

**Mesure ambulatoire de la pression
artérielle (MAPA): pour qui,
pourquoi et comment?**

C.H.U. Sart Tilman

J-M KRZESINSKI

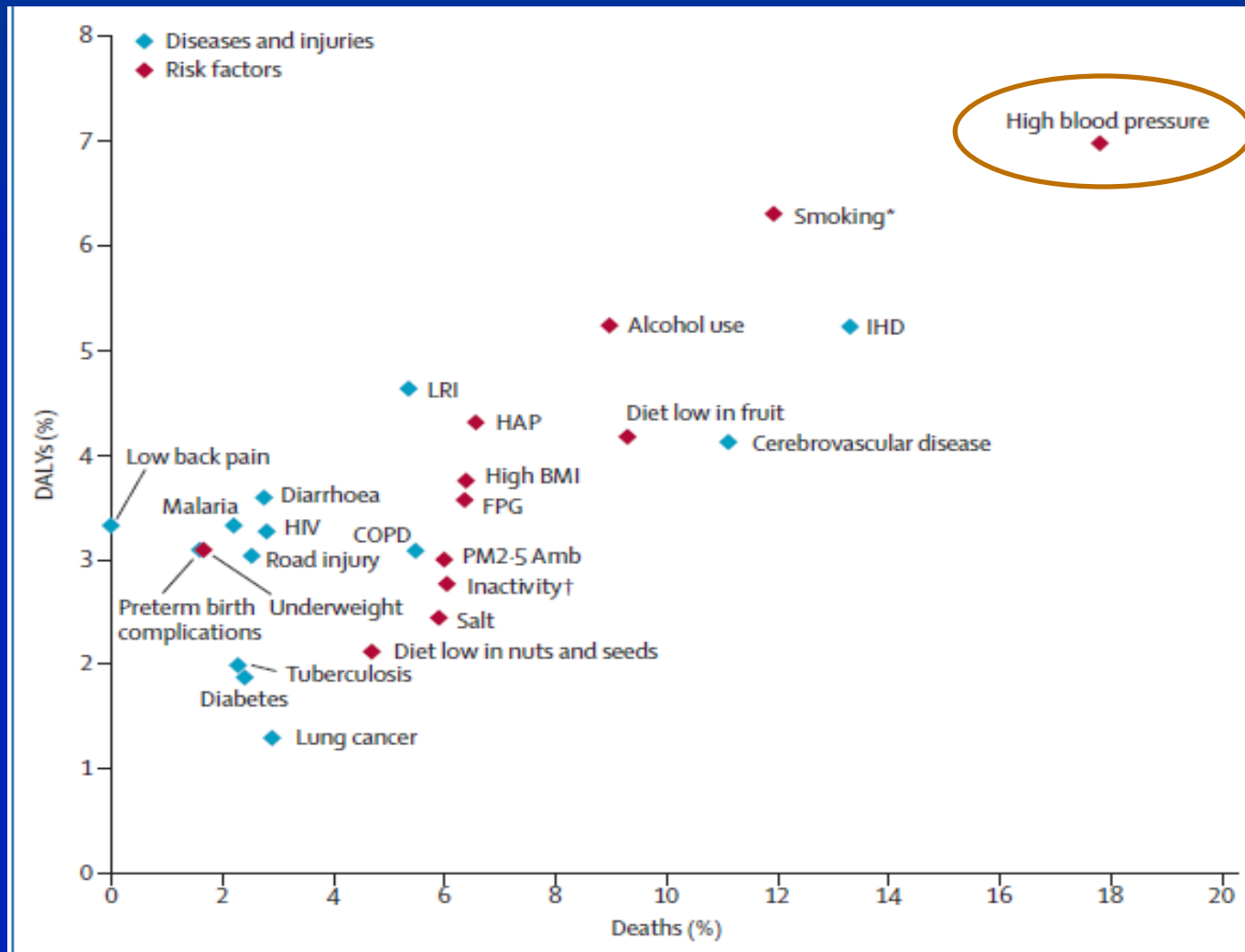


Figure 2: Comparison of the magnitude of the ten leading diseases and injuries and the ten leading risk factors based on the percentage of global deaths and the percentage of global DALYs, 2010

The figure shows 25 total diseases, injuries, and risk factors because some of the largest contributors to disability-adjusted life years (DALYs) were not in the top ten for deaths, and vice versa. DALYs=disability-adjusted life years. IHD=ischaemic heart disease. LRI=lower respiratory infections. COPD=chronic obstructive pulmonary disease. HAP=household air pollution from solid fuels. BMI=body-mass index. FPG=fasting plasma glucose. PM2.5 Amb=ambient particulate matter pollution. *Tobacco smoking, including second-hand smoke. †Physical inactivity and low physical activity.

Questions face à une HTA

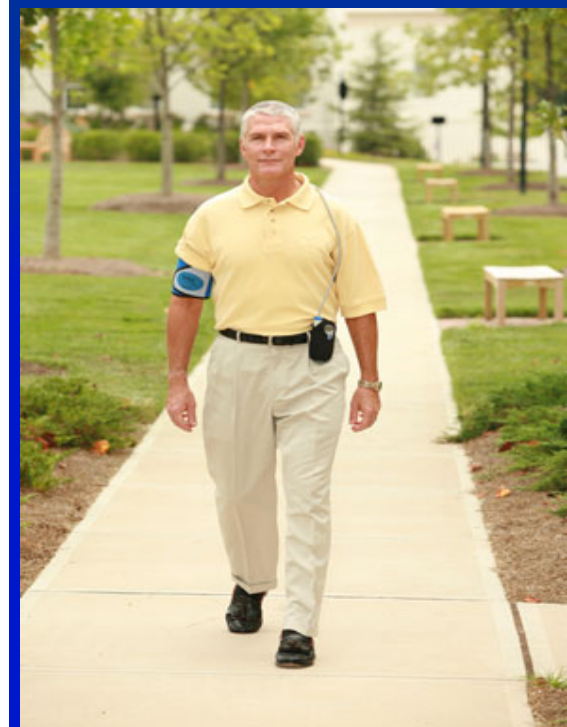
- Mon patient est-il réellement hypertendu?
- Quelle est l'origine de l'HTA?
- Quelles complications?
- Quelle prise en charge?
- Quels objectifs?

Questions face à une HTA

- Mon patient est-il réellement hypertendu?
- Répétition des mesures au cabinet mais risque HTA blouse blanche et HTA masquée!
- Nécessité devant toute élévation de PA de confirmer par des mesures en dehors de la consultation!

TABLE 6. Definitions of hypertension by office and out-of-office blood pressure levels

Category	Systolic BP (mmHg)		Diastolic BP (mmHg)
Office BP	≥140	and/or	≥90
Ambulatory BP			
Daytime (or awake)	≥135	and/or	≥85
Nighttime (or asleep)	≥120	and/or	≥70
24-h	≥130	and/or	≥80
Home BP	≥135	and/or	≥85

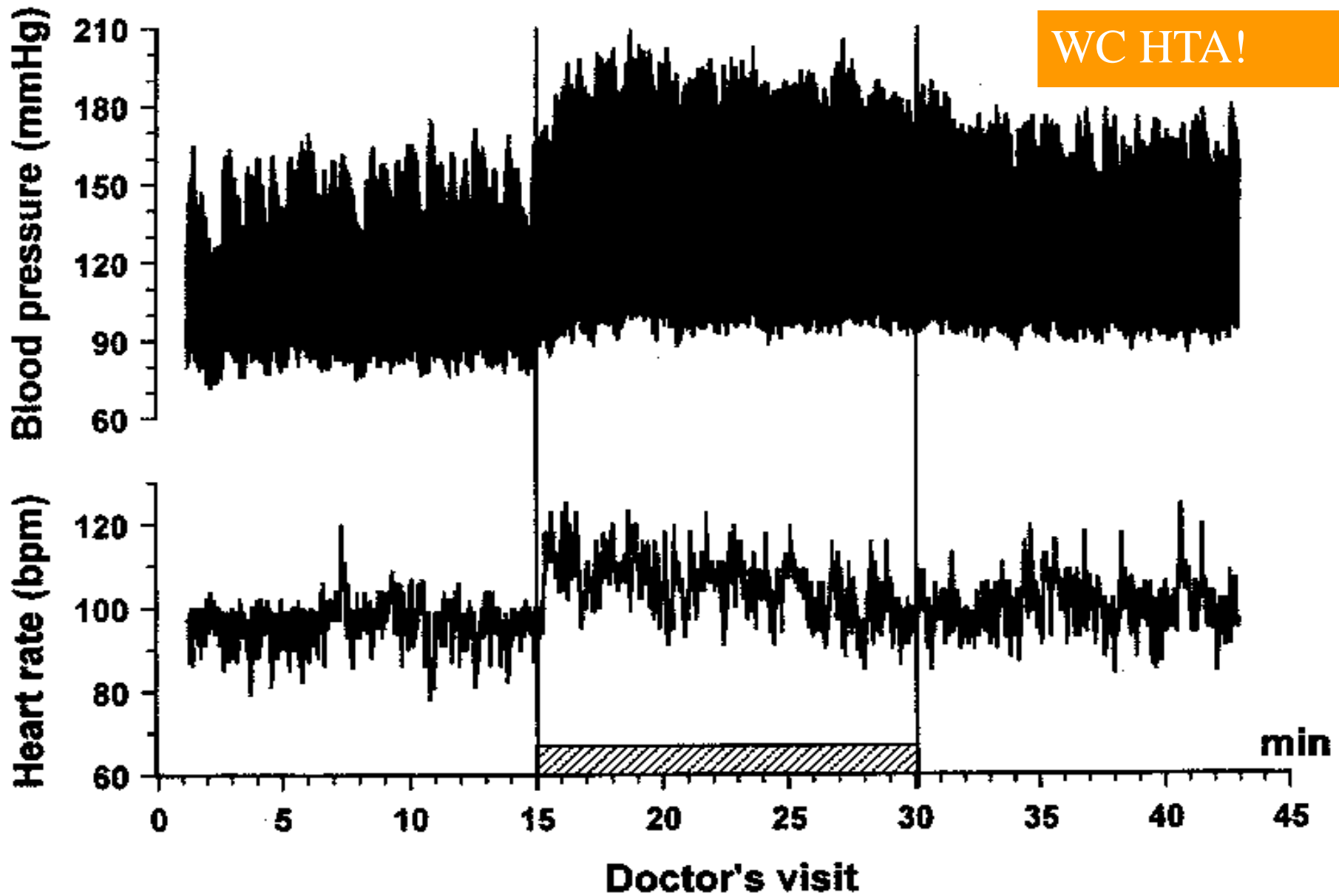


BP, blood pressure.

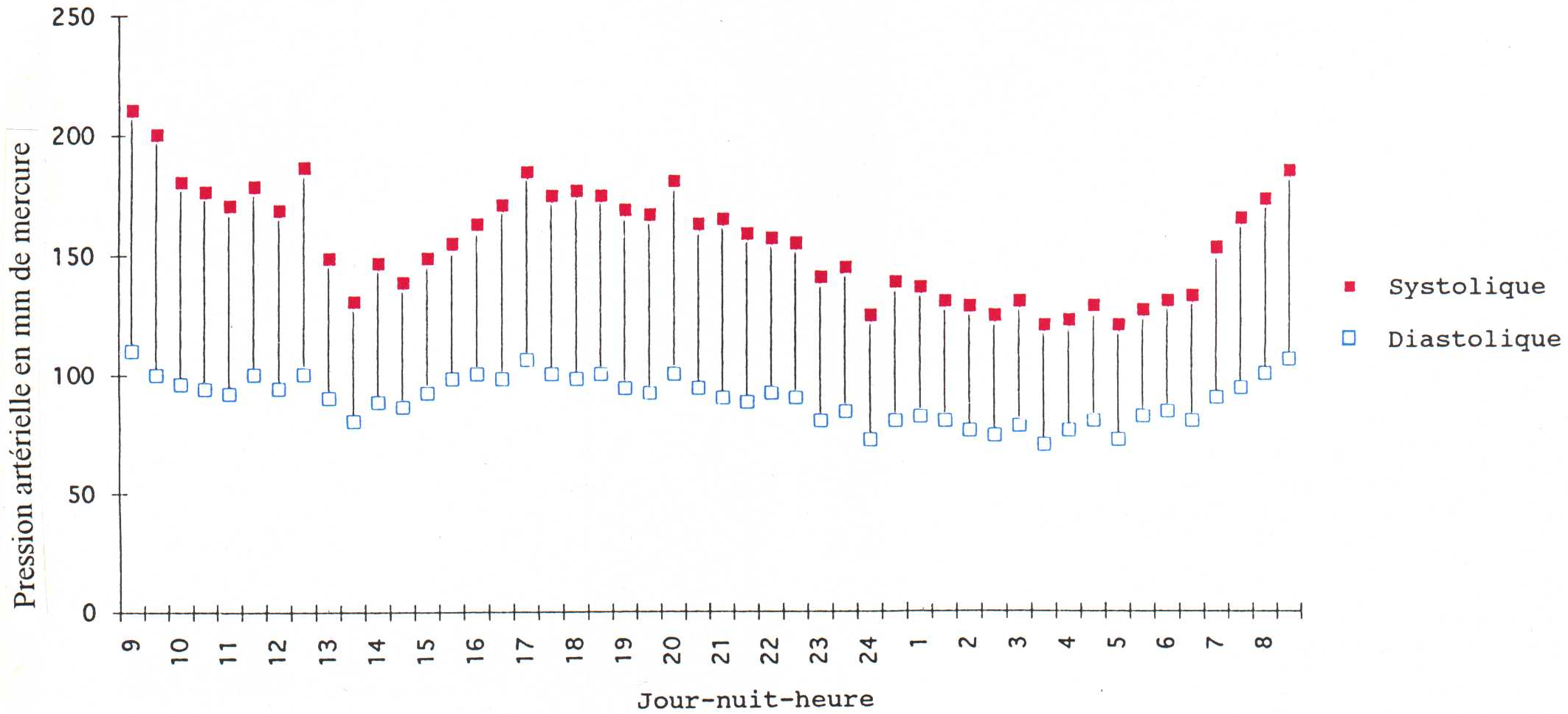


Quelle technique choisir?

- **MAPA**: information sur 24h, rythme nyctéméral, variabilité, charge tensionnelle, en période d'activité, **mais contrainte de la durée pendant 1 jour.**
- **Auto-mesure**: information sur plusieurs jours, plus confortable, **mais au repos seulement, pas d'information la nuit, nécessite une éducation, crée parfois de l'anxiété.**
- **En fait apportent des informations complémentaires**
- **Contre-indication relative si FA ou arythmie fréquente vu la technique oscillométrique.**

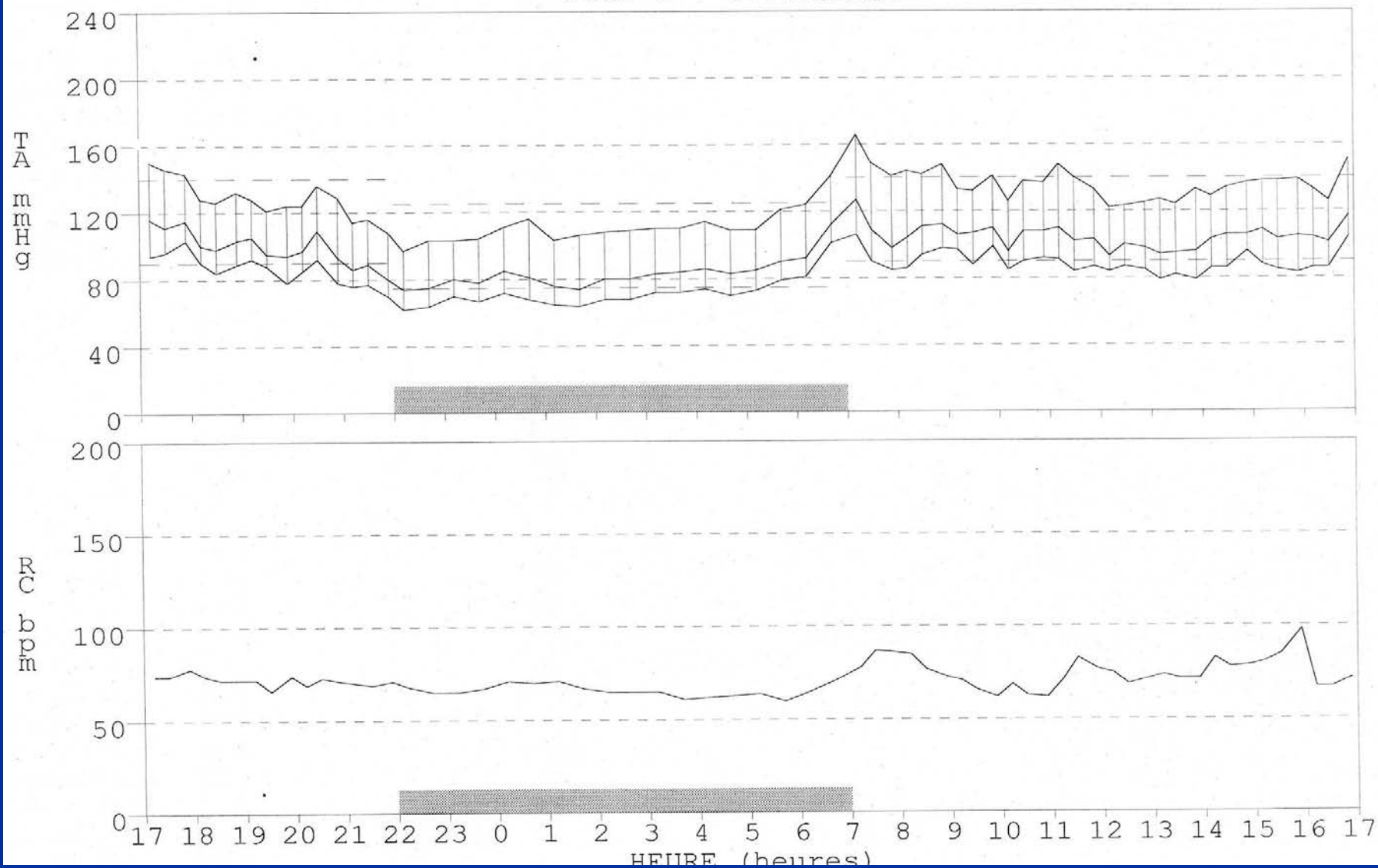


Enregistrement ambulatoire de la pression artérielle

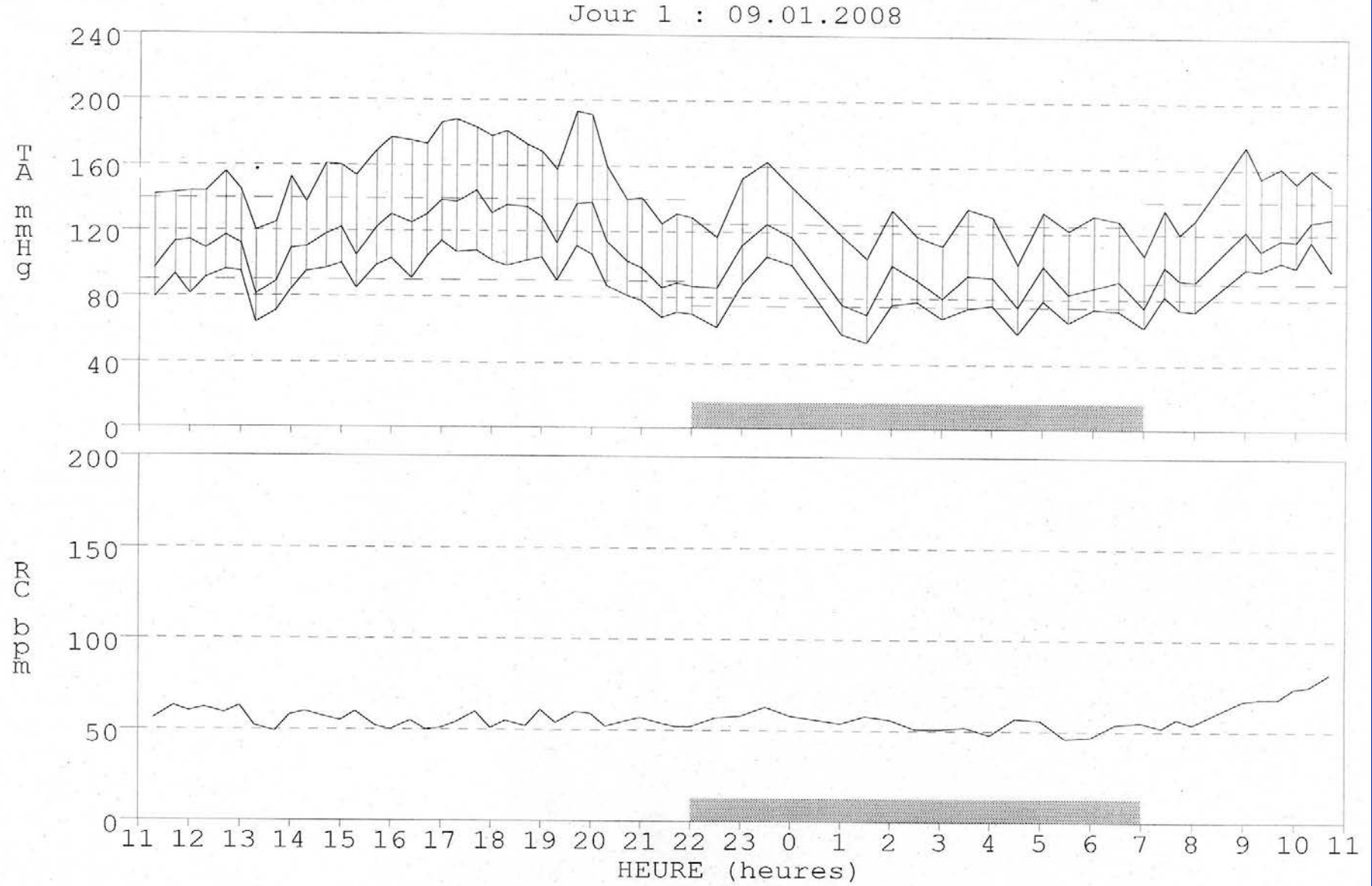


F.S. âgé de 50 ans, HTA blouse blanche

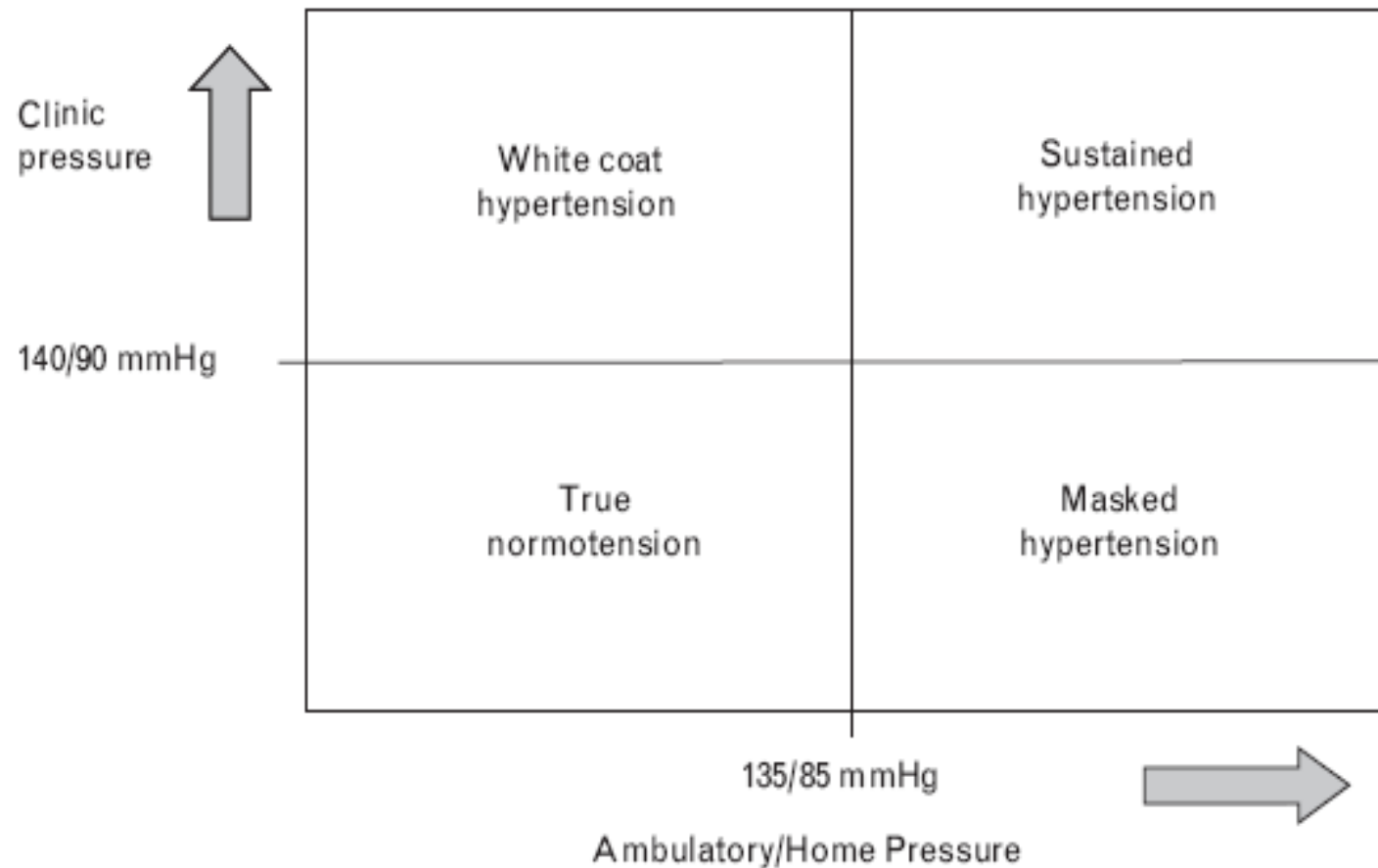
Jour 1 : 07.01.2008



D.J. âgé de 70 ans, HTA masquée



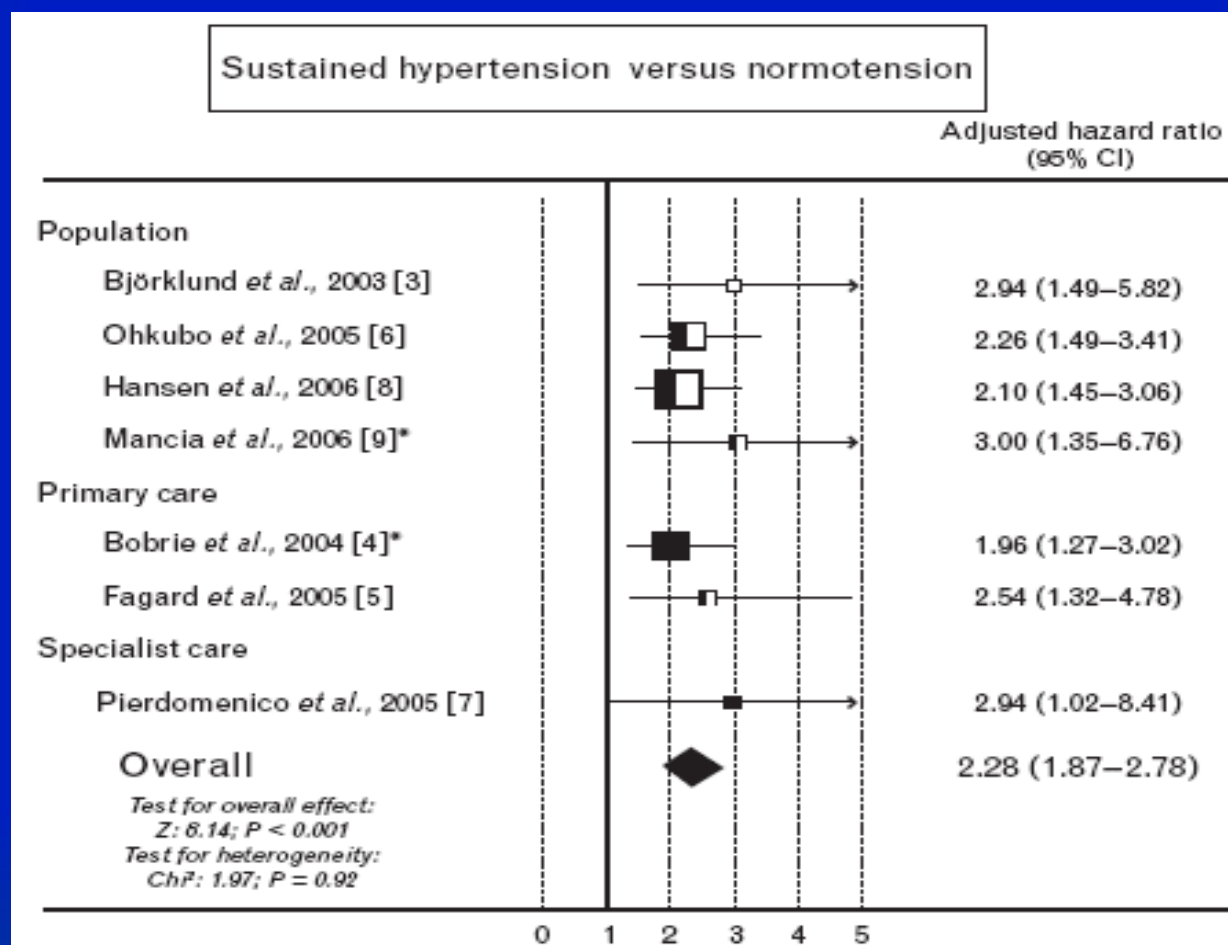
JHTA2008



Incidence of cardiovascular events in white-coat, masked and sustained hypertension versus true normotension: a meta-analysis

Robert H. Fagard and Véronique A. Cornelissen

JHTA 2007

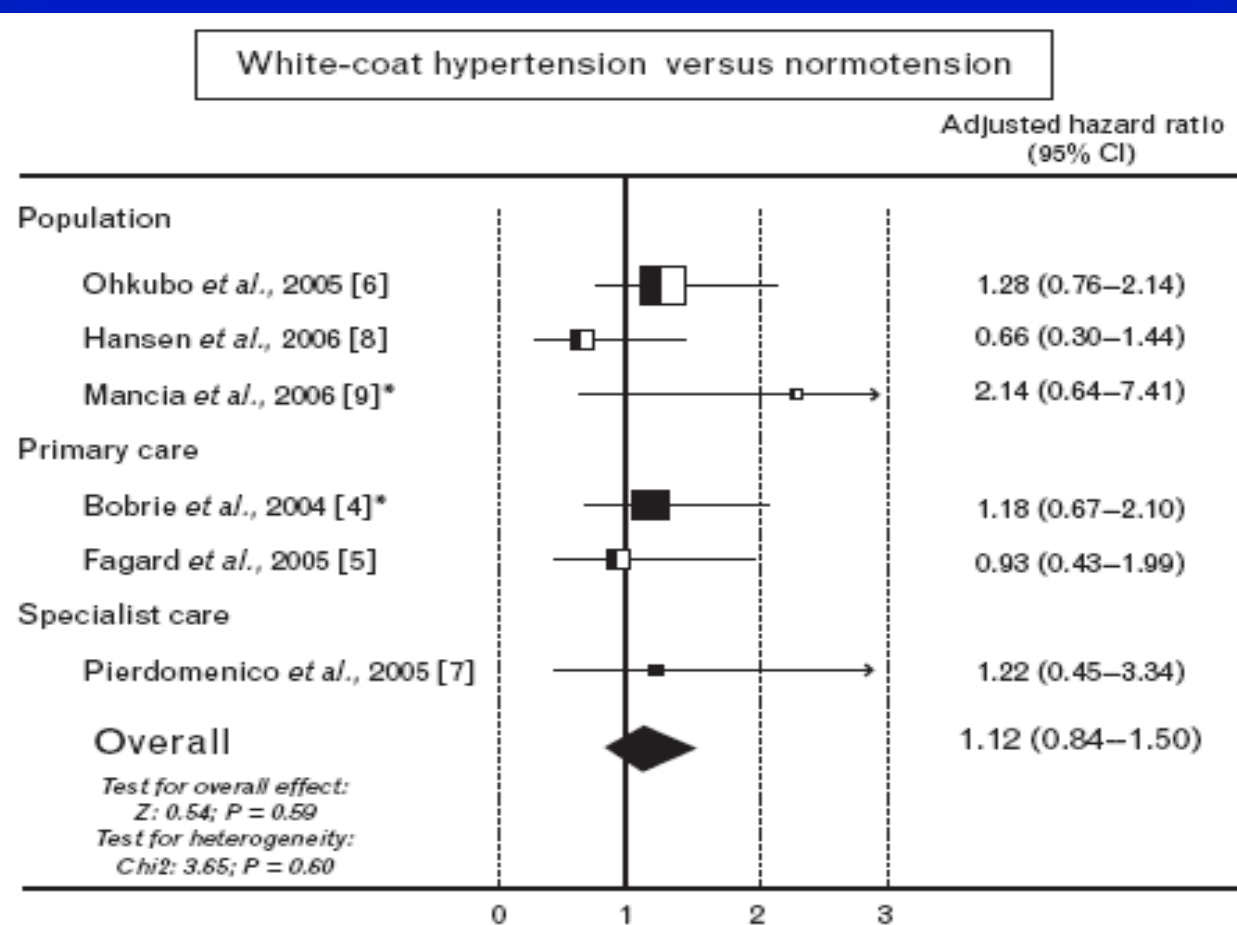


Adjusted hazard ratios and 95% confidence intervals of the individual studies and of the overall analysis for the incidence of cardiovascular events in sustained hypertension compared with true normotension.

Incidence of cardiovascular events in white-coat, masked and sustained hypertension versus true normotension: a meta-analysis

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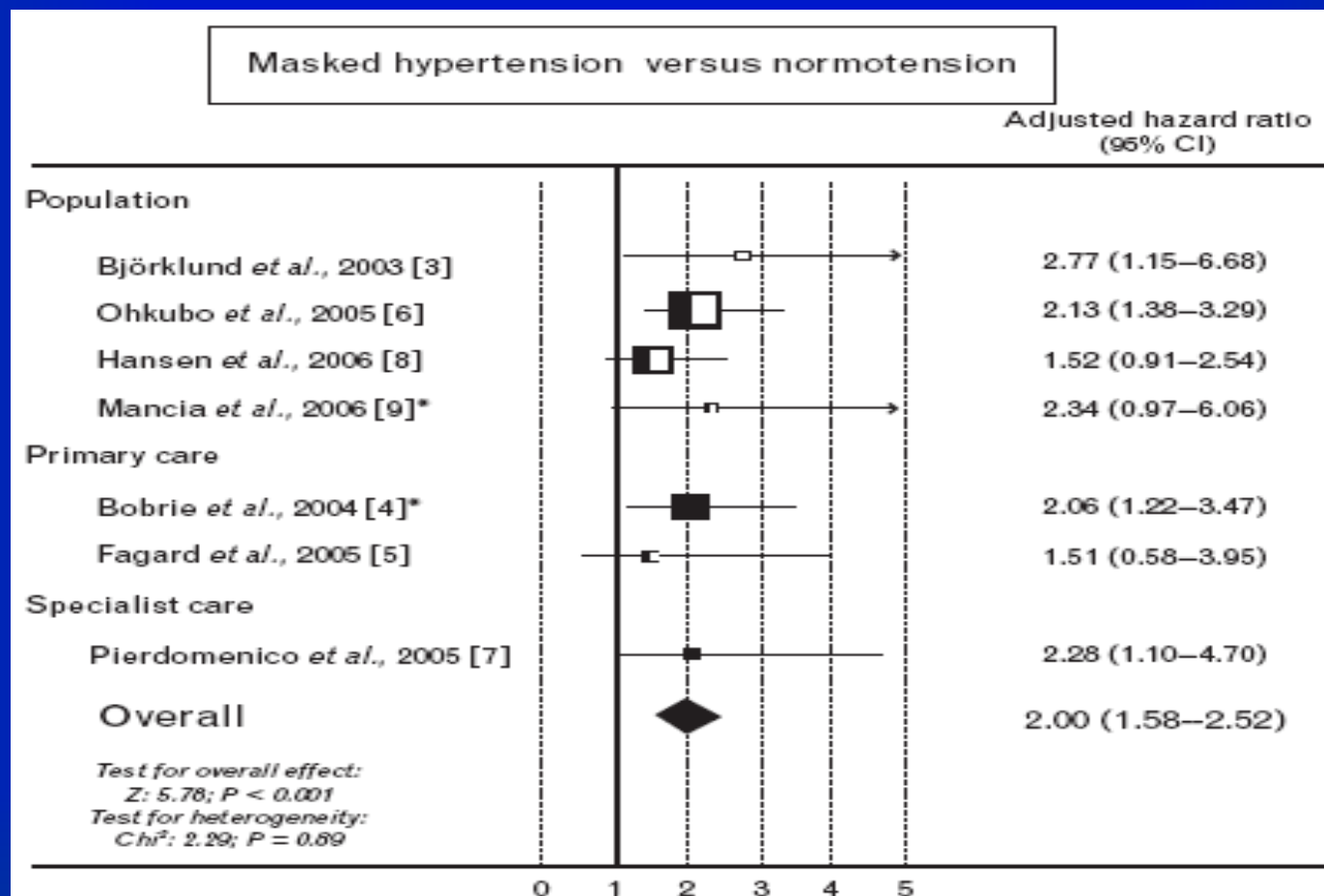
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Adjusted hazard ratios and 95% confidence intervals of the individual studies and of the overall analysis for the incidence of cardiovascular events in white-coat hypertension compared with true normotension.

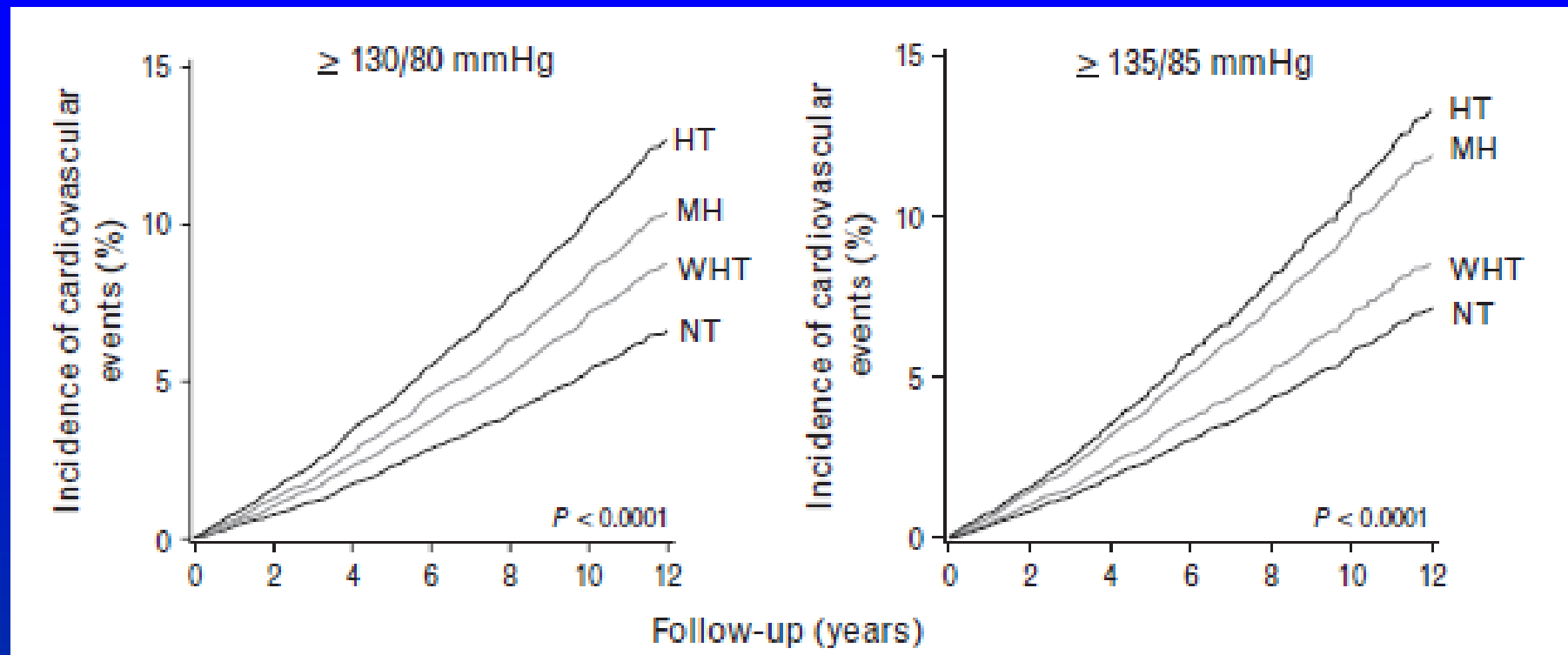
Incidence of cardiovascular events in white-coat, masked and sustained hypertension versus true normotension: a meta-analysis

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Adjusted hazard ratios and 95% confidence intervals of the individual studies and of the overall analysis for the incidence of cardiovascular events in masked hypertension compared with true normotension. The

Prognostic superiority of daytime ambulatory over conventional blood pressure in four populations: a meta-analysis of 7030 individuals



Incidence of cardiovascular events according to the cross classification of subjects by conventional and daytime ambulatory blood pressure. NT, normotension; WHT, white-coat hypertension; MH, masked hypertension; HT, sustained hypertension. The analyses were based on (a) lower ($\geq 130/80$ mmHg) or (b) higher ($\geq 135/85$ mmHg) cut-off limits for daytime ambulatory hypertension. Incidence was standardized to the sex distribution and mean age in the whole study population. The P -values are for trend across the blood pressure groups.

Intérêt de la MAPA

- Confirmer une HTA (HTA de la blouse blanche)
- Exclure une HTA masquée
- Hypotension chronique
- Variabilité (HTA épisodique)
- Symptômes d'hypotension lors d'un traitement
- Adaptation thérapeutique selon le profil de PA
- Confirmer une HTA résistante
- HTA nocturne (SAHOS, diabète compliqué, CKD, pré-éclampsie)

When proposing out of the office measurement?

ESH guidelines 2013

Clinical Indications for HBPM or ABPM

- Suspicion of white-coat hypertension
 - Grade I hypertension in the office
 - High office BP in individuals without asymptomatic organ damage and at low total CV risk
- Suspicion of masked hypertension
 - High normal BP in the office
 - Normal office BP in individuals with asymptomatic organ damage or at high total CV risk
- Identification of white-coat effect in hypertensive patients
- Considerable variability of office BP over the same or different visits
- Autonomic, postural, post-prandial, siesta- and drug-induced hypotension
- Elevated office BP or suspected pre-eclampsia in pregnant women
- Identification of true and false resistant hypertension

Specific Indications for ABPM

- Marked discordance between office BP and home BP
- Assessment of dipping status
- Suspicion of nocturnal hypertension or absence of dipping, such as in patients with sleep apnoea, CKD, or diabetes
- Assessment of BP variability

Home BP

- WCHTA
- Masked HTA
- Pregnancy induced HTA
- Highly variable HTA
- Resistant HTA

MAPA

- Dipping
- Discordance office and home BP values
- Variability approach

Ambulatory Blood Pressure Measurement

What Is the International Consensus?

Eoin O'Brien, Gianfranco Parati, George Stergiou

Table 4. Definition of White-Coat and Masked Hypertension Phenomena*

White-coat hypertension

Untreated subjects with elevated office blood pressure $\geq 140/90$ mm Hg and
and
24-h ABPM $< 130/80$ mm Hg and
Awake ABPM $< 135/85$ mm Hg and
Sleep $< 120/70$ mm Hg or
Home blood pressure $< 135/85$ mm Hg

Masked hypertension

Untreated subjects with office blood pressure $< 140/90$ mm Hg and
24-h ABPM $\geq 130/80$ mm Hg and
Awake ABPM $\geq 135/85$ mm Hg and
Sleep $\geq 120/70$ mm Hg or
Home blood pressure $\geq 135/85$ mm Hg

Masked uncontrolled hypertension

Treated subjects with office blood pressure $< 140/90$ mm Hg and
24-h ABPM $\geq 130/80$ mm Hg and/or
Awake ABPM $\geq 135/85$ mm Hg and/or
Sleep $\geq 120/70$ mm Hg or
Home blood pressure $\geq 135/85$ mm Hg

Table 2. Evaluation of ABPM Data

Hypertension. 2013;62:988-994.

Definition of daytime and night-time

Daytime and night-time intervals are best defined using sleeping times reported by individual users' diary cards (awake and asleep periods)

Fixed narrow time intervals can be applied by discarding transition periods between daytime and night-time (eg, daytime defined as 0900–2100 h and night-time 0100–0600 h)

Editing and requirements

Editing is not necessary for calculating average 24-h, daytime and night-time values

The ABPM should be repeated if the following criteria are not met

24-h Recording with $\geq 70\%$ of expected measurements

20 Valid awake (0900–2100 h)

7 Valid asleep (0100–0600 h)

Blood pressure measurements at 30 min intervals throughout 24 hours

For research purposes ≥ 2 valid daytime and 1 valid night-time measurement per h

Patient:
Adresse:
Ville:
Code Postal:

Numéro d'identification: D3
Numéro de Séc Soc.:

Age:
Sexe:
Taille:
Poids:

Numéro d'analyse:

Raison pour le test:

Médicaments:

Dosage:

Heure:

Informations sur le médecin

Médecin: prof.jm.krzesinski
Adresse:
Téléphone:

Données techniques

Date de début d'analyse:	23.06.2014	Durée de l'analyse:	23:00
Heure de début d'analyse:	08:25	Lectures valides:	59
Date de fin d'analyse:	24.06.2014	Pourcentage de succès:	92%
Heure de fin d'analyse:	07:25		

Commentaires:

SYNTHESE

	MIN	MOYEN	MAX	ECART	TYPE
Systolique	123 (1-13:05)	143	163 (2-07:25)	10,64	mmHg
Diastolique	58 (1-03:05)	86	118 (1-08:45)	10,29	mmHg
PAM	78	106	126	10,29	mmHg
Fréq. cardiaque	53	67	92	9,45	bpm

Pourcentage des lectures systoliques supérieur aux limites de période: 88,1 %
 Pourcentage des lectures diastoliques supérieur aux limites de période: 67,8 %

Pourcentage temps pour lequel Systolique dépassait seuils de période: 89,7 %
 Pourcentage temps pour lequel Diastolique dépassait seuils de période: 68,8 %

PERIODE DE SYNTHESE: 7:00 à 23:00

	MIN	MOYEN	MAX	ECART	TYPE
Systolique	123 (1-13:05)	146	163 (2-07:25)	10,21	mmHg
Diastolique	71 (1-15:07)	91	118 (1-08:45)	7,89	mmHg
PAM	93	109	126	8,87	mmHg
Fréq. cardiaque	54	70	92	9,97	bpm

Pourcentage des mesures systoliques > 135 mmHg 83,7 %
 Pourcentage des mesures diastoliques > 85 mmHg 67,4 %

Pourcentage de durée systolique > 135 mmHg 85,8 %
 Pourcentage de durée diastolique > 85 mmHg 72,0 %

PERIODE DE SYNTHESE: 23:00 à 7:00

	MIN	MOYEN	MAX	ECART	TYPE
Systolique	123 (1-04:35)	138	162 (1-05:07)	10,62	mmHg
Diastolique	58 (1-03:05)	75	89 (1-05:35)	8,71	mmHg
PAM	78	98	119	10,53	mmHg
Fréq. cardiaque	53	64	78	6,56	bpm

Pourcentage des mesures systoliques > 120 mmHg 100,0 %
 Pourcentage des mesures diastoliques > 70 mmHg 68,8 %

Pourcentage de durée systolique > 120 mmHg 100,0 %
 Pourcentage de durée diastolique > 70 mmHg 69,8 %

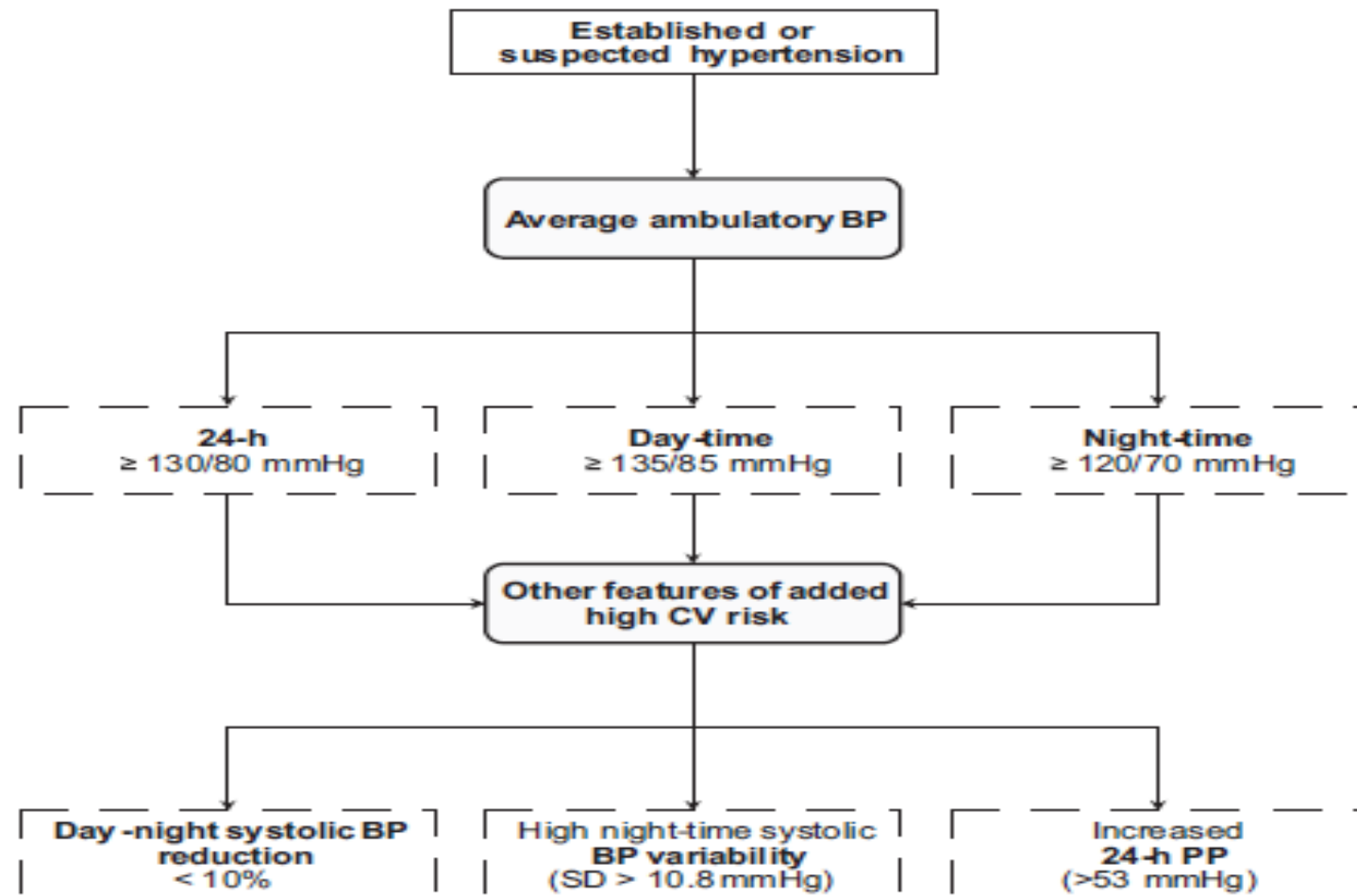


Figure. Components of ambulatory blood pressure (BP) monitoring that identify candidates for commencing antihypertensive drug treatment for increased cardiovascular (CV) risk. PP indicates pulse pressure.

Suivi de la PA

- Tenter de normaliser les valeurs anormales par règles H/D et médicaments et ramener la PA en consultation $<140/90$ mmHg
- Si HTA masquée, prôner HBP
- Si HTA réelle en consultation, preuve de l'efficacité du traitement à tester après quelques mois.
- Restaurer le rythme physiologique et réduire la charge tensionnelle et la variabilité, sinon..

Blood pressure and target organ damage

Current evidence suggests that:

- **Measures of 24-h blood pressure more closely predict target organ damage than do clinic or casual measurements**
- There is a higher incidence of cardiovascular complications when night-time blood pressure remains elevated
- Blood pressure variability is an additional and independent determinant of target organ damage
- The highest incidence of cardiovascular events occurs in the morning at (approximately) 24 h post dose

Hypertension and cardiovascular disease

24-h average blood pressure is correlated with:

- Overall target organ damage score
- Left ventricular mass
- Impaired left ventricular function
- (Micro) albuminuria
- Brain damage
- Retinopathy

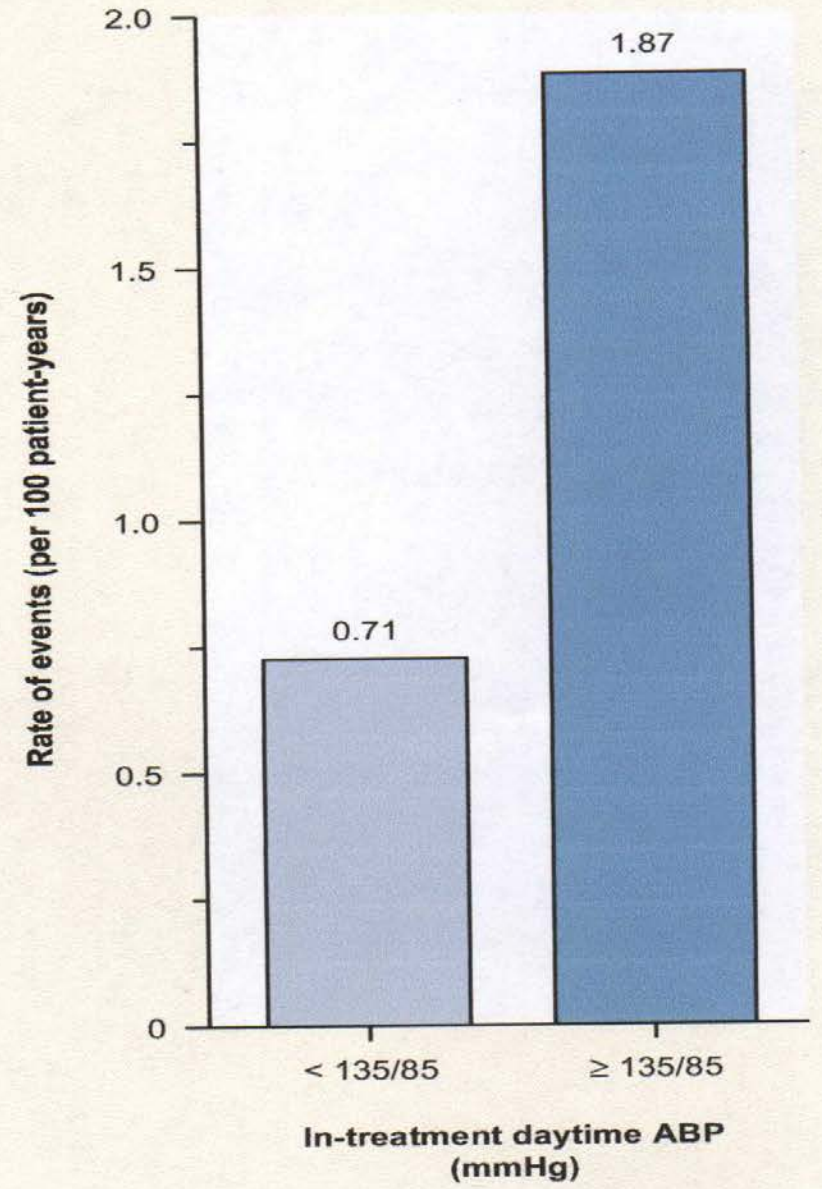
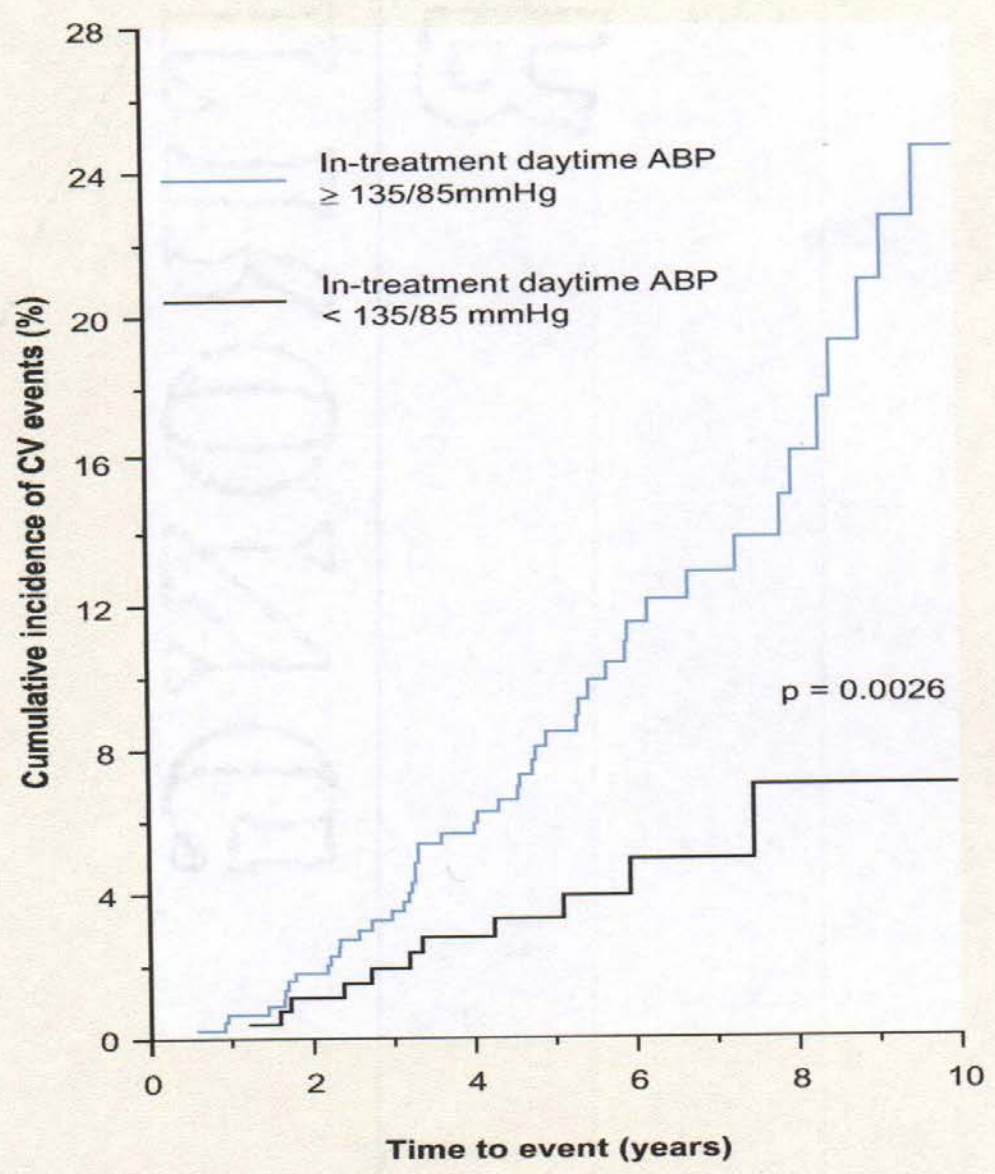


Figure 3. Incidence of cardiovascular disease in treated hypertensive subjects with and without adequate control of ambulatory blood pressure
 ABP: Ambulatory blood pressure; CV: Cardiovascular.

Prognostic value of ambulatory blood-pressure recordings in patients with treated hypertension

Clement D et al., *N Engl J Med* 2003; 348: 2407-15

Methods : Assessment of the association between baseline ambulatory blood pressures in treated patients and subsequent cardiovascular events.

Population: 1963 patients (mean age 56y) with a median follow-up of 5 years.

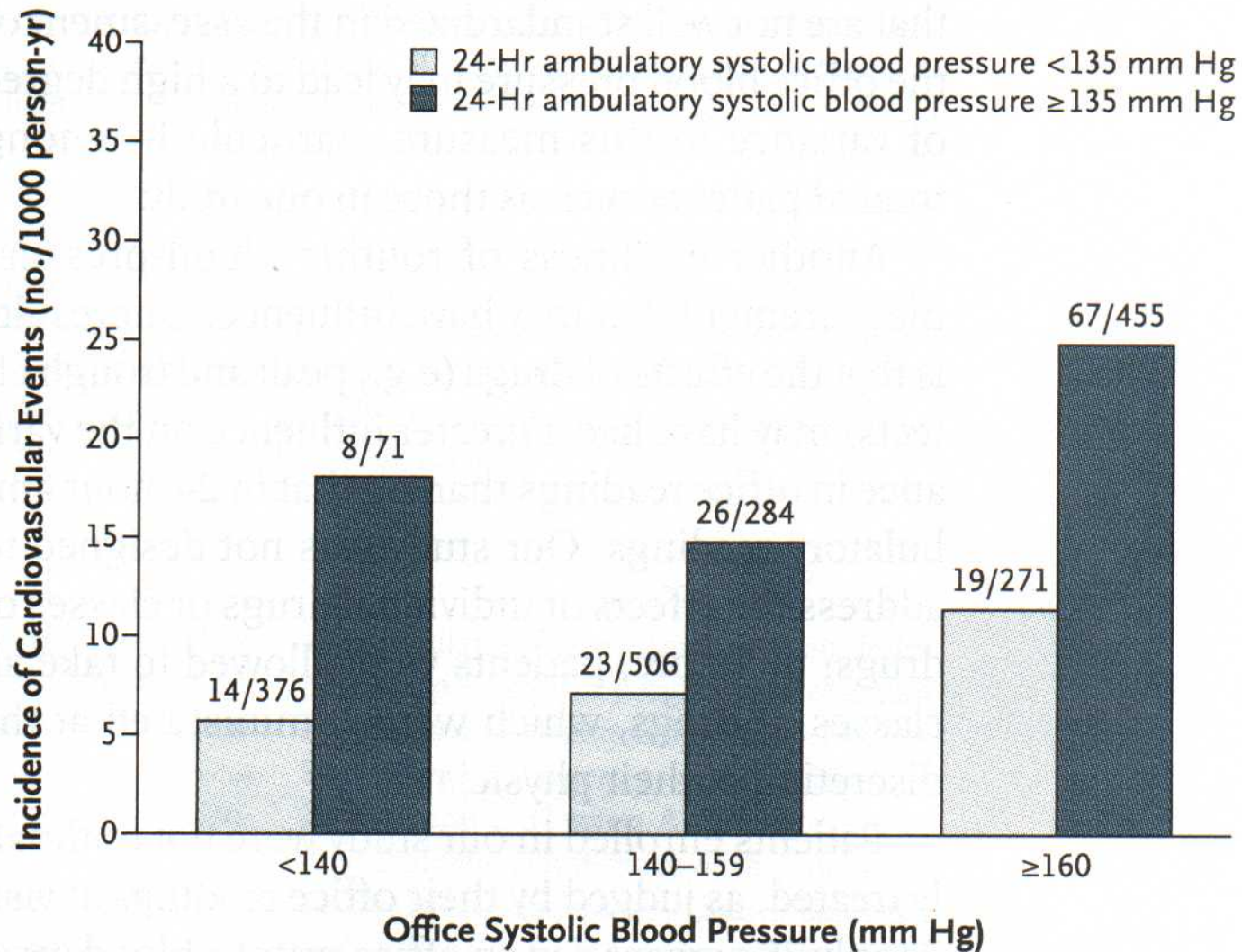


Figure 2. Incidence of Cardiovascular Events According to Category of Office Systolic Blood Pressure.

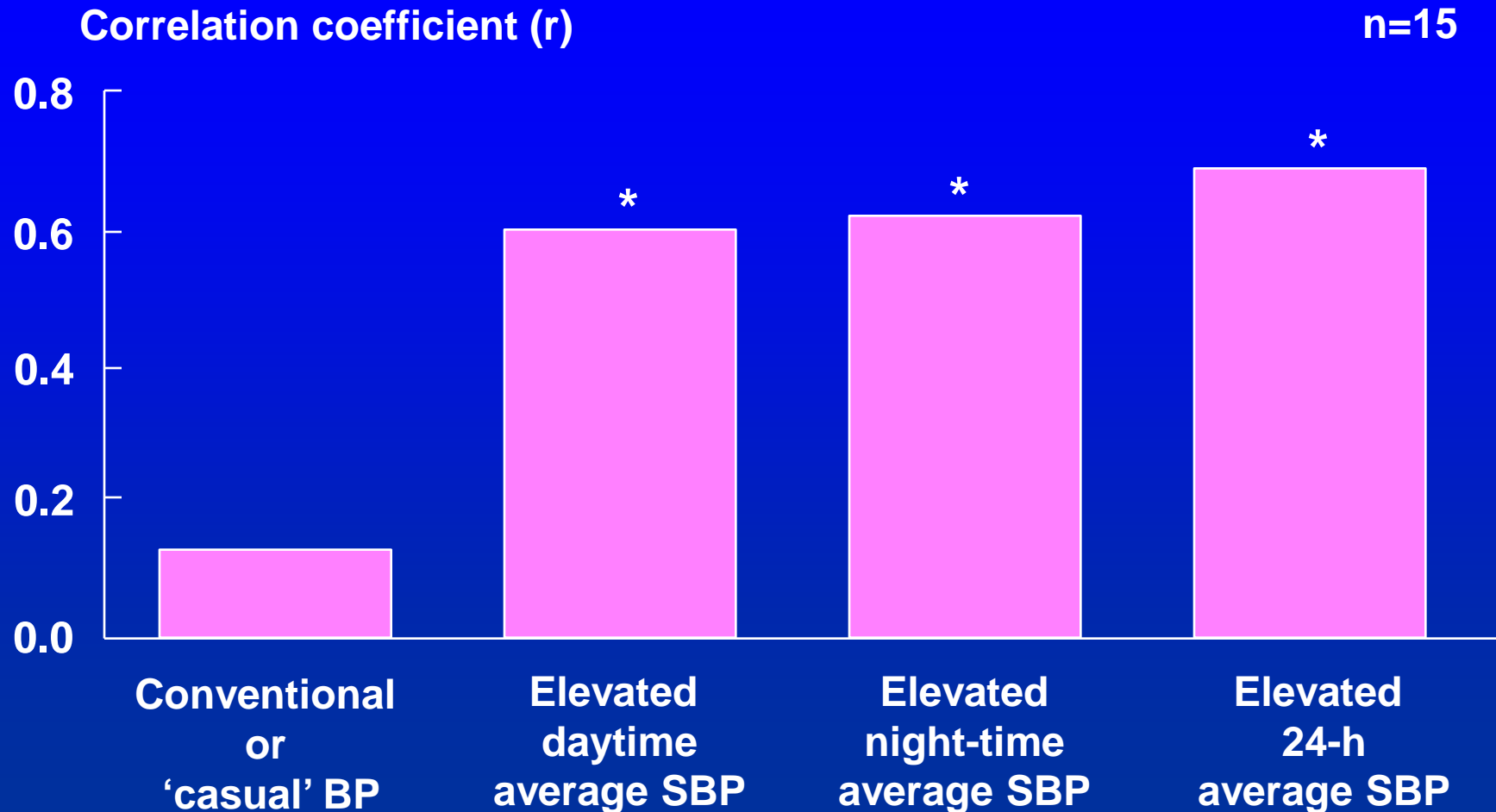
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Conclusions :

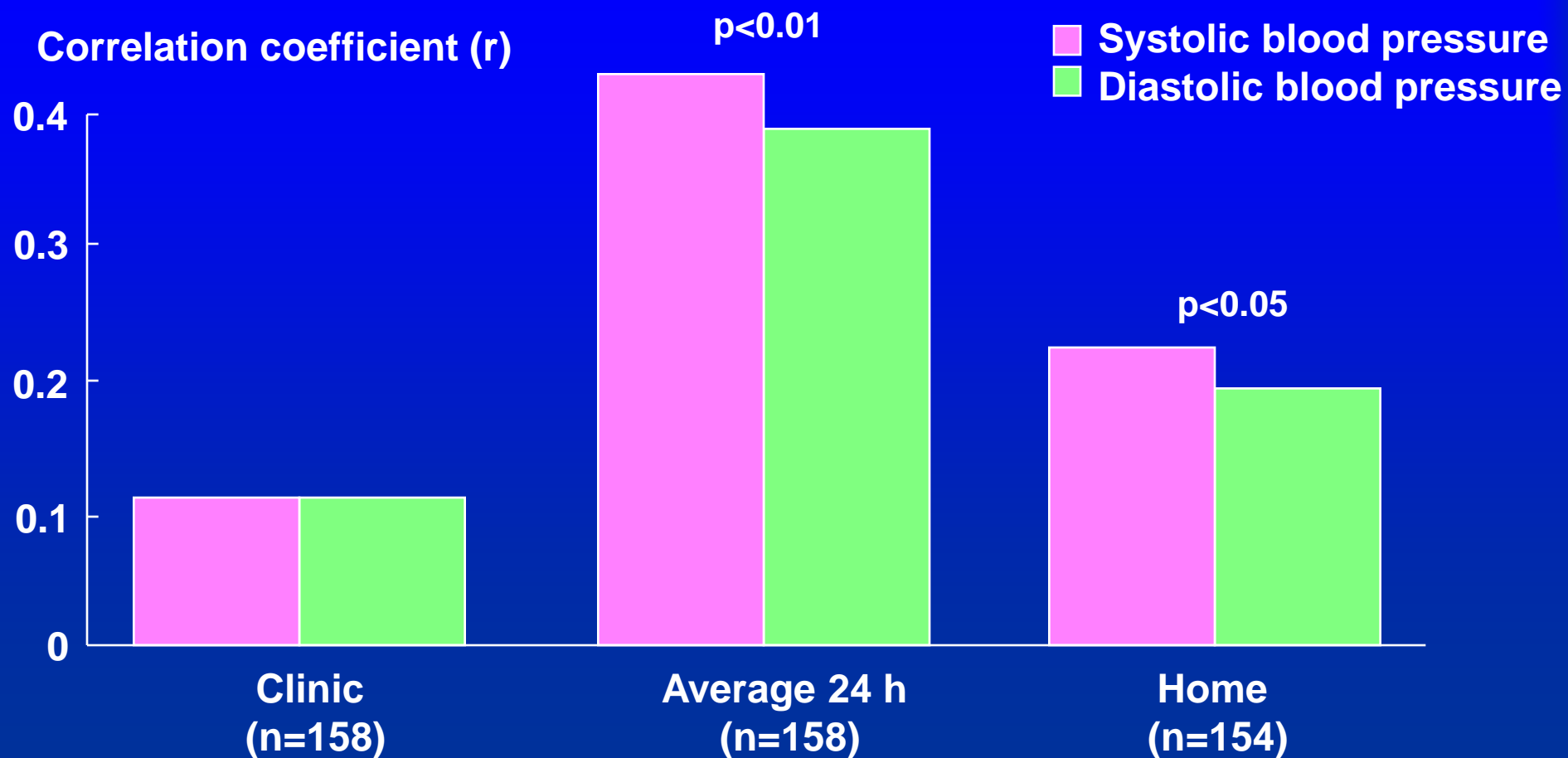
In patients with **treated** hypertension,
a **higher ambulatory systolic or diastolic blood pressure predicts cardiovascular events** even after adjustment for classic risk factors including office measurements of blood pressure.

Correlation between left ventricular mass index (LVMI) and elevated systolic BP measurement



* $p < 0.05$

Correlation of change in LVMI and change in blood pressure after 1 year of treatment: The SAMPLE study

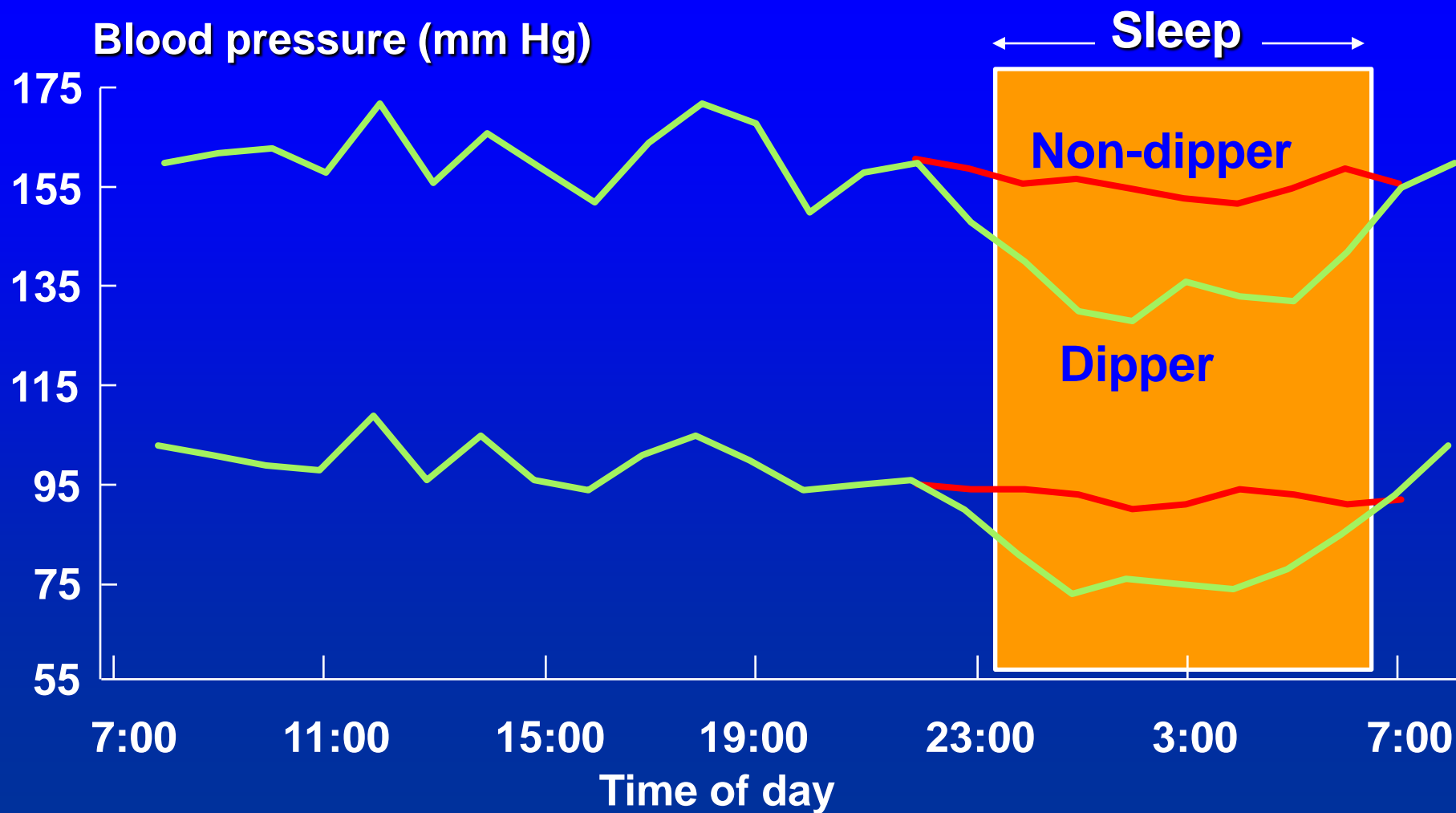


Blood pressure and target organ damage

Current evidence suggests that:

- Measures of 24-h blood pressure more closely predict target organ damage than do clinic or casual measurements
- **There is a higher incidence of cardiovascular complications when night-time blood pressure remains elevated**
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- The highest incidence of cardiovascular events occurs in the morning at (approximately) 24 h post dose

24-h blood pressure profile in two kind of patients with hypertension (dipper and non-dipper)



Dippers and non-dippers: brain and cardiac complications

	Normotensive (n=34)	Hypertensive dippers (n=38)	Hypertensive non-dippers (n=15)
CNS			
Lacunae (per subject)	0.9	1.0	3.7
Grade III damage (%)	17	18	53
CVS			
ECG-LVH (%)	0	5	53

Progression (over 3 years) of hypertensive renal disease: prospective importance of night-time blood pressure

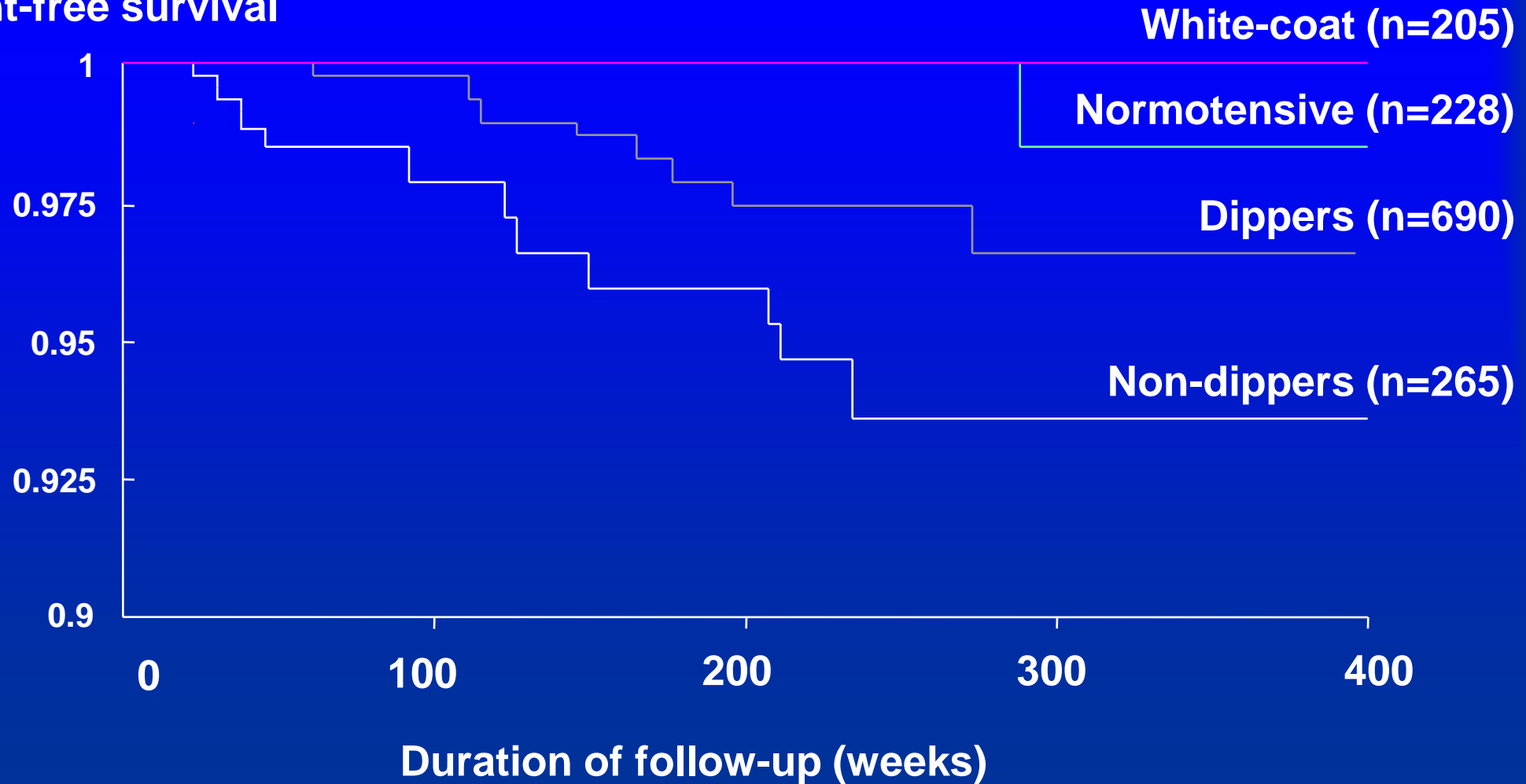
	Dippers* (n=20)	Non-dippers† (n=28)	P value
Fall in Cr Cl (ml/min.month)	-0.19	-0.33	<0.01
Level of proteinuria (mg/24 h)	390	659	<0.01
Night-time BP vs Δ Cr Cl		$r^2=0.45$	<0.001
Night-time BP vs proteinuria		$r^2=0.22$	<0.01

Δ BP: Night vs Day: *>10%; †<10%

*†Matched for age, sex, BMI, office BP, creatinine, lipids, antihypertensive R_x

Cardiovascular event-free survival according to blood pressure

Probability of event-free survival



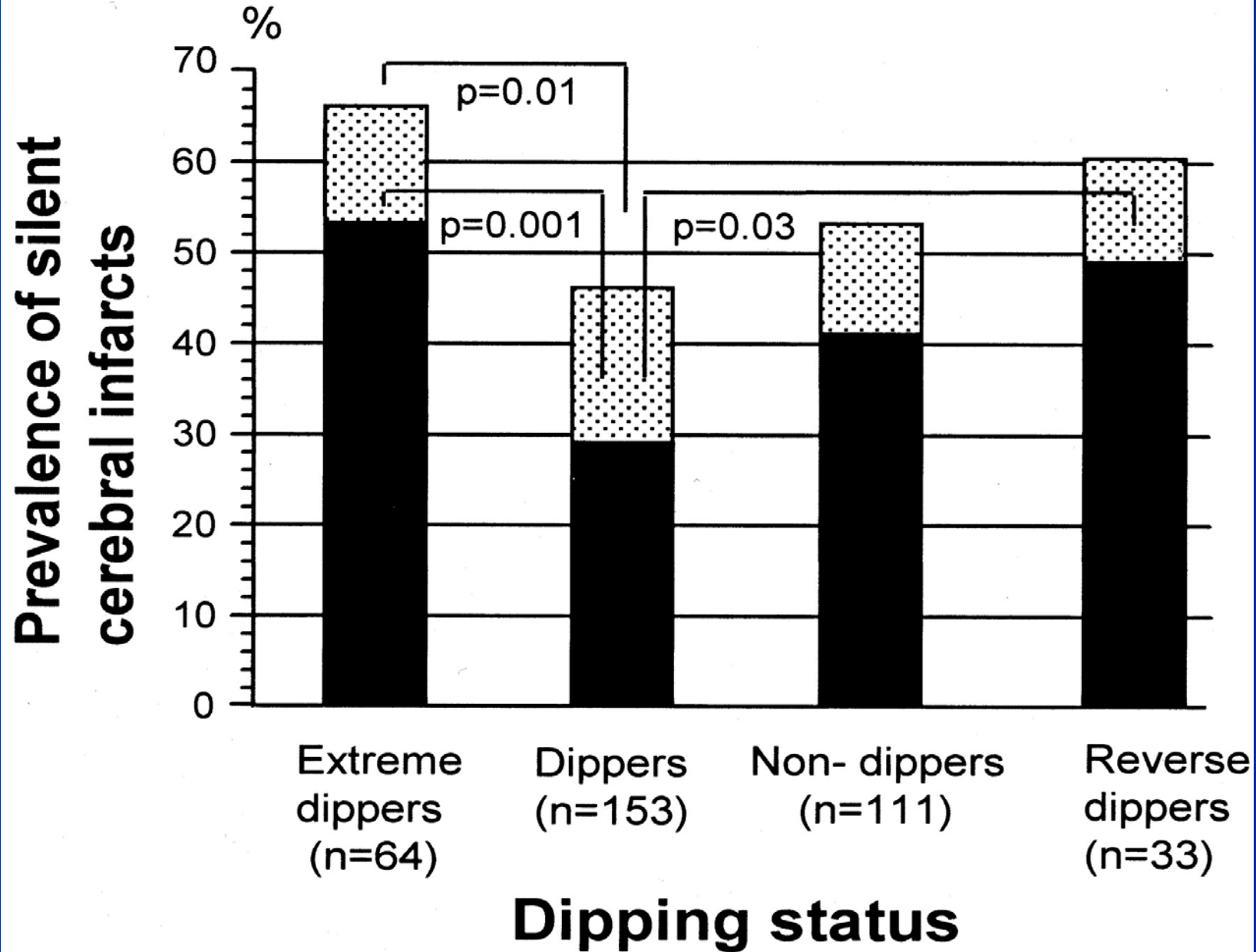
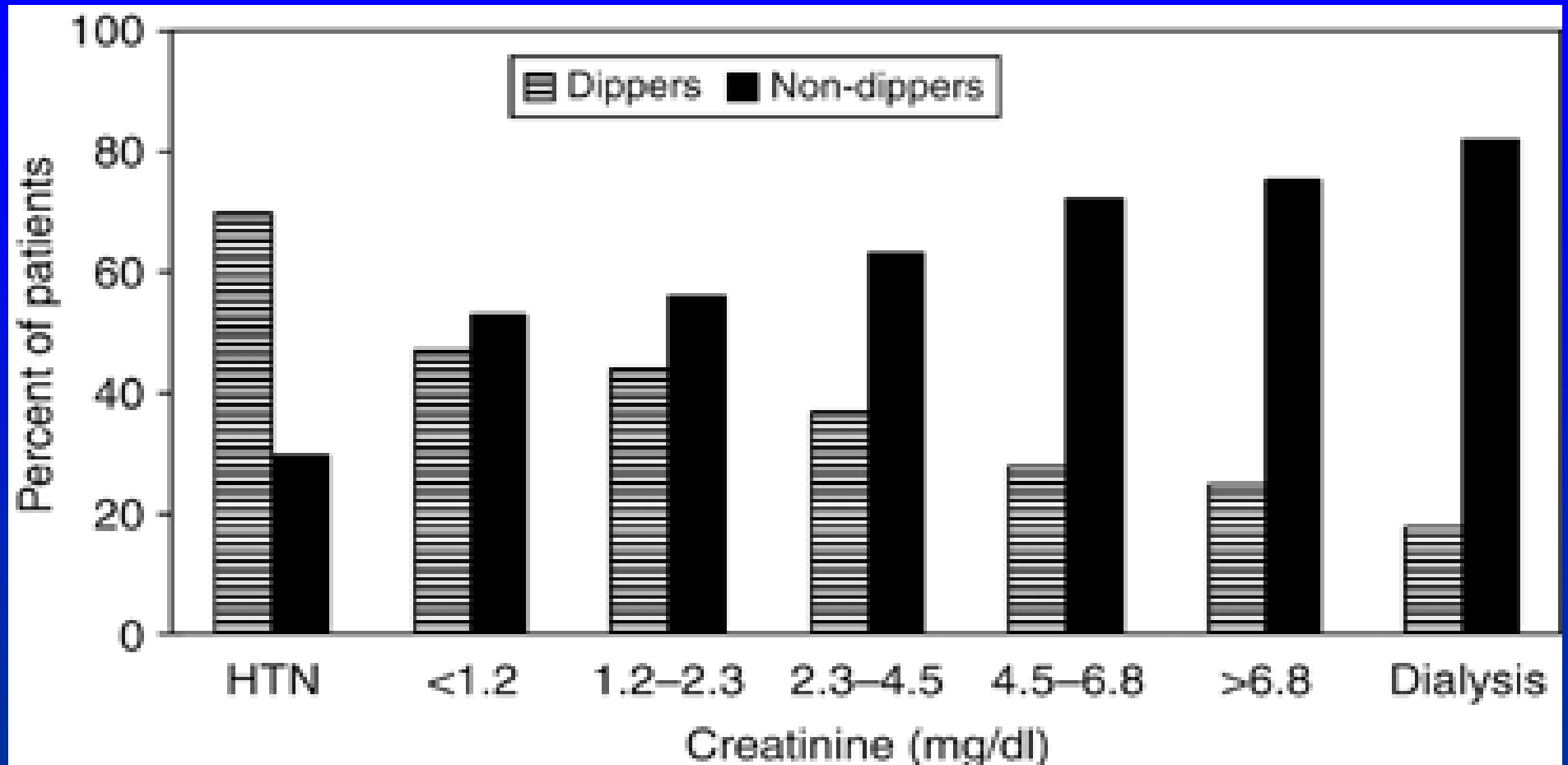


Figure : shaded area indicates 1 SCI detected by brain MRI per person; solid area, multiple SCIs (defined as ≥ 2 SCIs per person).

Relation dipping et fonction rénale



Prognostic Role of Ambulatory Blood Pressure Measurement in Patients With Nondialysis Chronic Kidney Disease

Roberto Minutolo, MD, PhD; Rajiv Agarwal, MD; Silvio Borrelli, MD; Paolo Chiodini, MSc; Vincenzo Bellizzi, MD, PhD; Felice Nappi, MD; Bruno Cianciaruso, MD; Pasquale Zamboli, MD; Giuseppe Conte, MD; Francis B. Gabbai, MD; Luca De Nicola, MD, PhD

Arch Intern Med. 2011;171(12):1090-1098

Conclusion: In chronic kidney disease, ambulatory BP measurement and, in particular, nighttime BP measurement, allows more accurate prediction of renal and cardiovascular risk; office measurement of BP does not predict any outcome.

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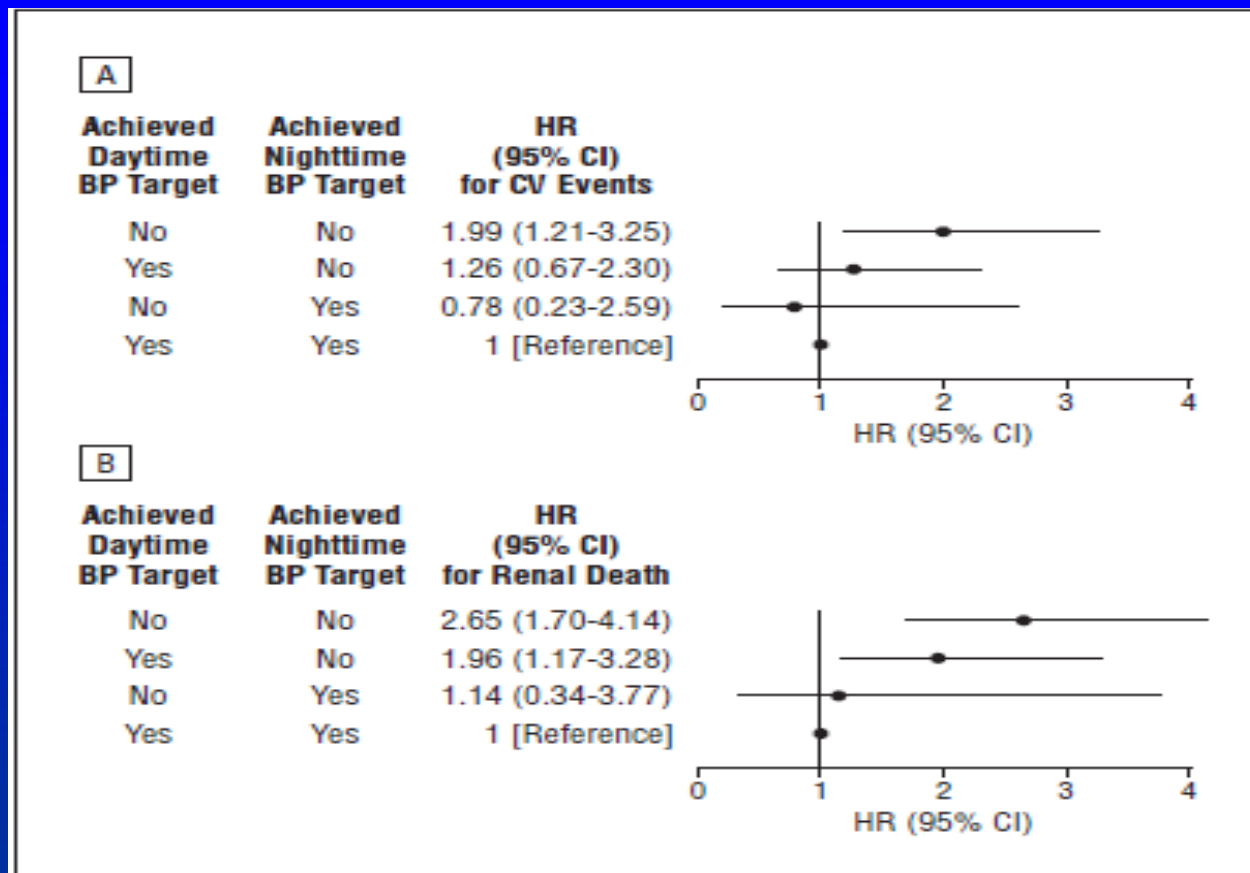


Figure 3. Risk of fatal and nonfatal cardiovascular (CV) events (A) and renal death (B) in patients stratified according to achievement of daytime blood pressure (BP) target (<135/85 mm Hg) and nighttime BP target (<120/70 mm Hg). CI indicates confidence interval; HR, hazard ratio.

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Table 5. Risk of Fatal and Nonfatal CV Events and Renal Death According to Dipping Status Based on Nighttime to Daytime Ratio of Mean BP^a

Characteristic	Fatal and Nonfatal CV Events		Renal Death	
	HR (95% CI)	P Value	HR (95% CI)	P Value
Dipping status		.009 ^b		.01 ^b
Extreme dippers	1.56 (0.68-3.62)	.30	1.61 (0.74-3.55)	.23
Dippers	1 [Reference]		1 [Reference]	
Nondippers	1.95 (1.15-3.31)	.01	1.62 (1.08-2.44)	.02
Reverse dippers	2.11 (1.11-4.00)	.02	1.72 (1.04-2.85)	.03

Blood pressure and target organ damage

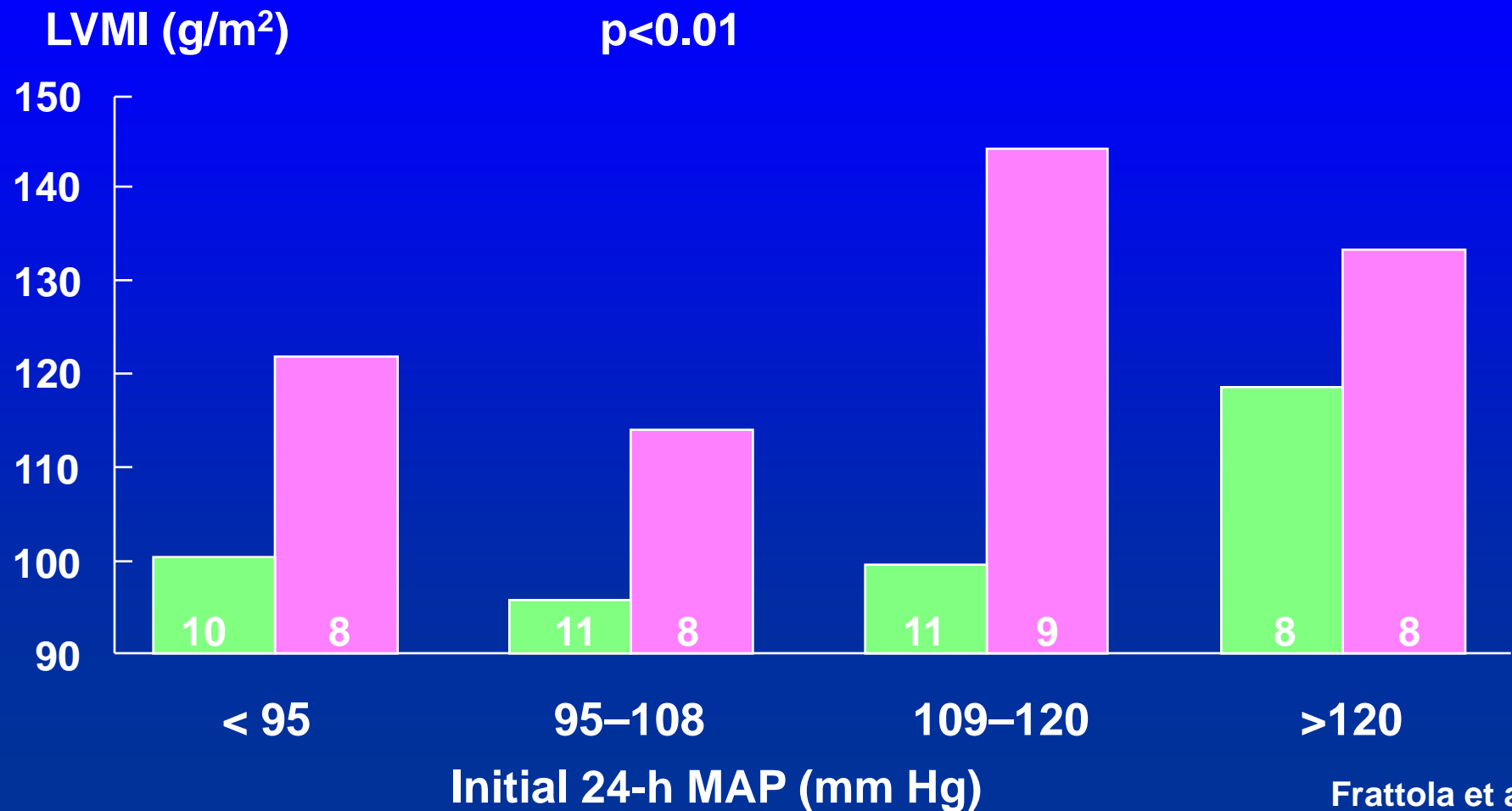
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Blood pressure variability and target organ damage: a longitudinal analysis

■ Variability >group average
■ Variability <group average

n=73

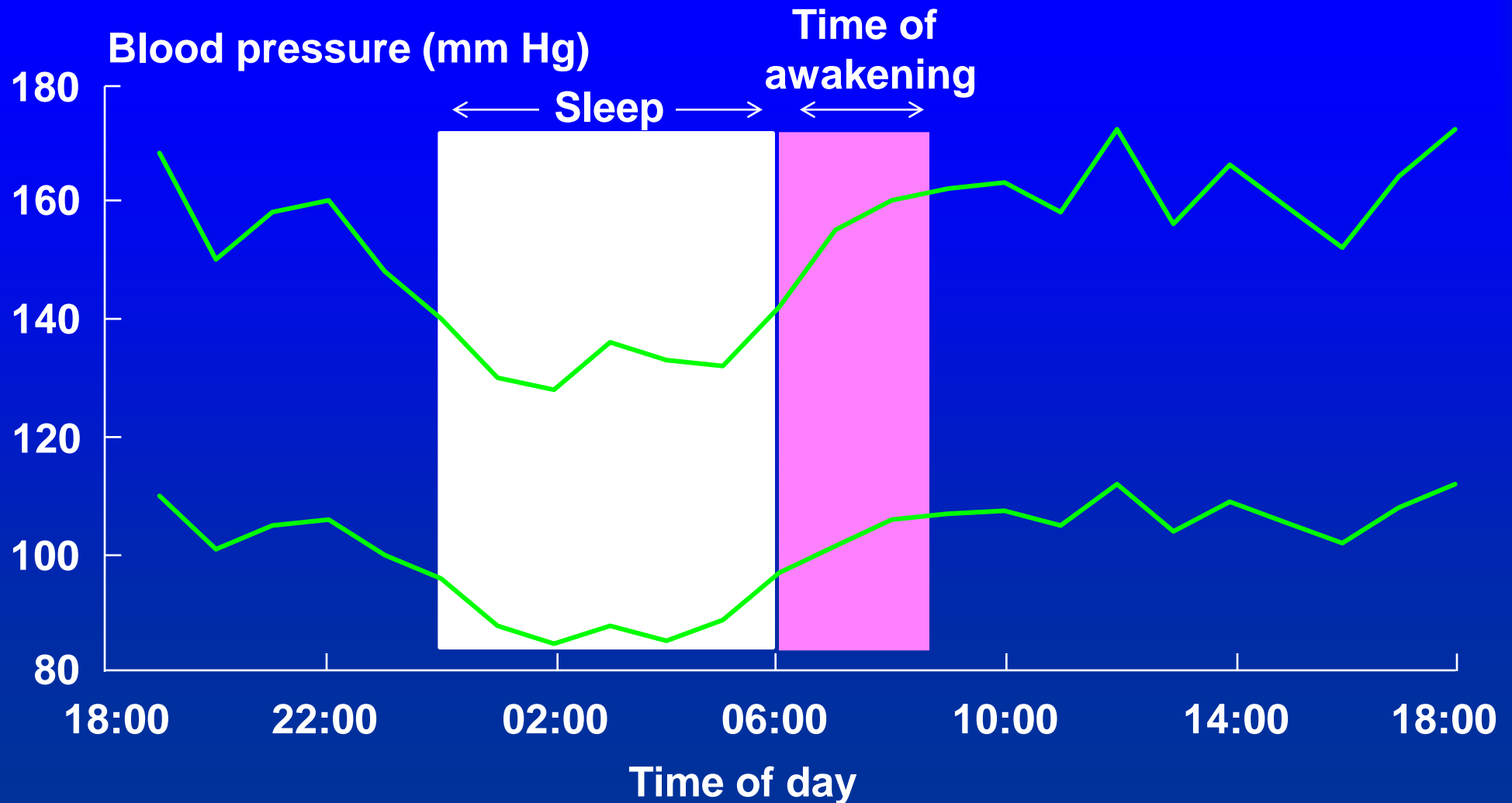


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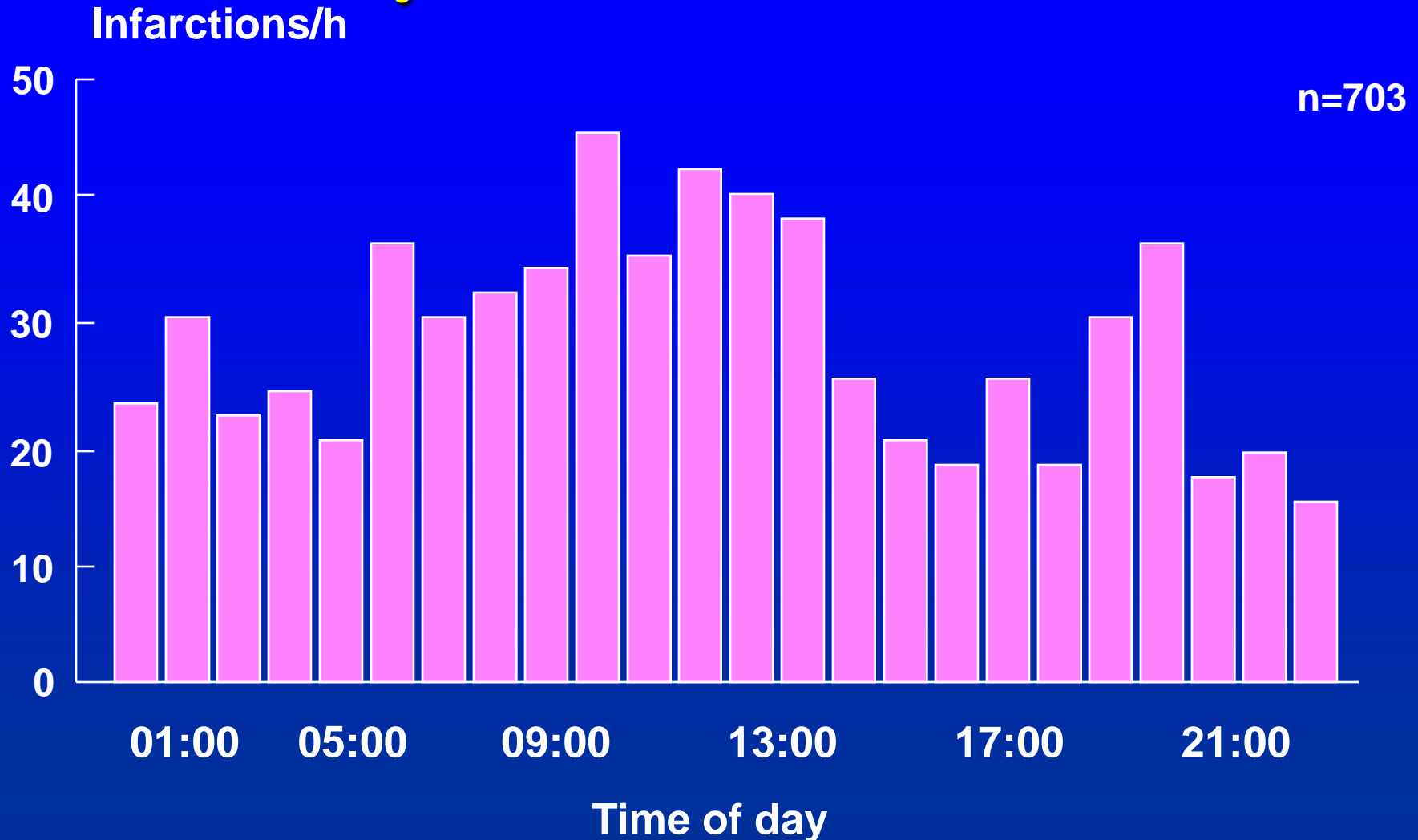
24-h blood pressure profile in a hypertensive patient: the morning blood pressure 'surge'



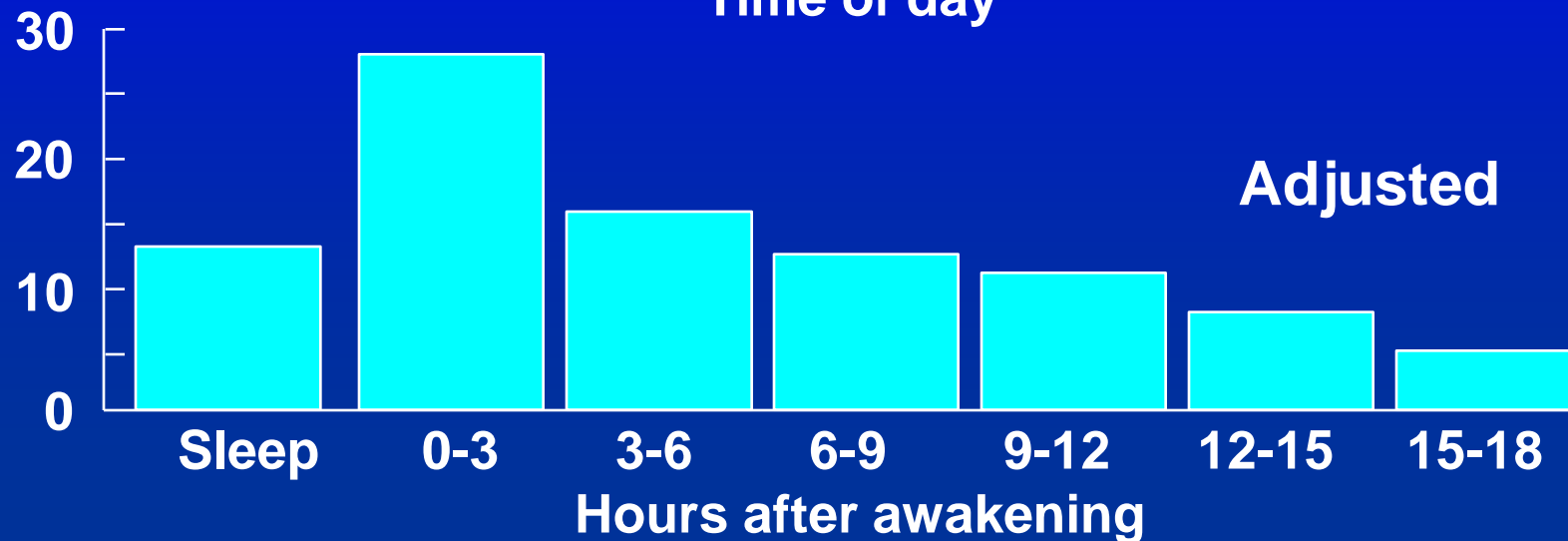
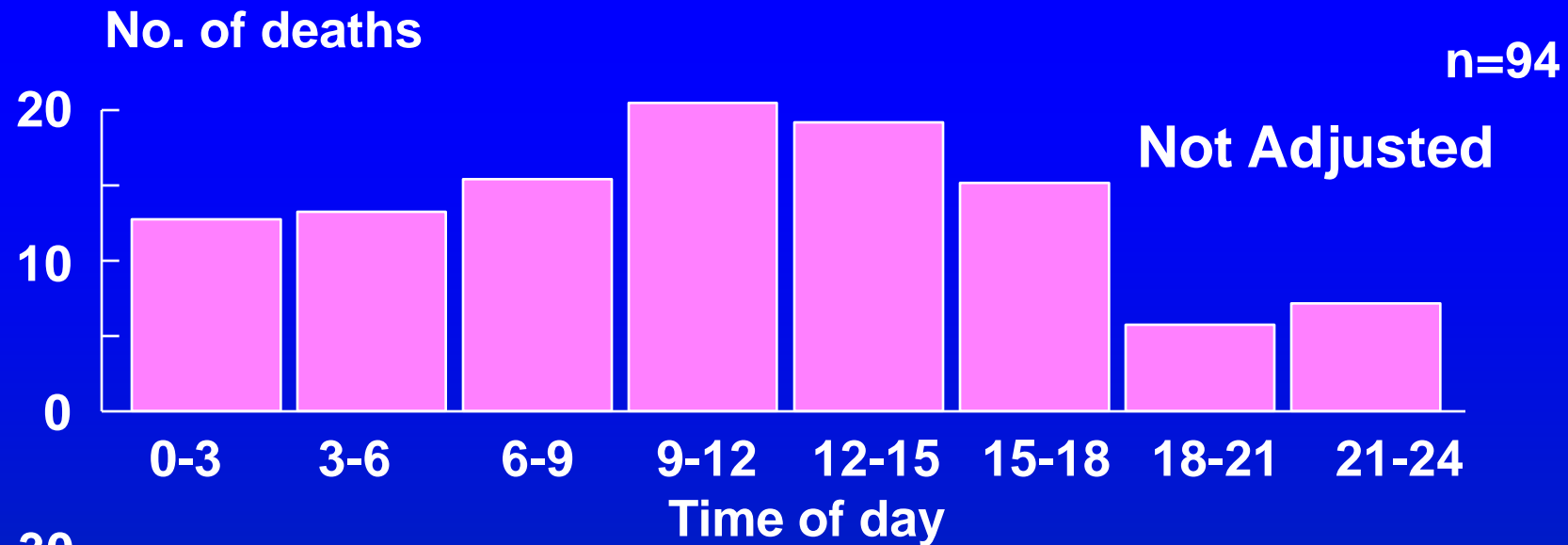
Cardiovascular events that are coincident with the morning blood pressure 'surge'

- Myocardial ischaemia
- Myocardial infarction
- Sudden cardiac death
- Cerebrovascular accident
 - thrombotic
 - haemorrhagic

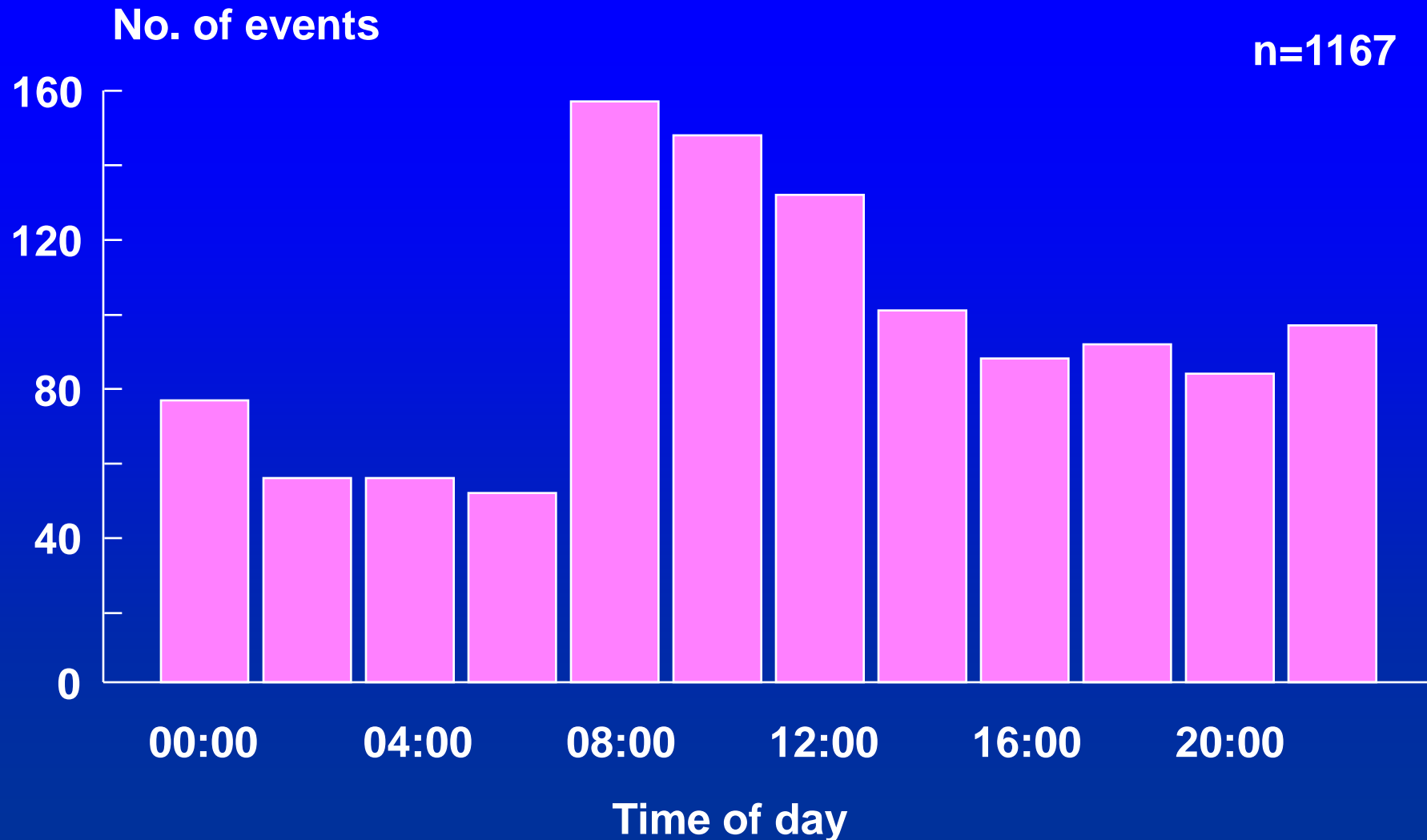
Circadian incidence of cardiovascular events: myocardial infarction



Circadian incidence of sudden cardiac death: adjusted for time of awakening



Circadian incidence of cardiovascular events: cerebrovascular accident

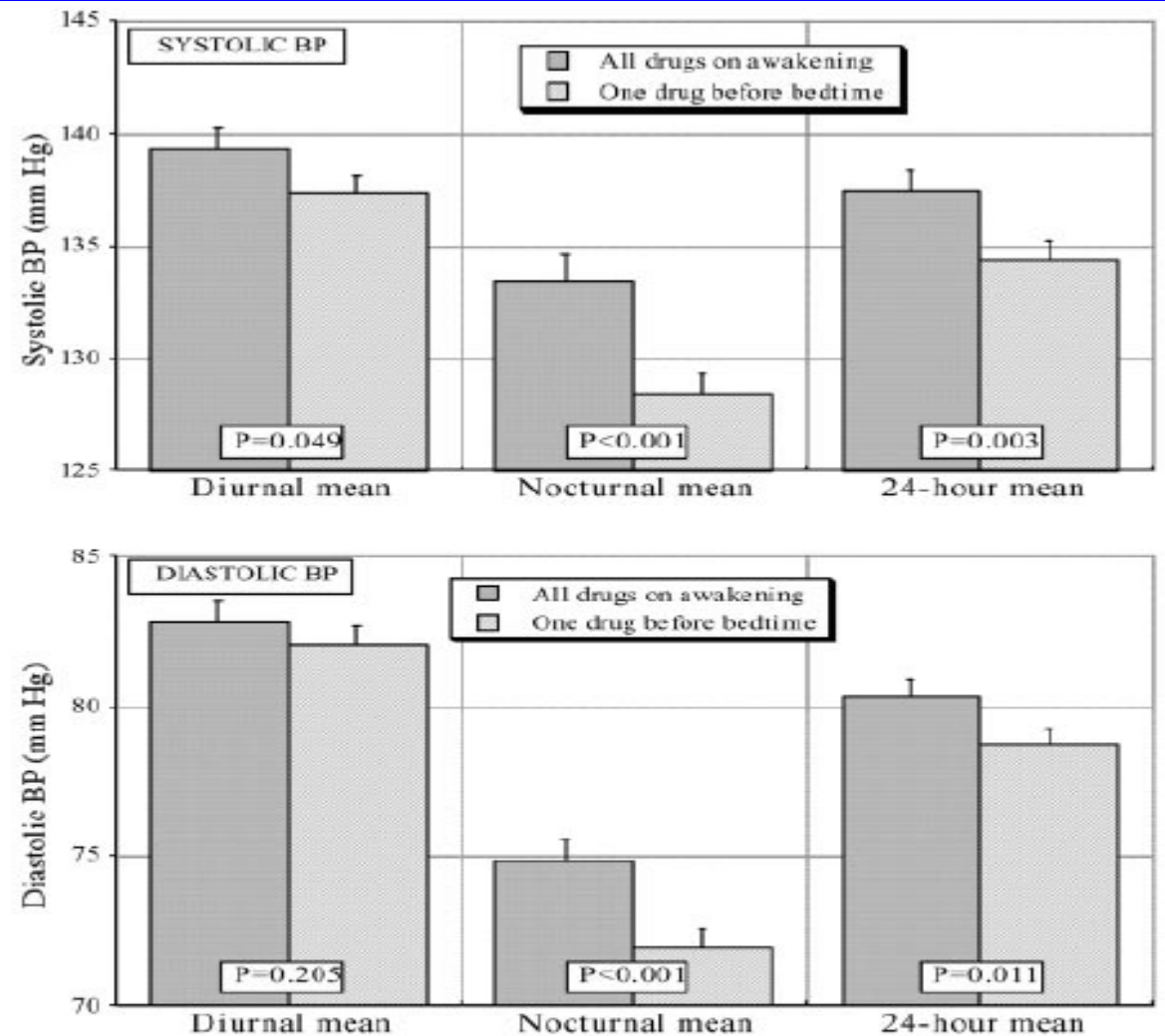


Therapeutic implications

These results suggest that optimal blood pressure control requires strategies that:

- lower blood pressure consistently and fully throughout the 24-h period
- maintain the 'normal' circadian pattern of blood pressure (i.e. with a reduction in overnight blood pressure)
- do not increase blood pressure variability

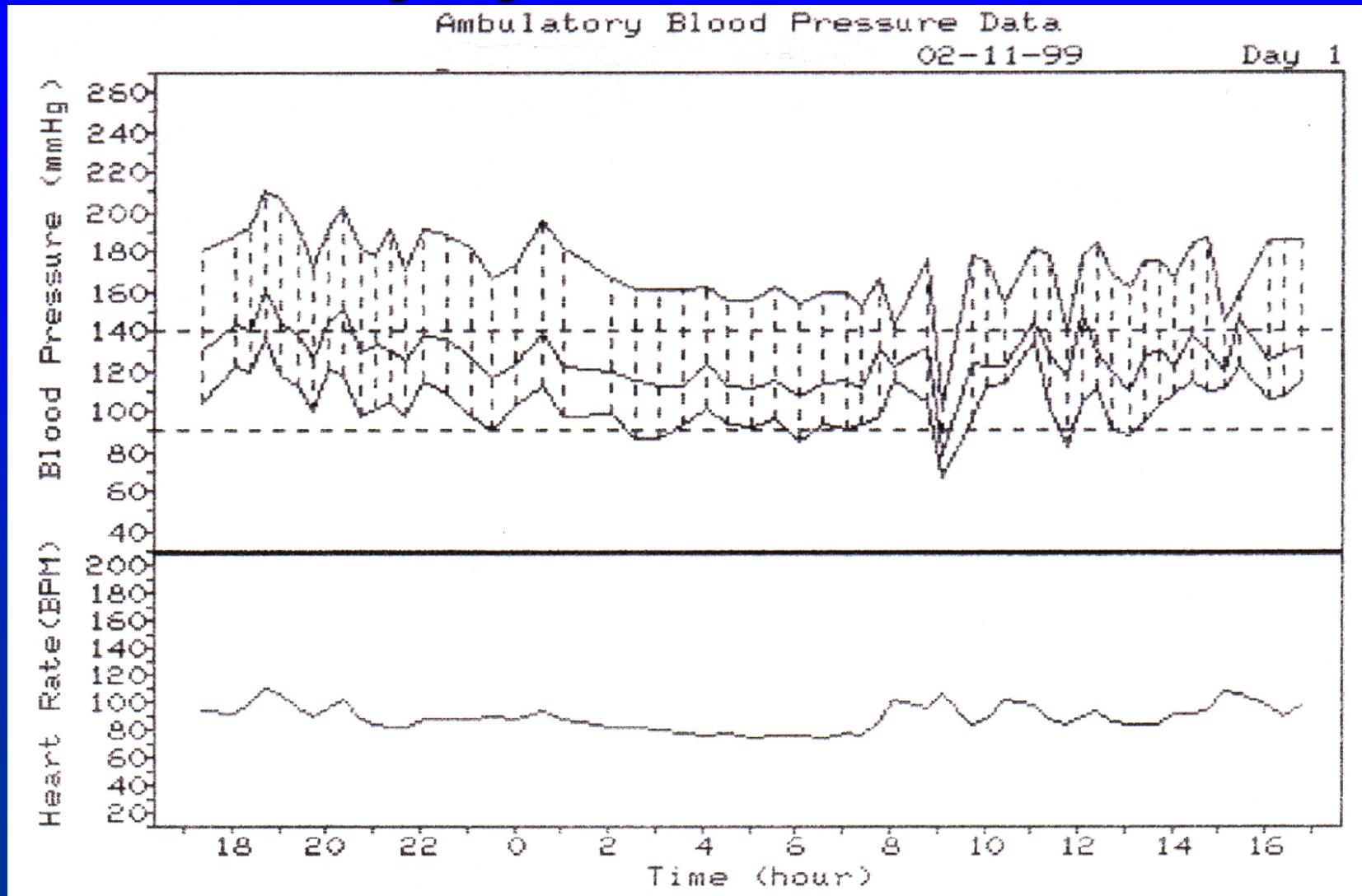
Effects of Time of Day of Treatment on Ambulatory Blood Pressure Pattern of Patients With Resistant Hypertension

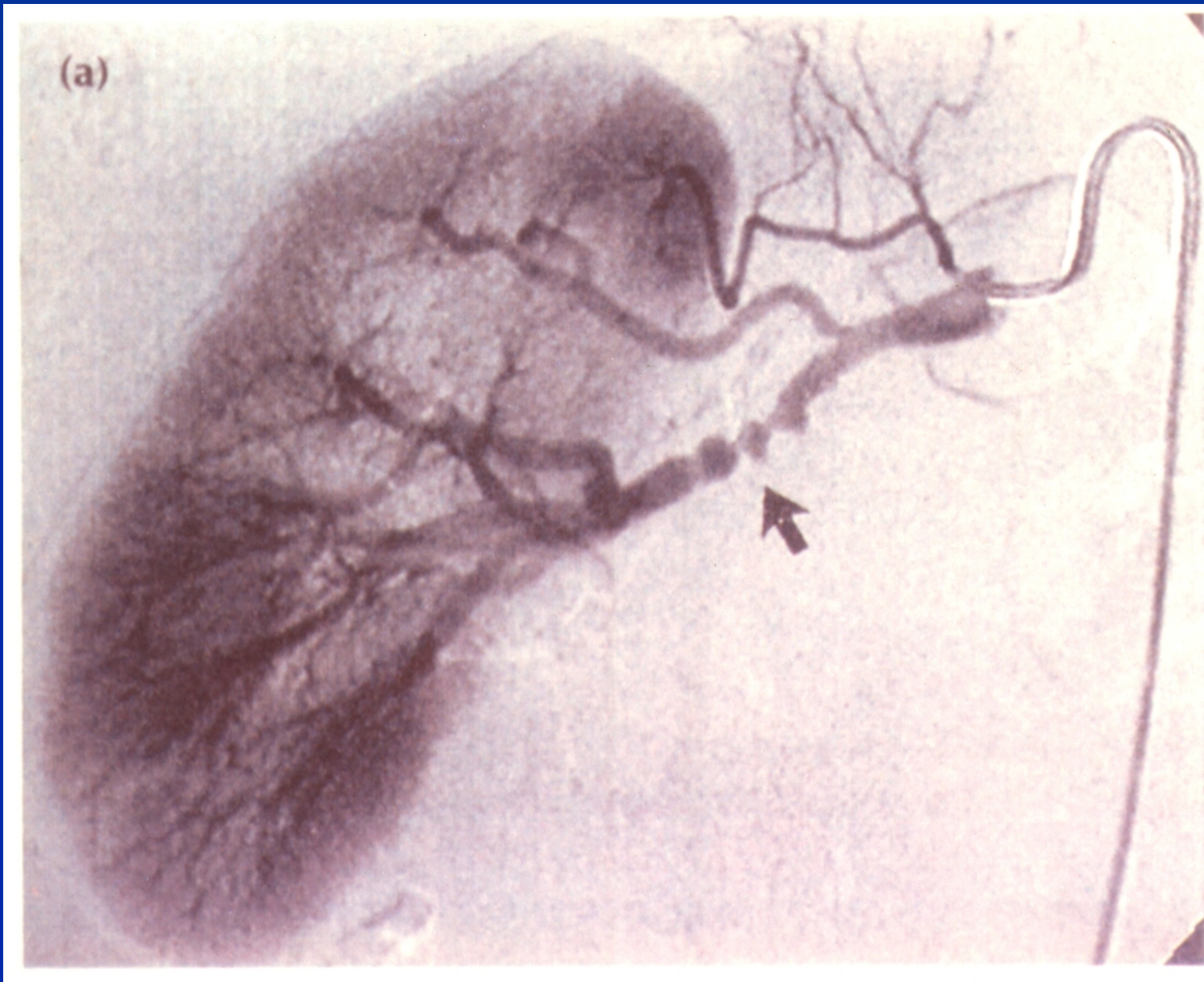


Hypertension October 2005 Part II

Figure 2. Diurnal, nocturnal, and 24-hour means of SBP (top) and DBP (bottom) in patients with resistant hypertension receiving all antihypertensive drugs on awakening, or receiving 1 of the drugs at bedtime, studied by 48-hour ABPM. *P* values are shown for comparison between the 2 groups of patients by ANOVA.

HTA résistante: 3 médicaments dont 1 diurétique pendant au moins 1 mois



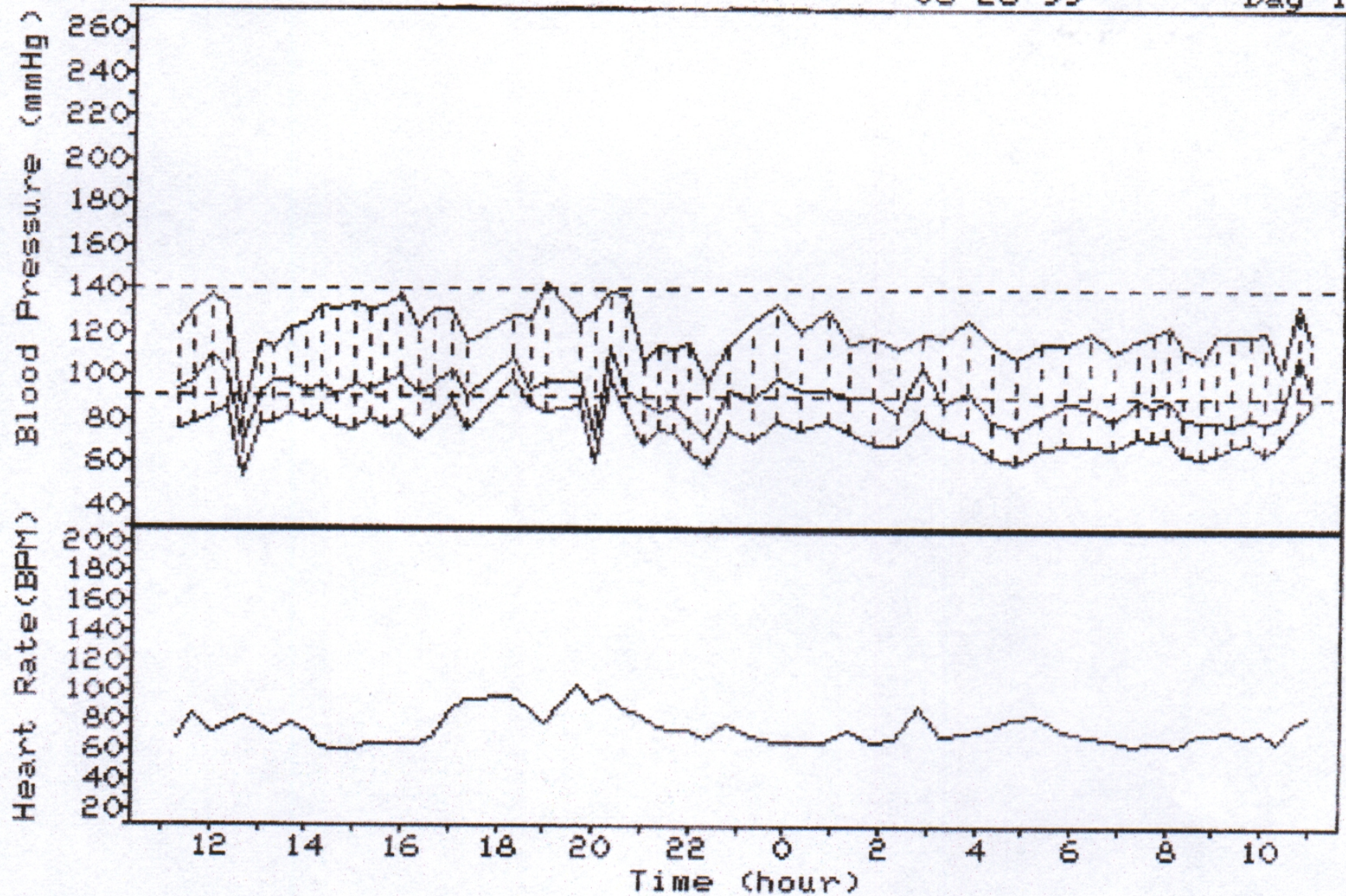


G.B. - Artériographie artères rénales: à D dysplasie fibro-musculaire

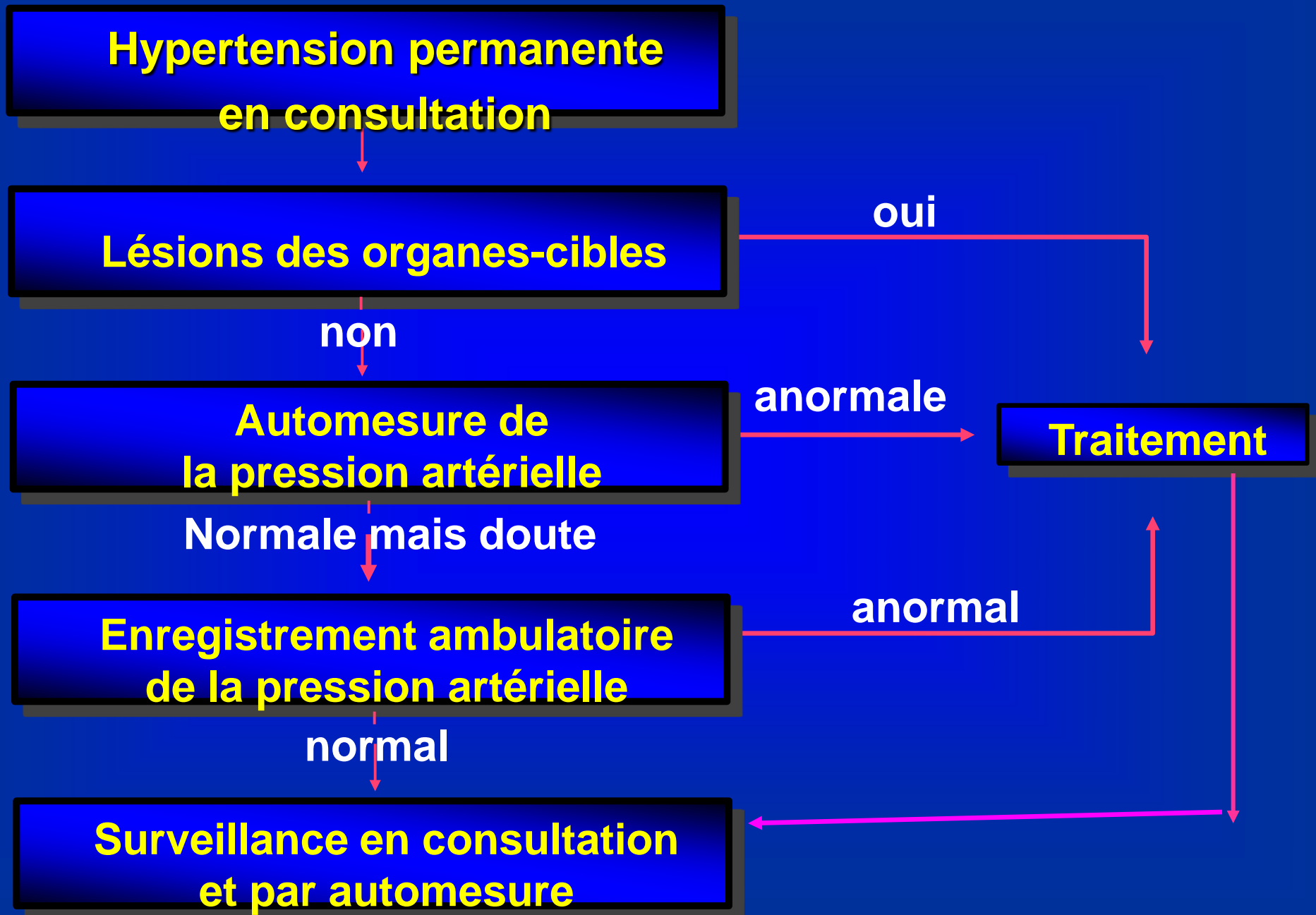
Ambulatory Blood Pressure Data

03-26-99

Day 1



GB. - AMBP 2



Auto-mesure

dableducational.com

- Utile pour valider le niveau de PA mesurée à la consultation
- Nécessite une formation
- Utilisation surtout d'un appareil validé avec brassard.



Position assise, le coude posé sur la table, le bras étendu et décontracté.



*Le brassard doit se situer au niveau du cœur.
Le brassard est enroulé autour du bras dénudé
(bras où la tension est la plus élevée selon
les indications du médecin).*

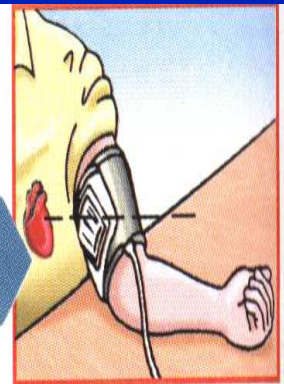


TABLEAU III. MODALITÉS POUR UNE BONNE PRATIQUE D'AUTOMESURE

Ne pas mesurer sa pression artérielle	<ul style="list-style-type: none"> - lors d'un malaise - juste après avoir fumé ou mangé - avant 5 minutes de repos, assis inconfortablement
Effectuer	- 2 mesures, matin et soir (les mesures du 1 ^{er} jour seront exclues).
Noter ou enregistrer les valeurs	<ul style="list-style-type: none"> - sans les sélectionner - à montrer au médecin qui sera seul juge

Technique de mesure idéalement au bras, brassard adapté.

Technique de mesure irréprochable avec un appareil validé

Diagnostic : mesures 7 jours de suite

Suivi : mesures 1 à 2 fois/semaine

Monitoring Ambulatoire de Pression Artérielle de 24h



Paramètres

- PA moyenne de 24 h
- PA moyenne de jour/ de nuit
- Variabilité
- Dipping/ Charge tensionnelle

Indications

- grande variation de PA clinique (intra ou inter-visites)
- PA clinique élevée alors que risque cv faible.
- grande différence entre PA clinique et à domicile.
- suspicion de résistance aux médicaments.
- suspicion d'hypotension surtout chez diabétiques et sujets âgés.
- suspicion de pré-éclampsie.

