

**Self-monitoring of blood pressure in patients with hypertension related multi-morbidity:
Systematic review and individual patient data meta-analysis**

Online supplemental material

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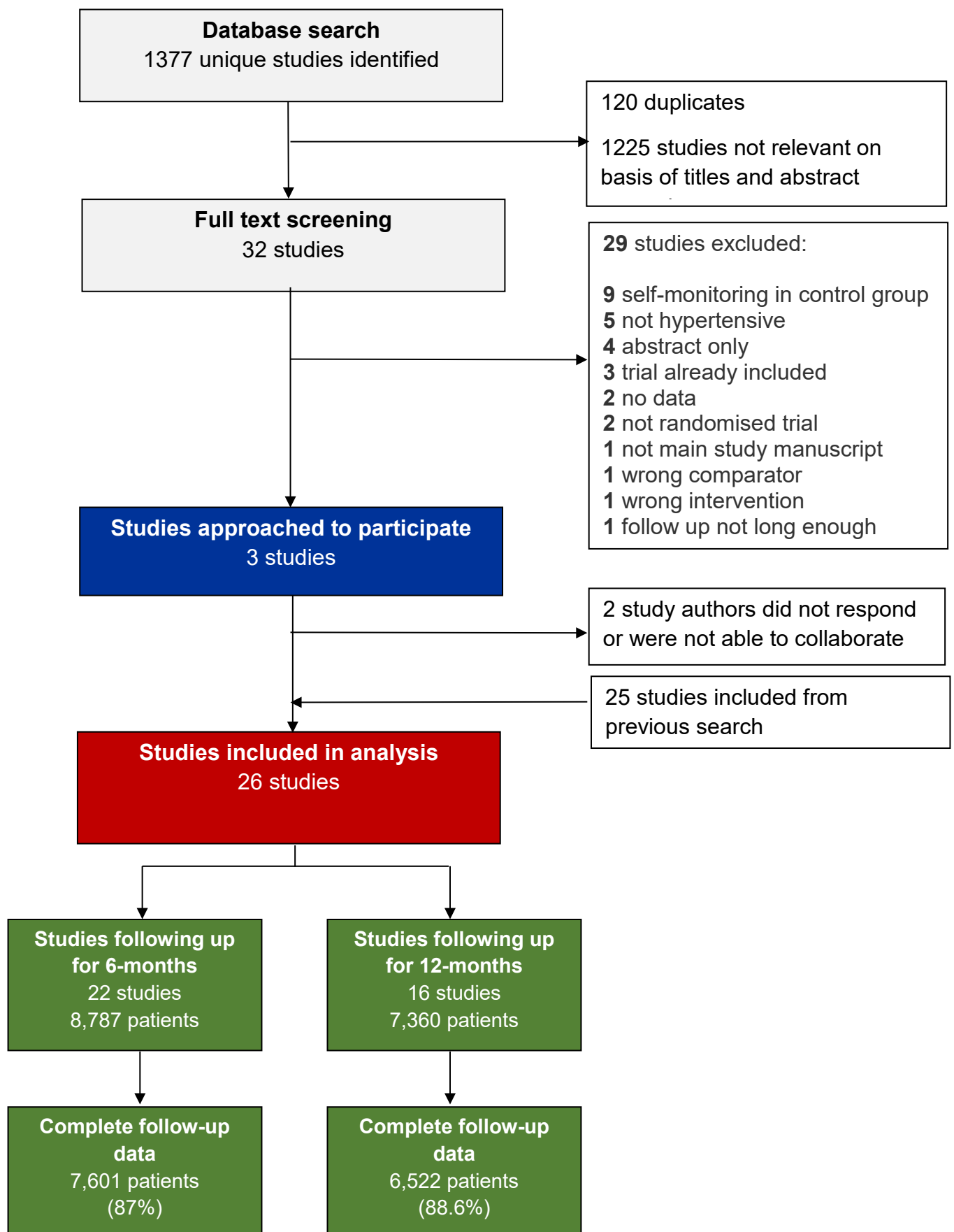
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eFigure 1. Example Search Strategy (Medline)

Database: Ovid MEDLINE(R) Updated from original search to January 2018
Only trials published since 2000 eligible.

1 blood pressure monitoring, ambulatory/
2 ((blood pressure or bp) adj3 (24h or 24hr? or 24-h or 24-hr? or 24 hour? or ambulatory or
determin\$ or measur\$ or monitoring or monitor\$ or self-measur\$ or self-monitor\$)).tw.
3 or/1-2
4 (home or self\$).tw.
5 (telemedicine or tele-medicine or telemonitor\$ or tele-monitor\$).mp.
6 or/4-
7 randomized controlled trial.pt.
8 controlled clinical trial.pt.
9 randomized.ab.
10 placebo.ab.
11 drug therapy.fs.
12 randomly.ab.
13 trial.ab.
14 groups.ab.
15 or/7-14
16 animals/ not (humans/ and animals/)
17 15 not 16
18 3 and 6 and 17

eFigure 2. Flow diagram of the update to the systematic search and selection of relevant studies.



eTable 1. Characteristics of included studies

Lead author/s Country & year	Study	Self-monitoring	Co-interventions	Pre-defined level of intervention	Comparison	Home target mmHg	Office target mmHg	Baseline BP ±SD mmHg	6 m follow -up	12 m follow -up	No. with multi- morbidity*	Morbidities recorded
Halme/ Kantola¹⁸ Finland, 2005	HOMER	Daily for 1 week every 2 months	None	Low intensity (level 1)	Usual care	135/80	140/85	157/93±18/8	170	n/a	85 (36.8%)	CHD Stroke Diabetes Obesity
McManus¹⁹ UK 2005	TASMINH	Monthly in GP practice waiting room	None	Low intensity (level 1)	Usual Care	140/85 140/80 DM	140/85 140/80 DM	156/88±15/7	413	401	238 (54.1%)	CHD Stroke Diabetes Obesity
Bosworth²⁰ US, 2007	HINTS	3 days per week	Behavioural intervention Or meds management Or both	High intensity (Level 3) High intensity (level 4)	Usual Care	135/85 135/80 DM	140/90 135/80 DM	129/77±18/13 130/78±19/14 128/77±19/13	535	523	389 (65.8%)	CHD Stroke Diabetes Obesity
Verberk²¹ Netherlands, 2007	HOMERUS	1 week per month then 1 week every 2 months	None	Low intensity (level 1)	Usual care with monthly clinic visits then 2 monthly	140/90	140/90	164/96±17/10	n/a	434	153 (29.6%)	CHD Stroke CKD Obesity
Green²² US, 2008	eBP	2 days per week	Website and email +/- web based pharmacist management	Low intensity (level 2) High intensity (level 4)	Usual care	135/85	140/90	151/89±12/9 151/89±12/9	n/a	730	458 (58.9%)	CHD Stroke Diabetes CKD Obesity
Bosworth²³ US, 2009	TCYB	3 days per week	None Or behavioural interventions, education and support	Low intensity (level 1) High intensity (level 4)	Usual care	135/85 130/80 DM	140/90 130/80 DM	125/71±16/10 125/71±18/11	383	350	187 (41.9%)	CHD Stroke Diabetes CKD Obesity
Parati & Omboni²⁴ Italy, 2009	TeleBPCare	3 days per week	Telemonitoring	Low intensity (level 2)	Usual care	135/85	140/90	146/88±12/8	298	n/a	59 (19.8%)	CHD Stroke Diabetes CKD Obesity
Godwin²⁵ Canada, 2010		At least weekly	None	Low intensity (level 1)	Usual Care	135/85	140/90	144/81±18/11	458	458	251 (54.8%)	Diabetes Obesity
Earle²⁶ UK, 2010		weekly	Blood glucose testing, text/App system with feedback from clinicians	High intensity (level 4)	Usual Care	140/90	140/90	131/77±17/10	126	n/a	127 (100%)	Diabetes CKD
McManus²⁷ UK, 2010	TASMINH2	Daily for the first week of each month	Telemonitoring and self- titration	High intensity (level 3)	Usual care	130/85 130/75 DM	140/90 140/80 DM	152/85±12/9	480	480	290 (55.0%)	CHD Stroke Diabetes CKD Obesity

Hebert²⁸ US, 2011		Variable	None Or nurse support	Low intensity (level 1) High intensity (level 4)	Usual care		140/90 130/80DM	153/86 16/13 153/86 18/13	n/a	n/a **	343 (82.5%)	Diabetes CKD Obesity
Wakefield²⁹ US, 2011		Daily	Low intensity management algorithm High intensity algorithm	Low intensity (level 2) High intensity (level 3)	Usual Care	135/85 130/80 DM	135/85 130/80 DM	135/72±18/11 136/74±19/11	268	261***	300 (100%)	Diabetes Obesity
Bove³⁰ US, 2013	HTN	2 days per week	Telemonitoring	Low intensity (level 2)	Usual care		140/90	155/88±15/11	202	n/a	170 (72.3%)	CHD Stroke Diabetes Obesity
Kerry¹⁵ UK, 2013		Daily in week 1, then 1 day per week	Nurse led telephone support	Low intensity (level 2)	Usual care	130/80	140/85	138/74±21/12	352	334	381 (100%)	CHD Stroke Diabetes Obesity
Magid³¹ US, 2013		3 days per week	Patient education and BP reporting or patient education, BP reporting and pharmacist management	High intensity (level 4)	Usual Care	135/85 125/75 DM/CKD	140/90 130/80DM / CKD	147/15±89/10	326	n/a	159 (48.8%)	Diabetes CKD Obesity
Margolis³² US, 2013	Hyperlink	3 days per week	Telemonitoring and pharmacist management	High intensity (level 4)	Usual Care	135/85 125/75 DM/CKD	140/90 130/80 DM/CKD	148/85±13/12	403	388	311 (69.1%)	CHD Stroke Diabetes CKD Obesity
McKinstry³³ UK, 2013	HITS	Daily in week 1, then at least 1 day per week thereafter	Optional automated telemonitoring	Low intensity (level 2)	Usual Care	135/85	140/90	153/91±15/11	374	n/a	168 (41.9%)	Stroke Diabetes CKD Obesity
Parati³⁴ Italy, 2013	TeleBPMET	3 days per week	Telemonitoring	Low intensity (level 2)	Usual Care	135/85	140/90	147/90±12/8	181	179	116 (63.7%)	CHD Stroke Diabetes CKD Obesity
Green³⁵ US, 2014	eCare	At least 1 day per week for 2 months, 1 day per fortnight for 2 months, then monthly	Dietician with BP plan and visits (weekly for 2 months, fortnightly for 2 months then monthly)	High intensity (level 4)	Usual care	135/85	140/90	150/92±12/9	90	n/a	72 (71.3%)	CHD Stroke Diabetes CKD Obesity
Leiva³⁶ Spain, 2014	Adherencia	Weekly, with morning and afternoon readings.	Motivational interview, pillbox reminder, Family support, BP and medication reminder form	High intensity (level 3)	Usual Care	135/85	140/90 and 130/80 for DM or CKD	156/84±15/11	n/a	214	164 (76.6%)	CHD Stroke Diabetes CKD Obesity

			and pharmacist review									
McManus⁷ UK 2014	TASMIN-SR	Daily for the first week of each month	Self-management	High intensity (level 3)	Usual Care	120/75	130/80 ST	144/80±13/10	439	450	450 (100%)	CHD Stroke Diabetes CKD Obesity
Ogedegbe³⁷ US, 2014	CAATCH	3 days per week	Education, lifestyle and behavioural support	High intensity (level 3)	Usual Care			151/91±17/10	610	691	656 (65.8%)	CHD Stroke Diabetes CKD Obesity
Stewart³⁸ Australia, 2014	HAPPy	Several readings per week	Pharmacist management with motivational interviewing, medication review, education and optional refill reminders	High intensity (level 4)	Usual Care	140/90 and 130/80 for DM and CKD	140/90 and 130/80 for DM and CKD	141/84±20/11	348	n/a	208 (53.6%)	CHD Stroke Diabetes CKD Obesity
Yi³⁹ US, 2015		As prescribed by their doctor	Educational material on hypertension	Low intensity (level 1)	Usual Care	140/90 or 130/80 DM or CKD	140/90 or 130/80 DM or CKD	152/83±16/11	529	n/a	723 (87.3%)	CHD Stroke Diabetes CKD Obesity
Parati Italy	AUPRES	3 days per week		Low intensity (level 1)	Usual Care	135/85	140/90	154/95±15/8	407	407	55 (13.5%)	CHD Stroke Diabetes CKD Obesity
Aekplakorn¹⁶ Thailand, 2016		Twice daily for 6 months	Clinic visits to discuss BP status and advice on medication and healthy lifestyle.	High intensity (level 4)	Usual Care	140/90	140/90	148/83	209	222	69 (30.8%)	CHD Stroke Diabetes Obesity

*Multi-morbidity defined as the presence of two or more morbidities (this study focused on cardiovascular multi-morbidity: Hypertension, coronary heart disease, stroke/transient ischemic attack, diabetes, chronic kidney disease and obesity).

**Study collected outcome data at 18 months.

***Participants self-monitored for 6 months, follow up data collected at 12 months.

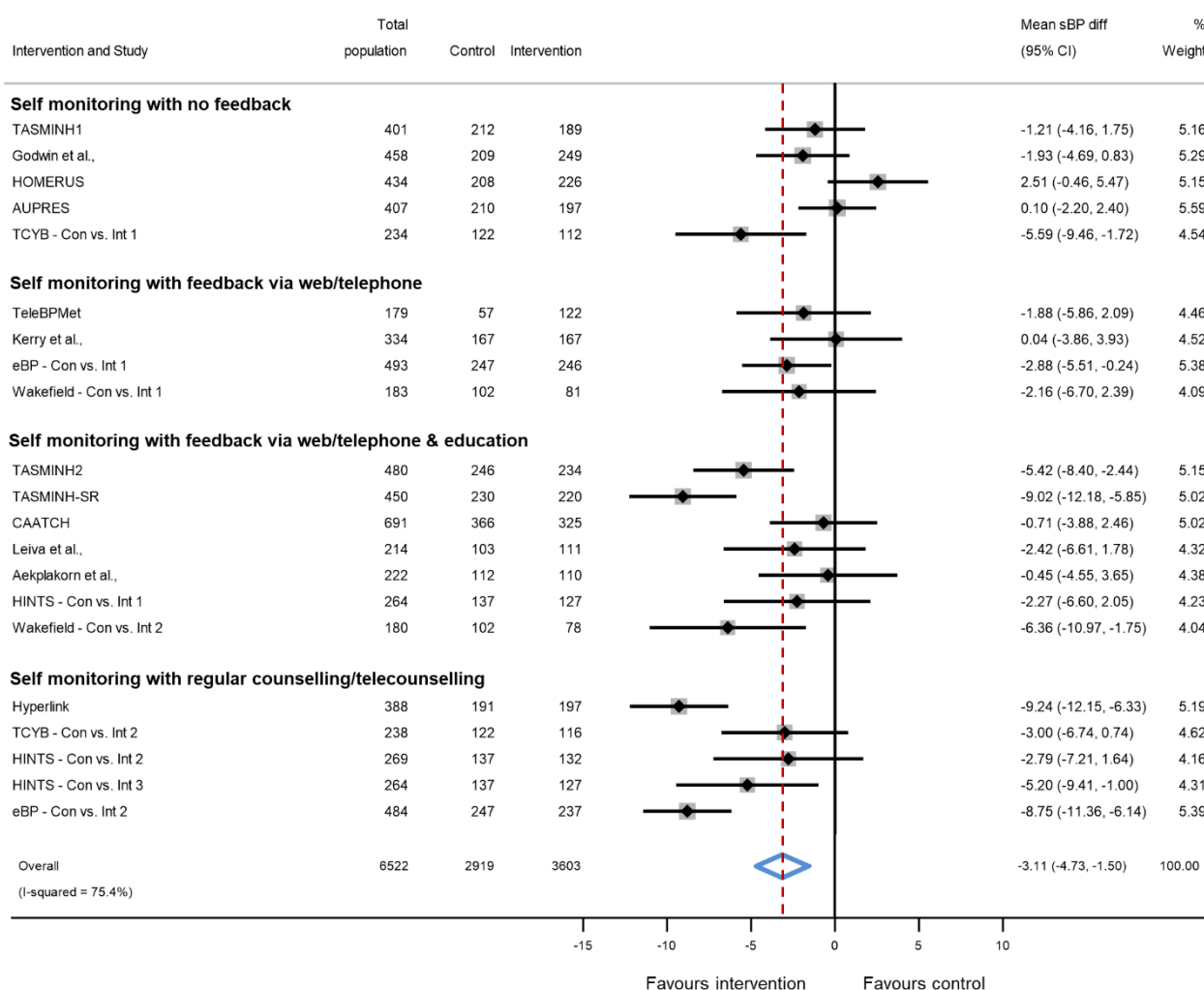
eTable 2. Baseline characteristics of included studies (with outcomes at 6 and/or 12 months)

Characteristic	Total population (hypertensives)*		CHD		Stroke		Diabetes		CKD		Obesity	
	Mean/ number	SD/IQR/%	Mean/ number	SD/IQR/%	Mean/ number	SD/IQR/%	Mean/ number	SD/IQR/%	Mean/ number	SD/IQR/%	Mean/ number	SD/IQR/%
Total population	10,713		827		789		2964		650		4,368	
Age (years)	62.7	11.7	67.7	10.9	68.6	12.2	63.0	11.0	64.9	11.5	59.8	11.0
Sex (% Male)	5,891	55.0%	459	55.5%	440	55.8%	1,789	60.4%	361	55.5%	2,363	54.1%
BMI (kg/m2)	30.6	6.4	30.5	6.5	28.5	5.9	32.7	7.1	31.3	6.6	35.8	5.5
Smoking (% , yes)	1,342	15.9%	56	14.6%	102	16.3%	341	18.9%	58	10.5%	507	14.5%
Alcohol (median, units per week)	2.0	0.0, 9.5	1.5	0.0, 9.0	0.0	0.0, 6.0	1.0	0.0, 7.8	2.0	0.0, 8.5	2.0	0.0
Clinic Systolic BP (mmHg)	147.6	18.3	147.9	18.8	145.3	20.9	144.8	19.7	147.6	17.8	147.8	17.6
Clinic Diastolic BP (mmHg)	85.3	12.2	80.8	11.6	79.2	12.8	80.8	12.6	83.0	11.5	85.7	11.9
BP meds at baseline	1.8	1.2	2.0	1.0	1.8	1.1	2.2	1.3	1.9	1.0	1.9	1.2

*All included participants had to have at least one morbidity (hypertension) to be included in each original trial

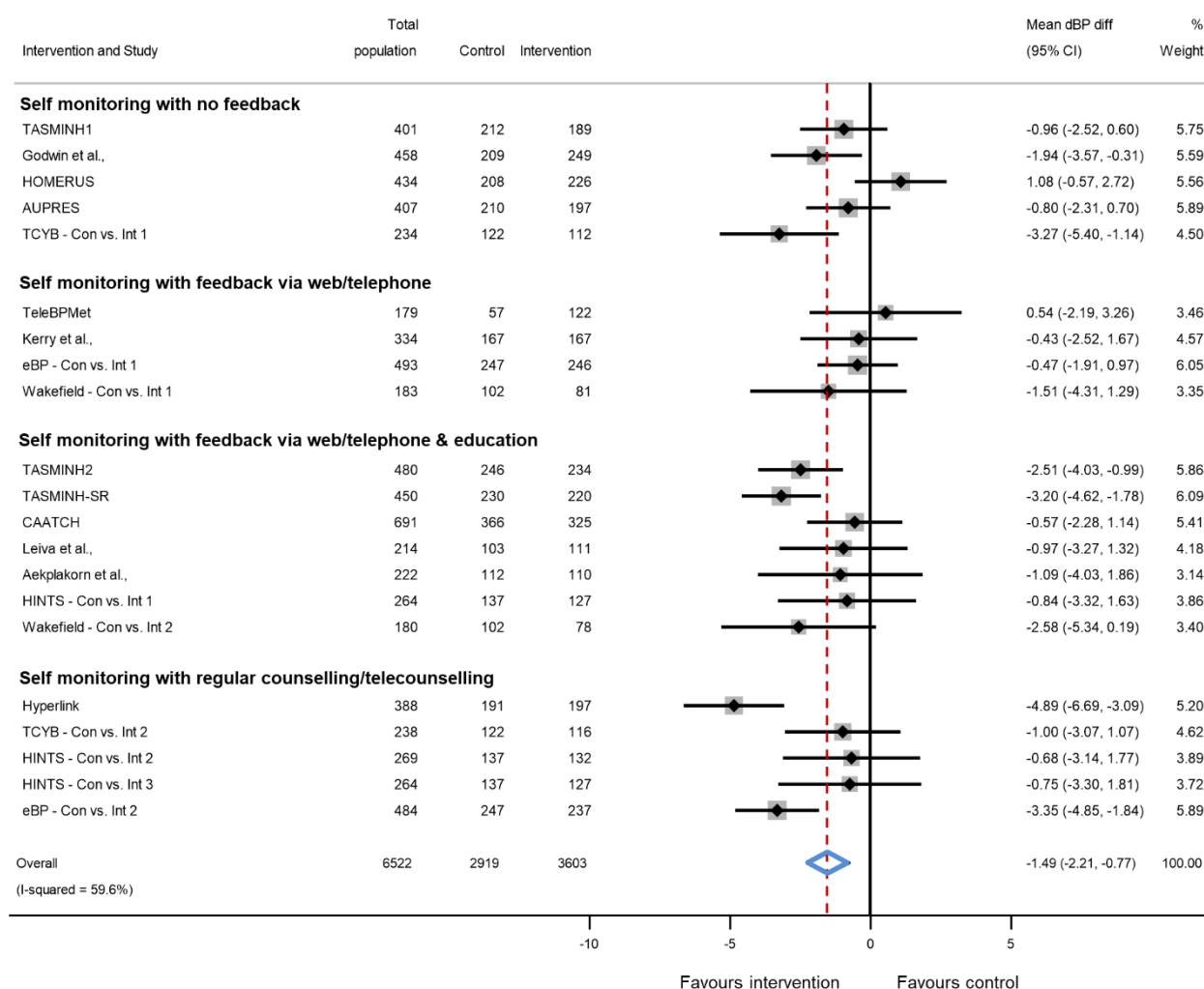
CHD=coronary heart disease; CKD=chronic kidney disease; SD=standard deviation; IQR=inter quartile range; BMI=body mass index; BP=blood pressure

eFigure 3. Effect of self-monitoring on clinic systolic blood pressure at 12-month follow-up by intervention intensity



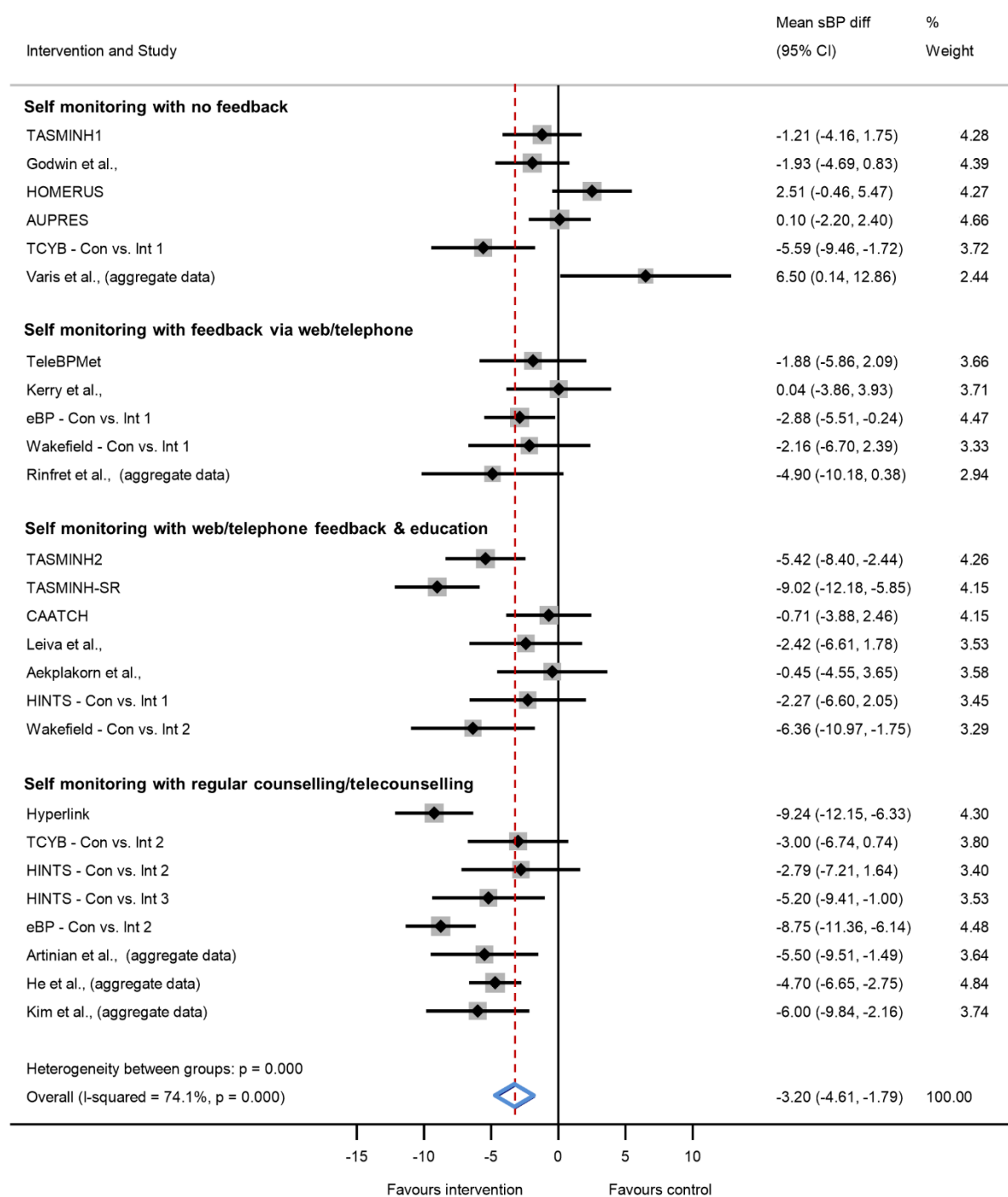
Analyses adjusted for age, sex, baseline systolic blood pressure and diabetes. sBP=systolic blood pressure; CI=confidence intervals

eFigure 4. Effect of self-monitoring on clinic diastolic blood pressure at 12-month follow-up by intervention intensity



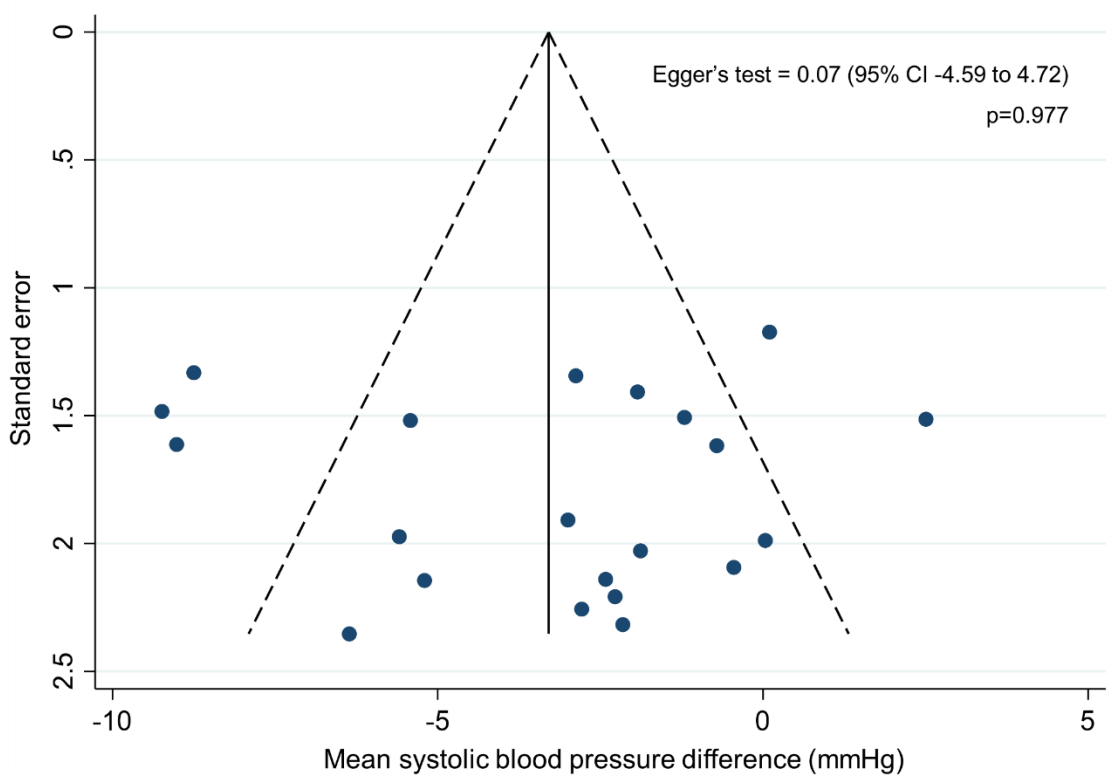
Analyses adjusted for age, sex, baseline diastolic blood pressure and diabetes. dBP=diastolic blood pressure; CI=confidence intervals

eFigure 5. Effect of self-monitoring on clinic systolic blood pressure at 12-month follow-up by intervention intensity, including aggregate data from studies (n=5) not contributing individual patient data



One eligible study which did not provide individual patient data (Qi *et al.*, *Biomedical Research*, 2017;28: 2898-2902) could not be included in this figure due to a lack of data on the variance (SE or SD) around the mean systolic blood pressure change at 12 month follow-up. Analyses adjusted for age, sex, baseline systolic blood pressure and diabetes. sBP=systolic blood pressure; CI=confidence intervals

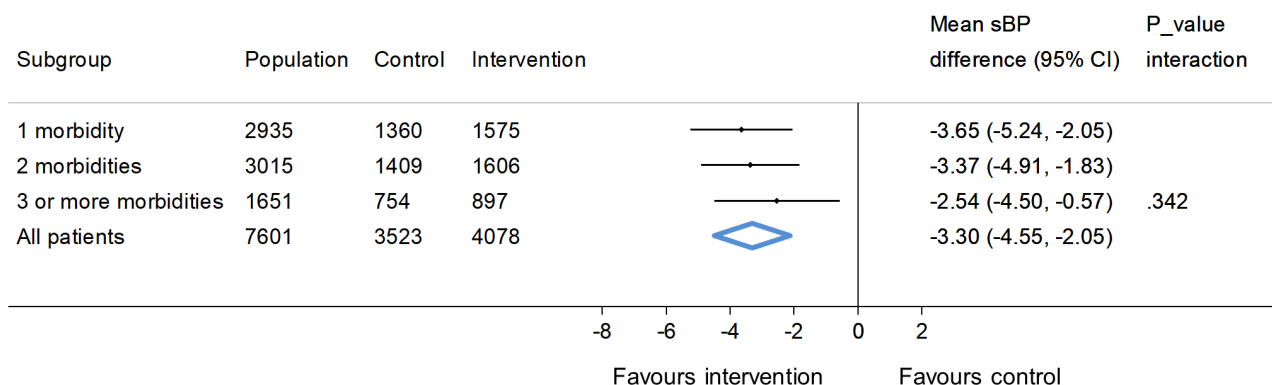
eFigure 6. Funnelplot showing mean change in systolic blood pressure at 12 months



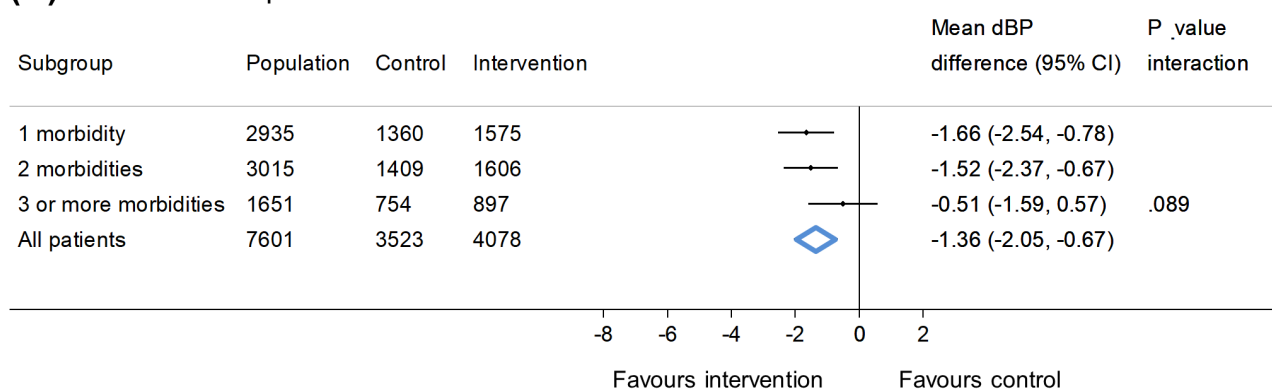
The standard error is plotted in against the mean change in systolic blood pressure at 12 months. An Egger's test of zero ($p=1.00$) would indicate no influence of publication bias

eFigure 7. Effect of self-monitoring on blood pressure at 6-month follow-up by number of hypertension related co-morbidities (22 studies)

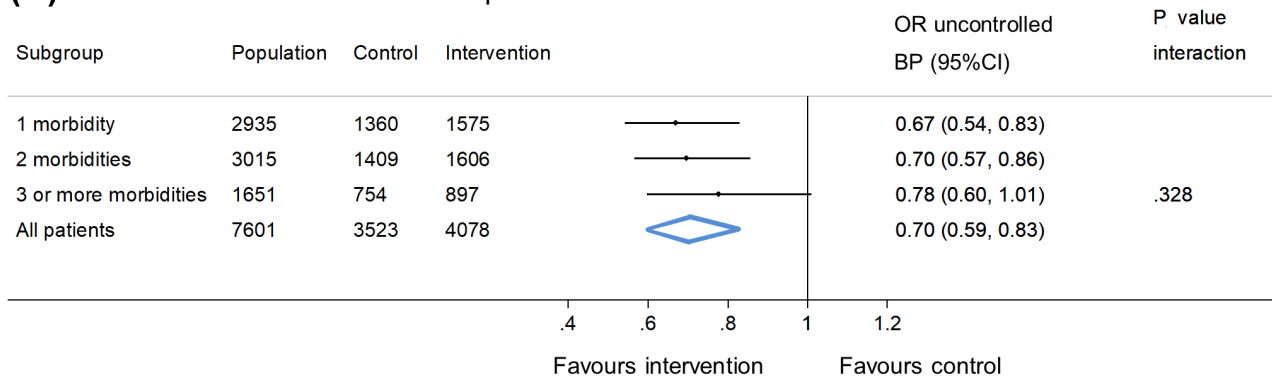
(A) Systolic blood pressure



(B) Diastolic blood pressure

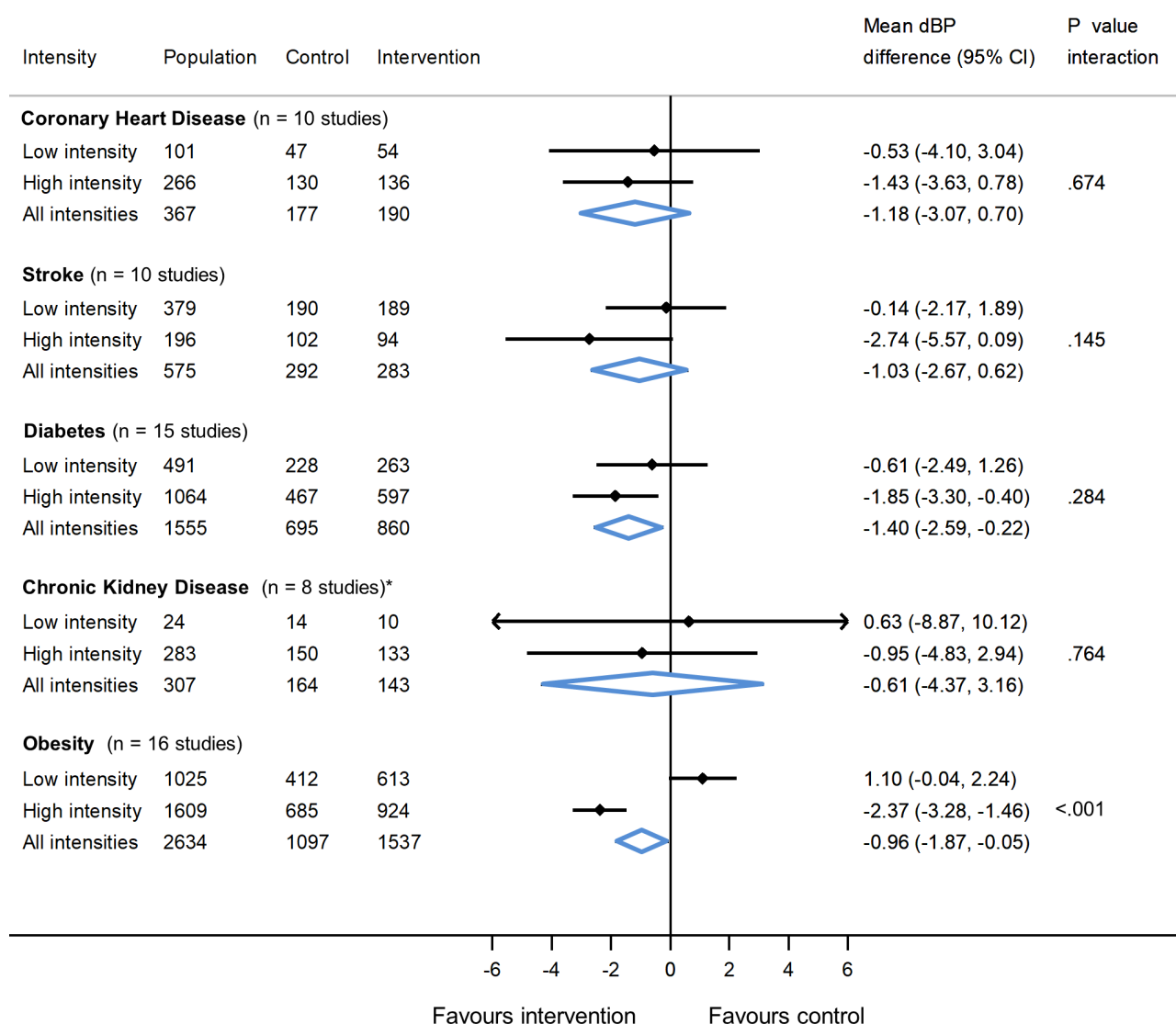


(C) Likelihood of uncontrolled blood pressure



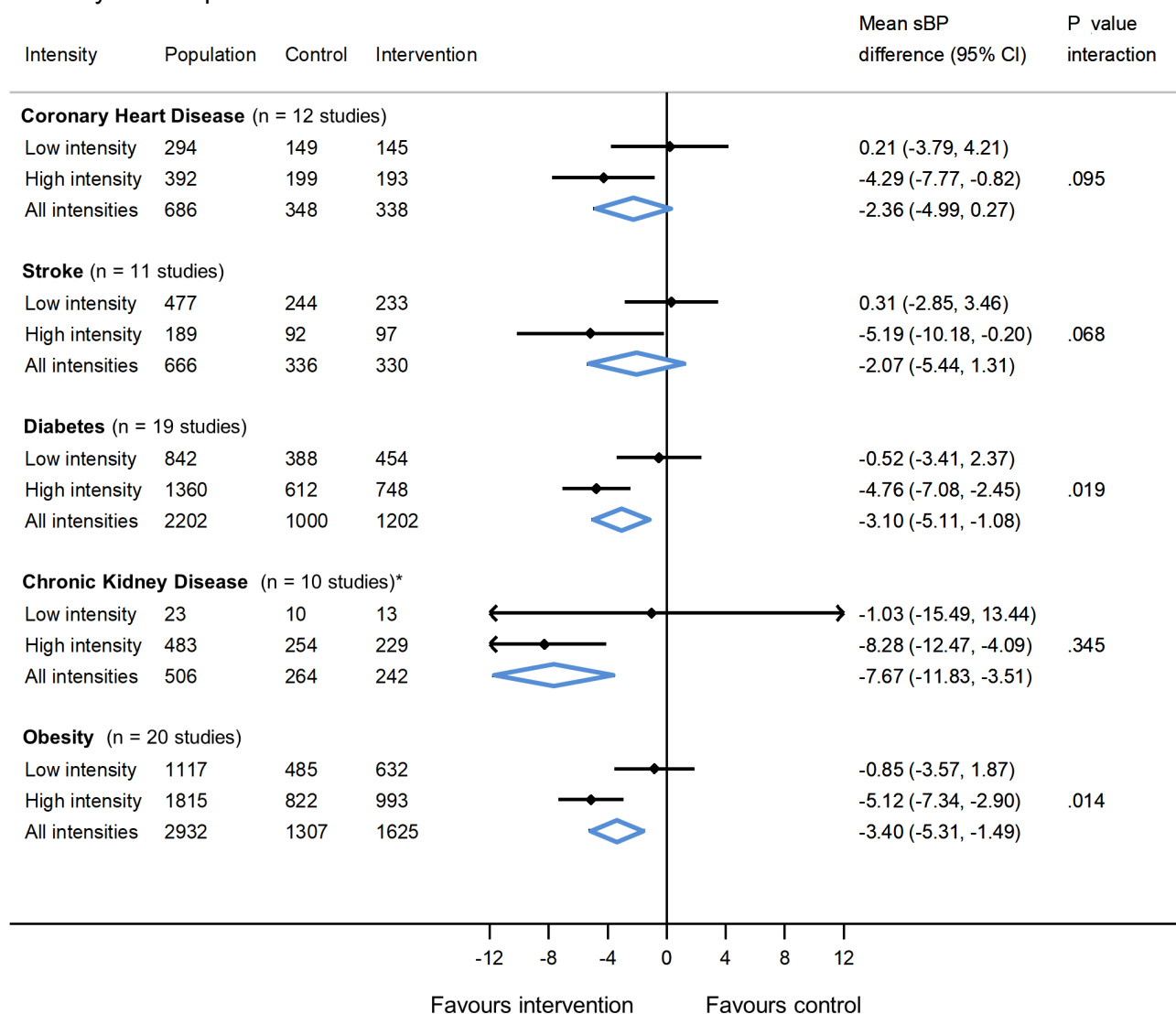
Blood pressure difference given in mm Hg. Analyses adjusted for age, sex, baseline blood pressure and level of intervention, with study level random effects for intervention and usual care
sBP=systolic blood pressure; dBP=diastolic blood pressure; CI=confidence intervals; OR=odds ratio

eFigure 8. Effect of self-monitoring on clinic diastolic blood pressure at 12-month follow-up by intervention intensity within specific morbidities



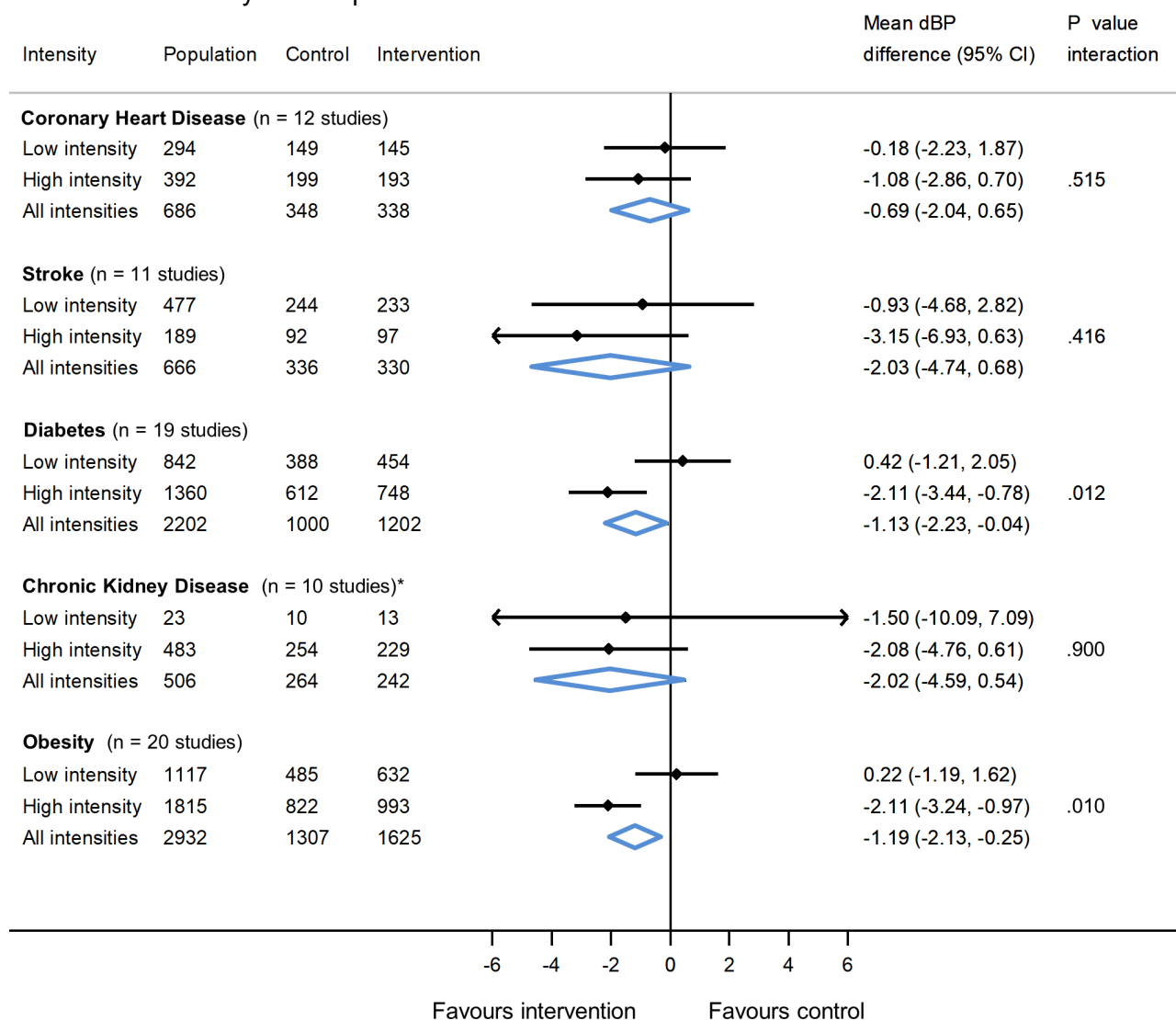
*Two studies only provided one patient each to the model. Blood pressure difference given in mm Hg. Analyses adjusted for age, sex and baseline blood pressure with study level random effects for intervention and usual care. dBP=diastolic blood pressure; CI=confidence intervals; CHD=coronary heart disease; CKD=chronic kidney disease

eFigure 9. Effect of self-monitoring on systolic blood pressure at 6-month follow-up by intervention intensity within specific morbidities



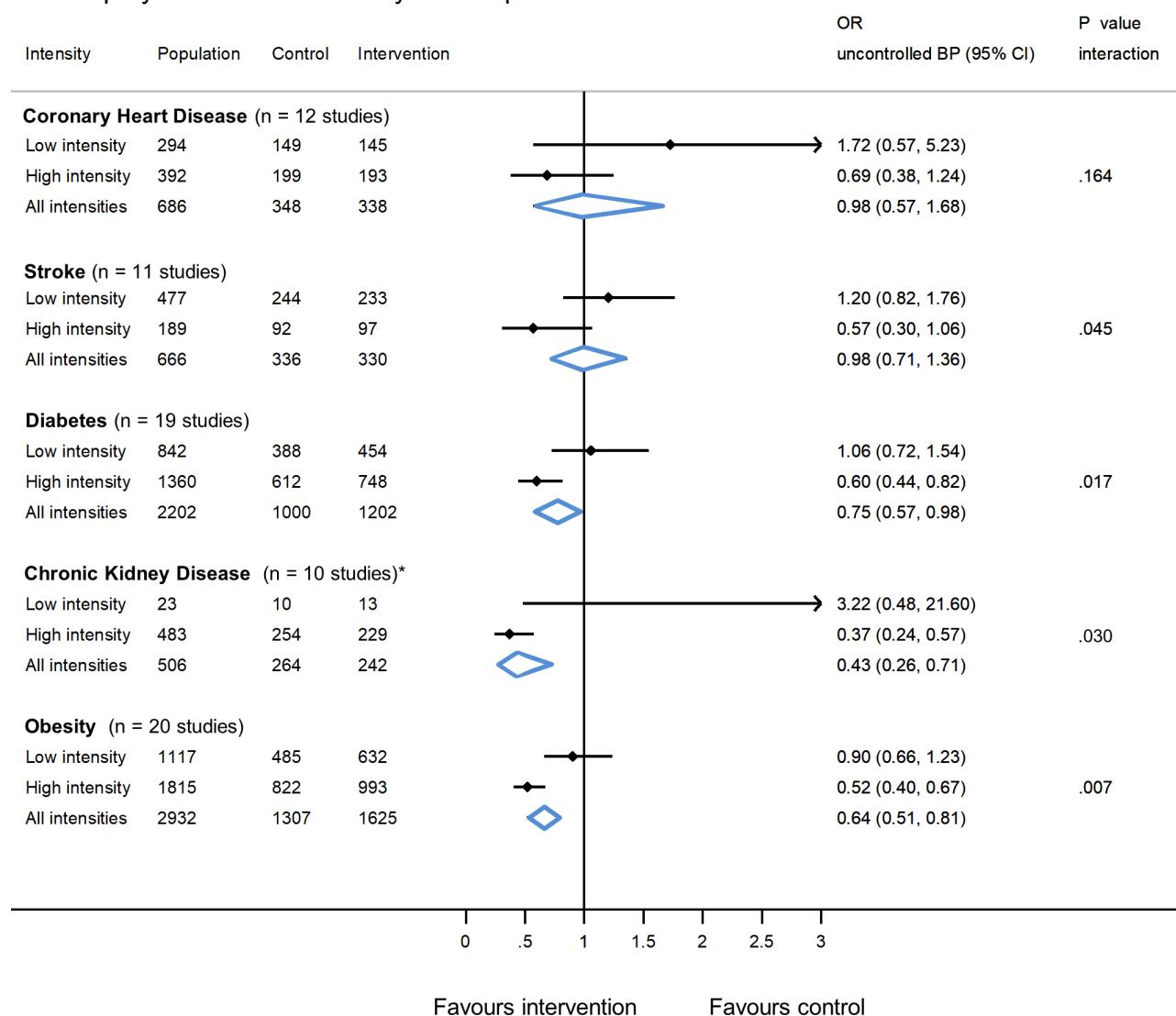
*Two studies only provided one patient each to the model. Blood pressure difference given in mm Hg. Analyses adjusted for age, sex and baseline blood pressure with study level random effects for intervention and usual care. sBP=systolic blood pressure; CI=confidence intervals; CHD=coronary heart disease; CKD=chronic kidney disease

eFigure 10. Effect of self-monitoring on diastolic blood pressure at 6-month follow-up by intervention intensity within specific morbidities



*Two studies only provided one patient each to the model. Blood pressure difference given in mm Hg. Analyses adjusted for age, sex and baseline blood pressure with study level random effects for intervention and usual care. dBP=diastolic blood pressure; CI=confidence intervals; CHD=coronary heart disease; CKD=chronic kidney disease

eFigure 11. Effect of self-monitoring on likelihood of uncontrolled blood pressure at 6-month follow-up by intervention intensity within specific morbidities



*Two studies only provided one patient each to the model. Analyses adjusted for age, sex and baseline blood pressure with study level random effects for intervention and usual care. OR=odds ratio; CI=confidence intervals; CHD=coronary heart disease; CKD=chronic kidney disease