Hypertension

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A Randomized Trial of Intensive versus Standard Blood-Pressure Control

The SPRINT Research Group*

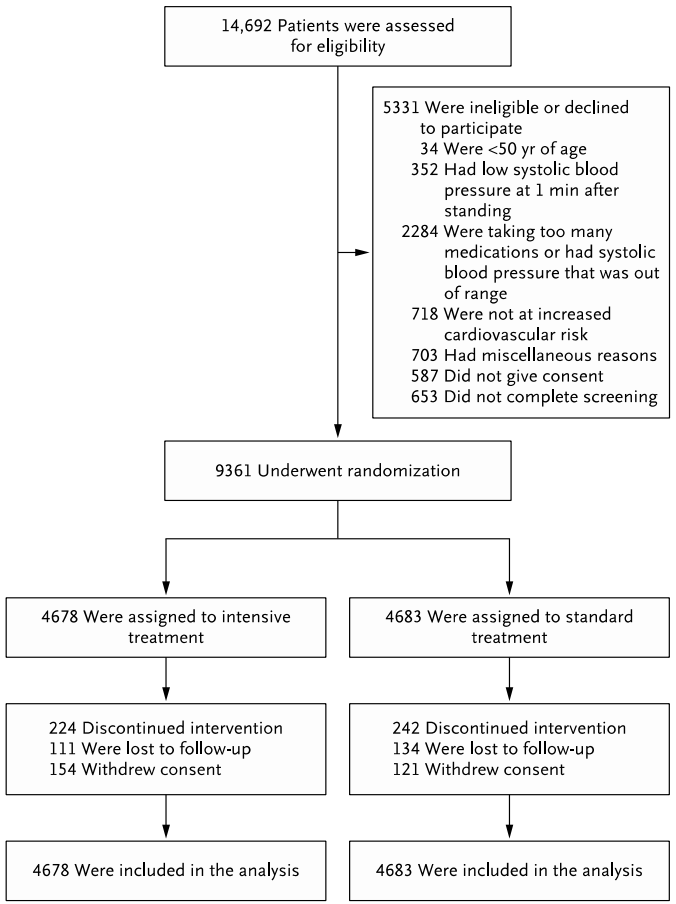
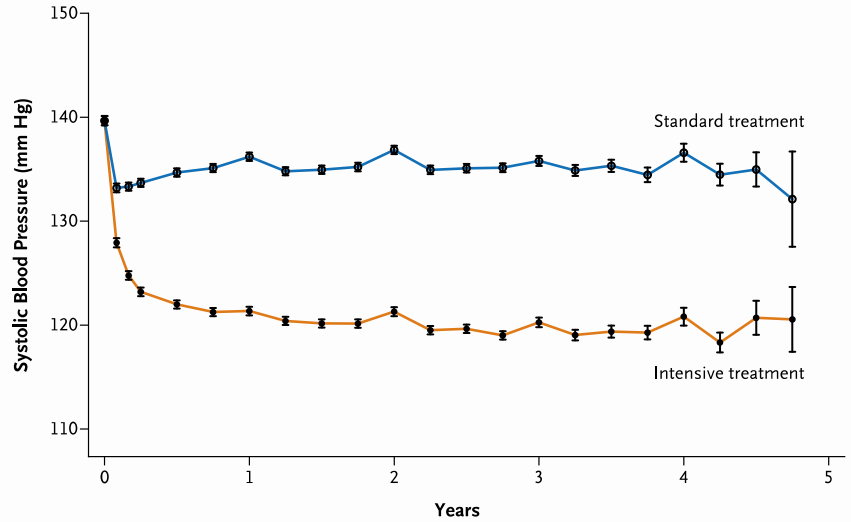


Figure 1. Eligibility, Randomization, and Follow-up.

Discontinued intervention refers to participants who discontinued the study treatment but did not withdraw consent or become lost to follow-up.



No. with Data										
Standard treatment	4683	4345	4222	4092	3997	3904	3115	1974	1000	274
Intensive treatment	4678	4375	4231	4091	4029	3920	3204	2035	1048	286
Mean No. of Medications										
Standard treatment	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9
Intensive treatment	2.3	2.7	2.8	2.8	2.8	2.8	2.8	2.8	2.8	3.0

Figure 2. Systolic Blood Pressure in the Two Treatment Groups over the Course of the Trial.

The systolic blood-pressure target in the intensive-treatment group was less than 120 mm Hg, and the target in the standard-treatment group was less than 140 mm Hg. The mean number of medications is the number of blood-pressure medications administered at the exit of each visit. I bars represent 95% confidence intervals.

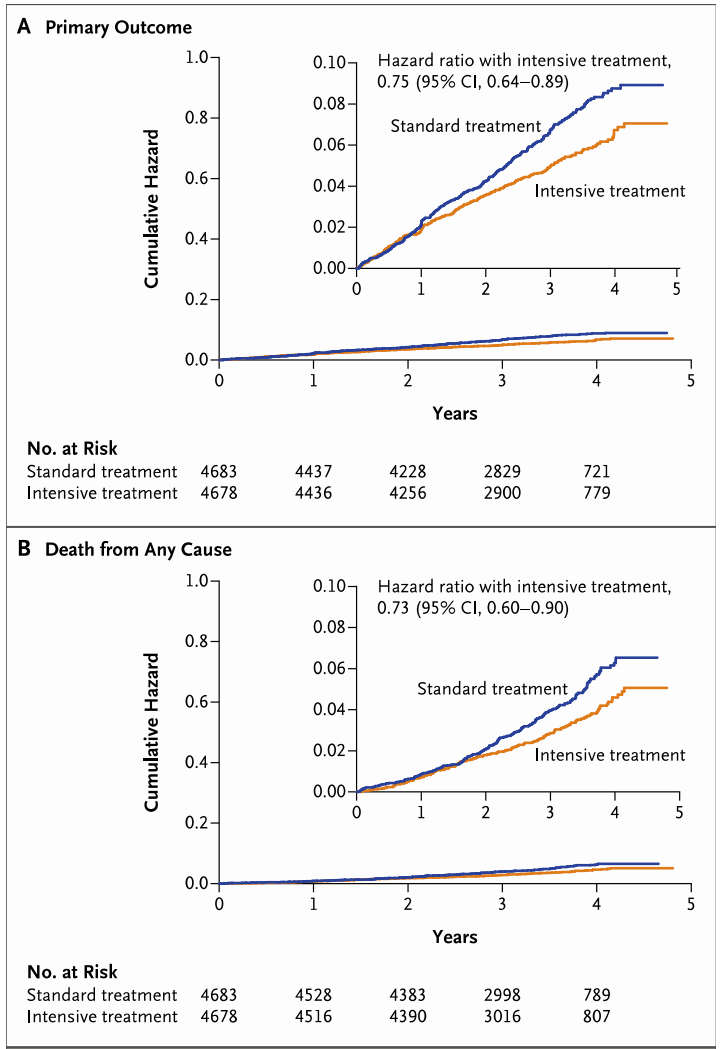


Figure 3. Primary Outcome and Death from Any Cause.

Shown are the cumulative hazards for the primary outcome (a composite of myocardial infarction, acute coronary syndrome, stroke, heart failure, or death from cardiovascular causes) (Panel A) and for death from any cause (Panel B). The inset in each panel shows the same data on an enlarged y axis. CI denotes confidence interval.

Table 2. Primary and Secondary Outcomes and Renal Outcomes.*

Outcome	Intensive Treatment		Standard Treatment		Hazard Ratio (95% CI)	P Value
	no. of patients (%)	*% per year*	*no. of patients (%)*	*% per year*		
All participants	**(N=4678)**		**(N=4683)**			
Primary outcome†	243 (5.2)	1.65	319 (6.8)	2.19	0.75 (0.64–0.89)	<0.001
Secondary outcomes						
Myocardial infarction	97 (2.1)	0.65	116 (2.5)	0.78	0.83 (0.64–1.09)	0.19
Acute coronary syndrome	40 (0.9)	0.27	40 (0.9)	0.27	1.00 (0.64–1.55)	0.99
Stroke	62 (1.3)	0.41	70 (1.5)	0.47	0.89 (0.63–1.25)	0.50
Heart failure	62 (1.3)	0.41	100 (2.1)	0.67	0.62 (0.45–0.84)	0.002
Death from cardiovascular causes	37 (0.8)	0.25	65 (1.4)	0.43	0.57 (0.38–0.85)	0.005
Death from any cause	155 (3.3)	1.03	210 (4.5)	1.40	0.73 (0.60–0.90)	0.003
Primary outcome or death	332 (7.1)	2.25	423 (9.0)	2.90	0.78 (0.67–0.90)	<0.001
Participants with CKD at baseline	**(N=1330)**		**(N=1316)**			
Composite renal outcome‡	14 (1.1)	0.33	15 (1.1)	0.36	0.89 (0.42–1.87)	0.76
≥50% reduction in estimated GFR§	10 (0.8)	0.23	11 (0.8)	0.26	0.87 (0.36–2.07)	0.75
Long-term dialysis	6 (0.5)	0.14	10 (0.8)	0.24	0.57 (0.19–1.54)	0.27
Kidney transplantation	0		0			
Incident albuminuria¶	49/526 (9.3)	3.02	59/500 (11.8)	3.90	0.72 (0.48–1.07)	0.11
Participants without CKD at baseline‖	**(N=3332)**		**(N=3345)**			
≥30% reduction in estimated GFR to <60 ml/min/1.73 m^2§	127 (3.8)	1.21	37 (1.1)	0.35	3.49 (2.44–5.10)	<0.001
Incident albuminuria¶	110/1769 (6.2)	2.00	135/1831 (7.4)	2.41	0.81 (0.63–1.04)	0.10

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ORIGINAL ARTICLE

Final Report of a Trial of Intensive versus Standard Blood-Pressure Control

The SPRINT Research Group*

Subgroup	Intensive	Standard	Hazard Ratio (95% CI)	P Value
	no. of participants/total no. (%)			
Overall	264/4678 (5.6)	354/4683 (7.6)	0.73 (0.63–0.86)	
Previous chronic kidney disease				0.23
No	146/3349 (4.4)	218/3367 (6.5)	0.67 (0.54–0.82)	
Yes	118/1329 (8.9)	136/1316 (10.3)	0.82 (0.63–1.05)	
Age				0.24
<75 yr	156/3361 (4.6)	196/3364 (5.8)	0.79 (0.64–0.97)	
≥75 yr	108/1317 (8.2)	158/1319 (12.0)	0.65 (0.50–0.83)	
Sex				0.42
Female	85/1684 (5.0)	101/1648 (6.1)	0.82 (0.61–1.09)	
Male	179/2994 (6.0)	253/3035 (8.3)	0.70 (0.58–0.85)	
Race				0.72
Black	70/1454 (4.8)	96/1493 (6.4)	0.77 (0.56–1.05)	
Non-Black	194/3224 (6.0)	258/3190 (8.1)	0.72 (0.59–0.86)	
Previous cardiovascular disease				0.46
No	161/3738 (4.3)	229/3746 (6.1)	0.70 (0.57–0.86)	
Yes	103/940 (11.0)	125/937 (13.3)	0.80 (0.61–1.04)	
Systolic blood pressure				0.64
≤132	77/1583 (4.9)	109/1553 (7.0)	0.67 (0.50–0.90)	
133–144	85/1489 (5.7)	120/1549 (7.7)	0.74 (0.56–0.98)	
≥145	102/1606 (6.4)	125/1581 (7.9)	0.82 (0.63–1.07)	

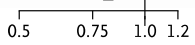


Figure 2. Subgroup Analysis of Hazard Ratios for the Primary Outcome during the Intervention Period (through August 20, 2015).

The box sizes are proportional to the precision of the estimates, with larger boxes indicating a greater degree of precision. The subgroup of participants with no previous chronic kidney disease includes some participants with unknown status with respect to chronic kidney disease at baseline. Black race includes Hispanic Black and Black as part of a multiracial identification. P values were adjusted for multiple subgroups tested.

- Serious adverse events of hypotension, electrolyte abnormalities, acute kidney injury or failure, and syncope were significantly more frequent in the intensive-treatment group.

- Targeting a systolic BP <120 mm Hg resulted in lower rates of major adverse cardiovascular events and lower all-cause mortality than targeting a systolic BP<140 mm Hg, both during receipt of the randomly assigned therapy and after the trial.

Current Guidelines

- 2016 National Heart Foundation (Australia)
  - Initiate drug treatment in patients with **low-CVD risk** (<10%; 5-year risk) with persistent BP **≥160/100 mmHg**
  - Initiate drug treatment in patients with **moderate-CVD risk** (10-15%; 5-year risk) with persistent SBP **≥140** and/or DBP **≥90 mmHg**
  - Treatment target is **<140/90mmHg** in uncomplicated hypertension. This also includes those with a history of chronic kidney disease, peripheral vascular disease, stroke, and diabetes mellitus
  - In selected **high-CVD risk** (>15%; 5-year risk) populations a secondary target of **<120 mmHg** systolic can be considered (but require close follow-up)
  - For elderly individuals of **≥75 years**, no specific threshold for commencing treatment is provided, but the primary recommended systolic target is **<120 mmHg**

Current Guidelines

- 2017 American College of Cardiology/American Heart Association
  - clinic systolic BP target of <130 mm Hg for uncomplicated hypertension (unless with low-CVD risk, where the target was ≤140 mmHg) and for noninstitutionalized, ambulatory, community-dwelling adults aged ≥65 years

- 2018 European Society of Cardiology/European Society of Hypertension
  - <65 years of age: clinic systolic BP target of <130 mm Hg for uncomplicated hypertension
  - ≥65 years:
    - Threshold for treatment: SBP 140mmHg (65-80 years), 160mmHg (>80 years)
    - Target for treatment is SBP <140mmHg

BP Measuring Methods

Table 4.3 Criteria for diagnosis of hypertension using different methods of blood pressure measurement

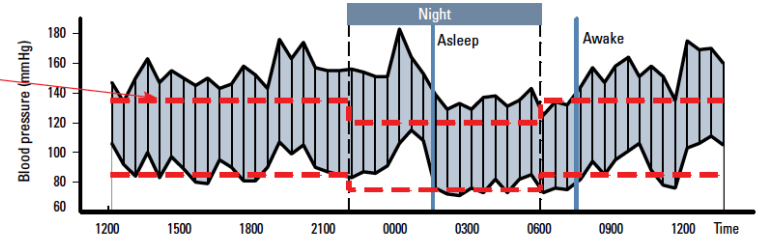
Method of measurement	Systolic (mmHg)		Diastolic (mmHg)
Clinic blood pressure	≥140	and/ or	≥90
ABPM daytime (awake)	≥135	and/ or	≥85
ABPM night-time (asleep)	≥120	and/ or	≥70
ABPM over 24 hours	≥130	and/ or	≥80
HBPM	≥135	and/ or	≥85

Ambulatory blood pressure report

Patient name:	Mr J Bond	ID:	007
Scan start date	29/08/2011	Clinic SBP/DBP	140/90
Scan start time	12:08	Total readings	56
Scan end date	30/08/2011	Successful readings	52
Scan end time	13:37	Percent successful	93

Clinic BP suggests hypertension

OK if >85%



Grade 1 hypertension threshold

SBP: Grade 2 hypertension ≥148 mmHg

DBP: Grade 1 hypertension ≥84 mmHg

Summary					
	Min	**Mean**	**Max**	**STD**	**BP load (<20%)**
Systolic	125	151	183	13.4	94%
Diastolic	71	90	115	11.9	67%
Heart rate	54	70	94	9.5	
Day summary 6:00 to 22:00					
	Min	**Mean**	**Max**	**STD**	**BP load**
Systolic	125	152	176	12.2	91%
Diastolic	73	91	111	10.9	68%
Heart rate	54	71	90	8.7	
Night summary 22:00 to 6:00					
	Min	**Mean**	**Max**	**STD**	**BP load**
Systolic	129	146	183	14.7	100%
Diastolic	71	86	115	135	70%
Heart rate	57	69	94	11.1	
% Night SBP dip (>10%)		3.9%	% Night DBP dip (>10%)		5.5%
Awake summary 7:00 to 1:30					
	Min	**Mean**	**Max**	**STD**	**BP load**
Systolic	132	155	183	11	93%
Diastolic	75	92	115	11	68%
Heart rate	55	73	94	9	
Asleep summary 1:30 to 7:00					
	Min	**Mean**	**Max**	**STD**	**BP Load**
Systolic	125	134	143	5	100%
Diastolic	71	76	85	5	55%
Heart rate	54	60	67	5	
% Night SBP dip (>10%)		14%	% Night DBP dip (>10%)		28%

Night SBP dipping abnormal

Night DBP dipping abnormal

Asleep SBP dipping normal

Asleep DBP dipping normal

Interpretation: Patient ABP day, night, awake, asleep BP, BP load values are all above hypertension grade 1 threshold (shown in red). While night summary suggests 'nondipping' (<10%) this is due to very late sleep onset. The nocturnal dipping based on awake and asleep values are satisfactory (>10%)

Conclusion: Confirmed grade 1 hypertension

Recommendation: Commence or increase antihypertensive therapy. Assess cardiovascular risk to determine correct target BP. Reassess after modification

Home Blood Pressure (BP) Diary

Name:_____ **Start date:** _____

When to take home BP?

DO take measures at around the same time in the morning and evening
DO take before taking medication, food or vigorous exercise
DO take for 7 days (5 day minimum)
DO take as advised by your doctor e.g. before visiting the doctor or after medication change

How to take home BP?

DO sit quietly for 5 minutes (no talking/distractions such as TV/extreme temperatures)
DO sit with feet flat on floor, legs uncrossed, upper arm bare, back and arm supported (relaxed position with the cuff at heart level)
DO take two measures 1 minute apart
DO record each measure in a paper diary or an electronic spread sheet
DO take a copy of the BP readings to your doctor appointment
DO NOT smoke or drink caffeine 30 minutes before measuring BP
DO NOT measure your BP if uncomfortable, stressed or in pain

	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
SBP 1														
DBP 1														
SBP 2														
DBP 2														

Average BP (except day 1)	SBP	DBP

Medications (name and dose):

Other BP readings as requested by your doctor (e.g. standing or midday or when you are symptomatic i.e. dizzy/headache):

Masked Hypertension

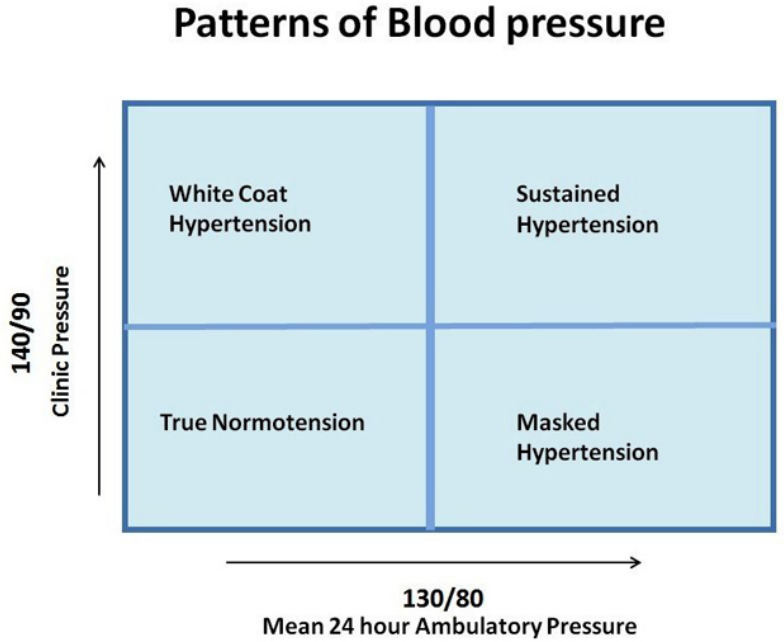


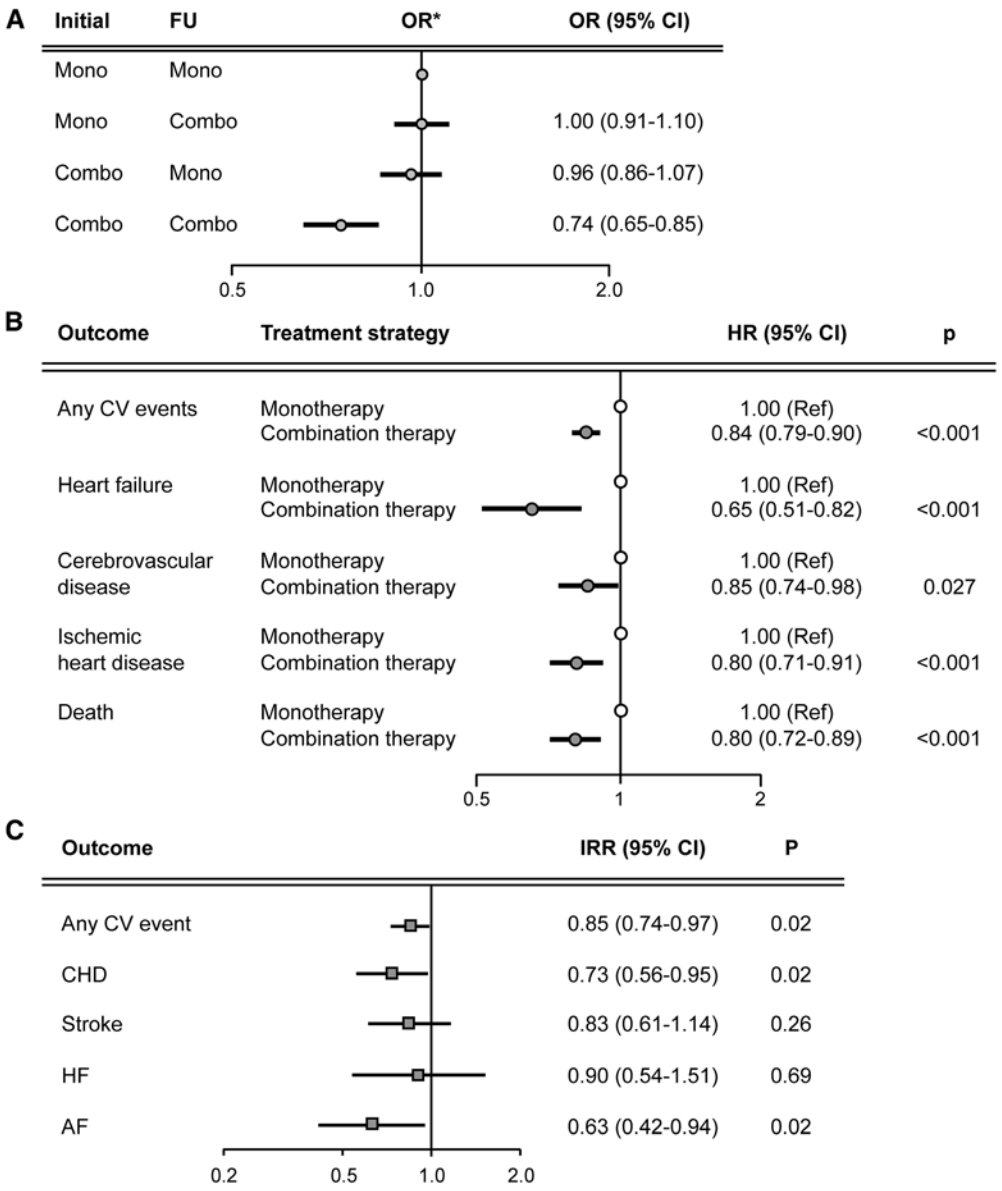
Table 2. Prevalence of Masked Hypertension by Treatment Status in Diabetics and Nondiabetics

	Prevalence, %		Odds Ratio		
Treatment Status	Nondiabetics	Diabetics	Unadjusted	Partly Adjusted	Fully Adjusted
Untreated	18.8% (1031/5486)	29.3% (67/229)	1.79 (1.33–2.40); $P<0.001$	1.46 (1.08–1.98); $P=0.014$	1.35 (0.98–1.86); $P=0.065$
Treated	30.5% (192/630)	42.5% (37/87)	1.69 (1.07–2.67); $P=0.025$	1.59 (1.00–2.52); $P=0.051$	1.59 (0.98–2.58); $P=0.058$

Hypertension. 2015;65:16-20.

Two-Drug Combinations as First-Step Antihypertensive Treatment

Giuseppe Mancia, Federico Rea, Giovanni Corrao, Guido Grassi



ratio; and OR, odds ratio. From Corrao et al[42] and Rea et al.[48,59]

cidence risk

Circ Res. 2019;124:1113-1123

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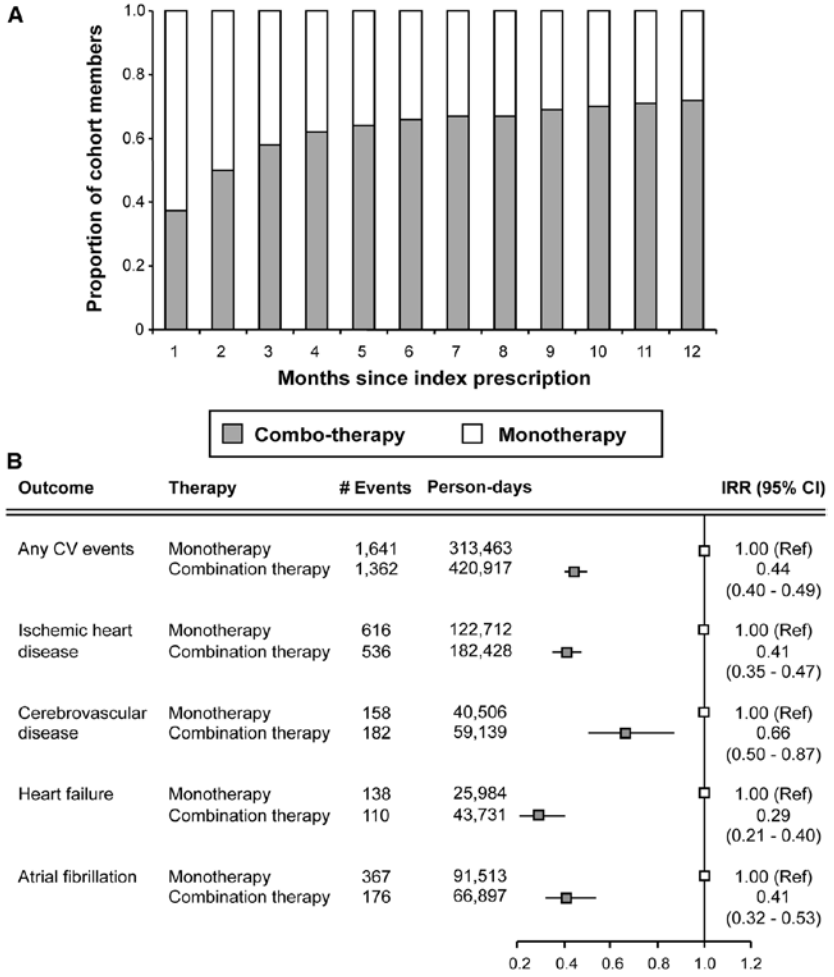

- Initial monotherapy preferred in:
  - Patients with grade 1 hypertension whose baseline SBP is closer to 140mmHg
  - Elderly and frail patients