Hypertensie bij chronisch nierlijden en dialyse

Dr Ron Daelemans

ZNA Antwerpen

14e Vlaamse Nefrologiedag

14/03/2023

Chat GPT: Hemodialysis and hypertension

Here are some general guidelines for managing hypertension in hemodialysis patients:

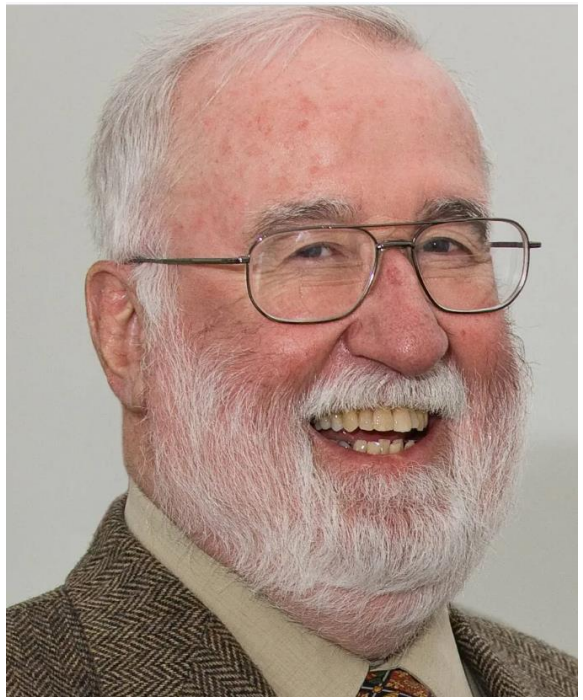
1. Lifestyle modifications

2. Medications: Several classes of medications are effective in controlling blood pressure in hemodialysis patients. These include diuretics, angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), calcium channel blockers, and beta-blockers.

3. Hemodialysis can lower blood pressure by helping to regulate fluid balance and removing excess salt and fluid.

4. It's important to work with a healthcare professional, such as a nephrologist and to develop a treatment plan tailored to the individual needs of the patient.

David Sackett: The father of evidence-based medicine
(1934-2015)



"Half of what you will learn in medical school will be shown to be wrong within 10 years of your graduation. The trouble is that nobody can tell you which half."

2021 European Society of Hypertension practice guidelines for office and out-of-office blood pressure measurement

G. Stergiou

Journal of Hypertension 2021, 39:1293–1302

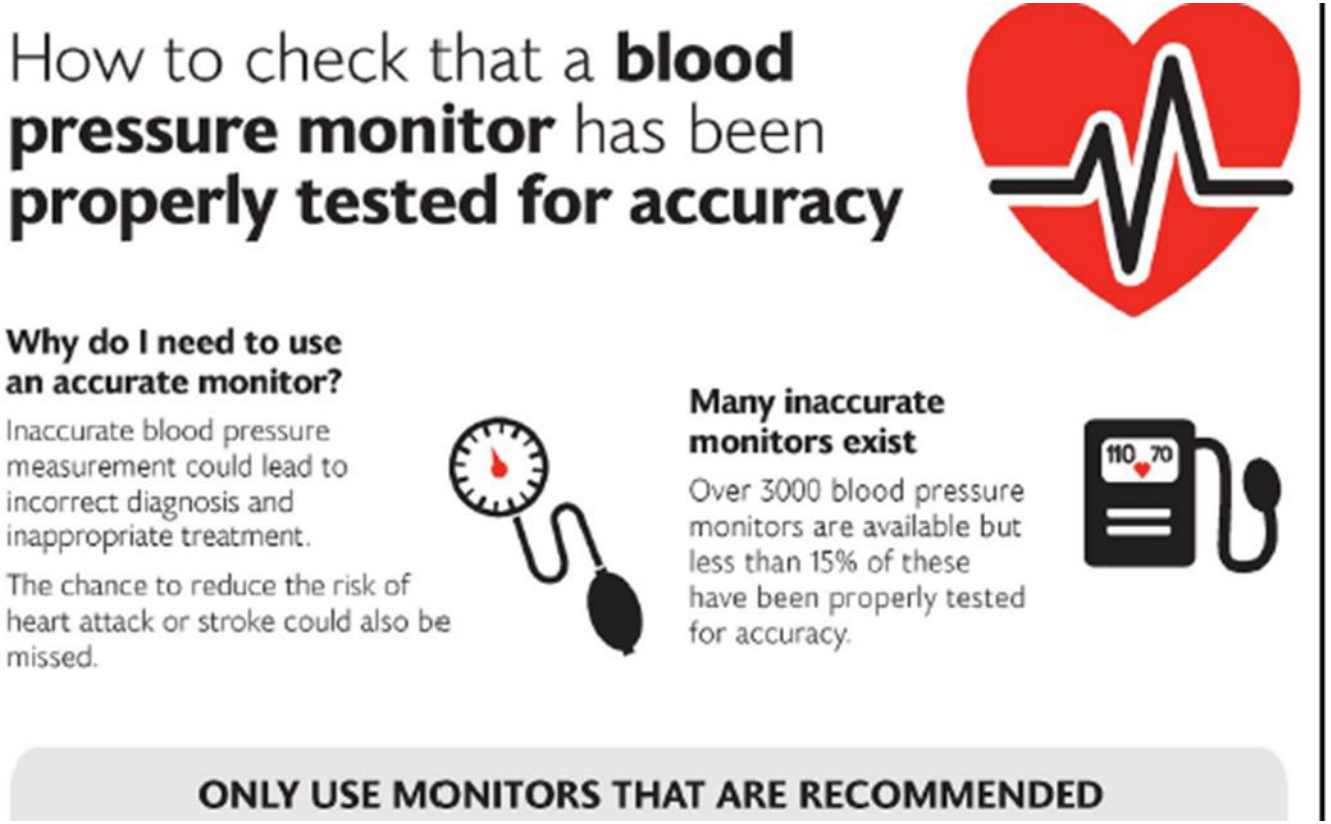
- Validated BP measuring devices
- How to measure BP?
- OBPM, HBPM, ABPM, cuffless wearable BP monitors
- Mobile technologies:

  telemonitoring, data integration, multidisciplinary approach, …

How to find and use validated blood pressure measuring devices?

D. Picone

Journal of Human Hypertension (2023) 37:108–114



www.stridebp.org

www.validatebp.org

www.dableducational.org

2021 European Society of Hypertension practice guidelines for office and out-of-office blood pressure measurement

G. Stergiou

Journal of Hypertension 2021, 39:1293–1302

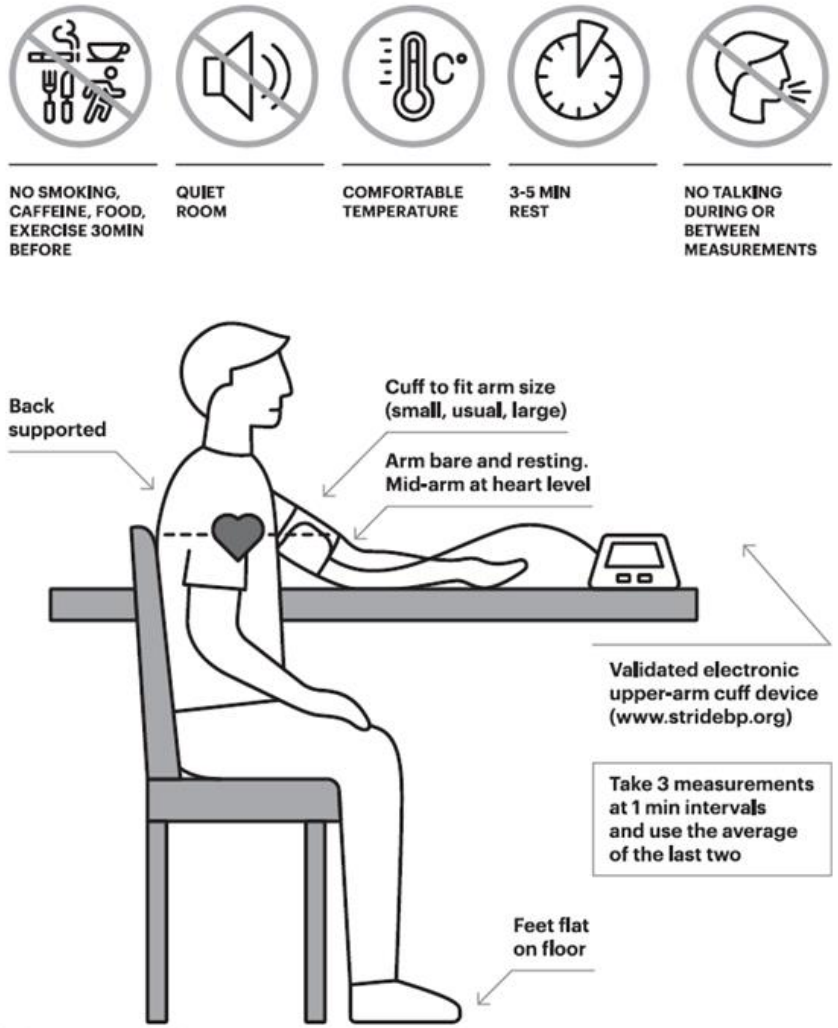


FIGURE 2 Poster of OBP measurement methodology.

Sources of inaccuracy in the measurement of adult patients' resting blood pressure in clinical settings:

Journal of Hypertension 2017, 35:421–441

N. Kallioinen

Potential source of inaccuracy	Search terms	Number of results
Acute ingestion of food	blood pressure AND (food OR meal OR ingest* OR eat) AND acute effect* NOT (alcohol OR caffein* OR nicotine)	143
Acute alcohol use	blood pressure AND alcohol AND acute NOT withdraw*	274
Acute caffeine use	blood pressure AND (caffeine OR coffee OR 'energy drink*') AND acute	139
Acute nicotine use	blood pressure AND (nicotine OR smok* OR cigarette*) AND acute effect*	215
Bladder distension	'blood pressure' AND 'bladder distension'	23
Cold exposure	blood pressure AND cold expos*	238
Paretic arm	blood pressure AND (paretic OR paralysed arm OR paralyzed arm)	9
White-coat effect	blood pressure AND (white coat effect OR white-coat effect)	294
Indirect measurement	aneroid AND mercury AND blood pressure	48
General device inaccuracy	sphygmomanometer* AND agreement	101
Aneroid device inaccuracy	aneroid AND mercury AND blood pressure	48
Automated device inaccuracy	auto* AND manual AND blood pressure	231
Pseudohypertension	pseudohypertension OR pseudo-hypertension	76
Rest period duration	(blood pressure measurement OR measuring blood pressure) AND before AND (wait* or rest*)	88
Body position	blood pressure AND (body position*)	224
Leg position	blood pressure AND (leg cross* OR leg position*)	84
Unsupported back	blood pressure AND (back support* OR supported back OR unsupported back OR back unsupported)	13
Unsupported arm	blood pressure AND (arm support* OR supported arm OR unsupported arm OR arm unsupported)	37
Arm position	blood pressure AND arm position*	117
Cuff size	blood pressure AND (cuff* size* OR bladder* size*)	221
Cuff tightness	blood pressure AND (loose* OR tight*) AND cuff	13
Clothing effect	blood pressure AND (clothes OR clothing)	167
Stethoscope placement	blood pressure AND stethoscope AND (placement OR location)	4
Talking during measurement	blood pressure measur* AND (talk OR talks OR talking)	28
Stethoscope head	blood pressure AND diaphragm AND bell	7
Deflation rate	blood pressure AND deflat* rate	24
Interval between repeated measurements	('blood pressure measurement' OR 'blood pressure measurements' OR 'blood pressure readings') AND interval AND time	142
Number of measurements	blood pressure AND number of measurements	65
Interarm difference	blood pressure AND (arm difference OR inter-arm difference OR interarm difference)	134
Auscultatory gap	auscultatory gap	8
General observer inaccuracy	blood pressure AND (observer error* OR observer factors)	40
Korotkoff sound interpretation	(korotkoff OR korotkov) AND (sound* OR phase*)	255
Terminal digit bias	blood pressure AND (terminal digit OR end digit OR final digit OR last digit OR terminal-digit OR end-digit OR final-digit OR last-digit)	50

Is blood pressure measured correctly in dialysis centres? Physicians' and patients' views

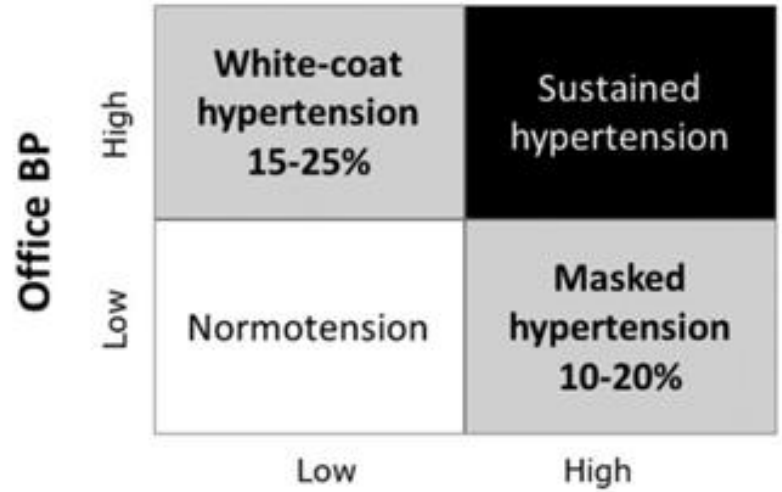
M.Pappaccogli, P. Van der Niepen, A.Persu, …

Nephrol Dial Transplant (2019) 34: 1612–1615

- Questionnaire, 95 dialysis centres
- Only 27% showed adherence to at least 80% of recommendations
- Nephrologists overestimate adherence compared to patients
- Validation of BP measurement integrated devices?
- Underuse of HBPM (56%) and ABPM (44%)

24 u bloeddrukmeting

te vermelden problemen :



uur	probleem
bv. 15uur	hoofdpijn
12.00	heldertrap
12.10	3 mg lexotan + 2 duvels (nerveus)
14.30 - 16.30	gerust
16.45	heldertrap
23.00	3 mg lexotan + 100 mg tramalan
03.10	opgestaan - 3 1/2 geslapen
"	beklemd / angstig
03.50	" " renitec 20 mg.
04.15	" " lexotan 6 mg.
04.25	" " 2 duvels
06.40	nerveus - lexotan 6 mg.
06.50	" - 2 duvels
.....	.....

Home Blood Pressure Measurement (HBPM) + Telemonitoring (TM) in patients with chronic kidney disease (CKD) in a care program: *a pilot study*

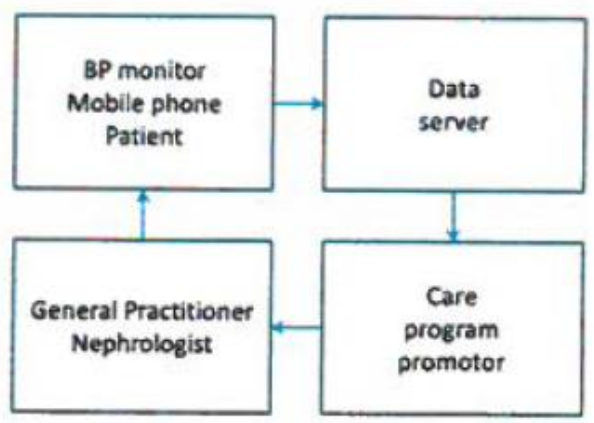
R. Daelemans[1]
W. Verhoeven[2]
M. Drijbooms[3]

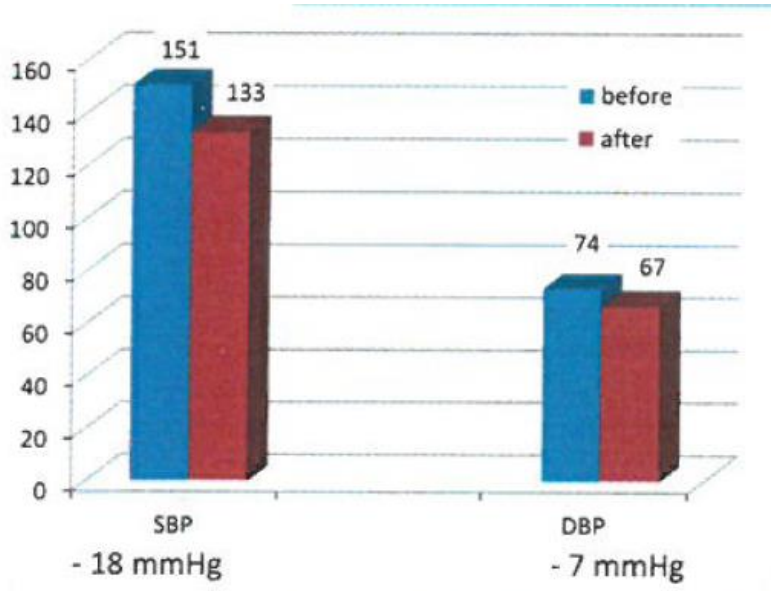
[1]Nephrology-Hypertension, ZNA Ziekenhuisnetwerk Antwerpen, Belgium
[2]General Practitioner (GP), Geneesherenkring Merksem-Schoten (GMS), Antwerp, Belgium
[3]Care Program Promotor (CPP), GMS, Antwerp, Belgium

ESC 2014, Barcelona

Purpose

1. Do HBPM + TM improve BP control in care program patients with CKD?
2. Is TM an added value for both CKD patients and general practitioners (GP's)?





QUESTIONNAIRE

1. Patients

- easy / convenient technique
- feel more involved in treatment
- better follow-up and control by GP
- education / support is necessary
- confusion about BP variability
- no office visits necessary to adapt treatment

2. General Practitioners

- transmitted data have a high level of accuracy and reliability
- not possible without support (care program promotor, nurse)
- feedback nephrologist to adjust treatment is desirable
- data must be integrated in electronic health record
- lack of reimbursement, reduction of office visits

Telemonitoring for Hypertension Management

S. Karam

KIDNEY360 3: 1961–1964, 2022

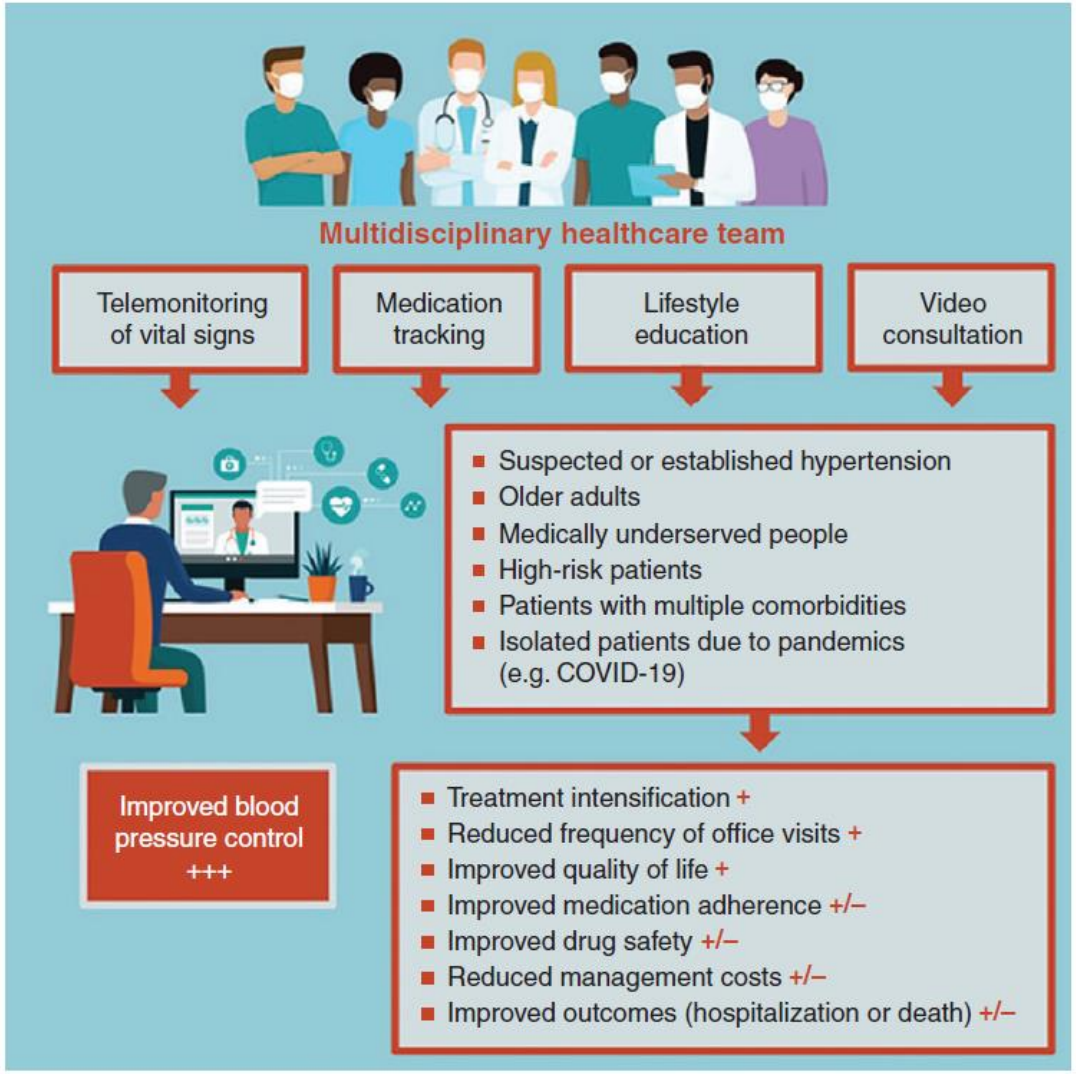


Figure 1. | Comprehensive, multidisciplinary hypertension telehealth programs improve blood pressure control.

The first study comparing a wearable watch-type blood pressure monitor with a conventional ambulatory blood pressure monitor on in-office and out-of-office settings

K. Kario

J Clin Hypertens. 2020;22:135–141

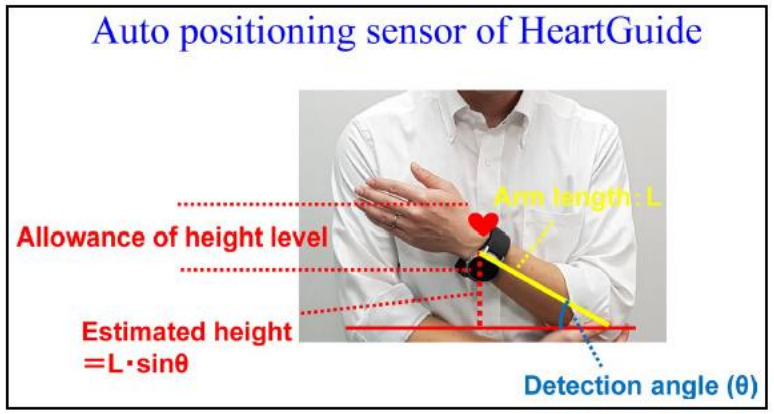
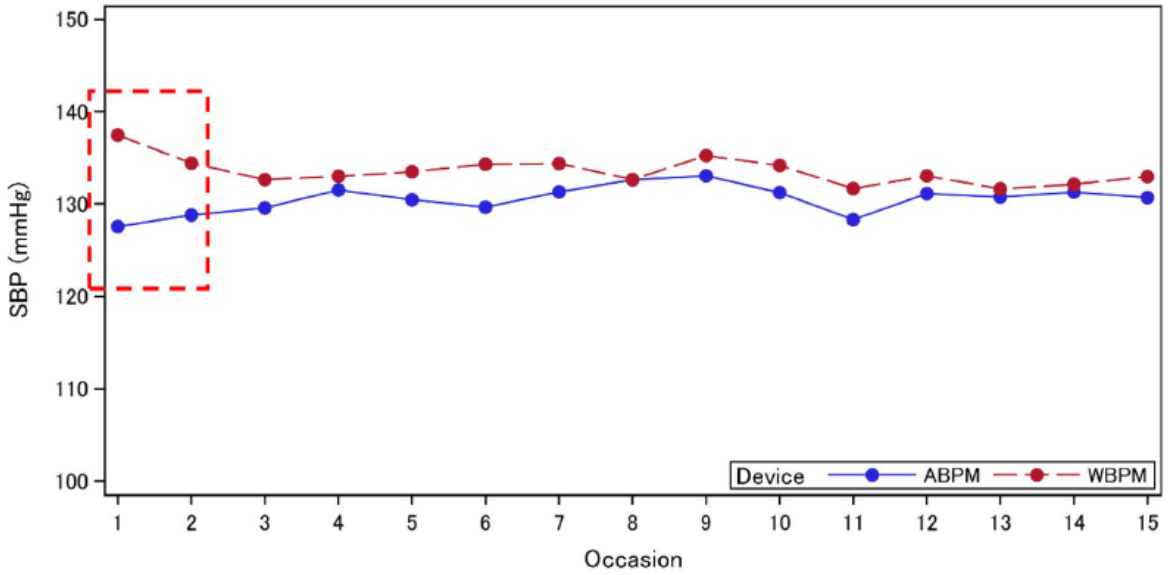
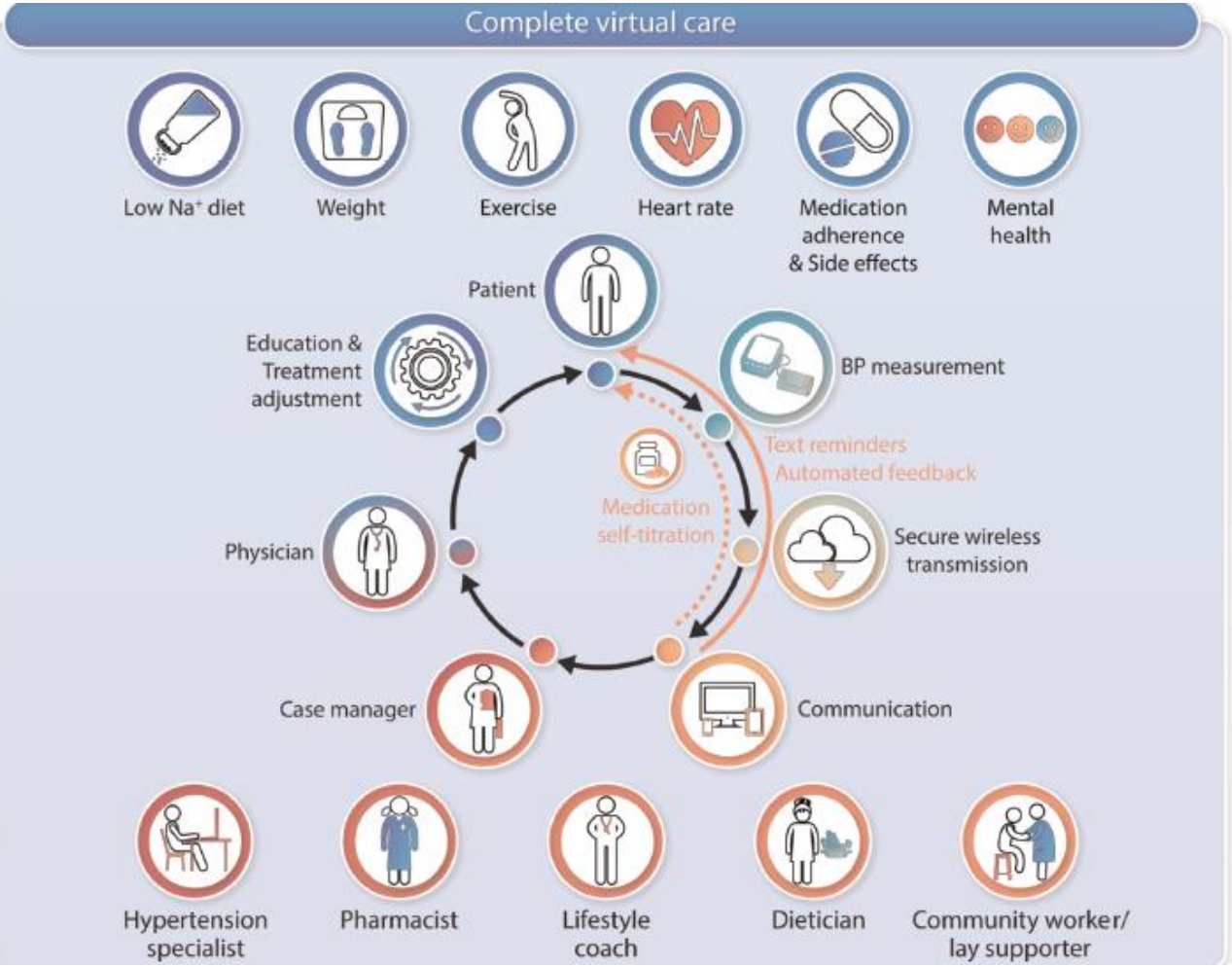


FIGURE 1 Auto-positioning sensor of HeartGuide. HeartGuide will vibrate automatically when the device is set within same height level to heart (within allowance of height level range defined by the upper and lower detection angles)



Virtual management of hypertension: ISH position paper endorsed by the WHL and ESH

N. Khan *Journal of Hypertension 2022, 40:1435–1448*



Innovative Remote Management Solutions for the Control of Hypertension

S. Lee *Hypertension. 2023; March 2, online ahead of print*

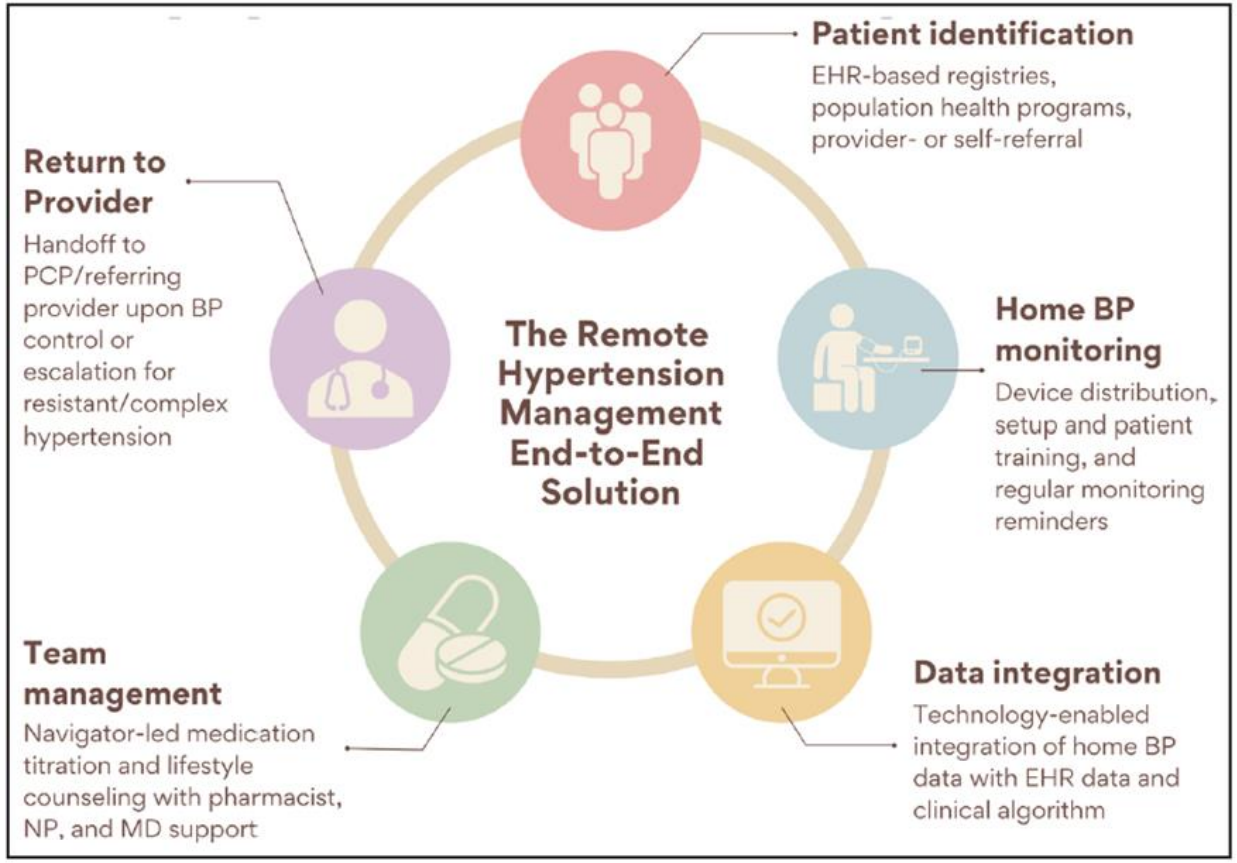


Figure 1. Key elements of the ideal remote hypertension management end-to-end solution.
MD denotes physician. BP indicates blood pressure; EHR, electronic health record; NP, nurse practitioner; and PCP, primary care provider.

Harmonization of the ACC/AHA and ESC/ESH Blood Pressure/ Hypertension Guidelines

Comparisons, Reflections, and Recommendations

P. Whelton, G. Mancia, B. Williams

European Heart Journal 2022; 43:3302 JACC 2022; 80:1192 Circulation 2022; 146:868

- BP measurement
- BP classification (table 4)
- Patient evaluation, CVD risk assessment: ASCVD versus SCORE
- Threshold for drug initiation
- Drug treatment strategy
- BP treatment targets

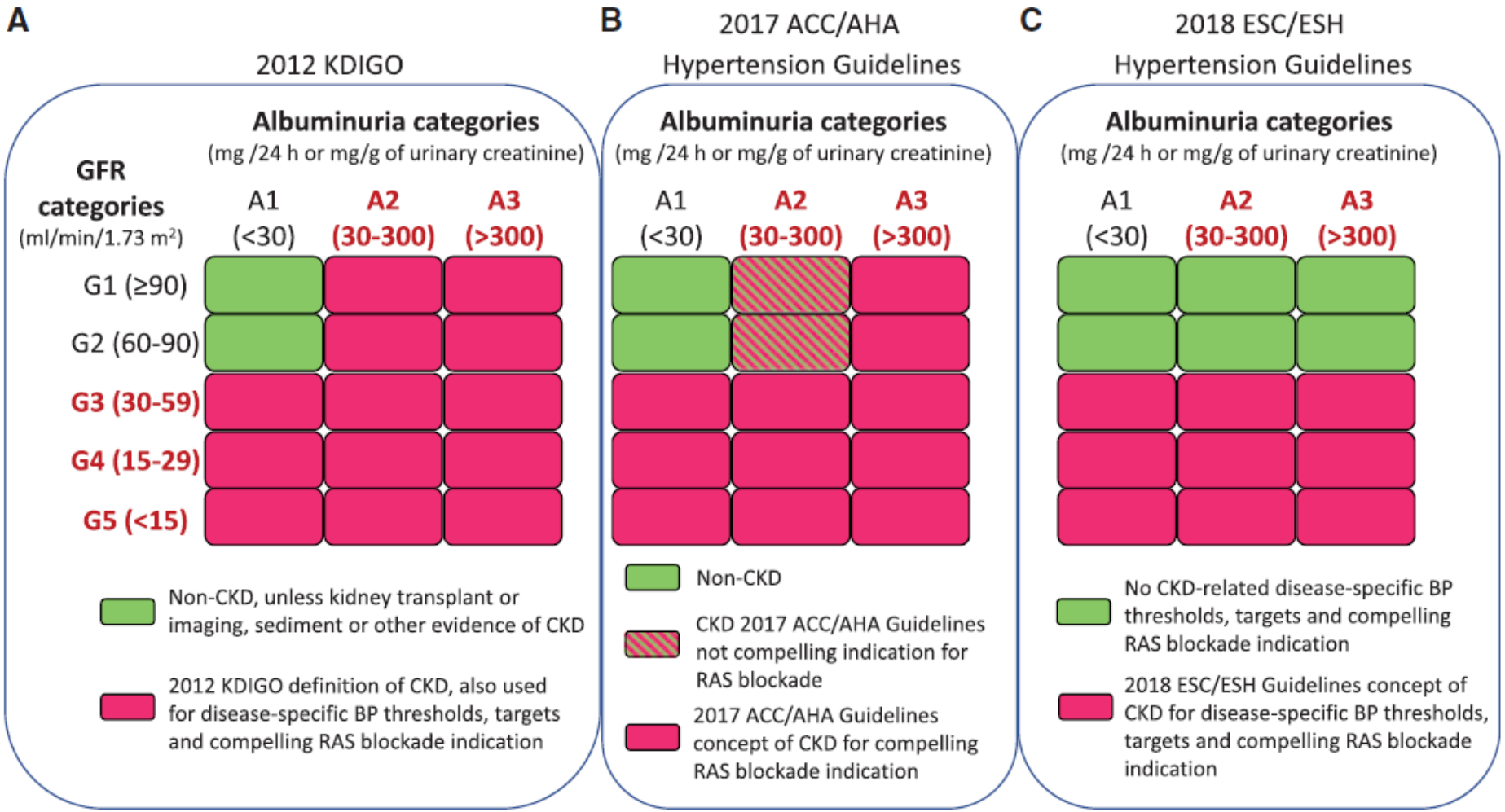
Table 4 Blood Pressure Classification

Categories	Systolic blood pressure, mm Hg	And/ or	Diastolic blood pressure, mm Hg
American College of Cardiology/American Heart Association			
Normal	<120	and	<80
Elevated	120–129	and	<80
Hypertension, stage 1	130–139	or	80–89
Hypertension, stage 2	≥140	or	≥90
European Society of Cardiology/European Society of Hypertension			
Optimal	<120	and	<80
Normal	120–129	and/or	80–84
High normal	130–139	and/or	85–89
Hypertension, grade 1	140–159	and/or	90–99
Hypertension, grade 2	160–179	and/or	100–109
Hypertension, grade 3	≥180	and/or	≥110
Isolated systolic hypertension	≥140	and	<90

The chaos of hypertension guidelines for chronic kidney disease patients

Esmeralda Castillo-Rodriguez[1,2,3], Beatriz Fernandez-Fernandez[1,2,3], Raquel Alegre-Bellassai[1,2,3], Mehmet Kanbay[4] and Alberto Ortiz[1,2,3]

Clinical Kidney Journal, 2019, vol. 12, no. 6, 771–777

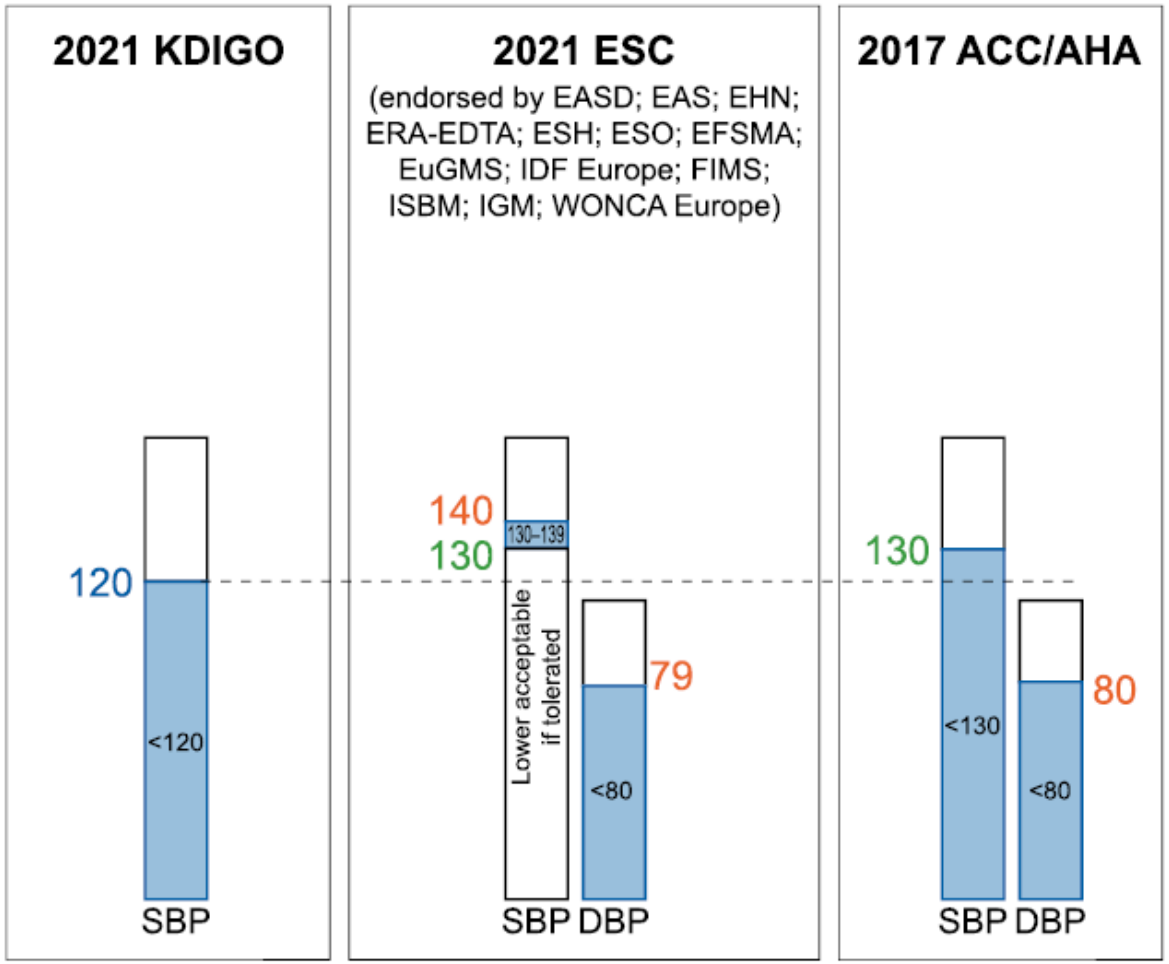


Blood pressure targets in CKD 2021: the never-ending guidelines debacle

Sol Carriazo [1,2], Pantelis Sarafidis [3], Charles J. Ferro [4] and Alberto Ortiz [1,2]

Clinical Kidney Journal, 2022, vol. 15, no. 5, 845–851

B BP targets for CKD patients in guidelines current as of November 2021



Hypertension treatment in CKD

- Hypertension => CKD + progression
- Treatment => CKD incidence ↘
- Treatment => mortality CKD ↘ (RR 42%)
- Medication:
  - RAAS blockade (ACE-I, ARB, MRA's)
  - Diuretics
  - CCB
  - ß blockers
  - Vasodilators, centrally acting
  - SGLT2 inhibitors

Cardiorenal Protection With the Newer Antidiabetic Agents in Patients With Diabetes and Chronic Kidney Disease

Circulation. 2020;142:e265–e286

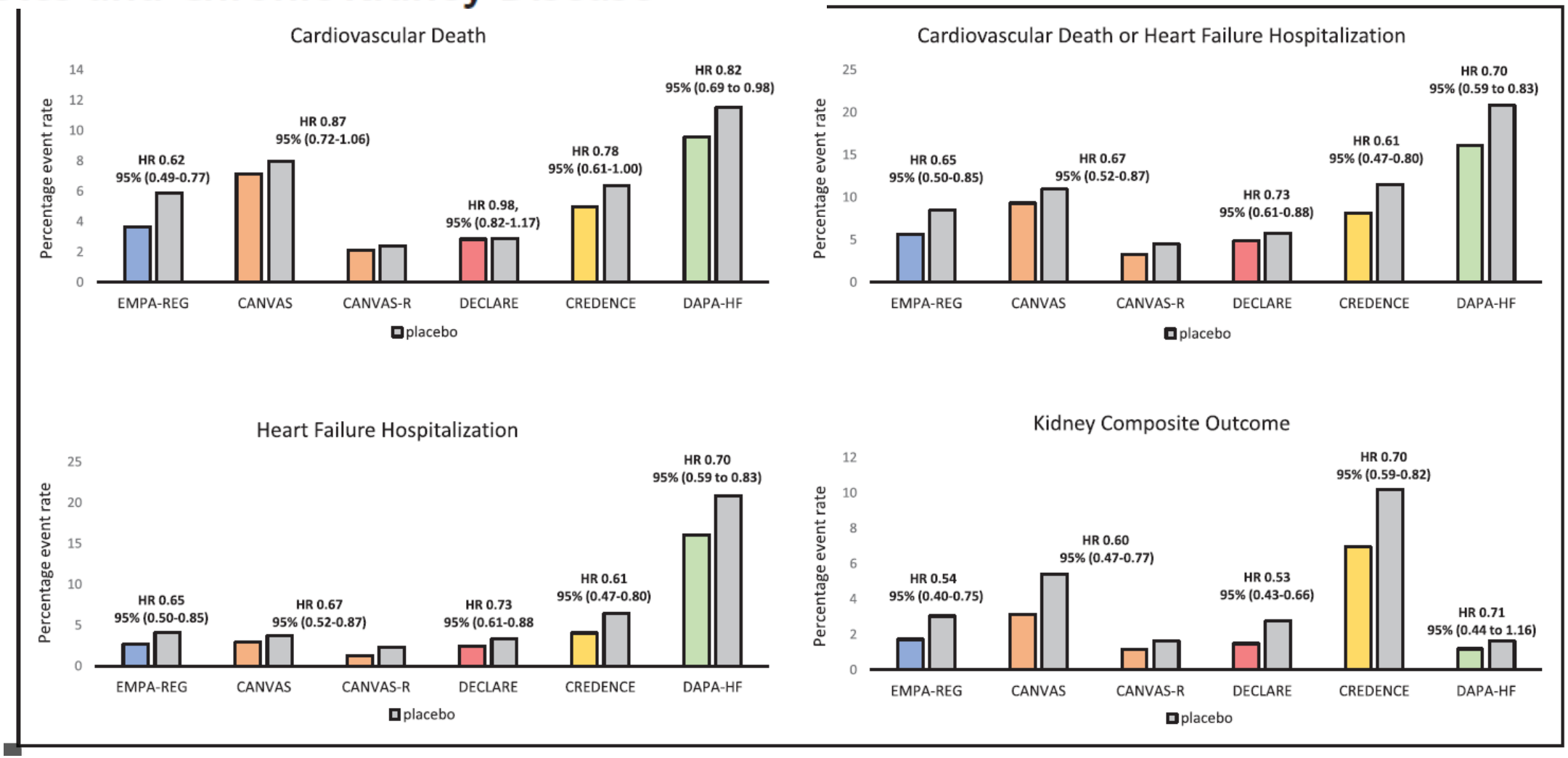


Figure 1. Hazard ratios (HRs) for key cardiovascular and kidney outcomes in cardiovascular outcomes trials with the SGLT2 (sodium glucose cotransporter 2) inhibitors.

Kidney outcomes with finerenone: an analysis from the FIGARO-DKD study

Nephrology Dialysis Transplantation (2023) 38: 372–383

Kidney outcomes with finerenone: an analysis from the FIGARO-DKD study

Background

The aim was to evaluate the effects of finerenone on kidney outcomes in patients with CKD and T2D.

Methods

FIGARO-DKD trial (NCT02545049)
7437 patients with T2D and CKD

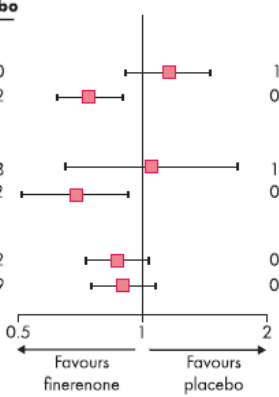
Kidney composite outcomes:
Time to kidney failure, sustained ≥ 40%/≥ 57% decrease from baseline in eGFR over ≥ 4 weeks, or renal death

CV composite outcome:
Time to CV death, non-fatal MI, non-fatal stroke, or hospitalization for HF

Acknowledgments: Funded by Bayer AG; FIDELIO-DKD

Results

Outcome	Finerenone n/N	Placebo n/N	Finerenone n/100 PY	Placebo n/100 PY	Hazard ratio (95% CI)	Pinteraction
eGFR ≥40% kidney composite						
UACR 30–<300 mg/g	145/1726 (8.4)	124/1688 (7.3)	2.63	2.30	1.16 (0.91–1.47)	0.02
UACR ≥300 mg/g	201/1851 (10.9)	268/1878 (14.3)	3.83	5.02	0.74 (0.62–0.90)	
eGFR ≥57% kidney composite						
UACR 30–<300 mg/g	34/1726 (2.0)	32/1688 (1.9)	0.60	0.58	1.05 (0.65–1.71)	0.37
UACR ≥300 mg/g	73/1851 (3.9)	106/1878 (5.6)	1.35	1.92	0.69 (0.51–0.93)	
CV composite						
UACR 30–<300 mg/g	226/1726 (13.1)	251/1688 (14.9)	3.88	4.42	0.87 (0.73–1.04)	0.60
UACR ≥300 mg/g	222/1851 (12.0)	254/1878 (13.5)	3.94	4.49	0.90 (0.75–1.08)	



Conclusion

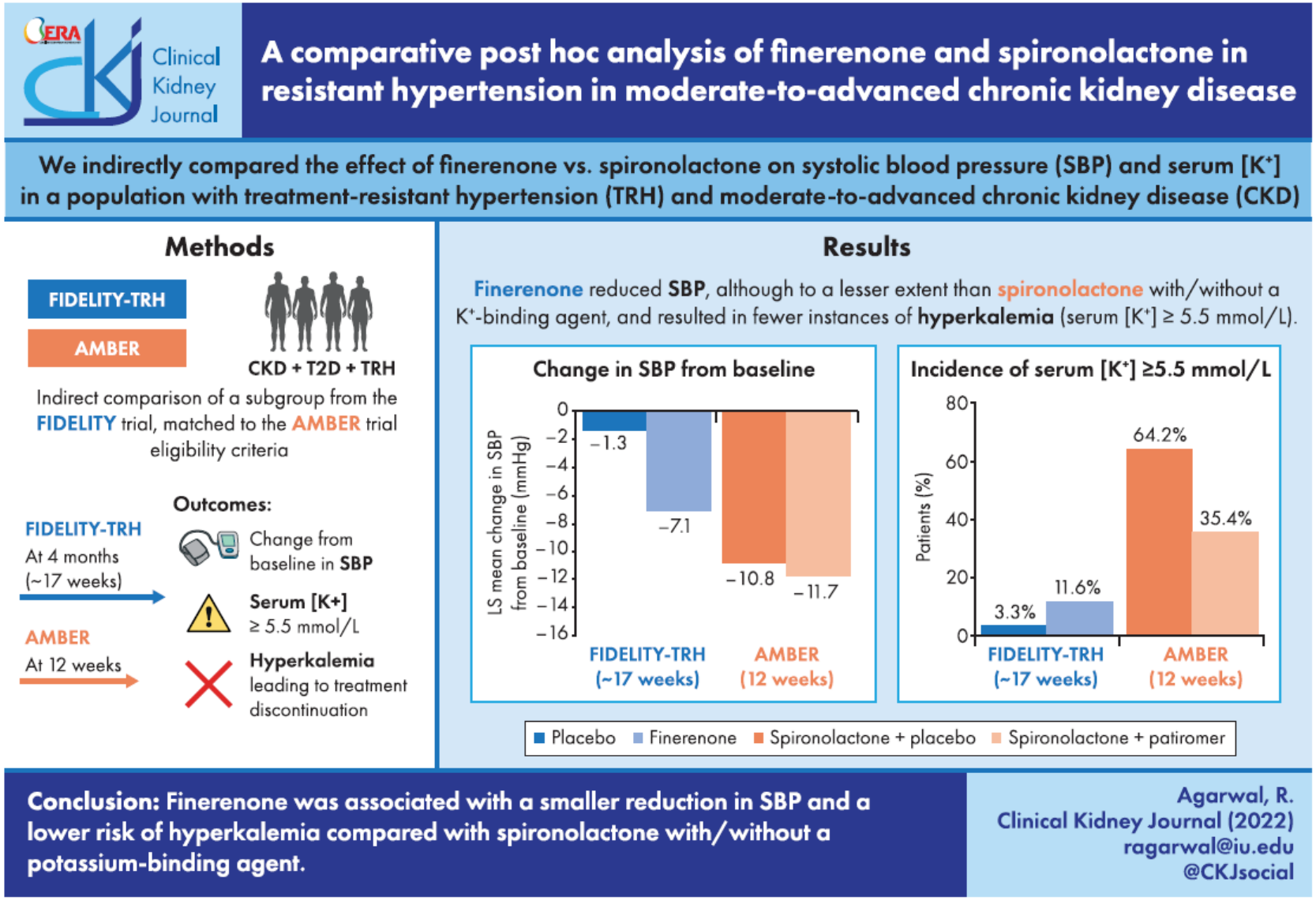
Finerenone protects against CV events and kidney disease progression in patients with T2D and early- or late-stage CKD.

ERA ndt NEPHROLOGY DIALYSIS TRANSPLANTATION

Ruilope et al. NDT (2022)
@NDTSocial

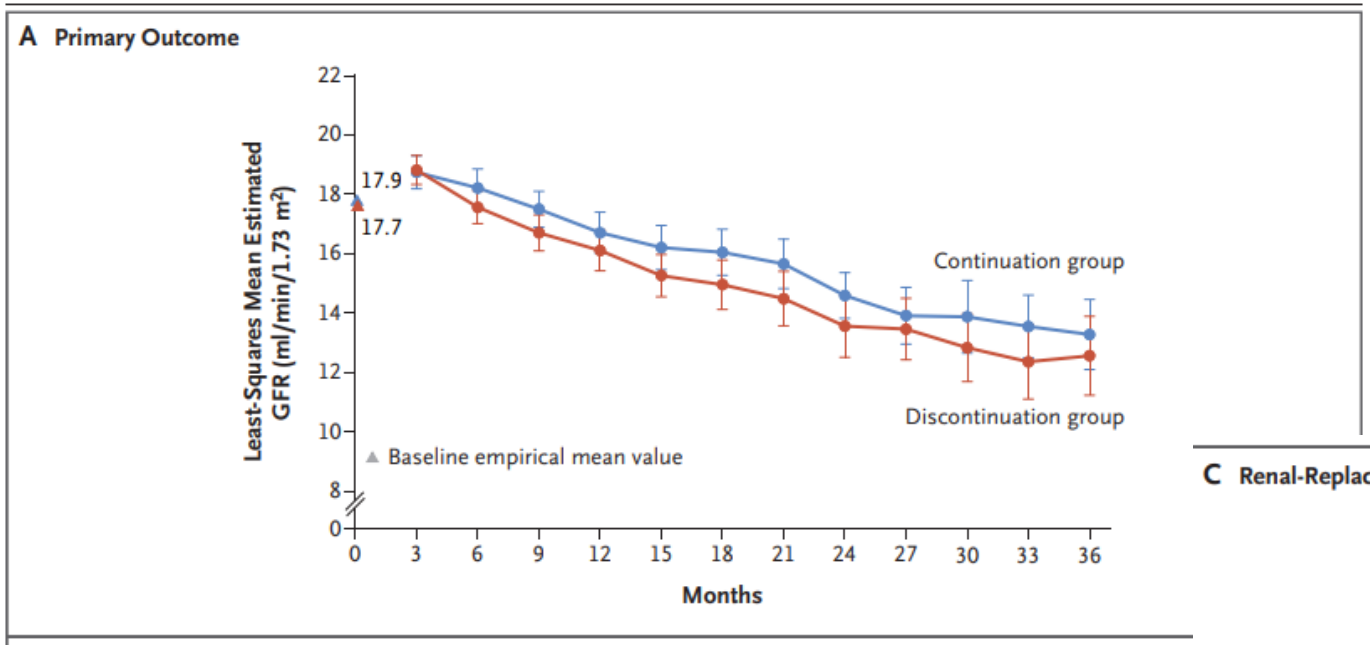
A comparative post hoc analysis of finerenone and spironolactone in resistant hypertension in moderate-to-advanced chronic kidney disease

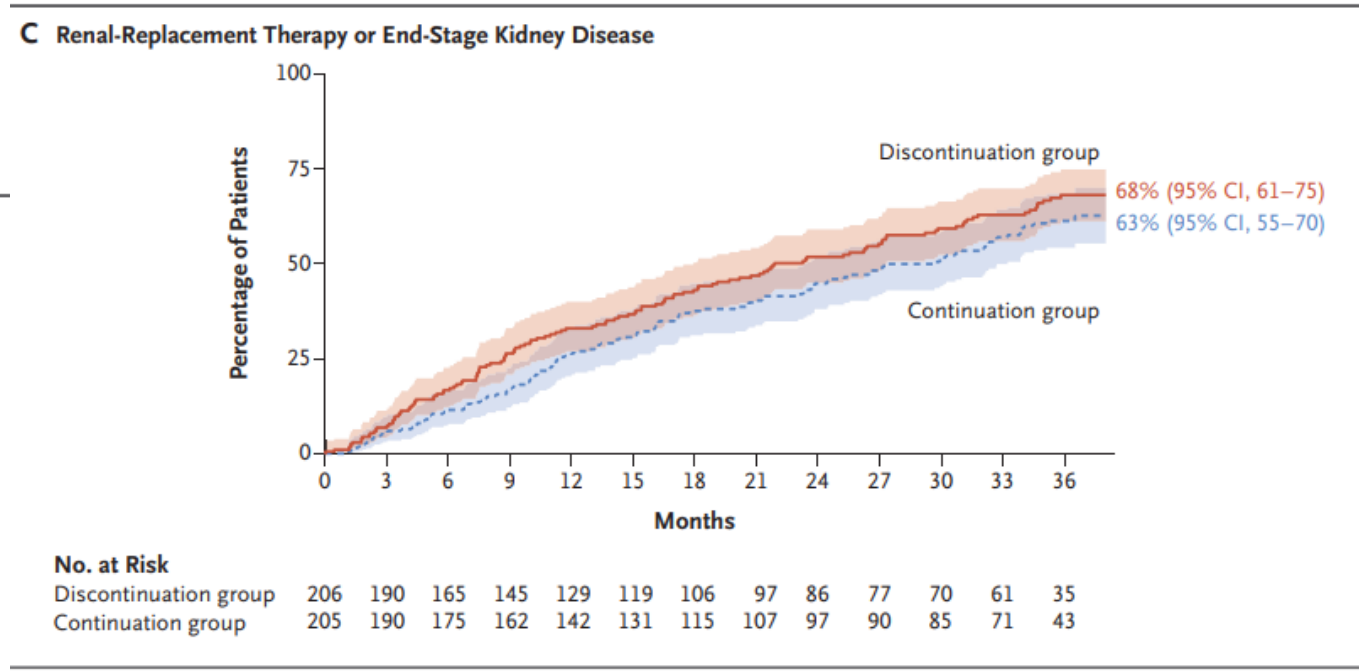
Clinical Kidney Journal, 2023, vol. 16, no. 2, 293–302



Renin–Angiotensin System Inhibition in Advanced Chronic Kidney Disease

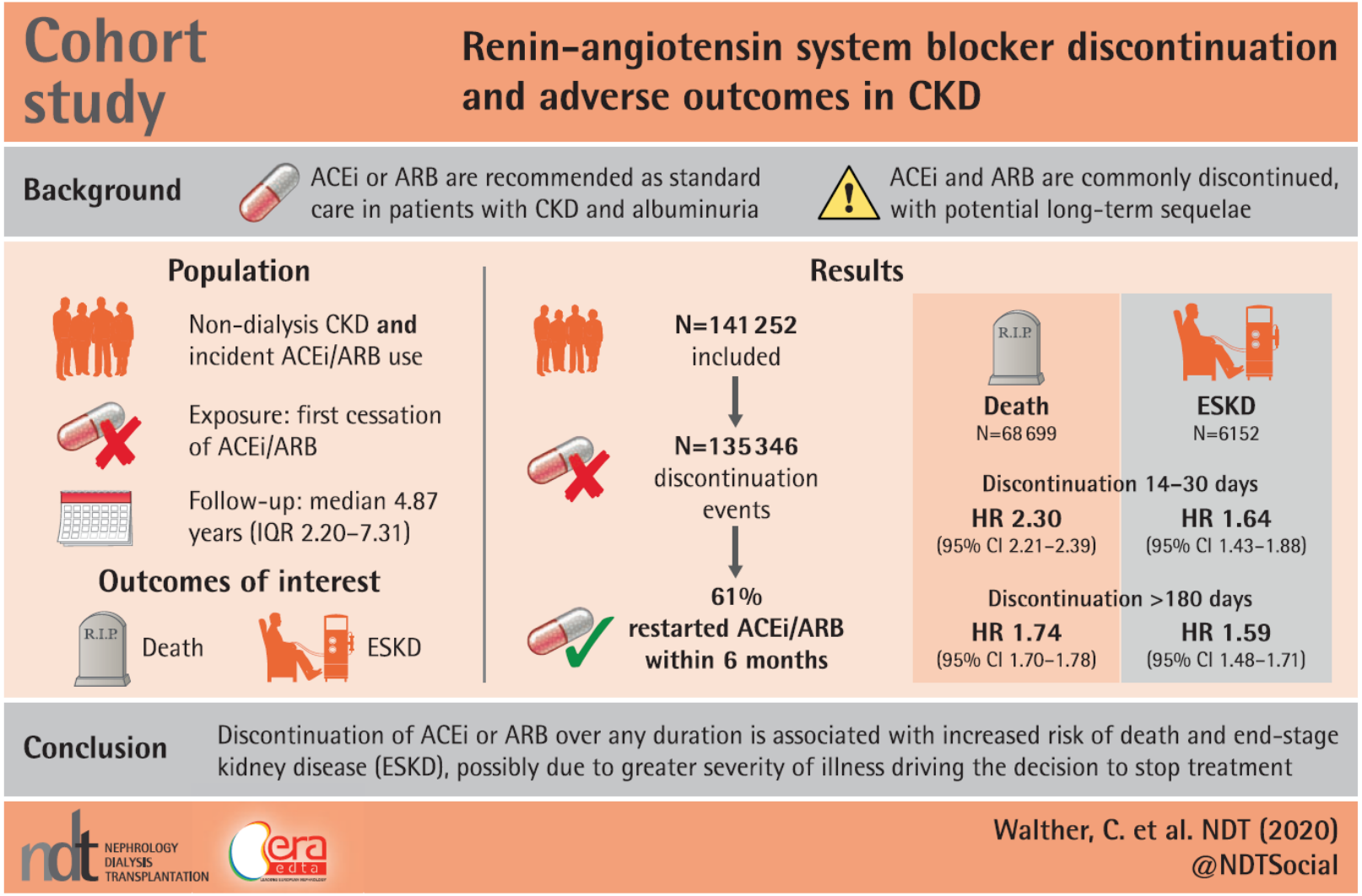
S. Bhandari *NEJM 2022; 387: 2021*





Renin–angiotensin system blocker discontinuation and adverse outcomes in chronic kidney disease

Nephrol Dial Transplant (2021) 36: 1893–1899

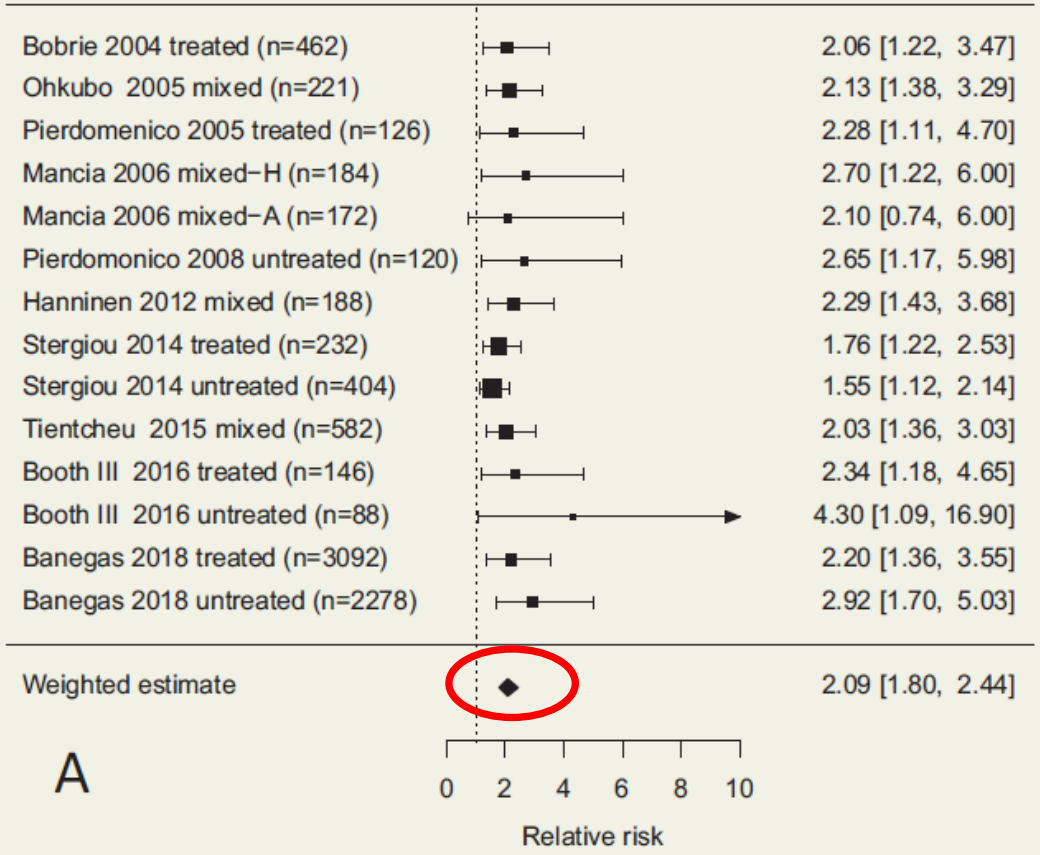


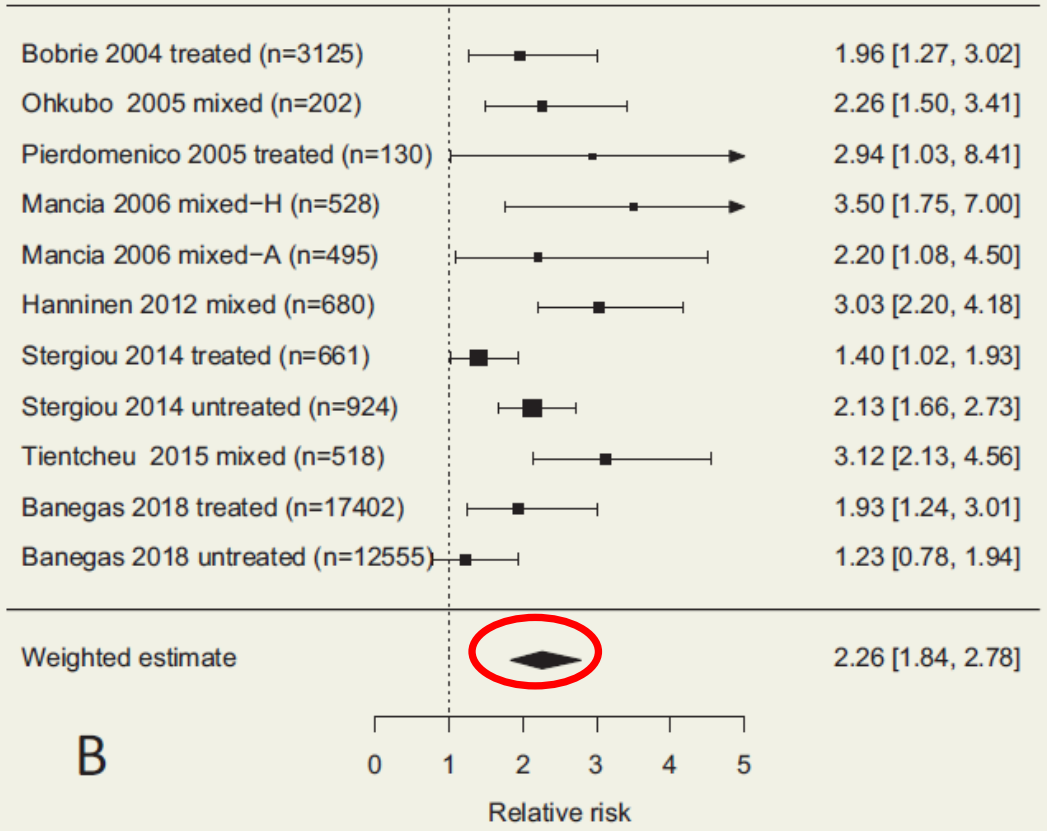
Masked Hypertension: A Systematic Review

H.Thakkar

Heart, Lung and Circulation (2020) 29, 102–111

Relative risk (RR) for cardiovascular and cerebrovascular events





A: RR in masked hypertension

B: RR in sustained hypertension

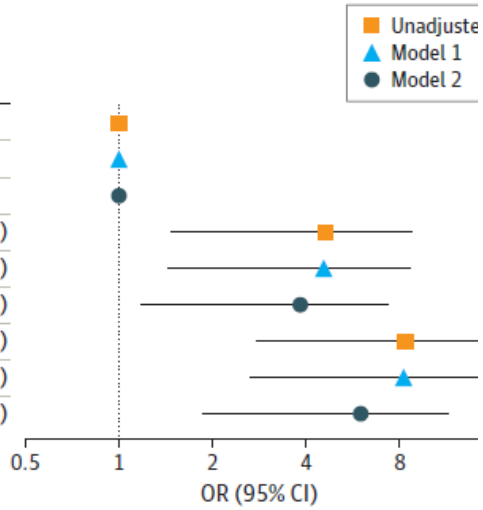
Association of Nighttime Masked Uncontrolled Hypertension With Left Ventricular Hypertrophy and Kidney Function Among Patients with Chronic Kidney Disease

JAMA Network Open. 2022;5(5):e2214460

Figure 3. Association Between Left Ventricular Hypertrophy (LVH) and Hypertension Subtypes

A MUCH vs sustained hypertension

Hypertension subtypes	Total patients, No.	Patients with LVH, No. (%)	OR (95% CI)
Controlled hypertension	125	6 (4.8)	1 [Reference]
			1 [Reference]
			1 [Reference]
MUCH	244	39 (16.0)	3.60 (1.48-8.77)
			3.53 (1.44-8.65)
			2.94 (1.18-7.34)
Sustained hypertension	280	72 (25.7)	6.61 (2.78-15.7)
			6.44 (2.67-15.5)
			4.64 (1.87-11.5)



B Isolated nighttime vs day-night MUCH

Hypertension subtypes	Total patients, No.	Patients with LVH, No. (%)	OR (95% CI)
Controlled hypertension	125	6 (4.8)	1 [Reference]
			1 [Reference]
			1 [Reference]
Isolated nighttime MUCH	154	24 (15.6)	3.43 (1.35-8.71)
			3.23 (1.27-8.25)
			2.50 (0.94-6.67)
Day-night MUCH	88	15 (17.0)	3.95 (1.46-10.7)
			3.83 (1.41-10.4)
			3.26 (1.15-9.25)

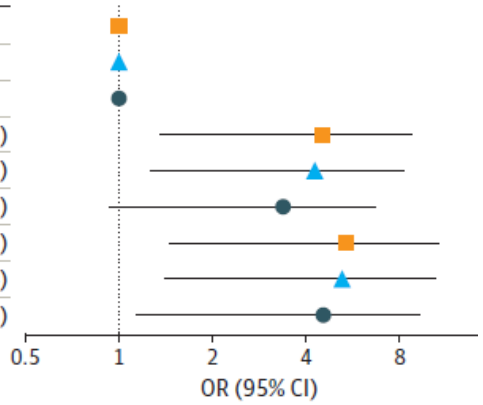
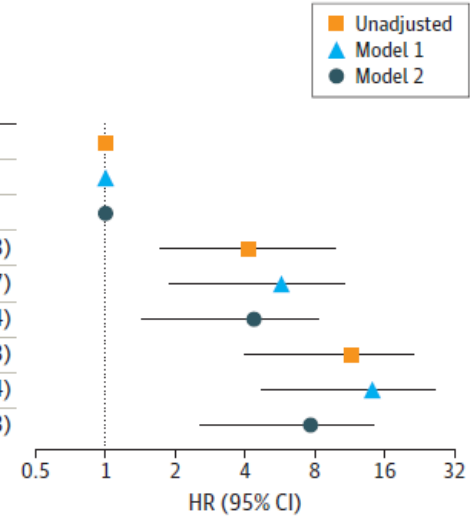


Figure 4. Association Between Composite Kidney Outcomes and Hypertension Subtypes

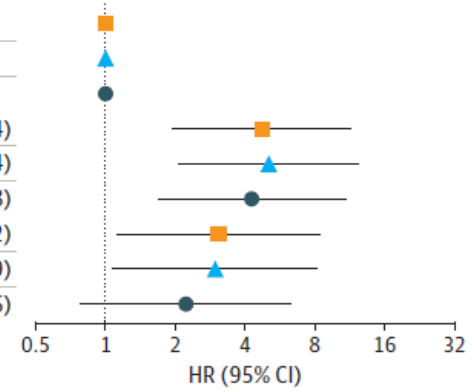
A MUCH vs sustained hypertension

Hypertension subtypes	Total patients, No.	Patients with composite kidney outcome, No. (%)	HR (95% CI)
Controlled hypertension	125	6 (4.8)	1 [Reference]
			1 [Reference]
			1 [Reference]
MUCH	244	40 (16.4)	4.12 (1.75-9.73)
			4.52 (1.90-10.7)
			3.45 (1.45-8.24)
Sustained hypertension	280	84 (30.3)	9.26 (4.03-21.3)
			11.2 (4.76-26.4)
			6.08 (2.58-14.3)



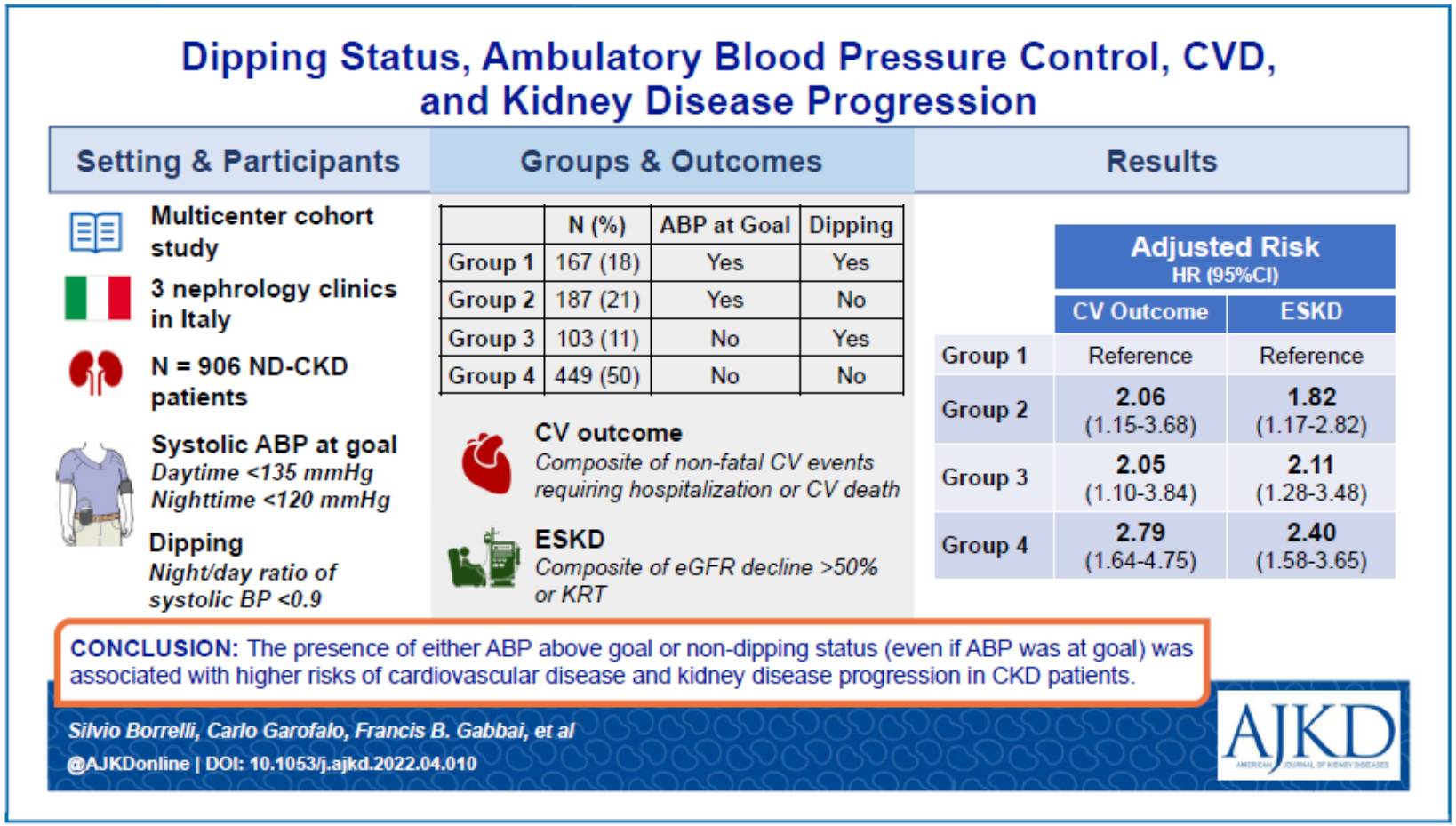
B Isolated nighttime vs day-night MUCH

Hypertension subtypes	Total patients, No.	Patients with composite kidney outcome, No. (%)	HR (95% CI)
Controlled hypertension	125	6 (4.8)	1 [Reference]
			1 [Reference]
			1 [Reference]
Isolated nighttime MUCH	154	29 (18.8)	4.72 (1.96-11.4)
			5.05 (2.06-12.4)
			4.27 (1.69-10.8)
Day-night MUCH	88	11 (12.5)	3.07 (1.14-8.32)
			2.96 (1.09-8.09)
			2.22 (0.79-6.26)



Dipping Status, Ambulatory Blood Pressure Control, Cardiovascular Disease, and Kidney Disease Progression: A Multicenter Cohort Study of CKD

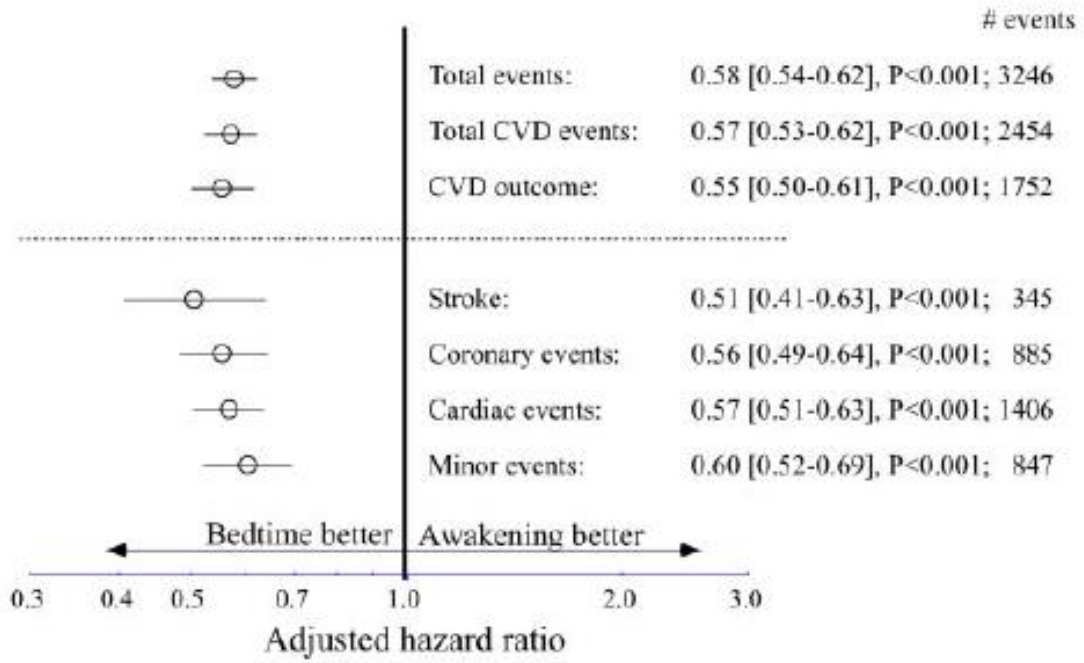
Silvio Borrelli, Carlo Garofalo,* Francis B. Gabbai, Paolo Chiodini, Simona Signoriello, Ernesto Paoletti, Maura Ravera, Elisabetta Bussalino, Vincenzo Bellizzi, Maria Elena Liberti, Luca De Nicola, and Roberto Minutolo*



Bedtime hypertension treatment improves cardiovascular risk reduction: the Hygia Chronotherapy Trial

R. Hermida

European Heart Journal (2020) 41, 4565–4576



Take home figure Adjusted hazard ratio (95% CI) of cardiovascular events as a function of hypertension treatment-time (either upon awakening or at bedtime). Total events: Death from all causes, myocardial infarction, coronary revascularization, heart failure, ischaemic and haemorrhagic stroke, angina pectoris, peripheral artery disease, thrombotic occlusion of the retinal artery, and transient ischaemic attack. Coronary events: cardiovascular disease death, myocardial infarction, and coronary revascularization. Cardiac events: Coronary events and heart failure. cardiovascular disease-outcome: Cardiac events plus ischaemic and haemorrhagic stroke. Minor events: angina events, peripheral artery disease, thrombotic occlusion of the retinal artery, and transient ischaemic attack.

Cardiovascular outcomes in adults with hypertension with evening versus morning dosing of usual antihypertensives in the UK (TIME study): a prospective, randomised, open-label, blinded-endpoint clinical trial

I.Mackenzie *Lancet 2022: 400:1417*

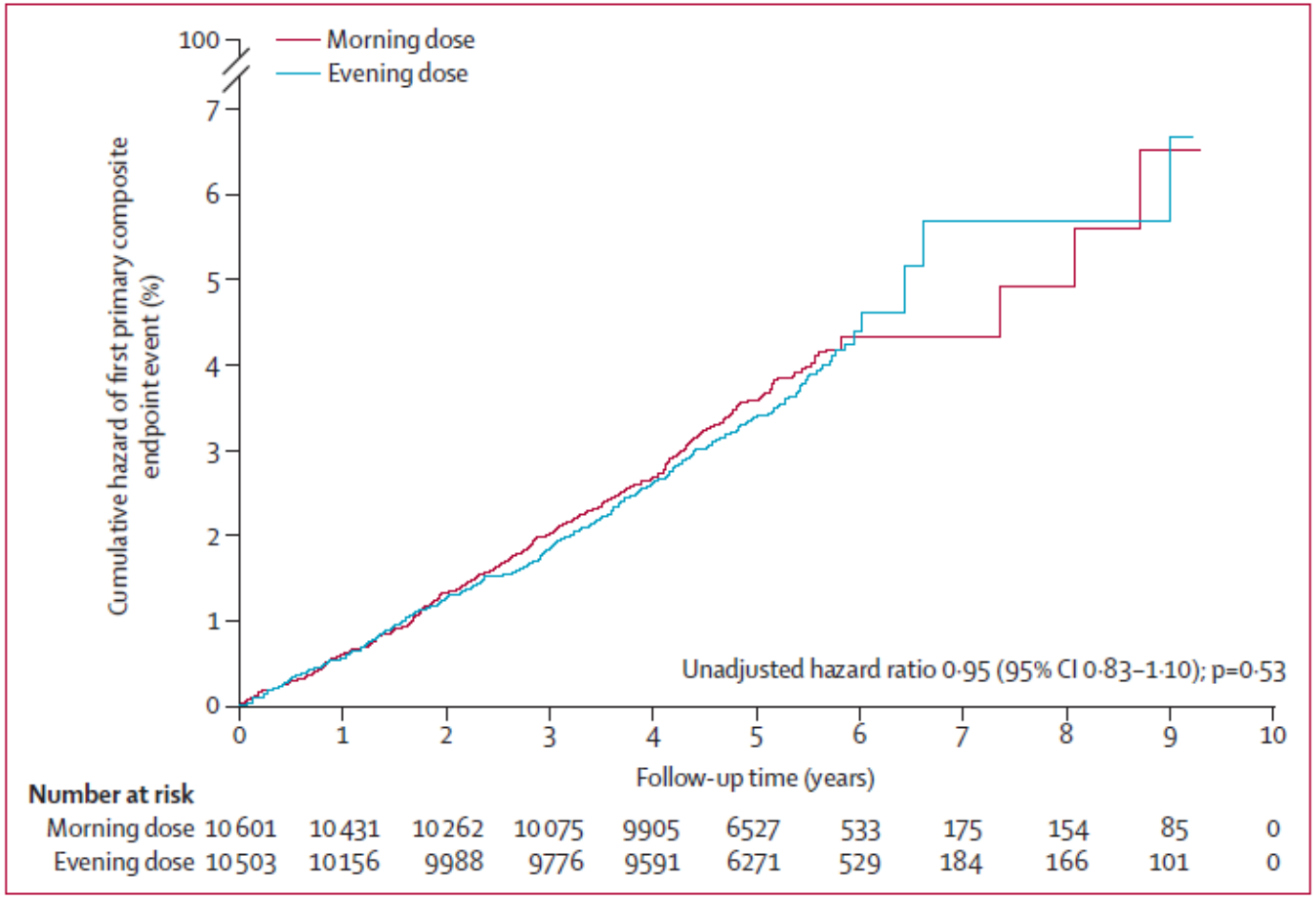


Figure 2: **Cumulative hazard of the first primary composite endpoint event, accounting for the competing risk of deaths not included in the endpoint (intention-to-treat population; n=21104)**

The primary composite endpoint was vascular death or hospitalisation for non-fatal myocardial infarction or non-fatal stroke.

Blood pressure and its variability: classic and novel measurement techniques

Aletta E. Schutte [1,2] ✉, *Anastasios Kollias* [3] *and George S. Stergiou* [3]

Nature Reviews | **Cardiology** volume 19 | October 2022

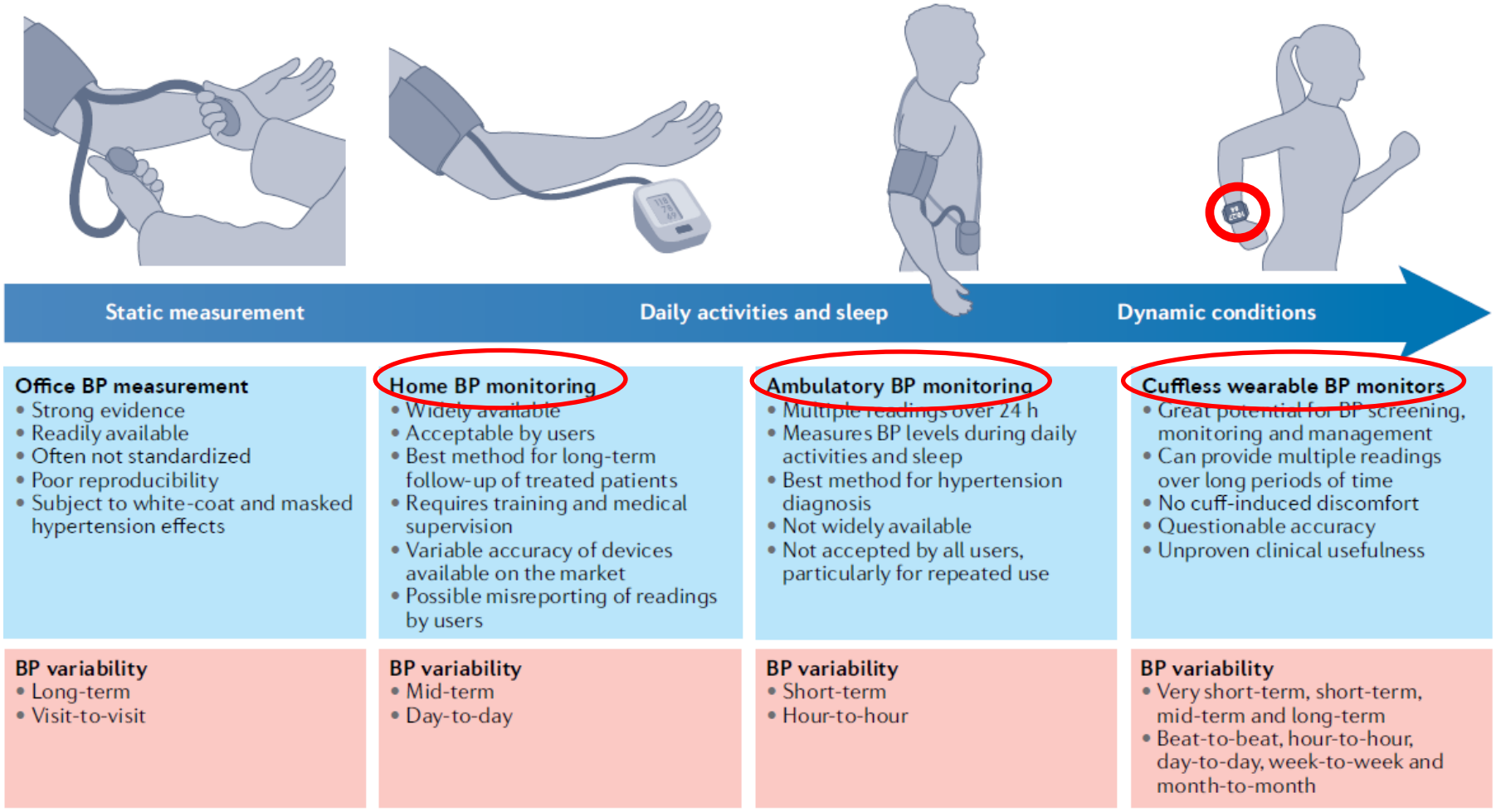


Fig. 4 | **Advantages and disadvantages of classic and novel blood pressure monitoring methods and capacity to capture blood pressure variability.** Blood pressure (BP) monitoring methods enable the assessment of BP during static or dynamic conditions over different time windows, and thus can capture different aspects of BP variability.

Consensus Document

Blood pressure variability: methodological aspects,clinical relevance and practical indications for management – ESH position paper Journal of Hypertension 2023, 41:527–544

G.Parati

Box 1. Factors determining BPV

INTRINSIC FACTORS

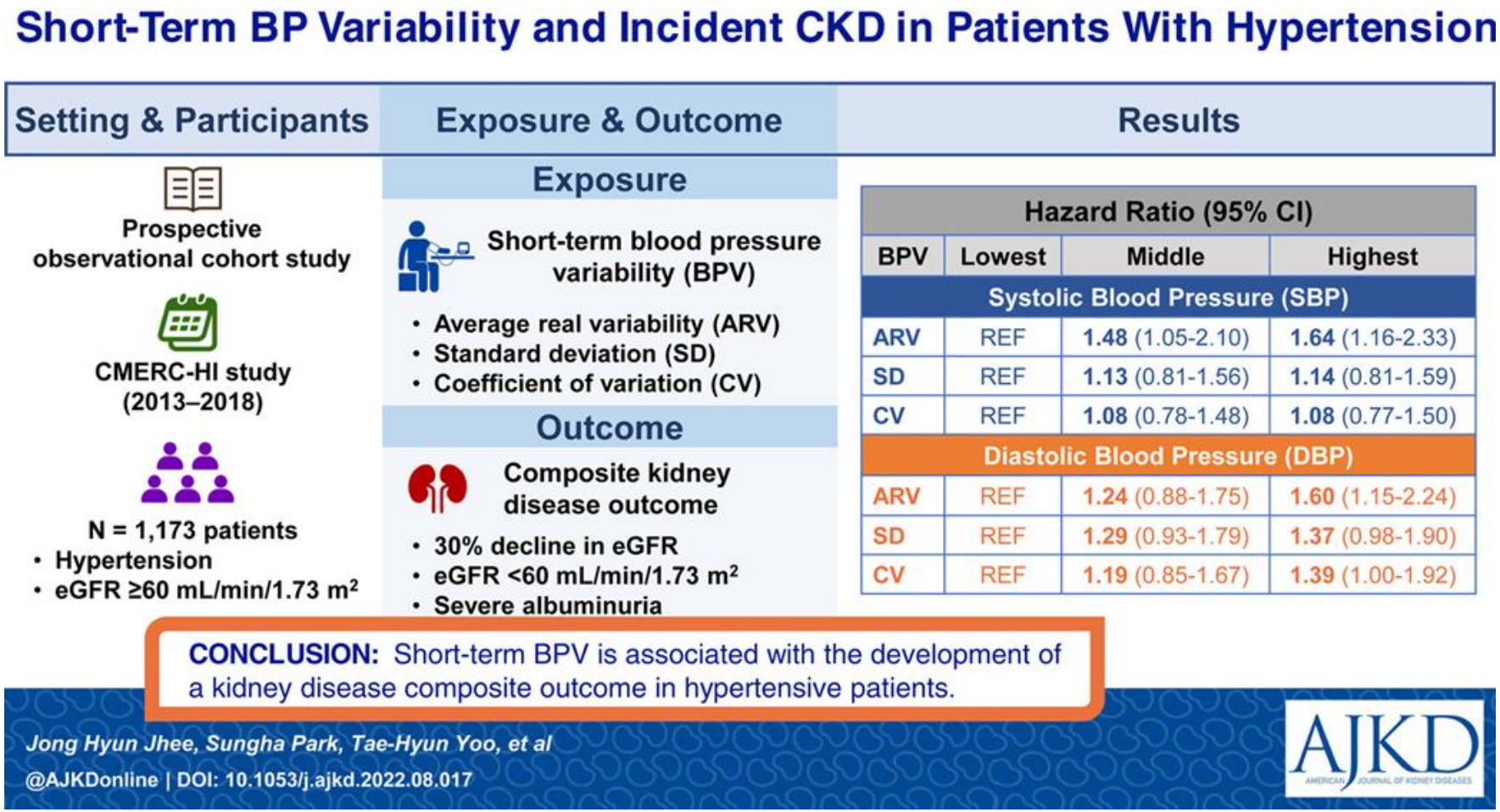
Neural mechanisms: central sympathetic drive, arterial and cardiopulmonary reflexes, chemoreflexes.
Humoral mechanisms: catecholamines, insulin, insulin resistance, renin, angiotensin II, bradykinin, cortisol, aldosterone and its metabolites, endothelin-1, nitric oxide, natriuretic peptides.
Vascular mechanisms: viscoelastic properties of large arteries, peripheral vasomotor modulation, endothelial dysfunction.
Cardiac function: changes in stroke volume and cardiac output caused by mechanical and hemodynamic factors, and arrhythmias.
Rheological mechanisms: changes in blood viscosity by anemia, hemodilution, erythrocytosis.
Metabolic activity: hypercapnia and hypoxia, acidosis and alkalosis.
Respiratory activity: spontaneous or device-induced changes in ventilatory mechanics.
Renal mechanisms: salt sensitivity, sodium excretion, renin secretion, tubuloglomerular feedback, hypo/hypervolemia
Genetic susceptibility: genes regulating the level of sympathetic cardiovascular modulation
Diseases affecting the autonomic function: neurodegenerative diseases (e.g.Parkinson's disease), sleep-related breathing disorders, carotid artery disease, arterial hypertension, chronic kidney disease, heart failure, diabetes mellitus, postural orthostatic tachycardia syndrome, orthostatic hypotension/ hypertension, post-COVID 19 syndrome.

EXTRINSIC FACTORS

Environmental factors: seasonal and altitude-related changes; barometric pressure changes (i.e. hypobaric hypoxia); changes in ambient temperature and humidity; sunshine, UV radiation, heat waves, wind chill, air pollution, noise.
Behavioural factors: job strain, physical activity, sleep/wakefulness cycles and jet lag, sleep quality and duration, postural changes, patterns of fluid and sodium intake, eating patterns, smoking/vaping, overeating, fasting, alcohol consumption, energy drinks, recreational drugs, screen time, e-gaming.
Emotional stimuli: psychological stress, depression, burnout.
Antihypertensive treatment factors: inconsistent BP control, poor patient's adherence; improper dosing/titration; dose omission or delays; differences in drugs class, pharmacokinetic and pharmacodynamic profiles.
Other treatments: drugs affecting BP.
Inappropriate BP monitoring: rare and irregular BP measurement; wrong brachial cuff size and placement; monitors sensitive to cardiac arrhythmias; not validated devices (finger/wrist monitors, cuffless devices).

Short-term Blood Pressure Variability and Incident CKD in Patients With Hypertension: Findings From the Cardiovascular and Metabolic Disease Etiology Research Center–High Risk (CMERC-HI) Study

AJKD 2022 Oct 12, online ahead of print



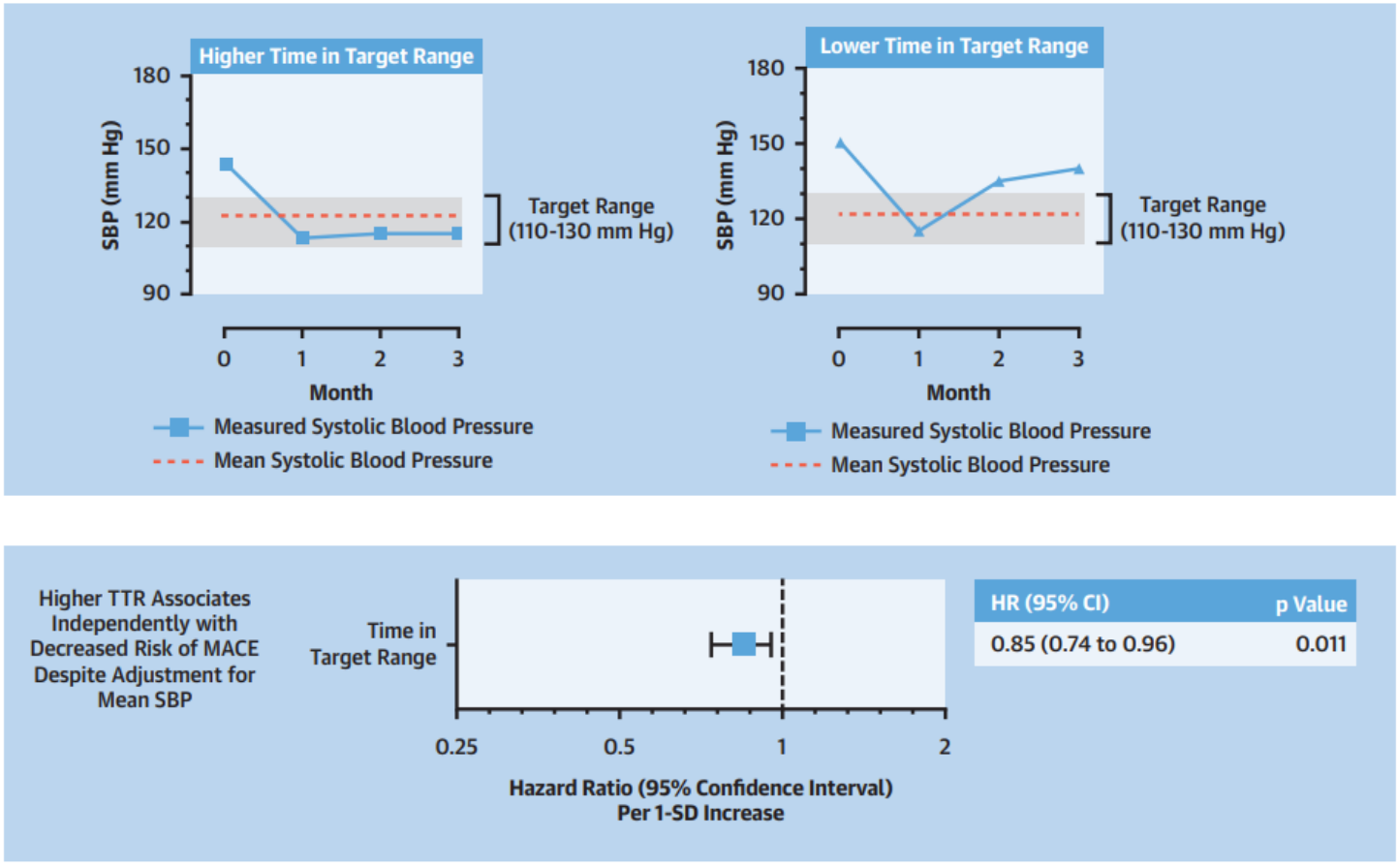
- CV mortality
- Stroke
- Coronary Heart Disease
- Heart failure
- Dementia

Systolic Blood Pressure Time in Target Range and Cardiovascular Outcomes in Patients With Hypertension

JACC 2021; 77:1290

Fatani

CENTRAL ILLUSTRATION **Systolic Blood Pressure Time in Target Range as an Independent Predictor of Cardiovascular Outcomes**



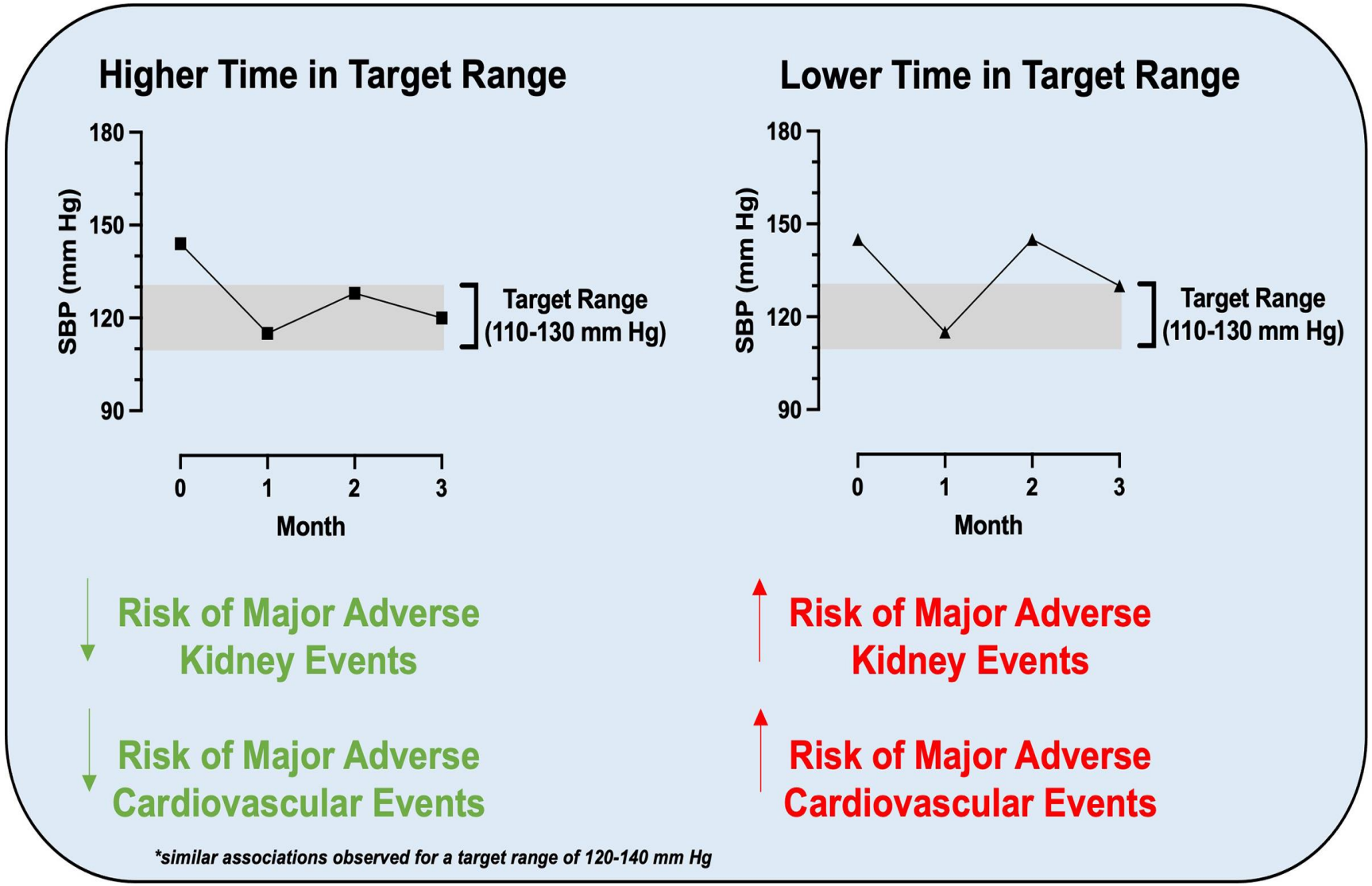
Fatani, N. et al. J Am Coll Cardiol. 2021;77(10):1290-9.

This figure depicts examples of high **(top left)** and low **(top right)** systolic blood pressure time in target range. Systolic blood pressure time in target range associates with a decreased risk of major cardiovascular outcomes after adjustment for cardiovascular risk factors and mean systolic blood pressure **(bottom)**. CI = confidence interval; HR = hazard ratio; MACE = major adverse cardiovascular events; SBP = systolic blood pressure; TTR = time in target range.

Systolic Blood Pressure Time in Target Range and Major Adverse Kidney and Cardiovascular Events

L. Buckley

Hypertension. 2023;80:305–313

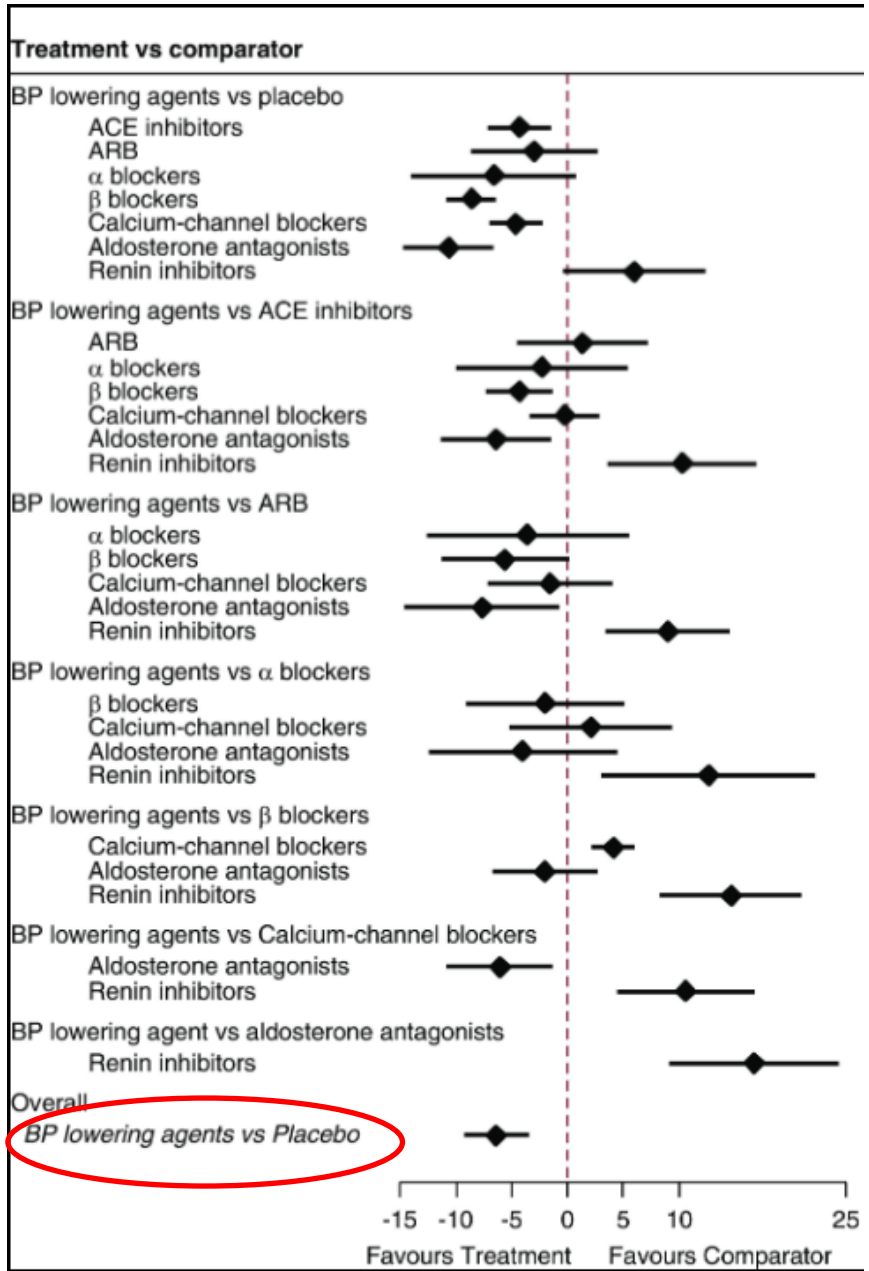


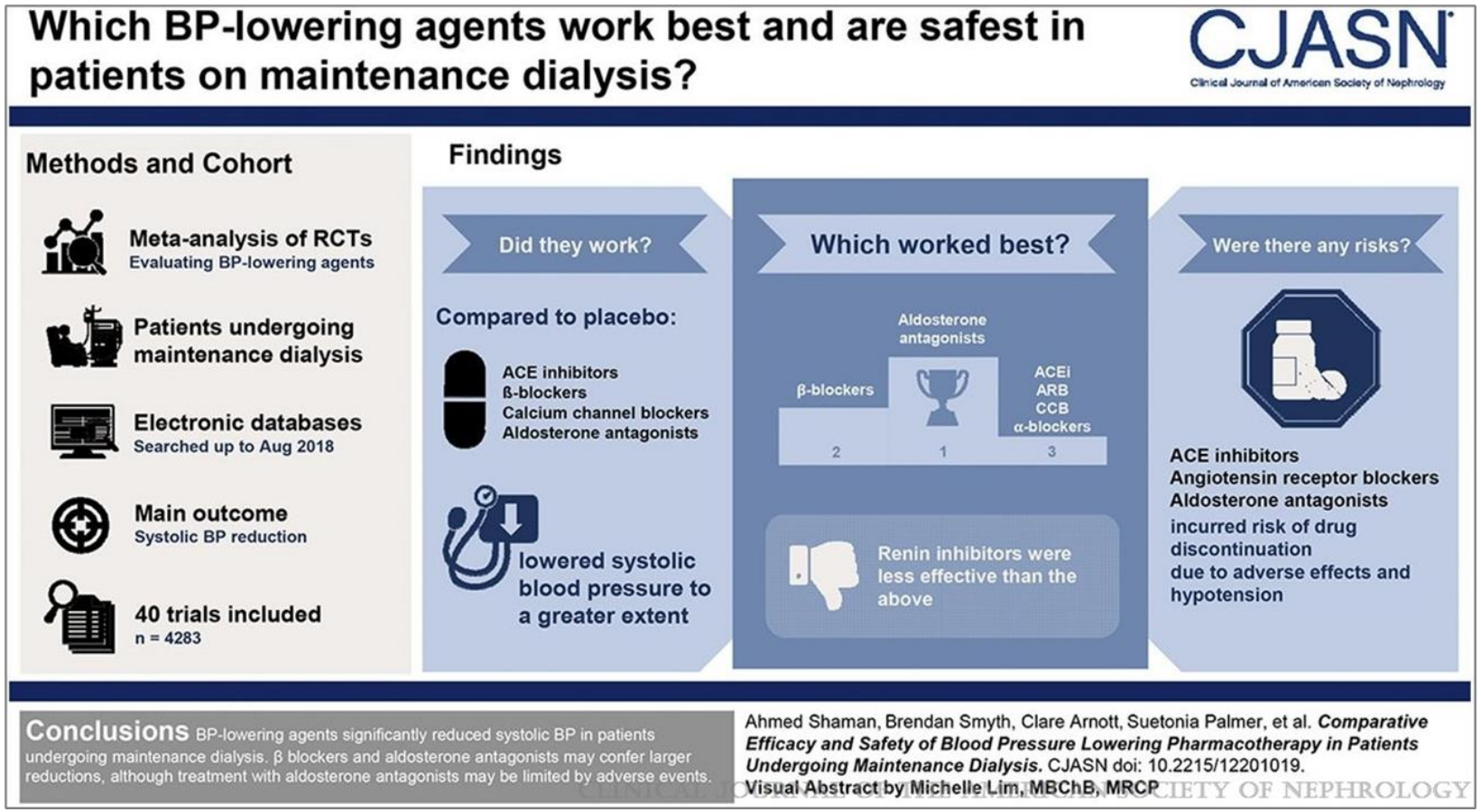
Hypertension management in hemodialysis

Panagiotis *Diagnostics 2022; 12:2961* Rowan *EMJ Nephrol 2023; 11:1*

- Diagnosis:
  - pre dialysis ≥ 140/90 – post dialysis > 130/90
  - HBPM ≥ 135/85 ABPM ≥ 130/80 ≈ CV events, mortality
- Target BP:
  - pre dialysis 130-140 / post dialysis 120-140
  - HBPM / ABPM 120-130
- Fluid, salt restriction
- Dialysate sodium
- Volume control
  - technique?
  - UF < 12 ml/kg/u (BVM)
- Night and home HD

Hypertension management in hemodialysis





Effect of angiotensin-converting enzyme inhibitors or angiotensin receptor blockers on cardiovascular outcomes in dialysis patients: a systematic review and meta-analysis

P. I. Georgianos *Nephrol Dial Transplant (2023) 38: 203*

Study or subgroup	ACE-Is/ARBs Events	Total	Control Events	Total	Weight	Risk ratio M-H, random, 95% CI	Year
Zannad 2006	31	196	30	210	45.4%	1.11 [0.70, 1.76]	2006
Suzuki 2008	12	183	20	183	21.9%	0.60 [0.30, 1.19]	2008
Iseki 2013	8	235	10	234	12.7%	0.80 [0.32, 1.98]	2013
Ruggenenti 2021	11	140	17	129	20.0%	0.60 [0.29, 1.22]	2021
Total (95% CI)		**754**		**756**	**100.0%**	**0.82 [0.59, 1.14]**	
Total events	62		77				

Heterogeneity: $\tau^2 = 0.01$; $\chi^2 = 3.18$, df = 3 (P = 0.37); $I^2 = 6\%$
Test for overall effect: Z = 1.18 (P = 0.24)

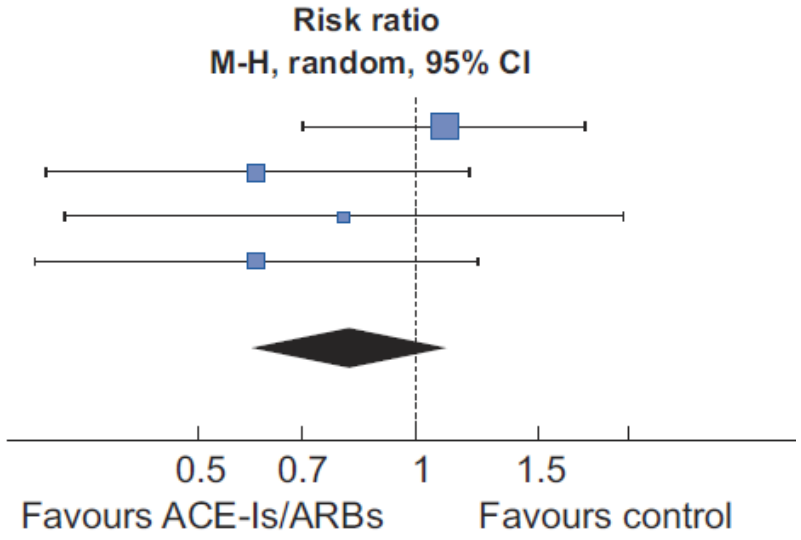


Figure 3: Forest plot for RCTs assessing the effect of ACEIs/ARBs on cardiovascular mortality.

Tissue sodium stores in peritoneal dialysis and hemodialysis patients determined by sodium-23 magnetic resonance imaging

M. Sahinoz

Nephrol Dial Transplant (2021) 36: 1307–1317

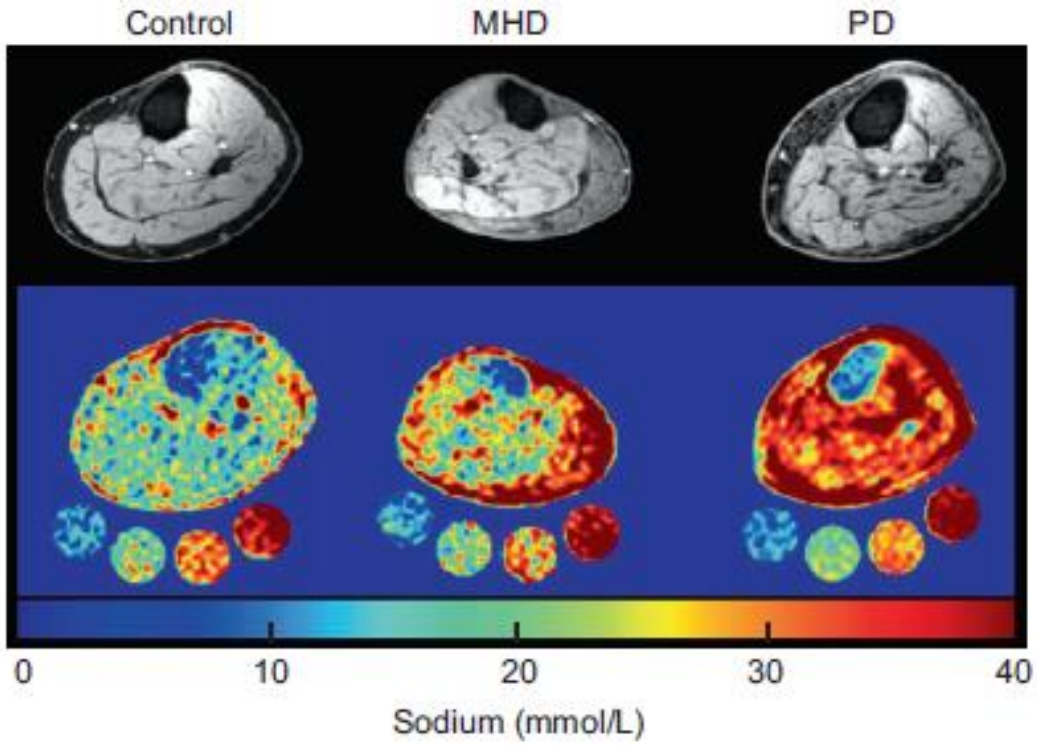


FIGURE 1: Anatomical and ^{23}NaMRI of the left calf of a 51-year-old African American male control, a 61-year-old African American male on MHD and a 63-year-old African American male on PD.

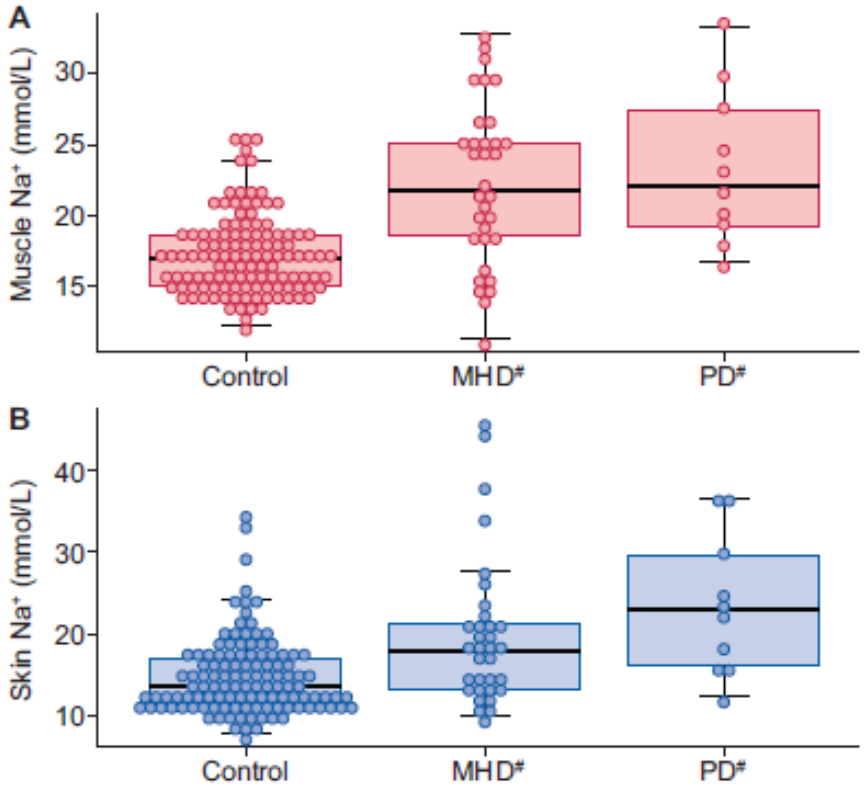
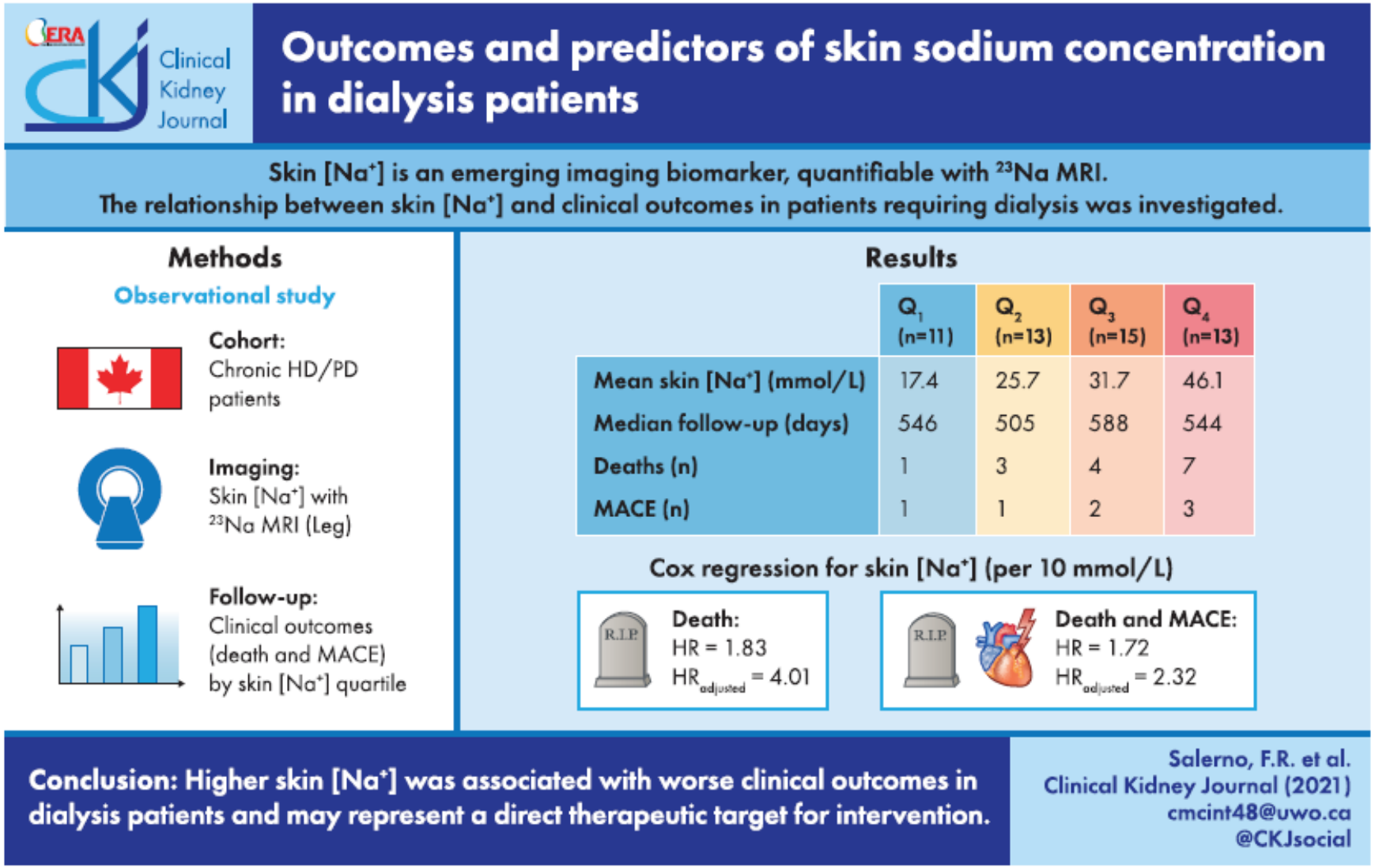


FIGURE 2: (A) Muscle Na^+ content in MHD, PD patients and controls. (B) Skin Na^+ content in MHD, PD patients and controls. $^{\#}P < 0.001$ compared with controls.

Outcomes and predictors of skin sodium concentration in dialysis patients

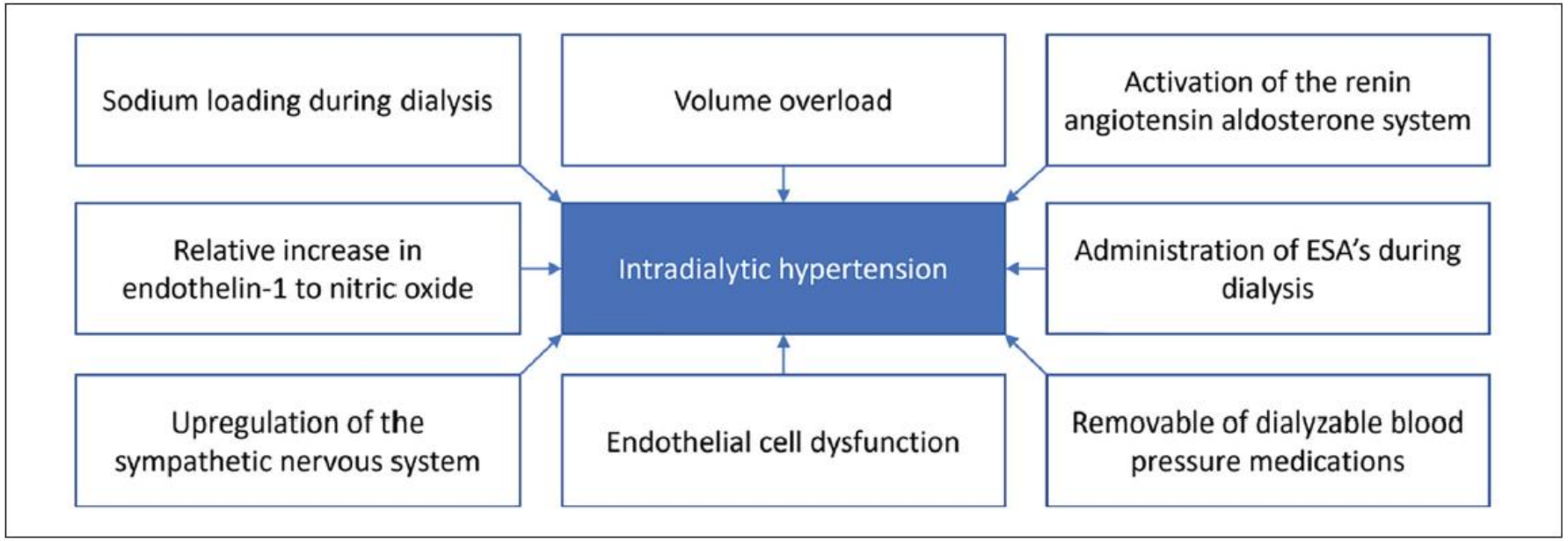
F. Salerno

Clinical Kidney Journal, 2022, vol. 15, no. 6, 1129–1136



Intradialytic Hypertension and Management

B.Prasad *Canadian Journal of Kidney Health and Disease 2022; 9:1*
F. Iatridi *Journal of Hypertension 2022; 40:2120*



- Volume control
- Modification dialysate sodium/calcium
- Modification dialysate temperature ?
- Less dialyzable antihypertensives
  - ARB > ACE-I
  - ß blockers (carvedilol, nebivolol)
  - CCB

Resistant hypertension

K.FAY

AJKD 2021; 77:110

- SBP not < 140 with lifestyle + 3 or more medications (diurectic)
- Confirm with ABPM or HBPM
- Exclude pseudo resistant hypertension
  - drug non-adherence
  - therapeutic inertia
  - white coat
  - BP measuring technique
  - medication, drugs, …
  - secondary hypertension
    - Obstructive sleep apnea, renovascular disease, primary aldosteronism, …

Renal artery stenting in the correct patients with atherosclerotic renovascular disease: time for a proper renal and cardiovascular outcome study?

M.Theodorakopoulou

Clinical Kidney Journal 2023; 16: 201

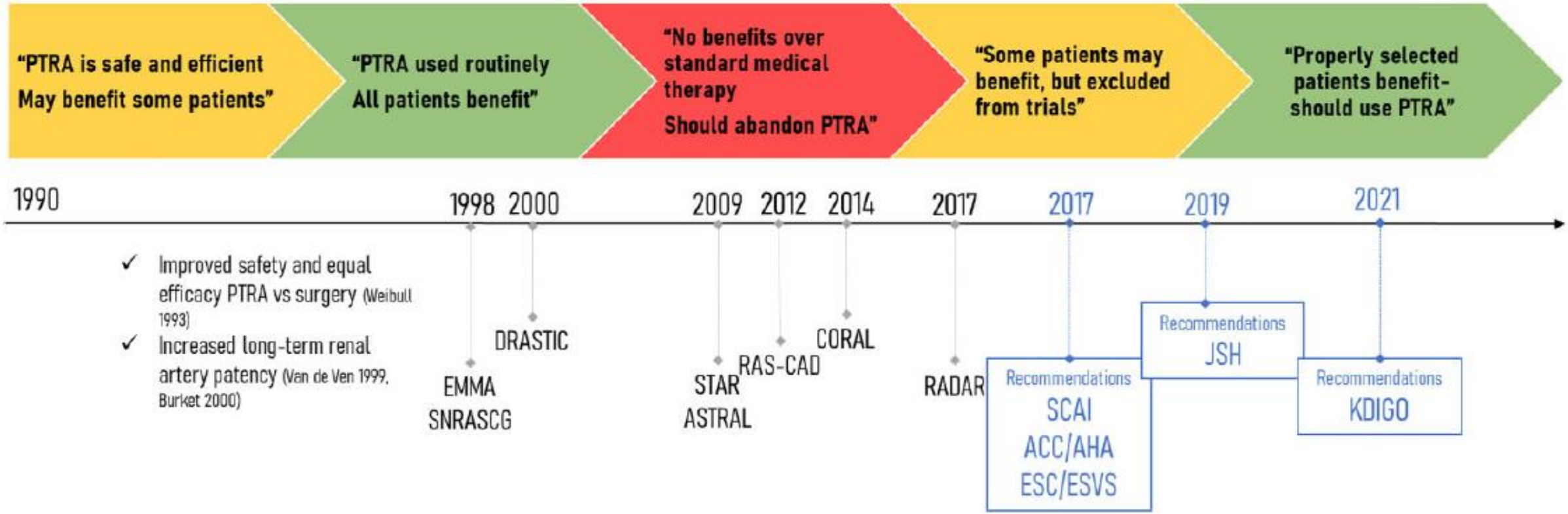
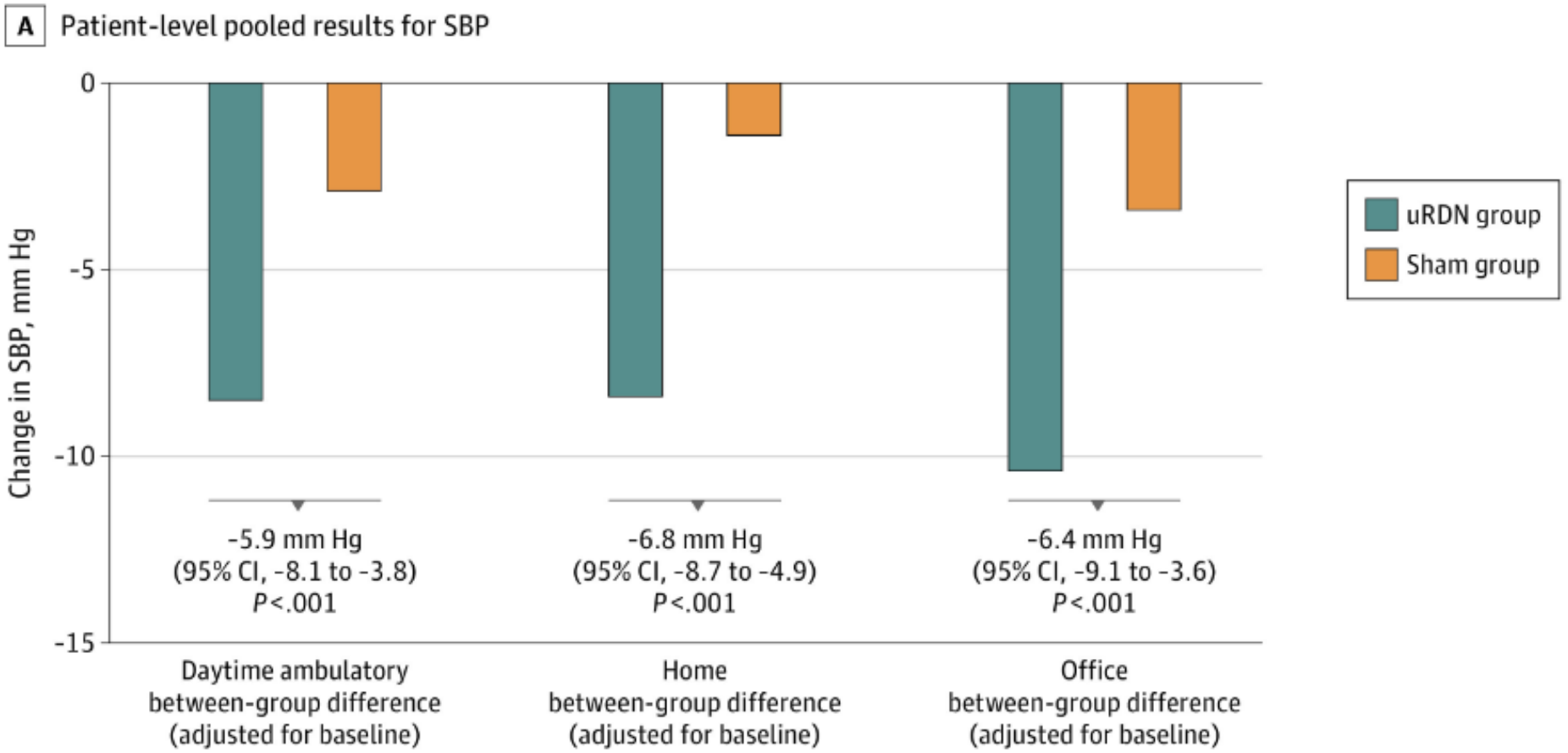


FIGURE 1: Historical timeline showing the different practice patterns and attitudes towards PTRA in the management of ARVD during the last 30 years and associations with published randomized trials and most recent recommendations.

Patient-Level Pooled Analysis of Ultrasound Renal Denervation in the Sham-Controlled RADIANCE II, RADIANCE-HTN SOLO, and RADIANCE-HTN TRIO Trials

A. Kirtane

Jama Cardiol. 2023 Feb 28



Human gut microbiota in health and disease: unveiling the relationship

M. Afzaal

Front Microbiol.2022; 29 September

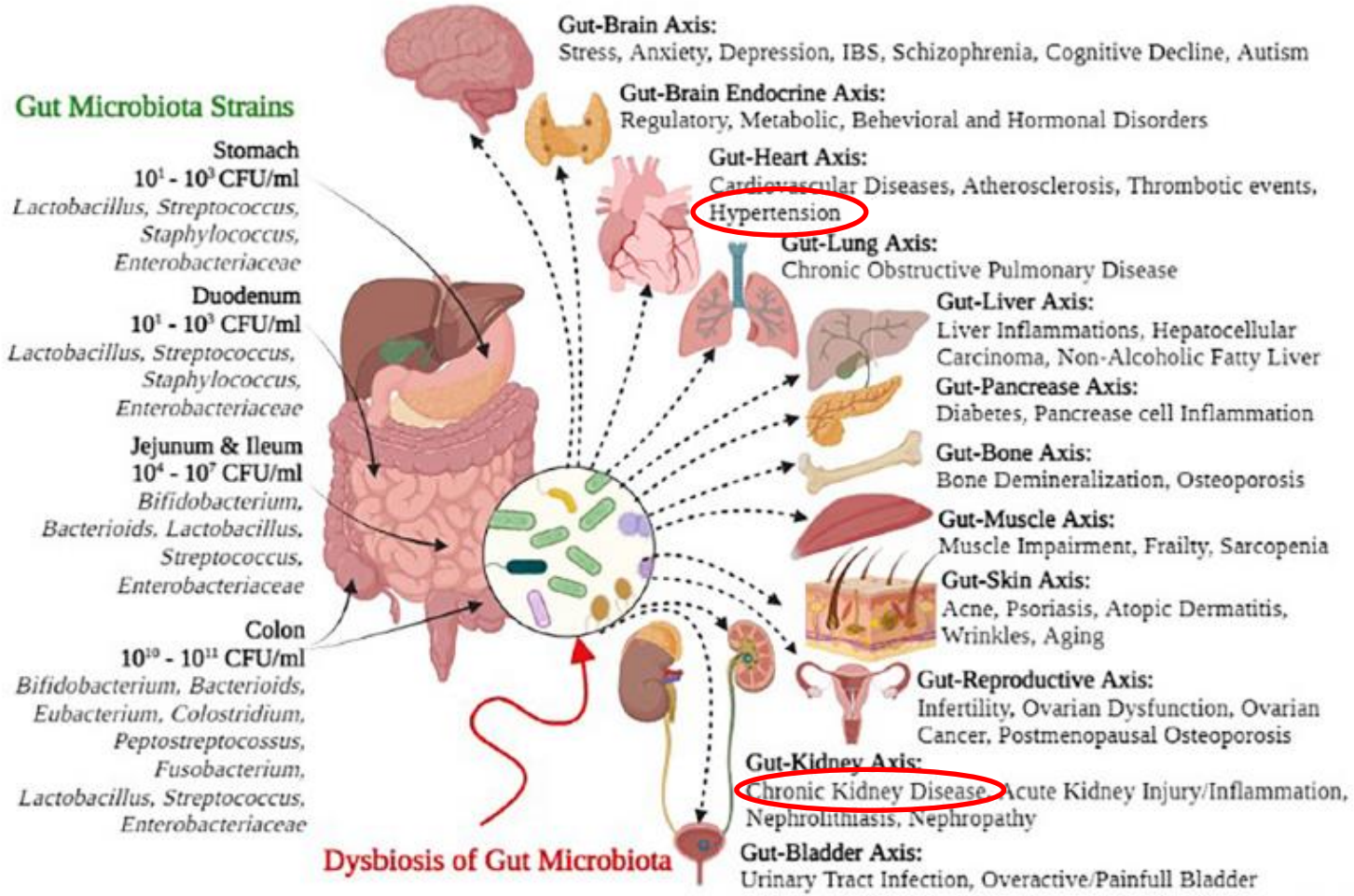


FIGURE 1
Gut microbial strains and negative health outcomes of gut microbial dysbiosis.

Artificial Intelligence in Hypertension Management

V. Visco

J. Cardiovasc. Dev. Dis. 2023; 10: 74

Table 1. AI application in hypertension management.

	Applications	Benefits
Measuring BP	Estimate BP by analyzing PPG signal with ML and DL algorithms.	Self-monitoring BP for hypertension
Predicting AH development	Predict the risk of developing AH by using genetics, medical data, and behavioral, environmental, and socioeconomic factors.	Timely intervention
Diagnosing AH	Accurately diagnosing AH by using CV risk factors, anthropometric data, vital signs, and laboratory data.	Precision diagnosis
Predicting AH treatment success	Identify factors contributing to treatment success.	Personalized treatment plan
Predicting AH prognosis	Stratify patients and predict CV outcomes.	Treatment plan adjustment

AI: artificial intelligence; BP: blood pressure; PPG: photoplethysmograph; ML: machine learning; DL: deep learning; AH: arterial hypertension; CV: cardiovascular.

Personalized hypertension treatment recommendations by a data-driven model

Y. Hu

BMC Medical Informatics and Decision Making (2023) 23:44

Take home messages

1. Half of what I told is probably wrong. But which half?
2. BP measurement: guidelines, validated devices, HBPM, ABPM, cuffless
3. Harmonization guidelines: CV risk, thresholds, targets, drug treatment
4. Skin sodium, BP variability, time in target
5. MRA's, SGLT2 inhibitors
6. Renal denervation
7. Remote management (telemonitoring, multidisciplinary healthcare team)
8. Artificial intelligence

2de Hemodialyse Update:

Van theorie naar praktijk

6 - 7 oktober 2023

Ter Elst, Edegem

Antwerpen - België

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'Meet the dialysis industry' sessie

www.hemodialyseupdate.org

ZAS Ziekenhuis aan de Stroom [ZAS] is het netwerk van ZNA en GZA Ziekenhuizen

GZA

ZNA

Voorlopig programma

Thuisdialyse:		Prof. dr. Bert Bammens (UZ Leuven)
Vaattoegang:		Dr. Maarten Snoeijs (Maastricht UMC) Prof. dr. Joris Rotmans (Leiden UMC) Margreet ter Meer (Amsterdam OLVG)
Antistolling:		Prof. dr. Karlien François (UZ Brussel)
Dialysemembranen:		Dr. Odyl ter Beek (Univ. Twente)
Vochtbeleid bij acuut nierfalen en dialyse:		Dr. Niels Van Regenmortel (ZNAntwerpen)
Dialysaat:	Mg, Ca, citraat Na, K, bicarbonaat	Prof. dr. Marc Vervloet (Amsterdam UMC) Prof. dr. Björn Meijers (UZ Leuven)
Uremische toxines:		Prof. dr. Griet Glorieux (UZ Gent)
Incrementele dialyse:		Dr. Rowena Vleut (UZ Antwerpen)
De stem van de patiënt:		Jan Van Cruchten (Roermond / EKPF)
Bewegen en voeding:		Prof. dr. Amaryllis Van Craenenbroeck (UZ Leuven)
Duurzame dialyse:		
Catastrofes en reanimatie op dialyse:		Dr. Manu Henckes (GZAntwerpen)
Dialyse en microcirculatie:		Prof. dr. Can Ince (Erasmus MC Rotterdam)
Aanpak van hemodialysestress/AI.:		Prof. dr. Jeroen Kooman (Maastrict UMC)
Dialysevoorschrift (CRRT/PIRRT):		Dr. Johan Huygh (ZNAntwerpen)
Adsorptie en plasmaferese op IZ		Dr. Hilde de Geus (Erasmus MC Rotterdam)
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Hands-on echografie vaattoegang:		iMEP/NIPRO (Mechelen)
'Meet the dialysis industry' sessie:		Baxter, Fresenius, Hemotech, Nipro, ...