

Limites Diagnósticos para Monitorização Ambulatorial da Pressão Arterial com Base em 10 Anos de Risco Cardiovascular



Apresentado por Murilo Fernandes
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Diagnostic Thresholds for Ambulatory Blood Pressure Monitoring Based on 10-Year Cardiovascular Risk

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Background—Current diagnostic thresholds for ambulatory blood pressure (ABP) mainly rely on statistical parameters derived from reference populations. We determined an outcome-driven reference frame for ABP measurement.

Methods and Results—We performed 24-hour ABP monitoring in 5682 participants (mean age 59.0 years; 43.3% women) enrolled in prospective population studies in Copenhagen, Denmark; Noorderkempen, Belgium; Ohasama, Japan; and Uppsala, Sweden. In multivariate analyses, we determined ABP thresholds, which yielded 10-year cardiovascular risks similar to those associated with optimal (120/80 mm Hg), normal (130/85 mm Hg), and high (140/90 mm Hg) blood pressure on office measurement. Over 9.7 years (median), 814 cardiovascular end points occurred, including 377 strokes and 435 cardiac events. Systolic/diastolic thresholds for optimal ABP were 116.8/74.2 mm Hg for 24 hours, 121.6/78.9 mm Hg for daytime, and 100.9/65.3 mm Hg for nighttime. Corresponding thresholds for normal ABP were 123.9/76.8, 129.9/82.6, and 110.2/68.1 mm Hg, respectively, and those for ambulatory hypertension were 131.0/79.4, 138.2/86.4, and 119.5/70.8 mm Hg. After rounding, approximate thresholds for optimal ABP amounted to 115/75 mm Hg for 24 hours, 120/80 mm Hg for daytime, and 100/65 mm Hg for nighttime. Rounded thresholds for normal ABP were 125/75, 130/85, and 110/70 mm Hg, respectively, and those for ambulatory hypertension were 130/80, 140/85, and 120/70 mm Hg.

Conclusions—Population-based outcome-driven thresholds for optimal and normal ABP are lower than those currently proposed by hypertension guidelines. (*Circulation*. 2007;115:2145-2152.)

Key Words: blood pressure monitoring, ambulatory ■ blood pressure ■ hypertension
■ cardiovascular diseases ■ epidemiology

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DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

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DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Introdução:

- Em pessoas de meia idade e nos mais idosos, a hipertensão é indicador predominante de risco cardiovascular



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

- Introdução:
 - Medidas da pressão arterial
 - Método convencional por ausculta
 - Técnica
 - Paciente
 - Monitorização ambulatorial
 - Alta reprodutibilidade
 - Efeito do jaleco branco



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Perspectivas clínicas:

- Necessidade de valores de referência para interpretação e classificação dos pacientes
 - Não guiado por desfechos clínicos
 - Valores derivados de populações de normotensos



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Perspectivas clinicas:

- Banco de dados internacional com o objetivo de determinar os limites diagnósticos para MAPA com base em desfechos cardiovasculares



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Métodos:

- Banco de dados internacional de monitorização ambulatorial da pressão arterial relacionado a desfechos cardiovasculares (IDACO)
 - 4 estudos incluídos
 - Dinamarca, Bélgica, Japão, e Suécia
 - 5682 indivíduos (média de idade: 59 anos)



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Métodos:

- Medida de pressão arterial convencional
 - 2 medidas consecutivas
- Classificação (JNC VI)
 - Ótimo - <120mmHg sistólica e 80mmHg diastólica
 - Normal – 120 a 129mmHg sistólica e 80 a 84mmHg diastólica
 - Hipertensão - > 140mmHg sistólica ou 90mmHg diastólica



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Métodos:

- Monitorização ambulatorial da pressão arterial
 - Medidas de 24 horas
- Questionário
 - História médica
 - Medicação
 - Tabagismo
 - Etilismo



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Eventos:

- Desfechos cardiovasculares fatais ou não fatais
 - AVE
 - IAM
 - Morte súbita
 - Insuficiência Cardíaca
 - Revascularização miocárdica



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

- Resultados:
 - Características dos participantes



TABLE 1. Baseline Characteristics by Cohort

Characteristic	Copenhagen (n=2137)	Noorderkempen (n=1131)	Ohasama (n=1317)	Uppsala (n=1097)	All (n=5682)
Women, n (%)	1024 (47.9)	573 (50.7)	864 (65.6)	0 (0.0)	2461 (43.3)
Age, y	56.4 (10.3)	49.0 (14.6)	61.8 (9.9)	71.0 (0.6)	59.0 (12.5)
Range	41.0–72.8	13.4–87.7	40.1–93.1	69.4–74.1	13.4–93.1
Body mass index, kg/m ²	26.0 (4.1)	25.8 (4.2)	23.5 (3.0)	26.3 (3.4)	25.4 (3.9)
Weight, kg	74.9 (14.1)	72.2 (13.4)	54.2 (9.0)	80.3 (11.6)	70.6 (15.6)
Height, cm	169.5 (9.0)	167.0 (9.4)	151.7 (8.6)	174.8 (5.9)	165.9 (11.8)
Conventional blood pressure, mm Hg					
Systolic	131.2 (19.2)	126.7 (17.8)	131.2 (18.5)	146.7 (18.5)	133.3 (19.8)
Diastolic	83.3 (10.7)	76.7 (10.6)	74.1 (11.4)	83.7 (9.4)	79.9 (11.4)
24-Hour blood pressure, mm Hg					
Systolic	128.6 (12.8)	118.8 (11.1)	123.1 (13.2)	132.9 (15.6)	126.2 (14.0)
Diastolic	75.1 (8.6)	71.3 (7.4)	71.9 (7.8)	75.1 (7.7)	73.6 (8.2)
Daytime blood pressure, mm Hg					
Systolic	136.4 (13.6)	125.0 (11.7)	128.9 (14.3)	140.2 (16.2)	133.1 (15.0)
Diastolic	80.5 (9.2)	77.1 (8.2)	76.1 (8.7)	79.8 (8.7)	78.7 (9.0)
Nighttime blood pressure, mm Hg					
Systolic	115.8 (14.1)	108.5 (12.2)	111.6 (14.7)	119.3 (18.6)	114.0 (15.3)
Diastolic	65.7 (9.1)	61.8 (8.2)	63.6 (8.2)	66.9 (9.0)	64.7 (9.0)
Serum total cholesterol, mmol/L*	6.21 (1.11)	5.68 (1.12)	5.00 (0.88)	5.82 (1.00)	5.75 (1.14)
Diabetes mellitus, n (%)	64 (3.0)	36 (3.2)	232 (17.6)	121 (11.0)	453 (8.0)
Previous cardiovascular disease, n (%)	128 (6.0)	119 (10.5)	72 (5.5)	191 (17.4)	510 (9.0)
Antihypertensive drug treatment, n (%)	319 (14.9)	170 (15.0)	466 (35.4)	383 (34.9)	1338 (23.5)

Data are expressed as mean (SD) unless otherwise noted. All between-cohort differences were significant ($P \leq 0.0001$).

*To convert serum total cholesterol levels to milligrams per deciliter, divide by 0.02586.

DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Resultados:

• Características dos participantes

- Pressão sistólica apresentou-se em média 0,2mmHg maior na medida convencional em relação a mensuração ambulatorial durante o dia ($p= 0,43$)
- Pressão diastólica apresentou-se em média 1,3mmHg maior na medida convencional em relação a mensuração ambulatorial durante o dia ($p < \text{ou} = 0,0001$)



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Resultados:

- Incidência dos “end points” e a relação com a pressão arterial



TABLE 2. Hazard Ratios for Cardiovascular End Points in Relation to Conventional and Ambulatory Blood Pressure at Entry*

	Fatal and Nonfatal Cardiovascular End Points Combined†				
	Cardiovascular Death	All	Stroke	Cardiac	Coronary Heart Disease
End points, n (%)	345 (6.1)	814 (14.3)	377 (6.6)	435 (7.7)	328 (5.8)
Systolic blood pressure					
Conventional	1.11 (1.05 to 1.17)¶	1.12 (1.08 to 1.16)	1.16 (1.09 to 1.22)	1.09 (1.04 to 1.15)¶	1.07 (1.01 to 1.14)‡
24-Hour	1.22 (1.13 to 1.30)	1.24 (1.19 to 1.30)	1.32 (1.23 to 1.41)	1.20 (1.13 to 1.27)	1.17 (1.09 to 1.26)
Daytime	1.16 (1.08 to 1.24)	1.20 (1.15 to 1.25)	1.26 (1.19 to 1.35)	1.16 (1.09 to 1.23)	1.16 (1.08 to 1.25)
Nighttime	1.16 (1.10 to 1.23)	1.18 (1.14 to 1.23)	1.21 (1.15 to 1.28)	1.16 (1.10 to 1.22)	1.12 (1.05 to 1.18)¶
Diastolic blood pressure					
Conventional	1.05 (1.00 to 1.10)	1.07 (1.03 to 1.11)	1.12 (1.07 to 1.17)	1.04 (0.99 to 1.09)	1.05 (1.00 to 1.11)
24-Hour	1.18 (1.10 to 1.25)	1.18 (1.13 to 1.23)	1.27 (1.19 to 1.34)	1.11 (1.05 to 1.18)¶	1.13 (1.05 to 1.20)¶
Daytime	1.12 (1.05 to 1.19)¶	1.13 (1.09 to 1.17)	1.21 (1.14 to 1.28)	1.07 (1.01 to 1.13)‡	1.10 (1.03 to 1.17)§
Nighttime	1.14 (1.08 to 1.21)	1.15 (1.10 to 1.19)	1.20 (1.13 to 1.26)	1.10 (1.05 to 1.16)	1.10 (1.04 to 1.16)§

*The analyses included 5682 subjects.

†Hazard ratios (95% CIs) reflect the risk associated with 10- and 5-mm Hg increases in systolic and diastolic blood pressure, respectively. Hazard ratios were adjusted for cohort, sex, age, body mass index, smoking and drinking, history of cardiovascular disease, diabetes mellitus, treatment with antihypertensive drugs, and serum total cholesterol.

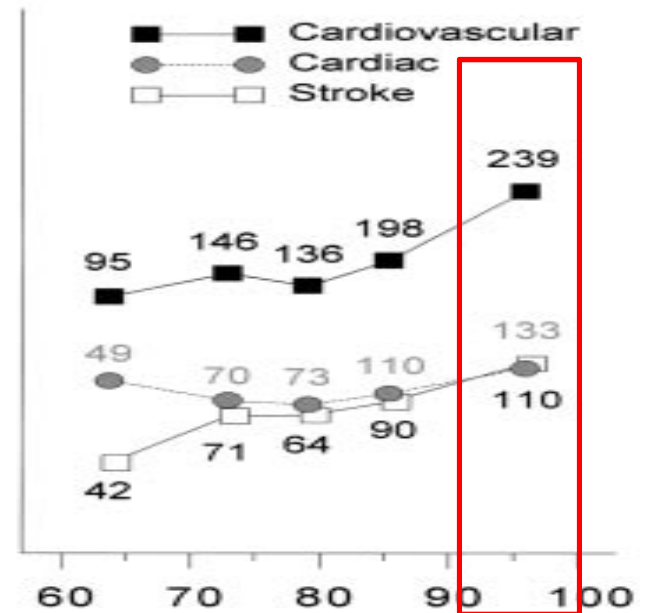
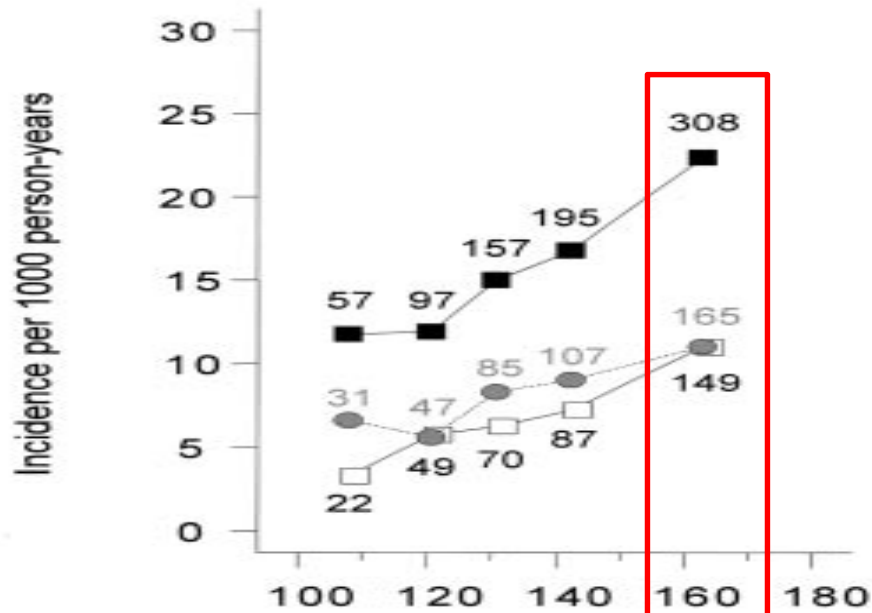
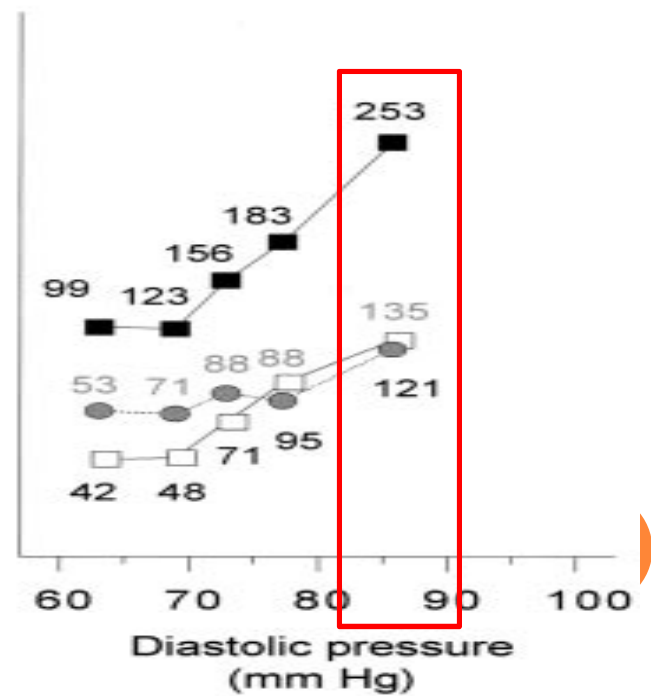
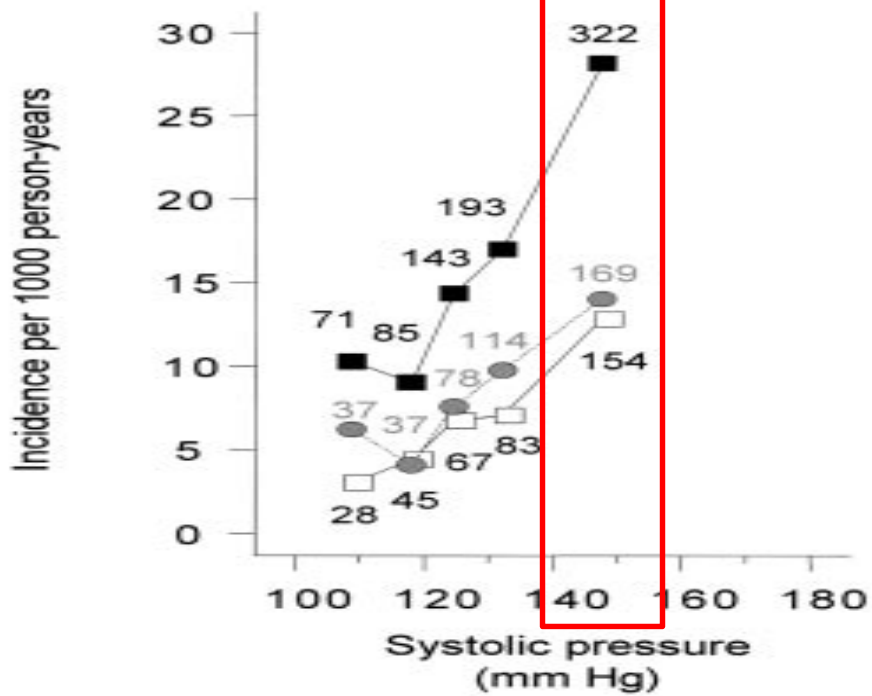
Significance of the hazard ratios: ‡ $P \leq 0.05$; § $P \leq 0.01$; ¶ $P \leq 0.001$; || $P \leq 0.0001$.

DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Resultados:

- Aumento da incidência de eventos cardiovasculares, AVE, e desfechos cardiovasculares em relação a pressão arterial sistólica e diastólica (convencional e 24h)
- A pressão arterial foi considerada um preditor consistente de desfechos cardiovasculares, independente do tipo da mensuração



A**B**

DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

- Limites diagnósticos para a medida de pressão arterial ambulatorial
 - Estabelecido valores diagnósticos para MAPA pela determinação de pontos de corte relacionado ao risco de doença cardiovascular em 10 anos
 - Comparação com a PA de consultório



TABLE 3. Ambulatory Blood Pressure Levels Yielding 10-Year Risks Similar to Those Associated With Optimal or Normal Blood Pressure or Hypertension on Conventional Measurement in All Subjects*

End Point (n)	Category	Conventional Blood Pressure, mm Hg	10-Year Absolute Risk, %	Ambulatory Blood Pressure Levels (95% CI), mm Hg			
				24-Hour	Daytime	Nighttime	
Cardiovascular (814)	Optimal						
	Systolic	120	9.4	116.8 (114.6 to 119.0)	121.6 (119.1 to 124.2)	100.9 (97.5 to 104.2)	
	Diastolic	80	13.1	74.2 (73.9 to 74.6)	78.9 (78.5 to 79.4)	65.9 (64.9 to 65.7)	
	Normal						
	Systolic	130	11.6	123.9 (122.8 to 125.0)	129.9 (128.7 to 131.2)	110.2 (108.5 to 111.8)	
	Diastolic	85	14.3	76.8 (76.3 to 77.4)	82.6 (81.9 to 83.4)	68.1 (67.5 to 68.7)	
Hypertension	Systolic	140	14.3	131.0 (130.6 to 131.4)	138.2 (137.8 to 138.7)	119.5 (118.8 to 120.1)	
	Diastolic	90	15.7	79.4 (78.2 to 80.7)	86.4 (84.5 to 88.2)	70.8 (69.4 to 72.3)	
	Stroke (377)	Optimal					
		Systolic	120	4.0	117.5 (114.7 to 120.4)	122.6 (119.2 to 126.0)	100.9 (96.7 to 105.1)
		Diastolic	80	5.7	74.4 (73.8 to 74.9)	79.1 (78.4 to 79.8)	65.3 (64.6 to 65.9)
		Normal					
	Systolic	130	5.0	124.3 (122.8 to 125.8)	130.4 (128.6 to 132.2)	110.2 (108.0 to 112.3)	
	Diastolic	85	6.6	77.1 (76.7 to 77.6)	82.7 (82.1 to 83.3)	68.5 (67.9 to 69.0)	
	Hypertension						
	Systolic	140	6.4	131.1 (130.7 to 131.5)	138.2 (137.8 to 138.7)	119.4 (118.8 to 120.0)	
	Diastolic	90	7.5	79.9 (78.7 to 81.1)	86.2 (84.6 to 87.9)	71.7 (70.2 to 73.2)	
Cardiac (435)	Optimal						
	Systolic	120	4.4	115.8 (112.6 to 118.9)	120.7 (116.8 to 124.5)	99.9 (95.3 to 104.5)	
	Diastolic	80	6.2	74.0 (73.6 to 74.5)	78.7 (77.9 to 79.4)	65.2 (64.7 to 65.8)	
	Normal						
	Systolic	130	5.4	123.4 (121.8 to 125.0)	129.4 (127.5 to 131.4)	109.7 (107.4 to 112.0)	
	Diastolic	85	6.7	76.7 (75.8 to 77.9)	83.1 (80.7 to 85.5)	67.8 (66.7 to 69.0)	
	Hypertension						
	Systolic	140	6.7	131.0 (130.5 to 131.4)	138.2 (137.7 to 138.8)	119.5 (118.8 to 120.2)	
	Diastolic	90	7.2	79.4 (78.8 to 82.0)	87.5 (87.7 to 92.3)	70.5 (67.7 to 73.2)	

*The analyses were adjusted for cohort. Point estimates and 95% CIs were obtained from the bootstrap distribution of 1000 random samples of the study population with replacement (for further details, see Methods).

TABLE 4. Ambulatory Blood Pressure Levels Yielding 10-Year Risks Similar to Those Associated With Optimal or Normal Blood Pressure or Hypertension on Conventional Measurement in 4344 Subjects Untreated at Baseline*

End Point (n)	Category	Conventional Blood Pressure, mm Hg	10-Year Absolute Risk, %	Ambulatory Blood Pressure Levels (95% CIs), mm Hg			
				24-Hour	Daytime	Nighttime	
Cardiovascular (462)	Optimal						
	Systolic	120	7.5	118.8 (116.6 to 121.0)	125.5 (123.2 to 127.8)	103.2 (99.6 to 106.9)	
	Diastolic	80	9.9	74.4 (74.1 to 74.8)	79.6 (79.2 to 79.9)	65.5 (65.1 to 65.9)	
	Normal						
	Systolic	130	9.3	125.3 (124.4 to 126.2)	132.5 (131.5 to 133.4)	112.1 (110.8 to 113.5)	
	Diastolic	85	10.7	76.4 (75.5 to 77.3)	82.1 (81.0 to 83.2)	67.6 (66.6 to 68.6)	
Hypertension	Systolic	140	11.5	131.9 (131.1 to 132.6)	139.5 (138.7 to 140.2)	121.0 (119.7 to 122.3)	
	Diastolic	90	11.6	78.3 (76.7 to 80.0)	84.6 (82.5 to 86.8)	69.7 (67.7 to 71.6)	
	Stroke (204)	Optimal					
		Systolic	120	3.2	119.5 (116.7 to 122.3)	126.6 (123.7 to 129.4)	103.6 (99.2 to 108.1)
	Diastolic	80	4.4	74.7 (74.2 to 75.2)	79.8 (79.2 to 80.4)	65.8 (65.3 to 66.4)	
		Normal					
Systolic	130	4.0	125.7 (124.5 to 127.0)	133.0 (131.7 to 134.3)	112.3 (110.5 to 114.1)		
	Diastolic	85	4.9	76.8 (75.9 to 77.7)	82.5 (81.4 to 83.6)	68.1 (67.1 to 69.1)	
Hypertension	Systolic	140	5.1	132.0 (131.2 to 132.7)	139.5 (138.8 to 140.2)	120.9 (119.8 to 122.1)	
	Diastolic	90	5.4	78.9 (77.1 to 80.7)	85.1 (82.8 to 87.5)	70.3 (68.3 to 72.3)	
Cardiac (249)	Optimal						
	Systolic	120	3.2	117.6 (114.5 to 120.7)	124.3 (120.8 to 127.7)	101.5 (96.3 to 106.7)	
	Diastolic	80	4.3	74.2 (73.8 to 74.6)	79.4 (78.9 to 79.8)	65.2 (64.7 to 65.7)	
	Normal						
	Systolic	130	4.0	124.8 (123.6 to 126.1)	132.0 (130.6 to 133.4)	111.5 (109.5 to 113.4)	
	Diastolic	85	4.6	76.6 (74.9 to 78.2)	82.4 (80.2 to 84.6)	67.9 (65.9 to 69.9)	
Hypertension	Systolic	140	4.9	132.1 (131.2 to 133.0)	139.7 (138.8 to 140.7)	121.4 (119.7 to 123.2)	
	Diastolic	90	5.0	78.9 (75.6 to 82.2)	85.5 (81.0 to 89.9)	70.6 (66.5 to 74.6)	

*The analyses were adjusted for cohort. Point estimates and 95% CIs were obtained from the bootstrap distribution of 1000 random samples of the study population with replacement (for further details, see Methods).



TABLE 5. Proposal for Outcome-Driven Reference Values for Ambulatory Blood Pressure Measurement*

	24-Hour	Daytime	Nighttime
Optimal blood pressure, mm Hg	<115/75	<120/80	<100/65
Normal blood pressure, mm Hg	<125/75	<130/85	<110/70
Ambulatory hypertension, mm Hg	≥130/80	≥140/85	≥120/70

Threshold values were obtained by rounding the point estimates reported in Table 3 to an integer value ending in 0 or 5.

DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Discussão:

- Pressão arterial elevada medida no consultório, comparada com pressão arterial ótima, foi associado com aumento da frequência de complicações cardiovasculares
- Estabelecido valores diagnósticos para MAPA para determinação de pontos de corte dirigidos por desfechos cardiovasculares



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Discussão:

- Apesar de a relação entre PA e desfechos cardiovasculares ser contínua, pontos de corte auxiliam no diagnóstico e no manejo dos pacientes hipertensos



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Discussão:

• Limitações

- Estudo de 4 populações europeia e japonesa
- Idade avançada (2,1% e 5,9% mais jovens que 30 ou 40 anos)
- Diferenças entre as coortes
 - Uppsala – somente homens
 - Copenhagen – alta prevalência de tabagismo



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Discussão:

- Pontos de corte da pressão arterial sistólica e diastólica para a normalidade, segundo os guidelines europeus foi de 125/80mmHg; nos Estados Unidos de 135/85mmHg na vigília, e 120/75mmHg para o sono



DIAGNOSTIC THRESHOLDS FOR AMBULATORY BLOOD PRESSURE MONITORING BASED ON 10-YEAR CARDIOVASCULAR RISK

○ Discussão:

- Os pesquisadores do presente estudo sugerem que os pontos de corte para níveis de PA considerados normais na MAPA seriam mais baixos do que os propostos pelas diretrizes de hipertensão

