed masked HTN	Normotensives identified	Number of office visits	Number of ABPMs	Number of HBPMs	Percent of population correctly classified	Percent of hypertensives correctly classified
ABPM	ABPM	306	0	0	694	0	1000	0	100.0	100.0
Office	ABPM	165	0	141	694	1000	234	0	85.9	53.9
Office*	Repeat office, then ABPM	132	0	174	694	1234	163	0	82.6	43.1
Office*	Repeat Office	132	31	174	663	1234	0	0	79.5	43.1
Office*	HBPM	139	28	167	666	1000	0	234	80.5	45.4

* One or multiple elevated office measure could have been used to indicate confirmation

Assumptions: Prevalence of 30.6% based on 24-h ABPM in untreated population 40-60 years old based on IDACO IPD-MA.[32] Screening OBPM sensitivity 0.54, specificity 0.90 based on KQ2 pooled estimates; for confirmatory testing with OBPM (sensitivity 0.80, specificity 0.55) or HBPM (sensitivity 0.84, specificity 0.60) based on KQ3 pooled estimates.

Abbreviations: ABPM = ambulatory blood pressure measurement; HBPM = home blood pressure measurement; HTN = hypertension; Tx = treatment; WCH = white coat hypertension

Table 23. Risk for Cardiovascular Events Associated With ABPM Phenotypes in Synthesized Literature

Author Study type	N analyzed and N events	Baseline treatment status	ABPM interval	Measure of risk and adjustments	WCHTN vs NT	WCHTN vs SHTN	MHTN vs NT	MHTN vs SHTN	SHTN vs NT
Briasoulis, 2016[182] SR/MA of 14 studies	N analyzed: 29,100* N events: NR	Treated and untreated (proportion NR)	Daytime, 24-h, and HBPM†	OR (95% CI); adjustments not reported	**1.73 (1.27 to 2.36)**	**0.40 (0.32 to 0.51)**	NR	NR	NR
Huang, 2017[183] SR/MA of 8 studies including 23 cohorts‡	N analyzed: 20,445 N CVD events: NR	Untreated§	Daytime, 24-h and HBPM‖	RR (95% CI); study-level adjustments for various CVD risk factors	**1.38 (1.15 to 1.65)**	NR	NR	NR	NR
Pierdomenico, 2011[38] SR/MA of 8 studies	N=7,961 N CVD events: 696	Untreated	Daytime, 24-h¶	HR (95% CI); study-level adjustments for various CVD risk factors	0.96 (0.65 to 1.42)	NR	**2.09 (1.55 to 2.81)**	NR	**2.59 (2.0 to 3.35)**
Asayama, 2014[37] IPD-MA of 12 cohorts	N analyzed: 8,237 N CVD events: 729	Untreated	24-h	HR (95% CI); age, sex, BMI, smoking, drinking, TC, DM, CVD history, and cohort	1.21 (0.91 to 1.61)	**0.51 (0.40 to 0.64)**	**2.03 (1.55 to 2.67)**	**0.70 (0.54 to 0.91)**	NR
			Daytime	HR (95% CI); age, sex, BMI, smoking, drinking, TC, DM, CVD history, and cohort	**1.38 (1.03 to 1.87)**	**0.57 (0.44 to 0.73)**	**1.85 (1.42 to 2.40)**	**0.61 (0.48 to 0.78)**	NR
Cohen, 2019[184] SR/MA of 27 studies	N analyzed: 85,239	Untreated#	Daytime, 24-h**	HR (95% CI); study-level adjustments for various CVD risk factors††	**1.36 (1.03 to 2.00)**	NR	NR	NR	**2.31 (1.91 to 3.15)** ‡‡[185]

Table 23. Risk for Cardiovascular Events Associated With ABPM Phenotypes in Synthesized Literature

Author Study type	N analyzed and N events	Baseline treatment status	ABPM interval	Measure of risk and adjustments	WCHTN vs NT	WCHTN vs SHTN	MHTN vs NT	MHTN vs SHTN	SHTN vs NT
	N CVD events: NR								

*Total N analyzed across all outcomes; NR by outcome
† One study used intra-arterial 24-h ABPM and 3 studies used HBPM
‡ For untreated population
§ Results for untreated population reported in table; in the treated population, the relative risk for a CVD event was nonsignificantly increased in those with WCHTN compared to NT [1.16 (95% CI, 0.91 to 1.49)]
‖ 1 study used HBPM
¶ Daytime ABPM used in seven out of eight studies
# In analyses restricted to treated participants, the adjusted HR for white coat hypertension compared to normotension was 1.12 (95% CI, 0.91 to 1.39)
** Five studies used HBPM
†† As reported in Supplement Table 4
‡‡ Shimbo and colleagues report hazard ratios for white coat vs sustained hypertension for the studies of untreated white coat hypertension reported in the review by Cohen and colleagues

Abbreviations: ABPM=ambulatory blood pressure monitoring; ACM=all-cause mortality; CVD=cardiovascular disease; HBPM=home blood pressure monitoring; IPD MA=individual patient-data meta-analysis; MHTN=masked hypertension; N=number; NR=not reported; NT=normotension; SHTN=sustained hypertension; SR/MA=systematic review and meta-analysis; WHTN=white coat hypertension

Literature search strategies for primary literature

Key:
/ = MeSH subject heading
* = truncation
ab = word in abstract
adj# = adjacent within # number of words
ae = adverse effects
bt = word in book title
co = complications
di = diagnosis
fs = floating subheading
kf = keyword heading word
kw= keyword
MH = MeSH Heading
MW = floating subheading
N# = adjacent within # number of words
near/# = adjacent within x number of words
NEXT = immediately adjacent
PT = Publication type
ti = word in title

Cochrane Central Register of Controlled Clinical Trials (CENTRAL)

Issue 8 of 12, August 2019

#1	"blood pressure":ti	12378
#2	"blood pressures":ti	100
#3	"arterial pressure":ti	350
#4	"arterial pressures":ti	6
#5	"systolic pressure":ti	48
#6	"systolic pressures":ti	1
#7	"diastolic pressure":ti	20
#8	"diastolic pressures":ti	1
#9	hypertensi*:ti	26580
#10	prehypertensi*:ti	295
#11	pre NEXT hypertensi*:ti	68
#12	sphygmomanomet*:ti	56
#13	aobp:ti	0
#14	mobp:ti	0
#15	obpm:ti	0
#16	hbpm:ti	3
#17	abpm:ti	72
#18	{#1-`#17	35871
#19	screen*:ti,ab,kw	63475
#20	monitor*:ti,ab,kw	84917
#21	diagnos*:ti,ab,kw	215515
#22	measur*:ti,ab,kw	410731

#23 determin*:ti,ab,kw 229847
#24 surveil*:ti,ab,kw 8011
#25 confirm*:ti,ab,kw 79820
#26 {or #19-#25} 749079
#27 #18 and #26 18198
#28 home:ti,ab,kw 36669
#29 office:ti,ab,kw 7125
#30 ambulatory:ti,ab,kw 19896
#31 ausculta*:ti,ab,kw 800
#32 oscillometr*:ti,ab,kw 708
#33 korotkoff:ti,ab,kw 67
#34 {or #28-#33} 61055
#35 #18 and #34 5598
#36 #27 or #35 with Publication Year from 2014 to 2019, with Cochrane Library publication date Between Jul 2018 and Dec 2019, in Trials 1987

OVID MEDLINE Indexed
Database: Ovid MEDLINE(R) <1946 to July Week 5 2019>, Ovid MEDLINE(R) Daily Update <August 07, 2019>

Search Strategy:
KQ1 Screening Trials

1 Hypertension/ (227235)
2 Essential Hypertension/ (2145)
3 Masked Hypertension/ (254)
4 White Coat Hypertension/ (374)
5 Prehypertension/ (873)
6 Blood Pressure/ (268434)
7 Arterial Pressure/ (4823)
8 hypertensi*.ti,bt. (175473)
9 prehypertensi*.ti,bt. (861)
10 arterial pressure*.ti,bt. (5335)
11 (systolic pressure* or diastolic pressure*).ti,ab,kf. (24759)
12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 (488330)
13 Mass Screening/ (98464)
14 screen*.ti,ab,kf. (602589)
15 13 or 14 (630045)
16 Hypertension/di (18926)
17 Prehypertension/di (178)
18 Essential Hypertension/di (42)
19 Masked Hypertension/di (138)
20 White Coat Hypertension/di (200)
21 16 or 17 or 18 or 19 or 20 (19223)
22 hypertensi*.ti,ab,kf. (377802)
23 prehypertensi*.ti,ab,kf. (2171)

24 pre hypertensi*.ti,ab,kf. (590)
25 arterial pressure*.ti,ab,kf. (56533)
26 blood pressure.ti,ab,kf. (265756)
27 (systolic pressure* or diastolic pressure*).ti,ab,kf. (24759)
28 22 or 23 or 24 or 25 or 26 or 27 (586814)
29 screen*.ti,ab,kf. (602589)
30 28 and 29 (17927)
31 limit 30 to ("in data review" or in process or "pubmed not medline") (0)
32 12 and 15 (10927)
33 21 or 31 or 32 (28369)
34 Blood Pressure Determination/ (26875)
35 Sphygmomanometers/ (869)
36 Blood Pressure Monitors/ (2223)
37 ((office or clinic*) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (11817)
38 (home adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (2226)
39 ((blood pressure* or BP or hypertensi*) adj3 kiosk*).ti,ab,kf. (12)
40 ((manual or automated) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (784)
41 ((ausculta* or oscillomet* or korotkoff) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (991)
42 ((blood pressure* or BP or hypertensi*) adj1 (monitor* or measur* or surveil*)).ti,ab,kf. (21373)
43 ((blood pressure* or BP or hypertensi*) adj3 confirm*).ti,ab,kf. (1370)
44 (((hypertensi* or blood pressure* or BP) adj3 screen*) and (instrument* or method* or technique*)).ti,ab,kf. (930)
45 aobp.ti,ab,kf. (47)
46 mobp.ti,ab,kf. (89)
47 obpm.ti,ab,kf. (30)
48 hbpm.ti,ab,kf. (203)
49 Sphygmomanomet*.ti,ab,kf. (2837)
50 Blood Pressure Monitoring, Ambulatory/ (9294)
51 abpm.ti,ab,kf. (2326)
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54 33 or 53 (81694)
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57 Meta-Analysis as Topic/ (17134)
58 Random allocation/ (99937)
59 control groups/ or double-blind method/ or single-blind method/ (180418)
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62 random*.ti,ab,kf. (905774)

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64 54 and 63 (15136)
65 limit 64 to "all adult (19 plus years)" (11398)
66 limit 64 to "all child (0 to 18 years)" (1969)
67 66 not 65 (585)
68 64 not 67 (14551)
69 animals/ not (humans/ and animals/) (4573928)
70 68 not 69 (14228)
71 limit 70 to english language (12959)
72 limit 71 to yr="2014 -Current" (3314)
73 remove duplicates from 72 (3308)
74 (201808* or 201809* or 201810* or 201811* or 201812* or 2019*).ed. (947729)
75 73 and 74 (607)

KQ2 and KQ3 Screening Diagnostic Accuracy

1 Hypertension/ (227235)
2 Essential Hypertension/ (2145)
3 Masked Hypertension/ (254)
4 White Coat Hypertension/ (374)
5 Prehypertension/ (873)
6 Blood Pressure/ (268434)
7 Arterial Pressure/ (4823)
8 hypertensi*.ti,bt. (175473)
9 prehypertensi*.ti,bt. (861)
10 arterial pressure*.ti,bt. (5335)
11 (systolic pressure* or diastolic pressure*).ti,ab,kf. (24759)
12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 (488330)
13 Mass Screening/ (98464)
14 screen*.ti,ab,kf. (602589)
15 13 or 14 (630045)
16 Hypertension/di (18926)
17 Prehypertension/di (178)
18 Essential Hypertension/di (42)
19 Masked Hypertension/di (138)
20 White Coat Hypertension/di (200)
21 16 or 17 or 18 or 19 or 20 (19223)
22 hypertensi*.ti,ab,kf. (377802)
23 prehypertensi*.ti,ab,kf. (2171)
24 pre hypertensi*.ti,ab,kf. (590)
25 arterial pressure*.ti,ab,kf. (56533)
26 blood pressure.ti,ab,kf. (265756)
27 (systolic pressure* or diastolic pressure*).ti,ab,kf. (24759)
28 22 or 23 or 24 or 25 or 26 or 27 (586814)
29 screen*.ti,ab,kf. (602589)
30 28 and 29 (17927)

31 limit 30 to ("in data review" or in process or "pubmed not medline") (0)
32 12 and 15 (10927)
33 21 or 31 or 32 (28369)
34 Blood Pressure Determination/ (26875)
35 Sphygmomanometers/ (869)
36 Blood Pressure Monitors/ (2223)
37 ((office or clinic*) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (11817)
38 (home adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (2226)
39 ((blood pressure* or BP or hypertensi*) adj3 kiosk*).ti,ab,kf. (12)
40 ((manual or automated) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (784)
41 ((ausculta* or oscillomet* or korotkoff) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (991)
42 ((blood pressure* or BP or hypertensi*) adj1 (monitor* or measur* or surveil*)).ti,ab,kf. (21373)
43 ((blood pressure* or BP or hypertensi*) adj3 confirm*).ti,ab,kf. (1370)
44 (((hypertensi* or blood pressure* or BP) adj3 screen*) and (instrument* or method* or technique*)).ti,ab,kf. (930)
45 aobp.ti,ab,kf. (47)
46 mobp.ti,ab,kf. (89)
47 obpm.ti,ab,kf. (30)
48 hbpm.ti,ab,kf. (203)
49 Sphygmomanomet*.ti,ab,kf. (2837)
50 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 (55272)
51 33 or 50 (75330)
52 Blood Pressure Monitoring, Ambulatory/ (9294)
53 abpm.ti,ab,kf. (2326)
54 (ambulat* and (blood pressure* or BP or hypertensi*)).ti,ab,kf. (14367)
55 52 or 53 or 54 (17720)
56 "Sensitivity and Specificity"/ (337969)
57 "Predictive Value of Tests"/ (193080)
58 ROC Curve/ (53126)
59 False Negative Reactions/ (17444)
60 False Positive Reactions/ (27151)
61 Diagnostic Errors/ (36643)
62 "Reproducibility of Results"/ (379982)
63 Reference Values/ (157427)
64 Reference Standards/ (41087)
65 Observer Variation/ (40998)
66 Prevalence/ (272713)
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68 ROC curve*.ti,ab,kf. (24460)
69 sensitivit*.ti,ab,kf. (668322)
70 specificit*.ti,ab,kf. (419213)
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73 false positive*.ti,ab,kf. (50776)
74 false negative*.ti,ab,kf. (28903)
75 miss rate*.ti,ab,kf. (382)
76 error rate*.ti,ab,kf. (10497)
77 prevalence.ti,ab,kf. (501046)
78 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 (2443663)
79 51 and 55 and 78 (3544)
80 limit 79 to "all adult (19 plus years)" (2600)
81 limit 79 to "all child (0 to 18 years)" (572)
82 81 not 80 (224)
83 79 not 82 (3320)
84 animals/ not (humans/ and animals/) (4573928)
85 83 not 84 (3309)
86 limit 85 to english language (2951)
87 limit 86 to yr="2014 -Current" (761)
88 remove duplicates from 87 (761)
89 (201808* or 201809* or 201810* or 201811* or 201812* or 2019*).ed. (947729)
90 88 and 89 (117)

KQ4 Screening Harms

1 Hypertension/ (227235)
2 Essential Hypertension/ (2145)
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13 Mass Screening/ (98464)
14 screen*.ti,ab,kf. (602589)
15 13 or 14 (630045)
16 Hypertension/di (18926)
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24 pre hypertensi*.ti,ab,kf. (590)

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26 blood pressure.ti,ab,kf. (265756)
27 (systolic pressure* or diastolic pressure*).ti,ab,kf. (24759)
28 22 or 23 or 24 or 25 or 26 or 27 (586814)
29 screen*.ti,ab,kf. (602589)
30 28 and 29 (17927)
31 limit 30 to ("in data review" or in process or "pubmed not medline") (0)
32 12 and 15 (10927)
33 21 or 31 or 32 (28369)
34 Blood Pressure Determination/ (26875)
35 Sphygmomanometers/ (869)
36 Blood Pressure Monitors/ (2223)
37 ((office or clinic*) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (11817)
38 (home adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (2226)
39 ((blood pressure* or BP or hypertensi*) adj3 kiosk*).ti,ab,kf. (12)
40 ((manual or automated) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (784)
41 ((ausculta* or oscillometr* or korotkoff) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (987)
42 ((blood pressure* or BP or hypertensi*) adj1 (monitor* or measur* or surveil*)).ti,ab,kf. (21373)
43 ((blood pressure* or BP or hypertensi*) adj3 confirm*).ti,ab,kf. (1370)
44 (((hypertensi* or blood pressure* or BP) adj3 screen*) and (instrument* or method* or technique*)).ti,ab,kf. (930)
45 aobp.ti,ab,kf. (47)
46 mobp.ti,ab,kf. (89)
47 obpm.ti,ab,kf. (30)
48 hbpm.ti,ab,kf. (203)
49 Sphygmomanometer.ti,ab,kf. (1981)
50 Blood Pressure Monitoring, Ambulatory/ (9294)
51 abpm.ti,ab,kf. (2326)
52 (ambulat* and (blood pressure* or BP or hypertensi*)).ti,ab,kf. (14367)
53 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 (62121)
54 "Quality of Life"/ (179329)
55 ABSENTEEISM/ (8783)
56 Sick Leave/ (5529)|
57 Sick Role/ (11307)
58 Illness Behavior/ (981)
59 ANXIETY/ (75777)
60 DEPRESSION/ (110709)
61 quality of life.ti,ab,kf. (214204)
62 self rated health.ti,ab,kf. (5570)
63 (psychological adj (distress or effect* or impact)).ti,ab,kf. (19979)
64 anxiet*.ti,ab,kf. (152104)
65 (depression or depressed or depressive).ti,ab,kf. (361412)
66 absenteeism.ti,ab,kf. (4889)

67 ((disability or sick) adj3 day*).ti,ab,kf. (1981)
68 ae.fs. (1663413)
69 (harm or harms or harmful or harmed).ti,ab,kf. (88494)
70 (adverse adj (effect* or event* or outcome* or reaction*)).ti,ab,kf. (284811)
71 complication*.ti,ab,kf. (811196)
72 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 (3105948)
73 (33 or 53) and 72 (13382)
74 (label* adj5 (hypertensi* or prehypertensi* or "blood pressure" or "arterial pressure")).ti,ab,kf. (373)
75 73 or 74 (13703)
76 limit 75 to "all adult (19 plus years)" (9373)
77 limit 75 to "all child (0 to 18 years)" (2097)
78 77 not 76 (748)
79 75 not 78 (12955)
80 animals/ not (humans/ and animals/) (4573928)
81 79 not 80 (12489)
82 limit 81 to english language (10794)
83 limit 82 to yr="2014 -Current" (3042)
84 remove duplicates from 83 (3039)
85 (201808* or 201809* or 201810* or 201811* or 201812* or 2019*).ed. (947729)
86 84 and 85 (649)

MEDLINE Non Indexed
Database: Ovid MEDLINE(R) Epub Ahead of Print <August 08, 2019>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <1946 to August 07, 2019>
Search Strategy:

KQ1 Screening Trials
1 Hypertension/ (0)
2 Essential Hypertension/ (0)
3 Masked Hypertension/ (0)
4 White Coat Hypertension/ (0)
5 Prehypertension/ (0)
6 Blood Pressure/ (0)
7 Arterial Pressure/ (0)
8 hypertensi*.ti,bt. (13979)
9 prehypertensi*.ti,bt. (99)
10 arterial pressure*.ti,bt. (189)
11 (systolic pressure* or diastolic pressure*).ti,ab,kf. (1384)
12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 (15258)
13 Mass Screening/ (0)
14 screen*.ti,ab,kf. (97400)
15 13 or 14 (97400)
16 Hypertension/di (0)
17 Prehypertension/di (0)

18 Essential Hypertension/di (0)
19 Masked Hypertension/di (0)
20 White Coat Hypertension/di (0)
21 16 or 17 or 18 or 19 or 20 (0)
22 hypertensi*.ti,ab,kf. (40693)
23 prehypertensi*.ti,ab,kf. (304)
24 pre hypertensi*.ti,ab,kf. (138
25 arterial pressure*.ti,ab,kf. (3664)
26 blood pressure.ti,ab,kf. (26043)
27 (systolic pressure* or diastolic pressure*).ti,ab,kf. (1384)
28 22 or 23 or 24 or 25 or 26 or 27 (59241)
29 screen*.ti,ab,kf. (97400)
30 28 and 29 (3110)
31 limit 30 to ("in data review" or in process or "pubmed not medline") (2707)
32 12 and 15 (695)
33 21 or 31 or 32 (2787)
34 Blood Pressure Determination/ (0)
35 Sphygmomanometers/ (0)
36 Blood Pressure Monitors/ (0)
37 ((office or clinic*) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (1560)
38 (home adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (352)
39 ((blood pressure* or BP or hypertensi*) adj3 kiosk*).ti,ab,kf. (3)
40 ((manual or automated) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (142)
41 ((ausculta* or oscillomet* or korotkoff) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (107)
42 ((blood pressure* or BP or hypertensi*) adj1 (monitor* or measur* or surveil*)).ti,ab,kf. (2569)
43 ((blood pressure* or BP or hypertensi*) adj3 confirm*).ti,ab,kf. (167)
44 (((hypertensi* or blood pressure* or BP) adj3 screen*) and (instrument* or method* or technique*)).ti,ab,kf. (182)
45 aobp.ti,ab,kf. (22)
46 mobp.ti,ab,kf. (11)
47 obpm.ti,ab,kf. (9)
48 hbpm.ti,ab,kf. (49)
49 Sphygmomanomet*.ti,ab,kf. (279)
50 Blood Pressure Monitoring, Ambulatory/ (0)
51 abpm.ti,ab,kf. (340)
52 (ambulat* and (blood pressure* or BP or hypertensi*)).ti,ab,kf. (1541)
53 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 (4753)
54 33 or 53 (7094)
55 (clinical trial or controlled clinical trial or randomized controlled trial or adaptive clinical trial or equivalence trial or pragmatic clinical trial or meta analysis).pt. (413)
56 clinical trials as topic/ or controlled clinical trials as topic/ or randomized controlled trials as topic/ or adaptive clinical trials as topic/ or equivalence trials as topic/ or pragmatic clinical trials as topic/ (0)

57 Meta-Analysis as Topic/ (0)
58 Random allocation/ (0)
59 control groups/ or double-blind method/ or single-blind method/ (0)
60 clinical trial*.ti,ab,kf. (53205)
61 (control* adj3 (study or studies or trial*)).ti,ab,kf. (68672)
62 random*.ti,ab,kf. (161593)
63 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 (217224)
64 54 and 63 (1440)
65 limit 64 to "all adult (19 plus years)" (0)
66 limit 64 to "all child (0 to 18 years)" (0)
67 66 not 65 (0)
68 64 not 67 (1440)
69 animals/ not (humans/ and animals/) (0)
70 68 not 69 (1440)
71 limit 70 to english language (1426)
72 limit 71 to yr="2014 -Current" (1071)
73 remove duplicates from 72 (1065)

KQ2 and KQ3 Screening Diagnostic Accuracy

1 Hypertension/ (0)
2 Essential Hypertension/ (0)
3 Masked Hypertension/ (0)
4 White Coat Hypertension/ (0)
5 Prehypertension/ (0)
6 Blood Pressure/ (0)
7 Arterial Pressure/ (0)
8 hypertensi*.ti,bt. (13979)
9 prehypertensi*.ti,bt. (99)
10 arterial pressure*.ti,bt. (189)
11 (systolic pressure* or diastolic pressure*).ti,ab,kf. (1384)
12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 (15258)
13 Mass Screening/ (0)
14 screen*.ti,ab,kf. (97400)
15 13 or 14 (97400)
16 Hypertension/di (0)
17 Prehypertension/di (0)
18 Essential Hypertension/di (0)
19 Masked Hypertension/di (0)
20 White Coat Hypertension/di (0)
21 16 or 17 or 18 or 19 or 20 (0)
22 hypertensi*.ti,ab,kf. (40693)
23 prehypertensi*.ti,ab,kf. (304)
24 pre hypertensi*.ti,ab,kf. (138)
25 arterial pressure*.ti,ab,kf. (3664)
26 blood pressure.ti,ab,kf. (26043)

27 (systolic pressure* or diastolic pressure*).ti,ab,kf. (1384)
28 22 or 23 or 24 or 25 or 26 or 27 (59241)
29 screen*.ti,ab,kf. (97400)
30 28 and 29 (3110)
31 limit 30 to ("in data review" or in process or "pubmed not medline") (2707)
32 12 and 15 (695)
33 21 or 31 or 32 (2787)
34 Blood Pressure Determination/ (0)
35 Sphygmomanometers/ (0)
36 Blood Pressure Monitors/ (0)
37 ((office or clinic*) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (1560)
38 (home adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (352)
39 ((blood pressure* or BP or hypertensi*) adj3 kiosk*).ti,ab,kf. (3)
40 ((manual or automated) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (142)
41 ((ausculta* or oscillomet* or korotkoff) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (107)
42 ((blood pressure* or BP or hypertensi*) adj1 (monitor* or measur* or surveil*)).ti,ab,kf. (2569)
43 ((blood pressure* or BP or hypertensi*) adj3 confirm*).ti,ab,kf. (167)
44 (((hypertensi* or blood pressure* or BP) adj3 screen*) and (instrument* or method* or technique*)).ti,ab,kf. (182)
45 aobp.ti,ab,kf. (22)
46 mobp.ti,ab,kf. (11)
47 obpm.ti,ab,kf. (9)
48 hbpm.ti,ab,kf. (49)
49 Sphygmomanomet*.ti,ab,kf. (279)
50 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 (4186)
51 33 or 50 (6551)]
52 Blood Pressure Monitoring, Ambulatory/ (0)
53 abpm.ti,ab,kf. (340)
54 (ambulat* and (blood pressure* or BP or hypertensi*)).ti,ab,kf. (1541)
55 52 or 53 or 54 (1578)
56 "Sensitivity and Specificity"/ (0)
57 "Predictive Value of Tests"/ (0)
58 ROC Curve/ (0)
59 False Negative Reactions/ (0)
60 False Positive Reactions/ (0)
61 Diagnostic Errors/ (0)
62 "Reproducibility of Results"/ (0)
63 Reference Values/ (0)
64 Reference Standards/ (0)
65 Observer Variation/ (0)
66 Prevalence/ (0)
67 Receiver operat*.ti,ab,kf. (12876)
68 ROC curve*.ti,ab,kf. (5325)

69 sensitivit*.ti,ab,kf. (103359)
70 specificit*.ti,ab,kf. (44604)
71 predictive value.ti,ab,kf. (10286)
72 accuracy.ti,ab,kf. (73665)
73 false positive*.ti,ab,kf. (5512)
74 false negative*.ti,ab,kf. (2794)
75 miss rate*.ti,ab,kf. (83)
76 error rate*.ti,ab,kf. (3020)
77 prevalence.ti,ab,kf. (79505)
78 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 (274346)
79 51 and 55 and 78 (255)
80 limit 79 to "all adult (19 plus years)" (0)
81 limit 79 to "all child (0 to 18 years)" (0)
82 81 not 80 (0)
83 79 not 82 (255)
84 animals/ not (humans/ and animals/) (0)
85 83 not 84 (255)
86 limit 85 to english language (251)
87 limit 86 to yr="2014 -Current" (199)
88 remove duplicates from 87 (198)

KQ4 Screening Harms

1 Hypertension/ (0)
2 Essential Hypertension/ (0)
3 Masked Hypertension/ (0)
4 White Coat Hypertension/ (0)
5 Prehypertension/ (0)
6 Blood Pressure/ (0)
7 Arterial Pressure/ (0)
8 hypertensi*.ti,bt. (13979)
9 prehypertensi*.ti,bt. (99)
10 arterial pressure*.ti,bt. (189)
11 (systolic pressure* or diastolic pressure*).ti,ab,kf. (1384)
12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 (15258)
13 Mass Screening/ (0)
14 screen*.ti,ab,kf. (97400)
15 13 or 14 (97400)
16 Hypertension/di (0)
17 Prehypertension/di (0)
18 Essential Hypertension/di (0)
19 Masked Hypertension/di (0)
20 White Coat Hypertension/di (0)
21 16 or 17 or 18 or 19 or 20 (0)
22 hypertensi*.ti,ab,kf. (40693)

23 prehypertensi*.ti,ab,kf. (304)
24 pre hypertensi*.ti,ab,kf. (138)
25 arterial pressure*.ti,ab,kf. (3664)
26 blood pressure.ti,ab,kf. (26043)
27 (systolic pressure* or diastolic pressure*).ti,ab,kf. (1384)
28 22 or 23 or 24 or 25 or 26 or 27 (59241)
29 screen*.ti,ab,kf. (97400)
30 28 and 29 (3110)
31 limit 30 to ("in data review" or in process or "pubmed not medline") (2707)
32 12 and 15 (695)
33 21 or 31 or 32 (2787)
34 Blood Pressure Determination/ (0)
35 Sphygmomanometers/ (0)
36 Blood Pressure Monitors/ (0)
37 ((office or clinic*) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (1560)
38 (home adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (352)
39 ((blood pressure* or BP or hypertensi*) adj3 kiosk*).ti,ab,kf. (3)
40 ((manual or automated) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (142)
41 ((ausculta* or oscillometr* or korotkoff) adj3 (blood pressure* or BP or hypertensi*)).ti,ab,kf. (107)
42 ((blood pressure* or BP or hypertensi*) adj1 (monitor* or measur* or surveil*)).ti,ab,kf. (2569)
43 ((blood pressure* or BP or hypertensi*) adj3 confirm*).ti,ab,kf. (167)
44 (((hypertensi* or blood pressure* or BP) adj3 screen*) and (instrument* or method* or technique*)).ti,ab,kf. (182)
45 aobp.ti,ab,kf. (22)
46 mobp.ti,ab,kf. (11)
47 obpm.ti,ab,kf. (9)
48 hbpm.ti,ab,kf. (49)
49 Sphygmomanometer.ti,ab,kf. (224)
50 Blood Pressure Monitoring, Ambulatory/ (0)
51 abpm.ti,ab,kf. (340)
52 (ambulat* and (blood pressure* or BP or hypertensi*)).ti,ab,kf. (1541)
53 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 (4721)
54 "Quality of Life"/ (0)
55 ABSENTEEISM/ (0)
56 Sick Leave/ (0)
57 Sick Role/ (0)
58 Illness Behavior/ (0)
59 ANXIETY/ (0)
60 DEPRESSION/ (0)
61 quality of life.ti,ab,kf. (42992)
62 self rated health.ti,ab,kf. (997)
63 (psychological adj (distress or effect* or impact)).ti,ab,kf. (3661)
64 anxiet*.ti,ab,kf. (26684)

65 (depression or depressed or depressive).ti,ab,kf. (50781)
66 absenteeism.ti,ab,kf. (668)
67 ((disability or sick) adj3 day*).ti,ab,kf. (227)
68 ae.fs. (0)
69 (harm or harms or harmful or harmed).ti,ab,kf. (18069)
70 (adverse adj (effect* or event* or outcome* or reaction*)).ti,ab,kf. (49108)
71 complication*.ti,ab,kf. (112421)
72 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 (264381)
73 (33 or 53) and 72 (1319)
74 (label* adj5 (hypertensi* or prehypertensi* or "blood pressure" or "arterial pressure")).ti,ab,kf. (47)
75 73 or 74 (1361)
76 limit 75 to "all adult (19 plus years)" (0)
77 limit 75 to "all child (0 to 18 years)" (0)
78 77 not 76 (0)
79 75 not 78 (1361)
80 animals/ not (humans/ and animals/) (0)
81 79 not 80 (1361)
82 limit 81 to english language (1336)
83 limit 82 to yr="2014 -Current" (1002)
84 remove duplicates from 83 (999)

CINAHL

KQ1 Screening Trials

#	Query	Results
S81	S77 AND S80	320
S80	S78 OR S79	334,171
S79	EM 2019-	189,166
S78	EM 201808* OR EM 201809* OR EM 201810* OR EM 201811* OR EM 201812*	145,005
S77	S74 AND S75 **(2014-2019) Limits**	2,300
S76	S74 AND S75	5,340
S75	(MH "Meta Analysis") OR (MH "Control Group") OR (MH "Single-Blind Studies") OR (MH "Double-Blind Studies") OR (MH "Triple-Blind Studies") OR (MH "Randomized Controlled Trials") OR (MH "Clinical Trials") OR (MH "Random Assignment") OR (AB clinical n1 trial*) OR (AB controlled n1 trial*) OR (TI clinical n1 trial*) OR (TI controlled n1 trial*) OR (PT Clinical trial) OR (PT randomized controlled trial)	411,569
S74	S39 OR S73	31,555
S73	(S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63 OR	23,603

	S64 OR S65 OR S66 OR S67 OR S68 OR S69 OR S70 OR S71 OR S72)	
S72	AB (ambulat*) AND (blood pressure* or BP or hypertensi*)	3,931
S71	TI (ambulat*) AND (blood pressure* or BP or hypertensi*)	1,622
S70	AB abpm	567
S69	TI abpm	27
S68	(MH "Blood Pressure Monitoring, Ambulatory")	3,023
S67	AB sphygmomanometer*	603
S66	TI sphygmomanometer*	142
S65	AB hbpm	81
S64	TI hbpm	0
S63	AB obpm	12
S62	TI obpm	0
S61	AB mobp	7
S60	TI mobp	2
S59	AB aobp	25
S58	TI aobp	1
S57	AB (confirm*) N3 (blood pressure* or BP or hypertensi*)	338
S56	TI (confirm*) N3 (blood pressure* or BP or hypertensi*)	20
S55	AB (monitor* or measur* or surveil*) N3 (blood pressure* or BP or hypertensi*)	10,131
S54	TI (monitor* or measur* or surveil*) N3 (blood pressure* or BP or hypertensi*)	2,444
S53	AB (ausculta* or oscillomet* or korotkoff) N3 (blood pressure* or BP or hypertensi*)	318
S52	TI (ausculta* or oscillomet* or korotkoff) N3 (blood pressure* or BP or hypertensi*)	143
S51	AB (manual or automated) N3 (blood pressure* or BP or hypertensi*)	327
S50	TI (manual or automated) N3 (blood pressure* or BP or hypertensi*)	158
S49	AB kiosk* N3 (blood pressure* or BP or hypertensi*)	7
S48	TI kiosk* N3 (blood pressure* or BP or hypertensi*)	5
S47	AB home N3 (blood pressure* or BP or hypertensi*)	821
S46	TI home N3 (blood pressure* or BP or hypertensi*)	602
S45	AB (office or clinic*) N3 (blood pressure* or BP or hypertensi*)	3,712
S44	TI (office or clinic*) N3 (blood pressure* or BP or hypertensi*)	1,008
S43	(MH "Blood Pressure Cuffs")	240
S42	(MH "Blood Pressure Devices")	708
S41	(MH "Sphygmomanometers")	539
S40	(MH "Blood Pressure Determination")	8,737
S39	S30 OR S38	11,286
S38	(S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37)	5,278

S37	(MH "Prehypertension/DI")	48
S36	(MH "Hypertension, Malignant/DI")	43
S35	(MH "Hypertension, Isolated Systolic/DI")	7
S34	(MH "Hypertension, Refractory/DI")	25
S33	(MH "Masked Hypertension/DI")	45
S32	(MH "Hypertension, White Coat/DI")	57
S31	(MH "Hypertension/DI")	5,123
S30	S24 AND S29	6,567
S29	(S25 OR S26 OR S27 OR S28)	158,344
S28	AB screen*	116,458
S27	TI screen*	54,032
S26	(MH "Rescreening")	164
S25	(MH "Health Screening")	39,820
S24	(S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23)	142,878
S23	AB "diastolic pressur*"	1,251
S22	TI "diastolic pressur*"	119
S21	AB "systolic pressur*"	1,619
S20	TI "systolic pressur*"	127
S19	AB "arterial pressur*"	6,674
S18	TI "arterial pressur*"	566
S17	AB "blood pressur*"	49,183
S16	TI "blood pressur*"	16,343
S15	AB prehypertensi* OR "pre hypertensi*"	985
S14	TI prehypertensi* OR "pre hypertensi*"	745
S13	AB hypertensi*	59,036
S12	TI hypertensi*	33,537
S11	(MH "Diastolic Pressure")	2,154
S10	(MH "Systolic Pressure")	3,242
S9	(MH "Arterial Pressure")	2,588
S8	(MH "Blood Pressure")	35,137
S7	(MH "Prehypertension")	277
S6	(MH "Hypertension, Malignant")	164
S5	(MH "Hypertension, Isolated Systolic")	67
S4	(MH "Hypertension, Refractory")	120
S3	(MH "Masked Hypertension")	99
S2	(MH "Hypertension, White Coat")	163
S1	(MH "Hypertension")	48,394

KQ2 and KQ3 Screening Diagnostic Accuracy

#	Query	Results
S113	S109 AND S112	49
S112	S110 OR S111	334,171
S111	EM 2019-	189,166
S110	EM 201808* OR EM 201809* OR EM 201810* OR EM 201811* OR EM 201812*	145,005

S109	S69 AND S75 AND S107 **(2014-2019) Date Limits**	329
S108	S69 AND S75 AND S107	814
S107	S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85 OR S86 OR S87 OR S88 OR S89 OR S90 OR S91 OR S92 OR S93 OR S94 OR S95 OR S96 OR S97 OR S98 OR S99 OR S100 OR S101 OR S102 OR S103 OR S104 OR S105 OR S106	393,737
S106	TI prevalence*	39,219
S105	AB "error rate*"	1,992
S104	TI "error rate*"	172
S103	AB "miss rate*"	116
S102	TI "miss rate*"	37
S101	AB "false negative*"	3,673
S100	TI "false negative*"	312
S99	AB "false positive*"	6,927
S98	TI "false positive*"	937
S97	AB accuracy	54,807
S96	TI accuracy	13,448
S95	AB "predictive value"	17,145
S94	TI "predictive value"	1,948
S93	AB specificit*	46,490
S92	TI specificit*	2,215
S91	AB sensitivit*	88,475
S90	TI sensitivit*	11,791
S89	AB "ROC curve*	6,436
S88	TI "ROC curve*	117
S87	AB "receiver operat*"	19,418
S86	TI "receiver operat*"	207
S85	(MH "Prevalence")	80,071
S84	(MH "Observer Bias")	8,364
S83	(MH "Reference Values")	20,067
S82	(MH "Reproducibility of Results")	56,528
S81	(MH "Diagnostic Errors")	10,025
S80	(MH "False Positive Results")	5,023
S79	(MH "False Negative Results")	2,780
S78	(MH "ROC Curve")	23,125
S77	(MH "Predictive Value of Tests")	44,521
S76	(MH "Sensitivity and Specificity")	74,503
S75	(S70 OR S71 OR S72 OR S73 OR S74)	5,897
S74	AB (ambulat*) AND (blood pressure* or BP or hypertensi*)	3,931
S73	TI (ambulat*) AND (blood pressure* or BP or hypertensi*)	1,622
S72	AB abpm	567
S71	TI abpm	27
S70	(MH "Blood Pressure Monitoring, Ambulatory")	3,023
S69	S39 OR S68	29,304
S68	S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR	21,113

	S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63 OR S64 OR S65 OR S66 OR S67	
S67	AB sphygmomanometer*	603
S66	TI sphygmomanometer*	142
S65	AB hbpm	81
S64	TI hbpm	0
S63	AB obpm	12
S62	TI obpm	0
S61	AB mobp	7
S60	TI mobp	2
S59	AB aobp	25
S58	TI aobp	1
S57	AB (confirm*) N3 (blood pressure* or BP or hypertensi*)	338
S56	TI (confirm*) N3 (blood pressure* or BP or hypertensi*)	20
S55	AB (monitor* or measur* or surveil*) N3 (blood pressure* or BP or hypertensi*)	10,131
S54	TI (monitor* or measur* or surveil*) N3 (blood pressure* or BP or hypertensi*)	2,444
S53	AB (ausculta* or oscillomet* or korotkoff) N3 (blood pressure* or BP or hypertensi*)	318
S52	TI (ausculta* or oscillomet* or korotkoff) N3 (blood pressure* or BP or hypertensi*)	143
S51	AB (manual or automated) N3 (blood pressure* or BP or hypertensi*)	327
S50	TI (manual or automated) N3 (blood pressure* or BP or hypertensi*)	158
S49	AB kiosk* N3 (blood pressure* or BP or hypertensi*)	7
S48	TI kiosk* N3 (blood pressure* or BP or hypertensi*)	5
S47	AB home N3 (blood pressure* or BP or hypertensi*)	821
S46	TI home N3 (blood pressure* or BP or hypertensi*)	602
S45	AB (office or clinic*) N3 (blood pressure* or BP or hypertensi*)	3,712
S44	TI (office or clinic*) N3 (blood pressure* or BP or hypertensi*)	1,008
S43	(MH "Blood Pressure Cuffs")	240
S42	(MH "Blood Pressure Devices")	708
S41	(MH "Sphygmomanometers")	539
S40	(MH "Blood Pressure Determination")	8,737
S39	S30 OR S38	11,286
S38	(S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37)	5,278
S37	(MH "Prehypertension/DI")	48
S36	(MH "Hypertension, Malignant/DI")	43
S35	(MH "Hypertension, Isolated Systolic/DI")	7
S34	(MH "Hypertension, Refractory/DI")	25
S33	(MH "Masked Hypertension/DI")	45
S32	(MH "Hypertension, White Coat/DI")	57

S31	(MH "Hypertension/DI")	5,123
S30	S24 AND S29	6,567
S29	(S25 OR S26 OR S27 OR S28)	158,344
S28	AB screen*	116,458
S27	TI screen*	54,032
S26	(MH "Rescreening")	164
S25	(MH "Health Screening")	39,820
S24	(S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23)	142,878
S23	AB "diastolic pressur*"	1,251
S22	TI "diastolic pressur*"	119
S21	AB "systolic pressur*"	1,619
S20	TI "systolic pressur*"	127
S19	AB "arterial pressur*"	6,674
S18	TI "arterial pressur*"	566
S17	AB "blood pressur*"	49,183
S16	TI "blood pressur*"	16,343
S15	AB prehypertensi* OR "pre hypertensi*"	985
S14	TI prehypertensi* OR "pre hypertensi*"	745
S13	AB hypertensi*	59,036
S12	TI hypertensi*	33,537
S11	(MH "Diastolic Pressure")	2,154
S10	(MH "Systolic Pressure")	3,242
S9	(MH "Arterial Pressure")	2,588
S8	(MH "Blood Pressure")	35,137
S7	(MH "Prehypertension")	277
S6	(MH "Hypertension, Malignant")	164
S5	(MH "Hypertension, Isolated Systolic")	67
S4	(MH "Hypertension, Refractory")	120
S3	(MH "Masked Hypertension")	99
S2	(MH "Hypertension, White Coat")	163
S1	(MH "Hypertension")	48,394

KQ4 Screening Harms

#	Query	Results
S113	S109 AND S112	655
S112	S110 OR S111	334,171
S111	EM 2019-	189,166
S110	EM 201808* OR EM 201809* OR EM 201810* OR EM 201811* OR EM 201812*	145,005
S109	S104 OR S107 **(2014-2019) Date Limits**	4,116
S108	S104 OR S107	9,941
S107	S105 OR S106	124
S106	AB label* N5 (hypertensi* or prehypertensi* or "blood pressure*" or arterial pressure*)	87
S105	TI label* N5 (hypertensi* or prehypertensi* or "blood pressure*" or arterial pressure*)	47
S104	S74 AND S103	9,842

S103	S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85 OR S86 OR S87 OR S88 OR S89 OR S90 OR S91 OR S92 OR S93 OR S94 OR S95 OR S96 OR S97 OR S98 OR S99 OR S100 OR S101 OR S102	1,149,243
S102	MW "co"	366,860
S101	MW "ae"	388,056
S100	AB complication*	141,245
S99	TI complication*	26,848
S98	AB adverse N1 (effect* or event* or outcome* or reaction*)	94,680
S97	TI adverse N1 (effect* or event* or outcome* or reaction*)	14,220
S96	AB harm or harms or harmful or harmed	30,895
S95	TI harm or harms or harmful or harmed	8,617
S94	AB (disability or sick) N3 day*	942
S93	TI (disability or sick) N3 day*	149
S92	AB absenteeism	2,057
S91	TI absenteeism	652
S90	AB depression or depressed or depressive	102,422
S89	TI depression or depressed or depressive	53,992
S88	AB anxiet*	57,813
S87	TI anxiet*	19,688
S86	AB psychological* N2 (distress* or effect* or impact*)	13,224
S85	TI psychological* N2 (distress* or effect* or impact*)	4,087
S84	AB "self rated health"	3,413
S83	TI "self rated health"	1,331
S82	AB "quality of life"	89,814
S81	TI "quality of life"	34,317
S80	(MH "Depression")	93,775
S79	(MH "Anxiety")	36,604
S78	(MH "Sick Role")	1,255
S77	(MH "Sick Leave")	4,363
S76	(MH "Absenteeism")	4,140
S75	(MH "Quality of Life")	96,318
S74	S39 OR S73	31,555
S73	(S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63 OR S64 OR S65 OR S66 OR S67 OR S68 OR S69 OR S70 OR S71 OR S72)	23,603
S72	AB (ambulat*) AND (blood pressure* or BP or hypertensi*)	3,931
S71	TI (ambulat*) AND (blood pressure* or BP or hypertensi*)	1,622
S70	AB abpm	567
S69	TI abpm	27

S68	(MH "Blood Pressure Monitoring, Ambulatory")	3,023
S67	AB sphygmomanometer*	603
S66	TI sphygmomanometer*	142
S65	AB hbpm	81
S64	TI hbpm	0
S63	AB obpm	12
S62	TI obpm	0
S61	AB mobp	7
S60	TI mobp	2
S59	AB aobp	25
S58	TI aobp	1
S57	AB (confirm*) N3 (blood pressure* or BP or hypertensi*)	338
S56	TI (confirm*) N3 (blood pressure* or BP or hypertensi*)	20
S55	AB (monitor* or measur* or surveil*) N3 (blood pressure* or BP or hypertensi*)	10,131
S54	TI (monitor* or measur* or surveil*) N3 (blood pressure* or BP or hypertensi*)	2,444
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S36	(MH "Hypertension, Malignant/DI")	43
S35	(MH "Hypertension, Isolated Systolic/DI")	7
S34	(MH "Hypertension, Refractory/DI")	25
S33	(MH "Masked Hypertension/DI")	45
S32	(MH "Hypertension, White Coat/DI")	57
S31	(MH "Hypertension/DI")	5,123
S30	S24 AND S29	6,567

S29	(S25 OR S26 OR S27 OR S28)	158,344
S28	AB screen*	116,458
S27	TI screen*	54,032
S26	(MH "Rescreening")	164
S25	(MH "Health Screening")	39,820
S24	(S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23)	142,878
S23	AB "diastolic pressur*"	1,251
S22	TI "diastolic pressur*"	119
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S8	(MH "Blood Pressure")	35,137
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S5	(MH "Hypertension, Isolated Systolic")	67
S4	(MH "Hypertension, Refractory")	120
S3	(MH "Masked Hypertension")	99
S2	(MH "Hypertension, White Coat")	163
S1	(MH "Hypertension")	48,394

PUBMED, publisher-supplied

Search	Query
#12	Search **#10 AND #11**
#11	Search **("2014"[Date - Publication] : "3000"[Date - Publication])**
#10	Search **#8 AND #9**
#9	Search **English [Language]**
#8	Search **#6 AND #7**
#7	Search **publisher[sb]**
#6	Search **#3 OR #5**
#5	Search **#1 AND #4**
#4	Search **home[tiab] OR office[tiab] OR ambulatory[tiab] OR clinic[tiab] OR ausculta*[tiab] OR oscillometr*[tiab] OR**

Search	Query
	korotkoff[tiab] OR sphygmomanomet*[tiab] OR aobp[tiab] OR mobp[tiab] OR obpm[tiab] OR hbpm[tiab] OR abpm[tiab]
#3	Search **#1 AND #2**
#2	Search **screen*[tiab] OR monitor*[tiab] OR diagnos*[tiab] OR measur*[tiab] OR determin*[tiab] or surveil*[tiab]**
#1	Search **"blood pressure"[ti] OR "blood pressures"[ti] OR "arterial pressure"[ti] "arterial pressures"[ti] OR "systolic pressure"[ti] OR "systolic pressures"[ti] OR hypertensi*[ti] OR prehypertens*[ti] OR "pre hypertension"[ti] OR "pre hypertensive"[ti] OR "pre-hypertensive"[ti]**

Targeted search of previous bibliographic database for diabetes

Field	Parameter(s)	Results
Title, Abstract OR Keyword	*Diabet	3459

* Asterisk indicates truncation of search term

Methods for quality assessment

For studies of test accuracy, good-quality studies had a low risk of bias on all four domains for critical appraisal which are further described below: patient selection, conduct or interpretation of the index text, conduct or interpretation of the reference standard, and patient flow and timing. Fair-quality studies did not meet these criteria but did not have serious threats to their internal validity related to the design, execution, or reporting of the study. Studies rated as poor quality had several important limitations across domains or one fatal flaw and were excluded from this review.

- *Patient selection domain:* Low risk of bias for patient selection was characterized by population-based, consecutive, or random selection of participants, the avoidance of inappropriate exclusions, and study designs that did not involve a volunteer subset from a larger trial. We recognize that studies may exclude patients with high clinic BPs (e.g., SBPs of >160 mm Hg or >170 mm Hg) because of safety concerns. Although it is unlikely that these patients would go through a confirmation step prior to treatment based on current practice guidelines, patient selection that limits inclusion based on high blood pressure will understate diagnostic accuracy. We established a priori that such studies have at least a medium risk of bias for the patient selection domain. Studies involving volunteer subsets where only those accepting ABPM from a larger study were not considered a fatal flaw but were rated as high risk of bias in the patient selection domain because of uncertainty around whether populations accepting versus declining ABPM may have differed.
- *Conduct or interpretation of index test:* Screening tests with a low risk of bias had well described protocols that were applied universally. Ideally, studies reported that the blood pressure measurement devices met validation criteria and were calibrated but this was not a requirement for a low risk of bias rating. Studies with unclear or sparse reporting of index test protocols were downgraded to medium or high risk of bias.
- *Conduct or interpretation of the reference standard:* We established a priori that generally, the ABPM reference test will have low risk of bias because it is automated with a computer algorithm. However, for KQ2, we considered it a fatal flaw if the ABPM reference standard was not independent of OBPM (e.g., an ABPM diagnostic threshold based upon on the upper 95% confidence interval for OBPM). For KQ3 where the comparison might be partial versus full 24-h ABPM and the index test and reference standard are part of the same test, low risk of bias could be achieved if the partial test was defined a priori and applied universally. This domain was down-graded to medium or high risk of bias based on issues of no reported criteria for completeness of ABPM, or unclear or problematic fidelity of reference standard conduct.
- *Patient flow and timing*: Per inclusion criteria, all participants had the same reference standard. Ideally, the screening test and reference standard were conducted on the same day, but an interval of less than 3 months was still considered low risk of bias. An interval of 3-6 months was considered reasonable with the biggest changes that can happen during this period likely being new chronic medications and weight changes. If the interval between tests was not explicitly reported, this was not considered a fatal flaw. Studies were downgraded on this domain for unknown or problematic exclusions for incomplete ABPM readings.

Appendix A Table 1. Search Terms Used in Title, Abstract, or Keyword Fields of Endnote for Prescreening

Search Terms in Title, Abstract or Keyword Fields
Animal
Braz*
Chin*
India*
Iran*
Mexic*
Turk*
Adoles*
Child*
Infant*
Mice*
Rats
Neonat*
Preg*
Rheum*
Arthrit*
Cancer*
Hepati*
HIV*
Infect*
Transplant*
Dialysis
Niger*
Peru*
Russ*
South Africa*
Allele
Polymorphism

* Asterisk indicates truncation of search term

Appendix A Table 2. Inclusion and Exclusion Criteria

Category	Included	Excluded
Aim	**KQs 1, 2, 4:** Screening for hypertension in a primary care setting **KQ 3:** Measuring blood pressure to confirm diagnosis of hypertension	Studies measuring blood pressure for reasons other than screening or confirmation of a hypertension diagnosis; mathematical transformation of blood pressure results (e.g., pulse pressure, variability) or diurnal variations (e.g., morning surge, dipping) for use as additional diagnostic criteria, predicting risk, or both
Population	**KQs 1, 2, 4:** Adults age ≥18 years **KQ 3:** Adults age ≥18 years with at least one elevated blood pressure measurement (as defined by study) identified by clinic-based screening	• Pregnant women, children (age <18 years), inpatients, persons in institutions, patients with secondary hypertension, and highly selected groups of patients (e.g., those with chronic kidney disease or renal transplant) who do not represent a primary screening population • Patients treated for hypertension with medication
Intervention	**KQs 1, 2, 4:** Clinic-based, noninvasive brachial blood pressure measurement (manual or automated) using any common device or screening protocol during a single encounter **KQ 3:** Any clinic-based or out-of-office noninvasive blood pressure measurement used to confirm an initial elevated blood pressure result (i.e., manual or automated office-based blood pressure, home blood pressure, or kiosk blood pressure measurement) **KQ 3a:** ABPM screening protocol that differs from the comparator ABPM protocol (e.g., 12- vs. 24-hour ABPM, daytime vs. nighttime ABPM)	Blood pressure measurement with wrist and finger monitors, forearm cuffs, or ankle and toe measures; any method not commonly used in routine blood pressure screening (e.g., invasive methods, noninvasive method of central blood pressure measurement); Osler's maneuver
Comparator	**KQs 1, 4:** No blood pressure measurement **KQs 2, 3:** ABPM (any protocol)	**KQs 2, 3:** Within-class comparative effectiveness of devices (e.g., automated vs. automated; random zero vs. standard sphygmomanometer) with identical screening protocols; validation and accuracy studies of devices compared with standards or using specific protocols (e.g., British Hypertension Society, Association for the Advancement of Medical Instrumentation)
Outcomes	**KQ 1:** • Mortality (all-cause and cardiovascular) • Cardiovascular disease events, including: myocardial infarction, sudden cardiac death, stroke, heart failure, and hospitalization for coronary heart disease • End-stage renal disease (i.e., kidney disease requiring dialysis) • Quality of life **KQs 2, 3:** Sensitivity, specificity, and positive and negative predictive values **KQ 4:** Harms of screening (e.g., labeling, absenteeism, quality of life measures, tolerability of ABPM devices)	**KQs 1, 3:** Cardiovascular symptoms (e.g., palpitations), angina pectoris (chest pain), revascularization, carotid intima-media thickness, left ventricular hypertrophy, or patient satisfaction **KQs 2, 3:** Studies that do not provide enough data to create 2×2 tables or to calculate sensitivity and specificity; studies designed to assess specific devices vs. blood pressure measurement standards
Timing of outcome assessment	No restrictions	No restrictions
Setting	**KQs 1, 2, 4:** Eligible primary care settings must have personnel trained in blood pressure measurement, established blood pressure measurement protocols, and ongoing documentation procedures **KQ 3:** Primary care settings (see above for definition) and out-of-office settings (e.g., home, pharmacy, kiosks in other settings)	**All KQs:** Inpatient/residential facilities **KQs 1, 2, 4:** Settings not generalizable to primary care

Appendix A Table 2. Inclusion and Exclusion Criteria

Category	Included	Excluded
Study design	**KQ 1:** RCTs and CCTs **KQs 2, 3:** Diagnostic accuracy studies, RCTs, and CCTs **KQ 4:** RCTs, CCTs, and cohort studies	**All KQs:** Before-after studies, time series, case series, case reports, case-control studies, and simulation studies **KQ 3:** Studies with a sample size <100 **KQ 4:** Cross-sectional studies
Country	Studies conducted in countries categorized as "very high" on the 2015 Human Development Index (as defined by the United Nations Development Programme)	Studies conducted in countries not categorized as "very high" on the 2015 Human Development Index
Language	English	Other languages than English
Study quality	Fair or good	Poor, according to design-specific USPSTF criteria

Abbreviations: ABPM = ambulatory blood pressure measurement; CCT = controlled clinical trial; RCT = randomized, controlled trial; vs = versus

Appendix A Table 3. Study-Design Quality Rating Criteria

Study Design	Adapted Quality Criteria
Cohort studies, adapted from Newcastle-Ottawa Scale[76]	**Bias arising in randomization process or due to confounding** • Balance in baseline characteristics • No baseline confounding • No time-varying confounding **Bias in selecting participants into the study** • No evidence of biased selection of sample • Start of followup and start of intervention coincide **Bias due to departures form intended interventions** • Participant intervention status is clearly and explicitly defined and measured • Classification of intervention status is unaffected by knowledge of the outcome or risk of the outcome **Bias in classifying interventions** • Fidelity to intervention protocol • Participants were analyzed as originally allocated **Bias from missing data** • Outcome data are reasonably complete and comparable between groups • Confounding variables that are controlled for in analysis are reasonably complete • Reasons for missing data are similar across groups • Missing data are unlikely to bias results **Bias in measurement of outcomes** • Blinding of outcome assessors • Outcomes are measured using consistent and appropriate procedures and instruments across treatment groups • No evidence of biased use of inferential statistics **Bias in reporting results selectively** No evidence that the measures, analyses, or subgroup analyses are selectively reported
Diagnostic accuracy studies, adapted from the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) I[77] and II[78] instrument	**Patient Selection** • Was a consecutive or random sample of patients enrolled? • Did the study avoid inappropriate exclusions? **Index Test** • Were the index test results interpreted without knowledge of the reference standard results? • If a threshold was used, was it prespecified or was a range of values presented? **Reference Standard** • Is the reference standard likely to correctly classify the target condition? • Were the reference standard results interpreted without knowledge of the index test? • Were staff trained in the use of the reference standard? • Was fidelity of the reference standard monitored or reported? **Flow and Timing** • Was there an appropriate interval between the index test and reference standard? • Did all patients receive a reference standard? • Did all patients receive the same reference standard? o Were all patients included in the analysis?

Appendix A Table 3. Study-Design Quality Rating Criteria

Study Design	Adapted Quality Criteria
Randomized clinical trials adapted from U.S. Preventive Services Task Force Manual[75]	**Bias arising in the randomization process or due to confounding** • Valid random assignment/random sequence generation method used • Allocation concealed • Balance in baseline characteristics **Bias in selecting participants into the study** • CCT only: No evidence of biased selection of sample **Bias due to departures from intended interventions** • Fidelity to the intervention protocol • Low risk of contamination between groups • Participants were analyzed as originally allocated **Bias from missing data** • No, or minimal, post-randomization exclusions • Outcome data are reasonably complete and comparable between groups • Reasons for missing data are similar across groups • Missing data are unlikely to bias results **Bias in measurement of outcomes** • Blinding of outcome assessors • Outcomes are measured using consistent and appropriate procedures and instruments across treatment groups • No evidence of biased use of inferential statistics **Bias in reporting results selectively** • No evidence that the measures, analyses, or subgroup analyses are selectively reported

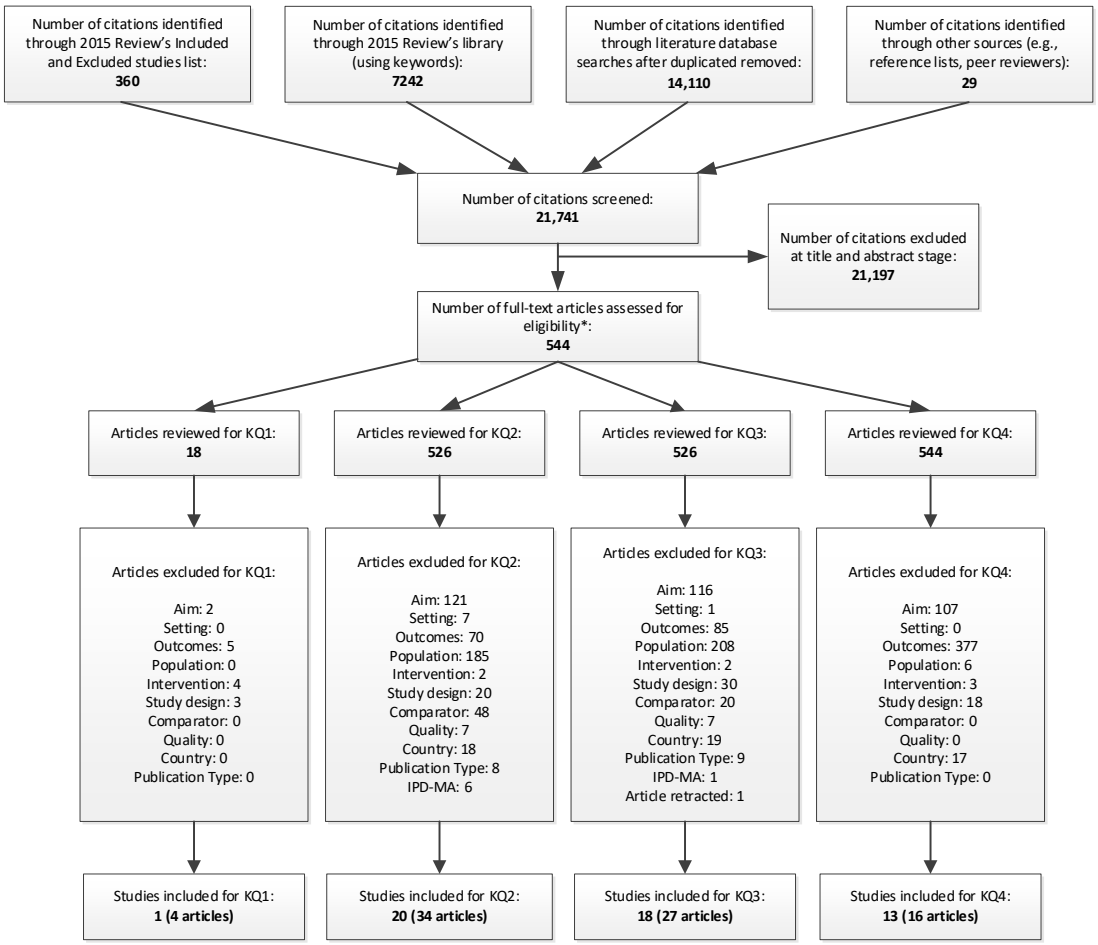
* Good quality studies generally meet all quality criteria. Fair quality studies do not meet all the criteria but do not have critical limitations that could invalidate study findings. Poor quality studies have a single fatal flaw or multiple important limitations that could invalidate study findings. Critical appraisal of studies using *a priori* quality criteria are conducted independently by at least two reviewers. Disagreements in final quality assessment are resolved by consensus, and, if needed, consultation with a third independent reviewer.

Appendix A Table 4. Determination of Pooling Boundaries for Diagnostic Thresholds Within 0.5 Standard Deviation

Modality	Mean	SD	0.5 SD	Preferred Threshold, mm Hg	Preferred Threshold - 0.5 SD	Preferred Threshold + 0.5 SD
OBPM SBP	128.8	21.6	10.8	140	129.2	150.8
OBPM DBP	78.6	11.3	5.65	90	84.35	95.65
24-h ABPM SBP	122.1	13.6	6.8	130	123.2	136.8
24-h ABPM DBP	73.1	8.2	4.1	80	75.9	84.1
Daytime ABPM SBP	128.5	14.5	7.25	135	127.75	142.25
Daytime ABPM DBP	78.3	8.9	4.45	85	80.55	89.45

Abbreviations: ABPM = ambulatory blood pressure monitoring; DBP = diastolic blood pressure; OBPM = office-based blood pressure measurement; SBP = systolic blood pressure; SD = standard deviation

Appendix B Figure 1. Literature Flow Diagram



* Articles may appear under more than one Key Question

Ancillary articles indented under primary article

Key Question 1

Kaczorowski J, Chambers LW, Dolovich L, et al. Improving cardiovascular health at population level: 39 community cluster randomised trial of Cardiovascular Health Awareness Program (CHAP). BMJ. 2011;342:d442. PMID: 21300712. https://doi.org/10.1136/bmj.d442

Kaczorowski J, Chambers LW, Karwalajtys T, et al. Cardiovascular Health Awareness Program (CHAP): a community cluster-randomised trial among elderly Canadians. Prev Med. 2008;46(6):537-44. PMID: 18372036. https://doi.org/10.1016/j.ypmed.2008.02.005

Karwalajtys T, Kaczorowski J, Chambers LW, et al. Community mobilization, participation, and blood pressure status in a Cardiovascular Health Awareness Program in Ontario. Am J Health Promot. 2013;27(4):252-61. PMID: 23448415. https://doi.org/10.4278/ajhp.101221-QUAL-408

Ye C, Foster G, Kaczorowski J, et al. The impact of a cardiovascular health awareness program (CHAP) on reducing blood pressure: a prospective cohort study. BMC Public Health. 2013;13:1230. PMID: 24369050. https://doi.org/10.1186/1471-2458-13-1230

Key Question 2

Abdalla M, Goldsmith J, Muntner P, et al. Is Isolated Nocturnal Hypertension A Reproducible Phenotype? Am J Hypertens. 2016;29(1):33-8. https://dx.doi.org/10.1093/ajh/hpv058

Fagard RH, van den Broeke C, de Cort P. Prognostic significance of blood pressure measured in the office, at home and during ambulatory monitoring in older patients in general practice. Journal of human hypertension. 2005;19(10):801-7. PMID: 15959536. https://doi.org/10.1038/sj.jhh.1001903

Gill P, Haque MS, Martin U, et al. Measurement of blood pressure for the diagnosis and management of hypertension in different ethnic groups: one size fits all. BMC Cardiovasc Disord. 2017;17(1):55. PMID: 28178928. https://dx.doi.org/10.1186/s12872-017-0491-8

Martin U, Haque MS, Wood S, et al. Ethnicity and differences between clinic and ambulatory blood pressure measurements. American journal of hypertension. 2015;28(6):729-38. PMID: 25398890. https://doi.org/10.1093/ajh/hpu211

Wood S, Martin U, Gill P, et al. Blood pressure in different ethnic groups (BP-Eth): a mixed methods study. BMJ Open. 2012;2(6):2012. PMID: 23129572. https://doi.org/10.1136/bmjopen-2012-001598

Gosse P, Dauphinot V, Roche F, et al. Prevalence of clinical and ambulatory hypertension in a population of 65-year-olds: the PROOF study. Journal of clinical hypertension (Greenwich, Conn). 2010;12(3):160-5. PMID: 20433528. https://doi.org/10.1111/j.1751-7176.2009.00235.x

Gourlay SG, McNeil JJ, Marriner T, et al. Discordance of mercury sphygmomanometer and ambulatory blood pressure measurements for the detection of untreated hypertension in a population study. Journal of human hypertension. 1993;7(5):467-72. PMID: 8263887.

Hanninen MR, Niiranen TJ, Puukka PJ, et al. Comparison of home and ambulatory blood pressure measurement in the diagnosis of masked hypertension. Journal of hypertension. 2010;28(4):709-14. PMID: 20061982. https://doi.org/10.1097/HJH.0b013e3283369faa

Hansen TW, Jeppesen J, Rasmussen S, et al. Ambulatory blood pressure monitoring and risk of cardiovascular disease: a population based study. American journal of hypertension. 2006;19(3):243-50. PMID: 16500508. https://doi.org/10.1016/j.amjhyper.2005.09.018

Sehestedt T, Jeppesen J, Hansen TW, et al. Can ambulatory blood pressure measurements substitute assessment of subclinical cardiovascular damage? Journal of hypertension. 2012;30(3):513-21. PMID: 22241138. https://doi.org/10.1097/HJH.0b013e32834f6f60

Ishikawa J, Hoshide S, Eguchi K, et al. Masked hypertension defined by ambulatory blood pressure monitoring is associated with an increased serum glucose level and urinary albumin-creatinine ratio. Journal of clinical hypertension (Greenwich, Conn). 2010;12(8):578-87. PMID: 20695934. https://doi.org/10.1111/j.1751-7176.2010.00286.x

Hoshide S, Ishikawa J, Eguchi K, et al. Masked nocturnal hypertension and target organ damage in hypertensives with well-controlled self-measured home blood pressure. Hypertension research. 2007;30(2):143-9. PMID: 17460384. https://doi.org/10.1291/hypres.30.143

Kanno A, Metoki H, Kikuya M, et al. Usefulness of assessing masked and white-coat hypertension by ambulatory blood pressure monitoring for determining prevalent risk of chronic kidney disease: the Ohasama study. Hypertension research. 2010;33(11):1192-8. PMID: 20703228. https://doi.org/10.1038/hr.2010.139

Hozawa A, Ohkubo T, Kikuya M, et al. Blood pressure control assessed by home, ambulatory and conventional blood pressure measurements in the Japanese general population: the Ohasama study. Hypertension research. 2002;25(1):57-63. PMID: 11924727. https://doi.org/10.1291/hypres.25.57

Imai Y, Tsuji I, Nagai K, et al. Ambulatory blood pressure monitoring in evaluating the prevalence of hypertension in adults in Ohasama, a rural Japanese community. Hypertension research. 1996;19(3):207-12. PMID: 8891750. https://doi.org/10.1291/hypres.19.207

Larkin KT, Schauss SL, Elnicki DM. Isolated clinic hypertension and normotension: false positives and false negatives in the assessment of hypertension. Blood pressure monitoring. 1998;3:247-54.

Lyamina NP, Smith ML, Lyamina SV, et al. Pressor response to 30-s breathhold: a predictor of masked hypertension. Blood Press. 2012;21(6):372-6. PMID: 22725829. https://doi.org/10.3109/08037051.2012.694213

Mancia G, Facchetti R, Bombelli M, et al. Long-term risk of mortality associated with selective and combined elevation in office, home, and ambulatory blood pressure. Hypertension. 2006;47(5):846-53. PMID: 16567588. https://doi.org/10.1161/01.HYP.0000215363.69793.bb

Cuspidi C, Facchetti R, Bombelli M, et al. Risk of new-onset metabolic syndrome associated with white-coat and masked hypertension: data from a general population. Journal of hypertension. 2018;36(9):1833-9. PMID: 29965885. https://doi.org/10.1097/hjh.0000000000001767

Mancia G, Sega R, Bravi C, et al. Ambulatory blood pressure normality: results from the PAMELA study. Journal of hypertension. 1995;13(12 Pt 1):1377-90. PMID: 8866899.

O'Flynn AM, Curtin RJ, Perry IJ, et al. Hypertension Prevalence, Awareness, Treatment, and Control: Should 24-Hour Ambulatory Blood Pressure Monitoring be the Tool of Choice? J Clin Hypertens. 2016;18(7):697-702. PMID: 26611695. https://dx.doi.org/10.1111/jch.12737

Poudel B, Booth JN, 3rd, Sakhuja S, et al. Prevalence of ambulatory blood pressure phenotypes using the 2017 American College of Cardiology/American Heart Association blood pressure guideline thresholds: data from the Coronary Artery Risk Development in Young Adults study. J

Hypertens. 2019;37(7):1401-10. PMID: 31145711. https://dx.doi.org/10.1097/HJH.0000000000002055

Muntner P, Lewis CE, Diaz KM, et al. Racial differences in abnormal ambulatory blood pressure monitoring measures: Results from the Coronary Artery Risk Development in Young Adults (CARDIA) study. American journal of hypertension. 2015;28(5):640-8. PMID: 25376639. https://dx.doi.org/10.1093/ajh/hpu193

Scuteri A, Morrell CH, Orru M, et al. Gender specific profiles of white coat and masked hypertension impacts on arterial structure and function in the SardiNIA study. International journal of cardiology. 2016;217:92-8. PMID: 27179214. https://dx.doi.org/10.1016/j.ijcard.2016.04.172

Scuteri A, Najjar SS, Orru M, et al. Age- and gender-specific awareness, treatment, and control of cardiovascular risk factors and subclinical vascular lesions in a founder population: the SardiNIA Study. Nutr Metab Cardiovasc Dis. 2009;19(8):532-41. PMID: 19321325. https://doi.org/10.1016/j.numecd.2008.11.004

Terracciano A, Scuteri A, Strait J, et al. Are personality traits associated with white-coat and masked hypertension? Journal of hypertension. 2014;32(10):1987-92; discussion 92. PMID: 25186529. https://dx.doi.org/10.1097/HJH.0000000000000289

Selenta C, Hogan BE, Linden W. How often do office blood pressure measurements fail to identify true hypertension? An exploration of white-coat normotension. Arch Fam Med. 2000;9(6):533-40. PMID: 10862216. https://doi.org/10.1001/archfami.9.6.533

Shimbo D, Newman JD, Schwartz JE. Masked hypertension and prehypertension: diagnostic overlap and interrelationships with left ventricular mass: the Masked Hypertension Study. American journal of hypertension. 2012;25(6):664-71. PMID: 22378035. https://doi.org/10.1038/ajh.2012.15

Oe Y, Shimbo D, Ishikawa J, et al. Alterations in diastolic function in masked hypertension: findings from the masked hypertension study. American journal of hypertension. 2013;26(6):808-15. PMID: 23446956. https://doi.org/10.1093/ajh/hpt021

Thomas SJ, Booth JN, 3rd, Bromfield SG, et al. Clinic and ambulatory blood pressure in a population-based sample of African Americans: the Jackson Heart Study. Journal of the American Society of Hypertension. 2017;11(4):204-12.e5. PMID: 28285829. https://dx.doi.org/10.1016/j.jash.2017.02.001

Diaz KM, Veerabhadrappa P, Brown MD, et al. Prevalence, Determinants, and Clinical Significance of Masked Hypertension in a Population-Based Sample of African Americans: The Jackson Heart Study. American journal of hypertension. 2015;28(7):900-8. PMID: 25499058. https://dx.doi.org/10.1093/ajh/hpu241

McMullan CJ, Hickson DA, Taylor HA, et al. Prospective analysis of the association of ambulatory blood pressure characteristics with incident chronic kidney disease. Journal of hypertension. 2015;33(9):1939-46; discussion 46. PMID: 26066645. https://dx.doi.org/10.1097/HJH.0000000000000638

Wei FF, Zhang ZY, Thijs L, et al. Conventional and Ambulatory Blood Pressure as Predictors of Retinal Arteriolar Narrowing. Hypertension. 2016;68(2):511-20. PMID: 27324224. https://dx.doi.org/10.1161/HYPERTENSIONAHA.116.07523

Wojciechowska W, Stolarz-Skrzypek K, Olszanecka A, et al. Subclinical arterial and cardiac damage in white-coat and masked hypertension. Blood Press. 2016;25(4):249-56. PMID: 26953075. https://dx.doi.org/10.3109/08037051.2016.1150563

Key Question 3

Bayo J, Cos FX, Roca C, et al. Home blood pressure self-monitoring: diagnostic performance in white-coat hypertension. Blood pressure monitoring. 2006;11(2):47-52. PMID: 16534404. https://doi.org/10.1097/01.mbp.0000200479.19046.94

de la Sierra A, Vinyoles E, Banegas JR, et al. Prevalence and clinical characteristics of white-coat hypertension based on different definition criteria in untreated and treated patients. Journal of hypertension. 2017;35(12):2388-94. PMID: 28723880. https://dx.doi.org/10.1097/HJH.0000000000001493

de la Sierra A, Vinyoles E, Banegas JR, et al. Short-Term and Long-Term Reproducibility of Hypertension Phenotypes Obtained by Office and Ambulatory Blood Pressure Measurements. J Clin Hypertens. 2016;18(9):927-33. PMID: 26890293. https://dx.doi.org/10.1111/jch.12792

Ernst ME, Sezate GS, Lin W, et al. Indication-specific 6-h systolic blood pressure thresholds can approximate 24-h determination of blood pressure control. Journal of human hypertension. 2011;25(4):250-5. PMID: 20574446. https://doi.org/10.1038/jhh.2010.66

Ernst ME, Weber CA, Dawson JD, et al. How well does a shortened time interval characterize results of a full ambulatory blood pressure monitoring session? Journal of clinical hypertension (Greenwich, Conn). 2008;10(6):431-5. PMID: 18550932. https://doi.org/10.1111/j.1751-7176.2008.07784.x

Fogari R, Corradi L, Zoppi A, et al. Repeated office blood pressure controls reduce the prevalence of white-coat hypertension and detect a group of white-coat normotensive patients. Blood pressure monitoring. 1996;1(1):51-4. PMID: 10226202.

Gerc V, Favrat B, Brunner HR, et al. Is nurse-measured blood pressure a valid substitute for ambulatory blood pressure monitoring? Blood pressure monitoring. 2000;5(4):203-9. PMID: 11035861. https://doi.org/10.1097/00126097-200008000-00002

Hoegholm A, Kristensen KS, Madsen NH, et al. White coat hypertension diagnosed by 24-h ambulatory monitoring. Examination of 159 newly diagnosed hypertensive patients. American journal of hypertension. 1992;5(2):64-70. PMID: 1550667. https://doi.org/10.1093/ajh/5.2.64

Hoegholm A, Kristensen KS, Madsen NH, et al. The frequency of white coat hypertension among patients with newly diagnosed hypertension. Cardiovasc Rev Rep. 1994;15:55-61.

Husain A, Lin FC, Tuttle LA, et al. The Reproducibility of Racial Differences in Ambulatory Blood Pressure Phenotypes and Measurements. American journal of hypertension. 2017;30(10):961-7. PMID: 28531258. https://dx.doi.org/10.1093/ajh/hpx079

Viera AJ, Lin FC, Tuttle LA, et al. Reproducibility of masked hypertension among adults 30 years or older. Blood pressure monitoring. 2014;19(4):208-15. PMID: 24842491. https://dx.doi.org/10.1097/MBP.0000000000000054

Kim S, Park JJ, Lee SA, et al. Diagnostic accuracy of manual office blood pressure measurement in ambulatory hypertensive patients in Korea. The Korean journal of internal medicine. 2018;33(1):113-20. PMID: 28602060. https://dx.doi.org/10.3904/kjim.2016.161

Kotsis V, Stabouli S, Toumanidis S, et al. Target organ damage in "white coat hypertension" and "masked hypertension". American journal of hypertension. 2008;21(4):393-9. PMID: 18292757. https://doi.org/10.1038/ajh.2008.15

Zakopoulos NA, Kotsis VT, Pitiriga V, et al. White-coat effect in normotension and hypertension. Blood pressure monitoring. 2002;7(5):271-6. PMID: 12409886. https://doi.org/10.1097/00126097-200210000-00004

Manios ED, Koroboki EA, Tsivgoulis GK, et al. Factors influencing white-coat effect. American journal of hypertension. 2008;21(2):153-8. PMID: 18174883. https://doi.org/10.1038/ajh.2007.43

Nasothimiou EG, Tzamouranis D, Rarra V, et al. Diagnostic accuracy of home vs. ambulatory blood pressure monitoring in untreated and treated hypertension. Hypertension research. 2012;35(7):750-5. PMID: 22357523. https://doi.org/10.1038/hr.2012.19

Stergiou GS, Salgami EV, Tzamouranis DG, et al. Masked hypertension assessed by ambulatory blood pressure versus home blood pressure monitoring: is it the same phenomenon? American journal of hypertension. 2005;18(6):772-8. PMID: 15925734. https://doi.org/10.1016/j.amjhyper.2005.01.003

Stergiou GS, Skeva II, Baibas NM, et al. Diagnosis of hypertension using home or ambulatory blood pressure monitoring: comparison with the conventional strategy based on repeated clinic blood pressure measurements. Journal of hypertension. 2000;18(12):1745-51. PMID: 11132597. https://doi.org/10.1097/00004872-200018120-00007

Nunan D, Thompson M, Heneghan CJ, et al. Accuracy of self-monitored blood pressure for diagnosing hypertension in primary care. Journal of hypertension. 2015;33(4):755-62; discussion 62. PMID: 25915880. https://doi.org/10.1097/HJH.0000000000000489

Park JS, Rhee MY, Namgung J, et al. Comparison of Optimal Diagnostic Thresholds of Hypertension With Home Blood Pressure Monitoring and 24-Hour Ambulatory Blood Pressure Monitoring. American journal of hypertension. 2017;30(12):1170-6. PMID: 28992112. https://dx.doi.org/10.1093/ajh/hpx115

Rhee MY, Kim JY, Kim JH, et al. Optimal schedule of home blood-pressure measurements for the diagnosis of hypertension. Hypertens Res. 2018. PMID: 29977083. https://doi.org/10.1038/s41440-018-0069-6

Salazar MR, Espeche WG, Stavile RN, et al. Could self-measured office blood pressure be a hypertension screening tool for limited-resources settings? Journal of human hypertension. 2018;32(6):415-22. PMID: 29713048. https://dx.doi.org/10.1038/s41371-018-0057-y

Shin J, Park SH, Kim JH, et al. Discordance between ambulatory versus clinic blood pressure according to global cardiovascular risk group. The Korean journal of internal medicine. 2015;30(5):610-9. PMID: 26354055. https://doi.org/10.3904/kjim.2015.30.5.610

Tocci G, Presta V, Figliuzzi I, et al. Prevalence and clinical outcomes of white-coat and masked hypertension: Analysis of a large ambulatory blood pressure database. J Clin Hypertens. 2018;20(2):297-305. PMID: 29370477. https://dx.doi.org/10.1111/jch.13181

Presta V, Figliuzzi I, D'Agostino M, et al. Nocturnal blood pressure patterns and cardiovascular outcomes in patients with masked hypertension. J Clin Hypertens. 2018. PMID: 30058135. https://doi.org/10.1111/jch.13361

Ungar A, Pepe G, Monami M, et al. Isolated ambulatory hypertension is common in outpatients referred to a hypertension centre. Journal of human hypertension. 2004;18(12):897-903. PMID: 15241442. https://doi.org/10.1038/sj.jhh.1001756

Zabludowski JR, Rosenfeld JB. Evaluation of clinic blood pressure measurements: assessment by daytime ambulatory blood pressure monitoring. Isr J Med Sci. 1992;28(6):345-8. PMID: 1607269.

Key Question 4

Ameling EH, de Korte DF, Man it, V. Impact of diagnosis and treatment of hypertension on quality of life: a double-blind, randomized, placebo-controlled, cross-over study of betaxolol. J Cardiovasc Pharmacol. 1991;18(5):752-60. PMID: 1723773. https://doi.org/10.1097/00005344-199111000-00014

Haynes RB, Sackett DL, Taylor DW, et al. Increased absenteeism from work after detection and labeling of hypertensive patients. N Engl J Med. 1978;299(14):741-4. PMID: 692548. https://doi.org/10.1056/NEJM197810052991403

Taylor DW, Haynes RB, Sackett DL, et al. Longterm follow-up of absenteeism among working men following the detection and treatment of their hypertension. Clin Invest Med. 1981;4(3-4):173-7. PMID: 7337988.

Kuwajima I, Nishinaga M, Kanamaru A. The accuracy and clinical performance of a new compact ambulatory blood pressure monitoring device, the ES-H531. American journal of hypertension. 1998;11(11:Pt 1):t-33. PMID: 9832176. https://doi.org/10.1016/s0895-7061(98)00155-1

Mann AH. The psychological effect of a screening programme and clinical trial for hypertension upon the participants. Psychol Med. 1977;7(3):431-8. PMID: 905459.

[No author listed]. Randomised controlled trial of treatment for mild hypertension: design and pilot trial. Report of Medical Research Council Working Party on Mild to Moderate Hypertension. Br Med J. 1977;1(6074):1437-40. PMID: 324577. https://doi.org/10.1136/bmj.1.6074.1437

Manning G, Rushton L, Donnelly R, et al. Variability of diurnal changes in ambulatory blood pressure and nocturnal dipping status in untreated hypertensive and normotensive subjects. American journal of hypertension. 2000;13(9):1035-8. PMID: 10981556. https://doi.org/10.1016/s0895-7061(00)00261-2

Manning G, Vijan SG, Millar-Craig MW. Does perception of sleep quality affect diurnal variation of blood pressure and heart rate during 24Hr blood pressure monitoring? Clin Sci. 1992;83(Suppl 27):22P.

Nasothimiou EG, Karpettas N, Dafni MG, et al. Patients' preference for ambulatory versus home blood pressure monitoring. Journal of human hypertension. 2013;28(4):224-9. PMID: 24152822. https://doi.org/10.1038/jhh.2013.104

Rudd P, Price MG, Graham LE, et al. Consequences of worksite hypertension screening. Changes in absenteeism. Hypertension. 1987;10(4):425-36. PMID: 3653971. https://doi.org/10.1161/01.hyp.10.4.425

Sherwood A, Hill LK, Blumenthal JA, et al. The Effects of Ambulatory Blood Pressure Monitoring on Sleep Quality in Men and Women With Hypertension: Dipper vs. Nondipper and Race Differences. Am J Hypertens. 2019;32(1):54-60. PMID: 30204833. https://dx.doi.org/10.1093/ajh/hpy138

Spruill TM, Feltheimer SD, Harlapur M, et al. Are there consequences of labeling patients with prehypertension? An experimental study of effects on blood pressure and quality of life. J Psychosom Res. 2013;74(5):433-8. PMID: 23597332. https://doi.org/10.1016/j.jpsychores.2013.01.009

Tompson AC, Ward AM, McManus RJ, et al. Acceptability and psychological impact of out-of-office monitoring to diagnose hypertension: an evaluation of survey data from primary care

patients. Br J Gen Pract. 2019;69(683):e389-e97. PMID: 30910876. https://dx.doi.org/10.3399/bjgp19X702221
Verdecchia P, Angeli F, Borgioni C, et al. Ambulatory blood pressure and cardiovascular outcome in relation to perceived sleep deprivation. Hypertension. 2007;49(4):777-83. PMID: 17261645. https://doi.org/10.1161/01.HYP.0000258215.26755.20
Viera AJ, Lingley K, Esserman D. Effects of labeling patients as prehypertensive. J Am Board Fam Med. 2010;23(5):571-83. PMID: 20823351. https://doi.org/10.3122/jabfm.2010.05.100047
Viera AJ, Lingley K, Hinderliter AL. Tolerability of the Oscar 2 ambulatory blood pressure monitor among research participants: a cross-sectional repeated measures study. BMC Med Res Methodol. 2011;11:59. PMID: 21524301. https://doi.org/10.1186/1471-2288-11-59

Appendix D. Excluded Studies List

Reasons for Exclusion

Exclusion Code	Definition
E1	Wrong study aim/relevance
E2	Wrong setting
E3	Wrong comparator (for KQ2 and 3, ABPM was not the gold standard; or within-class comparisons such as OMRON device A vs OMRON device B)
E4	No relevant outcomes
E4a	Not enough data to complete 2x2 table (KQ2) or 1x2 table (KQ3)
E4b	Reporting of concordance (kappa) without sens/spec/PPV/NPV
E4c	Sleep disturbance measure with no comparator not related to the ABPM device
E5	Population
E5a	>20% of excluded populations and data not stratified
E5b	>20% treated hypertensives
E6	Wrong intervention (e.g., wrist or finger monitors)
E7	Wrong study design
E8	Non-English
E9	Non-Very High HDI Country
E9a	Conducted in Brazil
E10	Poor study quality
E11	Ongoing study, no outcomes published
E11a	Abstract Only
E12	Unable to locate publication
E13	IPD-MA or registry where there are overlapping populations already included
E14	Article retracted

1. Design of the Women's Health Initiative clinical trial and observational study. Control Clin Trials. 1998;19:61-109. **KQ2E1, KQ3E1, KQ4E1.**
2. Ambulatory blood pressure monitoring for diagnosing hypertension in patients with elevated office blood pressure. Tecnologica MAP Supplement. 1999:1-3. **KQ2E7, KQ3E7, KQ4E7.**
3. "Masked" and "white-coat" hypertension could signal more serious complications. Experiencing temporary spikes in blood pressure may put you at greater risk of cardiac events. Heart Advisor. 2009;12(11):6. **KQ2E7, KQ3E7, KQ4E7.**
4. Measuring blood pressure: two arms are better than one. Johns Hopkins Medical Letter, Health After 50. 2012;24(3):6. PMID: 22649825. **KQ2E7, KQ3E7, KQ4E7.**
5. Abir-Khalil S, Zaimi S, Tazi MA, et al. Prevalence and predictors of white-coat hypertension in a large database of ambulatory blood pressure monitoring. Eastern Mediterranean Health Journal. 2009;15(2):400-7. **KQ2E9, KQ3E9, KQ4E9.**
6. Adiyaman A, Tosun N, Elving LD, et al. The effect of crossing legs on blood pressure. Blood pressure monitoring. 2007;12(3):189-93. PMID: 17496470. https://doi.org/10.1097/MBP.0b013e3280b083a7 **KQ2E5b, KQ3E5b, KQ4E4.**
7. Agarwal R, Weir MR. Treated hypertension and the white coat phenomenon: Office readings are inadequate measures of efficacy. Journal of the American Society of Hypertension. 2013;7(3):236-43. https://doi.org/10.1016/j.jash.2013.02.005 **KQ2E5, KQ3E5, KQ4E4.**
8. Aihara A, Imai Y, Sekino M, et al. Discrepancy between screening blood pressure and ambulatory blood pressure: a community-based study in Ohasama. Hypertension research. 1998;21(2):127-36. **KQ2E4a, KQ3E5, KQ4E4.**
9. Akilli H, Kayrak M, Aribas A, et al. The relationship between exercise capacity and masked hypertension in sedentary patients with diabetes mellitus. Clin Exp Hypertens. 2013;36(1):9-16. https://doi.org/10.3109/10641963.2013.783047 **KQ2E9, KQ3E9, KQ4E9.**
10. Al-Hashmi K, Al-Busaidi N, Amina B, et al. White coat hypertension and masked hypertension among omani patients attending a tertiary hospital for ambulatory blood pressure monitoring. Oman Med J. 2015;30(2):90-4. https://dx.doi.org/10.5001/omj.2015.20 **KQ2E5b, KQ3E5b, KQ4E4.**

11. Al-Husainy S, Farmer J, Gibson JM, et al. Is measurement of blood pressure worthwhile in the diabetic eye clinic? Eye. 2005;19(3):312-6. **KQ2E4a, KQ3E5, KQ4E4.**
12. Al-Turki KA, Al-Baghli NA, Al-Ghamdi AJ, et al. Hypertension in the eastern province of saudi arabia: results of a screening campaign. Journal of Family and Community Medicine. 2008;15(3):95-101. **KQ2E3, KQ3E3, KQ4E4.**
13. Ali F, Tacey M, Lykopandis N, et al. Microvascular narrowing and BP monitoring: A single centre observational study. PLoS ONE [Electronic Resource]. 2019;14(3):e0210625. PMID: 30870422. https://dx.doi.org/10.1371/journal.pone.0210625 **KQ2E5, KQ3E5b, KQ4E4.**
14. Almeida AE, Stein R, Gus M, et al. Relevance to Home Blood Pressure Monitoring Protocol of Blood Pressure Measurements Taken Before First- Morning Micturition and in the Afternoon. Arq Bras Cardiol. 2014;103(4):338-47. PMID: 25352508. https://doi.org/10.5935/abc.20140139 **KQ2E5, KQ3E9a, KQ4E4.**
15. Alpert BS. Are kiosk blood pressure readings trustworthy? Blood pressure monitoring. 2012;17(6):257-8. PMID: 23147536. **KQ2E7, KQ3E7, KQ4E7.**
16. Altintas E, Takoh K, Ohno Y, et al. Wearable and low-stress ambulatory blood pressure monitoring technology for hypertension diagnosis. Annual International Conference of the IEEE Engineering in Medicine & Biology Society. 2015;2015:4962-5. https://dx.doi.org/10.1109/EMBC.2015.7319505 **KQ2E4, KQ3E4, KQ4E4.**
17. AlWabel AH, Almufadhi MA, Alayed FM, et al. Assessment of hypertension and its associated risk factors among medical students in Qassim University. Saudi Journal of Kidney Diseases & Transplantation. 2018;29(5):1100-8. PMID: 30381506. https://dx.doi.org/10.4103/1319-2442.243959 **KQ2E3, KQ3E5, KQ4E4.**
18. Andreadis EA, Agaliotis GD, Angelopoulos ET, et al. Automated office blood pressure and 24-h ambulatory measurements are equally associated with left ventricular mass index. American journal of hypertension. 2011;24(6):661-6. PMID: 21415839. https://doi.org/10.1038/ajh.2011.38 **KQ2E5, KQ3E7c, KQ4E4.**
19. Andreadis EA, Angelopoulos ET, Tsakanikas AP, et al. Automated office versus home measurement of blood pressure in the assessment of morning hypertension. Blood pressure monitoring. 2012;17(1):24-34. **KQ2E5, KQ3E4b, KQ4E4.**
20. Andreadis EA, Geladari CV, Angelopoulos ET, et al. Morning Surge and Peak Morning Ambulatory Blood Pressure Versus Automated Office Blood Pressure in Predicting Cardiovascular Disease. High Blood Pressure & Cardiovascular Prevention. 2019;26(3):209-15. PMID: 30989620. https://dx.doi.org/10.1007/s40292-019-00315-7 **KQ2E5, KQ3E4a, KQ4E4.**
21. Andreadis EA, Geladari CV, Angelopoulos ET, et al. Attended and Unattended Automated Office Blood Pressure Measurements Have Better Agreement With Ambulatory Monitoring Than Conventional Office Readings. J Am Heart Assoc. 2018;7(8). PMID: 29627767. 10.1161/JAHA.118.008994 **KQ2E5, KQ3E4b, KQ4E4.**
22. Anstey DE, Booth JN, 3rd, Abdalla M, et al. Predicted Atherosclerotic Cardiovascular Disease Risk and Masked Hypertension Among Blacks in the Jackson Heart Study. Circ Cardiovasc Qual Outcomes. 2017;10(7). https://dx.doi.org/10.1161/CIRCOUTCOMES.116.003421 **KQ2E4a, KQ3E5, KQ4E4.**
23. Anstey DE, Colantonio LD, Yano Y, et al. The importance of using 24-hour and nighttime blood pressure for the identification of white coat hypertension: Data from the Jackson Heart Study. J Clin Hypertens. 2018;06:06. https://dx.doi.org/10.1111/jch.13330 **KQ2E4a, KQ3E5, KQ4E4.**
24. Anstey DE, Muntner P, Bello NA, et al. Diagnosing Masked Hypertension Using Ambulatory Blood Pressure Monitoring, Home Blood Pressure Monitoring, or Both? Hypertension. 2018;72(5):1200-7. PMID: 30354812. https://dx.doi.org/10.1161/HYPERTENSIONAHA.118.11319 **KQ2E4a, KQ3E5, KQ4E4.**
25. Antza C, Doundoulakis I, Akrivos E, et al. Early Vascular Aging Risk Assessment From Ambulatory Blood Pressure Monitoring: The Early Vascular Aging Ambulatory Score. American journal of hypertension. 2018;31(11):1197-204. PMID: 30239585. https://dx.doi.org/10.1093/ajh/hpy115 **KQ2E5, KQ3E5a, KQ4E4.**
26. Apostolides AY, Cutter G, Daugherty SA, et al. Three-year incidence of hypertension in thirteen U.S. communities. On behalf of the Hypertension Detection and Follow-up Program cooperative group. Preventive Medicine. 1982;11(5):487-99. **KQ2E1, KQ3E1, KQ4E1.**
27. Arima H, Kiyohara Y, Kato I, et al. Alcohol reduces insulin-hypertension relationship in a general population: the Hisayama study. Journal

of Clinical Epidemiology. 2002;55(9):863-9. **KQ2E1, KQ3E1, KQ4E1.**
28. Armanyous S, Ohashi Y, Lioudis M, et al. Diagnostic Performance of Blood Pressure Measurement Modalities in Living Kidney Donor Candidates. Clinical Journal of The American Society of Nephrology: CJASN. 2019;14(5):738-46. PMID: 30948455. https://dx.doi.org/10.2215/CJN.02780218 **KQ2E5, KQ3E5, KQ4E4.**
29. Armstrong D, Matangi M, Brouillard D, et al. Automated office blood pressure - being alone and not location is what matters most. Blood pressure monitoring. 2015;20(4):204-8. PMID: 26154710. https://doi.org/10.1097/MBP.0000000000000133 **KQ2E5, KQ3E5b, KQ4E4.**
30. Asayama K, Ohkubo T, Hara A, et al. Repeated evening home blood pressure measurement improves prognostic significance for stroke: a 12-year follow-up of the Ohasama study. Blood pressure monitoring. 2009;14(3):93-8. **KQ2E1, KQ3E1, KQ4E1.**
31. Asayama K, Ohkubo T, Kikuya M, et al. Use of 2003 European Society of Hypertension-European Society of Cardiology guidelines for predicting stroke using self-measured blood pressure at home: the Ohasama study. European Heart Journal. 2005;26(19):2026-31. **KQ2E1, KQ3E1, KQ4E1.**
32. Asayama K, Ohkubo T, Kikuya M, et al. Prediction of stroke by home "morning" versus "evening" blood pressure values: the Ohasama study. Hypertension. 2006;48(4):737-43. **KQ2E1, KQ3E1, KQ4E1.**
33. Asayama K, Thijs L, Li Y, et al. Setting thresholds to varying blood pressure monitoring intervals differentially affects risk estimates associated with white-coat and masked hypertension in the population. Hypertension. 2014;64(5):935-42. https://dx.doi.org/10.1161/HYPERTENSIONAHA.114.03614 **KQ2E13, KQ3E5, KQ4E4.**
34. Augustovski FA, Calvo CB, Deprati M, et al. The deep-breath test as a diagnostic maneuver for white-coat effect in hypertensive patients. Journal of the American Board of Family Practice. 2004;17(3):184-9. **KQ2E5b, KQ3E5b, KQ4E4.**
35. Baguet JP, Joseph X, Ormezzano O, et al. Ambulatory blood pressure variation in healthy subjects, hypertensive elderly and type 1 diabetic patients in relation to the sitting or standing position. Blood pressure monitoring. 2001;6(4):191-4. **KQ2E3, KQ3E3, KQ4E4.**
36. Bakris GL, Smith DH, Giles TD, et al. Comparative antihypertensive efficacy of angiotensin receptor blocker-based treatment in African-American and white patients. Journal of Clinical Hypertension. 596;7(10):587-95. **KQ2E5, KQ3E4a, KQ4E4.**
37. Bakx JC, Seidell JC, Deurenberg P, et al. Development of hypertension in obese subjects seen in general practice. Family Practice. 1987;4(1):11-8. **KQ2E1, KQ3E1, KQ4E1.**
38. Banegas JR, de la Cruz JJ, Graciani A, et al. Impact of Ambulatory Blood Pressure Monitoring on Reclassification of Hypertension Prevalence and Control in Older People in Spain. J Clin Hypertens. 2015;17(6):453-61. https://dx.doi.org/10.1111/jch.12525 **KQ2E2, KQ3E5, KQ4E4.**
39. Banegas JR, Ruilope LM, de la Sierra A, et al. Relationship between Clinic and Ambulatory Blood-Pressure Measurements and Mortality. N Engl J Med. 2018;378(16):1509-20. PMID: 29669232. https://doi.org/10.1056/NEJMoa1712231 **KQ2E5, KQ3E14, KQ4E4.**
40. Beltman FW, Heesen WF, Kok RH, et al. Predictive value of ambulatory blood pressure shortly after withdrawal of antihypertensive drugs in primary care patients. BMJ. 1996;313(7054):404-6. PMID: 8761232. **KQ2E5, KQ3E7c, KQ4E4.**
41. Ben-Dov IZ, Ben-Arie L, Mekler J, et al. Normal ambulatory blood pressure: a clinical practice-based comparison of two recently published definitions. Journal of human hypertension. 2005;19(7):565-7. **KQ2E3, KQ3E3, KQ4E4.**
42. Ben-Dov IZ, Ben-Arie L, Mekler J, et al. Normal ambulatory blood pressure: a clinical-practice-based analysis of recent American Heart Association recommendations. American Journal of Medicine. 2006;119(1):69-8. **KQ2E3, KQ3E3, KQ4E4.**
43. Birk JL, Cornelius T, Edmondson D, et al. Duration of Perseverative Thinking as Related to Perceived Stress and Blood Pressure: An Ambulatory Monitoring Study. Psychosomatic Medicine. 2019;03:03. PMID: 31274822. https://dx.doi.org/10.1097/PSY.0000000000000727 **KQ2E1, KQ3E1, KQ4E1.**
44. Bjorklund K, Lind L, Lithell H. Twenty-four hour ambulatory blood pressure in a population of elderly men. Journal of Internal Medicine. 2000;248(6):501-10. PMID: 11155143. **KQ2E10, KQ3E5, KQ4E4.**
45. Bjorklund K, Lind L, Vessby B, et al. Different metabolic predictors of white-coat and sustained hypertension over a 20-year follow-up period: a

population-based study of elderly men. Circulation. 2002;106(1):63-8. **KQ2E10, KQ3E5, KQ4E4.**

46. Bjorklund K, Lind L, Zethelius B, et al. Isolated ambulatory hypertension predicts cardiovascular morbidity in elderly men. Circulation. 2003;107(9):1297-302. **KQ2E10, KQ3E5, KQ4E4.**
47. Blanco F, Gil P, Arco CD, et al. Association of clinic and ambulatory blood pressure with vascular damage in the elderly: the EPICARDIAN study. Blood pressure monitoring. 2006;11(6):329-35. PMID: 17106317. **KQ2E4a, KQ3E5, KQ4E4.**
48. Blekkenhorst LC, Lewis JR, Prince RL, et al. Nitrate-rich vegetables do not lower blood pressure in individuals with mildly elevated blood pressure: a 4-wk randomized controlled crossover trial. Am J Clin Nutr. 2018;107(6):894-908. https://dx.doi.org/10.1093/ajcn/nqy061 **KQ2E1, KQ3E1, KQ4E1.**
49. Bobrie G, Chatellier G, Genes N, et al. Cardiovascular prognosis of "masked hypertension" detected by blood pressure self-measurement in elderly treated hypertensive patients. Jama. 2004;291(11):1342-9. **KQ2E1, KQ3E1, KQ4E1.**
50. Bombelli M, Sega R, Facchetti R, et al. Prevalence and clinical significance of a greater ambulatory versus office blood pressure ('reversed white coat' condition) in a general population. Journal of hypertension. 2005;23(3):513-20. PMID: 15716691. **KQ2E4a, KQ3E5, KQ4E4.**
51. Booth JN, Anstey DE, Bello NA, et al. Race and sex differences in asleep blood pressure: The Coronary Artery Risk Development in Young Adults (CARDIA) study. Journal of Clinical Hypertension. 2019;21(2):184-92. PMID: 30719843. https://dx.doi.org/10.1111/jch.13474 **KQ1E1, KQ2E4a, KQ3E5, KQ4E4.**
52. Booth JN, 3rd, Muntner P, Diaz KM, et al. Evaluation of Criteria to Detect Masked Hypertension. J Clin Hypertens. 2016;18(11):1086-94. https://dx.doi.org/10.1111/jch.12830 **KQ2E7, KQ3E7, KQ4E4.**
53. Botomino A, Martina B, Ruf D, et al. White coat effect and white coat hypertension in community pharmacy practice. Blood pressure monitoring. 2005;10(1):13-8. PMID: 15687869. **KQ2E5, KQ3E7c, KQ4E4.**
54. Boubouchairopoulou N, Karpettas N, Athanasakis K, et al. Cost estimation of home blood pressure monitoring versus combined office and ambulatory measurements in hypertension management. Value Health [serial on the Internet]. 2014; 17(7): Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/CN-01055065/full. **KQ2E1, KQ3E1, KQ4E1.**
55. Boucher P, Gilbert-Ouimet M, Trudel X, et al. Masked hypertension and effort-reward imbalance at work among 2369 white-collar workers. Journal of human hypertension. 2017;31(10):620-6. https://dx.doi.org/10.1038/jhh.2017.42 **KQ2E2, KQ3E5, KQ4E4.**
56. Boyko EJ, Barr EL, Zimmet PZ, et al. Two-hour glucose predicts the development of hypertension over 5 years: the AusDiab study. Journal of human hypertension. 2008;22(3):168-76. **KQ2E1, KQ3E1, KQ4E1.**
57. Brantsma AH, Bakker SJ, de ZD, et al. Urinary albumin excretion as a predictor of the development of hypertension in the general population. Journal of the American Society of Nephrology. 2006;17(2):331-5. **KQ2E1, KQ3E1, KQ4E1.**
58. Brguljan-Hitij J, Thijs L, Li Y, et al. Risk stratification by ambulatory blood pressure monitoring across JNC classes of conventional blood pressure. American journal of hypertension. 2014;27(7):956-65. https://dx.doi.org/10.1093/ajh/hpu002 **KQ2E4a, KQ3E5, KQ4E4.**
59. Bromfield SG, Booth JN, 3rd, Loop MS, et al. Evaluating different criteria for defining a complete ambulatory blood pressure monitoring recording: data from the Jackson Heart Study. Blood pressure monitoring. 2018;23(2):103-11. https://dx.doi.org/10.1097/MBP.0000000000000309 **KQ2E5b, KQ3E5, KQ4E4.**
60. Bromfield SG, Shimbo D, Booth JN, 3rd, et al. Cardiovascular Risk Factors and Masked Hypertension: The Jackson Heart Study. Hypertension. 2016;68(6):1475-82. https://dx.doi.org/10.1161/HYPERTENSIONAHA.116.08308 **KQ2E4a, KQ3E5, KQ4E4.**
61. Bulpitt CJ, Beckett N, Peters R, et al. Does white coat hypertension require treatment over age 80?: Results of the hypertension in the very elderly trial ambulatory blood pressure side project. Hypertension. 2013;61(1):89-94. **KQ2E5, KQ3E4a, KQ4E4.**
62. Cacciolati C, Hanon O, Alperovitch A, et al. Masked hypertension in the elderly: cross-sectional analysis of a population-based sample. American journal of hypertension. 2011;24(6):674-80. **KQ2E1, KQ3E1, KQ4E1.**

63. Cacciolati C, Hanon O, Dufouil C, et al. Categories of hypertension in the elderly and their 1-year evolution. The Three-City Study. Journal of hypertension. 2013;31(4):680-9. **KQ2E1, KQ3E1, KQ4E1.**
64. Cahan A, Ben-Dov IZ, Mekler J, et al. The role of blood pressure variability in misdiagnosed clinic hypertension. Hypertension. 2011;34(2):187-92. **KQ2E5, KQ3E5b, KQ4E4.**
65. Cameron AJ, Welborn TA, Zimmet PZ, et al. Overweight and obesity in Australia: the 1999-2000 Australian Diabetes, Obesity and Lifestyle Study (AusDiab). Med J Aust. 2003;178(9):427-32. **KQ2E1, KQ3E1, KQ4E1.**
66. Campbell NR, Myers MG, McKay DW. Is usual measurement of blood pressure meaningful? Blood pressure monitoring. 1999;4(2):71-6. **KQ2E5b, KQ3E5b, KQ4E4.**
67. Campbell P, Ghuman N, Wakefield D, et al. Long-term reproducibility of ambulatory blood pressure is superior to office blood pressure in the very elderly. Journal of human hypertension. 2010;24(11):749-54. **KQ2E4a, KQ3E5, KQ4E4.**
68. Canter DA, Texter MJ, McLain RW. Short report: ambulatory blood pressure monitoring can play an integral role in patient selection, dosage adjustment and efficacy assessment in clinical trials of antihypertensive agents. Journal of hypertension. 1994;12(4):491-4. **KQ2E5, KQ3E4a, KQ4E4.**
69. Carlson DJ, Dieberg G, McFarlane JR, et al. Blood pressure measurements in research: suitability of auscultatory, beat-to-beat, and ambulatory blood pressure measurements. Blood pressure monitoring. 2019;24(1):18-23. PMID: 30489333. https://dx.doi.org/10.1097/MBP.0000000000000355 **KQ2E4b, KQ3E5, KQ4E4.**
70. Carson AP, Lewis CE, Jacobs DR, Jr., et al. Evaluating the Framingham hypertension risk prediction model in young adults: the Coronary Artery Risk Development in Young Adults (CARDIA) study. Hypertension. 2013;62(6):1015-20. **KQ2E1, KQ3E1, KQ4E1.**
71. Carugo S, Solari D, Esposito A, et al. Clinic blood pressure, ambulatory blood pressure and cardiac structural alterations in nonagenarians and in centenarians. Blood Pressure. 2012;21(2):97-103. **KQ2E5b, KQ3E5, KQ4E4.**
72. Celis H, Staessen JA, Buntix F, et al. Antihypertensive treatment based on home or office blood pressure measurement: protocol of the randomized controlled THOP trial. Blood pressure monitoring. 1998;3:S29-S35. **KQ2E5, KQ3E10, KQ4E4.**
73. Celis H, Staessen JA, Thijs L, et al. Cardiovascular risk in white-coat and sustained hypertensive patients. Blood Press. 2002;11(6):352-6. **KQ2E1, KQ3E4a, KQ4E4.**
74. Cesar CV, Victoria PR, Rogelio TS. Loaned self-measurement equipment model compared with ambulatory blood pressure monitoring. Blood pressure monitoring. 2003;8(2):63-70. PMID: 12819557. **KQ2E9, KQ3E9, KQ4E9.**
75. Chan KS, Lai KPL, Chan PF, et al. Evaluation of the applicability of deep breathing test in the diagnosis of hypertension with white-coat effect in Chinese patients in primary care. Clin. 2019;25:2. PMID: 30774977. https://dx.doi.org/10.1186/s40885-018-0106-4 **KQ2E5, KQ3E5b, KQ4E4.**
76. Chanudet X, Chau NP, Larroque P. Short-term representatives of daytime and night-time ambulatory blood pressures. Journal of hypertension. 1992;10(6):595-600. **KQ2E4a, KQ3E4a, KQ4E4.**
77. Chatellier G, Battaglia C, Pagny JY, et al. Decision to treat mild hypertension after assessment by ambulatory monitoring and World Health Organisation recommendations. BMJ. 1992;305(6861):1062-6. **KQ2E1, KQ3E1, KQ4E1.**
78. Cheng YB, Thijs L, Zhang ZY, et al. Outcome-Driven Thresholds for Ambulatory Blood Pressure Based on the New American College of Cardiology/American Heart Association Classification of Hypertension. Hypertension. 2019:Hypertensionaha11913512. PMID: 31378104. https://doi.org/10.1161/hypertensionaha.119.13512 **KQ2E13, KQ3E5, KQ4E4.**
79. Cheung BM, Ong KL, Tso AW, et al. C-reactive protein as a predictor of hypertension in the Hong Kong Cardiovascular Risk Factor Prevalence Study (CRISPS) cohort. Journal of human hypertension. 2012;26(2):108-16. **KQ2E1, KQ3E1, KQ4E1.**
80. Cheung BM, Wat NM, Man YB, et al. Relationship between the metabolic syndrome and the development of hypertension in the Hong Kong Cardiovascular Risk Factor Prevalence Study-2 (CRISPS2). American journal of hypertension. 2008;21(1):17-22. **KQ2E1, KQ3E1, KQ4E1.**
81. Choi T, Rhee M, Park H, et al. Multiple office blood pressure measurement is not inferior to home blood pressure monitoring compared with 24-hour ambulatory blood pressure monitoring: a prospective multicenter study. Eur Heart J [serial on the Internet]. 2015; 36: Available from: https://www.cochranelibrary.com/central/doi/10.

1002/central/CN-01472592/full. **KQ2E5, KQ3E11a, KQ4E4.**

82. Chonan K, Kikuya M, Araki T, et al. Device for the self-measurement of blood pressure that can monitor blood pressure during sleep. Blood pressure monitoring. 2001;6(4):203-5. **KQ2E5, KQ3E5b, KQ4E5b.**
83. Chow WS, Cheung BM, Tso AW, et al. Hypoadiponectinemia as a predictor for the development of hypertension: a 5-year prospective study. Hypertension. 2007;49(6):1455-61. **KQ2E1, KQ3E1, KQ4E1.**
84. Chrubasik SA, Chrubasik CA, Piper J, et al. Impact of risk factors on cardiovascular risk: a perspective on risk estimation in a Swiss population. Swiss Med Wkly. 2015;145:w14180. https://dx.doi.org/10.4414/smw.2015.14180 **KQ2E4, KQ3E4, KQ4E4.**
85. Chrubasik-Hausmann S, Chrubasik C, Walz B, et al. Comparisons of home and daytime ambulatory blood pressure measurements. BMC Cardiovasc Disord. 2014;14:94. https://dx.doi.org/10.1186/1471-2261-14-94 **KQ2E3, KQ3E4a, KQ4E4.**
86. Clark S, Fowlie S, Pannarale G, et al. Age and blood pressure measurement: experience with the TM2420 ambulatory blood pressure monitor and elderly people. Age Ageing. 1992;21(6):398-403. **KQ2E4a, KQ3E4a, KQ4E4.**
87. Clement DL, De Buyzere ML, De Bacquer DA, et al. Prognostic value of ambulatory blood-pressure recordings in patients with treated hypertension. N Engl J Med. 2003;348(24):2407-15. **KQ2E1, KQ3E1, KQ4E1.**
88. Coll de Tuero G, Llibre JB, Poncelas AR, et al. Isolated clinical hypertension diagnosis: self-home BP, ambulatory BP monitoring, or both simultaneously? Blood pressure monitoring. 2011;16(1):11-5. **KQ2E5, KQ3E4a, KQ4E4.**
89. Coll-de-Tuero G, Saez M, Roca-Saumell C, et al. Evolution of target organ damage by different values of self-blood pressure measurement in untreated hypertensive patients. American journal of hypertension. 2012;25(12):1256-63. **KQ2E5, KQ3E4a, KQ4E4.**
90. Conen D, Aeschbacher S, Thijs L, et al. Age-specific differences between conventional and ambulatory daytime blood pressure values. Hypertension. 2014;64(5):1073-9. https://dx.doi.org/10.1161/HYPERTENSIONAHA.114.03957 **KQ2E13, KQ3E5, KQ4E4.**
91. Conroy RM, Atkins N, Mee F, et al. Using Hawksley random zero sphygmomanometer as a gold standard may result in misleading conclusions. Blood Pressure. 1994;3(5):283-6. **KQ2E3, KQ3E3, KQ4E4.**
92. Costa A, Bosone D, Ramusino MC, et al. Twenty-four-hour blood pressure profile, orthostatic hypotension, and cardiac dysautonomia in elderly type 2 diabetic hypertensive patients. Clinical autonomic research/. 2016;26(6):433-9. **KQ2E5, KQ3E4a, KQ4E4.**
93. Critselis E, Chrysohoou C, Kollia N, et al. Stage 1 hypertension, but not elevated blood pressure, predicts 10-year fatal and non-fatal CVD events in healthy adults: the ATTICA Study. Journal of human hypertension. 2019. 10.1038/s41371-019-0169-z **KQ2E3, KQ3E5, KQ4E4.**
94. Cuspidi C, Meani S, Sala C, et al. How reliable is isolated clinical hypertension defined by a single 24-h ambulatory blood pressure monitoring? Journal of hypertension. 2007;25(2):315-20. **KQ2E5, KQ3E4a, KQ4E4.**
95. Cuspidi C, Meani S, Salerno M, et al. Reproducibility of nocturnal blood pressure fall in early phases of untreated essential hypertension: a prospective observational study. Journal of human hypertension. 2004;18(7):503-9. **KQ2E1, KQ3E4a, KQ4E4.**
96. Cuspidi C, Parati G. Masked hypertension: an independent predictor of organ damage. Journal of hypertension. 2007;25(2):275-9. PMID: 17211231. https://doi.org/10.1097/HJH.0b013e32801da2d2 **KQ2E7, KQ3E7, KQ4E7.**
97. Cuspidi C, Sala C, Valerio C, et al. Nocturnal blood pressure in untreated essential hypertensives. Blood Pressure. 2011;20(6):335-41. **KQ2E5, KQ3E4a, KQ4E4.**
98. Danninger K, Hafez A, Binder RK, et al. High prevalence of hypertension and early vascular aging: a screening program in pharmacies in Upper Austria. Journal of human hypertension. 2019;29:29. PMID: 31358883. https://dx.doi.org/10.1038/s41371-019-0222-y **KQ2E2, KQ3E5, KQ4E4.**
99. de Gaudemaris R, Chau NP, Mallion JM. Home blood pressure: variability, comparison with office readings and proposal for reference values. Groupe de la Mesure, French Society of Hypertension. Journal of hypertension. 1994;12(7):831-8. PMID: 7963513. **KQ2E3, KQ3E5, KQ4E4.**
100. de la Sierra A, Banegas JR, Vinyoles E, et al. Prevalence of Masked Hypertension in Untreated and Treated Patients With Office Blood Pressure Below 130/80 mm Hg. Circulation. 2018;137(24):2651-3. PMID: 29712713.

https://dx.doi.org/10.1161/CIRCULATIONAHA.118.034619 **KQ2E5, KQ3E4a, KQ4E4.**

101. de la Sierra A, Banegas JR, Vinyoles E, et al. Prevalence of Masked Hypertension in Untreated and Treated Patients With Office Blood Pressure Below 130/80 mm Hg. Circulation. 2018;137:2651-3. https://doi.org/10.1161/CIRCULATIONAHA.118.034619 **KQ2E5, KQ3E4a, KQ4E4.**
102. De Leon-Robert A, Gascon-Canovas JJ, Anton-Botella JJ, et al. Validity of self blood pressure measurement in the control of the hypertensive patient: factors involved. BMC Cardiovascular Disorders. 2019;19(1):171. PMID: 31315567. https://dx.doi.org/10.1186/s12872-019-1145-9 **KQ2E5, KQ3E5, KQ4E4.**
103. de lSA, Banegas J, Divison J, et al. Ambulatory blood pressure in hypertensive patients with inclusion criteria for the SPRINT trial. Journal of the American Society of Hypertension. 2016; 10(12): Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/CN-01473618/full. **KQ2E5a, KQ3E5a, KQ4E4.**
104. de Tuero GC, Boreu QF, Rodriguez-Poncelas A, et al. Assessment of self-monitoring of blood pressure in the diagnosis of isolated clinic hypertension. Blood Pressure. 2006;15(4):227-36. PMID: 17078176. **KQ2E3, KQ3E5, KQ4E4.**
105. Dell'Oro R, Facchetti R, Bombelli M, et al., editors. 24-hour systolic blood pressure load represents an important variable in determining the cardiovascular risk profile of white-coat hypertension. High Blood Press Cardiovasc Prev; 2017; Conference: 34th national congress of the italian society of hypertension, SIIA 2017. Italy. **KQ2E11a, KQ3E11a, KQ4E4.**
106. Denissen SJ, van der Aalst CM, Vonder M, et al. Impact of a cardiovascular disease risk screening result on preventive behaviour in asymptomatic participants of the ROBINSCA trial. European journal of preventive cardiology. 2019;26(12):1313-22. PMID: 30966821. https://dx.doi.org/10.1177/2047487319843396 **KQ1E4, KQ21, KQ3E1, KQ4E1.**
107. Dernellis J, Panaretou M. Aortic stiffness is an independent predictor of progression to hypertension in nonhypertensive subjects. Hypertension. 2005;45(3):426-31. **KQ2E1, KQ3E1, KQ4E1.**
108. Di Monaco S, Rabbia F, Covella M, et al. Evaluation of a short home blood pressure measurement in an outpatient population of hypertensives. Clin Exp Hypertens. 2016;38(8):673-9. https://dx.doi.org/10.1080/10641963.2016.1200600 **KQ2E5, KQ3E7c, KQ4E4.**
109. Divison JA, Sanchis C, Artigao LM, et al. Home-based self-measurement of blood pressure: a proposal using new reference values (the PURAS study). Blood pressure monitoring. 2004;9(4):211-8. PMID: 1531148. **KQ2E3, KQ3E5, KQ4E4.**
110. Dolan E, Stanton A, Thijs L, et al. Superiority of ambulatory over clinic blood pressure measurement in predicting mortality: the Dublin outcome study. Hypertension. 2005;46(1):156-61. **KQ2E1, KQ3E1, KQ4E1.**
111. Ebbs D. A comparison of selected antihypertensives and the use of conventional vs ambulatory blood pressure in the detection and treatment of hypertension. Cardiology. 2001;96:Suppl-9. **KQ2E5, KQ3E4a, KQ4E4.**
112. Edick CM, Parnell D, Christensen ML, et al. Falsely elevated systolic blood pressure with patient-operated blood pressure measuring devices. J Am Pharm Assoc (Wash). 2000;40(5):670-2. PMID: 11029849. **KQ2E3, KQ3E5, KQ4E4.**
113. Eguchi K, Hoshide S, Ishikawa J, et al. Cardiovascular prognosis of sustained and white-coat hypertension in patients with type 2 diabetes mellitus. Blood pressure monitoring. 2008;13(1):15-20. https://doi.org/10.1097/MBP.0b013e3282f13f4a **KQ2E5, KQ3E4a, KQ4E4.**
114. Eguchi K, Pickering TG, Hoshide S, et al. Ambulatory blood pressure is a better marker than clinic blood pressure in predicting cardiovascular events in patients with/without type 2 diabetes. American journal of hypertension. 2008;21(4):443-50. **KQ2E4, KQ3E4a, KQ4E4.**
115. Elijovich F, Laffer CL. Bayesian analysis supports use of ambulatory blood pressure monitors for screening. Hypertension. 1992;19(2 Suppl):II268-II72. **KQ2E5, KQ3E5, KQ4E4.**
116. Endo Y, Serizawa F, Kato T, et al. Clinical characteristics of young-onset and medical treatment-requiring hypertension identified by targeted screening in university health check-up. Clinical & Experimental Hypertension (New York). 2011;33(8):552-7. **KQ2E3, KQ3E5, KQ4E4.**
117. Enstrom IE, Pennert KM. 24 h non-invasive ambulatory blood pressure monitoring: do the number of recordings per hour and/or ways of analyzing day and night matter? Blood pressure monitoring. 2001;6(5):253-6. **KQ2E4a, KQ3E4a, KQ4E4.**

118. Ernst ME, Bergus GR. Favorable patient acceptance of ambulatory blood pressure monitoring in a primary care setting in the United States: a cross-sectional survey. BMC family practice. 2003;4:15. PMID: 14533981. 10.1186/1471-2296-4-15 **KQ2E1, KQ3E1, KQ4E5b.**
119. Esme M, Yavuz BB, Yavuz B, et al. Masked Hypertension is Associated With Cognitive Decline in Geriatric Age-Geriatric MASked Hypertension and Cognition (G-MASH-cog) Study. J Gerontol A Biol Sci Med Sci. 2018;73(2):248-54. https://dx.doi.org/10.1093/gerona/glx150 **KQ2E9, KQ3E9, KQ4E9.**
120. Espinosa R, Spruill TM, Zawadzki MJ, et al. Can blood pressure measurements taken in the physician's office avoid the 'white coat' bias? Blood pressure monitoring. 2011;16(5):231-7. **KQ2E5, KQ3E4a, KQ4E4.**
121. Everson SA, Kaplan GA, Goldberg DE, et al. Hypertension incidence is predicted by high levels of hopelessness in Finnish men. Hypertension. 2000;35(2):561-7. **KQ2E1, KQ3E1, KQ4E1.**
122. Fagot-Campagna A, Balkau B, Simon D, et al. Is insulin an independent risk factor for hypertension? The Paris Prospective Study. Int J Epidemiol. 1997;26(3):542-50. **KQ2E1, KQ3E1, KQ4E1.**
123. Farhan H, Al-Hasani M, Misbah M, et al. Comparative study of ambulatory blood pressure monitoring and clinic blood pressure measurement in the risk assessment and management of hypertension. Sultan Qaboos University Medical Journal. 2010;10(3):370-6. **KQ2E5, KQ3E5a, KQ4E4.**
124. Faria J, Mesquita-Bastos J, Bertoquini S, et al. Long-term cardiovascular risk of white-coat hypertension with normal night-time blood pressure values. Blood pressure monitoring. 2019;24(2):59-66. PMID: 30856622. https://dx.doi.org/10.1097/MBP.0000000000000364 **KQ2E5, KQ3E4a, KQ4E4.**
125. Fava C, Burri P, Almgren P, et al. Heritability of ambulatory and office blood pressure phenotypes in Swedish families. Journal of hypertension. 2004;22(9):1717-21. **KQ2E4b, KQ3E5, KQ4E4.**
126. Figliuzzi I, Presta V, Miceli F, et al. 24-Hour ambulatory blood pressure levels and control in a large cohort of adult outpatients with different classes of obesity. Journal of human hypertension. 2019;33(4):298-307. PMID: 30420644. https://dx.doi.org/10.1038/s41371-018-0132-4 **KQ2E5, KQ3E4a, KQ4E4.**
127. Fitchett G, Powell LH. Daily spiritual experiences, systolic blood pressure, and hypertension among midlife women in SWAN. Ann Behav Med. 2009;37(3):257-67. **KQ2E1, KQ3E1, KQ4E1.**
128. Fogari R, Derosa G, Zoppi A, et al. Comparative effect of canrenone or hydrochlorothiazide addition to valsartan/amlodipine combination on urinary albumin excretion in well-controlled type 2 diabetic hypertensive patients with microalbuminuria. Expert Opin Pharmacother. 2014;15(4):453-9. https://dx.doi.org/10.1517/14656566.2014.874415 **KQ2E1, KQ3E1, KQ4E4.**
129. Formiga F, Ferrer A, Sobrino J, et al. Ambulatory blood pressure monitoring (ABPM) in nonagenarians. Archives of Gerontology & Geriatrics. 2009;48(3):367-71. **KQ2E5b, KQ3E5, KQ4E4.**
130. Franklin SS, Thijs L, Hansen TW, et al. Significance of white-coat hypertension in older persons with isolated systolic hypertension: a meta-analysis using the International Database on Ambulatory Blood Pressure Monitoring in Relation to Cardiovascular Outcomes population. [Review]. Hypertension. 2012;59(3):564-71. **KQ2E5, KQ3E5, KQ4E4.**
131. Franklin SS, Thijs L, Li Y, et al. Masked hypertension in diabetes mellitus: treatment implications for clinical practice. Hypertension. 2013;61(5):964-71. **KQ2E4a, KQ3E5, KQ4E4.**
132. Gaborieau V, Delarche N, Gosse P. Ambulatory blood pressure monitoring versus self-measurement of blood pressure at home: correlation with target organ damage. Journal of hypertension. 2008;26(10):1919-27. **KQ2E5, KQ3E5b, KQ4E4.**
133. Gasowski J, Li Y, Kuznetsova T, et al. Is "usual" blood pressure a proxy for 24-h ambulatory blood pressure in predicting cardiovascular outcomes? American journal of hypertension. 2008;21(9):994-1000. **KQ2E1, KQ3E1, KQ4E1.**
134. Gazzola K, Cammenga M, van der Hoeven NV, et al. Prevalence and reproducibility of differences between home and ambulatory blood pressure and their relation with hypertensive organ damage. Journal of human hypertension. 2017;31(9):555-60. https://dx.doi.org/10.1038/jhh.2017.27 **KQ2E5, KQ3E5b, KQ4E4.**
135. Giantin V, Franchin A, Toffanello ED, et al. Masked and white-coat hypertension in two cohorts of elderly subjects, ambulatory and hospitalized patients. Archives of Gerontology &

Geriatrics. 2009;49:Suppl-8. **KQ2E10, KQ3E5, KQ4E4.**

136. Giubertoni E, Bertelli L, Bartolacelli Y, et al. Parity as predictor of early hypertension during menopausal transition. Journal of hypertension. 2013;31(3):501-7. **KQ2E1, KQ3E1, KQ4E1.**
137. Glen S, Elliott H, Curzio J, et al. White-coat hypertension as a cause of cardiovascular dysfunction. Lancet. 1996;348(654-7). PMID: 8782756. https://doi.org/10.1016/S0140-6736(96)02303-3 **KQ2E4a, KQ3E7c, KQ4E4.**
138. Godwin M, Birtwhistle R, Delva D, et al. Manual and automated office measurements in relation to awake ambulatory blood pressure monitoring. Fam Pract. 2011;28(1):110-7. **KQ2E5b, KQ3E5b, KQ4E4.**
139. Gong S, Liu K, Ye R, et al. Nocturnal dipping status and the association of morning blood pressure surge with subclinical target organ damage in untreated hypertensives. Journal of Clinical Hypertension. 2019;03:03. PMID: 31376230. https://dx.doi.org/10.1111/jch.13641 **KQ2E9, KQ3E9, KQ4E9.**
140. Gorostidi M, de la Sierra A, Gonzalez-Albarran O, et al. Abnormalities in ambulatory blood pressure monitoring in hypertensive patients with diabetes. Hypertension Research - Clinical & Experimental. 2011;34(11):1185-9. https://doi.org/10.1038/hr.2011.100 **KQ2E5, KQ3E5b, KQ4E4.**
141. Graves JW, Grossardt BR. Discarding the first of three nurse-auscultatory or oscillometric blood pressure measurements does not improve the association of office blood pressure with ABPM. Blood pressure monitoring. 2010;15(3):146-51. **KQ2E5, KQ3E4a, KQ4E4.**
142. Graves JW, Grossardt BR, Gullerud RE, et al. The trained observer better predicts daytime ABPM diastolic blood pressure in hypertensive patients than does an automated (Omron) device. Blood pressure monitoring. 2006;11(2):53-8. **KQ2E5, KQ3E4b, KQ4E4.**
143. Green B, Anderson M, Cook A, et al., editors. Blood pressure checks for diagnosing hypertension (bp-check). Hypertension; 2017; Conference: american heart association's council on hypertension 2017 scientific sessions. United States. **KQ2E5, KQ3E11a, KQ4E4.**
144. Green BB, Anderson ML, Campbell J, et al. Blood pressure checks and diagnosing hypertension (BP-CHECK): Design and methods of a randomized controlled diagnostic study comparing clinic, home, kiosk, and 24-hour ambulatory BP monitoring. Contemporary Clinical Trials. 2019;79:1-13. PMID: 30634036. https://dx.doi.org/10.1016/j.cct.2019.01.003 **KQ2E5, KQ3E11, KQ4E4.**
145. Greiver M, White D, Kaplan DM, et al. Where should automated blood pressure measurements be taken? Pilot RCT of BpTRU measurements taken in private or nonprivate areas of a primary care office. Blood pressure monitoring. 2012;17(3):137-8. **KQ2E3, KQ3E3, KQ4E4.**
146. Grin JM, McCabe EJ, White WB. Management of hypertension after ambulatory blood pressure monitoring. Ann Intern Med. 1993;118(11):833-7. **KQ2E1, KQ3E4a, KQ4E4.**
147. Grossman A, Cohen N, Shemesh J, et al. Exaggerated blood pressure response to exercise is not associated with masked hypertension in patients with high normal blood pressure levels. J Clin Hypertens. 2014;16(4):277-82. https://dx.doi.org/10.1111/jch.12303 **KQ2E5, KQ3E4a, KQ4E4.**
148. Guagnano MT, Pace-Palitti V, Murri R, et al. The prevalence of hypertension in gynaecoid and android obese women. Journal of human hypertension. 1996;10(9):619-24. **KQ2E3, KQ3E3, KQ4E4.**
149. Gunawan F, Ng HY, Gilfillan C, et al. Ambulatory blood pressure monitoring in type 2 diabetes mellitus: a cross-sectional study. Current hypertension reviews. 2018;15(2):135-43. PMID: 29875006. https://dx.doi.org/10.2174/1573402114666180607090205 **KQ2E5b, KQ3E5, KQ4E4.**
150. Guo S, Lin H, Pan S, et al. The differential diagnostic value of serum homocysteine for white coat hypertension. Oncotarget. 2017;8(60):101271-83. https://dx.doi.org/10.18632/oncotarget.21020 **KQ2E9, KQ3E9, KQ4E9.**
151. Gustavsen PH, Hoegholm A, Bang LE, et al. White coat hypertension is a cardiovascular risk factor: a 10-year follow-up study. Journal of human hypertension. 2003;17(12):811-7. **KQ2E5, KQ3E4a, KQ4E4.**
152. Handler J, Mohan Y, Kanter MH, et al. Screening for High Blood Pressure in Adults During Ambulatory Nonprimary Care Visits: Opportunities to Improve Hypertension Recognition. J Clin Hypertens. 2015;17(6):431-9. https://dx.doi.org/10.1111/jch.12517 **KQ2E3, KQ3E5, KQ4E4.**
153. Handler J, Zhao Y, Egan BM. Impact of the number of blood pressure measurements on blood pressure classification in US adults: NHANES 1999-2008. Journal of clinical hypertension (Greenwich, Conn). 2012;14(11):751-9. **KQ2E3, KQ3E5, KQ4E4.**

154. Hanninen MR, Niiranen TJ, Puukka PJ, et al. Metabolic risk factors and masked hypertension in the general population: the Finn-Home study. Journal of human hypertension. 2014. PMID: 24384630. **KQ2E3, KQ3E5, KQ4E4.**
155. Hansen KW, Poulsen PL, Ebbehoj E, et al. What is hypertension in diabetes? Ambulatory blood pressure in 137 normotensive and normoalbuminuric Type 1 diabetic patients. Diabetic Medicine. 2001;18(5):370-3. PMID: 11472447. **KQ2E4a, KQ3E5, KQ4E4.**
156. Hansen TW, Jeppesen J, Rasmussen S, et al. Ambulatory blood pressure and mortality: a population-based study. Hypertension. 2005;45(4):499-504. **KQ2E1, KQ3E1, KQ4E1.**
157. Hansen TW, Kikuya M, Thijs L, et al. Prognostic superiority of daytime ambulatory over conventional blood pressure in four populations: a meta-analysis of 7,030 individuals. Journal of hypertension. 2007;25(8):1554-64. **KQ2E13, KQ3E5, KQ4E4.**
158. Hansen TW, Li Y, Boggia J, et al. Predictive role of the nighttime blood pressure. Hypertension. 2011;57(1):3-10. PMID: 21079049. 10.1161/hypertensionaha.109.133900 **KQ2E4a, KQ3E4a, KQ4E4.**
159. Hara A, Tanaka K, Ohkubo T, et al. Ambulatory versus home versus clinic blood pressure: the association with subclinical cerebrovascular diseases: the Ohasama Study. Hypertension. 2012;59(1):22-8. **KQ2E4a, KQ3E5, KQ4E4.**
160. Helvaci MR, Kaya H, Duru M, et al. What is the relationship between white coat hypertension and dyslipidemia? International Heart Journal. 2008;49(1):87-93. **KQ2E9, KQ3E9, KQ4E9.**
161. Helvaci MR, Kaya H, Yalcin A, et al. Prevalence of white coat hypertension in underweight and overweight subjects. International Heart Journal. 2007;48(5):605-13. **KQ2E9, KQ3E9, KQ4E9.**
162. Henskens LH, van Boxtel MP, Kroon AA, et al. Subjective sleep disturbance increases the nocturnal blood pressure level and attenuates the correlation with target-organ damage. Journal of hypertension. 2011;29(2):242-50. **KQ2E5, KQ3E4a, KQ45b.**
163. Her AY, Kim YH, Rim SJ, et al. Home blood pressure is the predictor of subclinical target organ damage like ambulatory blood pressure monitoring in untreated hypertensive patients. Anatolian journal of cardiology. 2014;14(8):711-8. https://dx.doi.org/10.5152/akd.2014.5119 **KQ2E5, KQ3E4b, KQ4E4.**
164. Hermida RC. Ambulatory blood pressure monitoring in the prediction of cardiovascular events and effects of chronotherapy: rationale and design of the MAPEC study. Chronobiol Int. 2007;24(4):749-75. **KQ2E1, KQ3E1, KQ4E1.**
165. Hermida RC. Sleep-time ambulatory blood pressure as a prognostic marker of vascular and other risks and therapeutic target for prevention by hypertension chronotherapy: Rationale and design of the Hygia Project. Chronobiol Int. 2016;33(7):906-36. PMID: 27221952. https://dx.doi.org/10.1080/07420528.2016.1181078 **KQ1E6, KQ4E6.**
166. Hermida RC, Ayala DE, Mojon A, et al. Sleep-Time Ambulatory BP Is an Independent Prognostic Marker of CKD. J Am Soc Nephrol. 2017;28(9):2802-11. https://dx.doi.org/10.1681/ASN.2016111186 **KQ2E1, KQ3E1, KQ4E1.**
167. Hermida RC, Ayala DE, Smolensky MH, et al. Sleep-time blood pressure: Unique sensitive prognostic marker of vascular risk and therapeutic target for prevention. Sleep medicine reviews. 2017;33:17-27. https://dx.doi.org/10.1016/j.smrv.2016.04.001 **KQ2E1, KQ3E1, KQ4E1.**
168. Hermida RC, Ayala DE, Ýn A, et al. Decreasing sleep-time blood pressure determined by ambulatory monitoring reduces cardiovascular risk. Journal of the American College of Cardiology. 2011;58(11):1165-73. **KQ2E1, KQ3E1, KQ4E1.**
169. Hond E, Celis H, Vandenhoven G, et al. Determinants of white-coat syndrome assessed by ambulatory blood pressure or self-measured home blood pressure. Blood pressure monitoring. 2003;8(1):37-40. **KQ2E5, KQ3E10, KQ4E4.**
170. Hond ED, Celis H, Fagard R, et al. Self-measured versus ambulatory blood pressure in the diagnosis of hypertension. Journal of hypertension. 2003;21(4):717-22. **KQ2E5, KQ3E10, KQ4E4.**
171. Huang J, Wang Y, Liu Z, et al. Simultaneous validation of the Grandway MD2301 digital automatic blood pressure monitor by the British Hypertension Society and the Association for the Advancement of Medical Instrumentation/the International Organization for Standardization protocols. Blood pressure monitoring. 2017;22(1):44-7. https://dx.doi.org/10.1097/MBP.0000000000000218 **KQ2E9, KQ3E9, KQ4E9.**
172. Iannucci G, Balsano C, Paroli M, et al. Office normotensives with a minimal augmentation of intima-media thickness of common carotid arteries: really normotensives? European Review for Medical & Pharmacological Sciences.

2013;17(23):3164-8. **KQ2E4a, KQ3E5, KQ4E4.**
173. Inden Y, Tsuda M, Hayashi H, et al. Relationship between Joint National Committee-VI classification of hypertension and ambulatory blood pressure in patients with hypertension diagnosed by casual blood pressure. Clin Cardiol. 1998;21(11):801-6. **KQ2E5, KQ3E4a, KQ4E4.**
174. Ingelsson E, Bjorklund-Bodegard K, Lind L, et al. Diurnal blood pressure pattern and risk of congestive heart failure. Jama. 2006;295(24):2859-66. **KQ2E1, KQ3E1, KQ4E1.**
175. Inoue R, Ohkubo T, Kikuya M, et al. Predicting stroke using 4 ambulatory blood pressure monitoring-derived blood pressure indices: the Ohasama Study. Hypertension. 2006;48(5):877-82. **KQ2E1, KQ3E1, KQ4E1.**
176. Inoue T, Iseki K, Iseki C, et al. Higher heart rate predicts the risk of developing hypertension in a normotensive screened cohort. Circ J. 2007;71(11):1755-60. **KQ2E1, KQ3E1, KQ4E1.**
177. Ishikawa J, Nasothimiou EG, Karpettas N, et al. Automatic office blood pressure measured without doctors or nurses present. Blood pressure monitoring. 2012;17(3):96-102. PMID: 22425703. 10.1097/MBP.0b013e328352ade4 **KQ2E5, KQ3E7c, KQ4E4.**
178. James GD, Marion R, Pickering TG. White-coat hypertension and sex. Blood pressure monitoring. 1998;3(5):281-7. **KQ2E5, KQ3E4a, KQ4E4.**
179. Juhaeri, Stevens J, Chambless LE, et al. Associations between weight gain and incident hypertension in a bi-ethnic cohort: the Atherosclerosis Risk in Communities Study. Int J Obes Relat Metab Disord. 2002;26(1):58-64. **KQ2E1, KQ3E1, KQ4E1.**
180. Jula A, Puukka P, Karanko H. Multiple clinic and home blood pressure measurements versus ambulatory blood pressure monitoring. Hypertension. 1999;34(2):261-6. **KQ2E5, KQ3E4a, KQ4E4.**
181. Jung DH, Kim JY, Kim JK, et al. Relative contribution of obesity and serum adiponectin to the development of hypertension. Diabetes Res Clin Pract. 2014;103(1):51-6. **KQ2E1, KQ3E1, KQ4E1.**
182. Juraschek SP, Ishak A, Mukamal KJ, et al. Impact of Clinic-Based Blood Pressure Approaches on Blood Pressure Measurement. American journal of hypertension. 2019;27:27. PMID: 31350541. https://dx.doi.org/10.1093/ajh/hpz118 **KQ2E5, KQ3E4a, KQ4E4.**
183. Kallem RR, Meyers KE, Cucchiara AJ, et al. Blood pressure variability of two ambulatory blood pressure monitors. Blood pressure monitoring. 2014;19(2):98-102. https://dx.doi.org/10.1097/MBP.0000000000000019 **KQ2E1, KQ3E1, KQ4E1.**
184. Kamel N, Gursoy A, Koseoglulari O, et al. Isolated office hypertension: association with target organ damage and cardiovascular risk indices. Journal of the National Medical Association. 2006;98(4):601-6. **KQ2E5, KQ3E5, KQ4E4.**
185. Kao YT, Huang CC, Leu HB, et al. Ambulatory pulse pressure as a novel predictor for long-term prognosis in essential hypertensive patients. Journal of human hypertension. 2011;25(7):444-50. **KQ2E5, KQ3E5b, KQ4E4.**
186. Kario K. Diagnosis of true uncontrolled hypertension using both home and ambulatory blood pressure monitoring. Journal of human hypertension. 2013. **KQ2E5, KQ3E10, KQ4E4.**
187. Kario K. Global Impact of 2017 American Heart Association/American College of Cardiology Hypertension Guidelines: A Perspective From Japan. Circulation. 2018;137(6):543-5. PMID: 29431656. 10.1161/CIRCULATIONAHA.117.032851 **KQ1E7, KQ2E7, KQ3E7, KQ4E7.**
188. Kario K, Shimada K, Schwartz JE, et al. Silent and clinically overt stroke in older Japanese subjects with white-coat and sustained hypertension. Journal of the American College of Cardiology. 2001;38(1):238-45. **KQ2E1, KQ3E1, KQ4E1.**
189. Karpettas N, Destounis A, Kollias A, et al. Prediction of treatment-induced changes in target-organ damage using changes in clinic, home and ambulatory blood pressure. Hypertension research. 2014;37(6):543-7. https://dx.doi.org/10.1038/hr.2014.24 **KQ2E5, KQ3E4a, KQ4E4.**
190. Karwalajtys T, Kaczorowski J, Hutchison B, et al. Blood pressure variability and prevalence of hypertension using automated readings from multiple visits to a pharmacy-based community-wide programme. Journal of human hypertension. 2009;23(9):585-9. **KQ2E4a, KQ3E5b, KQ4E4.**
191. Kay LE. Accuracy of blood pressure measurement in the family practice center. The Journal of the American Board of Family Practice. 1998;11(4):252-8. PMID: 9719346. **KQ2E3, KQ3E5, KQ4E4.**

192. Kenny IE, Saeed S, Gerdts E, et al. Masked hypertension in obesity: potential predictors and arterial damage. Blood pressure monitoring. 2017;22(1):12-7. https://dx.doi.org/10.1097/MBP.0000000000000220 **KQ2E5b, KQ3E5, KQ4E4.**
193. Khoury S, Yarows SA, O'Brien TK, et al. Ambulatory blood pressure monitoring in a nonacademic setting. Effects of age and sex. American journal of hypertension. 1992;5(9):616-23. **KQ2E5, KQ3E5b, KQ4E4.**
194. Kikuya M, Ohkubo T, Asayama K, et al. Ambulatory blood pressure and 10-year risk of cardiovascular and noncardiovascular mortality: the Ohasama study. Hypertension. 2005;45(2):240-5. **KQ2E1, KQ3E1, KQ4E1.**
195. Kim J, Kim E, Yi H, et al. Short-term incidence rate of hypertension in Korea middle-aged adults. Journal of hypertension. 2006;24(11):2177-82. **KQ2E1, KQ3E1, KQ4E1.**
196. Kim J, Lee MY, Kim J, et al. 3c.03: Optimal Duration of Home Blood Pressure Measurements for the Diagnosis of Arterial Hypertension: A Prospective Multicenter Study. Journal of hypertension. 2015;33 Suppl 1:e37. https://dx.doi.org/10.1097/01.hjh.0000467447.76482.cd **KQ2E11a, KQ3E11a, KQ4E4.**
197. Kim SJ, Lee J, Nam CM, et al. Progression rate from new-onset pre-hypertension to hypertension in Korean adults. Circ J. 2011;75(1):135-40. **KQ2E1, KQ3E1, KQ4E1.**
198. Kirkendall WM, Feinleib M, Freis ED, et al. Recommendations for human blood pressure determination by sphygmomanometers. Subcommittee of the AHA Postgraduate Education Committee. Circulation. 1980;62(5):1146A-55A. **KQ2E1, KQ3E1, KQ4E1.**
199. Kivimaki M, Batty GD, Singh-Manoux A, et al. Validating the Framingham Hypertension Risk Score: results from the Whitehall II study. Hypertension. 2009;54(3):496-501. **KQ2E1, KQ3E1, KQ4E1.**
200. Klarskov P, Bang LE, Schultz-Larsen P, et al. Intensive versus conventional blood pressure monitoring in a general practice population. The Blood Pressure Reduction in Danish General Practice trial: a randomized controlled parallel group trial. Fam Pract. 2018;35(4):433-9. https://dx.doi.org/10.1093/fampra/cmx106 **KQ2E5, KQ3E5b, KQ4E4.**
201. Klein R, Klein BE, Moss SE, et al. The relationship of retinopathy in persons without diabetes to the 15-year incidence of diabetes and hypertension: Beaver Dam Eye Study. Trans Am Ophthalmol Soc. 2006;104:98-107. **KQ2E1, KQ3E1, KQ4E1.**
202. Kollias A, Andreadis E, Agaliotis G, et al. The optimal night-time home blood pressure monitoring schedule: agreement with ambulatory blood pressure and association with organ damage. Journal of hypertension. 2018;36(2):243-9. PMID: 28915229. https://dx.doi.org/10.1097/HJH.0000000000001562 **KQ2E5, KQ3E4a, KQ4E4.**
203. Kotsis V, Stabouli S, Bouldin M, et al. Impact of obesity on 24-hour ambulatory blood pressure and hypertension. Hypertension. 2005;45(4):602-7. PMID: 15723966. **KQ2E4a, KQ3E4a, KQ4E4.**
204. Koupil I, Leon DA, Byberg L. Birth weight, hypertension and "white coat" hypertension: size at birth in relation to office and 24-h ambulatory blood pressure. Journal of human hypertension. 2005;19(8):635-42. **KQ2E10, KQ3E5, KQ4E4.**
205. Krogager C, Laugesen E, Rossen NB, et al. Evaluation of interarm blood pressure differences using the Microlife WatchBP Office in a clinical setting. Blood pressure monitoring. 2017;22(3):161-5. https://dx.doi.org/10.1097/MBP.0000000000000246 **KQ2E5, KQ3E4a, KQ4E4.**
206. Kroke A, Fleischhauer W, Mieke S, et al. Blood pressure measurement in epidemiological studies: a comparative analysis of two methods. Data from the EPIC-Potsdam Study. European Prospective Investigation into Cancer and Nutrition. Journal of hypertension. 1998;16(6):739-46. **KQ2E3, KQ3E5, KQ4E4.**
207. Kronish IM, Edmondson D, Shimbo D, et al. A Comparison of the Diagnostic Accuracy of Common Office Blood Pressure Measurement Protocols. American journal of hypertension. 2018;31(7):827-34. PMID: 29897394. 10.1093/ajh/hpy053 **KQ2E3, KQ3E5, KQ4E4.**
208. Krzesinski P, Gielerak G, Stanczyk A, et al. The benefit from hemodynamically guided antihypertensive therapy depends on baseline blood pressure. Journal of hypertension [serial on the Internet]. 2015; 33: Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/CN-01103973/full. **KQ2E11a, KQ3E11a, KQ4E4.**
209. Krzesinski P, Stanczyk A, Gielerak G, et al. The diagnostic value of supine blood pressure in hypertension. Arch Med Sci. 2016;12(2):310-8. https://dx.doi.org/10.5114/aoms.2016.59256 **KQ2E5b, KQ3E5b, KQ4E4.**
210. Kubo T, Fujino Y, Nakamura T, et al. An industry-based cohort study of the association between weight gain and hypertension risk

among rotating shift workers. J Occup Environ Med. 2013;55(9):1041-5. **KQ2E1, KQ3E1, KQ4E1.**

211. Kuznetsova T, Malyutina S, Pello E, et al. Ambulatory blood pressure of adults in Novosibirsk, Russia: interim report on a population study. Blood pressure monitoring. 2000;5(5-6):291-6. PMID: 11153053. **KQ2E4a, KQ3E5, KQ4E4.**
212. Kuznetsova T, Staessen JA, Kawecka-Jaszcz K, et al. Quality control of the blood pressure phenotype in the European Project on Genes in Hypertension. Blood pressure monitoring. 2002;7(4):215-24. PMID: 12198337. **KQ2E4a, KQ3E5, KQ4E4.**
213. Kvist TV, Lindholt JS, Rasmussen LM, et al. The DanCavas Pilot Study of Multifaceted Screening for Subclinical Cardiovascular Disease in Men and Women Aged 65-74 Years. Eur J Vasc Endovasc Surg. 2017;53(1):123-31. https://dx.doi.org/10.1016/j.ejvs.2016.10.010 **KQ1E6, KQ4E6.**
214. Lakoski SG, Cushman M, Siscovick DS, et al. The relationship between inflammation, obesity and risk for hypertension in the Multi-Ethnic Study of Atherosclerosis (MESA). Journal of human hypertension. 2011;25(2):73-9. **KQ2E1, KQ3E1, KQ4E1.**
215. Lamarre-Cliche M, Cheong NN, Larochelle P. Comparative assessment of four blood pressure measurement methods in hypertensives. Canadian Journal of Cardiology. 2011;27(4):455-60. **KQ2E5, KQ3E5a, KQ4E4.**
216. Landsbergis PA, Travis A, Schnall PL. Working conditions and masked hypertension. High Blood Pressure & Cardiovascular Prevention. 2013;20(2):69-76. **KQ2E4a, KQ3E5, KQ4E4.**
217. Lang T, De GR, Chatellier G, et al. Prevalence and therapeutic control of hypertension in 30,000 subjects in the workplace. Hypertension. 2001;38(3):449-54. **KQ2E3, KQ3E3, KQ4E4.**
218. Lantelme P, Milon H, Vernet M, et al. Difference between office and ambulatory blood pressure or real white coat effect: does it matter in terms of prognosis? Journal of hypertension. 2000;18(4):383-9. **KQ2E5, KQ3E7c, KQ4E4.**
219. Larsen TR, Gelaye A, Waanbah B, et al. Prevalence of masked hypertension in African Americans. J Clin Hypertens. 2014;16(11):801-4. https://dx.doi.org/10.1111/jch.12418 **KQ2E4a, KQ3E5, KQ4E4.**
220. Lee DH, Ha MH, Kim JR, et al. Gamma-glutamyltransferase, alcohol, and blood pressure. A four year follow-up study. Ann Epidemiol. 2002;12(2):90-6. **KQ2E1, KQ3E1, KQ4E1.**
221. Lee DH, Ha MH, Kim JR, et al. Effects of smoking cessation on changes in blood pressure and incidence of hypertension: a 4-year follow-up study. Hypertension. 2001;37(2):194-8. **KQ2E1, KQ3E1, KQ4E1.**
222. Lee DH, Ha MH, Kim KY, et al. Gamma-glutamyltransferase: an effect modifier in the association between age and hypertension in a 4-year follow-up study. Journal of human hypertension. 2004;18(11):803-7. **KQ2E1, KQ3E1, KQ4E1.**
223. Lee JH, Yang DH, Park HS, et al. Incidence of hypertension in Korea: 5-year follow-up study. J Korean Med Sci. 2011;26(10):1286-92. **KQ2E1, KQ3E1, KQ4E1.**
224. Lee JS, Kawakubo K, Kashihara H, et al. Effect of long-term body weight change on the incidence of hypertension in Japanese men and women. Int J Obes Relat Metab Disord. 2004;28(3):391-5. **KQ2E1, KQ3E1, KQ4E1.**
225. Leitao CB, Rodrigues TC, Kramer CK, et al. Which patients with diabetes should undergo ambulatory blood pressure monitoring? Journal of hypertension. 2011;29(2):236-41. https://doi.org/10.1097/HJH.0b013e32834068c3 **KQ2E9a, KQ3E9a, KQ4E4.**
226. Leitschuh M, Cupples LA, Kannel W, et al. High-normal blood pressure progression to hypertension in the Framingham Heart Study. Hypertension. 1991;17(1):22-7. **KQ2E1, KQ3E1, KQ4E1.**
227. Lempiainen P, Vasunta R-L, Bloigu R, et al. Non-dipping blood pressure pattern and new-onset diabetes in a 21-year follow-up. Blood pressure. 2019. PMID: Pubmed 31092019. 10.1080/08037051.2019.1615369 **KQ2E4a, KQ3E5, KQ4E4.**
228. Levine DA, Lewis CE, Williams OD, et al. Geographic and demographic variability in 20-year hypertension incidence: the CARDIA study. Hypertension. 2011;57(1):39-47. **KQ2E1, KQ3E1, KQ4E1.**
229. Li Y, Zhang L, Wei FF, et al. Strategies for Classifying Patients Based on Office, Home and Ambulatory Blood Pressure Measurement. Journal of hypertension. 2015;33 Suppl 1:e39. https://dx.doi.org/10.1097/01.hjh.0000467453.47773.9e **KQ2E5, KQ3E11a, KQ4E4.**
230. Licitra R, Acconcia MC, Puddu PE, et al. Ambulatory blood pressure monitoring in prehypertensive subjects. Cardiovasc Hematol Disord Drug Targets. 2012;12(1):44-50. **KQ2E1, KQ3E1, KQ4E1.**
231. Lim YH, Choi SY, Oh KW, et al. Comparison Between an Automated Device and a Manual Mercury Sphygmomanometer in an

Epidemiological Survey of Hypertension Prevalence. American journal of hypertension. 2013. **KQ2E3, KQ3E5, KQ4E4.**

232. Lindholt JS, Sogaard R. Population screening and intervention for vascular disease in Danish men (VIVA): a randomised controlled trial. Lancet. 2017;390(10109):2256-65. PMID: 28859943. https://doi.org/10.1016/S0140-6736(17)32250-X **KQ1E6, KQ4E6.**
233. Little P, Barnett J, Barnsley L, et al. Comparison of acceptability of and preferences for different methods of measuring blood pressure in primary care. BMJ. 2002;325(7358):258-9. **KQ2E1, KQ3E1, KQ4E5b.**
234. Liu JE, Roman MJ, Pini R, et al. Cardiac and arterial target organ damage in adults with elevated ambulatory and normal office blood pressure. Annals of Internal Medicine. 1999;131(8):564-72. **KQ2E7, KQ3E7, KQ4E7.**
235. Liu Y. Observation on repeatability of grading by casual blood pressure in hypertensives & new proposal. Circ Cardiovasc Qual Outcomes [serial on the Internet]. 2017; 10(Supplement 3) (no pagination): Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/CN-01469954/full. **KQ2E9, KQ3E9, KQ4E9.**
236. Mancia G, Bombelli M, Brambilla G, et al. Long-term prognostic value of white coat hypertension: an insight from diagnostic use of both ambulatory and home blood pressure measurements. Hypertension. 2013;62(1):168-74. PMID: 23716584. **KQ2E4a, KQ3E5, KQ4E4.**
237. Mancia G, Carugo S, Grassi G, et al. Prevalence of left ventricular hypertrophy in hypertensive patients without and with blood pressure control: data from the PAMELA population. Pressioni Arteriose Monitorate E Loro Associazioni. Hypertension. 2002;39(3):744-9. **KQ2E4a, KQ3E5, KQ4E4.**
238. Mancia G, Facchetti R, Parati G, et al. Effect of long-term antihypertensive treatment on white-coat hypertension. Hypertension. 2014;64(6):1388-98. https://dx.doi.org/10.1161/HYPERTENSIONAHA.114.04278 **KQ2E5, KQ3E5, KQ4E4.**
239. Mancia G, Ulian L, Parati G, et al. Increase in blood pressure reproducibility by repeated semi-automatic blood pressure measurements in the clinic environment. Journal of hypertension. 1994;12(4):469-73. **KQ2E1, KQ3E1, KQ4E1.**
240. Manios E, Michas F, Stamatelopoulos K, et al. Impact of masking effect on subclinical carotid atherosclerosis in normotensives and untreated masked hypertensive and hypertensive patients. Blood pressure monitoring. 2015;20(2):64-8. https://dx.doi.org/10.1097/MBP.0000000000000093 **KQ2E5, KQ3E4a, KQ4E4.**
241. Manning G, Rushton L, Millar-Craig MW. Twenty-four hour ambulatory blood pressure: a sample from a normal British population. Journal of human hypertension. 1998;12(2):123-7. **KQ2E4a, KQ3E5, KQ4E4c.**
242. Manning G, Rushton L, Millar-Craig MW. Clinical implications of white coat hypertension: an ambulatory blood pressure monitoring study. Journal of human hypertension. 1999;13(12):817-22. **KQ2E5, KQ3E4a, KQ4E4.**
243. Mannucci E, Lambertucci L, Monami M, et al. Pulse pressure and mortality in hypertensive type 2 diabetic patients. A cohort study. Diabetes/Metabolism Research Reviews. 2006;22(3):172-5. https://doi.org/10.1002/dmrr.598 **KQ2E5, KQ3E5b, KQ4E4.**
244. Mansoor GA, White WB. Self-measured home blood pressure in predicting ambulatory hypertension. American journal of hypertension. 2004;17(11 Pt 1):1017-22. PMID: 15533727. https://doi.org/10.1016/j.amjhyper.2004.06.015 **KQ2E5, KQ3E7c, KQ4E4.**
245. Mar J, Pastor R, Abasolo R, et al. Ambulatory blood pressure monitoring and diagnostic errors in hypertension: a Bayesian approach. Med Decis Making. 1998;18(4):429-35. **KQ2E5, KQ3E3, KQ4E4.**
246. Maricoto T, Silva EAR, Damiao P, et al. The OXIMAPA Study: Hypertension Control by ABPM and Association with Sleep Apnea Syndrome by Pulse Oximetry. Acta Med Port. 2017;30(2):93-9. https://dx.doi.org/10.20344/amp.7495 **KQ2E5b, KQ3E5b, KQ4E4.**
247. Marschang P, Niederwanger A, Gasser RW, et al. Symptomatic upper extremity deep vein thrombosis as a complication of ambulatory blood pressure monitoring. Thrombosis & Haemostasis. 2008;100(4):711-2. **KQ2E1, KQ3E1, KQ4E7.**
248. Martinez MA, Garcia-Puig J, Martin JC, et al. Frequency and determinants of white coat hypertension in mild to moderate hypertension: a primary care-based study. Monitorizacion Ambulatoria de la Presion Arterial (MAPA)-Area 5 Working Group. American journal of hypertension. 1999;12(3):251-9. **KQ2E5, KQ3E4a, KQ4E4.**
249. Mas-Heredia M, Moles-Moliner E, Gonzalez-de Paz L, et al. Validity and applicability of a new recording method for hypertension. Rev Esp

Cardiol. 2014;67(9):717-23. https://dx.doi.org/10.1016/j.rec.2013.12.017 **KQ2E5, KQ3E5a, KQ4E4.**

250. Masding MG, Jones JR, Bartley E, et al. Assessment of blood pressure in patients with Type 2 diabetes: comparison between home blood pressure monitoring, clinic blood pressure measurement and 24-h ambulatory blood pressure monitoring. Diabetic Medicine. 2001;18(6):431-7. PMID: 11472460. **KQ2E5b, KQ3E5, KQ4E4.**
251. Maselli M, Giantin V, Franchin A, et al. Detection of blood pressure increments in active elderly individuals: the role of ambulatory blood pressure monitoring. Nutr Metab Cardiovasc Dis. 2014;24(8):914-20. https://dx.doi.org/10.1016/j.numecd.2014.01.003 **KQ2E5, KQ3E5, KQ4E4.**
252. Matsumoto S, Fukui M, Hamaguchi M, et al. Clinical characteristics of patients who report incorrect data of home-measured blood pressure. Diabetes Care. 2014;37(2):e24-5. PMID: 103810232. Language: English. Entry Date: 20150116. Revision Date: 20150710. Publication Type: Journal Article. https://doi.org/10.2337/dc13-1821 **KQ2E3, KQ3E3, KQ4E4.**
253. Matsuo T, Sairenchi T, Suzuki K, et al. Long-term stable obesity increases risk of hypertension. Int J Obes (Lond). 2011;35(8):1056-62. **KQ2E1, KQ3E1, KQ4E1.**
254. Mazalovic K, Morlon F, Beis J-N, et al. Validity of ambulatory blood pressure monitoring in daily primary healthcare practice in France. Blood pressure monitoring. 2018;23(6):288-93. https://doi.org/10.1097/MBP.0000000000000342 **KQ2E5, KQ3E4a, KQ4E4.**
255. Mazze RS, Simonson GD, Robinson RL, et al. Characterizing blood pressure control in individuals with Type 2 diabetes: the relationship between clinic and self-monitored blood pressure. Diabetic Medicine. 2003;20(9):752-7. PMID: 12925057. **KQ2E3, KQ3E3, KQ4E4.**
256. McGowan N, Padfield PL. Self blood pressure monitoring: a worthy substitute for ambulatory blood pressure? Journal of human hypertension. 2010;24(12):801-6. PMID: 20164849. 10.1038/jhh.2010.15 **KQ2E5a, KQ3E5, KQ4E5a.**
257. McLean DL, McAlister FA, Johnson JA, et al. A randomized trial of the effect of community pharmacist and nurse care on improving blood pressure management in patients with diabetes mellitus: study of cardiovascular risk intervention by pharmacists-hypertension (SCRIP-HTN). Archives of Internal Medicine. 2008;168:2355-61. **KQ2E1, KQ3E1, KQ4E1.**
258. McMahon A, McNulty H, Hughes C, et al., editors. Investigating the association between the MTHFR C677 T polymorphism and blood pressure as measured by ambulatory blood pressure monitoring. Proc Nutr Soc; 2016; Conference: summer meeting 2016: new technology in nutrition research and practice. Ireland. **KQ2E11a, KQ3E11a, KQ4E4.**
259. Melgarejo JD, Maestre GE, Thijs L, et al. Prevalence, Treatment, and Control Rates of Conventional and Ambulatory Hypertension Across 10 Populations in 3 Continents. Hypertension. 2017;70(1):50-8. https://dx.doi.org/10.1161/HYPERTENSIONAHA.117.09188 **KQ2E13, KQ3E5, KQ4E4.**
260. Mesquita-Bastos J, Bertoquini S, Polonia J. Cardiovascular prognostic value of ambulatory blood pressure monitoring in a Portuguese hypertensive population followed up for 8.2 years. Blood pressure monitoring. 2010;15(5):240-6. **KQ2E1, KQ3E1, KQ4E1.**
261. Michaud A, Lamarre-Cliche M, Cloutier L. Screening for hypertension: an elevated office blood pressure measurement is valuable, adding an automated one is even better. Blood pressure monitoring. 2019;24(3):123-9. PMID: 30998552. https://dx.doi.org/10.1097/MBP.0000000000000382 **KQ2E5, KQ3E7c, KQ4E4.**
262. Modesti PA, Pieri F, Cecioni I, et al. Comparison of ambulatory blood pressure monitoring and conventional office measurement in the workers of a chemical company. International journal of cardiology. 1994;46(2):151-7. **KQ2E10, KQ3E5, KQ4E4.**
263. Modin D, Biering-Sørensen SR, Mogelvang R, et al. Prognostic Value of Echocardiography in Hypertensive Versus Nonhypertensive Participants From the General Population. Hypertension (0194911X). 2018;71(4):742-51. https://doi.org/10.1161/HYPERTENSIONAHA.117.10674 **KQ2E3, KQ3E5, KQ4E4.**
264. Moran A, Palmas W, Pickering TG, et al. Office and ambulatory blood pressure are independently associated with albuminuria in older subjects with type 2 diabetes. Hypertension. 2006;47(5):955-61. https://doi.org/10.1161/01.HYP.0000216634.73504.7d **KQ2E5b, KQ3E5, KQ4E4.**
265. Moreira JSR, de Paula TP, Sperb LF, et al. Association of plasma vitamin D status with lifestyle patterns and ambulatory blood pressure monitoring parameters in patients with type 2 diabetes and hypertension. Diabetes Res Clin Pract. 2018;139:139-46.

https://dx.doi.org/10.1016/j.diabres.2018.02.038 **KQ2E5, KQ3E5, KQ4E4.**

266. Morikawa Y, Nakagawa H, Miura K, et al. Relationship between shift work and onset of hypertension in a cohort of manual workers. Scand J Work Environ Health. 1999;25(2):100-4. **KQ2E1, KQ3E1, KQ4E1.**
267. Morrin NM, Stone MR, Henderson KJ. Reproducibility of 24-h ambulatory blood pressure and measures of autonomic function. Blood pressure monitoring. 2017;22(3):169-72. PMID: 28125521. https://dx.doi.org/10.1097/MBP.0000000000000241 **KQ2E5, KQ3E5a, KQ4E4.**
268. Mortensen RN, Gerds TA, Jeppesen JL, et al. Office blood pressure or ambulatory blood pressure for the prediction of cardiovascular events. Eur Heart J. 2017;38(44):3296-304. https://dx.doi.org/10.1093/eurheartj/ehx464 **KQ2E1, KQ3E1, KQ4E1.**
269. Muldoon MF, Nazzaro P, Sutton-Tyrrell K, et al. White-coat hypertension and carotid artery atherosclerosis: a matching study. Archives of Internal Medicine. 2000;160(10):1507-12. **KQ2E4a, KQ3E5, KQ4E4.**
270. Muntner P, Woodward M, Mann DM, et al. Comparison of the Framingham Heart Study hypertension model with blood pressure alone in the prediction of risk of hypertension: the Multi-Ethnic Study of Atherosclerosis. Hypertension. 2010;55(6):1339-45. **KQ2E1, KQ3E1, KQ4E1.**
271. Musso NR, Vergassola C, Barone C, et al. Ambulatory blood pressure monitoring: how reproducible is it? American journal of hypertension. 1997;10(8):936-9. PMID: 9270090. **KQ2E1, KQ3E1, KQ4E1.**
272. Mwasongwe S, Min Y-I, Booth J, et al. Masked hypertension and kidney function decline: the Jackson Heart Study. Journal of hypertension [serial on the Internet]. 2018; 36(7): Available from:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5990961/pdf/nihms968864.pdf. **KQ2E4a, KQ3E5, KQ4E4.**
273. Myers M, Godwin M, Dawes M, et al. Conventional versus automated measurement of blood pressure in primary care patients with systolic hypertension: randomised parallel design controlled trial. BMJ. 2011;342(7793):372-. **KQ2E5, KQ3E5b, KQ4E4.**
274. Myers MG. A proposed algorithm for diagnosing hypertension using automated office blood pressure measurement. Journal of hypertension. 2010;28(4):703-8. **KQ2E5, KQ3E4a, KQ4E4.**
275. Myers MG, Godwin M, Dawes M, et al. Measurement of blood pressure in the office: recognizing the problem and proposing the solution. Hypertension. 2010;55(2):195-200. PMID: 20038756. 10.1161/HYPERTENSIONAHA.109.141879 **KQ2E7, KQ3E7, KQ4E7.**
276. Myers MG, Godwin M, Dawes M, et al. Conventional versus automated measurement of blood pressure in the office (CAMBO) trial. Fam Pract. 2012;29(4):376-82. **KQ2E5, KQ3E5b, KQ4E4.**
277. Myers MG, Valdivieso M, Chessman M, et al. Can sphygmomanometers designed for self-measurement of blood pressure in the home be used in office practice? Blood pressure monitoring. 2010;15(6):300-4. PMID: 20975533. 10.1097/MBP.0b013e328340d128 **KQ2E5, KQ3E5b, KQ4E4.**
278. Myers MG, Valdivieso M, Kiss A. Optimum frequency of office blood pressure measurement using an automated sphygmomanometer. Blood pressure monitoring. 2008;13(6):333-8. **KQ2E5, KQ3E4a, KQ4E4.**
279. Myers MG, Valdivieso M, Kiss A. Use of automated office blood pressure measurement to reduce the white coat response. Journal of hypertension. 2009;27(2):280-6. **KQ2E5b, KQ3E4a, KQ4E1.**
280. Nakanishi N, Suzuki K, Tatara K. Clustering of cardiovascular risk factors and risk of development of hypertension in Japanese male office workers. J Cardiovasc Risk. 2003;10(3):213-20. **KQ2E1, KQ3E1, KQ4E1.**
281. Narita K, Eguchi K, Kario K. Ambulatory blood pressure variability increases over a 19-year follow-up in a clinic on a solitary island. Blood pressure monitoring. 2018;23(6):283-7. PMID: 30048257. https://dx.doi.org/10.1097/MBP.0000000000000343 **KQ2E4a, KQ3E5, KQ4E4.**
282. Nielsen FS, Gaede P, Vedel P, et al. White coat hypertension in NIDDM patients with and without incipient and overt diabetic nephropathy. Diabetes Care. 1997;20(5):859-63. PMID: 9135956. **KQ2E5, KQ3E4a, KQ4E4.**
283. Nielsen PE, Christensen HR, Hilden T. Ambulatory daytime blood pressure in relation to age and gender compared to previous population studies based on office blood pressure. The Danish Study Group on Ambulatory Blood Pressure. Journal of human hypertension. 1996;10:Suppl-8. **KQ2E7, KQ3E7, KQ4E7.**
284. Niiranen TJ, Asayama K, Thijs L, et al. Optimal number of days for home blood pressure measurement. American journal of hypertension. 2015;28(5):595-603. https://dx.doi.org/10.1093/ajh/hpu216 **KQ2E3, KQ3E5, KQ4E4.**

285. Niiranen TJ, Hanninen MR, Johansson J, et al. Home-measured blood pressure is a stronger predictor of cardiovascular risk than office blood pressure: the Finn-Home study. Hypertension. 2010;55(6):1346-51. **KQ2E1, KQ3E1, KQ4E1.**
286. Niiranen TJ, Jula AM, Kantola IM, et al. Comparison of agreement between clinic and home-measured blood pressure in the Finnish population: the Finn-HOME Study. Journal of hypertension. 2006;24(8):1549-55. PMID: 16877957. 10.1097/01.hjh.0000239290.94764.81 **KQ2E3, KQ3E5, KQ4E4.**
287. Nilsson PM, Engstrom G, Hedblad B. Long-term predictors of increased mortality risk in screened men with new hypertension; the Malmo preventive project. Journal of hypertension. 2008;26(12):2288-94. https://doi.org/10.1097/HJH.0b013e32831313b1 **KQ1E6, KQ4E4.**
288. Ntineri A, Nasothimiou E, Kollias A, et al. 3c.05: Diagnostic Agreement of the European Society of Hypertension Home Blood Monitoring Schedule with Ambulatory Blood Pressure Monitoring in Untreated and Treated Subjects. Journal of hypertension. 2015;33 Suppl 1:e38. https://dx.doi.org/10.1097/01.hjh.0000467449.84105.d0 **KQ2E11a, KQ3E11a, KQ4E4.**
289. Nystrom F, Malmstrom O, Karlberg BE, et al. Twenty-four hour ambulatory blood pressure in the population. Journal of Internal Medicine. 1996;240(5):279-84. **KQ2E4a, KQ3E5, KQ4E4.**
290. O'Brien E, Murphy J, Tyndall A, et al. Twenty-four-hour ambulatory blood pressure in men and women aged 17 to 80 years: the Allied Irish Bank Study. Journal of hypertension. 1991;9(4):355-60. **KQ2E4a, KQ3E5, KQ4E4.**
291. O'Shea JC, Murphy MB. Ambulatory blood pressure monitoring: which arm? Journal of human hypertension. 2000;14(4):227-30. **KQ2E5, KQ3E4a, KQ4E4.**
292. Ogedegbe G, Pickering TG, Clemow L, et al. The misdiagnosis of hypertension: the role of patient anxiety. Arch Intern Med. 2008;168(22):2459-65. **KQ2E5, KQ3E5, KQ4E4.**
293. Ohkubo T, Asayama K, Kikuya M, et al. How many times should blood pressure be measured at home for better prediction of stroke risk? Ten-year follow-up results from the Ohasama study. Journal of hypertension. 2004;22(6):1099-104. **KQ2E1, KQ3E1, KQ4E1.**
294. Ohkubo T, Asayama K, Kikuya M, et al. Prediction of ischaemic and haemorrhagic stroke by self-measured blood pressure at home: the Ohasama study. Blood pressure monitoring. 2004;9(6):315-20. **KQ2E1, KQ3E1, KQ4E1.**
295. Ohkubo T, Hozawa A, Nagai K, et al. Prediction of stroke by ambulatory blood pressure monitoring versus screening blood pressure measurements in a general population: the Ohasama study. Journal of hypertension. 2000;18(7):847-54. **KQ2E1, KQ3E1, KQ4E1.**
296. Ohkubo T, Imai Y, Tsuji I, et al. Home blood pressure measurement has a stronger predictive power for mortality than does screening blood pressure measurement: a population-based observation in Ohasama, Japan. Journal of hypertension. 1998;16(7):971-5. **KQ2E1, KQ3E1, KQ4E1.**
297. Ohkubo T, Imai Y, Tsuji I, et al. Prediction of mortality by ambulatory blood pressure monitoring versus screening blood pressure measurements: a pilot study in Ohasama. Journal of hypertension. 1997;15(4):357-64. **KQ2E1, KQ3E1, KQ4E1.**
298. Ohkubo T, Kikuya M, Metoki H, et al. Prognosis of "masked" hypertension and "white-coat" hypertension detected by 24-h ambulatory blood pressure monitoring 10-year follow-up from the Ohasama study. Journal of the American College of Cardiology. 2005;46(3):508-15. **KQ2E1, KQ3E1, KQ4E1.**
299. Okubo Y, Sairenchi T, Irie F, et al. Association of alcohol consumption with incident hypertension among middle-aged and older Japanese population: the Ibarakai prefectural health study (IPHS). Hypertension. 2014;63(1):41-7. **KQ2E1, KQ3E1, KQ4E1.**
300. Okubo Y, Suwazono Y, Kobayashi E, et al. An association between smoking habits and blood pressure in normotensive Japanese men: a 5-year follow-up study. Drug Alcohol Depend. 2004;73(2):167-74. **KQ2E1, KQ3E1, KQ4E1.**
301. Omboni S, Aristizabal D, De la Sierra A, et al. Hypertension types defined by clinic and ambulatory blood pressure in 14 143 patients referred to hypertension clinics worldwide. Data from the ARTEMIS study. Journal of hypertension. 2016;34(11):2187-98. PMID: 27512964. https://dx.doi.org/10.1097/HJH.0000000000001074 **KQ2E5, KQ3E13, KQ4E4.**
302. Ormezzano O, Baguet JP, Francois P, et al. Is there any real target organ damage associated with white-coat normotension? Clinical Autonomic Research. 2004;14(3):160-6. **KQ2E4a, KQ3E5, KQ4E4.**
303. Ostchega Y, Nwankwo T, Sorlie PD, et al. Assessing the validity of the Omron HEM-

907XL oscillometric blood pressure measurement device in a National Survey environment. Journal of clinical hypertension (Greenwich, Conn). 2010;12(1):22-8. **KQ2E3, KQ3E5, KQ4E4.**

304. Otsuka K, Okajima K, Oinuma S, et al. Aging and circadian disruption of blood pressure observed using 7-day/24-hour ambulatory blood pressure monitoring. J Am Geriatr Soc. 2014;62(11):2213-5. https://dx.doi.org/10.1111/jgs.13115 **KQ2E1, KQ3E1, KQ4E1.**
305. Owens P, Lyons S, O'Brien E. Ambulatory blood pressure in the hypertensive population: patterns and prevalence of hypertensive subforms. Journal of hypertension. 1998;16(12:Pt 1):t-43. **KQ2E5, KQ3E4a, KQ4E4.**
306. Ozdemir FN, Guz G, Sezer S, et al. Ambulatory blood pressure monitoring in potential renal transplant donors. Nephrol Dial Transplant. 2000;15(7):1038-40. PMID: 10862644. **KQ2E9, KQ3E9, KQ4E9.**
307. Padwal R, Rashead M, Snider J, et al. Worksite-based cardiovascular risk screening and management: a feasibility study. Vasc Health Risk Manag. 2017;13:209-13. https://dx.doi.org/10.2147/VHRM.S138800 **KQ1E7, KQ4E4.**
308. Padwal RS, Townsend RR, Trudeau L, et al. Comparison of an in-pharmacy automated blood pressure kiosk to daytime ambulatory blood pressure in hypertensive subjects. Journal of the American Society of Hypertension. 2015;9(2):123-9. PMID: 25600420. https://doi.org/10.1016/j.jash.2014.11.004 **KQ2E5b, KQ3E5b, KQ4E4.**
309. Palatini P, Pessina A, Dal Palu C. The Hypertension and Ambulatory Recording Venetia Study (HARVEST): a trial on the predictive value of ambulatory blood pressure monitoring for the development of fixed hypertension in patients with borderline hypertension. High Blood Press. 1993;2:11-8. **KQ2E5, KQ3E10, KQ4E4.**
310. Palatini P, Reboldi G, Beilin LJ, et al. Prognostic Value of Ambulatory Blood Pressure in the Obese: The Ambulatory Blood Pressure-International Study. J Clin Hypertens. 2016;18(2):111-8. https://dx.doi.org/10.1111/jch.12700 **KQ2E4b, KQ3E4a, KQ4E4.**
311. Palatini P, Reboldi G, Beilin LJ, et al. Masked tachycardia. A predictor of adverse outcome in hypertension. Journal of hypertension. 2017;35(3):487-92. PMID: 27930441. https://dx.doi.org/10.1097/HJH.0000000000001194 **KQ2E1, KQ3E1, KQ4E1.**
312. Palatini P, Saladini F, Mos L, et al. Clinical characteristics and risk of hypertension needing treatment in young patients with systolic hypertension identified with ambulatory monitoring. Journal of hypertension. 2018;36(9):1810-5. PMID: 30005026. https://doi.org/10.1097/hjh.0000000000001754 **KQ2E4a, KQ3E5, KQ4E4.**
313. Palatini P, Thijs L, Staessen JA, et al. Predictive value of clinic and ambulatory heart rate for mortality in elderly subjects with systolic hypertension. Archives of Internal Medicine. 2002;162(20):2313-21. **KQ2E1, KQ3E1, KQ4E1.**
314. Palatini P, Winnicki M, Santonastaso M, et al. Prevalence and clinical significance of isolated ambulatory hypertension in young subjects screened for stage 1 hypertension. Hypertension. 2004;44(2):170-4. PMID: 15210653. https://doi.org/10.1161/01.HYP.0000135250.57004.19 **KQ2E5, KQ3E10, KQ4E4.**
315. Pang TC, Brown MA. Accuracy of ambulatory blood pressure monitors in routine clinical practice. American journal of hypertension. 2006;19(8):801-9. PMID: 16876678. **KQ2E5, KQ3E4a, KQ4E4.**
316. Pannarale G, Bebb G, Clark S, et al. Bias and variability in blood pressure measurement with ambulatory recorders. Hypertension. 1993;22(4):591-8. **KQ2E4, KQ3E5, KQ4E4.**
317. Pannarale G, Gaudio C, Mirabelli F, et al. Ambulatory monitoring predicts development of drug-treated hypertension in subjects with high normal blood pressure. Blood Press. 2004;13(4):247-51. PMID: 15581340. **KQ2E5, KQ3E5, KQ4E4.**
318. Pannarale G, Moroni C, Acconcia MC, et al. The natural history of prehypertension. A 20-year follow-up. Eur Rev Med Pharmacol Sci. 2017;21(6):1329-34. **KQ2E5, KQ3E4a, KQ4E4.**
319. Parati G, Omboni S, Bilo G. Why Is Out-of-Office Blood Pressure Measurement Needed? Home Blood Pressure Measurements Will Increasingly Replace Ambulatory Blood Pressure Monitoring in the Diagnosis and Management of Hypertension. Hypertension. 2009. **KQ2E7, KQ3E7, KQ4E7.**
320. Parati G, Omboni S, Staessen J, et al. Limitations of the difference between clinic and daytime blood pressure as a surrogate measure of the 'white-coat' effect. Syst-Eur investigators. Journal of hypertension. 1998;16(1):23-9. PMID: 9533413. **KQ2E5, KQ3E4a, KQ4E4.**

321. Pavlik VN, Hyman DJ, Toronjo C. Comparison of Automated and Mercury Column Blood Pressure Measurements in Health Care Settings. Journal of clinical hypertension (Greenwich, Conn). 2000;2(2):81-6. **KQ2E3, KQ3E3, KQ4E4.**
322. Pessanha P, Viana M, Ferreira P, et al. Diagnostic value and cost-benefit analysis of 24 hours ambulatory blood pressure monitoring in primary care in Portugal. BMC Cardiovascular Disorders. 2013;13:57. **KQ2E5, KQ3E4a, KQ4E4.**
323. Peters GL, Binder SK, Campbell NR. The effect of crossing legs on blood pressure: a randomized single-blind cross-over study. Blood pressure monitoring. 1999;4(2):97-101. **KQ2E3, KQ3E5, KQ4E4.**
324. Petersen EH, Theilade S, Hansen TW, et al. Cuff inflations do not affect night-time blood pressure: comparison of 24h ambulatory blood pressure measured by a cuff and a tonometric device in type 2 diabetes. Blood pressure monitoring. 2015;20(6):369-72. https://dx.doi.org/10.1097/MBP.0000000000000140 **KQ2E6, KQ3E6, KQ4E4.**
325. Piantanida E, Gallo D, Veronesi G, et al. Masked hypertension in newly diagnosed hypothyroidism: a pilot study. J Endocrinol Invest. 2016;39(10):1131-8. https://dx.doi.org/10.1007/s40618-016-0488-7 **KQ2E5, KQ3E5, KQ4E4.**
326. Pickering TG. Should doctors still measure blood pressure? Journal of Clinical Hypertension. 2006;8(6):394-6. **KQ2E7, KQ3E7, KQ4E7.**
327. Pickering TG, Shimbo D, Haas D. Ambulatory blood-pressure monitoring. N Engl J Med. 2006;354(22):2368-74. PMID: 354/22/2368 [pii];10.1056/NEJMra060433 [doi]. **KQ2E7, KQ3E7, KQ4E7.**
328. Pierdomenico SD, Lapenna D, Bucci A, et al. Cardiovascular outcome in treated hypertensive patients with responder, masked, false resistant, and true resistant hypertension. American journal of hypertension. 2005;18(11):1422-8. **KQ2E1, KQ3E1, KQ4E1.**
329. Pierdomenico SD, Mezzetti A, Lapenna D, et al. 'White-coat' hypertension in patients with newly diagnosed hypertension: evaluation of prevalence by ambulatory monitoring and impact on cost of health care. Eur Heart J. 1995;16(5):692-7. **KQ2E5, KQ3E4a, KQ4E4.**
330. Pincomb GA, Lovallo WR, McKey BS, et al. Acute blood pressure elevations with caffeine in men with borderline systemic hypertension. Am J Cardiol. 1996;77(4):270-4. **KQ2E3, KQ3E5, KQ4E4.**
331. Player MS, King DE, Mainous AG, III, et al. Psychosocial factors and progression from prehypertension to hypertension or coronary heart disease. Ann Fam Med. 2007;5(5):403-11. **KQ2E1, KQ3E1, KQ4E1.**
332. Polonia JJ, Gama GM, Silva JA, et al. Sequential follow-up clinic and ambulatory blood pressure evaluation in a low risk population of white-coat hypertensive patients and in normotensives. Blood pressure monitoring. 2005;10(2):57-64. **KQ2E7, KQ3E7, KQ4E4.**
333. Pugliese DN, Booth JN, 3rd, Deng L, et al. Sex differences in masked hypertension: the Coronary Artery Risk Development in Young Adults study. Journal of hypertension. 2019;24:24. PMID: 31246891. https://dx.doi.org/10.1097/HJH.0000000000002175 **KQ2E4a, KQ3E5, KQ4E4.**
334. Punzi HA. Efficacy and safety of olmesartan/amlodipine/hydrochlorothiazide in patients with hypertension not at goal with mono, dual or triple drug therapy: results of the CHAMPiOn study. Ther Adv Cardiovasc Dis. 2014;8(1):12-21. https://dx.doi.org/10.1177/1753944713520062 **KQ2E5, KQ3E5, KQ4E4.**
335. Rabkin SW, Mathewson FAL, Hsu PH. Relation of body weight to development of ischemic heart disease in a cohort of young north American men after a 26 year observation period: The manitoba study. Am J Cardiol. 1977;39(3):452-8. **KQ2E1, KQ3E1, KQ4E1.**
336. Radi S, Lang T, Lauwers-Cances V, et al. One-year hypertension incidence and its predictors in a working population: the IHPAF study. Journal of human hypertension. 2004;18(7):487-94. **KQ2E3, KQ3E3, KQ4E4.**
337. Raptis AE, Spring MW, Viberti G. Comparison of blood pressure measurement methods in adult diabetics. Lancet. 1997;349:175-6. **KQ2E3, KQ3E3, KQ4E4.**
338. Ravenell J, Shimbo D, Booth Iii JN, et al. Thresholds for Ambulatory Blood Pressure Among African Americans in the Jackson Heart Study. Circulation. 2017;135(25):2470-80. https://doi.org/10.1161/CIRCULATIONAHA.116.027051 **KQ2E4, KQ3E5, KQ4E4.**
339. Redmond N, Booth JN, 3rd, Tanner RM, et al. Prevalence of Masked Hypertension and Its Association With Subclinical Cardiovascular Disease in African Americans: Results From the Jackson Heart Study. J Am Heart Assoc. 2016;5(3):e002284.

https://dx.doi.org/10.1161/JAHA.115.002284 **KQ2E4a, KQ3E5, KQ4E4.**

340. Reino-Gonzalez S, Pita-Fernandez S, Cibiriain-Sola M, et al. Validity of clinic blood pressure compared to ambulatory monitoring in hypertensive patients in a primary care setting. Blood Press. 2015;24(2):111-8. https://dx.doi.org/10.3109/08037051.2014.992197 **KQ2E5b, KQ3E5b, KQ4E4.**
341. Rhee MY, Kim SW, Choi EH, et al. Prevalence of Masked Hypertension: a Population-Based Survey in a Large City by Using 24-Hour Ambulatory Blood Pressure Monitoring. Korean circ. 2016;46(5):681-7. **KQ2E4a, KQ3E5, KQ4E4.**
342. Rinfret F, Cloutier L, Larochelle P, et al. Impact of devices and environments on automated office blood pressure measurements. Canadian journal of cardiology. 2017;33(10):S175-. **KQ2E3, KQ3E5, KQ4E4.**
343. Rizzoni D, Muiesan ML, Montani G, et al. Relationship between initial cardiovascular structural changes and daytime and nighttime blood pressure monitoring.[Erratum appears in Am J Hypertens 1993 Feb;6(2):177]. American journal of hypertension. 1992;5(3):180-6. **KQ2E5, KQ3E4a, KQ4E4.**
344. Rollnik JD, Kugler J. Sphygmomanometry induces different blood pressure changes in normotensive and untreated (borderline) hypertensive subjects. Journal of hypertension. 1999;17(2):303-4. **KQ2E3, KQ3E3, KQ4E4.**
345. Ruxer J, Mozdzan M, Baranski M, et al. "White coat hypertension" in type 2 diabetic patients. Polskie Archiwum Medycyny Wewnetrznej. 2007;117(10):452-6. **KQ2E5, KQ3E4a, KQ4E4.**
346. Ryan JM, Howes LG. White coat effect of alcohol. American journal of hypertension. 2000;13(10):1135-8. **KQ2E4a, KQ3E5, KQ4E4.**
347. Sakuma M, Imai Y, Tsuji I, et al. Predictive value of home blood pressure measurement in relation to stroke morbidity: a population-based pilot study in Ohasama, Japan. Hypertension research. 1997;20(3):167-74. **KQ2E1, KQ3E1, KQ4E1.**
348. Salazar MR, Espeche WG, Aizpurua M, et al. Should the first blood pressure reading be discarded? Journal of human hypertension. 2015;29(6):373-8. https://dx.doi.org/10.1038/jhh.2014.98 **KQ2E4b, KQ3E4b, KQ4E4.**
349. Sandrim VC, Yugar-Toledo JC, Desta Z, et al. Endothelial nitric oxide synthase haplotypes are related to blood pressure elevation, but not to resistance to antihypertensive drug therapy. Journal of hypertension. 2006;24(12):2393-7. **KQ2E1, KQ3E1, KQ4E1.**
350. Satoh H, Saijo Y, Kishi R, et al. Brachial-ankle pulse wave velocity is an independent predictor of incident hypertension in Japanese normotensive male subjects. Environ Health Prev Med. 2011;16(4):217-23. **KQ2E1, KQ3E1, KQ4E1.**
351. Schettini C, Bianchi M, Nieto F, et al. Ambulatory blood pressure: normality and comparison with other measurements. Hypertension Working Group. Hypertension. 1999;34(4:Pt 2):t-25. **KQ2E9, KQ3E9, KQ4E9.**
352. Schrader J, Lüders S, Züchner C, et al. Practice vs ambulatory blood pressure measurement under treatment with ramipril (PLUR Study): a randomised, prospective long-term study to evaluate the benefits of ABPM in patients on antihypertensive treatment. Journal of human hypertension. 2000;14:435-40. **KQ2E5, KQ3E4a, KQ4E4.**
353. Schulz M, Liese AD, Boeing H, et al. Associations of short-term weight changes and weight cycling with incidence of essential hypertension in the EPIC-Potsdam Study. Journal of human hypertension. 2005;19(1):61-7. **KQ2E1, KQ3E1, KQ4E1.**
354. Schulze MB, Hoffmann K, Kroke A, et al. Risk of hypertension among women in the EPIC-Potsdam Study: comparison of relative risk estimates for exploratory and hypothesis-oriented dietary patterns. American journal of epidemiology. 2003;158(4):365-73. **KQ2E1, KQ3E1, KQ4E1.**
355. Schwan A. Postural effects on diastolic blood pressure are differently recorded by a non-invasive ambulatory blood pressure monitor and a standard auscultatory device. Clinical Physiology. 1993;13:621-9. **KQ2E3, KQ3E5, KQ4E4.**
356. Schwartz C, Koshiaris C, Clark C, et al. 1b.10: Does the Right Arm Know What the Left Arm Is Doing? Ethnic Variations in Clinical Interarm Difference and Relationship to White Coat Effects. Journal of hypertension. 2015;33 Suppl 1:e7. https://dx.doi.org/10.1097/01.hjh.0000467372.96193.86 **KQ2E1, KQ3E1, KQ4E1.**
357. Schwartz CL, Clark C, Koshiaris C, et al. Interarm Difference in Systolic Blood Pressure in Different Ethnic Groups and Relationship to the "White Coat Effect": A Cross-Sectional Study. American journal of hypertension. 2017;30(9):884-91.

https://dx.doi.org/10.1093/ajh/hpx073 **KQ2E4a, KQ3E5, KQ4E4.**

358. Schwartz JE, Burg MM, Shimbo D, et al. Clinic Blood Pressure Underestimates Ambulatory Blood Pressure in an Untreated Employer-Based US Population: Results From the Masked Hypertension Study. Circulation. 2016;134(23):1794-807. PMID: 27920072. https://doi.org/10.1161/circulationaha.116.023404 **KQ2E1, KQ3E5, KQ4E4.**
359. Scisney-Matlock M, Grand A, Steigerwalt SP, et al. Reliability and reproducibility of clinic and home blood pressure measurements in hypertensive women according to age and ethnicity. Blood pressure monitoring. 2009;14(2):49-57. **KQ2E5, KQ3E5b, KQ4E4.**
360. Segura J, Banegas JR, Ruilope LM. Usefulness of ambulatory blood pressure monitoring (ABPM) in daily clinical practice: Data from the Spanish ABPM registry. Clin Exp Pharmacol Physiol. 2014;41(1):30-6. PMID: 23710883. https://doi.org/10.1111/1440-1681.12126 **KQ2E7, KQ3E7, KQ4E7.**
361. Seo J, Lee CJ, Oh J, et al. Large discrepancy between unobserved automated office blood pressure and ambulatory blood pressure in a high cardiovascular risk cohort. Journal of hypertension. 2019;37(1):42-9. PMID: 30507862. https://dx.doi.org/10.1097/HJH.0000000000001868 **KQ2E5, KQ3E5a, KQ4E4.**
362. Seravalle G, Bombelli M, Villa P, et al., editors. 24-h systolic blood pressure load represents an important variable in determining the cardiovascular risk of white-coat hypertension. Eur Heart J; 2017; Conference: European Society of Cardiology, ESC Congress 2017. Spain. **KQ2E11a, KQ3E5, KQ4E4.**
363. Sheppard JP, Martin U, Gill P, et al. Prospective external validation of the Predicting Out-of-OFfice Blood Pressure (PROOF-BP) strategy for triaging ambulatory monitoring in the diagnosis and management of hypertension: observational cohort study. BMJ. 2018;361:k2478. https://dx.doi.org/10.1136/bmj.k2478 **KQ2E6, KQ3E6, KQ4E4.**
364. Sheps SG, Bailey KR, Zachariah PK. Short-term (six hour), ambulatory blood pressure monitoring. Journal of human hypertension. 1994;8(12):873-8. **KQ2E4, KQ3E5, KQ4E4.**
365. Shimbo D, Kuruvilla S, Haas D, et al. Preventing misdiagnosis of ambulatory hypertension: algorithm using office and home blood pressures. Journal of hypertension. 2009;27(9):1775-83. **KQ2E5, KQ3E7c, KQ4E4.**
366. Shimbo D, Muntner P. Should Out-of-Office Monitoring Be Performed for Detecting White Coat Hypertension? Ann Intern Med. 2019. PMID: 31181573. https://doi.org/10.7326/m19-1134 **KQ1E7, KQ2E7, KQ3E7, KQ4E7.**
367. Shimbo D, Muntner P, Mann D, et al. Endothelial dysfunction and the risk of hypertension: the multi-ethnic study of atherosclerosis. Hypertension. 2010;55(5):1210-6. PMID: 20308612. **KQ2E3, KQ3E5, KQ4E4.**
368. Shimbo D, Pickering TG, Spruill TM, et al. Relative utility of home, ambulatory, and office blood pressures in the prediction of end-organ damage. American journal of hypertension. 2007;20(5):476-82. **KQ2E5, KQ3E4b, KQ4E4.**
369. Shin J, Xu E, Lim YH, et al. Relationship between nocturnal blood pressure and 24-h urinary sodium excretion in a rural population in Korea. Clin Hypertens. 2014;20:9. https://dx.doi.org/10.1186/2056-5909-1-3 **KQ2E1, KQ3E1, KQ4E4.**
370. Shook RP, Lee DC, Sui X, et al. Cardiorespiratory fitness reduces the risk of incident hypertension associated with a parental history of hypertension. Hypertension. 2012;59(6):1220-4. **KQ2E1, KQ3E1, KQ4E1.**
371. Silveira A, Mesquita A, Maldonado J, et al. White coat effect in treated and untreated patients with high office blood pressure. Relationship with pulse wave velocity and left ventricular mass index. Revista Portuguesa de Cardiologia. 2002;21(5):517-30. **KQ2E4a, KQ3E4a, KQ4E4.**
372. Smirnova M, Britov AN, Platonova EM, et al. 1b.06: Masked Hypertension Prevalence and Its Markers in Organized Cohort. Journal of hypertension. 2015;33 Suppl 1:e6. https://dx.doi.org/10.1097/01.hjh.0000467368.42828.71 **KQ2E4a, KQ3E4a, KQ4E4.**
373. Sova M, Sovova E, Hobzova M, et al. The effect of continuous positive airway pressure therapy on the prevalence of masked hypertension in obstructive sleep apnea patients. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2015;159(2):277-82. https://dx.doi.org/10.5507/bp.2014.063 **KQ2E5, KQ3E5, KQ4E4.**
374. Spruill TM, Shallcross AJ, Ogedegbe G, et al. Psychosocial Correlates of Nocturnal Blood Pressure Dipping in African Americans: The Jackson Heart Study. American journal of hypertension. 2016;29(8):904-12. https://dx.doi.org/10.1093/ajh/hpw008 **KQ2E4a, KQ3E5, KQ4E4.**
375. Staessen J, Amery A. APTH--a trial on ambulatory blood pressure monitoring and

treatment of hypertension: objectives and protocol. Acta Cardiol. 1993;48(1):25-42. **KQ2E5, KQ3E4a, KQ4E4.**

376. Staessen JA, Bieniaszewski L, O'Brien ET, et al. An epidemiological approach to ambulatory blood pressure monitoring:the Belgian Population Study. Blood pressure monitoring. 1996;1(1):13-26. PMID: 10226197. **KQ2E4a, KQ3E5, KQ4E4.**
377. Staessen JA, Byttebier G, Buntinx F, et al. Antihypertensive treatment based on conventional or ambulatory blood pressure measurement. A randomized controlled trial. Ambulatory Blood Pressure Monitoring and Treatment of Hypertension Investigators. Jama. 1997;278(13):1065-72. **KQ2E5, KQ3E4, KQ4E4.**
378. Staessen JA, Celis H, Hond ED, et al. Comparison of conventional and automated blood pressure measurements: interim analysis of the THOP trial. Treatment of Hypertension According to Home or Office Blood Pressure. Blood pressure monitoring. 2002;7(1):61-2. **KQ2E1, KQ3E5b, KQ4E4.**
379. Staessen JA, Den HE, Celis H, et al. Antihypertensive treatment based on blood pressure measurement at home or in the physician's office: a randomized controlled trial. Jama. 2004;291(8):955-64. **KQ2E5, KQ3E10, KQ4E4.**
380. Staessen JA, Fagard R, Lijnen P, et al. Ambulatory blood pressure and blood pressure measured at home: progress report on a population study. Journal of Cardiovascular Pharmacology. 1994;23 Suppl 5:S5-11. **KQ2E4b, KQ3E5, KQ4E4.**
381. Staessen JA, Fagard R, Thijs L, et al. Randomised double-blind comparison of placebo and active treatment for older patients with isolated systolic hypertension. The Systolic Hypertension in Europe (Syst-Eur) Trial Investigators. Lancet. 1997;350(9080):757-64. **KQ2E1, KQ3E1, KQ4E1.**
382. Staessen JA, Hansen TW, ¤ger WH. Added VALUE of an ancillary study on ambulatory blood pressure monitoring. Journal of hypertension. 2007;25(3):513-5. **KQ2E7, KQ3E7, KQ4E7.**
383. Staessen JA, O'Brien ET, Amery AK, et al. Ambulatory blood pressure in normotensive and hypertensive subjects: results from an international database. J Hypertens Suppl. 1994;12(7):S1-12. PMID: 7769499. **KQ2E4a, KQ3E4a, KQ4E4.**
384. Staessen JA, Thijs L, Fagard R, et al. Predicting cardiovascular risk using conventional vs ambulatory blood pressure in older patients with systolic hypertension. Systolic Hypertension in Europe Trial Investigators. Jama. 1999;282(6):539-46. **KQ2E1, KQ3E1, KQ4E1.**
385. Staessen JA, Thijs L, O'Brien ET, et al. Ambulatory pulse pressure as predictor of outcome in older patients with systolic hypertension. American journal of hypertension. 2002;15(10 Pt 1):835-43. **KQ2E1, KQ3E1, KQ4E1.**
386. Stergiou GS, Asayama K, Thijs L, et al. Prognosis of white-coat and masked hypertension: International Database of HOme blood pressure in relation to Cardiovascular Outcome. Hypertension. 2014;63(4):675-82. https://doi.org/10.1161/hypertensionaha.113.02741 **KQ2E3, KQ3E5, KQ4E4.**
387. Strachan MW, Gough K, McKnight JA, et al. Ambulatory blood pressure monitoring: is it necessary for the routine assessment of hypertension in people with diabetes? Diabetic Medicine. 2002;19(9):787-9. PMID: 12207818. **KQ2E5, KQ3E4a, KQ4E4.**
388. Suarez C, del AC, Garcia-Polo I. Ambulatory blood pressure monitoring: is the daytime period enough for making clinical decisions? Blood pressure monitoring. 2003;8(6):267-70. **KQ2E5, KQ3E5b, KQ4E4.**
389. Sung KC, Lim S, Rosenson RS. Hyperinsulinemia and homeostasis model assessment of insulin resistance as predictors of hypertension: a 5-year follow-up study of Korean sample. American journal of hypertension. 2011;24(9):1041-5. **KQ2E1, KQ3E1, KQ4E1.**
390. Sung KC, Wild SH, Byrne CD. Development of new fatty liver, or resolution of existing fatty liver, over five years of follow-up, and risk of incident hypertension. J Hepatol. 2014. **KQ2E1, KQ3E1, KQ4E1.**
391. Sung SH, Cheng HM, Wang KL, et al. White coat hypertension is more risky than prehypertension: important role of arterial wave reflections. Hypertension. 2013;61(6):1346-53. **KQ2E4a, KQ3E5, KQ4E4.**
392. Suzuki H, Kobayashi K, Okada H. Combination of Echocardiography and Pulse Wave Velocity Provides Clues for the Differentiation between White Coat Hypertension and Hypertension in Postmenopausal Women. Pulse. 2014;1(3-4):131-8. https://dx.doi.org/10.1159/000360977 **KQ2E3, KQ3E5, KQ4E4.**
393. Svendsen M, Tonstad S, Heggen E, et al. The effect of kiwifruit consumption on blood pressure in subjects with moderately elevated blood pressure: a randomized, controlled study.

Blood Press. 2015;24(1):48-54. https://dx.doi.org/10.3109/08037051.2014.976979 **KQ2E5, KQ3E4a, KQ4E4.**

394. Tadic M, Bombelli M, Villa P, et al. 24-hour systolic blood pressure load represents an important variable in determining the cardiovascular RIK profile of white-coat hypertension. Journal of hypertension [serial on the Internet]. 2017; 35: Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/CN-01407109/full. **KQ2E11a, KQ3E5, KQ4E4.**
395. Takeno K, Mita T, Nakayama S, et al. Masked hypertension, endothelial dysfunction, and arterial stiffness in type 2 diabetes mellitus: a pilot study. American journal of hypertension. 2012;25(2):165-70. **KQ2E4a, KQ3E5, KQ4E4.**
396. Talleruphuus U, Bang LE, Wiinberg N, et al. Isolated systolic hypertension in an elderly Danish population. Prevalence and daytime ambulatory blood pressure. Blood Press. 2006;15(6):347-53. **KQ2E5, KQ3E4a, KQ4E4.**
397. Tanabe P, Persell SD, Adams JG, et al. Increased blood pressure in the emergency department: pain, anxiety, or undiagnosed hypertension? Ann Emerg Med. 2008;51(3):221-9. **KQ2E2, KQ3E2, KQ4E4.**
398. Taner A, Unlu A, Kayrak M, et al. The value of serum asymmetric dimethylarginine levels for the determination of masked hypertension in patients with diabetes mellitus. Atherosclerosis. 2013;228(2):432-7. https://doi.org/10.1016/j.atherosclerosis.2013.02.024 **KQ2E9, KQ3E9, KQ4E9.**
399. Tanner RM, Shimbo D, Seals SR, et al. White-Coat Effect Among Older Adults: Data From the Jackson Heart Study. J Clin Hypertens. 2016;18(2):139-45. https://dx.doi.org/10.1111/jch.12644 **KQ2E4a, KQ3E5, KQ4E4.**
400. Theilade S, Lajer M, Joergensen C, et al. Discrepancy between tonometric ambulatory and cuff-based office blood pressure measurements in patients with type 1 diabetes. Journal of Clinical Hypertension. 2012;14(10):686-93. **KQ2E3, KQ3E5, KQ4E4.**
401. Thijs L, Hansen TW, Kikuya M, et al. The International Database of Ambulatory blood pressure in relation to Cardiovascular Outcome (IDACO): protocol and research perspectives. Blood pressure monitoring. 2007;12(4):255-62. **KQ2E13, KQ3E5, KQ4E4.**
402. Thijs L, Staessen J, Fagard R, et al. Number of measurements required for the analysis of diurnal blood pressure profile. Journal of human hypertension. 1994;8(4):239-44. **KQ2E5, KQ3E5, KQ4E4.**
403. Thijs L, Staessen JA, Celis H, et al. The international database of self-recorded blood pressures in normotensive and untreated hypertensive subjects. Blood pressure monitoring. 1999;4(2):77-86. PMID: 10450117. **KQ2E3, KQ3E5, KQ4E4.**
404. Thomas O, Shipman KE, Day K, et al. Prevalence and determinants of white coat effect in a large UK hypertension clinic population. Journal of human hypertension. 2016;30(6):386-91. https://dx.doi.org/10.1038/jhh.2015.95 **KQ2E5, KQ3E5b, KQ4E4.**
405. Thomopoulos C, Papadopoulos DP, Papazachou O, et al. Free leptin is associated with masked hypertension in nonobese subjects: a cross-sectional study. Hypertension. 2009;53(6):965-72. **KQ2E1, KQ3E1, KQ4E1.**
406. Tientcheu D, Ayers C, Das SR, et al. Target Organ Complications and Cardiovascular Events Associated With Masked Hypertension and White-Coat Hypertension: Analysis From the Dallas Heart Study. Journal of the American College of Cardiology. 2015;66(20):2159-69. https://dx.doi.org/10.1016/j.jacc.2015.09.007 **KQ2E3, KQ3E3, KQ4E4.**
407. Ting-Tse L, Jyh-Ming Juang J, Jen-Kuang L, et al. Comparison of Home and Ambulatory Blood Pressure Measurements in Association With Preclinical Hypertensive Cardiovascular Damage. Journal of Cardiovascular Nursing. 2019;34(2):106-14. https://doi.org/10.1097/JCN.0000000000000515 **KQ2E5, KQ3E5b, KQ4E4.**
408. Tomiyama H, Hashimoto H, Hirayama Y, et al. Synergistic acceleration of arterial stiffening in the presence of raised blood pressure and raised plasma glucose. Hypertension. 2006;47(2):180-8. **KQ2E1, KQ3E1, KQ4E1.**
409. Tomiyama H, Koji Y, Yambe M, et al. Elevated C-reactive protein augments increased arterial stiffness in subjects with the metabolic syndrome. Hypertension. 2005;45(5):997-1003. **KQ2E1, KQ3E1, KQ4E1.**
410. Torres G, Sanchez-de-la-Torre M, Martinez-Alonso M, et al. Use of Ambulatory Blood Pressure Monitoring for the Screening of Obstructive Sleep Apnea. J Clin Hypertens. 2015;17(10):802-9. https://dx.doi.org/10.1111/jch.12619 **KQ2E5, KQ3E4a, KQ4E4.**
411. Toyama H, Hasegawa Y, Ejima Y, et al. Characteristics of young-onset white coat hypertension identified by targeted screening for hypertension at a university health check-up.

Hypertension research. 2008;31(6):1063-8. **KQ2E3, KQ3E3, KQ4E4.**
412. Tozawa M, Iseki K, Iseki C, et al. Impact of multiple risk factor clustering on the elevation of blood pressure. Hypertension research. 2002;25(6):811-6. **KQ2E1, KQ3E1, KQ4E1.**
413. Tozawa M, Oshiro S, Iseki C, et al. Multiple risk factor clustering of hypertension in a screened cohort. Journal of hypertension. 2000;18(10):1379-85. **KQ2E1, KQ3E1, KQ4E1.**
414. Trudel X, Brisson C, Larocque B, et al. Masked hypertension: different blood pressure measurement methodology and risk factors in a working population. Journal of hypertension. 2009;27(8):1560-7. PMID: 19444141. **KQ2E2, KQ3E5, KQ4E4.**
415. Trudel X, Brisson C, Milot A. Job strain and masked hypertension. Psychosom Med. 2010;72(8):786-93. PMID: 20639388. https://doi.org/10.1097/PSY.0b013e3181eaf327 **KQ2E2, KQ3E5, KQ4E4.**
416. Trudel X, Milot A, Brisson C. Persistence and progression of masked hypertension: a 5-year prospective study. International Journal of Hypertension. 2013;2013:836387. **KQ2E2, KQ3E5, KQ4E4.**
417. Tsivgoulis G, Pikilidou M, Katsanos AH, et al. Association of Ambulatory Blood Pressure Monitoring parameters with the Framingham Stroke Risk Profile. J Neurol Sci. 2017;380:106-11. https://dx.doi.org/10.1016/j.jns.2017.07.007 **KQ2E5a, KQ3E5b, KQ4E4.**
418. Tsuji I, Imai Y, Nagai K, et al. Proposal of reference values for home blood pressure measurement: prognostic criteria based on a prospective observation of the general population in Ohasama, Japan. American journal of hypertension. 1997;10(4 Pt 1):409-18. **KQ2E1, KQ3E1, KQ4E1.**
419. Ugajin T, Hozawa A, Ohkubo T, et al. White-coat hypertension as a risk factor for the development of home hypertension: the Ohasama study. Arch Intern Med. 2005;165(13):1541-6. PMID: 16009871. **KQ2E3, KQ3E5, KQ4E4.**
420. Umemoto S, Kawano R, Kawamura A, et al. Effects of Japan diet-based antihypertensive diet on blood pressure and its variability in subjects with untreated normal high blood pressure and stage I hypertension: a randomized controlled trial. Circ Cardiovasc Genet [serial on the Internet]. 2017; 136(Supplement 1) (no pagination): Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/CN-01440989/full. **KQ2E3, KQ3E3, KQ4E4.**
421. Uzu T, Nakao K, Kume S, et al. High sodium intake is associated with masked hypertension in Japanese patients with type 2 diabetes and treated hypertension. American journal of hypertension. 2012;25(11):1170-4. **KQ2E5b, KQ3E5, KQ4E4.**
422. van der Steen MS, Lenders JW, Thien T. Side effects of ambulatory blood pressure monitoring. Blood pressure monitoring. 2005;10(3):151-5. **KQ2E1, KQ3E1, KQ4E5a.**
423. Vasan RS, Larson MG, Leip EP, et al. Assessment of frequency of progression to hypertension in non-hypertensive participants in the Framingham Heart Study: a cohort study. Lancet. 2001;358(9294):1682-6. **KQ2E1, KQ3E1, KQ4E1.**
424. Veerabhadrappa P, Diaz KM, Feairheller DL, et al. Endothelial-dependent flow-mediated dilation in African Americans with masked-hypertension. American journal of hypertension. 2011;24(10):1102-7. **KQ2E4a, KQ3E4a, KQ4E4.**
425. Veerman DP, van Montfrans GA. Nurse-measured or ambulatory blood pressure in routine hypertension care. Journal of hypertension. 1993;11(3):287-92. **KQ2E5, KQ3E5b, KQ4E4.**
426. Verberk WJ, Kroon AA, Thien T, et al. Prevalence of the white-coat effect at multiple visits before and during treatment. Journal of hypertension. 2006;24(12):2357-63. PMID: 17082716. https://doi.org/10.1097/01.hjh.0000251899.47626.4f **KQ2E5, KQ3E4a, KQ4E4.**
427. Verdecchia P, Angeli F, Mazzotta G, et al. Home Blood Pressure Measurements Will Not Replace 24-Hour Ambulatory Blood Pressure Monitoring. Hypertension. 2009. **KQ2E7, KQ3E7, KQ4E7.**
428. Verdecchia P, Angeli F, Reboldi G. Masked and White-Coat Hypertension: Moving to African Americans. Journal of the American College of Cardiology. 2015;66:2170-2. https://doi.org/10.1016/j.jacc.2015.09.008 **KQ2E7, KQ3E7, KQ4E4.**
429. Verdecchia P, Palatini P, Schillaci G, et al. Independent predictors of isolated clinic ('white-coat') hypertension. Journal of hypertension. 2001;19(6):1015-20. **KQ2E5, KQ3E4a, KQ4E4.**
430. Verdecchia P, Porcellati C, Schillaci G, et al. Ambulatory blood pressure. An independent predictor of prognosis in essential hypertension.

Hypertension. 1994;24(6):793-801. **KQ2E5, KQ3E5, KQ4E4.**
431. Verdecchia P, Schillaci G, Boldrini F, et al. Variability between current definitions of 'normal' ambulatory blood pressure. Implications in the assessment of white coat hypertension. Hypertension. 1992;20(4):555-62. **KQ2E5, KQ3E5, KQ4E4.**
432. Verdecchia P, Schillaci G, Borgioni C, et al. White-coat hypertension. Lancet. 1996;348(9039):1444-5. **KQ2E7, KQ3E7, KQ4E7.**
433. Verdecchia P, Schillaci G, Borgioni C, et al. White coat hypertension and white coat effect. Similarities and differences. American journal of hypertension. 1995;8(8):790-8. **KQ2E5, KQ3E5, KQ4E4.**
434. Verdecchia P, Schillaci G, Reboldi G, et al. Different prognostic impact of 24-hour mean blood pressure and pulse pressure on stroke and coronary artery disease in essential hypertension. Circulation. 2001;103(21):2579-84. **KQ2E1, KQ3E1, KQ4E1.**
435. Viera AJ, Lin FC, Tuttle LA, et al. Levels of office blood pressure and their operating characteristics for detecting masked hypertension based on ambulatory blood pressure monitoring. American journal of hypertension. 2015;28(1):42-9. https://dx.doi.org/10.1093/ajh/hpu099 **KQ2E4a, KQ3E5, KQ4E4.**
436. Vinyoles E, Felip A, Pujol E, et al. Clinical characteristics of isolated clinic hypertension. Journal of hypertension. 2008;26(3):438-45. PMID: 18300853. 10.1097/HJH.0b013e3282f3150b **KQ2E5, KQ3E4a, KQ4E4.**
437. Vinyoles E, Rodriguez-Blanco T, de la Sierra A, et al. Isolated clinic hypertension: diagnostic criteria based on 24-h blood pressure definition. Journal of hypertension. 2010;28(12):2407-13. **KQ2E5, KQ3E3, KQ4E4.**
438. Vischer AS, Mayr M, Socrates T, et al. Impact of Single-Occasion American vs. Canadian Office Blood Pressure Measurement Recommendations on Blood Pressure Classification. American journal of hypertension. 2019;32(2):143-5. PMID: 30371728. https://dx.doi.org/10.1093/ajh/hpy159 **KQ2E3, KQ3E3, KQ4E4.**
439. Volzke H, Fung G, Ittermann T, et al. A new, accurate predictive model for incident hypertension. Journal of hypertension. 2013;31(11):2142-50. **KQ2E1, KQ3E1, KQ4E1.**
440. Vrijkotte TG, van Doornen LJ, de Geus EJ. Effects of work stress on ambulatory blood pressure, heart rate, and heart rate variability. Hypertension. 2000;35(4):880-6. **KQ2E5, KQ3E5, KQ4E4.**
441. Wang L, Forman J, Gold D, et al. Self-reported blood pressure is comparable to measured blood pressure in a study of general population participants. Cad Saude Publica [serial on the Internet]. 2017; 135(no pagination): Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/CN-01417350/full. **KQ2E11a, KQ3E5, KQ4E4.**
442. White WB, Jalil F, Wakefield DB, et al. Relationships among clinic, home, and ambulatory blood pressures with small vessel disease of the brain and functional status in older people with hypertension. American Heart Journal. 2018;205:21-30. PMID: 30145340. https://dx.doi.org/10.1016/j.ahj.2018.08.002 **KQ2E5, KQ3E4a, KQ4E4.**
443. Wiinberg N, Hoegholm A, Christensen HR, et al. 24-h ambulatory blood pressure in 352 normal Danish subjects, related to age and gender. American journal of hypertension. 1995;8(10:Pt 1):t-86. https://doi.org/10.1016/0895-7061(95)00216-2 **KQ2E4a, KQ3E5, KQ4E4.**
444. Wijkman M, ¤nne T, Grodzinsky E, et al. Ambulatory systolic blood pressure predicts left ventricular mass in type 2 diabetes, independent of central systolic blood pressure. Blood pressure monitoring. 2012;17(4):139-44. https://doi.org/10.1097/MBP.0b013e328355fdfb **KQ2E5b, KQ3E5, KQ4E4.**
445. Wijkman M, Lanne T, Engvall J, et al. Masked nocturnal hypertension--a novel marker of risk in type 2 diabetes. Diabetologia. 2009;52(7):1258-64. **KQ2E4a, KQ3E5b, KQ4E4.**
446. Wing LM, Brown MA, Beilin LJ, et al. 'Reverse white-coat hypertension' in older hypertensives. Journal of hypertension. 2002;20:639-44. **KQ2E5, KQ3E4a, KQ4E4.**
447. Wing LMH, Chowdhury EK, Reid CM, et al. Night-time ambulatory blood pressure is the best pretreatment blood pressure predictor of 11-year mortality in treated older hypertensives. Blood pressure monitoring. 2018. PMID: 29864033. https://doi.org/10.1097/mbp.0000000000000331 **KQ2E4a, KQ3E4a, KQ4E4.**
448. Wing LMH, Chowdhury EK, Reid CM, et al. Night-time ambulatory blood pressure is the best pretreatment blood pressure predictor of 11-year mortality in treated older hypertensives. Blood pressure monitoring. 2018;23(5):237-43. PMID: 29864033.

https://dx.doi.org/10.1097/MBP.0000000000000331 **KQ2E5, KQ3E4a, KQ4E4.**

449. Wittenberg C, Erman A, Sulkes J, et al. Which cuff size is preferable for blood pressure monitoring in most hypertensive patients? Journal of human hypertension. 1994;8(11):819-22. **KQ2E5, KQ3E5b, KQ4E4.**
450. Wolak T, Wilk L, Paran E, et al. Is it possible to shorten ambulatory blood pressure monitoring? Journal of clinical hypertension (Greenwich, Conn). 2013;15(8):570-4. **KQ2E5, KQ3E5b, KQ4E4.**
451. Woodiwiss AJ, Molebatsi N, Maseko MJ, et al. Nurse-recorded auscultatory blood pressure at a single visit predicts target organ changes as well as ambulatory blood pressure. Journal of hypertension. 2009;27(2):287-97. **KQ2E9, KQ3E9, KQ4E9.**
452. Wuerzner G, Bochud M, Zweiacker C, et al. Step count is associated with lower nighttime systolic blood pressure and increased dipping. American journal of hypertension. 2013;26(4):527-34. **KQ2E5b, KQ3E5b, KQ4E4.**
453. Wuopio J, Ostgren CJ, Lanne T, et al. The association between circulating endostatin and a disturbed circadian blood pressure pattern in patients with type 2 diabetes. Blood Pressure. 2018;27(4):215-21. PMID: 29488402. https://dx.doi.org/10.1080/08037051.2018.1444941 **KQ2E4a, KQ3E5, KQ4E4.**
454. Yamada Y, Ishizaki M, Kido T, et al. Alcohol, high blood pressure, and serum gamma-glutamyl transpeptidase level. Hypertension. 1991;18(6):819-26. **KQ2E1, KQ3E1, KQ4E1.**
455. Yamasue K, Hayashi T, Ohshige K, et al. Masked hypertension in elderly managerial employees and retirees. Clin Exp Hypertens. 2008;30(3):203-11. PMID: 18425700. **KQ2E10, KQ3E5, KQ4E4.**
456. Yambe M, Tomiyama H, Yamada J, et al. Arterial stiffness and progression to hypertension in Japanese male subjects with high normal blood pressure. Journal of hypertension. 2007;25(1):87-93. **KQ2E1, KQ3E1, KQ4E1.**
457. Yang Y, Xu JZ, Wang Y, et al. Ambulatory versus clinic blood pressure in predicting overall subclinical target organ damage progression in essential hypertensive patients: a 3-year follow-up study. Blood pressure monitoring. 2016;21(6):319-26. PMID: 27579902 https://dx.doi.org/10.1097/MBP.0000000000000209 **KQ2E9, KQ3E9, KQ4E9.**
458. Yasui D, Asayama K, Takada N, et al. Evaluating home blood pressure in treated hypertensives in comparison with the referential value of casual screening of blood pressure: the Ohasama study. Blood pressure monitoring. 2012;17(3):89-95. PMID: 22425704. **KQ2E3, KQ3E5, KQ4E4.**
459. Zambrana RE, Lopez L, Dinwiddie GY, et al. Prevalence and Incident Prehypertension and Hypertension in Postmenopausal Hispanic Women: Results from the Women's Health Initiative. American journal of hypertension. 2014;27(3):372-81. **KQ2E1, KQ3E1, KQ4E1.**
460. Zawadzka A, Bird R, Casadei B, et al. Audit of ambulatory blood pressure monitoring in the diagnosis and management of hypertension in practice. Journal of human hypertension. 1998;12(4):249-52. **KQ2E5, KQ3E4a, KQ4E4.**
461. Zhang L, Li Y, Wei FF, et al. Strategies for classifying patients based on office, home, and ambulatory blood pressure measurement. Hypertension. 2015;65(6):1258-65. https://dx.doi.org/10.1161/HYPERTENSIONAHA.114.05038 **KQ2E9, KQ3E9, KQ4E9.**
462. Zhou J, Liu C, Shan P, et al. Prevalence and distinguishing features of masked hypertension in type 2 diabetic patients. Journal of Diabetes & its Complications. 2013;27(1):82-6. https://doi.org/10.1016/j.jdiacomp.2012.07.003 **KQ2E9, KQ3E9, KQ4E9.**
463. Zoccali C, Mallamaci F. The overdriven glomerulus as a cardiovascular risk factor. Kidney Int. 2018;93(1):13-5. https://dx.doi.org/10.1016/j.kint.2017.08.035 **KQ2E1, KQ3E1, KQ4E1.**

Appendix E Table 1. Study Characteristics of Included Studies for KQ 1

Author, Year Study name Quality	Country	N	Inclusion criteria	Exclusion criteria	Mean FU (range, yrs)	Intervention(s)
Kaczorowski, 2011[89] CHAP Good	Canada	140,642	Communities: Population of 10-60k based on 1996 & 2001 census, ≥ 5 physicians, ≥ 2 pharmacies, registered persons database to census population ratio < 10%, no recent geopolitical amalgamation into a major center. Participants: Aged ≥ 65 years	Communities: Townships, first nations reserves, dissolved and amalgamated townships and counties; initially test-piloted CHAP Participants: NR	1 (NR)	CHAP intervention: invitation to attend CV risk assessment and edu sessions over 10 wks No intervention

Abbreviations: CHAP = Cardiovascular Health Awareness Program; CV = cardiovascular; FU = followup; k = thousand; NR = not reported; wks = weeks

Appendix E Table 2. Baseline Population Characteristics of Included Studies for KQ 1

Author, Year Study name Quality	N	Mean age (range, yrs)	% Female	% Non-white	% smokers	Mean BMI, kg/m^2	% DM	% CVD	% HTN % Tx	Mean Office SBP/DBP (mmHg)
Kaczorowski, 2011[89] CHAP Good	140,642	74.8 (≥65)	57.2	NR	NR	NR (NR)	21.7	12.3	0 NR	NR

Abbreviations: BMI = body mass index; CHAP = Cardiovascular Health Awareness Program; CVD = cardiovascular disease; DBP = diastolic blood pressure; DM = diabetes mellitus; HTN = hypertension; kg = kilogram(s); m = meter; mm Hg = millimeters of mercury; NR = not reported; SBP = systolic blood pressure; Tx = treated

Appendix E Table 3. Inclusion and Exclusion Criteria of Included Studies for KQ 2, by Author

Author, Year Study name Quality	Inclusion criteria	Exclusion criteria	Treatment Inclusion in the Study
Abdalla, 2016[90] The Improving the Detection of HTN study Fair	NR	Screening clinic blood pressure ≥160 mm Hg systolic or ≥105 mm Hg diastolic; evidence of secondary hypertension; taking antihypertensive medications or other medications that are known to affect BP (i.e., steroids, tricyclic antidepressants, etc); history of overt CVD, chronic kidney disease, liver disease, adrenal disease, thyroid disease, rheumatologic disease, hematologic disease, organ transplantation, cancer, dementia, or were pregnant.	Study conducted in 100% untreated participants
Fagard, 2005[91] Fair	Adults 60 years or older attending a primary care practice in Flanders, Belgium	Patients who were bedridden, demented, admitted in a home for sick elderly people or had suffered a MI or a stroke	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated
Gill, 2017[82] BP-Eth Fair	Individuals with and without diagnosed HTN recruited from primary care who are between 40 and 74 years and belong to one of the four ethnic groups: White British, White Irish, South Asian, and African-Caribbean. Participants need to have had at least one BP recorded in their electronic medical records within the last 5 years.	Unable to consent to participation, belong to a different ethnic group, individuals whose general practitioner feels they are unable to take part	Study conducted in 100% untreated participants
Gosse, 2010[92] PROOF Fair	Aged 65 yrs old in 2001 (according to electoral rolls of Saint-Etienne; born between January 1, 1934 and September 30, 1936)	Prior myocardial infarction, prior stroke, heart failure, atrial fibrillation, insulin-treated diabetes mellitus, cardiac pacemaker, disease limiting life expectancy to <5 years, contraindication to brain magnetic resonance imaging, living in an institution, and intention to move during the next 2 years.	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated
Gourlay, 1993[93] Fair	Agreement to wear ABPM recorder	Vasovagal syncope, inability to achieve agreement between observers and ABPM recorders	Study conducted in 100% untreated participants

Appendix E Table 3. Inclusion and Exclusion Criteria of Included Studies for KQ 2, by Author

Author, Year Study name Quality	Inclusion criteria	Exclusion criteria	Treatment Inclusion in the Study
		during calibration, treatment for hypertension	
Hanninen, 2010[81] Fair	Age 35-64 and residing in Turku, Finland and 3 neighboring municipalities	Coronary artery disease, cerebrovascular disease, insulin-treated diabetes mellitus, hemodynamically significant valvular disease and pregnancy	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
Hansen, 2006[94] MONICA Fair	Participants of previous MONICA health survey who agreed to be reexamined 9-10 years later	Technical problems or unwillingness to participate in ABPM, too few ABPM readings according to recommendations, working at night, prior diagnosis of myocardial infarction or stroke, or taking digoxin or nitrates	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
Ishikawa, 2010[95] Fair	Resident of Kinugawa and at least 20 years old	Use of antihypertensive medicaiton. Subjects with renal failure (serum creatinine level ≥176 μmol/l) or hepatic damage (aspartate aminotransferase or alanine aminotransferase >40 IU/l), or with a past history of coronary artery disease, stroke, congestive heart failure, or atrial fibrillation.	Study conducted in 100% untreated participants
Kanno, 2010[96] Ohasama Study Fair	Resident of Ohasama and aged 40 years or older	Residents who worked out of town, were hospitalized, demented or bedridden; data unavailable on serum creatinine levels and urine tests (Kanno)	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
Larkin, 1998[80] Fair	NR	Patients diagnosed with serious medical disorders (other than hypertension) and psychiatric disorders, and any persons taking antihypertensive medications or any psychoactive drugs that affected blood pressure.	Study conducted in 100% untreated participants
Lyamina, 2012[97] Fair	Young subjects without cardiovascular disease, diabetes, or other chronic disease, including end organ damage due to hypertension;	Highly fit athletes (i.e., members of sports teams and body builders)	Study conducted in 100% untreated participants

Appendix E Table 3. Inclusion and Exclusion Criteria of Included Studies for KQ 2, by Author

Author, Year Study name Quality	Inclusion criteria	Exclusion criteria	Treatment Inclusion in the Study
	attending annual exam at outpatient cardiology clinic		
Mancia, 2006[98] PAMELA Good	Residents of the town of Monza, Italy ages 25-74 years	NR	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
O'Flynn, 2016[99] Mitchelstown cohort Fair	Patients registered with the clinic and in the 50 to 69 yr old age bracket	NR	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
Poudel, 2019[100] CARDIA Fair	African American and White men and women aged 18-30 years (at baseline) from Birmingham and Chicago CARDIA sites who underwent ABPM following the Year 30 exam	Incomplete ABPM recording, unknown treatment use, missing echocardiography data	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated
Scuteri, 2016[101] SardiNIA Fair	All residents aged 14 years and older (at baseline) in 4 towns of the Sardinia Region of Italy	NR	Study conducted in 100% untreated participants
Selenta, 2000[102] Fair	NR	Use of cardioactive medications	Study conducted in 100% untreated participants
Shimbo, 2012[103] Masked Hypertension Study Fair	Adults ≥18 years	Taking HTN or other medications that are known to affect BP; history of CVD or major arrhythmias including afib; evidence of secondary HTN other than a history of pregnancy-induced HTN, chronic renal failure, liver disease, adrenal disease, or thyroid disease; screening clinic SBP >160 or DBP >105; pregnant; working <20h per week; non-English speaking; active substance abuse or severe debilitating psychiatric disorder; were not interested; not available; dropped out before starting the study; pending study visits or dropped otu during the study	Study conducted in 100% untreated participants

Appendix E Table 3. Inclusion and Exclusion Criteria of Included Studies for KQ 2, by Author

Author, Year Study name Quality	Inclusion criteria	Exclusion criteria	Treatment Inclusion in the Study
Thomas, 2017[104] Jackson Heart Study Fair	African American adults 20 to 95 years of age living in the Jackson, Mississippi metro area	Participants without a complete ABPM recording, clinic measurements, and information on self-reported anti-htn medication use were excluded from this analysis	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated
Wei, 2016[105] FLEMENGHO Fair	Teen-aged and older household members with a records of ABPM and retinal photography	Conventional and ambulatory measurements taking >7 days interval, daytime ABPM was the mean of <10 readings, if retinal photographs were of too low quality to be reliably graded, if retinal microvascular diameters were >3 SDs lower than the population mean.	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
Wojciechowska, 2016[106] Fair	Adults ages 18 years and older, residing in a geographically defined area close to Krakow, Poland	NR	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated

Abbreviations: ABPM = ambulatory blood pressure monitoring; CARDIA = the Coronary Artery Risk Development in Young Adults study; DBP = diastolic blood pressure; FLEMENGHO = the Flemish Study on Environment, Genes and Health Outcomes; HTN = hypertension; NR = not reported; MONICA = MONItoring of trends and determinants in Cardiovascular Disease study; OBPM = office-based BP measurement; PAMELA = Pressioni Arteriose Monitorate e Loro Associazioni study; PROOF = The Prognostic Indicator of Cardiovascular and Cerebrovascular Events study; SBP = systolic blood pressure; yr(s) = year(s)

Appendix E Table 4. Protocol Variations and Conclusions of Included Studies for KQ2a, by Author

Author, Year Trial name Quality	Protocol variation of interest	Conclusions
Gill, 2017[82] BP-Eth Fair	3 variations of an OBPM index test: the first reading on the first visit (1 measurement), the mean of second and third readings from 3 visits (6 measurements), and the mean of second and sixth readings from 3 visits (6 measurements)	The first reading from the first visit showed the highest sensitivity and lowest specificity of all three protocols
Lyamina, 2012[97] Fair	Addition of a breath-hold to BP measurement protocol	Results suggest that breath-holding may improve accuracy
Selenta, 2000[102] Fair	Avg of 5 OBPMs from a single visit vs avg of 2 OBPMs from a single visit	Accuracy was nearly identical for diagnoses based on 2 OBPMs and those based on 5 OBPMs
Shimbo, 2012[103] Masked Hypertension Study Fair	Mean of 3 readings from a single visit vs mean of 9 readings from 3 visits	Accuracy results were similar with overlapping confidence intervals

Abbreviations: OBPM = office-based BP measurement

Appendix E Table 5. Inclusion and Exclusion Criteria of Included Studies for KQ 3, by Author

Author, Year Study name Quality	Inclusion criteria	Exclusion criteria	Treatment Inclusion in the Study
Bayo, 2006[122] Fair	Patients aged from 18 to 80 years with mild–moderate hypertension (not defined); without previous antihypertensive treatment	NR	Study conducted in 100% untreated participants
de la Sierra, 2017[74] Spanish ABPM Registry Fair	Complete registry records (demographics, clinical data, office BP and ABPM monitoring of enough quality). Valid ABPMs had to fulfill a series of preestablished criteria: ≥80% of SBPs and DBPs successfully recorded during the day and night periods, 24-h duration, and ≥1 BP measurement per hour	NR	Study conducted in 100% untreated participants
Ernst, 2011[124] Fair	All ABPM sessions processed by the clinic in a defined time period as part of routine clinical practice for one of four indications ((1) borderline hypertension (not currently treated but with a series of variable office blood pressures in both the normal and elevated range), (2) evaluation of BP control on therapy, (3) suspected WCH, or (4) treatment resistance)	Duplicate sessions from individual patients, ABPM sessions referred to the clinic for indications other than those identified	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
Fogari, 1996[126] Fair	Newly diagnosed new-treated essential hypertension (DBP>90 mm Hg), male, aged 31-60	Patients with diabetes, autonomic neuropathy or cerebrovascular disease that might affect the circadian BP pattern, vascular or ischemic heart disease, heart or renal failure, and secondary causes of hypertension	Study conducted in 100% untreated participants
Gerc, 2000[127] Fair	Patients with an elevated office BP referred to hypertension clinic for confirmation of hypertension diagnosis, available nurse and ABPM blood pressure values	Difference between auscultatory and automatic readings repeatedly greater than 5 mmHg; fewer than 10 ABPM measures	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
Hoegholm, 1992[128] Fair	Essential hypertension (DBP >90 mm Hg, mean of at least 3 measurements with intervals of at least 1 week), planned (but not yet began) anti-htn treatment. BP was under observation for a median of 4 months prior to diagnosis in included patients.	Below 16 or above 80 years of age, received anti-htn treatment within the previous month, or not willing/able to undergo 24-h monitoring	Study conducted in 100% untreated participants
Husain, 2017[130] Fair	Recent office BP measurements of 120–149 mm Hg systolic and/or as 80–95 mm Hg diastolic with neither greater than 149/95 mm Hg. At least 30 years of age, have a dedicated primary care physician, and currently be on no antihypertensive medication	Participants with SBP <110 mm Hg or >159 mm Hg or with DBP <71 mm Hg or >99 mm Hg on their initial visit; potential participant with dementia, pregnancy, persistent atrial fibrillation or other arrhythmia, or a condition prohibiting placement of an ambulatory BP monitor.	Study conducted in 100% untreated participants

Appendix E Table 5. Inclusion and Exclusion Criteria of Included Studies for KQ 3, by Author

Author, Year Study name Quality	Inclusion criteria	Exclusion criteria	Treatment Inclusion in the Study
Kim, 2018[131] Fair	Ambulatory patients who underwent OBP and ABP measurements during 2013.	NR	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated
Kotsis, 2008[132] Fair	(i) they had never been treated earlier with antihypertensive medication; (ii) they were taking no medication with the potential to raise BP (prednisone or NSAIDs); (iii) they showed no clinical signs or laboratory evidence of secondary causes of hypertension; and (iv) they had no history of coronary artery disease or heart failure.	NR	Study conducted in 100% untreated participants
Manios, 2008[133] Fair	Patients referred to HTN clinic from primary care for conventional clinical indications*. (i) No previous antihypertensive treatment; (ii) absence of hypertension-related complications (coronary artery disease, heart failure, cerebrovascular disease, renal insufficiency or peripheral artery disease); (iii) no clinical or laboratory evidence of secondary causes of arterial hypertension; (iv) at least three valid BP measurements per hour over 24-h ABPM (75% successful measurements)	Individuals with BP differences between the arms of >20 mmHg SBP and >10 mmHg DBP; individuals who stated they had not rested during the night; individuals with excess physical activity (not further defined)	Study conducted in 100% untreated participants
Nasothimiou, 2012[134] Good	Consecutive adults referred for elevated BP, untreated or on stable antihypertensive treatment for ≥4 weeks	Severe renal, cardiac or other systemic diseases, sustained arrhythmia and evidence of secondary hypertension. Inadequate HBP and/or ABP readings, multiple evaluations, treatment changes during the study, acute disease during the study, provided fewer than 8 valid HBP readings, or "other reasons"	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated
Nunan, 2015[135] Fair	Aged 40-85 years; SBP between 130-179 mm Hg; not previously diagnosed with or treated for hypertension, atrial fib, autonomic failure or dementia; willing to monitor their own BP and perform 24h ABPM	Patients were excluded if their family physician decided they needed HTN treatment during the study timeframe (i.e., within 30 days) or if they had started self-monitoring readings after day 1, had insufficient self-monitoring readings, inadequate ABPM readings or technical failures	Study conducted in 100% untreated participants
Park, 2017[136] Fair	Elevated office blood pressure (≥140/90mm Hg)	Secondary hypertension, hypertensive emergency or urgency; heart failure (NYHA III-IV); clinically	Study conducted in 100% untreated participants

Appendix E Table 5. Inclusion and Exclusion Criteria of Included Studies for KQ 3, by Author

Author, Year Study name Quality	Inclusion criteria	Exclusion criteria	Treatment Inclusion in the Study
		significant cardiac arrhythmia; impaired renal function; pregnancy; participating in night labor or shift work; history of abusing drugs or alcohol within 6 mo; current participation in other clinical studies; taking other clinical trials drugs within the past month; taking drugs known to affect BP, such as steroids, monoamine oxidase inhibitors, oral contraceptives or sympathomimetics.	
Salazar, 2018[139] Fair	Patients consecutively referred to the Cardiometabolic Diseases Unit; complete ABPM data (70% or greater successful measurements and at least one record per hour)	Women with suspected hypertensive disorders of pregnancy	Study includes treated and untreated participants; baseline data not stratified and reflects combination of untreated and treated
Shin, 2015[73] Kor-ABP Fair	Undergone ABPM for evaluation of high BP	Incomplete data, lack of informed consent	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated
Tocci, 2018[142] Fair	(1) more than 18 years-old, (2) absence of stable (more than 3 months) pharmacological treatment with any antihypertensive drug	(1) previous or current antihypertensive treatment; (2) secondary hypertension or true resistant hypertension; (3) recent (< 6 months) history of acute CV diseases (including at least one of the following: coronary artery disease, stroke, congestive heart failure, severe valve disease, or peripheral artery disease); and (4) any neurological or psychiatric disease that may at least in part affect the BP assessment or the signature of the informed consent.	Study conducted in 100% untreated participants
Ungar, 2004[143] Good	Consecutive patients referred to outpatient HTN clinic for clinical evaluation of HTN between December 1995 and December 1999 (not further specified)	NR	Study includes treated and untreated participants; baseline data stratified and reflects 100% untreated
Zabludowski, 1992[145] Fair	Referred for ABPM because of untreated borderline hypertension (i.e., those whose blood pressure would occasionally but not consistently rise in the mild range [DBP>90])	NR	Study conducted in 100% untreated participants

Appendix E Table 5. Inclusion and Exclusion Criteria of Included Studies for KQ 3, by Author

***** These included suspected white-coat hypertension, suspected nocturnal hypertension, evaluation of hypotension, or symptoms suggesting possible abnormal BP variations such as headache, tinnitus, dizziness, fainting, and epistaxis

Abbreviations: BP = blood pressure; ABPM = ambulatory blood pressure monitoring; DBP = diastolic blood pressure; hr = hour; HTN = hypertension; mm HG = millimeter of mercury; mo = months; NR = not reported; OBPM = office-based BP measurement; SBP = systolic blood pressure; WCH = white coat hypertension

Appendix E Table 6. Protocol Variations and Conclusions of Included Studies for KQ 3a, by Category

Category	Author, Year Trial name Quality	Protocol variation of interest	Conclusions
Repeat OBPM	Fogari, 1996[126]	Repeat OBPM at several visits; OBPMs were taken at office visits occurring every 2 weeks for a total of 5 visits	Results suggested that there are fewer screen positives over time with repeated visits (reduced white coat hypertension)
	Husain, 2017[130]	Repeat sets of OBPM and ABPM	Accuracy results were nearly identical in the first and second comparisons, and short-term reproducibility was characterized as fair
HBPM	Nunan, 2015[135]	Avg of measures from various days; averaging measures taken in the morning and evening on days 1-7 (28 measures), days 2-7 (24 measures), days 1-5 (20 measures), and days 2-5 (16 measures)	Accuracy results for various protocols were similar
	Park, 2017[136, 138]	Number of days measured and which measures; out of three taken each in the morning and evening, to include in the averaged value	Accuracy results were similar for HBPM protocols taken over various number of days; similar accuracy was found for each averaging method
Self-OBPM	Salazar, 2019[139]	Using avg of 3 compared to 5 measures in one sitting	Reported that the use of five measures instead of three did not significantly improve correlations or AUCs of self-OBPM compared with the ABPM reference standard

Abbreviations: ABPM = ambulatory blood pressure measurement; AUC = area under the curve; HBPM = home blood pressure measurement; OBPM = office-based blood pressure measurement

Appendix E Table 7. QoL/Psychiatric Distress Results of Included Studies for KQ 4, by Author

Author, Year Quality	Outcome	FU (mo)	Group	N	BL Mean (SE) or Number (%)	FU Mean (SE or Number (%), p-value vs. BL	Difference btwn groups
Ameling, 1991[148] Fair	Angry, AML (score)	0.5	Hypertensives	331	4.6 (NR)	3.9‡ (NR), p<0.05	NA
	Anxious, AML (score)	0.5	Hypertensives	331	7.5 (NR)	6.9‡ (NR), NS	NA
	Arrogant, AML (score)	0.5	Hypertensives	331	2.8 (NR)	2.8‡ (NR), NS	NA
	Depressive, AML (score)	0.5	Hypertensives	331	4.6 (NR)	4.0‡ (NR), p<0.05	NA
	Elated, AML (score)	0.5	Hypertensives	331	12.8 (NR)	12.2‡ (NR), NS	NA
	Indifferent, AML (score)	0.5	Hypertensives	331	5.9 (NR)	5.2‡ (NR), p<0.05	NA
	Moody, AML (score)	0.5	Hypertensives	331	5.2 (NR)	4.8‡ (NR), NS	NA
	Physical symptoms (score)	0.5	Hypertensives	331	15.1 (NR)	14.4‡ (NR), p<0.05	NA
	Sexual function (score)	0.5	Hypertensives	331	3.5 (NR)	3.4‡ (NR), NS	NA
	Shy, AML (score)	0.5	Hypertensives	331	4.6 (NR)	4.0‡ (NR), p<0.05	NA
	Sleep dysfunction (score)	0.5	Hypertensives	331	3.5 (NR)	3.1‡ (NR), p<0.05	NA
	Tired, AML (score)	0.5	Hypertensives	331	5.9 (NR)	5.3‡ (NR), p<0.05	NA
Mann, 1977[150] Fair	GHQ, deteriorated (N)	0.25	Normal controls	215	NR (NR)	21 (9.8%)	NSD
			Recalled controls	204	NR (NR)	17 (8.3%)	
			Trial participants	235	NR (NR)	26 (11.1%)	
	GHQ, improved (N)	0.25	Normal controls	215	NR (NR)	16 (7.4%)	NSD
			Recalled controls	204	NR (NR)	18 (8.8%)	
			Trial participants	235	NR (NR)	10 (4.3%)	
	GHQ, negative response (N)	0.25	Normal controls	215	175 (81.4%)	180 (83.7%)	NR
			Recalled controls	204	169 (82.8%)	168 (82.4%)	
			Trial participants	235	191 (81.3%)	207 (88.1%)	
	GHQ, positive response (N)	0.25	Normal controls	215	40 (18.6%)	35 (16.3%)	NR
			Recalled controls	204	35 (17.2%)	36 (17.6%)	

Appendix E Table 7. QoL/Psychiatric Distress Results of Included Studies for KQ 4, by Author

Author, Year Quality	Outcome	FU (mo)	Group	N	BL Mean (SE) or Number (%)	FU Mean (SE or Number (%), p-value vs. BL	Difference btwn groups
			Trial participants	235	44 (18.7%)	28 (11.9%)	
Spruill, 2013[155] Good	Mental health, SF-12	3	Labelled	47	46.9 (6.1)*	-0.2 (95% CI, -2.9 to 2.5)†	P=0.56
			Unlabelled	50	46.3 (9.2)*	2.1 (95% CI, -0.9 to 5.1)	
	Physical health, SF-12	3	Labelled	47	50.5 (3.6)*	-1.7 (95% CI, -2.8 to -0.6)†	P=0.23
			Unlabelled	50	47.8 (6.9)*	-0.6 (95% CI, -2.4 to 1.2)†	
Tompson, 2019[162]	HADS depression status (N with score >7)	1§	Participants	139	22 (15.8%)	14 (10.3%)‖	NR
	HADS anxiety status (N with score >7)	1§	Participants	138	48 (34.8%)	37 (27.0)¶	NR
Viera, 2010[157] Fair	Deteriorated (N)	3	Labelled	38	NR (NR)	0 (0%)	Overall change in health, p=0.78
			Unlabelled	32	NR (NR)	1 (3.1%)	
	Improved (N)	3	Labelled	38	NR (NR)	16 (42.1%)	
			Unlabelled	32	NR (NR)	13 (40.6%)	
	No change (N)	3	Labelled	38	NR (NR)	22 (57.9%)	
			Unlabelled	32	NR (NR)	18 (56.3%)	
	SF-36 (one question), excellent health (N)	3	Labelled	38	NR (NR)	10 (26.3%)	Overall self-reported health, p=0.30
			Unlabelled	32	NR (NR)	4 (12.5%)	
	SF-36 (one question), very good health (N)	3	Labelled	38	NR (NR)	14 (36.8%)	
			Unlabelled	32	NR (NR)	14 (43.8%)	
	SF-36 (one question), good health (N)	3	Labelled	38	NR (NR)	11 (29.0%)	
			Unlabelled	32	NR (NR)	11 (34.4%)	
	SF-36 (one question), fair health (N)	3	Labelled	38	NR (NR)	3 (7.9%)	
			Unlabelled	32	NR (NR)	3 (9.4%)	
	SF-36 (one question), poor health (N)	3	Labelled	38	NR (NR)	0 (0%)	
			Unlabelled	32	NR (NR)	0 (0%)	

*SD
†Mean difference

Appendix E Table 7. QoL/Psychiatric Distress Results of Included Studies for KQ 4, by Author

‡Decrease in value signifies an improvement.
§28 days
‖Total n at followup was 136. Nine individuals classified as depressed at baseline improved, one person became depressed at followup.
¶Total n at followup was 137. Fifteen individuals classified as anxious at baseline improved, five individuals became anxious at followup.

Abbreviations: AML = Amsterdam Mood List; BL = baseline; btwn = between; CI = confidence interval; FU = followup; GHQ = General Health Questionnaire; NA = not applicable; NR = not reported; NS = not significant; NSD = no significant different; SE = standard error; SF = Short Form; vs = versus

Appendix E Table 8. Absenteeism Results of Included Studies for KQ 4, by Author

Author, Year Quality	Outcome	FU (mo)	Group	N	BL Mean (SE) or Number (%)	FU Mean (SE) or Number (%), p-value vs BL	Difference btw groups
Haynes, 1978[149, 152] Fair	Absenteeism due to illness (days/year)	12	Aware	70	5.4 (1.4)	6.1 (1.9), NS	p<0.05
			Unaware	138	2.7 (0.61)	8.4 (1.6), p<0.01	
	Duration of illness episodes (days)	12	Aware	70	1.9 (0.38)	2.7 (0.68), NS	p<0.05
			Unaware	138	1.1 (0.17)	4.0 (1.0), p<0.05	
	Number of illness episodes (number/year)	12	Aware	70	1.6 (1.9)	1.6 (1.9), NS	NSD
			Unaware	138	1.2 (0.14)	1.6 (0.18), p<0.05	
	Total absenteeism (days/year)	12	Aware	70	7.0 (1.4)	11.1 (3.7), NS	NSD
			Unaware	138	6.6 (1.6)	12.3 (2.7), p<0.05	
	Total absenteeism (days/year)	24	Aware	69	6.18 (1.606)	6.06 (1.430)	NR
			Unaware	141	3.49 (0.711)	9.15 (2.524), p<0.01	
	Total absenteeism (days/year)	36	Aware	66	6.18 (1.606)	10.89 (3.063)	NR
			Unaware	137	3.49 (0.711)	12.14 (2.447), p<0.01	
	Total absenteeism (days/year)	48	Aware	66	6.18 (1.606)	7.84 (2.515)	NR
			Unaware	136	3.49 (0.711)	9.07 (2.486), p<0.01	
Rudd, 1987[151] Fair	Number of illness episodes (number/year)	12	Aware	197	2.9 (0.2)	0.3 (0.2)*, NS	NSD
			Unaware	97	2.7 (0.3)	0.1 (0.4)*, NS	
	Absenteeism due to illness (days/year)	12	Aware	197	6.2 (0.7)	0.1 (0.1)*, NS	NSD
			Unaware	97	3.8, (0.5)	0.2 (0.2)*, NS	

*Corrected change scores

Abbreviations: BL = baseline; FU = followup; GHQ = General Health Questionnaire; NA = not applicable; NR = not reported; NS = not significant; NSD = no significant different; SE = standard error

Appendix E Table 9. Tolerability/Sleep Results of Included Studies for KQ 4, by Author

Author, Year Quality	Outcome	Group	N	BL Mean (SE) or Number (%)	FU Mean (SE) or Number (%), p-value vs BL	Difference btw groups
Kuwajima, 1998[161] Fair	Sleep disturbance from device (N)	ABPM	24	NA	7 (29%)	NA
	Hyperreaction on the skin (N)	ABPM	24	NA	0 (0%)	NA
	Pain of the upper arm*	ABPM	24	NA	3.5	NA
Manning, 2000[154] Fair	Poor sleep quality (N)	ABPM	79	NA	29 (37%)	NA
Nasothimiou, 2013[160] Fair	Daily restriction, moderate to severe (N)	ABPM	104	NR (NR)	31 (30)	NR
		HBPM	104	NR (NR)	7 (7)	
	Daily restriction, moderate to severe†	ABPM	104	NR (NR)	1.6 (1.5)	p<0.001
		HBPM	104	NR (NR)	0.6 (1.0)	
	Discomfort, moderate to severe (N)	ABPM	104	NR (NR)	57 (55)	NR
		HBPM	104	NR (NR)	14 (13)	
	Discomfort, moderate to severe†	ABPM	104	NR (NR)	2.7 (1.3)	p<0.001
		HBPM	104	NR (NR)	1.5 (0.8)	
Sherwood, 2019[163] Fair	Sleep efficiency (% of time asleep during sleep period)	Men	69	77 (10)‡	ABPM-3: 80 (12)	NR
		Women	52	79 (9)‡	ABPM-3: 81 (11)	NR
	Total sleep time (hours)	Men	69	5.4 (1.4)‡	ABPM-3: 5.8 (1.3)	NR
		Women	52	5.6 (1.1)‡	ABPM-3: 6.2 (1.2)	NR
Tompson, 2019[162] Fair	Acceptability score§	ABPM	183	NA (NA)	3.2 (2.7, 3.7)‖	-0.6 (-1.2, -0.1) p<0.01
		HBPM	183	NA (NA	2.4 (1.9, 3.1)‖	
Verdecchia, 2007[156] Fair	Sleep duration < 2 hours < usual (N)	ABPM	2924	NA	807 (27.6%)	NA
	Sleep duration 2-4 hours < usual (N)	ABPM	2924	NA	281 (9.6%)	NA
	Sleep duration >4 hours < usual (N)	ABPM	2924	NA	117 (4.0%)	NA
	Sleep duration as usual (N)	ABPM	2924	NA	1711 (58.5%)	NA
Viera, 2011[158]	Disturbed significantly to	ABPM	60	5 (8.8%)	5 (8.8%), p=1.0	NA

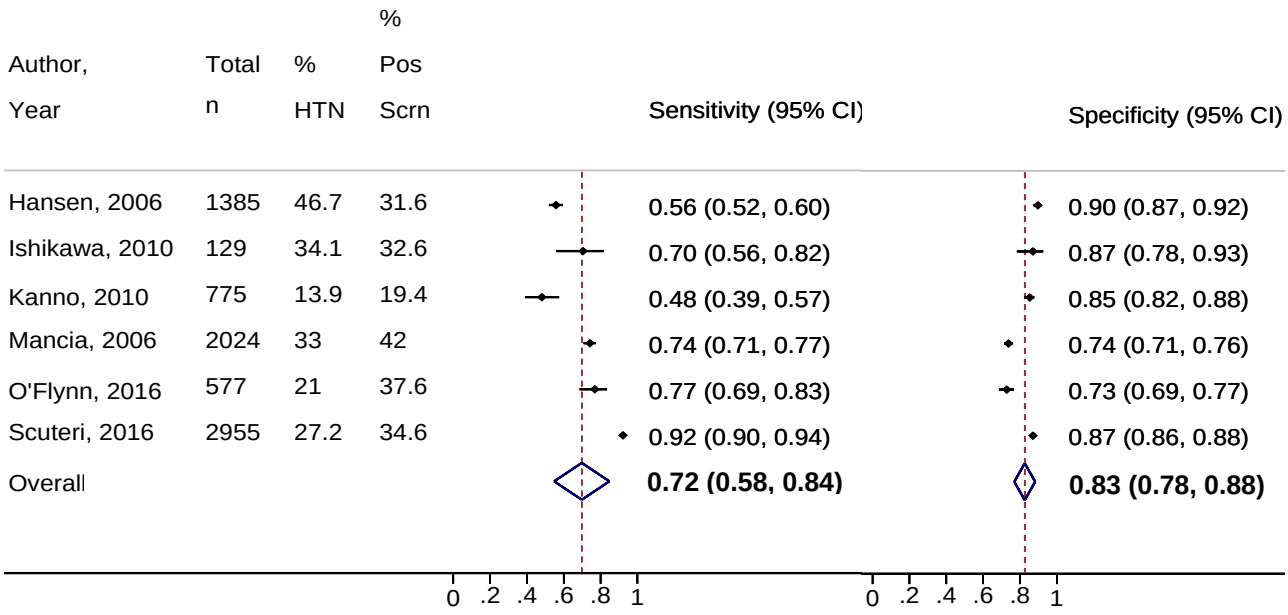
Appendix E Table 9. Tolerability/Sleep Results of Included Studies for KQ 4, by Author

Author, Year Quality	Outcome	Group	N	BL Mean (SE) or Number (%)	FU Mean (SE) or Number (%), p-value vs BL	Difference btw groups
Fair	remove it during night (N)					
	Interfered with normal sleep pattern (score)	ABPM	60	4.2 (3.3)*	4.3 (3.5)*, p=0.84	NA
	Stopped from falling asleep (N)	ABPM	60	12 (19.6%)	10 (16.1%), p=0.48	NA
	Woke up after falling asleep (N)	ABPM	60	42 (70.2%)	39 (64.9%), p=0.41	NA
	Disturbed significantly to remove it during day (N)	ABPM	60	3 (5.1%)	5 (8.5%), p=0.32	NA
	Bruising (N)	ABPM	60	4 (6.8%)	12 (20.3%), p=0.02	NA
	Pain (N)	ABPM	60	20 (33.9%)	21 (35.6%), p=0.76	NA
	Skin irritation (N)	ABPM	60	23 (39.0%)	27 (45.8%), p=0.35	NA
	Found monitor embarrassing (score)	ABPM	60	1.7 (2.8)*	2.2 (3.0)*, p=0.04	NA

*Points on Likert scale; extreme to painless: 1 to 5
† Likert scale 0 or 1–5 with higher levels indicating worse performance
‡Mean (Standard deviation)
§Mean of thirteen individual items, with scoring reversed for the positive items (11: accurate, 12: control, 13: good use of time). Lower scores indicate better acceptability
‖Median score (IQR)

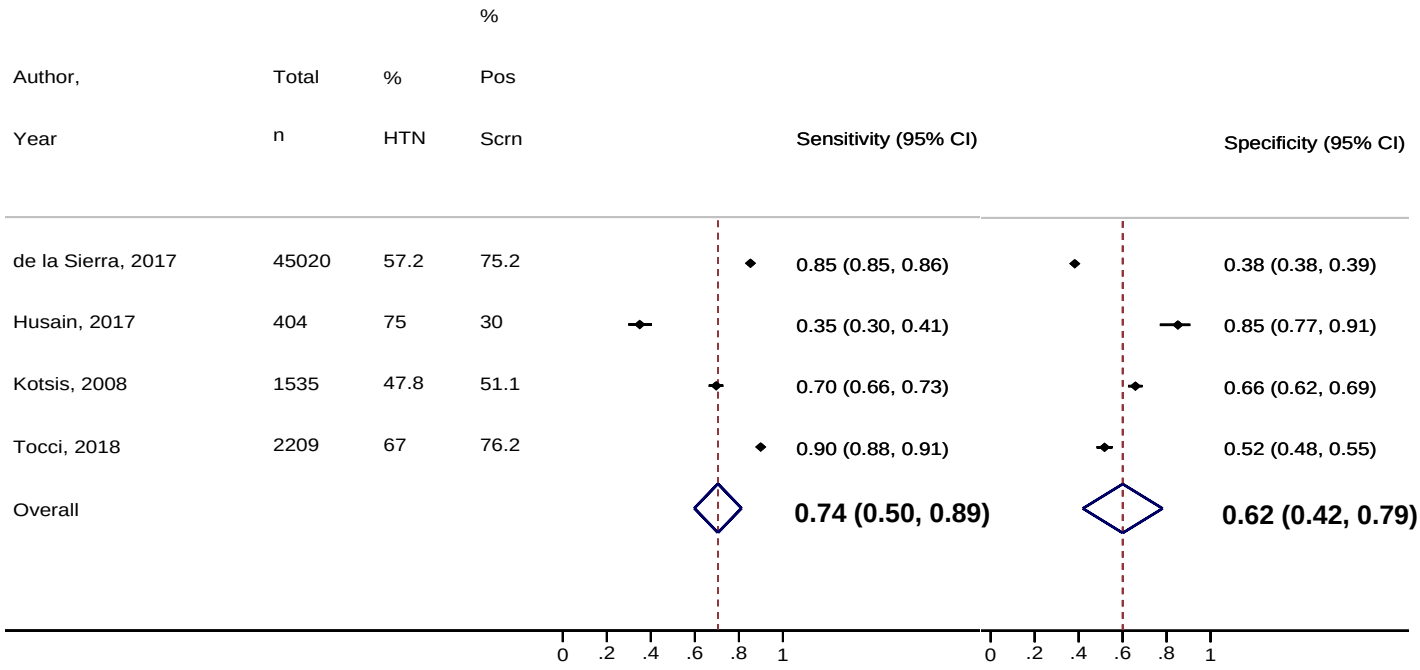
Abbreviations: ABPM = ambulatory blood pressure monitoring; AML = Amsterdam Mood List; BL = baseline; CI = confidence interval; FU = followup; HBPM = home blood pressure monitoring; NA = not applicable; NR = not reported; NS = not significant; NSD = no significant different; SE = standard error

Appendix F Figure 1. Key Question 2 Exploratory Analysis: Test Accuracy of Office Blood Pressure Monitoring at a Threshold of ≥140/90 mm Hg to Identify Hypertension Detected by 24-hr Ambulatory Blood Pressure Monitoring, by Author



NOTE: I^2 for sensitivity=98.2%, I^2 for specificity=96.9%

Appendix F Figure 2. Key Question 3 Exploratory Analysis: Test Accuracy of Confirmatory Office Blood Pressure Monitoring at a Threshold of ≥140/90 mm Hg to Identify Hypertension Detected by 24-hr Ambulatory Blood Pressure Monitoring, by Author



NOTE: I^2 for sensitivity=99.6%, I^2 for specificity=99.4%

Appendix G Table 1. Ongoing or Recently Completed Studies

Study reference/ trial identifier Principal Investigator	Official title	Location	Estimated N	Study objective	Relevant Outcomes	2021 status (Jan 2021)
NCT03267420 Marcel Ruzicka	Blood Pressure Measurement: Should Technique Define Targets?	Canada	90	To compare 4 different methods of measuring blood pressure in the office (casual, resting average of 3 readings with nurse present or absent for resting period, and average of 5 readings) as well as a 24-hour ambulatory measurement.	Difference in avg SBP between BP protocols	Unknown Est completion date: Jun 2019; no results published
NCT03130257 Beverly Green	Blood Pressure Checks for Diagnosing Hypertension (BP-CHECK)	US	510	To compare the accuracy and acceptability (i.e., comfort, convenience) of clinic, home, and kiosk BP testing to 24-hour BP ambulatory monitoring.	Comparative acceptability of clinic, home, kiosk, and 24-hour blood pressure diagnostic testing Pt reported QoL	Completed Completion date: Aug 2019; no results published Protocol published 2019
NCT03147573 Luis González de Paz	Validity of 1BPM for Diagnosis of Hypertension	Spain	214	To compare 1-hour ABPM, OBPM, and HBPM to daytime ABPM for the confirmation of hypertension diagnosis.	Accuracy of confirmation modalities compared to daytime ABPM	Completed Completion date: Sep 2019; No results published Protocol published 2019
NCT03732924 Sheldon Tobe	Zero to Five Automated Oscillometric Office Blood Pressure (AOBP) Measurement	Canada	600	To compare the difference between the daytime ABPM and AOBP with zero or five minutes wait time.	Difference in SBP and DBP between groups Difference in SBP and DBP between AOBP and daytime ABPM	Completed Completion date: Jul 2020; no results published
NCT03774147 Claire Zabawa	24-hr Ambulatory Blood Pressure Monitoring in Patients With Blood Pressure Above Thresholds in General Practice (MAPAGE)	France	1067	To analyze the feasibility and benefits of ABPM among primary care hypertensive patients in daily practice	Prevalence of WCH	Unknown Est completion date: Dec 2019

Appendix G Table 1. Ongoing or Recently Completed Studies

Study reference/ trial identifier Principal Investigator	Official title	Location	Estimated N	Study objective	Relevant Outcomes	2021 status (Jan 2021)
NCT03480217 Ian Kronish	Implementing Hypertension Screening Guidelines in Primary Care	US	2000	Use cluster-randomized design among 8 primary care clinics to test the effectiveness of a theory-informed multifaceted implementation strategy designed to increase the uptake of the 2015 United States Preventive Services Task Force (USPSTF) hypertension screening guidelines	Change in ordering of out-of-office blood pressure testing	Recruiting Est completion date: Apr 2021 Protocol published 2020
NCT03866226 XiaoHong PAN	The Effect of ABPM on Sleep Disturbance (EMBED)	China	450	To examine whether ABPM affects sleep, as well as the relationship and influencing factors of sleep and ABPM results, and screening for people who are susceptible to ABPM testing	Sleep questionnaire score	Active, not recruiting Est completion date: Dec 2021
NCT03855605 Moo-Yong Rhee	Diagnosis of Hypertension by Home Blood Pressure Monitoring	S Korea	500	To validate the diagnostic algorithm of HTN by using 24-hour ambulatory blood pressure and home blood pressure measurement	Validation of the diagnostic algorithm of HTN	Recruiting Est completion date: Dec 2020
NCT02804074 Gianfranco Parati	MASked-unconTrolled hypERtension Management Based on Office BP or on Out-of-office (Ambulatory) BP Measurement (MASTER)	Italy	1240	To investigate whether a management strategy based on out-of-office BP (Ambulatory BP monitoring) versus a management strategy based on office BP measurements is associated with differences in outcome	Percentage of participants w masked HTN; Tx of masked HTN	Recruiting Est completion date: Jan 2023 Protocol published 2018
ISRCTN13127656 Colin McAlister	HYVET 2: treatment of white coat hypertension in the very elderly	UK	100	To assess the cardiovascular outcomes following treatment of white coat hypertension with established anti-hypertensive drugs versus standard of care in the very elderly - feasibility study	Tx of WCH	Stopped; No longer recruiting Est completion date: Apr 2021
NCT02142881 Paul E Drawz	Treatment of Masked Hypertension	US	4	To evaluate whether antihypertensive treatment can	Percentage of participants w	Completed

Appendix G Table 1. Ongoing or Recently Completed Studies

Study reference/ trial identifier Principal Investigator	Official title	Location	Estimated N	Study objective	Relevant Outcomes	2021 status (Jan 2021)
				modify BP patterns in patients with masked hypertension	masked HTN; Tx of masked HTN	Completion date: Dec 2017; No results published
NCT02893358 Yan Li	Antihypertensive Treatment in Masked Hypertension for Target Organ Protection (ANTI-MASK)	China	300	To estimate the target organ protection after 12 months of antihypertensive treatment in masked hypertension patients with at least one kind of target organ damage	Percentage of participants w masked HTN; Tx of masked HTN	Recruiting Est completion date: Dec 2021

Abbreviations: ABPM = ambulatory blood pressure monitoring; avg = average; BP = blood pressure; DBP = diastolic blood pressure; Est = estimated; HTN = hypertension; SBP = systolic blood pressure; Tx = treatment; WCH = white coat hypertension