

Hypertensie: meten ≠ weten

Jaap Deinum, internist

Onthulling belangen J. Deinum

| | |
|--|--------------------------|
| (potentiële) belangenverstengeling | Geen |
| Voor bijeenkomst mogelijk relevante relaties met bedrijven | |
| <ul style="list-style-type: none">• Sponsoring of onderzoeksgeld• Honorarium of andere (financiële) vergoeding• Aandeelhouder• Andere relatie, namelijk ... | EU Horizon 2020 ENSAT-HT |

SPRINT en bloeddrukmeetmethode

Vergelijkbaarheid meetmethoden?

Bloeddrukfenotypen

Nieuwe manieren van bloeddruk meten

Meethygiene



Spreekkamer



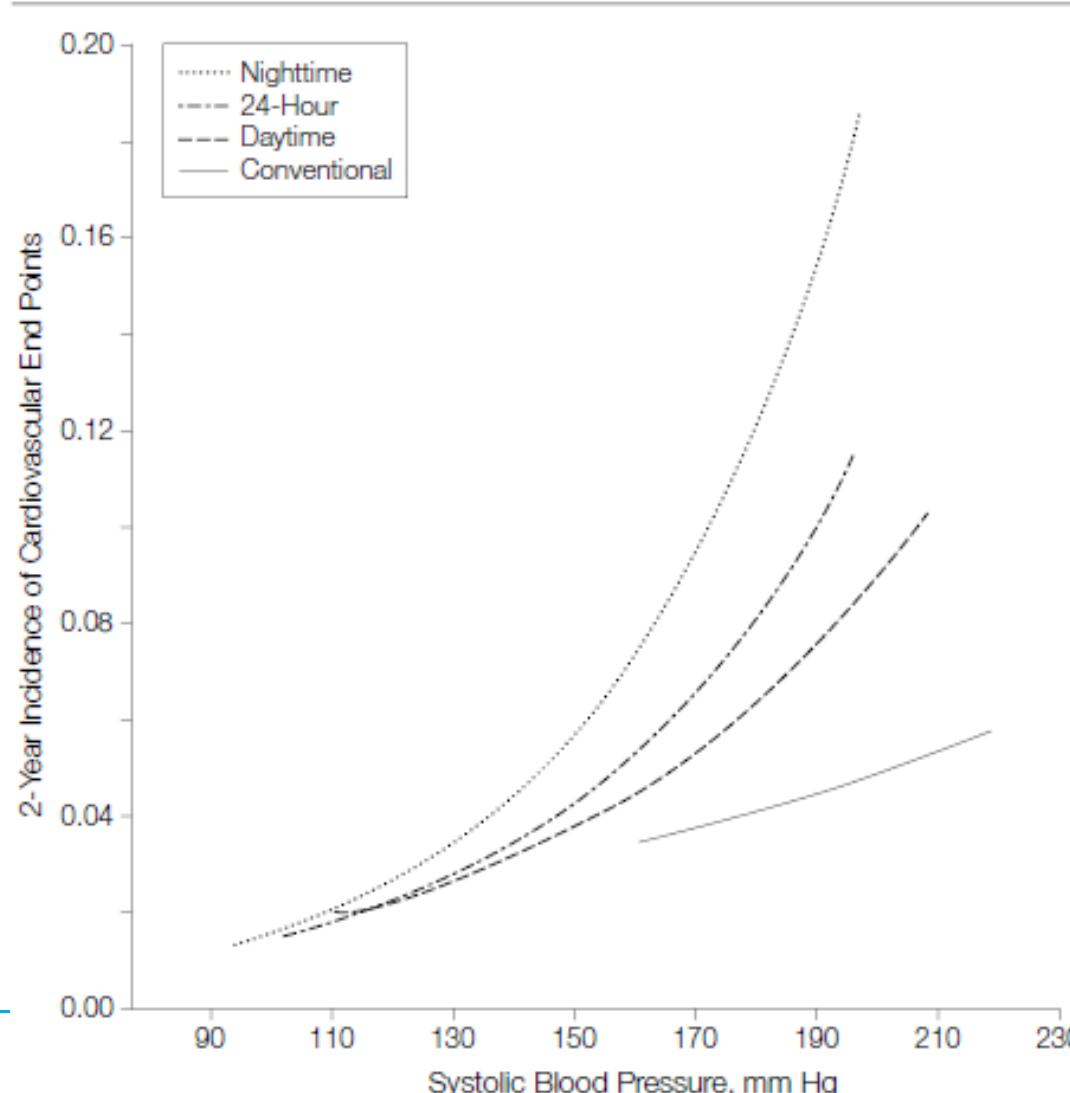
Home BP monitoring
uitsluiten wittejashypertensie, patientbetrokkenheid



Ambulatory BP monitoring
uitsluiten wittejashypertensie

meten ≠ weten : CV risico o.b.v. bloeddruk

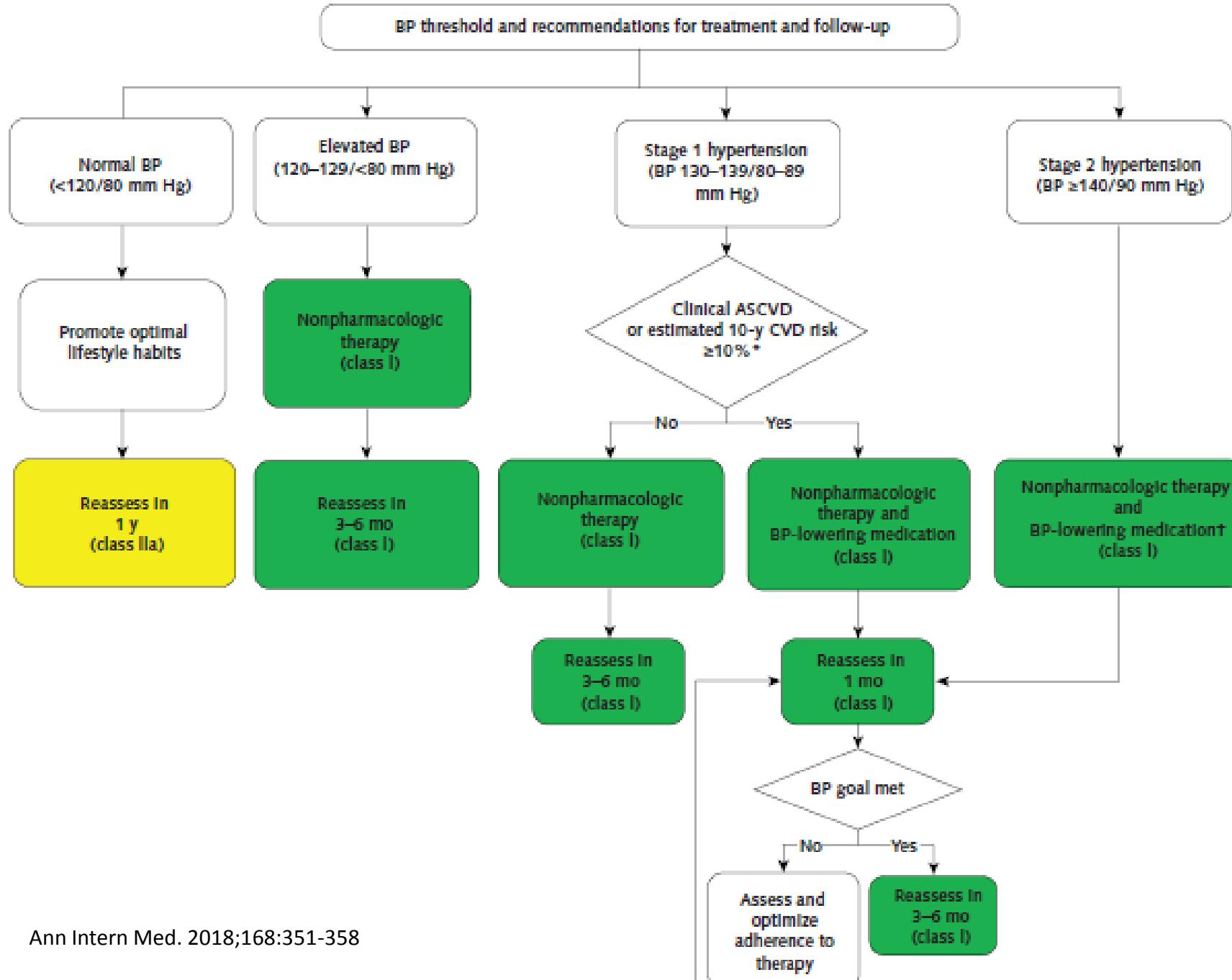
Figure 3. Systolic Blood Pressure on Conventional, 24-Hour, Daytime, and Nighttime Measurement at Entry as Predictors of the 2-Year Incidence of Cardiovascular End Points in the Placebo Group



Staessen et al. 1999, 282:539

November 2017: plotse epidemie van hypertensie



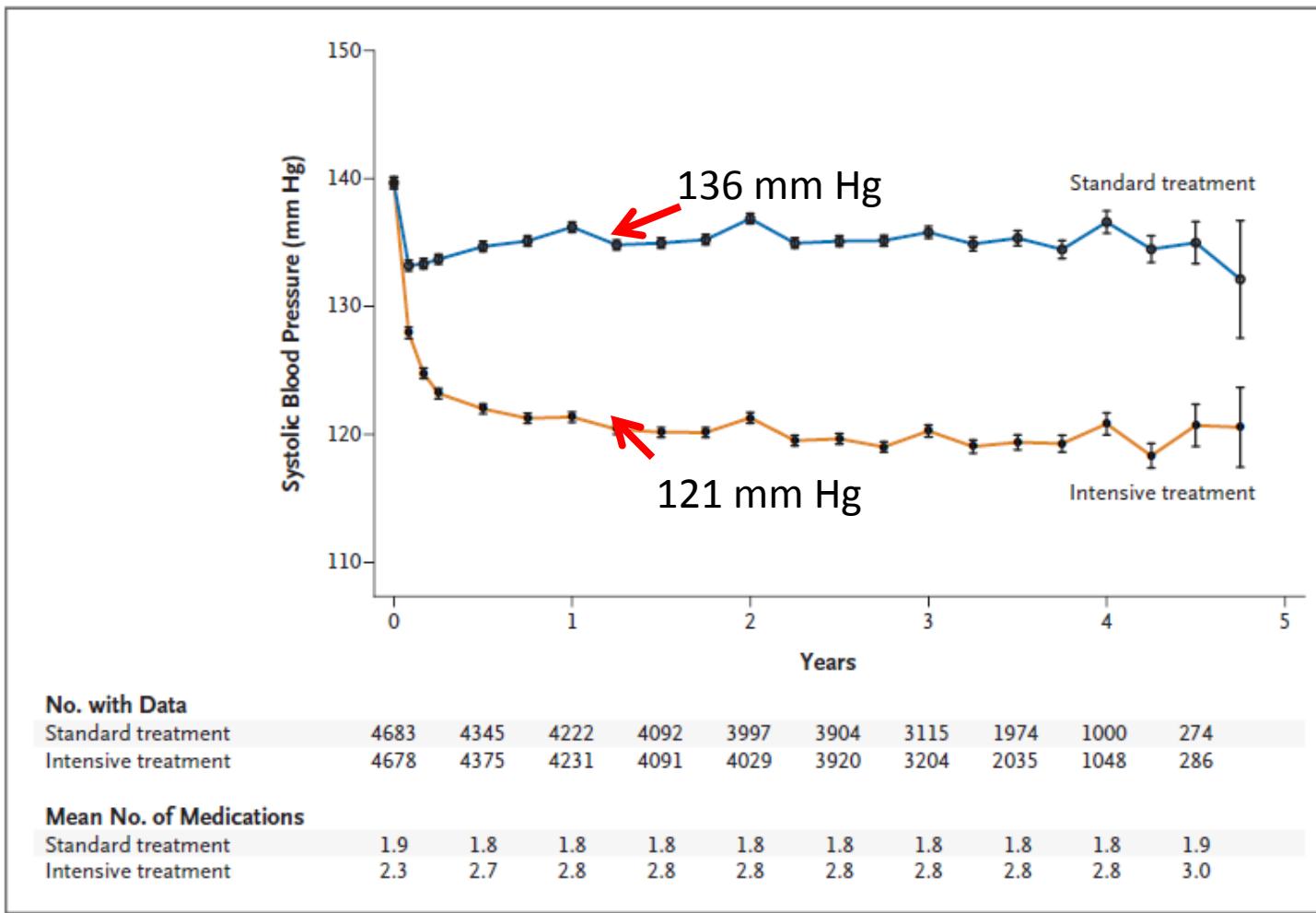


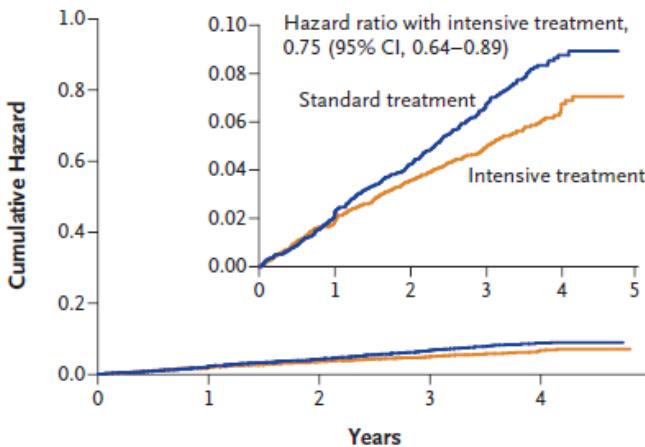
Vergelijk bloeddrukclassificaties

| Blood Pressure, mm Hg | | | JNC 6 ^a | JNC 7 ^a | ACC/AHA ^b | ESC/ESH ^c | |
|-----------------------|--------|-----------|----------------------|----------------------|----------------------|----------------------|--|
| Systolic | | Diastolic | | | | | |
| <120 | and | <80 | Optimal | Normal | Normal | Optimal | |
| 120-129 | and | <80 | Normal | Prehypertension | Elevated | Normal | |
| | and/or | 80-84 | | | Stage 1 hypertension | | |
| | | 85-89 | | | | | |
| 130-139 | and/or | 85-89 | High normal | | | High normal | |
| 140-159 | and/or | 90-99 | Stage 1 hypertension | Stage 1 hypertension | | Grade 1 hypertension | |
| ≥160-179 | and/or | ≥100-109 | Stage 2 hypertension | Stage 2 hypertension | Stage 2 hypertension | Grade 2 hypertension | |
| ≥180 | and/or | ≥110 | Stage 3 hypertension | | | Grade 3 hypertension | |

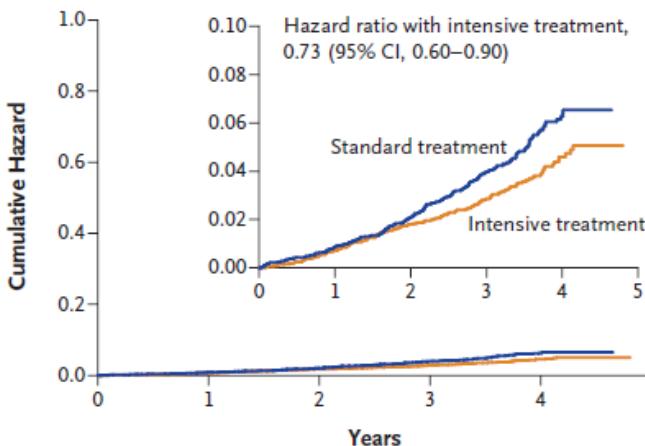
Basis voor lagere streefwaarde is SPRINT

>50 jaar, verhoogd cardiovasculair risico, geen DM of stroke



A Primary Outcome**No. at Risk**

| | | | | | |
|---------------------|------|------|------|------|-----|
| Standard treatment | 4683 | 4437 | 4228 | 2829 | 721 |
| Intensive treatment | 4678 | 4436 | 4256 | 2900 | 779 |

B Death from Any Cause**No. at Risk**

| | | | | | |
|---------------------|------|------|------|------|-----|
| Standard treatment | 4683 | 4528 | 4383 | 2998 | 789 |
| Intensive treatment | 4678 | 4516 | 4390 | 3016 | 807 |

NNT = 61 (3.26 jr)

NNT = 90 (3.26 jr)

Side effects

| Variable | Intensive Treatment (N=4678) | Standard Treatment (N=4683) | Hazard Ratio | P Value |
|---|---------------------------------|--------------------------------|--------------|---------|
| | no. of patients (%) | | | |
| Serious adverse event* | 1793 (38.3) | 1736 (37.1) | 1.04 | 0.25 |
| Conditions of interest | | | | |
| Serious adverse event only | | | | |
| Hypotension | 110 (2.4) | 66 (1.4) | 1.67 | 0.001 |
| Syncope | 107 (2.3) | 80 (1.7) | 1.33 | 0.05 |
| Bradycardia | 87 (1.9) | 73 (1.6) | 1.19 | 0.28 |
| Electrolyte abnormality | 144 (3.1) | 107 (2.3) | 1.35 | 0.02 |
| Injurious fall† | 105 (2.2) | 110 (2.3) | 0.95 | 0.71 |
| Acute kidney injury or acute renal failure‡ | 193 (4.1) | 117 (2.5) | 1.66 | <0.001 |
| Emergency department visit or serious adverse event | | | | |
| Hypotension | 158 (3.4) | 93 (2.0) | 1.70 | <0.001 |
| Syncope | 163 (3.5) | 113 (2.4) | 1.44 | 0.003 |
| Bradycardia | 104 (2.2) | 83 (1.8) | 1.25 | 0.13 |
| Electrolyte abnormality | 177 (3.8) | 129 (2.8) | 1.38 | 0.006 |
| Injurious fall† | 334 (7.1) | 332 (7.1) | 1.00 | 0.97 |
| Acute kidney injury or acute renal failure‡ | 204 (4.4) | 120 (2.6) | 1.71 | <0.001 |

Welke bloeddruk eigenlijk?

Sprint mat bloeddruk met 'automated office blood pressure'



- aanleggen manchet
- programmeren apparaat
- dokter verdwijnt uit kamer***
- 5 min rust
- 3 metingen (*unobserved/unattended*)

(Doel: elimineren van wittejaseffect)

Welke bloeddruk eigenlijk?

Bloeddrukken in SPRINT na 27 maanden (N=876)

Clinic and Ambulatory BP and Group Differences

| Variable | Intensive Treatment Mean \pm SD | Standard Treatment Mean \pm SD | Mean Difference (SE) | p-Value |
|----------------------|--------------------------------------|-------------------------------------|-------------------------|---------|
| 27M clinic SBP | 119.6 \pm 13 | 135.5 \pm 14 | 15.8 (0.93) | <0.001 |
| Nighttime SBP | 116.8 \pm 14 | 126.6 \pm 14 | 9.8 (0.97) | <0.001 |
| Daytime SBP | 126.5 \pm 12 | 138.5 \pm 12 | 12.0 (0.83) | <0.001 |
| 24 hour SBP | 125.4 \pm 12 | 137.1 \pm 12 | 11.7 (0.81) | <0.001 |
| Night-day SBP ratio | 0.92 (0.87 to 0.97) | 0.92 (0.85 to 0.98) | -0.01 (0.01) | 0.194 |
| SBP variability (SD) | 12.1 (10.5 to 14.5) | 13.1 (11.1 to 15.6) | 0.88 (0.24) | <0.001 |

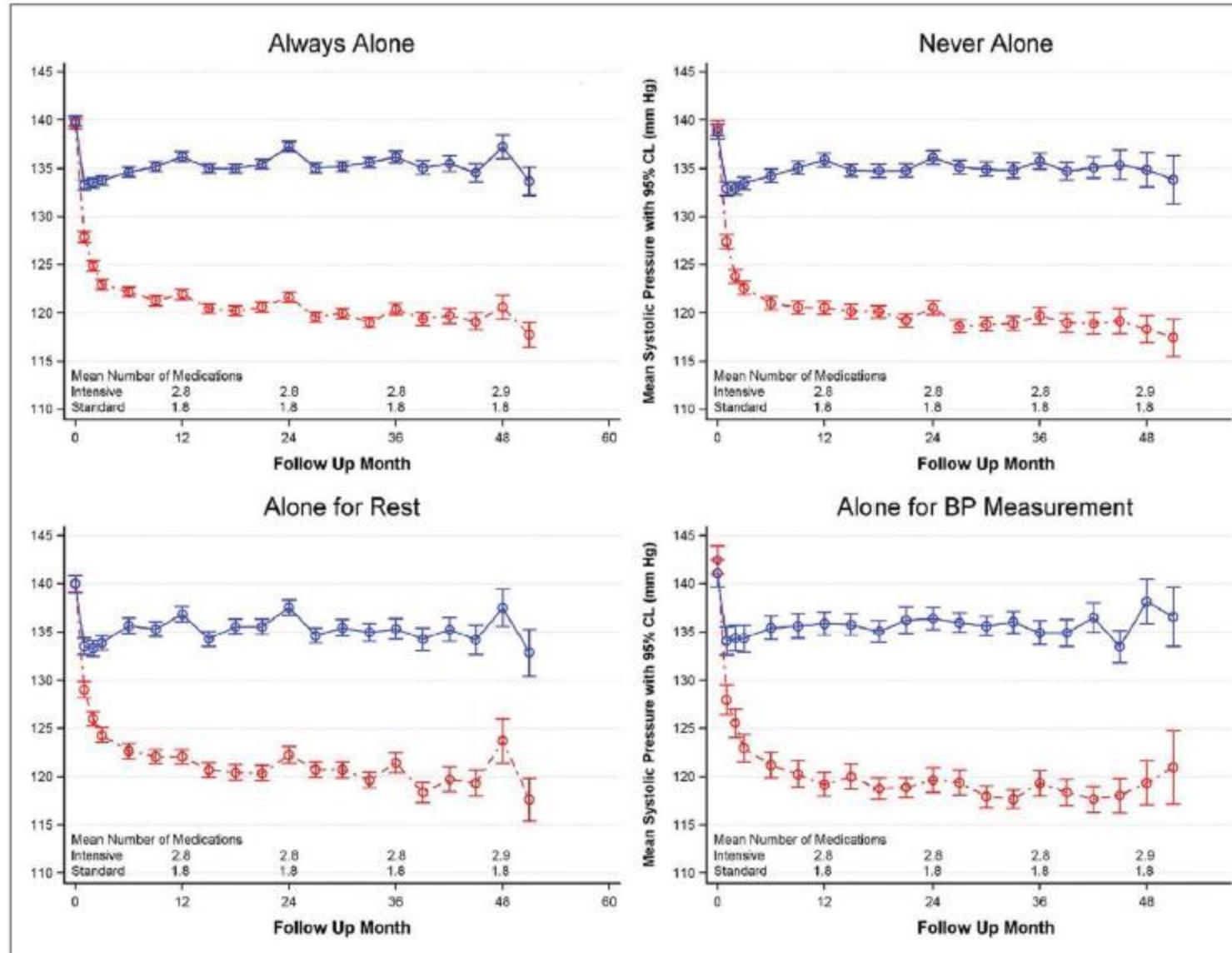
Welke bloeddruk eigenlijk?

SPRINT-methode

| | Automated BP (mmHg) | Office BP (mmHg) |
|----------------------------|------------------------|---------------------|
| <hr/> | | |
| Total sample ($n = 353$) | | |
| SBP | 131.2 ± 21.8 | 146.9 ± 20.8 |
| DBP | 77.8 ± 12.1 | 85.8 ± 12.4 |
| <hr/> | | |

BLOOD PRESSURE 2016: 4, 228–234

Bloeddrukken in SPRINT, toch niet zo unattended



Post-hoc!

| Study | No. of Subjects | Subjects; Visits | BP Measurements; Device Type | Average Attended BP Levels (mm Hg) | Unattended vs Attended BP Difference (mm Hg) |
|---|---|--------------------------------|---|---------------------------------------|---|
| Stergiou et al ⁷ (2003) | n=30, attended and unattended | Same subjects; separate visits | 3 measurements; Omron HEM-705CP | S: 139.6±16.0 | S: -1.9 (-4.2 to 0.4) |
| | | | | D: 88.6±8.1 | D: -1.6 (-3.3 to 0.2) |
| Greiver et al ⁸ (2012) | n=50, attended (open areas) and unattended | Same subjects; same visit | 6 measurements (first discarded); BpTRU | S: 121.1±17.9 | S: -1.8 (-3.6 to 0.1) |
| | | | | D: 73.9±10.2 | D: -0.8 (-2.5 to 0.8) |
| Al-Karkhi et al ⁹ (2015) | n=162, attended and unattended | Same subjects; same visit | 3 measurements; Omron i-C10 | S: 139.1±18.0 | S: -1.1 (-2.5 to 0.3) |
| | | | | D: 84.8±11.0 | D: 1.1 (-0.1 to 2.3) |
| Rinfret et al ¹⁰ (2017) | n=65, attended (open areas) and unattended | Same subjects; same visit | 6 measurements (first discarded); BpTRU | S: 126.7±16.1 | S: 0.2 (-1.6 to 2.0) |
| | | | | D: 73.4±8.1 | D: -0.7 (-1.6 to 0.2) |
| Bauer et al ¹¹ (2018) | n=51, attended and unattended | Same subjects; same visit | 3 measurements; Omron HEM-907 | S: 135.7±21.5 | S: -1.5 (-1.1 to 0.9) |
| | | | | D: 80.6±12.0 | D: 0.0 (-0.7 to 0.7) |
| Johnson et al ³ (SPRINT; 2018) | Intensive arm: attended n=1123; unattended n=2037 | Different subjects | 3 measurements; Omron HEM-907 | S: 139.2±15.8 | Intensive arm: S: 0.4 (-0.8 to 1.6) |
| | Standard arm: attended n=1124; unattended n=2045 | | | D: 79.3±12.1 | D: -1.4 (-2.3 to -0.5) |
| | | | | S: 138.8±15.3 | Standard arm: S: 1.1 (-0.0 to 2.2) |
| | | | | D: 78.7±11.6 | D: -0.7 (-1.6 to 0.2) |

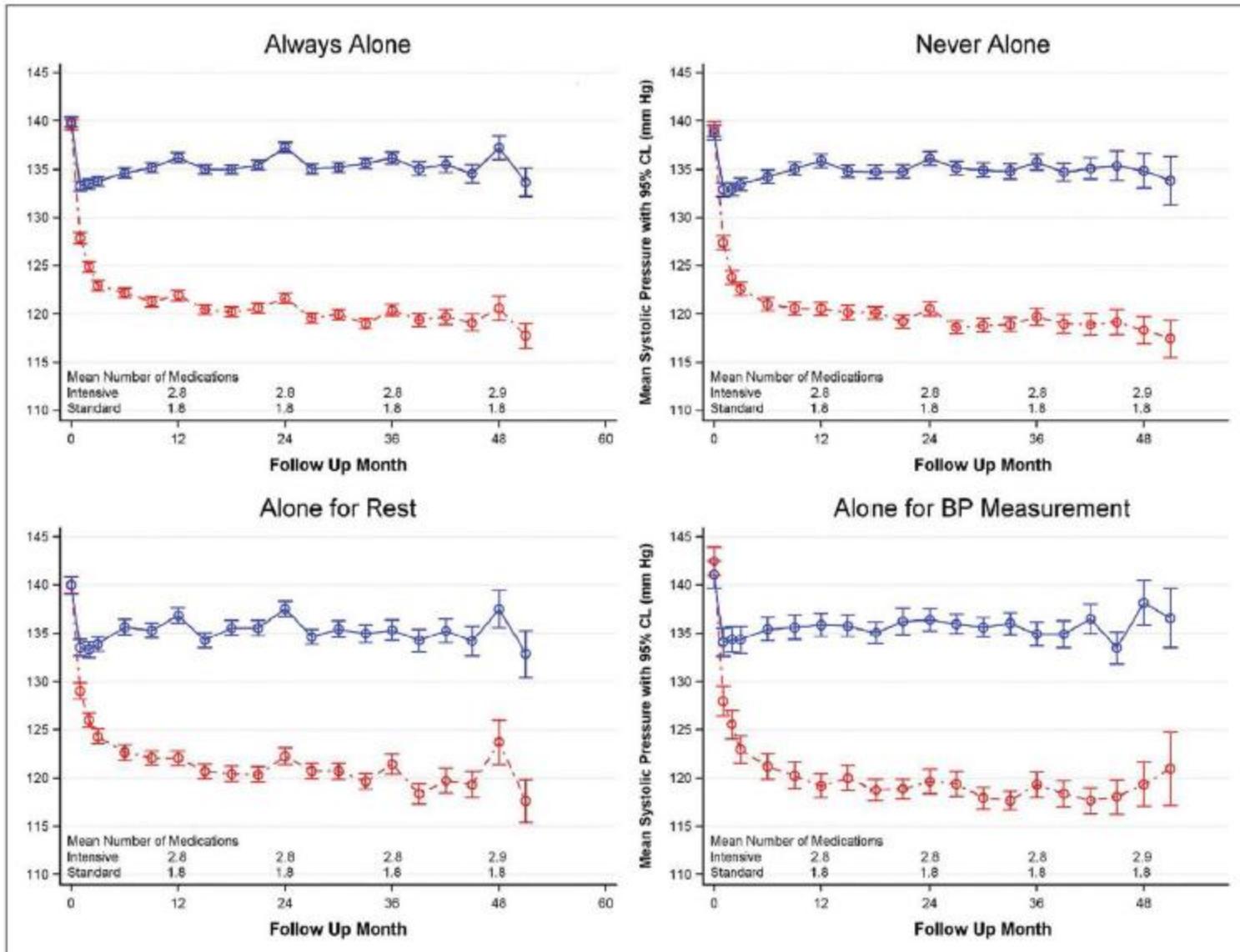
Mean±SD (95% CIs). BP indicates blood pressure; D, diastolic BP; and S, systolic BP.

Stergiou 2018

3 typen spreekkamerbloeddruk:

- clinical trial/research
- general practice +10-15 mm Hg
- unattended automatic -5 mm Hg

Bloeddrukken in SPRINT



Post-hoc!

| Study | No. of Subjects | Subjects; Visits | BP Measurements; Device Type | Average Attended BP Levels (mm Hg) | Unattended vs Attended BP Difference (mm Hg) |
|---|---|-----------------------------------|---|---------------------------------------|---|
| Stergiou et al ⁷ (2003) | n=30, attended and unattended | Same subjects; separate visits | 3 measurements; Omron HEM-705CP | S: 139.6±16.0 | S: -1.9 (-4.2 to 0.4) |
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| | | | | D: 84.8±11.0 | D: 1.1 (-0.1 to 2.3) |
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| | | | | D: 73.4±8.1 | D: -0.7 (-1.6 to 0.2) |
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| | | | | D: 80.6±12.0 | D: 0.0 (-0.7 to 0.7) |
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| | | | | S: 138.8±15.3 | Standard arm: S: 1.1 (-0.0 to 2.2) |
| | | | | D: 78.7±11.6 | D: -0.7 (-1.6 to 0.2) |

■ Mean±SD (95% CIs). BP indicates blood pressure; D, diastolic BP; and S, systolic BP.

Dus:

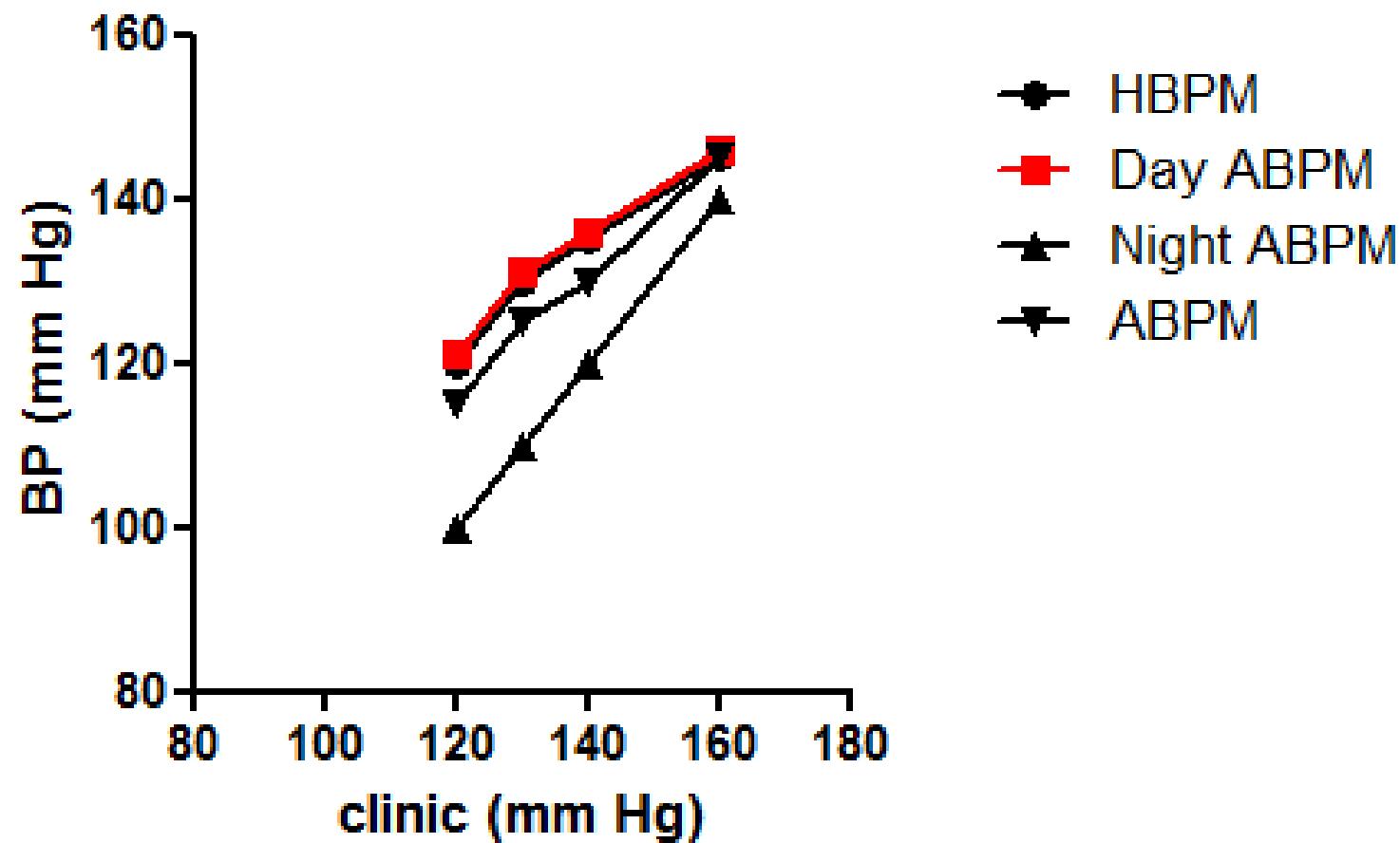
Als in SRINT op een andere manier de bloeddruk gemonitord was
dan waren de streefwaarden misschien wel anders geweest

Kunnen we bloeddrukken omrekenen?

Table 11. Corresponding Values of SBP/DBP for Clinic, HBPM, Daytime, Nighttime, and 24-Hour ABPM Measurements

| Clinic | HBPM | Daytime ABPM | Nighttime ABPM | 24-Hour ABPM |
|---------|--------|--------------|----------------|--------------|
| 120/80 | 120/80 | 120/80 | 100/65 | 115/75 |
| 130/80 | 130/80 | 130/80 | 110/65 | 125/75 |
| 140/90 | 135/85 | 135/85 | 120/70 | 130/80 |
| 160/100 | 145/90 | 145/90 | 140/85 | 145/90 |

ABPM indicates ambulatory blood pressure monitoring; BP, blood pressure; DBP, diastolic blood pressure; HBPM, home blood pressure monitoring; and SBP, systolic blood pressure.



'The precise relationships between office readings, ABPM, and HBPM are unsettled...'

Moeten we misschien naar ‘Bloeddrukfenotypen’?

Relationship between Clinic and Ambulatory Blood-Pressure Measurements and Mortality

J.R. Banegas, L.M. Ruilope, A. de la Sierra, E. Vinyoles, M. Gorostidi,
J.J. de la Cruz, G. Ruiz-Hurtado, J. Segura, F. Rodríguez-Artalejo, and B. Williams

N Engl J Med 2018;378:1509-20.

DOI: 10.1056/NEJMoa1712231

CONCLUSIONS

Ambulatory blood-pressure measurements were a stronger predictor of all-cause and cardiovascular mortality than clinic blood-pressure measurements. White-coat hypertension was not benign, and masked hypertension was associated with a greater risk of death than sustained hypertension. (Funded by the Spanish Society of Hypertension and others.)

-ABPM betere voorspeller van uitkomsten dan spreekkamer- of thuisbloeddruk

Maar:

-weinig en relatief kleine studies, onzeker welke ABPM-parameter het beste voorspelt

-met ABPM en spreekkamerbloeddruk zijn 'bloeddrukfenotypen' vast te stellen.

Doel: vaststellen van prognostische waarde voor totale en CV mortaliteit van

-spreekkamer- en ABPM-bloeddrukken

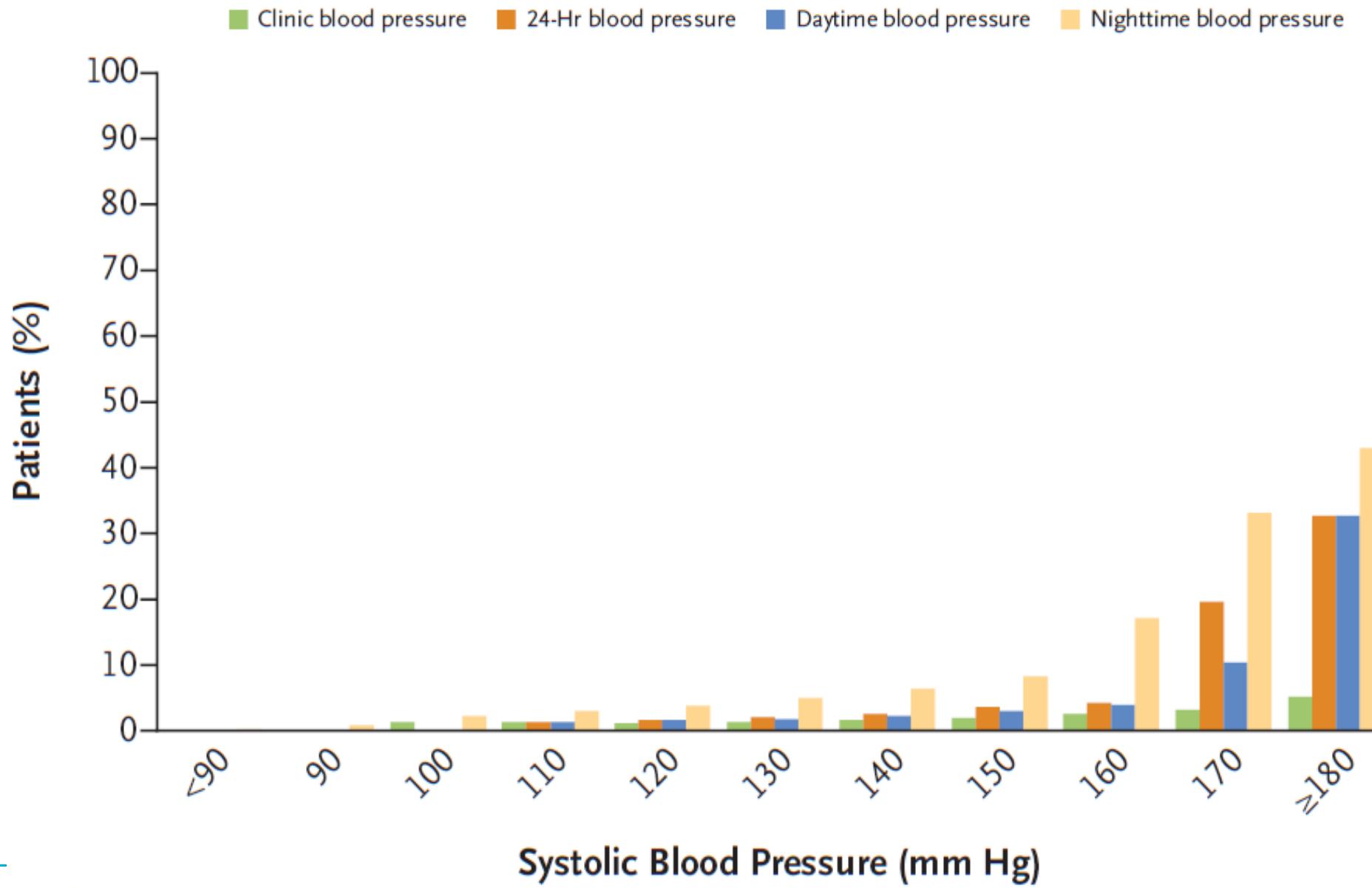
-bloeddrukfenotype

Setting: Spanish Ambulatory Blood Pressure Registry (eerstelijnscohort)

N=66 636, 2004-2014

| ABPM | Spreekkamer | fenotype |
|-----------------|--------------------|-------------------------|
| <130/<80 | <140/<90 | sustained normotension |
| <130/<80 | <u>≥140/≥90</u> | white-coat hypertension |
| <u>≥130/≥80</u> | <140/<90 | masked hypertension |
| <u>≥130/≥80</u> | <u>>140/≥90</u> | sustained hypertension |

Sterfsterisico door cardiale oorzaak voor systolische bloeddruk



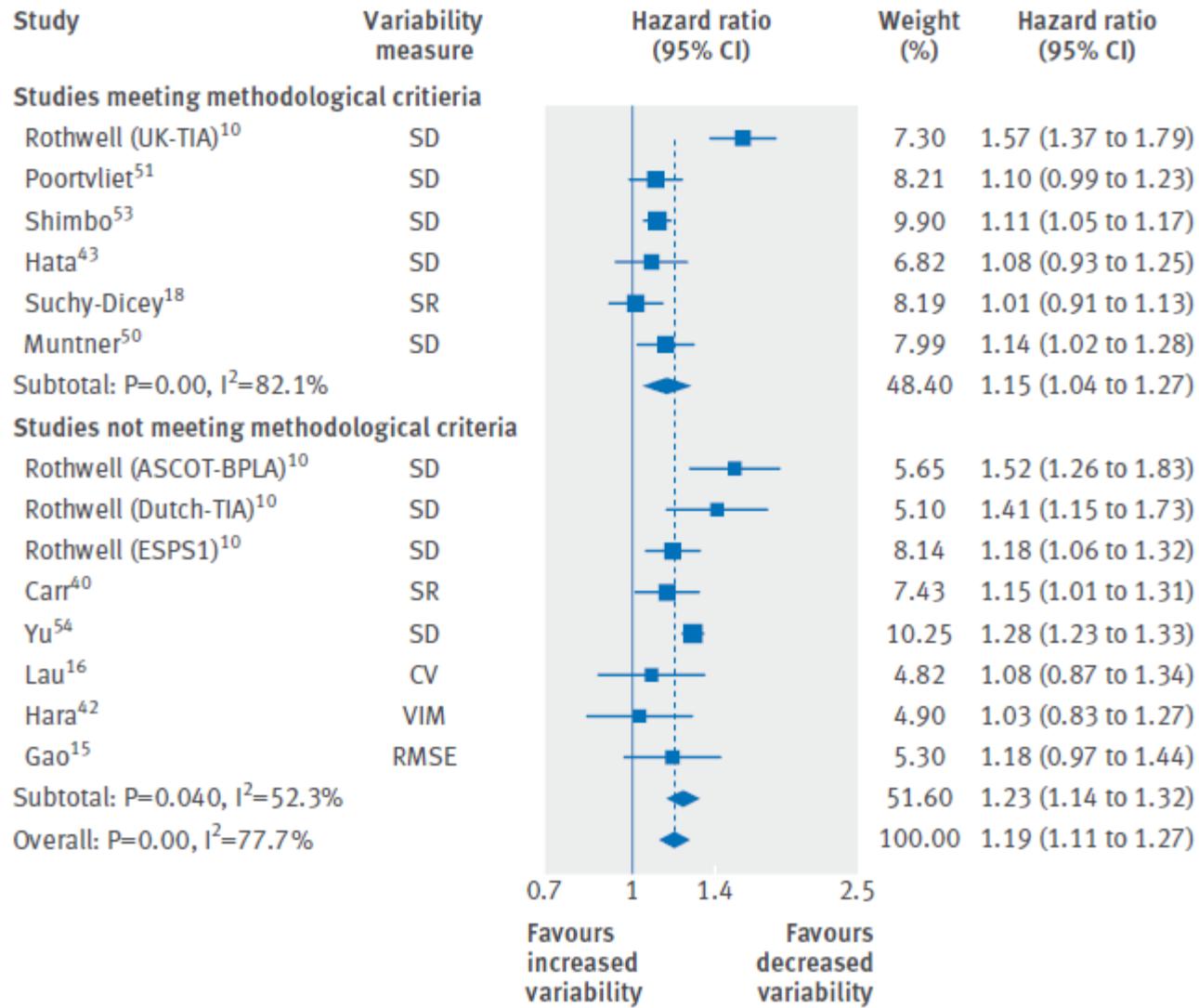
Fenotype van wittejashypertensie niet zo onschuldig

| | All Patients | Deaths | Hazard Ratio (95% CI) |
|--------------------------------------|--------------|--------|--------------------------|
| Cardiovascular mortality | | | |
| Normotension | 4,221 | 22 | Reference |
| Controlled hypertension | 6,692 | 84 | 0.90 (0.55–1.46) |
| White-coat hypertension | 6,628 | 94 | 2.36 (1.49–3.76) |
| White-coat uncontrolled hypertension | 11,042 | 223 | 1.23 (0.78–1.94) |
| Masked hypertension | 2,278 | 32 | 2.92 (1.70–5.03) |
| Masked uncontrolled hypertension | 3,092 | 95 | 2.20 (1.36–3.55) |
| Sustained hypertension | 12,555 | 172 | 2.42 (1.55–3.78) |
| Sustained uncontrolled hypertension | 17,402 | 573 | 1.93 (1.23–3.01) |

Screening op gemaskeerde hypertensie?

- Cardiovasculaire schade bij normale spreekkamerbloeddruk
- ACC-AHA: 120-129 mm Hg
- ESC-ESH: 130-139 mm Hg

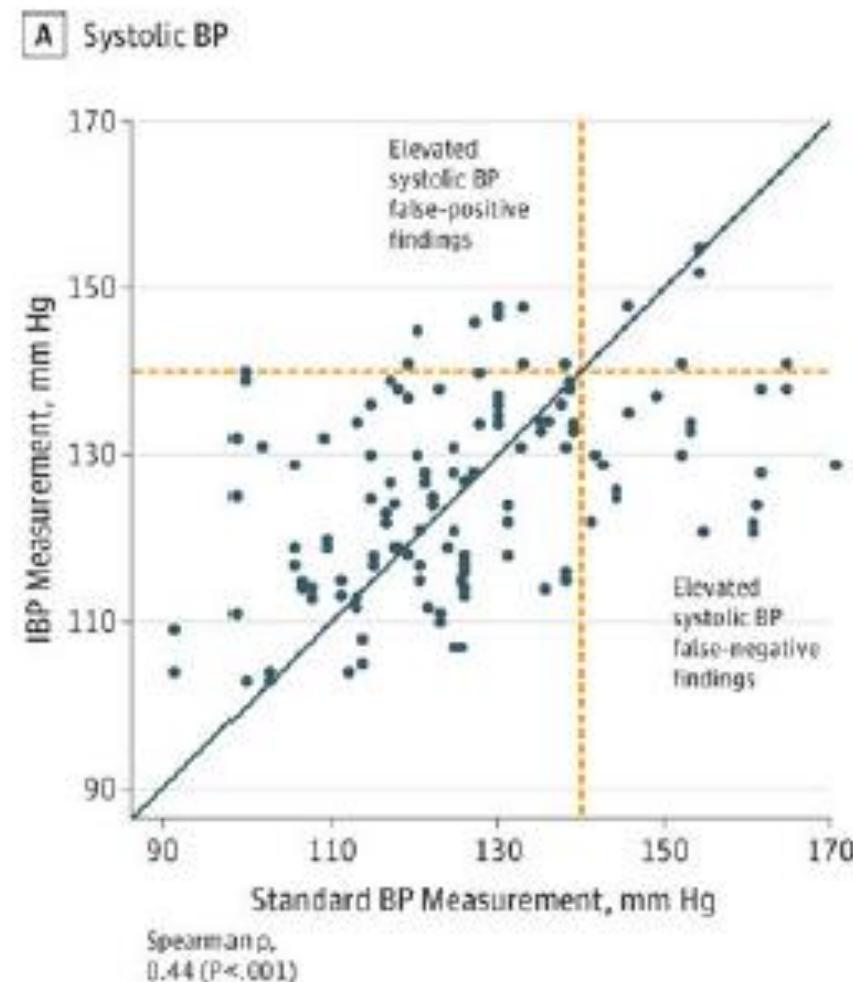
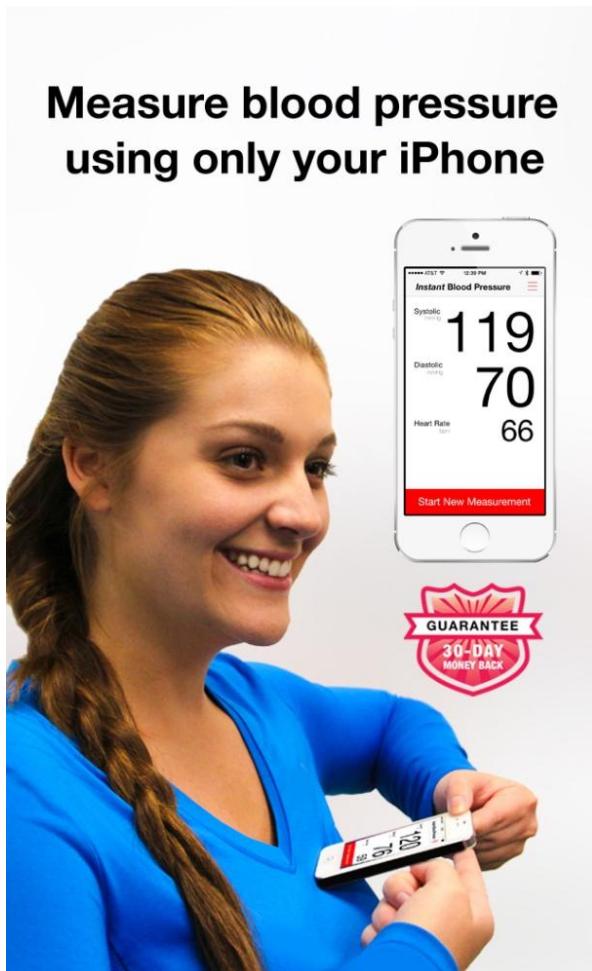
Fenotypering: variabiliteit van spreekkamerbloeddruk



Strokerisico

Zijn er nog meer mogelijkheden van bloeddrukmeten?

Anders meten: de Smartphone!



77% hypertensie gemist...

Anders meten: bijv 'Polsgolf transitie tijd'



Calibratie nodig met gewone meting
Lukt niet in 25%

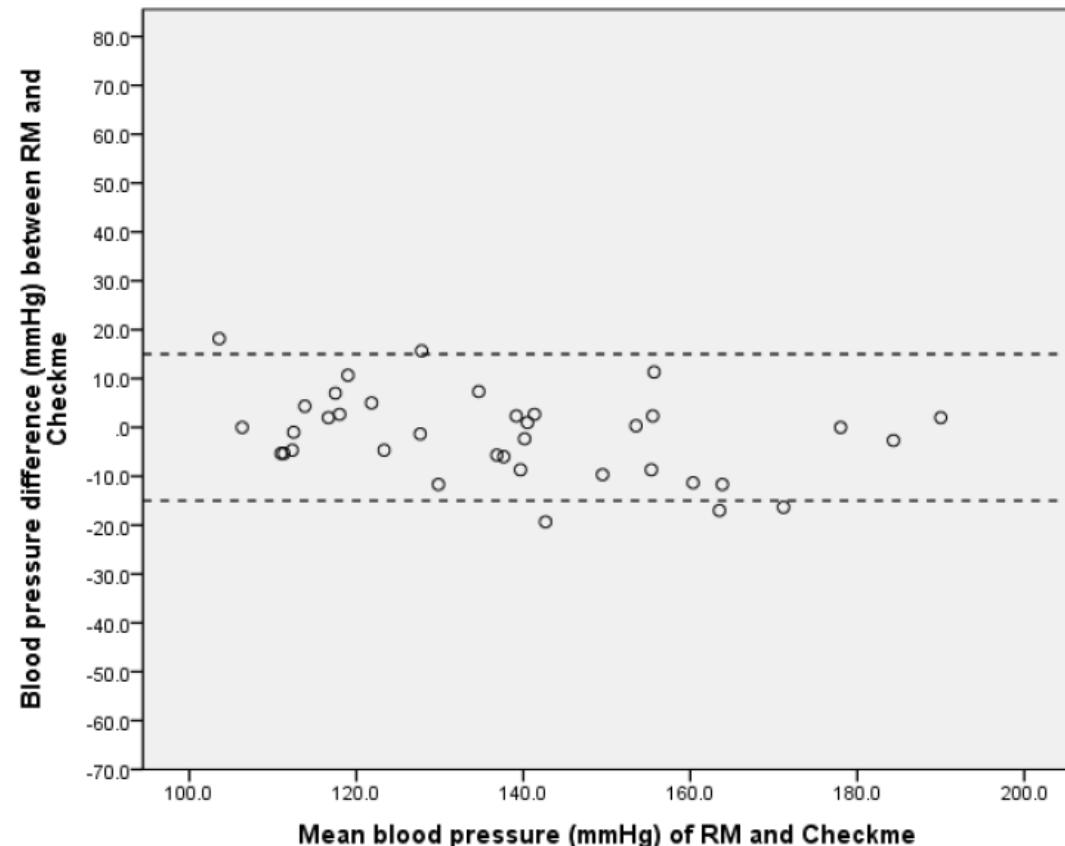


Table 8. Checklist for Accurate Measurement of BP^{54,1-3,54,1-4}

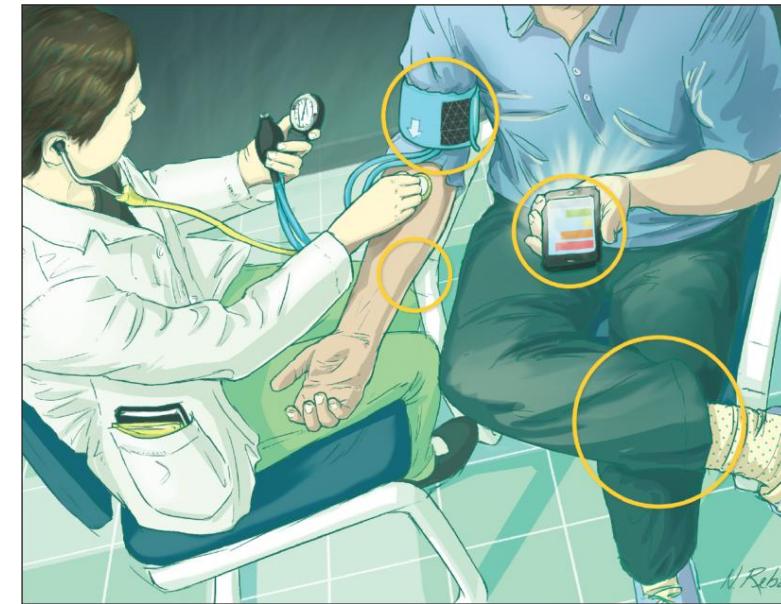
| Key Steps for Proper BP Measurements | Specific Instructions |
|---|---|
| Step 1: Properly prepare the patient | <ol style="list-style-type: none"> Have the patient relax, sitting in a chair (feet on floor, back supported) for >5 min. The patient should avoid caffeine, exercise, and smoking for at least 30 min before measurement. Ensure patient has emptied his/her bladder. Neither the patient nor the observer should talk during the rest period or during the measurement. Remove all clothing covering the location of cuff placement. Measurements made while the patient is sitting or lying on an examining table do not fulfill these criteria. |
| Step 2: Use proper technique for BP measurements | <ol style="list-style-type: none"> Use a BP measurement device that has been validated, and ensure that the device is calibrated periodically.* Support the patient's arm (eg, resting on a desk). Position the middle of the cuff on the patient's upper arm at the level of the right atrium (the midpoint of the sternum). Use the correct cuff size, such that the bladder encircles 80% of the arm, and note if a larger- or smaller-than-normal cuff size is used (Table 9). Either the stethoscope diaphragm or bell may be used for auscultatory readings.^{54,1-3,54,1-6} |
| Step 3: Take the proper measurements needed for diagnosis and treatment of elevated BP/hypertension | <ol style="list-style-type: none"> At the first visit, record BP in both arms. Use the arm that gives the higher reading for subsequent readings. Separate repeated measurements by 1–2 min. For auscultatory determinations, use a palpated estimate of radial pulse obliteration pressure to estimate SBP. Inflate the cuff 20–30 mm Hg above this level for an auscultatory determination of the BP level. For auscultatory readings, deflate the cuff pressure 2 mm Hg per second, and listen for Korotkoff sounds. |
| Step 4: Properly document accurate BP readings | <ol style="list-style-type: none"> Record SBP and DBP. If using the auscultatory technique, record SBP and DBP as onset of the first Korotkoff sound and disappearance of all Korotkoff sounds, respectively, using the nearest even number. Note the time of most recent BP medication taken before measurements. |
| Step 5: Average the readings | Use an average of ≥2 readings obtained on ≥2 occasions to estimate the individual's level of BP. |
| Step 6: Provide BP readings to patient | Provide patients the SBP/DBP readings both verbally and in writing. |

*See Section 4.2 for additional guidance.
Adapted with permission from Manolio et al^{54,1-3} (Oxford University Press), Pickering et al^{54,1-2} (American Heart Association, Inc.), and Weir et al^{54,1-4} (American College of Physicians, Inc.).

BP indicates blood pressure; DBP, diastolic blood pressure; and SBP, systolic blood pressure.

Netjes meten!

Clinic



1/159 studenten mat goed
4,1/11 stappen goed uitgevoerd

HBPM

Table 10. Procedures for Use of HBPM^{54,2-6-54,2-7}

| |
|---|
| Patient training should occur under medical supervision, including: |
| Information about hypertension |
| Selection of equipment |
| Acknowledgment that individual BP readings may vary substantially |
| Interpretation of results |
| Devices: |
| Verify use of automated validated devices. Use of auscultatory devices (mercury, aneroid, or other) is not generally useful for HBPM because patients rarely master the technique required for measurement of BP with auscultatory devices. |
| Monitors with provision for storage of readings in memory are preferred. |
| Verify use of appropriate cuff size to fit the arm (Table 9). |
| Verify that left/right inter-arm differences are insignificant. If differences are significant, instruct patient to measure BPs in the arm with higher readings. |
| Instructions on HBPM procedures: |
| Remain still: |
| Avoid smoking, caffeinated beverages, or exercise within 30 min before BP measurements. |
| Ensure ≥5 min of quiet rest before BP measurements. |
| Sit correctly: |
| Sit with back straight and supported (on a straight-backed dining chair, for example, rather than a sofa). |
| Sit with feet flat on the floor and legs uncrossed. |
| Keep arm supported on a flat surface (such as a table), with the upper arm at heart level. |
| Bottom of the cuff should be placed directly above the antecubital fossa (bend of the elbow). |
| Take multiple readings: |
| Take at least 2 readings 1 min apart in morning before taking medications and in evening before supper. Optimally, measure and record BP daily. Ideally, obtain weekly BP readings beginning 2 weeks after a change in the treatment regimen and during the week before a clinic visit. |
| Record all readings accurately: |
| Monitors with built-in memory should be brought to all clinic appointments. |
| BP should be based on an average of readings on ≥2 occasions for clinical decision making. |
| The information above may be reinforced with videos available online. |

See Table 11 for HBPM targets.
BP indicates blood pressure; and HBPM, home blood pressure monitoring.

JAMA, 2017, 318:991 & J Clin Hypertens (Greenwich). 2017;19:614

ACC/AHA guideline 2017 Hypertension. 2018;71:e13-e115

Radboudumc

Boodschappen

- OBPM, HBPM en ABPM spelen alle een rol in hypertensiemanagement, OBPM is vooral screening
- streefwaarden hebben minder/geen betekenis als de meetmethode niet gemeld wordt
- spreekkamerbloeddruk kan niet zomaar omgerekend worden naar HBPM/ABPM
- wittejashypertensie verliest zijn onschuld
- smartphone en ‘handige apparaatjes’ (nog) niet geschikt
- het belangrijkste blijft: netjes meten. Daarvoor bent u verantwoordelijk
- er moeten nog veel gecontroleerde studies gedaan worden op het gebied van hypertensie

