Online supplemental content.

Accuracy of Cuff Measured Blood Pressure: Compendium of three separate systematic reviews and individual participant data meta-analyses

Online Appendix 1. Unpublished study methods.

Meta-analysis 1.

Picone et al
52 participants undergoing cardiac catheterization at the Royal Hobart Hospital were studied. Exclusion criteria included arrhythmia or acute myocardial infarction. Upon completion of the diagnostic cardiac catheterization, a fluid-filled catheter was positioned in the ascending aorta and confirmed by fluoroscopy. The catheter was flushed and continuous, stable pressure waveform recordings were made for 20 seconds. The catheter was then immediately pulled back to the brachial artery (mid-humerus and confirmed by fluoroscopy) and flushed before recordings were made. A brachial cuff (placed on the contra-lateral upper arm as part of concurrent studies) was then inflated. Stable brachial pressure waveform recordings 20 seconds prior to the completion of cuff deflation were used in the analysis. No major haemodynamic shift between the aortic and brachial BP measurements was observed. The intra-arterial pressure signal was converted from Volts to mm Hg via a 2-point calibration method (LabChart version 7.1, AD Instruments, Colorado Springs, CO, USA). The University of Tasmania Health and Medical Human Research Ethics Committee approved the study protocol and participants signed informed consent.

Cheng et al
Study methods were the same as those for Cheng et al, 2010.

Pucci et al
29 participants undergoing diagnostic catheterization were studied. Exclusion criteria were: history of peripheral arterial disease, aortic aneurysm, absent brachial or radial pulses or known obstructive large artery atherosclerotic disease, active malignancy, hypotension (SBP <90mmHg), valvular heart disease, known left ventricular dysfunction (ejection fraction <50%) or arrhythmias (including frequent ventricular and supraventricular premature beats). A fluid-filled catheter was used for all haemodynamic recordings. Firstly, intra-arterial ascending aortic BP was recorded and then the catheter was pulled back to the brachial artery site (using a pre-defined length) in about 5-10 seconds. Intra-arterial brachial artery BP was then recorded. The fluid-filled catheter-manometer system (ACIST medical systems, Eden Prairie, MN, USA). The study protocol was reviewed and approved by the institutional
ethics committee. Written informed consent was obtained from each patient.

Meta-analysis 2.

Picone et al
40 participants undergoing cardiac catheterization at the Royal Hobart Hospital were studied. Exclusion criteria included arrhythmia or acute myocardial infarction. Upon completion of the diagnostic cardiac catheterization, a fluid-filled catheter was positioned mid-humerus. A brachial cuff (placed on the contra-lateral upper arm) was then inflated whilst intra-arterial BP waveforms were simultaneously recorded. The intra-arterial pressure 20 seconds prior to the completion of cuff deflation was used in the analysis. The intra-arterial pressure signal was converted from Volts to mm Hg via a 2-point calibration method (LabChart version 7.1, AD Instruments, Colorado Springs, CO, USA). The University of Tasmania Health and Medical Human Research Ethics Committee approved the study protocol and every participant signed informed consent.

Cheng et al
Study methods were the same as those for Cheng et al, 2010.

Pucci et al
29 participants undergoing diagnostic catheterization were studied. Exclusion criteria were: history of peripheral arterial disease, aortic aneurysm, absent brachial or radial pulses or known obstructive large artery atherosclerotic disease, active malignancy, hypotension (SBP <90mmHg), valvular heart disease, known left ventricular dysfunction (ejection fraction <50%) or arrhythmias (including frequent ventricular and supraventricular premature beats). A fluid-filled catheter was used for brachial artery recordings (ACIST medical systems, Eden Prairie, MN, USA). Brachial cuff BP was measured simultaneously with intra-arterial brachial artery BP from the contralateral arm. The study protocol was reviewed and approved by the institutional
ethics committee. Written informed consent was obtained from each patient.

Meta-analysis 3.

Broyd et al
Patients undergoing diagnostic angiography were recruited. Prior to angiography the brachial cuff of an oscillometric device was applied to the left upper arm. Intra-arterial access was achieved through either a radial or femoral approach and a 6 French catheter was inserted into the ascending aortic under fluoroscopic guidance and positioned approximately 1cm above the aortic valve. Central pressure was collected intra-arterially from the tip of the fluid-filled catheter using a Combomap console (Volcano Corporatino, San Diego, CA). Prior to each measurement, catheters were flushed and the BP trace visually inspected for quality. During all recordings, transducers were maintained at heart level. A simultaneous non-invasive measure was recorded using the suprasystolic blood pressure device (Pulsecor R6.5; Auckland, New Zealand), ensuring a signal quality was excellent. Meticulous attention was paid to the timing of the non-invasive data acquisition and the identical portion of the intra-arterial data was exported.

Cheng et al
Study methods were the same as those for Cheng et al, 2010.

Korolkova et al
Study methods were the same as those for Park et al, 2014.

Picone et al
We studied 146 participants undergoing cardiac catheterization at the Royal Hobart Hospital. Exclusion criteria included arrhythmia, aortic stenosis or acute myocardial infarction. Prior to the cardiac angiogram, a fluid-filled catheter was positioned in the ascending aorta, confirmed by fluoroscopy. The catheter was flushed and recording commenced. An oscillometric cuff was then inflated to obtain brachial cuff BP. Ten seconds of steady state intra-arterial aortic BP was analysed, and this was recorded approximately 10 seconds after the brachial cuff BP, to coincide with non-invasive central BP estimation. The intra-arterial pressure signal was converted from Volts to mm Hg via a 2-point calibration method (LabChart version 7.1, AD Instruments, Colorado Springs, CO, USA). The University of Tasmania Health and Medical Human Research Ethics Committee approved the study protocol and every participant signed informed consent.

Pucci et al
29 participants undergoing diagnostic catheterization were studied. Exclusion criteria were: history of peripheral arterial disease, aortic aneurysm, absent brachial or radial pulses or known obstructive large artery atherosclerotic disease, active malignancy, hypotension (SBP <90mmHg), valvular heart disease, known left ventricular dysfunction (ejection fraction <50%) or arrhythmias (including frequent ventricular and supraventricular premature beats). A fluid-filled catheter was used for intra-arterial aortic BP recordings (ACIST medical systems, Eden Prairie, MN, USA). Intra-arterial ascending aortic BP was recorded and then the catheter was pulled back to the brachial artery site (using a pre-defined length) in about 5-10 seconds. Brachial cuff BP was measured simultaneously with intra-arterial brachial artery BP. Brachial cuff BP and intra-arterial aortic BP data was extracted and used in the present meta-analysis.

Online Appendix 2. Methods for data extraction from published tables.

Meta-analysis 1

Gould and Shariff et al, 1969[1]

Data were extracted from Table 1 on page 35 of the publication. Intra-arterial aortic BP was extracted from the column labelled "Aorta", and intra-arterial brachial BP from the column labelled "B.A".

Kavanagh-Gray, 1964[2]

Data were extracted from Table I page 1469 of the publication. Clinical characteristics were extracted from the "Sex" and "Age" columns. Intra-arterial brachial systolic and diastolic BP was extracted from the column "Brachial artery pressure (mm. Hg) S/D". Intra-arterial aortic systolic and diastolic BP were extracted from the column "Central aortic pressure (mm. Hg) S/D".

Kelly et al, 1990[3]

Data were extracted from Table I on page 141 of the publication. Clinical characteristics were extracted from the "Age" and "Sex" columns. Intra-arterial ascending aortic systolic and diastolic BP were extracted from the columns labelled "AA systolic" and "AA diastolic". Intra-arterial brachial systolic and diastolic BP were extracted from the columns labelled "BA systolic" and "BA diastolic". Heart rate data was extracted from the column labelled "Heart rate". In all cases only the data labelled "C" were extracted because this was collected under control (baseline conditions.

Meta-analysis 2

Berliner et al, 1961[4]

Table 1 (pages 11-12) of the publication reported the brachial cuff BP and the highest and lowest intra-arterial brachial BP taken during a simultaneous recording period. The highest and lowest intra-arterial brachial BP values were averaged and used in the meta-analysis.

Freis et al, 1968[5]

Data was extracted from Table 5 of the publication (page 1093) and used for analysis.

Gelman et al, 1981[6]

Table 2 of the publication (page 370) reported a "representative raw data sample" of Group 3 (Cardiac catheterizations). Data from five subjects was reported and the IBP column (brachial cuff BP) and the BAP column (intra-arterial brachial BP) were extracted and used in the meta-analysis.

Hunyor et al, 1978[7]

This study compared seven different brachial cuff BP device against intra-arterial brachial BP in nine participants. The individual data was presented in Table 2 (page 161). Data from the comparison between brachial cuff BP device "Accoson" (a standard mercury sphygmomanometer) and intra-arterial brachial BP was used in the meta-analysis.

Raftery and Ward, 1968[8]

Data were extracted from Table 1 (page 212) of the publication. Age, height, weight were extracted as clinical characteristics. Brachial cuff systolic and diastolic BP data were extracted from the "indirect" column in the "systolic" section and the "Phase V diastolic" section. Intra-arterial brachial BP were extracted from the "direct" columns of the same sections of the table.

Roberts et al, 1953[9]

Table 1 of the publication (pages 234-235) reported the individual brachial cuff and intra-arterial brachial BP data. Column 4 reported the brachial cuff data and was labelled "Cuff". This column corresponded to the intra-arterial brachial column labelled "Sanb." Both these columns were extracted and used in analysis. The diastolic BP extracted was from the 5th Korotkoff sound, unless this value was 0, in which case, the 4th Korotkoff sound was extracted.

Meta-analysis 3

Borow et al, 1982[10]

Clinical data (age, sex and heart rate) were extracted from Table I on page 881 of the publication. Systolic and diastolic blood pressure data from the "Mean Ao" and "Mean Din" columns were extracted from Table II on page 882 of the publication. "Din" refers to the brachial cuff device that was used in the study, the Dinamap 845.

Nagle et al, 1966[11]

This study comprised two subjects. The supine resting "direct recording" and "auscultation" systolic and diastolic blood pressures were extracted from Table 1. Heart rate during supine rest was extracted from Table 2, as well as subject age and weight. Under the heading "Procedures" in the text of the publication, the authors state that both subjects are male.

Online Appendix 3. Description of study quality score attributes

Meta-analysis 1

A study quality score was developed to assess the methods used in each study included in the meta-analysis. The scoring system considered five study attributes and one point was awarded per attribute when the highest standard was achieved. If the highest standard was not achieved for an attribute, then a zero was assigned for that attribute. Thus a study could achieve a score from 0 to 5 points. A description is presented below.

1. Type of catheter

- **a)** micromanometer tip: **1 point** OR
- **b)** fluid filled catheter manometer system – description of frequency and damping characteristics: **1 point** OR
- **c)** Fluid filled catheter manometer system – insufficient detail for b): **0 points**

2. Sequence of aortic and brachial BP measurements

- **a)** Simultaneous: **1 point** OR
- **b)** sequential, describing the time between measurements and that no major haemodynamic changes occurred: **1 point** OR
- **c)** sequential, insufficient detail for b): **0 points**

3. Position of catheter in aorta/brachial artery

- **a)** described with sufficient detail to ascertain position (aortic BP was required to be measured in the proximal aorta or aortic arch): **1 point** OR
- **b)** general description: **0 points**

4. Pressure wave capture length

- **a)** > 1 beat of continuously captured data, with a description that the recording was of good quality (i.e period of capture was stable): **1 point** OR
- **b)** 1 beat: **0 points** OR
- **c)** or no description: **0 points**

5. Participant characteristics

- **a)** description of patient inclusion/exclusion criteria (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **1 point** OR
- **b)** detailed description of the patient clinical characteristics (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **1 point** OR
- **c)** no, or poor, description of the patient inclusion/exclusion criteria (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **0 points** OR
- **d)** no or poor description of patient clinical characteristics (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **0 points**

Meta-analysis 2

A study quality score was developed to assess each study included in the meta-analysis. The scoring system considered six study attributes and one point was awarded per attribute when the highest standard was achieved. If the highest standard was not achieved for an attribute, then a zero was assigned for that attribute. Thus a study could achieve a score from 0 to 6 points. A description is presented below.

1. Type of catheter used

- **a)** micromanometer tip: **1 point** OR
- **b)** fluid filled catheter manometer system – description of frequency and damping characteristics: **1 point** OR
- **c)** Fluid filled catheter manometer system – insufficient detail for b): **0 points**

2. Sequence of brachial cuff and intra-arterial brachial BP measurement protocol

- **a)** Simultaneous: **1 point** OR

b) sequential, describing the time between measurements and that no major haemodynamic changes occurred: **1 point** OR
c) sequential, insufficient detail for b): **0 points**

3. **Position of catheter in brachial artery**

a) described with sufficient detail to ascertain position: **1 point** OR
b) general description: **0 points**

4. Pressure wave capture length

a) > 1 beat of continuously captured data, with a description that the recording was of good quality (i.e period of capture was stable): **1 point** OR
b) 1 beat: **0 points** OR
c) or no description: **0 points**

5. Patient characteristics description

a) description of patient inclusion/exclusion criteria (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **1 point** OR
b) detailed description of the patient clinical characteristics (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **1 point** OR
c) no, or poor, description of the patient inclusion/exclusion criteria (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **0 points** OR
d) no or poor description of patient clinical characteristics (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **0 points**

Meta-analysis 3

A study quality score was developed to assess the risk of bias for each study included in the meta-analysis. The scoring system considered five study attributes and one point was awarded per attribute when the highest standard was achieved. If the highest standard was not achieved for an attribute, then a zero was assigned for that attribute. Thus a study could achieve a score from 0 to 5 points. A description is presented below.

1. Type of catheter

a) micromanometer tip: **1 point** OR
b) fluid filled catheter manometer system – description of frequency and damping characteristics: **1 point** OR
c) Fluid filled catheter manometer system – insufficient detail for b): **0 points**

2. Sequence of aortic and brachial BP measurements

a) Simultaneous: **1 point** OR
b) sequential, describing the time between measurements and that no major haemodynamic changes occurred: **1 point** OR
c) sequential, insufficient detail for b): **0 points**

3. Position of catheter in aorta/brachial artery

a) described with sufficient detail to ascertain position (aortic BP was required to be measured in the proximal aorta or aortic arch): **1 point** OR
b) general description: **0 points**

4. Pressure wave capture length

a) > 1 beat of continuously captured data, with a description that the recording was of good quality (i.e period of capture was stable): **1 point** OR
b) 1 beat: **0 points** OR
c) or no description: **0 points**

5. Participant characteristics

- **a)** description of patient inclusion/exclusion criteria (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **1 point** OR
- **b)** detailed description of the patient clinical characteristics (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **1 point** OR
- **c)** no, or poor, description of the patient inclusion/exclusion criteria (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **0 points** OR
- **d)** no or poor description of patient clinical characteristics (with reference to conditions that may cause haemodynamic instability / difficulty to obtain accurate measurements): **0 points**

Online Appendix 4. Additional statistical methods

Mean absolute difference was calculated as the absolute value of the BP difference at the individual participant level. This approach provides a measure of agreement between a "predicted" value (cuff BP) and "observed" value (intra-arterial BP). Linear mixed modelling was used for one-stage meta-analysis to account for the clustering of individuals within studies.

Each individual data set was normally distributed except for mean absolute difference data which were square root transformed to obtain normal distributions and back transformed for presentation.

In several studies, multiple brachial cuff devices were tested on the same subjects. In each of these cases, the preference was to use mercury sphygmomanometry data, because this is the current brachial cuff reference standard. This protocol was used to ensure that each subject was included once in the analysis so that there was not greater weighting toward certain data where variance may be reduced due to data being from the same subject.

Subject characteristic analysis (Online Tables 13-15) was derived from individual data, and in the cases that this was unavailable, aggregate data extracted from published studies was used. Therefore, two-stage meta-analysis was used to calculate the subject characteristics.

Using linear mixed modelling, clinical and demographic factors (Online Tables 19-20) were assessed to determine correlations and potential predictors of the difference between cuff BP and intra-arterial brachial or aortic BP. This analysis was performed in a subset of studies where the variables (e.g. age, sex, body mass index) were available.

Sensitivity analyses were among studies that received the maximum study quality score to assess whether results were influenced by study design factors (Online Tables 20-22) and separately to assess published, compared with unpublished data sources (Online Tables 23-25). These analyses were completed using linear mixed modelling, with the study score or publication status included as a variable (0=non-maximum rated study, 1=maximum rated study and 0=published, 1=published). Linear mixed models were also used for sensitivity analysis of the number of cuff BP measures (0=single cuff BP or uncertain, 1=average of multiple cuff BP) and type of catheter (0=fluid-filled, 1=micromanometer-tipped). BP classification analysis was performed separately for single cuff BP (or uncertain number of measurements) compared with average of multiple cuff BP measurements.

Online Appendix 5. Reasons for discrepancies between number of subjects analysed with number of subjects reported in publication.

Meta-analysis 1

Kavanagh-Gray, 1964[2]
50 subjects in publication, 49 used in analysis.
One extreme data point judged to be non-physiological was identified whereby aortic SBP was 120 mm Hg and brachial SBP 250 mm Hg. [2] The subject was a 24-year-old male with aortic valvular incompetence. This data was extracted from a published table and we were unable to contact the relevant author to verify this result and, therefore, removed this subject from all analyses.

Meta-analysis 2

Bos et al, 1992[12]
76 subjects in publication, 57 used in analysis.
Group A (n=19) was excluded because the intra-arterial BP was measured in the aorta.

Gelman et al, 1981[6]
20 subjects in publication, 5 used in analysis.
Data was extracted from a table in the publication (see Online Appendix 2), however, individual data was only reported for five subjects.

Gould et al, 1984[13]
26 subjects in publication, 28 used in analysis.
Extra data available from the raw thesis data provided.

Melamed et al, 2012[14]
53 subjects in publication, 3 used in analysis.
47 patients excluded because the radial artery was used for intra-arterial BP measurement. A further three subjects were excluded due to data being recorded in the presence of a blood conserving device that was determined to influence the natural frequency of the intra-arterial pressure system and therefore may affect the accuracy of these measurements.

Muecke et al, 2009[38]
18 subjects in publication, 2 used in analysis.
16 patients excluded because the radial artery was used for intra-arterial BP measurement.

Sagiv et al, 1999[15]
14 subjects in publication, 12 used in analysis.
Data was extracted from a scatter plot (see Online Table 3), however, could not be extracted for two subjects.

Vardan et al, 1983[16]
26 subjects in publication, 24 used in analysis.
Data was extracted from a scatter plot (see Online Table 3), however, could not be extracted for two subjects.

Meta-analysis 3

Aakhus et al, 1993[17]
26 subjects in publication, 28 used in analysis.
Extra data was available from the author that was not used in the original publication.

Bos et al, 1992[12]
76 subjects in publication, 19 used in analysis.
Groups B, C and D (n=13, 15, 29) were excluded because the intra-arterial BP was measured in the brachial artery.

Cremer et al, 2012
145 subjects in publication, 144 used in SBP analysis, 142 in DBP and PP analysis.
One data point unavailable for all analysis. 2 subjects did not have intra-arterial DBP available.

Laugesen et al 2014[18]/Rossen et al, 2014[19]
34 subjects in Laugesen et al, 22 in Rossen et al. 37 total used in analysis.
Data were pooled for analysis due to use of identical study protocols except for the type of cuff BP device. Many subjects were included in both studies, therefore, all data from Laugesen et al was used, and additional subjects from the Rossen et al study were subsequently pooled for the analysis.

Lin AC et al, 2012 [20]
37 subjects in publication, 35 used in analysis.
2 subjects excluded due to intra-arterial aortic BP recording in subclavian root.

Lowe et al, 2009[21]
16 subjects in publication, 37 used in analysis.
Extra data was available from the author that was not used in the original publication.

Pucci et al, 2013[22]
50 subjects in publication, 58 used in analysis.
8 subjects excluded from publication due to poor quality radial tonometry waveforms. These are included in the current analysis because the brachial cuff and intra-arterial aortic BP data was good quality.

Saul et al, 1995[23]
100 subjects in publication, 97 used in analysis.
Data was extracted from a scatter plot (see Online Table 3), however, could not be extracted for three subjects.

Smulyan et al, 2003[24]
50 subjects in publication, 25 used in analysis.
25 subjects excluded due to recording of intra-aortic BP from the descending aorta.

Takazawa et al, 2012[25]
66 subjects in publication, 52 used in analysis.
14 subjects excluded due to identical data in Takazawa et al, 2007[26].

Weber et al, 1999[27]
33 subjects in publication, 36 used in analysis.
Extra data was available from the author that was not used in the original publication.

Online Appendix 6. Meta-analysis one results

In meta-analysis 1, brachial artery SBP was significantly higher than aortic SBP and PP ($p<0.0001$; Online Figure 7A, C). On the other hand, brachial DBP was marginally, but significantly lower than aortic DBP ($p=0.038$; Online Figure 7B). The range of differences for SBP, DBP and PP was large (-9 to 62 mmHg, -22 to 25 mmHg and -17 to 62 mmHg respectively, Online Figure 8). The pooled correlation coefficients showed strong associations between intra-arterial brachial and aortic SBP ($r=0.92$, 95%CI 0.88 to 0.95), DBP ($r=0.93$, 95%CI 0.91 to 0.95) and PP ($r=0.89$, 95%CI 0.86 to 0.93, $p<0.0001$ all, Online Figure 9).

Sensitivity analysis

Participants were significantly older and had higher intra-arterial brachial SBP and intra-arterial aortic PP in the maximum rated compared to the non-maximum rated studies in meta-analysis 1. There were no other significant differences between the maximum rated and non-maximum rated studies ($p>0.05$ all, Online Table 20). There were no significant differences in BP values for published versus unpublished data ($p>0.05$, Online Tables 23).

Online Table 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses-individual participant data (PRISMA-IPD) checklist.

PRISMA-IPD Section/topic	Item No	Checklist item	Reported on page
Title			
Title	1	Identify the report as a systematic review and meta-analysis of individual participant data.	1
Abstract			
Structured summary	2	Provide a structured summary including as applicable:	3
		Background: state research question and main objectives, with information on participants, interventions, comparators and outcomes.	
		Methods: report eligibility criteria; data sources including dates of last bibliographic search or elicitation, noting that IPD were sought; methods of assessing risk of bias.	
		Results: provide number and type of studies and participants identified and number (%) obtained; summary effect estimates for main outcomes (benefits and harms) with confidence intervals and measures of statistical heterogeneity. Describe the direction and size of summary effects in terms meaningful to those who would put findings into practice.	
		Discussion: state main strengths and limitations of the evidence, general interpretation of the results and any important implications.	
		Other: report primary funding source, registration number and registry name for the systematic review and IPD meta-analysis.	
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known.	5-6
Objectives	4	Provide an explicit statement of the questions being addressed with reference, as applicable, to participants, interventions, comparisons, outcomes and study design (PICOS). Include any hypotheses that relate to particular types of participant-level subgroups.	6
Methods			
Protocol and registration	5	Indicate if a protocol exists and where it can be accessed. If available, provide registration information including registration number and registry name. Provide publication details, if applicable.	Protocol available on request
Eligibility criteria	6	Specify inclusion and exclusion criteria including those relating to participants, interventions, comparisons, outcomes, study design and characteristics (e.g. years when conducted, required minimum follow-up). Note whether these were applied at the study or individual level i.e. whether eligible participants were included (and ineligible participants excluded) from a study that included a wider population than specified by the review inclusion criteria. The rationale for criteria should be stated.	7-8
Identifying studies - information sources	7	Describe all methods of identifying published and unpublished studies including, as applicable: which bibliographic databases were searched with dates of coverage; details of any hand searching including of conference proceedings; use of study registers and agency or company databases; contact with the original research team and experts in the field; open adverts and surveys. Give the date of last search or elicitation.	7
Identifying studies - search	8	Present the full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Online Table 2
Study selection processes	9	State the process for determining which studies were eligible for inclusion.	7-8
Data collection processes	10	Describe how IPD were requested, collected and managed, including any processes for querying and confirming data with investigators. If IPD were not sought from any eligible study, the reason for this should be stated (for each such study).	8
		If applicable, describe how any studies for which IPD were not available were dealt with. This should include whether, how and what aggregate data were sought or extracted from study reports and publications (such as extracting data independently in duplicate) and any processes for obtaining and confirming these data with investigators.	

Data items	11	Describe how the information and variables to be collected were chosen. List and define all study level and participant level data that were sought, including baseline and follow-up information. If applicable, describe methods of standardising or translating variables within the IPD datasets to ensure common scales or measurements across studies.	8
IPD integrity	A1	Describe what aspects of IPD were subject to data checking (such as sequence generation, data consistency and completeness, baseline imbalance) and how this was done.	8, Online Table 3
Risk of bias assessment in individual studies.	12	Describe methods used to assess risk of bias in the individual studies and whether this was applied separately for each outcome. If applicable, describe how findings of IPD checking were used to inform the assessment. Report if and how risk of bias assessment was used in any data synthesis.	8
Specification of outcomes and effect measures	13	State all treatment comparisons of interests. State all outcomes addressed and define them in detail. State whether they were pre-specified for the review and, if applicable, whether they were primary/main or secondary/additional outcomes. Give the principal measures of effect (such as risk ratio, hazard ratio, difference in means) used for each outcome.	6, 8-9
Synthesis methods	14	Describe the meta-analysis methods used to synthesise IPD. Specify any statistical methods and models used. Issues should include (but are not restricted to): • Use of a one-stage or two-stage approach. • How effect estimates were generated separately within each study and combined across studies (where applicable). • Specification of one-stage models (where applicable) including how clustering of patients within studies was accounted for. • Use of fixed or random effects models and any other model assumptions, such as proportional hazards. • How (summary) survival curves were generated (where applicable). • Methods for quantifying statistical heterogeneity (such as I^2 and τ^2). • How studies providing IPD and not providing IPD were analysed together (where applicable). • How missing data within the IPD were dealt with (where applicable).	9-10, Online Appendix 4
Exploration of variation in effects	A2	If applicable, describe any methods used to explore variation in effects by study or participant level characteristics (such as estimation of interactions between effect and covariates). State all participant-level characteristics that were analysed as potential effect modifiers, and whether these were pre-specified.	9
Risk of bias across studies	15	Specify any assessment of risk of bias relating to the accumulated body of evidence, including any pertaining to not obtaining IPD for particular studies, outcomes or other variables.	9-10
Additional analyses	16	Describe methods of any additional analyses, including sensitivity analyses. State which of these were pre-specified.	10
Results			
Study selection and IPD obtained	17	Give numbers of studies screened, assessed for eligibility, and included in the systematic review with reasons for exclusions at each stage. Indicate the number of studies and participants for which IPD were sought and for which IPD were obtained. For those studies where IPD were not available, give the numbers of studies and participants for which aggregate data were available. Report reasons for non-availability of IPD. Include a flow diagram.	10, Online Figures 1-6
Study characteristics	18	For each study, present information on key study and participant characteristics (such as description of interventions, numbers of participants, demographic data, unavailability of outcomes, funding source, and if applicable duration of follow-up). Provide (main) citations for each study. Where applicable, also report similar study characteristics for any studies not providing IPD.	Online Tables 7-15
IPD integrity	A3	Report any important issues identified in checking IPD or state that there were none.	11

Risk of bias within studies	19	Present data on risk of bias assessments. If applicable, describe whether data checking led to the up-weighting or down-weighting of these assessments. Consider how any potential bias impacts on the robustness of meta-analysis conclusions.	Online Tables 20-25
Results of individual studies	20	For each comparison and for each main outcome (benefit or harm), for each individual study report the number of eligible participants for which data were obtained and show simple summary data for each intervention group (including, where applicable, the number of events), effect estimates and confidence intervals. These may be tabulated or included on a forest plot.	Figure 1, 2, 3
Results of syntheses	21	Present summary effects for each meta-analysis undertaken, including confidence intervals and measures of statistical heterogeneity. State whether the analysis was pre-specified, and report the numbers of studies and participants and, where applicable, the number of events on which it is based.	11-13, Figure 1, 2, 3
		When exploring variation in effects due to patient or study characteristics, present summary interaction estimates for each characteristic examined, including confidence intervals and measures of statistical heterogeneity. State whether the analysis was pre-specified. State whether any interaction is consistent across trials.	
		Provide a description of the direction and size of effect in terms meaningful to those who would put findings into practice.	
Risk of bias across studies	22	Present results of any assessment of risk of bias relating to the accumulated body of evidence, including any pertaining to the availability and representativeness of available studies, outcomes or other variables.	Online Tables 20-25
Additional analyses	23	Give results of any additional analyses (e.g. sensitivity analyses). If applicable, this should also include any analyses that incorporate aggregate data for studies that do not have IPD. If applicable, summarise the main meta-analysis results following the inclusion or exclusion of studies for which IPD were not available.	13-14, Online Tables 6-19
Discussion			
Summary of evidence	24	Summarise the main findings, including the strength of evidence for each main outcome.	14-15
Strengths and limitations	25	Discuss any important strengths and limitations of the evidence including the benefits of access to IPD and any limitations arising from IPD that were not available.	18
Conclusions	26	Provide a general interpretation of the findings in the context of other evidence.	18-19
Implications	A4	Consider relevance to key groups (such as policy makers, service providers and service users). Consider implications for future research.	14-19
Funding			
Funding	27	Describe sources of funding and other support (such as supply of IPD), and the role in the systematic review of those providing such support.	No funding

Online Table 2. A search of four online databases (PubMed [Medline], Scopus, Web of Knowledge and Embase) was conducted from the earliest available records to 9 May 2016. There were slight modifications of the search terms for each meta-analysis, as outlined in this table. The search terms were similar across the databases, with the exception of differences in the controlled language between each. Manual searches of reference lists within identified articles were also undertaken.

Meta-analysis 1. Intra-arterial aortic and intra-arterial brachial BP	
PubMed	(((invasive OR invasively OR intra arterial OR direct OR true OR catheter* OR simultaneous* OR pull back OR needle OR wire)) AND (aorta OR aortic OR central)) AND (brachi* OR ((upper) AND (limb OR arm)) OR peripher*)) AND (pulse OR arterial pressure[MeSH Major Topic] OR pressure* OR blood pressure determination[MeSH Major Topic]))))) NOT (animals [mh] not (humans [mh] and animals [mh]))))
Scopus	TITLE-ABS-KEY (invasive*) OR TITLE-ABS-KEY (intra arterial) OR TITLE-ABS-KEY (direct) OR TITLE-ABS-KEY (true) OR TITLE-ABS-KEY (catheter*) OR TITLE-ABS-KEY (simultaneous*) OR TITLE-ABS-KEY (pull back) OR TITLE-ABS-KEY (needle) OR TITLE-ABS-KEY (wire) AND TITLE-ABS-KEY (aorta) OR TITLE-ABS-KEY (aortic) OR TITLE-ABS-KEY (central) AND TITLE-ABS-KEY (brachi*) OR TITLE-ABS-KEY ((upper) AND (limb OR arm)) OR TITLE-ABS-KEY (peripher*) AND TITLE-ABS-KEY (pressure*) OR TITLE-ABS-KEY (pulse) OR INDEXTERMS (blood pressure determination) OR INDEXTERMS (arterial pressure) AND SRCTYPE (j) AND KEY (human*) AND (EXCLUDE (DOCTYPE , "re"))
Web of Knowledge	((invasive OR invasively OR intra arterial OR direct OR true OR catheter* OR simultaneous* OR pull back OR needle OR wire) AND (aorta OR aortic OR central) AND ((brachi* OR ((upper) AND (limb OR arm)) OR peripher*)) AND (pulse OR pressure*)) Refined by: RESEARCH AREAS: (CARDIOVASCULAR SYSTEM CARDIOLOGY) AND [excluding]DOCUMENT TYPES: (REVIEW) Timespan: All years. Search language=Auto
Embase	invasive OR invasively OR intra AND arterial OR direct OR true OR catheter* OR simultaneous* OR (pull AND back) OR needle OR wire AND (aorta OR aortic OR central) AND (brachi* OR (upper AND (limb OR arm)) OR peripher*) AND (pulse OR pressure* OR blood AND pressure AND measurement OR 'arterial pressure') NOT (animal NOT (human AND animal)) AND ([article]/lim OR [article in press]/lim OR [conference abstract]/lim OR [conference paper]/lim OR [erratum]/lim OR [letter]/lim OR [note]/lim)
Meta-analysis 2. Cuff BP and intra-arterial brachial BP	
PubMed	(((invasive OR invasively OR intra arterial OR direct OR true OR catheter* OR simultaneous* OR needle OR wire OR blood pressure determination[MeSH Major Topic]) AND (noninvasive OR indirect OR oscillometr* OR cuff OR auscultat* OR accura* OR casual OR office OR clinic) AND (brachi* OR ((upper) AND (limb OR arm)) OR peripher* OR oscillometr* OR cuff OR auscultat* OR sphygmomano* OR korotko*) AND (pulse OR arterial pressure[MeSH Major Topic] OR pressure*))) NOT (animal* NOT (human AND animal))
Scopus	TITLE-ABS-KEY (invasive) OR TITLE-ABS-KEY (invasively) OR TITLE-ABS-KEY (intra arterial) OR TITLE-ABS-KEY (direct) OR TITLE-ABS-KEY (true) OR TITLE-ABS-KEY (catheter*) OR TITLE-ABS-KEY (simultaneous*) OR TITLE-ABS-KEY (needle) OR TITLE-ABS-KEY (wire) OR INDEXTERMS (blood pressure determination) AND TITLE-ABS-KEY (noninvasive) OR TITLE-ABS-KEY (indirect) OR TITLE-ABS-

	KEY (oscillometr*) OR TITLE-ABS-KEY (cuff) OR TITLE-ABS-KEY (auscultat*) OR TITLE-ABS-KEY (accura*) OR TITLE-ABS-KEY (casual) OR TITLE-ABS-KEY (office) OR TITLE-ABS-KEY (clinic) AND TITLE-ABS-KEY (brachi*) OR TITLE-ABS-KEY ((upper) AND (limb OR arm)) OR TITLE-ABS-KEY (peripher*) OR TITLE-ABS-KEY (oscillomet*) OR TITLE-ABS-KEY (cuff) OR TITLE-ABS-KEY (auscultat*) OR TITLE-ABS-KEY (korotko*) OR TITLE-ABS-KEY (sphygmomanomet*) AND TITLE-ABS-KEY (pressure*) OR TITLE-ABS-KEY (pulse) OR INDEXTERMS (arterial pressure) AND SRCTYPE (j) AND KEY (human*)
Web of Knowledge	invasive OR invasively OR intra arterial OR direct OR true OR catheter* OR simultaneous* OR needle OR wire OR 'blood pressure determination') AND (noninvasive OR indirect OR oscillometr* OR cuff OR auscultat* OR accura* OR casual OR office OR clinic) AND (brachi* OR ((upper) AND (limb OR arm)) OR peripher* OR oscillometr* OR cuff OR auscultat* OR sphygmomano* OR korotko*) AND (pulse OR 'arterial pressure' OR pressure*))) NOT (animal* NOT (human AND animal))) Refined by: RESEARCH AREAS: (CARDIOVASCULAR SYSTEM CARDIOLOGY) Timespan: All years. Search language=Auto
Embase	invasive OR invasively OR intra AND arterial OR direct OR true OR catheter* OR simultaneous* OR needle OR wire OR 'blood pressure measurement' AND (noninvasive OR indirect OR oscillometr* OR cuff OR auscultat* OR accura* OR casual OR office OR clinic) AND (brachi* OR (upper AND (limb OR arm)) OR peripher* OR oscillometr* OR cuff OR auscultat* OR sphygmomano* OR korotko*) AND (pulse OR 'arterial pressure' OR pressure*) NOT (animal* NOT ('human' AND 'animal'))
Meta-analysis 3.	**Cuff BP and intra-arterial aortic BP**
PubMed	((invasive OR invasively OR intra arterial OR direct OR true OR catheter* OR simultaneous* OR pull back OR needle OR wire)) AND (aorta OR aortic OR central)) AND (brachi* OR ((upper) AND (limb OR arm)) OR peripher* OR oscillometr* OR cuff OR auscultat* OR korotko* OR sphygmoman* OR noninvasive OR indirect)) AND (pulse OR arterial pressure[MeSH Major Topic] OR pressure* OR blood pressure determination[MeSH Major Topic]))))) NOT (animals [mh] not (humans [mh] and animals [mh]))
Scopus	TITLE-ABS-KEY (invasive*) OR TITLE-ABS-KEY (intra arterial) OR TITLE-ABS-KEY (direct) OR TITLE-ABS-KEY (true) OR TITLE-ABS-KEY (catheter*) OR TITLE-ABS-KEY (simultaneous*) OR TITLE-ABS-KEY (pull back) OR TITLE-ABS-KEY (needle) OR TITLE-ABS-KEY (wire) AND TITLE-ABS-KEY (aorta) OR TITLE-ABS-KEY (aortic) OR TITLE-ABS-KEY (central) AND TITLE-ABS-KEY (brachi*) OR TITLE-ABS-KEY ((upper) AND (limb OR arm)) OR TITLE-ABS-KEY (peripher*) OR TITLE-ABS-KEY (oscillomet*) OR TITLE-ABS-KEY (cuff) OR TITLE-ABS-KEY (auscultat*) OR TITLE-ABS-KEY (korotko*) OR TITLE-ABS-KEY (sphygmomanomet*) OR TITLE-ABS-KEY (noninvasive) OR TITLE-ABS-KEY (indirect) AND TITLE-ABS-KEY (pressure*) OR TITLE-ABS-KEY (pulse) OR INDEXTERMS (blood pressure determination) OR INDEXTERMS (arterial pressure) AND SRCTYPE (j) AND KEY (human*) AND (EXCLUDE (DOCTYPE , "re"))
Web of Knowledge	invasive OR invasively OR intra arterial OR direct OR true OR catheter* OR simultaneous* OR pull back OR needle OR wire) AND (aorta OR aortic OR central) AND ((brachi* OR ((upper) AND (limb OR arm)) OR peripher* OR oscillometr* OR cuff OR auscultat* OR korotko* OR sphygmoman* OR noninvasive OR indirect)) AND (pulse OR pressure*))))

	Refined by: RESEARCH AREAS: (CARDIOVASCULAR SYSTEM CARDIOLOGY) AND [excluding]DOCUMENT TYPES: (REVIEW) Timespan: All years. Search language=Auto
Embase	invasive OR invasively OR intra AND arterial OR direct OR true OR catheter* OR simultaneous* OR (pull AND back) OR needle OR wire AND (aorta OR aortic OR central) AND (brachi* OR (upper AND (limb OR arm)) OR peripher* OR oscillometr* OR cuff OR auscultat* OR korotko* OR sphygmoman* OR noninvasive OR indirect) AND (pulse OR pressure* OR blood AND pressure AND measurement OR 'arterial pressure') NOT (animal NOT (human AND animal)) AND ([article]/lim OR [article in press]/lim OR [conference abstract]/lim OR [conference paper]/lim OR [erratum]/lim OR [letter]/lim OR [note]/lim)

Online Table 3. Validation of individual data extracted from scatter plots.

Meta-analysis 1. **Study name**	**Intra-arterial brachial SBP (mm Hg)**	**Intra-arterial aortic SBP (mm Hg)**	**Brachial - aortic SBP (mm Hg)**	**Correlation coefficient**	**Published figure used for data extraction**
Kobayashi et al, 2013[28] (published data)	141.8 ± 19.8	140.1 ± 18.5	1.7 ± 5.2	0.97	Figure 4 on page 1678 of the publication. Intra-arterial brachial SBP was on the x-axis and intra-arterial aortic SBP on the y-axis.
Kobayashi et al, 2013 (extracted data)	141.6 ± 18.9	140.0 ± 20.8	1.6 ± 5.4	0.97	
Meta-analysis 2. **Study name**	**Cuff SBP (mm Hg)**	**Intra-arterial brachial SBP (mm Hg)**	**Cuff – intra-arterial brachial SBP (mm Hg)**	**Correlation coefficient**	**Published figure used for data extraction**
Blank et al, 1988[29] (published data)			-15	0.94	Figure 4 (left), on page 1301 of the publication. Intra-arterial brachial SBP was on the x-axis and brachial cuff (auscultatory) SBP on the y-axis.
Blank et al, 1988 (extracted data)	138.4 (38.1)	152.7 (35)	-14.3	0.95	
Kobayashi et al, 2013[28] (published data)	133.5 (18.6)	141.8 (19.8)	-8.3 (8.7)	0.89	Figure 3 (left), on page 1677 of the publication. Brachial cuff SBP was on the x-axis and intra-arterial brachial SBP on the y-axis.
Kobayashi et al, 2013 (extracted data)	133.5 (18.6)	141.6 (19.3)	-8.2 (8.8)	0.89	
Sagiv et al, 1999[15] (published data)	107 (7)	101 (6)	-	0.68	Figure 1 (top left), on page 277 of the publication. Intra-arterial brachial SBP was on the x-axis and brachial cuff (auscultatory) SBP on the y-axis.
Sagiv et al, 1999 (extracted data)	106 (8)	100 (5)	-	0.67	
Vardan et al, 1983[16] (published data)	183.1 (17.6)	182.2 (21.0)	-	-	Figure (top left) on page 937 of the publication. Brachial cuff SBP was on the x-axis and intra-arterial brachial SBP on the y-axis. The 'x' plot markers, which corresponded to the first SBP measurement were extracted.
Vardan et al, 1983 (extracted data)	183.6 (17.9)	181.6 (22.1)	-	-	
Meta-analysis 3. **Study name**	**Cuff SBP (mm Hg)**	**Intra-arterial aortic SBP (mm Hg)**	**Cuff – intra-arterial aortic SBP (mm Hg)**	**Correlation coefficient**	**Published figure used for data extraction**
Davies et al, 2003[30] (published data)	137.0 (26)	134.0 (28)	3.4 (10.5)	0.92	Figure 2 (top), on page 574 of the publication. Intra-arterial aortic SBP was on the x-axis and brachial cuff SBP on the y-axis.

Davies et al, 2003 (extracted data)	137.2 (27)	133.8 (26)	3.4 (10.4)	0.92	
Kobayashi et al, 2013[28] (published data)	133.5 (18.6)	138.1 (18.5)	-4.7 (9.0)	0.88	Figure 2 (left), on page 1677 of the publication. Brachial cuff SBP was on the x-axis and intra-arterial aortic SBP on the y-axis.
Kobayashi et al, 2013 (extracted data)	133.5 (18.6)	138.3 (18.5)	-4.8 (9.1)	0.88	
Saul et al, 1995[23] (published data)	150.0	149.0	0.9 (11.1)	0.91	Figure 2 (top, labelled Abb. 2 in publication). Brachial cuff SBP (labelled RR syst. Oberarm links) was on the x-axis and intra-arterial aortic SBP (labelled RR syst. Aorta) on the y-axis.
Saul et al, 1995 (extracted data)	150.3	149.2	1.0 (11.4)	0.91	

Online Table 4. Individual quality scores of each study included in meta-analysis 1.

Study	Type of catheter	Sequence of aortic and brachial blood pressure measurements	Position of catheter in aorta/brachial artery	Pressure wave capture length	Participant characteristics	Total
Cheng et al, 2010[31]	1	1	1	1	1	5
Cheng et al, unpublished	1	1	1	1	1	5
Davies et al, 2010[32]	1	0	1	1	1	4
Ding et al, 2013[33]	1	1	1	1	1	5
Gould and Shariff, 1969[13]	0	0	1	0	1	2
Kavanagh-Gray, 1964[2]	0	0	1	0	1	2
Kelly et al, 1990[3]	1	1	1	0	1	4
Kobayashi et al, 2013[28]	1	0	1	0	1	3
Liang et al, 2015[34]	1	1	1	1	1	5
Lin et al, 2012[35]	1	1	1	1	1	5
Picone et al, unpublished	1	1	1	1	1	5
Pucci et al, unpublished	0	1	1	1	1	4
Westerhof et al, 2008[36]	1	1	1	0	0	3

The study quality score was developed in consideration of 5 study attributes. One point was awarded per attribute when the highest standard was achieved, whilst if the highest standard was not achieved then a zero was assigned for that attribute. The maximum score of 5/5 indicated the highest study quality. Studies with a rating of 5/5 were used in sensitivity analysis to assess any impact of study protocols on the analysis.

Online Table 5. Individual quality scores of each study included in meta-analysis 2.

Study	Type of catheter	Sequence of measurement protocol	Position of catheter in brachial artery	Pressure wave capture length	Participant characteristics description	Arm used or description of differences	Total
Berliner et al, 1961[4]	0	1	1	1	1	1	5
Blank et al, 1988[29]	0	1	1	0	0	1	3
Bos et al, 1992*[12]	1	1	1	1	1	0/1	5/6
Cheng et al, 2010[31]	1	1	1	1	1	1	6
Cheng et al, unpublished	1	1	1	1	1	1	6
Ding et al, 2013[33]	1	1	1	1	1	1	6
Freis et al, 1968[5]	0	1	1	0	1	1	4
Gelman et al, 1981[6]	0	0	1	0	0	1	2
Gould et al, 1984[13]	0	1	1	1	0	1	4
Hayashi et al, 2014[37]	1	1	1	1	1	0	5
Hunyor et al, 1978[7]	0	1	1	1	1	1	5
Kobayashi et al, 2013[28]	1	1	1	1	1	0	5
Lin et al, 2012[35]	1	1	1	1	1	1	6
Melamed et al, 2012[14]	0	1	1	1	1	1	5
Muecke et al, 2009[38]	1	1	1	1	1	1	6
Omboni et al, 1997[39]	0	1	1	1	1	0	4
Picone et al, unpublished	1	1	1	1	1	1	6
Pucci et al, unpublished	0	1	1	1	1	1	5
Raftery and Ward, 1968[8]	1	1	1	0	0	1	4
Roberts et al, 1953[9]	0	1	1	0	0	1	3
Sagiv et al, 1999[15]	1	1	1	1	1	0	5
Vardan et al, 1983[16]	1	1	1	0	0	0	3

The study quality score was developed in consideration of 6 study attributes. One point was awarded per attribute when the highest standard was achieved, whilst if the highest standard was not achieved then a zero was assigned for that attribute. The maximum score of 6/6 indicated the highest study quality. Studies with a rating of 6/6 were used in sensitivity analysis to assess any impact of study protocols on the analysis. *In the study of Bos et al, 1992, 13/57 patients had an inter-arm BP difference > 5mmHg and thus received a study quality score of 5/6. From the same study, 46/57 patients had an inter-arm BP difference < 5mmHg and received a study quality score of 6/6.

Online Table 6. Individual quality scores of each study included in meta-analysis 3

Study	Type of catheter	Sequence of measurement protocol	Position of catheter in aorta	Pressure wave capture length	Participant characteristics description	Total
Aakhus et al, 1993[17]	0	0	1	1	1	3
Bhatt et al, 2011[40]	0	1	1	1	1	4
Borow et al, 1982[10]	0	1	1	1	1	4
Bos et al, 1992[12]	1	1	1	1	1	5
Broyd et al, unpublished	0	1	1	1	1	4
Cheng et al, 2010[31]	1	1	1	1	1	5
Cheng et al, unpublished	1	1	1	1	1	5
Costello et al, 2015[41]	0	1	1	1	1	4
Cremer et al, 2012[42]	1	1	1	1	1	5
Davies et al, 2003[30]	0	1	1	1	1	4
Ding et al, 2013[33]	1	1	1	1	1	5
Kobayashi et al, 2013[28]	1	1	1	0	1	4
Korolkova et al, unpublished	0	1	1	1	1	4
Laugesen[18]/Rossen et al[19], 2014	0	1	1	1	1	4
Lin AC et al, 2012[20]	0	1	1	1	1	4
Lin MM et al, 2012[35]	1	1	1	1	1	5
Lowe et al, 2009[21]	0	1	1	1	1	4
Milne et al, 2015[43]	1	1	1	1	1	5
Nagle et al, 1966[11]	0	1	1	0	1	3
Nakagomi et al, 2016[44]	0	1	1	1	1	4
Ohte et al, 2007[45]	1	1	1	1	1	5
Ott et al, 2012[46]	0	0	1	1	1	3
Park et al, 2014[47]	1	1	1	1	1	5

Pereira et al, 2014[48]	0	1	1	1	1	4
Picone et al, unpublished	1	1	1	1	1	5
Pucci et al, 2013[22]	0	1	1	1	1	4
Pucci et al, unpublished	0	1	1	1	1	4
Rajani et al, 2008[49]	1	1	1	1	1	5
Saul et al, 1995[23]	0	1	1	1	0	3
Smulyan et al, 2003[24]	1	1	1	1	1	5
Smulyan et al, 2008[50]	0	1	1	1	1	4
Smulyan et al, 2010[51]	1	1	1	1	1	5
Sueta et al, 2015[52]	0	1	1	0	0	2
Takazawa et al, 2007[26]	1	1	1	1	1	5
Takazawa et al, 2012[25]	1	1	1	1	1	5
Weber et al, 1999[27]	1	1	1	1	0	4
Weber et al, 2011[53]	1	1	1	1	1	5
Williams et al, 2011[54]	1	1	1	1	1	5

The study quality score was developed in consideration of 5 study attributes. One point was awarded per attribute when the highest standard was achieved, whilst if the highest standard was not achieved then a zero was assigned for that attribute. The maximum score of 5/5 indicated the highest study quality. Studies with a rating of 5/5 were used in sensitivity analysis to assess any impact of study protocols on the analysis.

Online Table 7. Details of each study included in meta-analysis 1.

No	Study	n	Age (years)	Male (%)	Measurement protocol	Catheter type	Pressure wave capture time	Study exclusion criteria
1	Cheng et al, 2010 [31]	100	62.1 ± 12.6	78	Sequential (brachial to aorta)	Micromanometer tip	Aorta: 30 beats Brachial: 20-30 beats	Acute coronary syndrome, peripheral arterial disease, abnormal sinus rhythm and > 3mm Hg pressure difference between left and right arms
2	Cheng et al, unpublished	15	61.6 ± 13.9	70	Sequential (brachial to aorta)	Micromanometer tip	Aorta: 30 beats Brachial: 20-30 beats	Same as No 1 (Cheng et al, 2010)
3	Davies et al, 2010 [32]	12	54 ± 10	67	Simultaneous	Micromanometer tip	1 minute	Previous coronary intervention, valvular pathology, regional wall motion abnormality, arrhythmia, use of nitrates < 24hrs before procedure
4	Ding et al, 2013 [33]	33	60.1 ± 8.7	64	Simultaneous	Fluid-filled	At least 10 stable beats	Failure to measure central SBP, arrhythmia, severe valvular disease, heart failure defined as left ventricular ejection fraction <50%, >5 mm Hg difference in SBP between left and right arms
5	Gould and Shariff, 1969 [1]	23	N/A	N/A	Unclear	Fluid-filled	Not reported	None reported
6	Kavanagh-Gray, 1964 [2]	49	31.4 ± 16.5	48	"Either simultaneously or in quick succession"	Fluid-filled	Not reported	None reported
7	Kelly et al, 1990 [3]	14	53.7 ± 9.8	93	Sequential (brachial to aorta)	Micromanometer tip	Not reported	None reported. Note: no patients had evidence of valvular disease or left ventricular dysfunction
8	Kobayashi et al, 2013 [28]	20	68.9 ± 8.1	65	Sequential (aorta to brachial)	Micromanometer tip	Not reported	>10 mm Hg difference in BP between left and right arms
9	Liang et al, 2015 [34]	40	63.0 ± 10.9	60	Sequential (brachial to aorta)	Micromanometer tip	10 stable beats	>10% variation of heart rate or mean arterial pressure during measurements
10	Lin et al, 2012 [35]	78	65.9 ± 12.9	80	Simultaneous	Micromanometer tip	At least two respiratory cycles / at least 20 beats	Acute coronary syndrome, peripheral arterial disease, abnormal sinus rhythm

11	Picone et al, unpublished	52	60.5 ± 10.3	68	Sequential (aorta to brachial)	Fluid-filled	Aorta and brachial 20 seconds of stable data	>5 mm Hg difference in BP between left and right arms
12	Pucci et al, unpublished	29	68.3 ± 10.9	86	Sequential (brachial to aorta)	Fluid-filled	At least 10 seconds	History of peripheral arterial disease, aortic aneurysm, absent brachial or radial pulses or known obstructive large artery atherosclerotic disease, active malignancy, hypotension (<90 mm Hg), valvular heart disease, known left ventricular dysfunction (ejection fraction <50%) or arrhythmias (including frequent ventricular and supraventricular premature beats)
13	Westerhof et al, 2008 [36]	50	51.3 ± 8.5	86	Sequential (brachial to aorta)	Fluid-filled	One beat	None reported

Data are mean ± standard deviation, n or percentage. SBP, systolic blood pressure

Online Table 8. Details of the studies included in meta-analysis 2.

No	Study	n	Age (years)	Male (%)	Brachial cuff method	Intra-arterial measurement method	Pressure wave capture time
1	Berliner et al, 1961[4]	100	55.8 ± 13.2	56	Mercury sphygmomanometry	20 Gauge needle and electromanometer	50-80 seconds pre non-intra-arterial BP and 20-30 seconds during non-invasive BP
2	Blank et al, 1988[29]	11	-	-	Mercury sphygmomanometry	Fluid-filled or micromanometer tip	Unclear
3	Bos et al, 1992 (groups B, C, D)[12]	57	61 (52-83)	61	Mercury sphygmomanometry	Fluid-filled	One beat corresponding to the non-invasive Korotkoff sounds
4	Cheng et al, 2010[31]	100	60 ± 11	74	Oscillometric device	Micromanometer tip	20-30 beats (at least two respiratory cycles)
5	Cheng et al, unpublished	14	61.6 ± 13.9	70	Oscillometric device	Micromanometer tip	20-30 beats (at least two respiratory cycles)
6	Ding et al, 2013[33]	33	60.1 ± 8.7	64	Oscillometric device	Fluid-filled	At least 10 stable beats
7	Freis et al, 1968[5]	6	Range: 26-38	100	Mercury sphygmomanometry	16 Gauge needle and strain gauge pressure transducer	One beat corresponding to the non-invasive Korotkoff sounds
8	Gelman et al, 1981[6]	5	63.1 ± 10.3	66	Auscultatory sphygmomanometry	Fluid-filled	Unclear
9	Gould et al, 1984[13]	28	50 (23-67)	75	Mercury sphygmomanometry	Fluid-filled	Unclear
10	Hayashi et al, 2014[37]	55	Unclear	Unclear	Oscillometric device	Fluid-filled	Unclear
11	Hunyor et al, 1978[7]	9	25-80	Unclear	Mercury sphygmomanometry	Fluid-filled	Average of 15 complexes immediately proceeding cuff inflation
12	Kobayashi et al, 2013[28]	20	68.9 ± 8.1	65	Oscillometric device	Micromanometer tip	Unclear
13	Lin et al, 2012[35]	78	61 ± 10	83	Oscillometric device	Micromanometer tip	Mean of 10 stable consecutive pulses immediately prior to brachial BP measurement
14	Melamed et al, 2012[14]	3	68.7 ± 9.6	50	Oscillometric device	Fluid-filled	10 seconds
15	Muecke et al, 2009[38]	2	38.5 ± 19.1	100	Oscillometric device	Fluid-filled	60 seconds

16	Omboni et al, 1997[39]	12	45.9 ± 10.8	75	Mercury sphygmomanometry	Fluid-filled	Unclear – non-invasive brachial BP taken every 2 minutes over a 20 minute period
17	Picone et al, unpublished	40	61.4 ± 10.9	70	Oscillometric device	Fluid-filled	Average of 20 seconds of stable data
18	Pucci et al, unpublished	29	68.3 ± 10.9	86	Oscillometric device	Fluid-filled	
19	Raftery and Ward, 1968[8]	50	26.7 (18-44)	0	Mercury sphygmomanometry	Thin walled needle and inductance manometer	Unclear
20	Roberts et al, 1953[9]	47	Unclear	Unclear	Mercury sphygmomanometry	Cournand needle and electromanometer	Unclear
21	Sagiv et al, 1999[15]	12	60.4	82	Mercury sphygmomanometry	Fluid-filled	Several respiratory cycles
22	Vardan et al, 1983[16]	24	59.4 ± 10.9	53	Mercury sphygmomanometry	Fluid-filled	Unclear

Details of the studies included in meta-analysis 2 (continued)

No	Measurement protocol	Study exclusion criteria	Same or different arms for measurement	DBP 4th or 5th Korotkoff sound
1	Simultaneous	Atrial fibrillation	Same	Unclear
2	Simultaneous	Unclear	Same	Unclear
3	Simultaneous	Left/right arm BP difference > 10 mmHg, valvular disease or arrhythmia	Different	5th
4	Sequential (intra-arterial then brachial cuff BP)	Acute coronary syndrome, PAD, abnormal sinus rhythm and left/right arm BP difference >3mmHg	Different	N/A
5	Sequential (intra-arterial then brachial cuff BP)	Acute coronary syndrome, peripheral arterial disease, abnormal sinus rhythm and >3mmHg pressure difference between left and right arms	Different	N/A
6	Simultaneous	Failure to measure central systolic BP, arrhythmia, severe valvular disease, heart failure defined as left ventricular EF <50%, left/right arm BP difference >5mmHg	Different	N/A
7	Simultaneous	Obesity or cardiovascular abnormalities	Same	4th
8	Sequential (intra-arterial then brachial cuff BP)	Unclear	Different	5th
9		Bundle branch block, pacemaker, severe aortic failure	Different	5th
10	Simultaneous	Moderate or severe mitral/aortic valve disease, LV outflow tract obstruction	Unclear	N/A
11	Simultaneous	None listed	Same	5th
12	Sequential (brachial cuff then intra-arterial)	Left/right arm BP difference > 10 mmHg	Different	N/A
13	Sequential intra-arterial brachial then brachial cuff	Acute coronary syndrome, PAD, abnormal sinus rhythm and >3mmHg pressure difference between L/R arms	Different	N/A
14	Simultaneous	Lower extremity catheter, inability to measure non-invasive BP in the same arm as the arterial line, lack of oscillations suitable for measurement despite optimal fast flush test technique	Same	N/A
15	Sequential (intra-arterial then brachial cuff)	Past history of hypertension or > 60 years of age. Participants were also excluded if arm circumference exceeded brachial cuff manufacturer recommendations (n=1) and if hypothermic (n=1)	Same	N/A
16	Simultaneous	"None of the patients had TOD or other major diseases in addition to HTN"	Different	5th
17	Simultaneous	>5 mm Hg difference between left and right arms.	Different	N/A
18	Simultaneous	History of peripheral arterial disease, aortic aneurysm, absent brachial or radial pulses or known obstructive large artery atherosclerotic disease, active malignancy, hypotension (<90 mm	Different	N/A

		Hg), valvular heart disease, known left ventricular dysfunction (ejection fraction <50%) or arrhythmias (including frequent ventricular and supraventricular premature beats)		
19	Simultaneous	Unclear	Same	5th
20	Simultaneous	Unclear	Same	5th
21	Simultaneous	None stated, however no participants were judged to have coronary artery disease or any major risk factors.	Different	5th
22	Simultaneous	Unclear	Different	5th

Data are presented as mean ± standard deviation, range (minimum-maximum) or percentage. BP, blood pressure; DBP, diastolic BP

Online Table 9. Details of the studies included in meta-analysis 3.

No	Study	n	Age (years)	Male (%)	Brachial cuff method	Intra-arterial measurement method	Pressure wave capture time
1	Aakhus et al, 1993[17]	28	62.9 ± 9.9	89	Oscillometric	Fluid-filled	At least five cardiac cycles (aortic)
2	Bhatt et al, 2011[40]	98	58 ± 12	55	Oscillometric	Fluid-filled	Not reported
3	Borow et al, 1982[10]	30	60 ± 11	73	Oscillometric	Fluid-filled	Not reported
4	Bos et al, 1992 (group A)[12]	19	63 ± 11.4	84	Mercury sphygmomanometer	Fluid-filled	Not reported
5	Broyd et al, unpublished	25	58.3 ± 10.2	72	Oscillometric	Fluid-filled	7-10 cardiac cycles
6	Cheng et al, 2010[31]	100	61.9 ± 13.2	74	Oscillometric	Micromanometer tip	30 seconds (aortic)
7	Cheng et al, unpublished	17	61.9 ± 13.2	74	Oscillometric	Micromanometer tip	30 seconds (aortic)
8	Costello et al, 2015[41]	40	63.1 ± 10.3	66	Oscillometric	Fluid-filled	10-15 seconds (aortic)
9	Cremer et al, 2012[42]	144	60.8 ± 12.7	66	Oscillometric	Fluid-filled	Mean of 5 consecutive beats (aortic)
10	Davies et al, 2003[30]	28	60 ± 10	71	Oscillometric	Fluid-filled	Unclear
11	Ding et al, 2013[33]	33	60.1 ± 8.7	64	Oscillometric	Fluid-filled	At least 10 stable beats
12	Kobayashi et al, 2013[28]	20	68.9 ± 8.1	65	Oscillometric	Micromanometer tip	Unclear
13	Korolkova et al, unpublished	14	68.8 ± 9.1	64	Oscillometric	Fluid-filled	7-10 cardiac cycles
14	Laugesen[18]/Rossen et al, 2014[19]	37	64.8 ± 10.4	84	Oscillometric	Fluid-filled	10 seconds
15	Lin AC et al, 2012[20]	35	64 ± 12	68	Oscillometric	Fluid-filled	Unclear
16	Lin MM et al, 2012[35]	78	64.1 ± 14	74	Oscillometric	Micromanometer tip	20-30 beats
17	Lowe et al, 2009[21]	37	N/A	N/A	Oscillometric	Fluid-filled	10 seconds
18	Milne et al, 2015[43]	9	10.5 ± 5	44	Aneroid sphygmomanometer	Micromanometer tip	5-10 seconds
19	Nagle et al, 1966[11]	2	48.5 ± 12	100	Auscultation	Fluid-filled	30-40 pressure pulses
20	Nakagomi et al, 2016[44]	139	66.7 ± 12.2	76	Oscillometric	Fluid-filled	At least 10 seconds
21	Ohte et al, 2007[45]	82	64.3 ± 9.4	79	Oscillometric	Micromanometer tip	Mean of 5 cardiac cycles
22	Ott et al, 2012[46]	52	63.7 ± 11	58	Oscillometric	Fluid-filled	Unclear
23	Park et al, 2014[47]	6	65 ± 20	67	Oscillometric	Micromanometer tip	7-10 cardiac cycles

24	Pereira et al, 2014[48]	15	62.1 ± 10.6	53	Oscillometric	Fluid-filled	15 seconds
25	Picone et al, unpublished	146	62.3 ± 10.6	70	Oscillometric	Fluid-filled	10 seconds
26	Pucci et al, 2013[22]	58	61 ± 11	62	Oscillometric	Fluid-filled	Unclear
27	Pucci et al, unpublished	29	68.3 ± 10.9	86	Oscillometric	Fluid-filled	Unclear
28	Rajani et al, 2008[49]	14	74 ± N/A	71	Oscillometric	Micromanometer tip	At least 20 consecutive waveforms
29	Saul et al, 1995[23]	97	59.3 ± N/A	69	Oscillometric	Fluid-filled	Unclear
30	Smulyan et al, 2003[24]	25	54.4 ± 12.4	52	Oscillometric	Micromanometer tip	Several respiratory cycles
31	Smulyan et al, 2008[50]	100	60.4 ± 11.9	82	Oscillometric	Fluid-filled	Several respiratory cycles
32	Smulyan et al, 2010[51]	25	57.2 ± 10.9	82	Oscillometric	Micromanometer tip	Several respiratory cycles
33	Sueta et al, 2015[52]	85	69.8 ± 10.0	74	Oscillometric	Unclear	Unclear
34	Takazawa et al, 2007[26]	18	61 ± 10	83	Oscillometric	Micromanometer tip	Mean of 10 stable consecutive pulses immediately prior to brachial BP measurement
35	Takazawa et al, 2012[25]	52	63.4 ± 9.7	74	Oscillometric	Micromanometer tip	10 stable consecutive pulses
36	Weber et al, 2011[53]	30	59 ± 11	87	Oscillometric	Micromanometer tip	3-4 minutes
37	Weber et al, 1999[27]	36	53.3 ± 10.4	85	Automatic Korotkoff sounds	Fluid-filled	10 beats (5 before oscillometric mark on trace and 5 after)
38	Williams et al, 2011[54]	20	61 ± 8.6	75	Oscillometric	Micromanometer tip	10, ten second blocks

Details of the studies included in meta-analysis 3 (continued)

No	Measurement protocol	Study exclusion criteria
1	Sequential (brachial cuff then aorta then brachial cuff. Average of brachial cuff BP used in analysis)	Aortic valvular disease, arrhythmias, clinical signs of subclavian arterial disease (neck vessel murmurs or left or right arm pressure differences ≥ 10 mmHg)
2	Simultaneous	Acute coronary syndrome, contraindication to BP cuff placement on either arm, arrhythmia, upper extremity arterial disease.
3	Simultaneous	"No patients had peripheral vascular disease"
4	Simultaneous	Valvular disease, arrhythmia
5	Simultaneous	Failure to obtain satisfactory intra-arterial and/or non-invasive waveforms
6	Sequential (intra-arterial aortic then brachial cuff)	Acute coronary syndrome, PAD, abnormal sinus rhythm and >3mmHg pressure difference between L/R arms
7	Sequential (intra-arterial aortic then brachial cuff)	Acute coronary syndrome, PAD, abnormal sinus rhythm and >3mmHg pressure difference between L/R arms
8	Sequential (oscillometric brachial then ascending aortic)	Unclear
9	Simultaneous	Bundle branch block, pacemaker, severe aortic failure
10	Sequential (oscillometric brachial then ascending aortic)	Left radial artery easily palpated and history of subclavian or brachial stenosis
11	Simultaneous	Failure to measure cSP, arrhythmia, severe valvular disease, heart failure defined as LV ejection fraction <50%, >5mmHg difference in SBP between left and right arms
12	Simultaneous	>10 mmHg difference in brachial BP
13	Simultaneous	Failure to obtain satisfactory intra-arterial and/or non-invasive waveforms
14	Sequential oscillometric brachial then ascending aortic	Atrial fibrillation or other cardiac arrhythmias, diagnosis of subclavian or brachial artery stenosis
15	Sequential	Age <30 or >80 years, atrial fibrillation or atrial flutter, aortic stenosis or aortic regurgitation of any severity, mitral stenosis or mitral regurgitation graded more than mild in severity, severe pulmonary hypertension, ventricular septal defect or other significant intracardiac shunt, aortic coarctation, ventricular pacemaker, haemodynamic instability, active ischaemic symptoms, use of intravenous vasoactive or inotropic medications, history of coronary artery bypass surgery, history of aortic valve replacement, history of thoracic or abdominal aortic surgery and history of left mastectomy with axillary node dissection.
16	Simultaneous	Acute coronary syndrome, PAD, abnormal sinus rhythm and >3mmHg pressure difference between L/R arms
17	Sequential oscillometric brachial then ascending aortic	Cardiovascular instability causing aortic and brachial mean pressure differences of > 9mmHg
18	Sequential	Arrhythmia, clinical evidence of heart failure
19	Simultaneous	Unclear
20	Simultaneous	Prior coronary surgical revascularization, haemodynamically significant valvular heart disease, left ventricular outflow tract

		obstruction and renal insufficiency, patients with arrhythmias
21	Simultaneous	Acute coronary syndrome, primary valvular heart disease or atrial fibrillation
22	Sequential aortic then oscillometric brachial then aortic	Arrhythmia
23	Simultaneous	Failure to obtain satisfactory intra-arterial and/or non-invasive waveforms
24	Sequential oscillometric brachial then ascending aortic	PAD, large artery atherosclerotic disease, aortic aneurysm, active malignancy, hypotension - SBP<90mmHg, valvular heart disease, LV dysfunction (EF<50%), frequent arrhythmias
25	Sequential oscillometric brachial then ascending aortic	Arrhythmia, acute myocardial infarction, aortic stenosis
26	Sequential	History of peripheral arterial disease, aortic aneurysm, absent brachial or radial pulses or known obstructive large artery atherosclerotic disease, active malignancy, hypotension (SBP <90mmHg), valvular heart disease, known left ventricular dysfunction (ejection fraction <50%) or arrhythmias (including frequent ventricular and supraventricular premature beats)
27	Sequential	History of peripheral arterial disease, aortic aneurysm, absent brachial or radial pulses or known obstructive large artery atherosclerotic disease, active malignancy, hypotension (SBP <90mmHg), valvular heart disease, known left ventricular dysfunction (ejection fraction <50%) or arrhythmias (including frequent ventricular and supraventricular premature beats)
28	Sequential oscillometric brachial then ascending aortic	Atrial fibrillation, significant ventricular ectopy
29	Sequential aortic then oscillometric brachial	Unclear
30	Sequential (aortic then brachial cuff)	Arrhythmia, significant valvular disease or any constitutional illnesses
31	Simultaneous	"More than mild valvular heart disease", atrial fibrillation, frequent premature beats
32	Simultaneous	Frequent atrial or ventricular premature beats, atrial fibrillation, significant valve disease
33	Simultaneous	Unclear
34	Sequential aortic then oscillometric brachial	Arrhythmia
35	Sequential aortic then oscillometric brachial	Arrhythmia, inadequate quality data
36	Simultaneous	Unstable clinical conditions, arrhythmias, valvular heart disease
37	Simultaneous	Upper arm >35cm, arrhythmia
38	Sequential oscillometric brachial then ascending aortic	Atrial fibrillation or significant valvular disease

Online Table 10. Reasons individual participant data was not obtained from studies eligible for meta-analysis 1.

Studies where IPD was not sought	Reason
1. Bazaral et al, 1990[55]	Corresponding author passed away, unable to contact others
Studies where IPD not provided	**Reason**
1. De Hert et al, 1994[56]	Author unable to access data
2. O'Rourke, 1970[57]	Author unable to access data
3. VanBeck et al, 1993[58]	No response
4. Gravlee et al, 1989[59]	Author unable to access data
5. Gravlee et al, 1989[60]	Author unable to access data
6. Karamanoglu et al, 1993[61]	Author unable to access data

IPD, individual participant data

Online Table 11. Reasons individual participant data was not obtained from studies eligible for meta-analysis 2.

Studies where IPD was not sought	Reason
1. Bachmann et al, 1981[62]	Could not find contact information
2. Baeriswyl et al, 1982[63]	Incorrect details available and could not find new information
3. Breit et al, 1974[64]	Could not find contact information
4. Fagher et al, 1994[65]	Could not find contact information
5. Forsberg et al, 1970[66]	Could not find contact information
6. Ginsburg and Duncan 1969[67]	Could not find contact information
7. He et al, 1994[68]	Could not find contact information
8. Julien et al, 1988[69]	Could not find contact information
9. Karlefors et al, 1966[70]	Could not find contact information
10. Kuwajima et al, 1990[71]	Incorrect details available and could not find new information
11. London et al, 1967[72]	Could not find contact information
12. Molhoek et al, 1984[73]	Could not find contact information
13. Moss et al, 1965[74]	Author passed away
14. Murray 1991[75]	Could not find contact information
15. Netea et al, 1998[76]	Incorrect details available and could not find new information
16. Ochiai et al, 1997[77]	Incorrect details available and could not find new information
17. Sanchez et al, 1977[78]	Could not find contact information
18. Turjanmaa et al, 1988[79]	Could not find contact information
19. Turjanmaa, 1989[80]	Could not find contact information
Studies where IPD not provided	**Reason**
1. Casadei et al, 1988[81]	Data unavailable to author
2. Elseed et al, 1973[82]	No response
3. Fukuoka et al, 1987[83]	No response
4. Gould et al, 1985[84]	Data unavailable to author
5. Gould et al, 1986[85]	Data unavailable to author
6. Graettinger et al, 1988[86]	No response
7. Gravlee et al, 1990[87]	Data unavailable to author
8. Groppelli et al, 1992[88]	Data unavailable to author
9. Holland and Humerfelt, 1964[89]	Data unavailable to author
10. Hunyor et al, 1978[90]	No response
11. Lemson et al, 2009[91]	Data not provided after initial contact
12. Mejia et al, 1990[92]	No response
13. Milsom et al, 1986[93]	Unable to assist

14. Nielsen et al, 1974[94]	No response
15. Nielsen et al, 1979[95]	No response
16. Nielsen et al, 1983[96]	No response
17. Pereira et al, 1985[97]	No response
18. Pitlik et al, 1986[98]	No response
19. Robinson et al, 1988[99]	No response
20. Sagiv et al, 1995[100]	No response
21. Stolt et al, 1990[101]	No response
22. Stolt et al, 1993[102]	No response
23. Stolt et al, 1993[103]	No response
24. Van Egmond et al, 1993[104]	No response
25. Villani et al, 1992[105]	Data unavailable to author
26. White et al, 1989[106]	Data unavailable to author
27. White et al, 1989[107]	Data unavailable to author
28. White et al, 1990[108]	Data unavailable to author
29. Wiecek et al, 1990[109]	No response

IPD, individual participant data

Online Table 12. Reasons individual participant data was not obtained from studies eligible for meta-analysis 3.

Studies where IPD was not sought	Reason
1. Li et al, 1999[110]	Unable to find contact information
Studies where IPD not provided	**Reason**
1. Alihanoglu et al, 2013[111]	No response
2. Baguet et al, 2013[112]	No response
3. Brett et al, 2012[113]	No response
4. Choi et al, 2010 [114]	No response
5. Cloud et al, 2013 [115]	No response
6. Eckert et al, 1994 [116]	No response
7. Eckert et al, 1996 [117]	No response
8. Fleming et al, 1983 [118]	No response
9. Guilcher et al, 2011[119]	No response
10. Høegholm et al, 1992[120]	No response
11. Hope et al, 2004[121]	No response
12. Horvath et al, 2010[122]	No response
13. Kayrak et al, 2008[123]	No response
14. Kayrak et al, 2010[124]	No response
15. Klaus et al, 1991[125]	No response
16. Lehmann et al, 1998[126]	No response
17. Park et al, 2011[127]	No response
18. Shangguan et al, 2015[128]	No response
19. Sharir et al, 1993[129]	Data unavailable to the author
20. Sugawara et al, 2015[130]	No response
21. Umana et al, 2006[131]	No response
22. Zuo et al, 2010[132]	No response

IPD, individual participant data

Online Table 13. Subject characteristics from meta-analysis 1

	Mean (95%CI) or n (%)	n=individual subjects, S=studies
Age (years)	58.6 (53.7 to 63.6)	n=487, S=12
Male sex	353 (72)	n=490, S=12
Height (cm)	165.5 (162.5 to 168.6)	n=382, S=7
Weight (kg)	70.9 (67.6 to 74.3)	n=382, S=7
Body mass index (kg/m^2)	26.0 (24.9 to 26.7)	n=382, S=7
Intra-arterial aortic systolic blood pressure (mm Hg)	131.8 (126.4 to 137.0)	n=515, S=13
Intra-arterial brachial systolic blood pressure (mm Hg)	140.3 (135.7 to 144.7)	n=515, S=13
Intra-arterial aortic diastolic blood pressure (mm Hg)	70.9 (68.6 to 73.1)	n=495, S=12
Intra-arterial brachial diastolic blood pressure (mm Hg)	69.9 (67.2 to 72.5)	n=495, S=12
Intra-arterial aortic pulse pressure (mm Hg)	60.3 (55.3 to 65.2)	n=495, S=12
Intra-arterial brachial pulse pressure (mm Hg)	70.3 (65.9 to 74.6)	n=495, S=12

Data are mean (95% confidence interval (CI)) or n (percentage). Subject characteristics were not available for all studies, and the numbers available are reported in the right hand column of the table. The maximum data available was n=515 from 13 studies. Subject characteristic data was derived from individual data, and when this was unavailable, aggregate data extracted from published studies.

Online Table 14. Subject characteristics from meta-analysis 2.

	Mean (95%CI) or n (%)	n=individual participants, S=studies
Age (years)	53.0 (42.7 to 63.4)	n=538, S=13
Male sex	261 (62%)	n=418, S=11
Height (cm)	164.0 (162.0 to 166.1)	n=494, S=10
Weight (kg)	73.8 (68.7 to 79.0)	n=494, S=10
Body mass index (kg/m^2)	27.3 (26.3 to 28.4)	n=494, S=10
Brachial cuff systolic blood pressure (mm Hg)	141.5 (133.4 to 149.3)	n=735, S=22
Intra-arterial brachial systolic blood pressure (mm Hg)	147.5 (139.4 to 155.5)	n=735, S=22
Brachial cuff diastolic blood pressure (mm Hg)	78.8 (73.8 to 83.6)	n=668, S=18
Intra-arterial brachial diastolic blood pressure (mm Hg)	73.6 (69.6 to 77.6)	n=668, S=18
Brachial cuff pulse pressure (mm Hg)	62.8 (57.3 to 68.1)	n=668, S=18
Intra-arterial brachial pulse pressure (mm Hg)	74.6 (70.0 to 79.2)	n=668, S=18

Data are mean (95% confidence interval (CI)) or n (percentage). Subject characteristics were not available for all studies, and the numbers available are reported in the right hand column of the table. The maximum data available was n=735 from 22 studies. Subject characteristic data was derived from individual data, and when this was unavailable, aggregate data extracted from published studies.

Online Table 15. Subject characteristics from meta-analysis 3.

n=1823 subjects	**Mean (95%CI) or n (%)**	**n=individual subjects, S=studies**
Age (years)	60.4 (57.2-63.5)	n=1640, S=35
Male sex	1222 (70)	n=1751, S=35
Height (cm)	166.5 (164.7-168.4)	n=1447, S=26
Weight (kg)	76.9 (72.8-81.0)	n=1447, S=26
Body mass index (kg/m^2)	27.1 (26.2-28.1)	n=1447, S=26
Brachial cuff systolic blood pressure (mm Hg)	135.3 (132.2-138.4)	n=1823, S=39
Intra-arterial aortic systolic blood pressure (mm Hg)	135.1 (132.0-138.2)	n=1823, S=39
Brachial cuff diastolic blood pressure (mm Hg)	76.4 (74.2-78.5)	n=1676, S=36
Intra-arterial aortic diastolic blood pressure (mm Hg)	70.9 (69.3-72.4)	n=1676, S=36
Brachial cuff pulse pressure (mm Hg)	58.5 (55.8-61.1)	n=1676, S=36
Intra-arterial aortic pulse pressure (mm Hg)	63.8 (61.3-66.3)	n=1676, S=36

Data are mean (95% confidence interval (CI)) or n (percentage). Subject characteristics were not available for all studies, and the numbers available are reported in the right hand column of the table. The maximum data available was n=1823 from 39 studies. Subject characteristic data was derived from individual data, and when this was unavailable, aggregate data extracted from published studies.

Online Table 16. Mean differences, mean absolute differences, range of differences and heterogeneity between studies using oscillometric cuff BP or mercury sphygmomanometry in comparison with intra-arterial brachial SBP, DBP and PP.

		Mean difference	Mean absolute difference	Range of difference	I^2
Oscillometric devices	Brachial cuff – intra-arterial brachial SBP, mm Hg (n=374, 10 studies)	-8.0 (-11.1 to -4.8)*	8.1 (5.8 to 10.8)	-67 to 36	89.4*
	Brachial cuff – intra-arterial brachial DBP, mm Hg (n=354, 9 studies)	4.5 (2.4 to 6.6)*	6.1 (5.3 to 7.0)	-32 to 41	83.2*
	Brachial cuff – intra-arterial brachial PP, mm Hg (n=354, 9 studies)	-12.8 (-15.9 to -9.7)*	12.4 (10.3 to 14.6)	-47 to 38	82.2*
Mercury sphygmomanometry	Brachial cuff – intra-arterial brachial SBP, mm Hg (n=356, 11 studies)	-3.4 (-6.9 to -0.2)^	7.5 (5.7 to 9.6)	-46 to 62	93.1*
	Brachial cuff – intra-arterial brachial DBP, mm Hg (n=309, 8 studies)	6.3 (2.8 to 9.8)*	8.4 (6.5 to 10.5)	-36 to 43	94.0*
	Brachial cuff – intra-arterial brachial PP, mm Hg (n=309, 8 studies)	-11.4 (-15.7 to -7.1)*	11.8 (9.1 to 14.7)	-52 to 34	94.0*

Data are mean (95% confidence intervals), range (minimum – maximum) or I^2 statistic. *p<0.0001, ^p=0.0637. Gelman et al[6] (n=5) not included in this analysis because it was not clear the specific type of cuff BP device used in that study.

Online Table 17. Number of subjects and percentage concordance between brachial cuff and intra-arterial brachial (panel A) and aortic (panel B) systolic blood pressure (BP) for classification of BP control.

A N=735		**Intra-arterial brachial systolic blood pressure**			
		Normal	**Prehypertension**	**Stage 1 hypertension**	**Stage 2 hypertension**
Brachial cuff systolic blood pressure	**Normal**	103(63)	54 (32)	6 (4)	1 (1)
	Prehypertension	15 (6)	131 (52)	77 (37)	7 (5)
	Stage 1 hypertension	0 (0)	15 (10)	86 (54)	51 (36)
	Stage 2 hypertension	0 (0)	1 (1)	26 (14)	162 (85)
B N=1823		**Intra-arterial aortic systolic blood pressure**			
		Normal	**Prehypertension**	**Stage 1 hypertension**	**Stage 2 hypertension**
Brachial cuff systolic blood pressure	**Normal**	360 (78)	91 (20)	6 (2)	2 (0)
	Prehypertension	125 (19)	363 (55)	150 (22)	14 (4)
	Stage 1 hypertension	14 (3)	96 (22)	238 (54)	104 (21)
	Stage 2 hypertension	1(0)	7 (3)	44 (19)	208 (78)

Data are presented as n (%) and each row adds to 100%. Linear mixed modelling was used to account for clustering of subjects within studies. Brachial cuff SBP measurements were classified based on JNC7 guidelines, and compared for concordance with classification of the corresponding intra-arterial brachial (panel A) and aortic (panel B) SBP. The proportion of intra-arterial brachial or aortic measurements concordant with brachial cuff SBP is reported as a percentage. A value of 100% within the shaded boxes is equal to complete concordance of SBP classification. According to JNC 7, based on SBP only, normal range <120 mmHg; prehypertension 120-139 mmHg; stage 1 hypertension 140-159 mmHg and stage 2 hypertension ≥160 mmHg.

Online Table 18. Univariable and multivariable analysis of associations with systolic BP, diastolic BP and pulse pressure difference between brachial cuff and intra-arterial brachial BP.

Systolic BP difference	**Univariable**			**Multivariable**		
n=474, 9 studies	Estimate	95%CI	P value	Estimate	95%CI	P value
Age (years)	-0.1	-0.2 to -0.0	0.033	-0.067	-0.2 to 0.0	0.13
Body mass index (kg/m^2)	0.4	0.2 to 0.5	<0.0001	0.33	0.2 to 0.5	0.0003
Type of brachial cuff device (0=oscillometric, 1=mercury)	8.2	0.6 to 15.7	0.034	6.38	-1.2 to 13.8	0.098
Diastolic BP difference	**Univariable**			**Multivariable**		
n=518, 12 studies	Estimate	95%CI	P value	Estimate	95%CI	P value
Age (years)	0.08	0.02 to 0.1	0.014	-	-	-
Pulse pressure difference	**Univariable**			**Multivariable**		
n=474, 9 studies	Estimate	95%CI	P value	Estimate	95%CI	P value
Age (years)	-0.2	-0.3 to -0.1	<0.0001	-0.16	-0.2 to -0.1	0.0002
Body mass index (kg/m^2)	0.3	0.1 to 0.4	0.001	0.24	0.1 to 0.4	0.006
Type of brachial cuff device (0=oscillometric, 1=mercury)	8.4	3.0 to 13.7	0.002	5.70	-1.1 to 12.4	0.10

Linear mixed modelling used to account for participant clustering within studies. BP, blood pressure; 95%CI, 95% confidence interval. Clinical and demographic data was not available from all studies, therefore this analysis is on a subset of subjects and studies as reported in the table.

Online Table 19. Univariable and multivariable analysis of clinical and demographic associations with the difference between brachial cuff and intra-arterial aortic systolic BP, diastolic BP and pulse pressure.

Systolic BP difference	**Univariable**			**Multivariable**		
n=1225, 21 studies	Estimate	95%CI	P value	Estimate	95%CI	P value
Age (years)	-0.2	-0.3 - -0.1	<0.0001	-0.2	-0.2 – 0.1	<0.0001
Sex (0=female, 1=male)	5.0	3.5 – 6.4	<0.0001	4.1	2.3 – 5.9	<0.0001
Heart rate (bpm)	0.1	0.1 - 0.2	<0.0001	0.1	0.1 – 0.2	<0.0001
Body mass index (kg/m^2)	0.2	0.0 - 0.3	0.015	0.1	-0.0 – 0.2	0.13
Measurement protocol (0=simultaneous, 1=sequential)	6.6	1.0 – 12.2	0.02	7.3	1.5 – 13.0	0.014
Diastolic BP difference	**Univariable**			**Multivariable**		
n=1373, 25 studies	Estimate	95%CI	P value	Estimate	95%CI	P value
Age (years)	0.2	0.1 – 0.2	<0.0001	0.2	0.1 – 0.2	<0.0001
Sex (0=female, 1=male)	1.2	0.2 – 2.1	0.021	1.3	0.3 – 2.2	0.008
Body mass index (kg/m^2)	-0.2	-0.3 - -0.1	<0.0001	-0.1	-0.2 - -0.1	0.001
Pulse pressure difference	**Univariable**			**Multivariable**		
n=1225, 21 studies	Estimate	95%CI	P value	Estimate	95%CI	P value
Age (years)	-0.4	-0.4 – -0.3	<0.0001	-0.3	-0.4 - -0.3	<0.0001
Sex (0=female, 1=male)	3.9	2.4 – 5.4	<0.0001	4.1	2.7 – 5.5	<0.0001
Heart rate (bpm)	0.2	0.1 – 0.2	<0.0001	0.2	0.1 – 0.2	<0.0001
Body mass index (kg/m^2)	0.2	0.2 – 0.2	<0.0001	0.3	0.1 – 0.4	0.0001

Linear mixed modelling used to account for participant clustering within studies. BP, blood pressure; 95%CI, 95% confidence interval. Clinical and demographic data was not available from all studies, therefore this analysis is on a subset of subjects and studies as reported in the table.

Online Table 20. Comparison of meta-analysis 1 participant characteristics and blood pressure between maximum rated studies (5/5) based on our study quality rating versus those studies that did not receive the maximum rating.

	Mean difference (95%CI) between non-maximum rated studies (<5) and maximum rated (=5) or %	P value of difference
Age (years)	12.4 (1.2 to 23.3)	0.031
Male sex	72% (max rated) vs 73% (non-max rated)	0.95
Height (cm)	-7.8 (-15.7 to -0.02)	0.055
Weight (kg)	-1.1 (-13.3 to 10.8)	0.86
Body mass index (kg/m^2)	2.0 (-0.5 to 4.4)	0.12
Heart rate (beats/min)	-3.0 (-7.3 to 1.3)	0.18
Intra-arterial brachial – intra-arterial aortic SBP, mmHg	-0.2 (-6.6 to 6.1)	0.96
Intra-arterial brachial – intra-arterial aortic DBP, mmHg	1.5 (-0.2 to 3.2)	0.078
Intra-arterial brachial – intra-arterial aortic PP, mmHg	-3.0 (-9.6 to 3.5)	0.37
Intra-arterial brachial SBP (mmHg)	8.7 (0.7 to 16.5)	0.033
Intra-arterial aortic SBP (mmHg)	9.1 (-0.7 to 18.6)	0.069
Intra-arterial brachial DBP (mmHg)	2.4 (-3.0 to 7.7)	0.38
Intra-arterial aortic DBP (mmHg)	1.0 (-3.8 to 5.8)	0.68
Intra-arterial brachial PP (mmHg)	7.4 (-1.1 to 15.6)	0.084
Intra-arterial aortic PP (mmHg)	10.6 (2.2 to 18.8)	0.014

Data are mean (95% confidence interval (95%CI)) or percentage. A positive mean difference indicates a higher value for the maximum rated studies versus the non-maximum rated studies, whereas a negative mean difference indicates a higher value for the non-maximum rated studies compared with the maximum rated studies. SBP, systolic blood pressure; DBP, diastolic blood pressure; PP, pulse pressure.

Online Table 21. Comparison of meta-analysis 2 participant characteristics and blood pressure between maximum rated studies (6/6) based on our study quality rating versus those studies that did not receive the maximum rating.

	Mean difference (95%CI) between non-maximum rated studies (=0) and maximum rated (=1) or %	P value of difference
Age (years)	-1.6 (-8.1 to 4.9)	0.64
Male sex	71% (max rated) vs 59% (non-max rated)	0.002
Height (cm)	2.0 (-1.7 to 5.7)	0.29
Weight (kg)	2.1 (-6.0 to 10.0)	0.61
Body mass index (kg/m^2)	-0.2 (-3.0 to 2.5)	0.90
Heart rate (beats/min)	No data in non-maximum rated studies	-
Brachial cuff – intra-arterial brachial SBP, mm Hg	-2.0 (-6.6 to 2.4)	0.38
Brachial cuff – intra-arterial brachial DBP, mm Hg	-2.0 (-5.4 to 1.4)	0.27
Brachial cuff – intra-arterial brachial PP, mm Hg	-0.2 (-4.5 to 4.0)	0.91
Brachial cuff SBP (mm Hg)	5.0 (-7.3 to 16.9)	0.43
Intra-arterial brachial SBP (mm Hg)	6.2 (-6.1 to 18.2)	0.32
Brachial cuff DBP (mm Hg)	-1.2 (-8.0 to 5.5)	0.74
Intra-arterial brachial DBP (mm Hg)	0.9 (-5.3 to 6.9)	0.78
Brachial cuff PP (mm Hg)	4.7 (-4.1 to 13.4)	0.30
Intra-arterial brachial PP (mm Hg)	3.0 (-5.1 to 11.0)	0.47

Data are mean (95% confidence interval (95%CI)) or percentage. A positive mean difference indicates a higher value for the maximum rated studies versus the non-maximum rated studies, whereas a negative mean difference indicates a higher value for the non-maximum rated studies compared with the maximum rated studies. SBP, systolic blood pressure; DBP, diastolic blood pressure; PP, pulse pressure.

Online Table 22. Comparison of meta-analysis 3 participant characteristics and blood pressure between maximum rated studies (5/5) based on our study quality rating versus those studies that did not receive the maximum rating.

	Mean difference (95%CI) between non-maximum rated studies (=0) and maximum rated (=1) or %	P value of difference
Age (years)	-4.1 (-10.6 to 2.2)	0.21
Male sex	72% (max rated) vs 67% (non-max rated)	0.032
Height (cm)	-4.0 (-9.9 to 1.7)	0.18
Weight (kg)	-11.2 (-22.5 to -0.1)	0.053
Body mass index (kg/m^2)	-2.8 (-5.8 to 0.2)	0.072
Heart rate (beats/min)	-0.7 (-3.1 to 1.7)	0.57
Brachial cuff – intra-arterial aortic SBP, mmHg	2.0 (-2.0 to 5.8)	0.33
Brachial cuff – intra-arterial aortic DBP, mm Hg	0.3 (-3.3 to 3.7)	0.89
Brachial cuff – intra-arterial aortic PP, mm Hg	1.7 (-3.1 to 6.5)	0.48
Brachial cuff SBP (mm Hg)	-3.2 (-9.5 to 2.9)	0.31
Intra-arterial aortic SBP (mm Hg)	-5.1 (-11.2 to 0.9)	0.10
Brachial cuff DBP (mm Hg)	-1.4 (-5.8 to 2.9)	0.52
Intra-arterial aortic DBP (mm Hg)	-1.6 (-4.7 to 1.4)	0.31
Brachial cuff PP (mm Hg)	-1.2 (-6.6 to 4.0)	0.65
Intra-arterial aortic PP (mm Hg)	-2.8 (-7.9 to 2.1)	0.27

Data are mean (95% confidence interval (95%CI)) or percentage. A positive mean difference indicates a higher value for the maximum rated studies versus the non-maximum rated studies, whereas a negative mean difference indicates a higher value for the non-maximum rated studies compared with the maximum rated studies. SBP, systolic blood pressure; DBP, diastolic blood pressure; PP, pulse pressure.

Online Table 23. Comparison of meta-analysis 1 participant characteristics and blood pressure between published and unpublished data

	Mean difference (95%CI) or n (%) between published studies (=0) and unpublished studies (=1)	P value of difference
N	416 (81%) published, 99 (19%) unpublished	
Age (years)	7.3 (-6.9 to 21.1)	0.31
Male sex	71% (published) vs 78% (unpublished)	0.20
Height (cm)	-0.6 (-8.8 to 7.5)	0.90
Weight (kg)	5.5 (-2.6 to 13.4)	0.19
Body mass index (kg/m^2)	1.9 (0.1 to 3.7)	0.043
Heart rate (beats/min)	-1.3 (-6.4 to 3.7)	0.62
Intra-arterial brachial – intra-arterial aortic SBP, mm Hg	-0.4 (-7.9 to 7.0)	0.92
Intra-arterial brachial – intra-arterial aortic DBP, mm Hg	-1.6 (-3.5 to 0.3)	0.10
Intra-arterial brachial – intra-arterial aortic PP, mm Hg	0.4 (-7.4 to 8.0)	0.93
Intra-arterial brachial SBP (mm Hg)	4.4 (-6.6 to 15.2)	0.43
Intra-arterial aortic SBP (mm Hg)	5.0 (-7.9 to 17.6)	0.45
Intra-arterial brachial DBP (mm Hg)	-2.8 (-9.0 to 3.3)	0.38
Intra-arterial aortic DBP (mm Hg)	-1.2 (-6.8 to 4.2)	0.66
Intra-arterial brachial PP (mm Hg)	7.4 (-2.3 to 17.0)	0.13
Intra-arterial aortic PP (mm Hg)	7.1 (-4.2 to 18.3)	0.22

Data are mean (95% confidence interval (95%CI)) or percentage. A positive mean difference indicates a higher value for the unpublished studies versus the published studies, whereas a negative mean difference indicates a higher value for the published studies compared with the unpublished studies. SBP, systolic blood pressure; DBP, diastolic blood pressure; PP, pulse pressure.

Online Table 24. Comparison of meta-analysis 2 participant characteristics and blood pressure between published and unpublished data

	Mean difference (95%CI) or n (%) between published studies (=0) and unpublished studies (=1)	P value of difference
N	648 (88%) published, 87 (12%) unpublished	
Age (years)	10.3 (-5.2 to 24.9)	0.20
Male sex	58% (published) vs 77% (unpublished)	0.002
Height (cm)	1.3 (-4.7 to 7.2)	0.66
Weight (kg)	0.2 (-13.1 to 13.2)	0.98
Body mass index (kg/m^2)	-0.7 (-5.3 to 3.9)	0.77
Heart rate (beats/min)	-2.5 (-10.8 to 5.7)	0.56
Brachial cuff – intra-arterial brachial SBP, mm Hg	-5.2 (-12.7 to 2.1)	0.17
Brachial cuff – intra-arterial brachial DBP, mm Hg	-0.8 (-6.4 to 4.6)	0.77
Brachial cuff – intra-arterial brachial PP, mm Hg	-4.1 (-10.2 to 2.0)	0.20
Brachial cuff SBP (mm Hg)	-8.8 (-31.8 to 13.7)	0.45
Intra-arterial brachial SBP (mm Hg)	-3.6 (-27.1 to 19.4)	0.76
Brachial cuff DBP (mm Hg)	-7.9 (-20.6 to 4.4)	0.22
Intra-arterial brachial DBP (mm Hg)	-7.2 (-17.3 to 2.7)	0.16
Brachial cuff PP (mm Hg)	-1.4 (-16.0 to 12.9)	0.85
Intra-arterial brachial PP (mm Hg)	2.4 (-10.0 to 14.6)	0.70

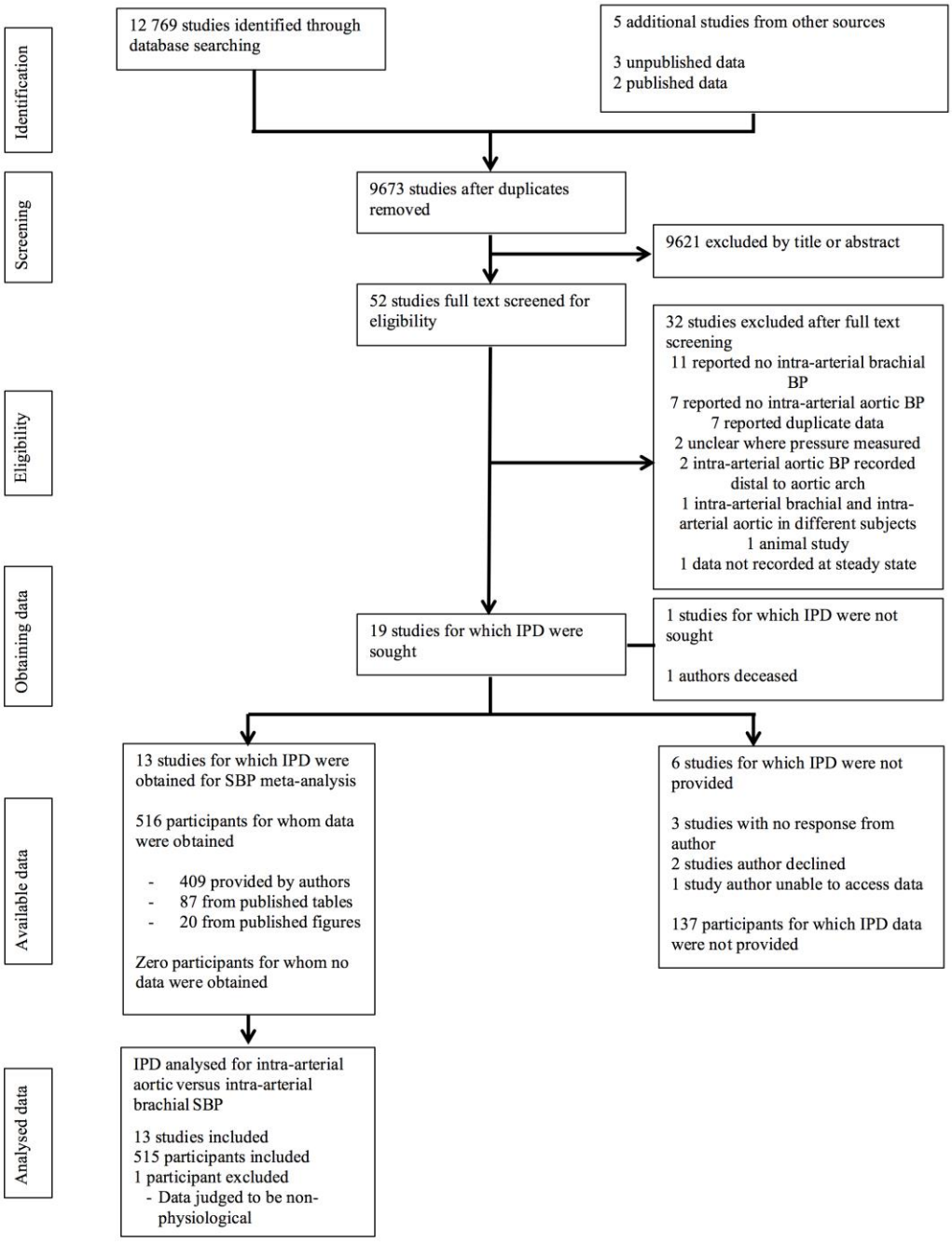
Data are mean (95% confidence interval (95%CI)) or percentage. A positive mean difference indicates a higher value for the unpublished studies versus the published studies, whereas a negative mean difference indicates a higher value for the published studies compared with the unpublished studies. SBP, systolic blood pressure; DBP, diastolic blood pressure; PP, pulse pressure.

Online Table 25. Comparison of meta-analysis 3 participant characteristics and blood pressure between published and unpublished data

	Mean difference (95%CI) or n (%) between published studies (=0) and unpublished studies (=1)	P value of difference
N	1493 (81%) published, 351 (19%) unpublished	
Age (years)	4.1 (-3.8 to 11.7)	0.31
Male sex	68% (published) vs 73% (unpublished)	0.057
Height (cm)	2.5 (-5.0 to 9.9)	0.51
Weight (kg)	0.4 (-14.3 to 14.7)	0.96
Body mass index (kg/m^2)	-0.3 (-4.0 to 3.3)	0.87
Heart rate (beats/min)	-1.7 (-4.9 to 1.4)	0.29
Brachial cuff – intra-arterial brachial SBP, mm Hg	-0.9 (-6.0 to 4.1)	0.73
Brachial cuff – intra-arterial brachial DBP, mm Hg	-1.3 (-3.1 to 5.6)	0.56
Brachial cuff – intra-arterial brachial PP, mm Hg	-2.3 (-8.3 to 3.7)	0.47
Brachial cuff SBP (mm Hg)	1.9 (-6.3 to 9.8)	0.66
Intra-arterial aortic SBP (mm Hg)	2.4 (-5.8 to 10.4)	0.56
Brachial cuff DBP (mm Hg)	-1.0 (-6.5 to 4.4)	0.72
Intra-arterial aortic DBP (mm Hg)	-2.2 (-6.0 to 1.6)	0.27
Brachial cuff PP (mm Hg)	3.5 (-3.0 to 10.0)	0.30
Intra-arterial aortic PP (mm Hg)	5.0 (-1.4 to 11.2)	0.12

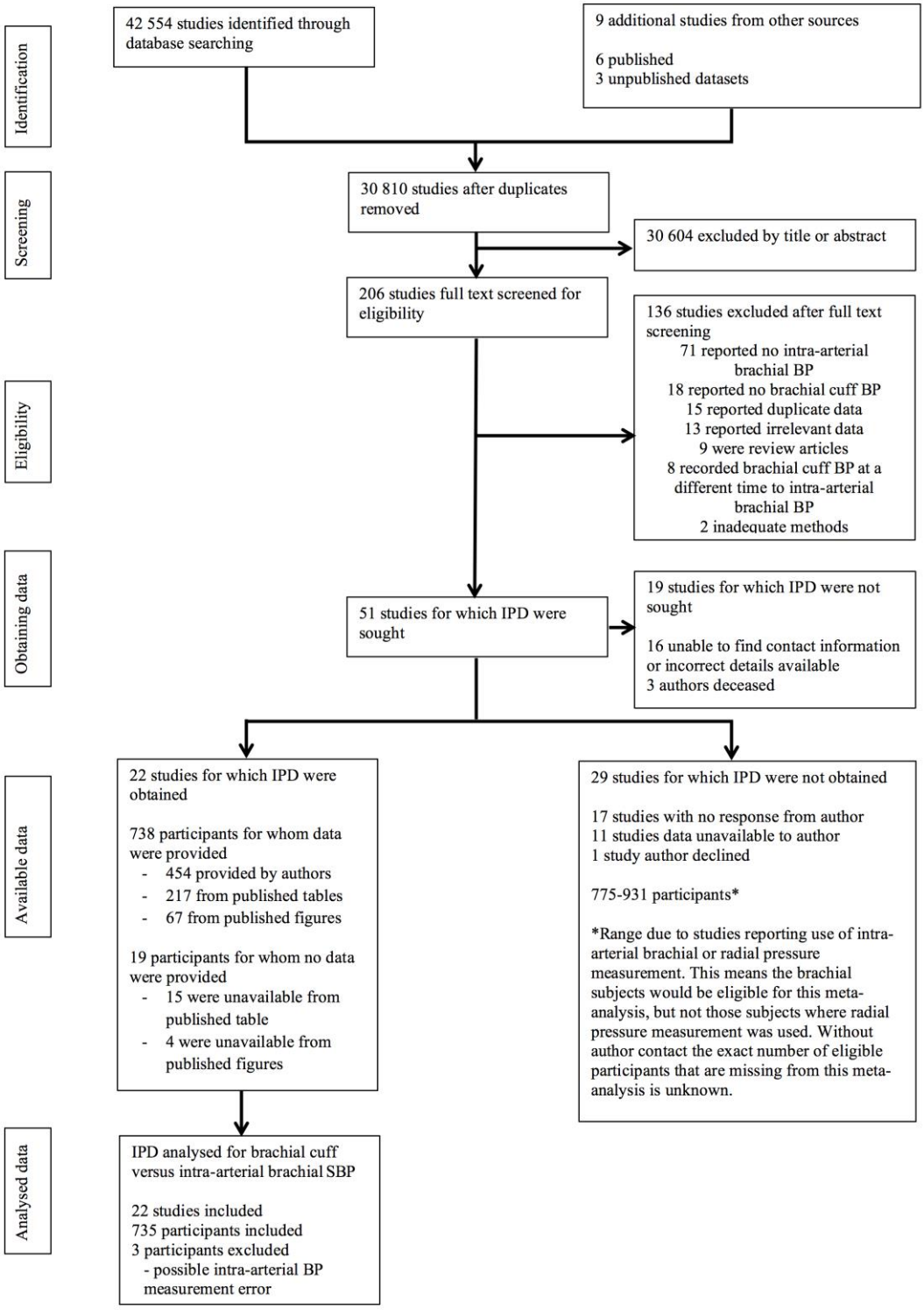
Data are mean (95% confidence interval (95%CI)) or percentage. A positive mean difference indicates a higher value for the unpublished studies versus the published studies, whereas a negative mean difference indicates a higher value for the published studies compared with the unpublished studies. SBP, systolic blood pressure; DBP, diastolic blood pressure; PP, pulse pressure.

Online Figure 1. Study flow diagram for systolic blood pressure in meta-analysis 1, formatted as recommended by the Preferred Reporting Items for Systematic reviews and Meta-Analysis of individual participant data (PRISMA-IPD).



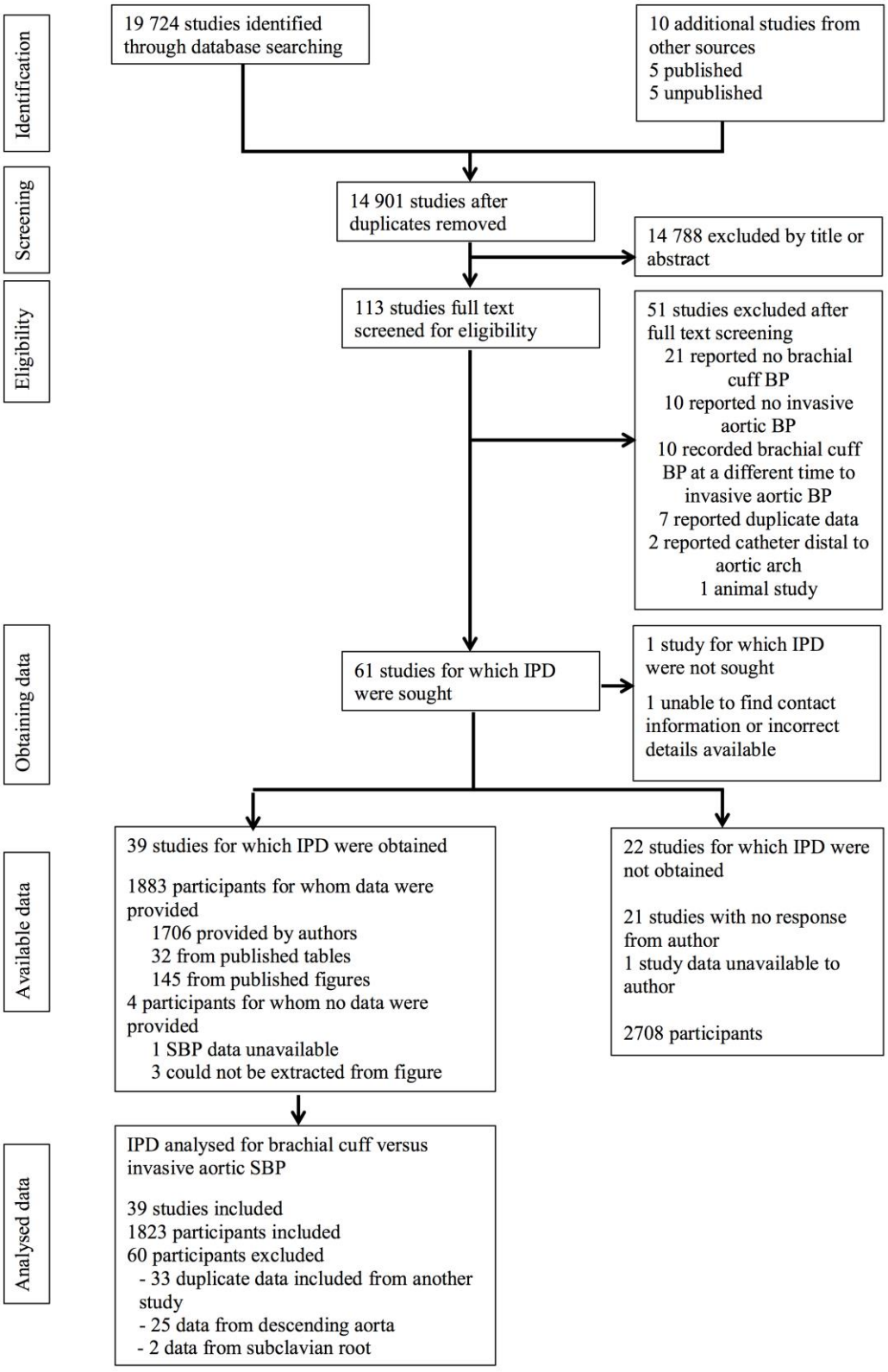
BP, blood pressure; SBP, systolic BP; IPD, individual participant data

Online Figure 2. Study flow diagram for systolic blood pressure in meta-analysis 2, formatted as recommended by the Preferred Reporting Items for Systematic reviews and Meta-Analysis of individual participant data (PRISMA-IPD).



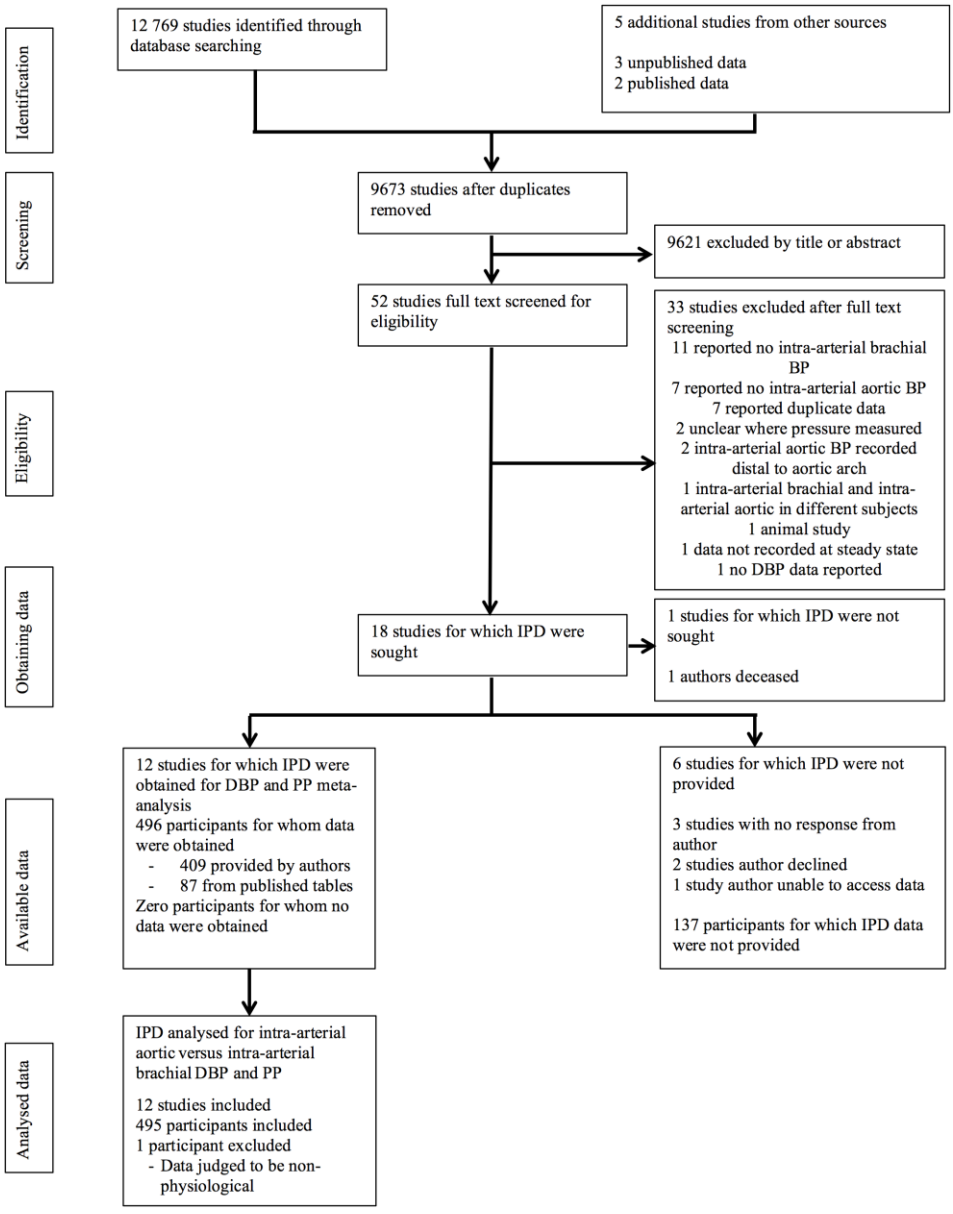
BP, blood pressure; SBP, systolic BP; IPD, individual participant data

Online Figure 3. Study flow diagram for systolic blood pressure in meta-analysis 3, formatted as recommended by the Preferred Reporting Items for Systematic reviews and Meta-Analysis of individual participant data (PRISMA-IPD).



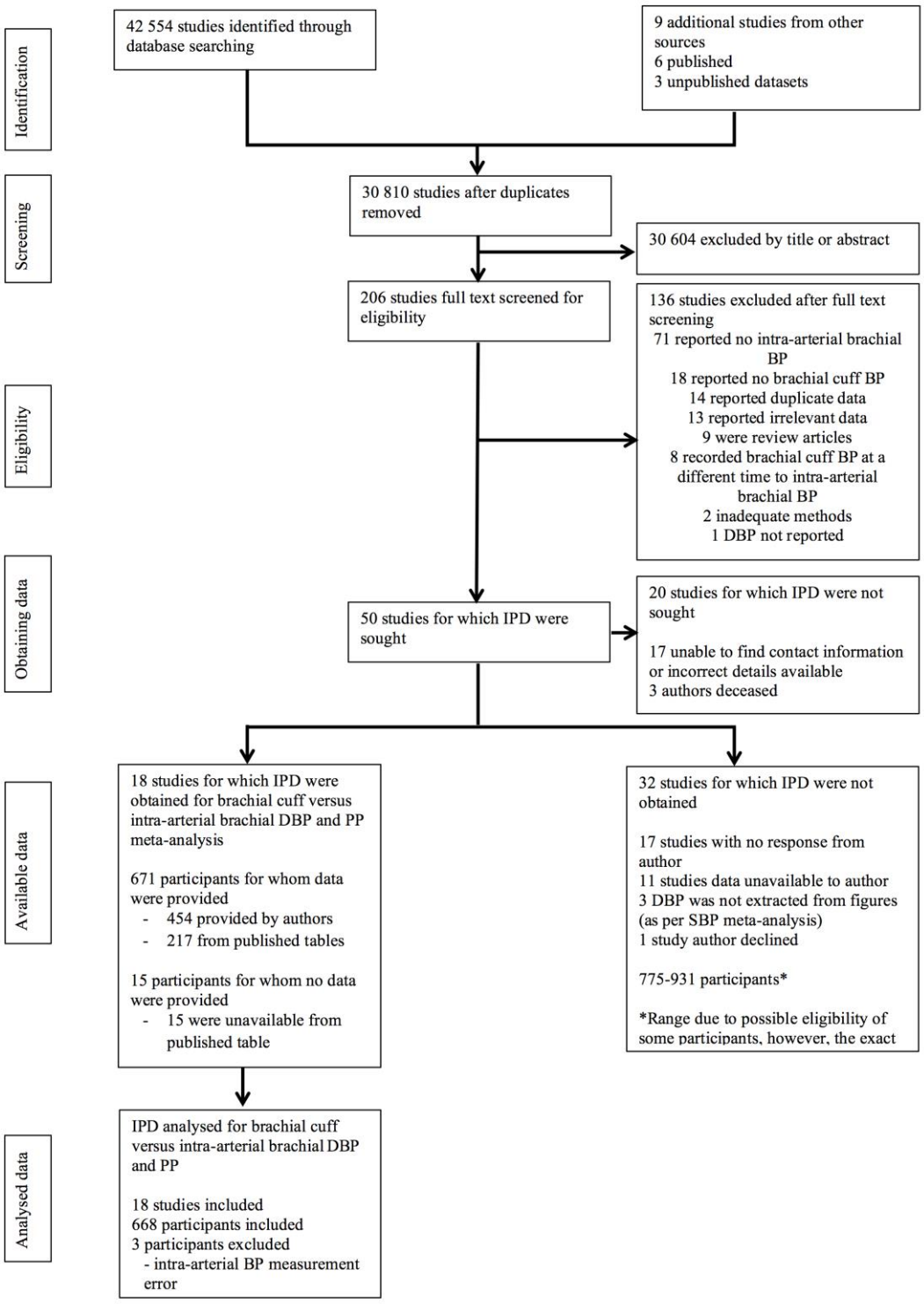
BP, blood pressure; SBP, systolic BP; IPD, individual participant data

Online Figure 4. Study flow diagram formatted as recommended by the Preferred Reporting Items for Systematic reviews and Meta-Analysis of individual participant data (PRISMA-IPD) statement for diastolic blood pressure and pulse pressure in meta-analysis 1.



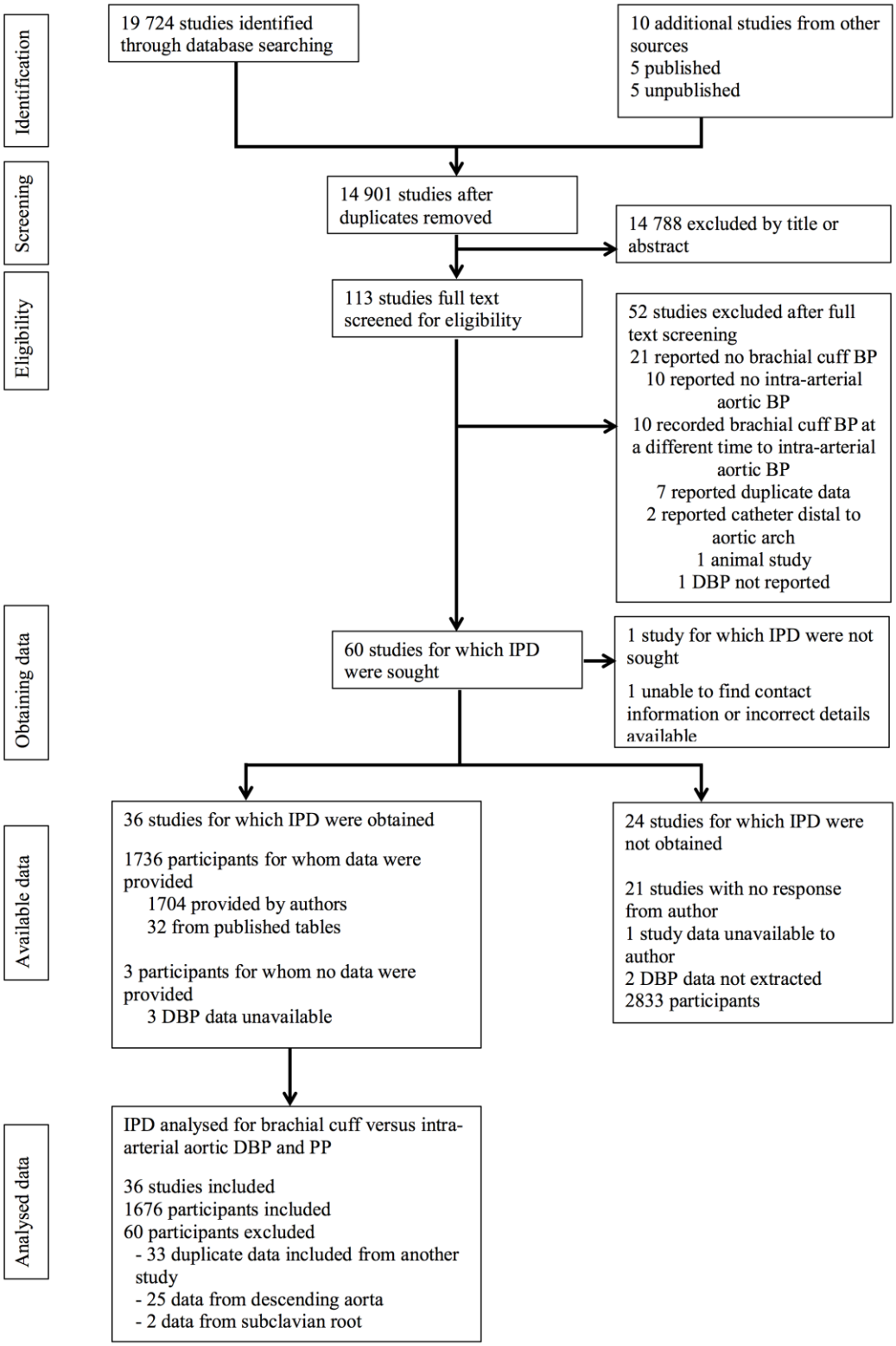
BP, blood pressure; DBP, diastolic BP, PP, pulse pressure; IPD, individual participant data

Online Figure 5. Study flow diagram formatted as recommended by the Preferred Reporting Items for Systematic reviews and Meta-Analysis of individual participant data (PRISMA-IPD) statement for diastolic blood pressure and pulse pressure in meta-analysis 2.



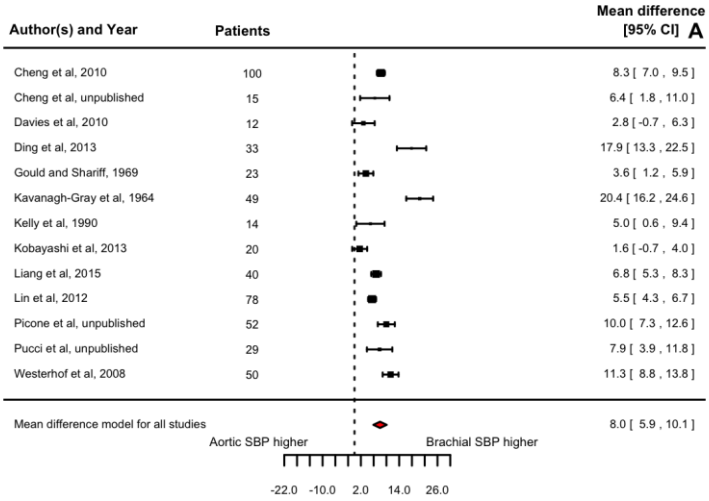
BP, blood pressure; DBP, diastolic BP, PP, pulse pressure; IPD, individual participant data

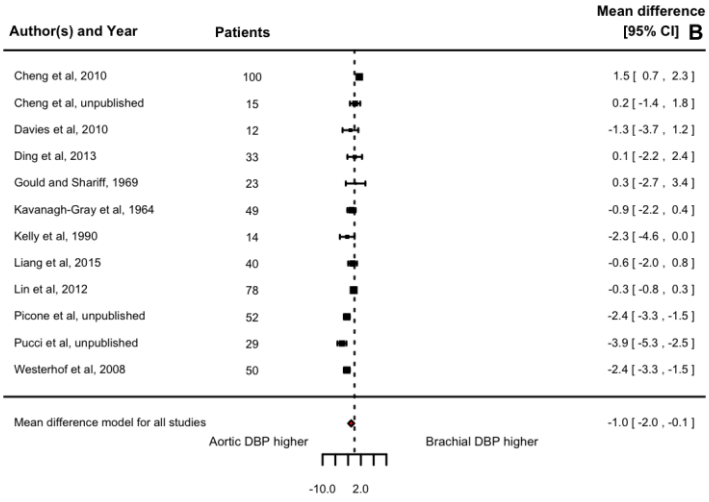
Online Figure 6. Study flow diagram formatted as recommended by the Preferred Reporting Items for Systematic reviews and Meta-Analysis of individual participant data (PRISMA-IPD) statement for diastolic blood pressure and pulse pressure in meta-analysis 3.

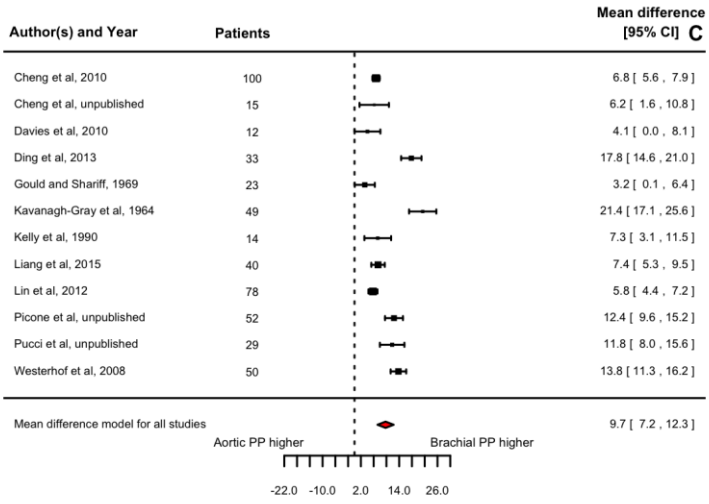


BP, blood pressure; DBP, diastolic BP, PP, pulse pressure; IPD, individual participant data

Online Figure 7. Forest plot of intra-arterial aortic and brachial BP difference.

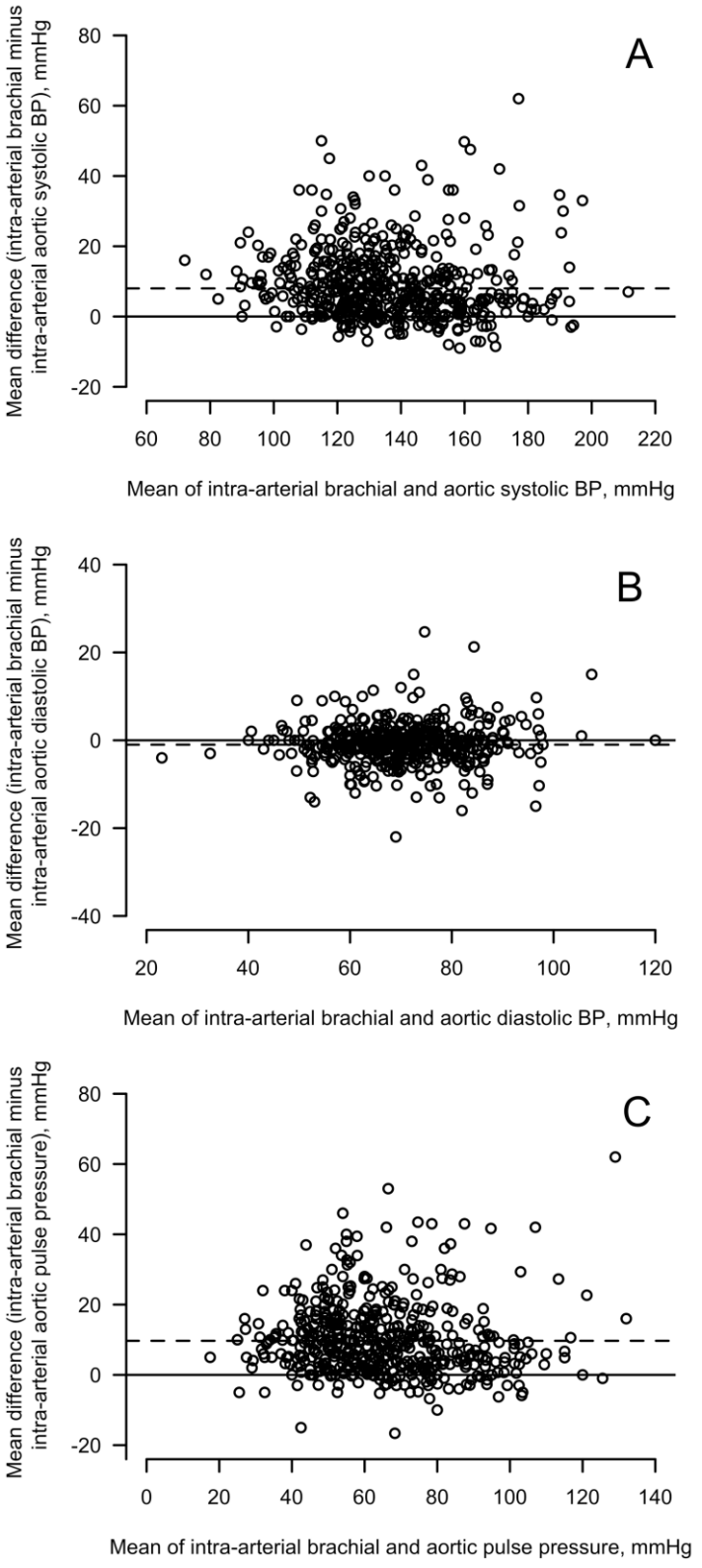






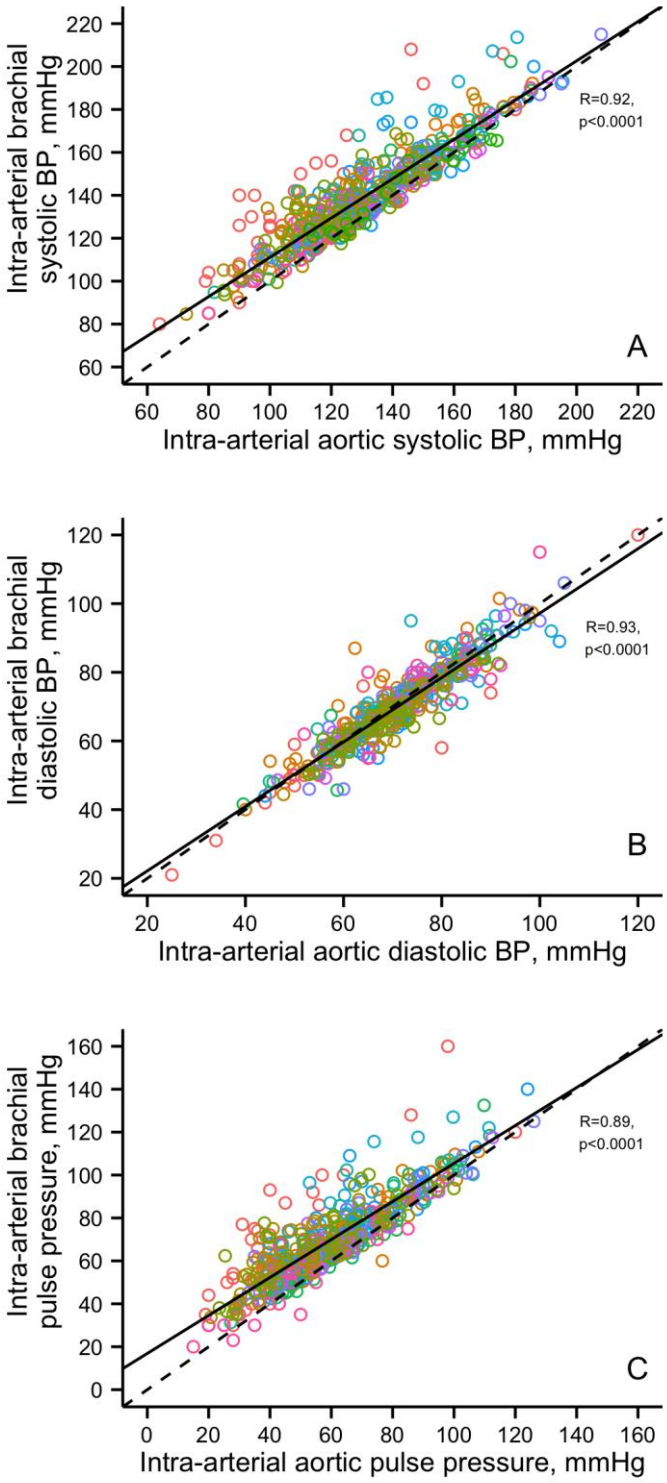
Pooled mean difference and 95% confidence interval for meta-analysis 1, the comparison of intra-arterial aortic and brachial systolic blood pressure (SBP, panel A), diastolic BP (DBP, panel B) and pulse pressure (PP, panel C).

Online Figure 87. Agreement plots for systolic blood pressure (SBP), diastolic BP (DBP) and pulse pressure (panels A-C respectively) for meta-analysis 1.



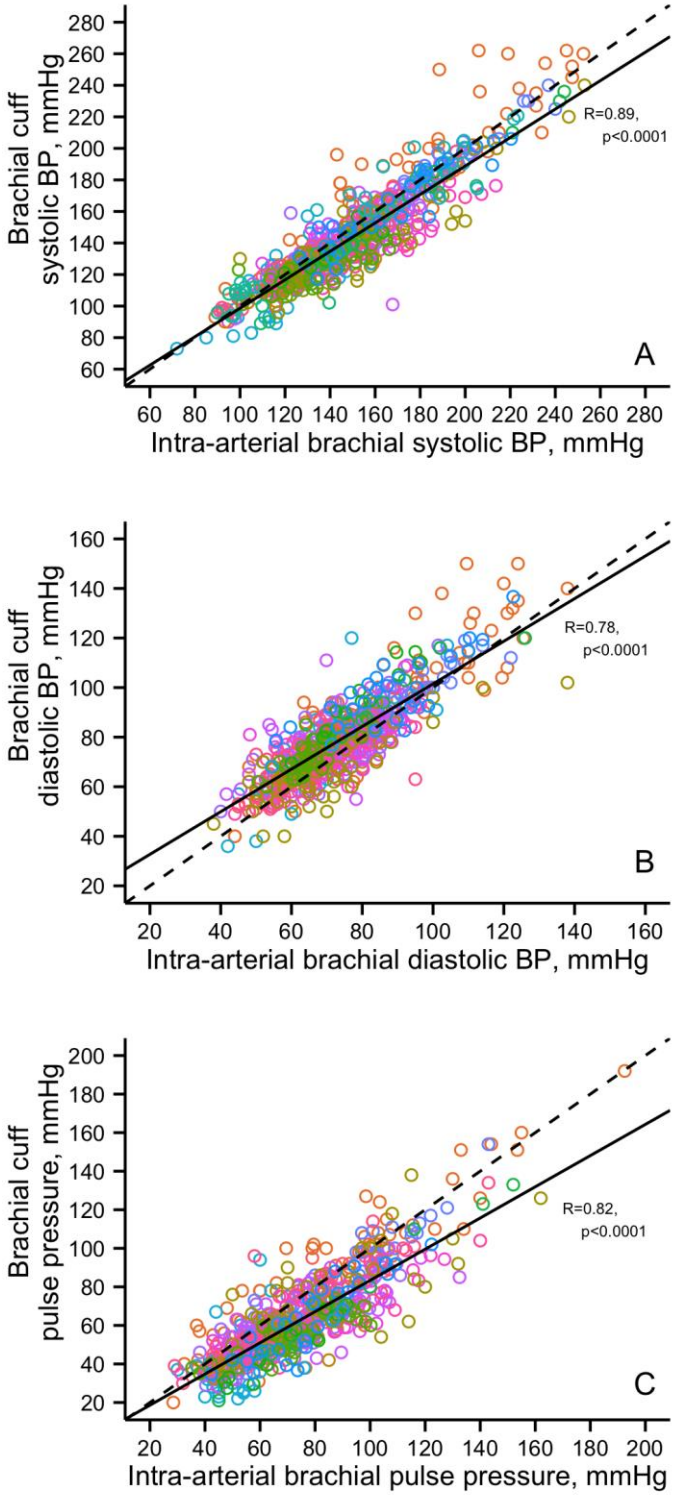
The x-axis represents the mean of intra-arterial aortic and brachial SBP, DBP or pulse pressure. The y-axis is the mean difference calculated as intra-arterial brachial minus intra-arterial aortic SBP, DBP or pulse pressure. The solid horizontal line indicates a mean difference of zero, whilst the dashed horizontal line represents the pooled mean difference of the data.

Online [DP2]**Figure ~~8~~9. Association between intra-arterial aortic and brachial systolic blood pressure (SBP), diastolic BP (DBP) and pulse pressure (panels A-C respectively) for meta-analysis 1.**



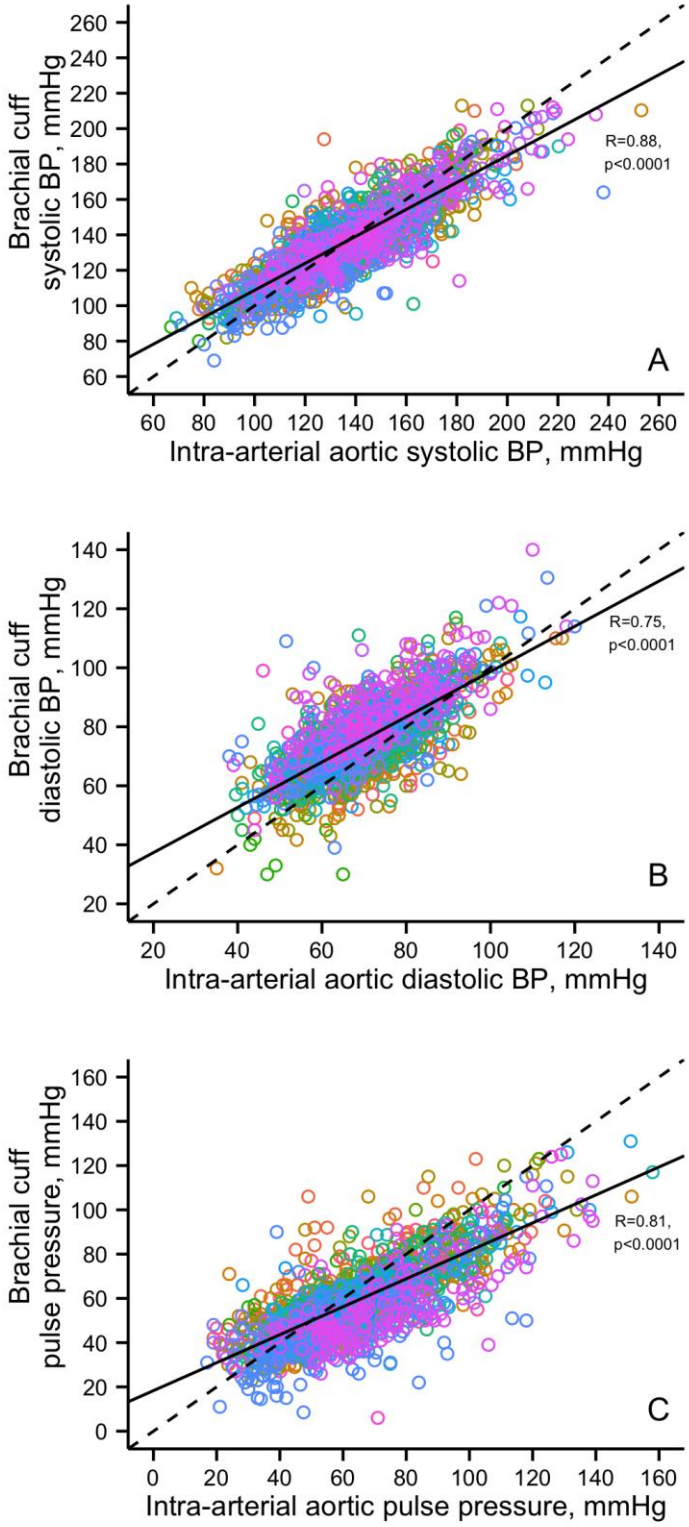
Intra-arterial aortic values are on the x-axis and intra-arterial brachial values on the y-axis. In each panel the solid black line is the regression line and the dashed line represents the line of identity. The pooled correlation coefficient and corresponding p-value are reported on each plot. Each colour represent a different study from the meta-analysis.

Online Figure 109. Scatter plots for brachial cuff and intra-arterial brachial systolic blood pressure (SBP), diastolic BP (DBP) and pulse pressure (panels A-C respectively) for meta-analysis 2.



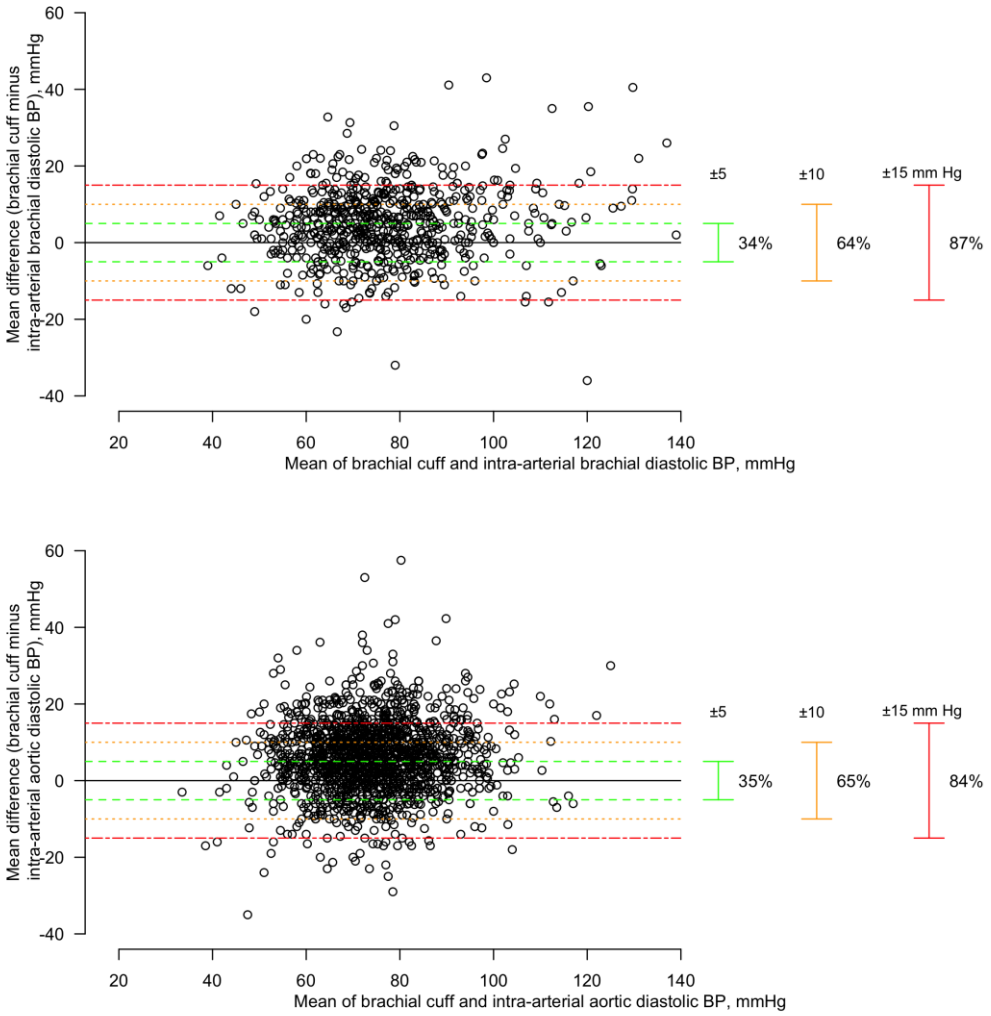
Intra-arterial brachial values are on the x-axis and brachial cuff values on the y-axis. In each panel the solid black line is the regression line and the dashed line represents the line of identity. The pooled correlation coefficient and corresponding p-value are reported on each plot. This analysis does not inform individual risk stratification, see Table 1 of the main article for this detail.

Online Figure 101. Scatter plots for brachial cuff and intra-arterial brachial systolic blood pressure (SBP), diastolic BP (DBP) and pulse pressure (panels A-C respectively) for meta-analysis 3.



Intra-arterial aortic values are on the x-axis and brachial cuff values on the y-axis. In each panel the solid black line is the regression line and the dashed line represents the line of identity. The pooled correlation coefficient and corresponding p-value are reported on each plot. This analysis does not inform individual risk stratification, see Table 1 of the main article for this detail.

Online [DP3]**Figure 1~~1~~2. Agreement plot of brachial cuff DBP and intra-arterial brachial and aortic DBP**



Plots of brachial cuff and intra-arterial brachial (top panel), and brachial cuff and intra-arterial aortic (bottom panel) diastolic blood pressure (BP). The mean of the brachial cuff diastolic BP and intra-arterial diastolic BP is on the x-axis and the mean difference between brachial cuff diastolic BP and the intra-arterial diastolic BP is on the y-axis. The proportion of brachial cuff systolic BP values within ±5 mmHg of the intra-arterial systolic BP measures is represented by the dashed line (green), and reported under the ±5 error bar. The same presentation is provided for cuff systolic BP values within ±10 mmHg (dotted line (orange)) and ±15 mmHg (dot-dashed line (red)). The solid black horizontal line represents the point that the mean difference = 0 mmHg.

Online references

1. Gould L, Shariff M. Comparison of the left ventricular, aortic and brachial arterial first derivative. *Vasc Surg.* 1969;3(1):34-39.
2. Kavanagh-Gray D. Comparison of central aortic and peripheral artery pressure curves. *Can Med Assoc J.* 1964;90:1468-1471.
3. Kelly RP, Gibbs HH, O'Rourke MF, et al. Nitroglycerin Has More Favorable Effects on Left-Ventricular Afterload Than Apparent from Measurement of Pressure in a Peripheral Artery. *Eur Heart J.* 1990;11(2):138-144.
4. Berliner K, Yildiz M, Garnier B, Lee DH, Fujiy H. Blood Pressure Measurements in Obese Persons - Comparison of Intra-Arterial and Auscultatory Measurements. *Am J Cardiol.* 1961;8(1):10-&.
5. Freis ED, Sappington RF, Jr. Dynamic reactions produced by deflating a blood pressure cuff. *Circulation.* 1968;38(6):1085-1096.
6. Gelman ML, Nemati C. A new method of blood pressure recording that may enhance patient compliance. *JAMA.* 1981;246(4):368-370.
7. Hunyor SN, Flynn JM, Cochineas C. Comparison of Performance of Various Sphygmomanometers with Intra-Arterial Blood-Pressure Readings. *Br Med J.* 1978;2(6131):159-162.
8. Raftery EB, Ward AP. The indirect method of recording blood pressure. *Cardiovasc Res.* 1968;2(2):210-218.
9. Roberts LN, Smiley JR, Manning GW. A comparison of direct and indirect blood-pressure determinations. *Circulation.* 1953;8(2):232-242.
10. Borow KM, Newburger JW. Noninvasive estimation of central aortic pressure using the oscillometric method for analyzing systemic artery pulsatile blood flow: comparative study of indirect systolic, diastolic, and mean brachial artery pressure with simultaneous direct ascending aortic pressure measurements. *Am Heart J.* 1982;103(5):879-886.
11. Nagle FJ, Naughton J, Balke B. Comparisons of direct and indirect blood pressure with pressure-flow dynamics during exercise. *J Appl Physiol.* 1966;21(1):317-320.
12. Bos WJW, Van Goudoever J, Wesseling KH, et al. Pseudohypertension and the measurement of blood pressure. *Hypertension.* 1992;20(1):26-31.
13. Gould BA, Hornung RS, Kieso HA, Altman DG, Cashman PM, Raftery EB. Evaluation of the Remler M2000 blood pressure recorder. Comparison with intraarterial blood pressure recordings both at hospital and at home. *Hypertension.* 1984;6(2 Pt 1):209-215.
14. Melamed R, Johnson K, Pothen B, Sprenkle MD, Johnson PJ. Invasive blood pressure monitoring systems in the ICU: influence of the blood-conserving device on the dynamic response characteristics and agreement with noninvasive measurements. *Blood Press Monit.* 2012;17(5):179-183.
15. Sagiv M, Ben-Sira D, Goldhammer E. Direct vs. indirect blood pressure measurement at peak anaerobic exercise. *Int J Sports Med.* 1999;20(5):275-278.
16. Vardan S, Mookherjee S, Warner R, Smulyan H. Systolic hypertension. Direct and indirect BP measurements. *Arch Intern Med.* 1983;143(5):935-938.
17. Aakhus S, Torp H, Haugland T, Hatle L. Noninvasive Estimates of Aortic Root Pressures - External Subclavian Arterial Pulse Tracing Calibrated by Oscillometrically Determined Brachial Arterial Pressures. *Clin Physiol.* 1993;13(6):573-586.

18. Laugesen E, Rossen NB, Peters CD, et al. Assessment of central blood pressure in patients with type 2 diabetes: a comparison between SphygmoCor and invasively measured values. *Am J Hypertens.* 2014;27(2):169-176.
19. Rossen NB, Laugesen E, Peters CD, et al. Invasive validation of arteriograph estimates of central blood pressure in patients with type 2 diabetes. *Am J Hypertens.* 2014;27(5):674-679.
20. Lin AC, Lowe A, Sidhu K, Harrison W, Ruygrok P, Stewart R. Evaluation of a novel sphygmomanometer, which estimates central aortic blood pressure from analysis of brachial artery suprasystolic pressure waves. *J Hypertens.* 2012;30(9):1743-1750.
21. Lowe A, Harrison W, El-Aklouk E, Ruygrok P, Al-Jumaily AM. Non-invasive model-based estimation of aortic pulse pressure using suprasystolic brachial pressure waveforms. *J Biomech.* 2009;42(13):2111-2115.
22. Pucci G, Cheriyan J, Hubsch A, et al. Evaluation of the Vicorder, a novel cuff-based device for the noninvasive estimation of central blood pressure. *J Hypertens.* 2013;31(1):77-85.
23. Saul F, Aristidou Y, Klaus D, Wiemeyer A, Losse B. Comparison of Invasive Blood-Pressure Measurements with Indirect Oscillometric Wrist and Upper Arm Values. *Z Kardiol.* 1995;84(9):675-685.
24. Smulyan H, Siddiqui DS, Carlson RJ, London GM, Safar ME. Clinical utility of aortic pulses and pressures calculated from applanated radial-artery pulses. *Hypertension.* 2003;42(2):150-155.
25. Takazawa K, Kobayashi H, Kojima I, et al. Estimation of central aortic systolic pressure using late systolic inflection of radial artery pulse and its application to vasodilator therapy. *J Hypertens.* 2012;30(5):908-916.
26. Takazawa K, Kobayashi H, Shindo N, Tanaka N, Yamashina A. Relationship between radial and central arterial pulse wave and evaluation of central aortic pressure using the radial arterial pulse wave. *Hypertens Res.* 2007;30(3):219-228.
27. Weber F, Lindemann M, Erbel R, Philipp T. Indirect and direct simultaneous, comparative blood pressure measurements with the Bosstron 2 (R) device. *Kidney Blood Press Res.* 1999;22(3):166-171.
28. Kobayashi H, Kinou M, Takazawa K. Correlation Between the Brachial Blood Pressure Values Obtained Using the Cuff Method and the Central Blood Pressure Values Obtained Invasively. *Intern Med.* 2013;52(15):1675-1680.
29. Blank SG, West JE, Muller FB, et al. Wideband external pulse recording during cuff deflation: a new technique for evaluation of the arterial pressure pulse and measurement of blood pressure. *Circulation.* 1988;77(6):1297-1305.
30. Davies JI, Band MM, Pringle S, Ogston S, Struthers AD. Peripheral blood pressure measurement is as good as applanation tonometry at predicting ascending aortic blood pressure. *J Hypertens.* 2003;21(3):571-576.
31. Cheng HM, Wang KL, Chen YH, et al. Estimation of central systolic blood pressure using an oscillometric blood pressure monitor. *Hypertens Res.* 2010;33(6):592-599.
32. Davies JE, Shanmuganathan M, Francis DP, Mayet J, Hackett DR, Hughes AD. Caution using brachial systolic pressure to calibrate radial tonometric pressure waveforms: lessons from invasive study. *Hypertension.* 2010;55(1):e4.
33. Ding FH, Li Y, Zhang RY, Zhang Q, Wang JG. Comparison of the SphygmoCor and Omron devices in the estimation of pressure amplification against the invasive catheter measurement. *J Hypertens.* 2013;31(1):86-93.
34. Liang F, Yin Z, Fan Y, Chen K, Wang C. In vivo validation of an oscillometric method for estimating central aortic pressure. *Int J Cardiol.* 2015;199:439-441.

35. Lin MM, Cheng HM, Sung SH, et al. Estimation of central aortic systolic pressure from the second systolic peak of the peripheral upper limb pulse depends on central aortic pressure waveform morphology. *J Hypertens.* 2012;30(3):581-586.
36. Westerhof BE, Guelen I, Stok WJ, et al. Individualization of transfer function in estimation of central aortic pressure from the peripheral pulse is not required in patients at rest. *J Appl Physiol.* 2008;105(6):1858-1863.
37. Hayashi S, Yamada H, Bando M, et al. Augmentation index does not reflect risk of coronary artery disease in elderly patients. *Circ J.* 2014;78(5):1176-1182.
38. Muecke S, Bersten A, Plummer J. The mean machine; accurate non-invasive blood pressure measurement in the critically ill patient. *J Clin Monit Comput.* 2009;23(5):283-297.
39. Omboni S, Parati G, Groppelli A, Ulian L, Mancia G. Performance of the AM-5600 blood pressure monitor: comparison with ambulatory intra-arterial pressure. *J Appl Physiol (1985).* 1997;82(2):698-703.
40. Bhatt SD, Hinderliter AL, Stouffer GA. Influence of Sex on the Accuracy of Oscillometric-Derived Blood Pressures. *J Clin Hypertens.* 2011;13(2):112-119.
41. Costello BT, Schultz MG, Black JA, Sharman JE. Evaluation of a brachial cuff and suprasystolic waveform algorithm method to noninvasively derive central blood pressure. *Am J Hypertens.* 2015;28(4):480-486.
42. Cremer A, Butlin M, Codjo L, et al. Determination of central blood pressure by a noninvasive method (brachial BP and QKD interval). *J Hypertens.* 2012;30(8):1533-1539.
43. Milne L, Keehn L, Guilcher A, et al. Central aortic blood pressure from ultrasound wall-tracking of the carotid artery in children: comparison with invasive measurements and radial tonometry. *Hypertension.* 2015;65(5):1141-1146.
44. Nakagomi A, Okada S, Shoji T, Kobayashi Y. Aortic pulsatility assessed by an oscillometric method is associated with coronary atherosclerosis in elderly people. *Blood Press.* 2016:1-8.
45. Ohte N, Saeki T, Miyabe H, et al. Relationship between blood pressure obtained from the upper arm with a cuff-type sphygmomanometer and central blood pressure measured with a catheter-tipped micromanometer. *Heart Vessels.* 2007;22(6):410-415.
46. Ott C, Haetinger S, Schneider MP, Pauschinger M, Schmieder RE. Comparison of two noninvasive devices for measurement of central systolic blood pressure with invasive measurement during cardiac catheterization. *J Clin Hypertens (Greenwich).* 2012;14(9):575-579.
47. Park CM, Korolkova O, Davies JE, et al. Arterial pressure: agreement between a brachial cuff-based device and radial tonometry. *J Hypertens.* 2014;32(4):865-872.
48. Pereira T, Maldonado J, Coutinho R, et al. Invasive validation of the Complior Analyse in the assessment of central artery pressure curves: a methodological study. *Blood Press Monit.* 2014;19(5):280-287.
49. Rajani R, Chowienczyk P, Redwood S, Guilcher A, Chambers JB. The noninvasive estimation of central aortic blood pressure in patients with aortic stenosis. *J Hypertens.* 2008;26(12):2381-2388.
50. Smulyan H, Sheehe PR, Safar ME. A preliminary evaluation of the mean arterial pressure as measured by cuff oscillometry. *Am J Hypertens.* 2008;21(2):166-171.
51. Smulyan H, Mukherjee R, Sheehe PR, Safar ME. Cuff and aortic pressure differences during dobutamine infusion: a study of the effects of systolic blood pressure amplification. *Am Heart J.* 2010;159(3):399-405.

52. Sueta D, Yamamoto E, Tanaka T, et al. The accuracy of central blood pressure waveform by novel mathematical transformation of non-invasive measurement. *Int J Cardiol.* 2015;189:244-246.
53. Weber T, Wassertheurer S, Rammer M, et al. Validation of a brachial cuff-based method for estimating central systolic blood pressure. *Hypertension.* 2011;58(5):825-832.
54. Williams B, Lacy PS, Yan P, Hwee CN, Liang C, Ting CM. Development and validation of a novel method to derive central aortic systolic pressure from the radial pressure waveform using an n-point moving average method. *J Am Coll Cardiol.* 2011;57(8):951-961.
55. Bazaral MG, Welch M, Golding LAR, Badhwar K. Comparison of Brachial and Radial Arterial-Pressure Monitoring in Patients Undergoing Coronary-Artery Bypass-Surgery. *Anesthesiology.* 1990;73(1):38-45.
56. De Hert SG, Vermeyen KM, Moens MM, Hoffmann VL, Bataillie KJ. Central-to-peripheral arterial pressure gradient during cardiopulmonary bypass: relation to pre- and intra-operative data and effects of vasoactive agents. *Acta Anaesthesiol Scand.* 1994;38(5):479-485.
57. O'Rourke MF. Influence of ventricular ejection on the relationship between central aortic and brachial pressure pulse in man. *Cardiovasc Res.* 1970;4(3):291-300.
58. VanBeck JO, White RD, Abenstein JP, Mullany CJ, Orszulak TA. Comparison of axillary artery or brachial artery pressure with aortic pressure after cardiopulmonary bypass using a long radial artery catheter. *J Cardiothorac Vasc Anesth.* 1993;7(3):312-315.
59. Gravlee GP, Brauer SD, Orourke MF, Avolio AP. A Comparison of Brachial, Femoral, and Aortic Intra-Arterial Pressures before and after Cardiopulmonary Bypass. *Anaesth Intensive Care.* 1989;17(3):305-311.
60. Gravlee GP, Wong AB, Adkins TG, Case LD, Pauca AL. A comparison of radial, brachial, and aortic pressures after cardiopulmonary bypass. *J Cardiothorac Anesth.* 1989;3(1):20-26.
61. Karamanoglu M, O'Rourke MF, Avolio AP, Kelly RP. An analysis of the relationship between central aortic and peripheral upper limb pressure waves in man. *Eur Heart J.* 1993;14(2):160-167.
62. Bachmann K, Baeuerlein G. Ambulatory monitoring of arterial blood pressure. Comparison between blood pressure measurements obtained with the Remler M 2000 portable recorder and by radiotelemetry under laboratory conditions and during everyday activities. *Biotelem Patient Monit.* 1981;8(1-2):47-55.
63. Baeriswyl C, Muller PO, Regamey C. Development and clinical testing of a new electronic device for blood pressure measurement. (Sphygmodigital 4000). *Schweizerische Medizinische Wochenschrift.* 1982;112(50):1829-1830.
64. Breit SN, O'Rourke MF. Comparison of direct and indirect arterial pressure measurements in hospitalised patients. *Aust N Z J Med.* 1974;4(5):485-491.
65. Fagher B, Magnusson J, Thulin T. Direct and Indirect Blood-Pressure in Normotensive and Hypertensive Subjects. *J Intern Med.* 1994;236(1):85-90.
66. Forsberg SA, de Guzman M, Berlind S. Validity of blood pressure measurement with cuff in the arm and forearm. *Acta Med Scand.* 1970;188(5):389-396.
67. Ginsburg J, Duncan S. Direct and indirect blood pressure measurement in pregnancy. *The Journal of obstetrics and gynaecology of the British Commonwealth.* 1969;76(8):705-710.
68. He B, Miao W. A study on pseudo-hypertension. *Chinese Journal of Cardiology.* 1994;22(2):93-95+155.

69. Julien J, Pagny JY, Jeunemaitre X, Fouqueray B, Plouin PF, Corvol P. Comparison of 3 methods of blood pressure measurement in obesity. *Arch Mal Coeur Vaiss.* 1988;81 Spec No:241-245.
70. Karlefors T, Nilsén R, Westling H. On the accuracy of indirect auscultatory blood pressure measurements during exercise. *Acta Medica Scandinavica, Supplement.* 1966;449:81-87.
71. Kuwajima I, Hoh E, Suzuki Y, Matsushita S, Kuramoto K. Pseudohypertension in the elderly. *J Hypertens.* 1990;8(5):429-432.
72. London SB, London RE. Comparison of indirect pressure measurements (Korotkoff) with simultaneous direct brachial artery pressure distal to the cuff. *Adv Intern Med.* 1967;13:127-142.
73. Molhoek GP, Wesseling KH, Settels JJ, et al. Evaluation of the Penaz servo-plethysmo-manometer for the continuous, non-invasive measurement of finger blood pressure. *Basic Res Cardiol.* 1984;79(5):598-609.
74. Moss AJ, Adams FH. Auscultatory and Intra-Arterial Pressure - a Comparison in Children with Special Reference to Cuff Width. *J Pediatr.* 1965;66(6):1094-+.
75. Murray WB, Gorven AM. Invasive V Noninvasive Blood-Pressure Measurements - the Influence of the Pressure Contour. *S Afr Med J.* 1991;79(3):134-139.
76. Netea RT, Bijlstra PJ, Lenders JWM, Smits P, Thien T. Influence of the arm position on intra-arterial blood pressure measurement. *J Hum Hypertens.* 1998;12(3):157-160.
77. Ochiai H, Miyazaki N, Miyata T, Mitake A, Tochikubo O, Ishii M. Assessment of the accuracy of indirect blood pressure measurements. *Jpn Heart J.* 1997;38(3):393-407.
78. Sánchez G, Gutiérrez E, Monroy JR, Gil M, Ramírez A, Salazar Valdéz E. Correlation between the direct intra-arterial method and the sphygmomamometric auscultation in the determination of the systemic arterial pressure. *Arch Inst Cardiol Mex.* 1977;47(6):673-683.
79. Turjanmaa VM, Kalli ST, Uusitalo AJ. Blood pressure level changes caused by posture change and physical exercise: can they be determined accurately using a standard cuff method? *J Hypertens Suppl.* 1988;6(4):S79-81.
80. Turjanmaa V. Determination of blood pressure level and changes in physiological situations: comparison of the standard cuff method with direct intra-arterial recording. *Clin Physiol.* 1989;9(4):373-387.
81. Casadei R, Parati G, Pomidossi G, et al. 24-hour blood pressure monitoring: evaluation of Spacelabs 5300 monitor by comparison with intra-arterial blood pressure recording in ambulant subjects. *J Hypertens.* 1988;6(10):797-803.
82. Elseed AM, Shinebourne EA, Joseph MC. Assessment of techniques for measurement of blood pressure in infants and children. *Arch Dis Child.* 1973;48(12):932-936.
83. Fukuoka M, Yamori Y, Ueno T. Evaluation of a new non-invasive semiautomatic blood pressure monitoring device. *Clinical and Experimental Hypertension - Part A Theory and Practice.* 1987;9(1):141-152.
84. Gould BA, Hornung RS, Altman DG. Indirect measurement of blood pressure during exercise testing can be misleading. *Br Heart J.* 1985;53(6):611-615.
85. Gould BA, Hornung RS, Cashman PM, Altman D, Raftery EB. An evaluation of the Avionics Pressurometer III 1978 at home and in hospital. *Clin Cardiol.* 1986;9(7):335-343.
86. Graettinger WF, Lipson JL, Cheung DG, Weber MA. Validation of portable noninvasive blood pressure monitoring devices: Comparisons with intra-arterial and sphygmomanometer measurements. *Am Heart J.* 1988;116(4):1155-1160.
87. Gravlee GP, Brockschmidt JK. Accuracy of four indirect methods of blood pressure measurement, with hemodynamic correlations. *J Clin Monit.* 1990;6(4):284-298.

88. Groppelli A, Omboni S, Parati G, Mancia G. Evaluation of noninvasive blood pressure monitoring devices Spacelabs 90202 and 90207 versus resting and ambulatory 24-hour intra-arterial blood pressure. *Hypertension.* 1992;20(2):227-232.
89. Holland WW, Humerfelt S. Measurement of Blood-Pressure: Comparison of Intra-Arterial and Cuff Values. *Br Med J.* 1964;2(5419):1241-1243.
90. Hunyor S, Nyberg G. Comparison of intra-arterial and indirect blood pressures at rest and during isometric exercise in hypertensive patients before and after metoprolol. *Br J Clin Pharmacol.* 1978;6(2):109-114.
91. Lemson J, Hofhuizen CM, Schraa O, Settels JJ, Scheffer GJ, van der Hoeven JG. The Reliability of Continuous Noninvasive Finger Blood Pressure Measurement in Critically III Children. *Anesth Analg.* 2009;108(3):814-821.
92. Mejia AD, Egan BM, Schork NJ, Zweifler AJ. Artefacts in measurement of blood pressure and lack of target organ involvement in the assessment of patients with treatment-resistant hypertension. *Ann Intern Med.* 1990;112(4):270-277.
93. Milsom I, Svahn SO, Forssman L, Sivertsson R. An evaluation of automated indirect blood pressure measurement during pregnancy. *Acta Obstet Gynecol Scand.* 1986;65(7):721-725.
94. Nielsen PE, Barras JP, Holstein P. Systolic pressure amplification in the arteries of normal subjects. *Scand J Clin Lab Invest.* 1974;33(4):371-377.
95. Nielsen PE, Hilden T. Intra-arterial blood pressure measured during 24-hours in evaluation of hypertensive subjects. *Acta Med Scand Suppl.* 1979;625:92-96.
96. Nielsen PE, Larsen B, Holstein P, Poulsen HL. Accuracy of auscultatory blood pressure measurements in hypertensive and obese subjects. *Hypertension.* 1983;5(1):122-127.
97. Pereira E, Prys-Roberts C, Dagnino J. Auscultatory measurement of arterial pressure during anaesthesia: a reassessment of Korotkoff sounds. *Eur J Anaesthesiol.* 1985;2(1):11-20.
98. Pitlik SD, Morduchowicz G, Blai A, Rosenfeld JB. Overestimation of blood pressure in the elderly. *Isr J Med Sci.* 1986;22(6):435-437.
99. Robinson TE, Sue DY, Huszczuk A, Weiler-Ravell D, Hansen JE. Intra-arterial and cuff blood pressure responses during incremental cycle ergometry. *Med Sci Sports Exerc.* 1988;20(2):142-149.
100. Sagiv M, Hanson PG, Ben-Sira D, Nagle FJ. Direct vs indirect blood pressure at rest and during isometric exercise in normal subjects. *Int J Sports Med.* 1995;16(8):514-518.
101. Stolt M, Sjonell G, Astrom H, Hansson L. The reliability of auscultatory measurement of arterial blood pressure. A comparison of the standard and a new methodology. *Am J Hypertens.* 1990;3(9):697-703.
102. Stolt M, Sjonell G, Astrom H, Hansson L. Factors Affecting the Validity of the Standard Blood-Pressure Cuff. *Clin Physiol.* 1993;13(6):611-620.
103. Stolt M, Sjonell G, Astrom H, Rossner S, Hansson L. Improved Accuracy of Indirect Blood-Pressure Measurement in Patients with Obese Arms. *Am J Hypertens.* 1993;6(1):66-71.
104. van Egmond J, Lenders JW, Weernink E, Thien T. Accuracy and reproducibility of 30 devices for self-measurement of arterial blood pressure. *Am J Hypertens.* 1993;6(10):873-879.
105. Villani A, Parati G, Groppelli A, Omboni S, Dirienzo M, Mancia G. Noninvasive Automatic Blood-Pressure Monitoring Does Not Attenuate Nighttime Hypotension - Evidence from 24h Intraarterial Blood-Pressure Monitoring. *Am J Hypertens.* 1992;5(10):744-747.

106. White WB, Lund-Johansen P, McCabe EJ. Clinical evaluation of the colin abpm 630 at rest and during exercise: An ambulatory blood pressure monitor with gas-powered cuff inflation. *J Hypertens.* 1989;7(6):477-483.
107. White WB, Lund-Johansen P, McCabe EJ, Omvik P. Clinical evaluation of the Accutracker II ambulatory blood pressure monitor: assessment of performance in two countries and comparison with sphygmomanometry and intra-arterial blood pressure at rest and during exercise. *J Hypertens.* 1989;7(12):967-975.
108. White WB, Lund-Johansen P, Omvik P. Assessment of four ambulatory blood pressure monitors and measurements by clinicians versus intraarterial blood pressure at rest and during exercise. *The American Journal of Cardiology.* 1990;65(1):60-66.
109. Wiecek EM, McCartney N, McKelvie RS. Comparison of Direct and Indirect Measures of Systemic Arterial-Pressure during Weightlifting in Coronary-Artery Disease. *Am J Cardiol.* 1990;66(15):1065-1069.
110. Li L, Yang F, Huang J. A study on comparing blood pressure of ankle artery with brachial artery and intra-aortic pressures. *Chinese Journal of Cardiology.* 1999;27(5):376-378.
111. Alihanoglu YI, Kayrak M, Ulgen MS, et al. The impact of central blood pressure levels on the relationship between oscillometric and central blood pressure measurements: a multicenter invasive study. *J Clin Hypertens (Greenwich).* 2013;15(9):681-686.
112. Baguet JP, de Poli F, Sosner P, et al. Using a large cuff reduces the difference between peripheral and central blood pressure readings. The BP-CUFF study. *Int J Cardiol.* 2013;170(2):e43-44.
113. Brett SE, Guilcher A, Clapp B, Chowienczyk P. Estimating central systolic blood pressure during oscillometric determination of blood pressure: proof of concept and validation by comparison with intra-aortic pressure recording and arterial tonometry. *Blood Press Monit.* 2012;17(3):132-136.
114. Choi CU, Kim EJ, Kim SH, et al. Differing effects of aging on central and peripheral blood pressures and pulse wave velocity: a direct intraarterial study. *J Hypertens.* 2010;28(6):1252-1260.
115. Cloud GC, Rajkumar C, Kooner J, Cooke J, Bulpitt CJ. Estimation of central aortic pressure by SphygmoCor requires intra-arterial peripheral pressures. *Clin Sci (Lond).* 2003;105(2):219-225.
116. Eckert S, Hammentgen R, Ohlmeier H, Gleichmann U. 24-Stunden-Langzeitblutdruckmessung: Liefert die auskultatorische oder oszillometrische Meßtechnik genauere Ergebnisse. *Nieren- und Hochdruckkrankheiten.* 1994;23(5):236-237.
117. Eckert S, Gleichmann S, Gleichmann U. Blood pressure self-measurement in upper arm and in wrist for treatment control of arterial hypertension compared to ABPM. *Z Kardiol.* 1996;85(Suppl 3):109-111.
118. Fleming SE, Horvath JS, Korda A. Errors in the measurement of blood pressure. *Aust N Z J Obstet Gynaecol.* 1983;23(3):136-138.
119. Guilcher A, Brett S, Munir S, Clapp B, Chowienczyk PJ. Estimating central SBP from the peripheral pulse: influence of waveform analysis and calibration error. *J Hypertens.* 2011;29(7):1357-1366.
120. Hoegholm A, Eidemak I, Kristensen KS, Bang LE, Madsen NH. Clinical evaluation of the Takeda Medical (A & D) TM 2420 ambulatory blood pressure monitor. Practical experience and comparison with direct and indirect measurements. *Scand J Clin Lab Invest.* 1992;52(4):261-268.

121. Hope SA, Meredith IT, Cameron JD. Effect of non-invasive calibration of radial waveforms on error in transfer-function-derived central aortic waveform characteristics. *Clin Sci.* 2004;107(2):205-211.
122. Horvath IG, Nemeth A, Lenkey Z, et al. Invasive validation of a new oscillometric device (Arteriograph) for measuring augmentation index, central blood pressure and aortic pulse wave velocity. *J Hypertens.* 2010;28(10):2068-2075.
123. Kayrak M, Ulgen MS, Yazici M, et al. [Comparison between brachial blood pressures obtained by aneroid sphygmomanometer and central aortic pressures: factors affecting the measurements]. *Turk Kardiyol Dern Ars.* 2008;36(4):239-246.
124. Kayrak M, Ulgen MS, Yazici M, et al. A comparison of blood pressure and pulse pressure values obtained by oscillometric and central measurements in hypertensive patients. *Blood Press.* 2010;19(2):98-103.
125. Klaus D, Wetzchewald D, Saul F, Obermeier G, Lambers F. Vergleich von direkter invasiver Blutdruckmessung mit indirekter Blutdruckmessung mittels Oszillometrie oder Sphygmomanometrie. *Nieren- und Hochdruckkrankheiten.* 1991;20(4):160-169.
126. Lehmann KG, Gelman JA, Weber MA, Lafrades A. Comparative accuracy of three automated techniques in the noninvasive estimation of central blood pressure in men. *Am J Cardiol.* 1998;81(8):1004-1012.
127. Park S-H, Lee S-J, Kim JY, et al. Direct comparison between brachial pressure obtained by oscillometric method and central pressure using invasive method. *Soonchunhyang Medical Science.* 2011;17(2):65-71.
128. Shangguan Q, Wu Y, Xu J, et al. The impact of arm circumference on noninvasive oscillometric blood pressure referenced with intra-aortic blood pressure. *Blood Press Monit.* 2015.
129. Sharir T, Marmor A, Ting CT, et al. Validation of a method for noninvasive measurement of central arterial pressure. *Hypertension.* 1993;21(1):74-82.
130. Sugawara R, Horinaka S, Yagi H, Ishimura K, Honda T. Central blood pressure estimation by using N-point moving average method in the brachial pulse wave. *Hypertens Res.* 2015;38(5):336-341.
131. Umana E, Ahmed W, Fraley MA, Alpert MA. Comparison of oscillometric and intraarterial systolic and diastolic blood pressures in lean, overweight, and obese patients. *Angiology.* 2006;57(1):41-45.
132. Zuo JL, Li Y, Yan ZJ, et al. Validation of the central blood pressure estimation by the SphygmoCor system in Chinese. *Blood Press Monit.* 2010;15(5):268-274.