

Hypertension

JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart
Association®



Learn and Live SM

Prognostic Value of the Morning Blood Pressure Surge in 5645 Subjects From 8 Populations

Patrícia Caldas de Oliveira
Residente da Cardiologia
Hospital Sírio Libânes

Introdução

- Vários estudos mostram o pico de complicações cardiovasculares durante a manhã
- PA segue padrão circadiano

Objetivo

- Avaliar se o pico matinal da PA contribui para a estratificação do risco cardiovascular.

Métodos

- IDACO
- 5645 participantes
- Idade média: 53 a
- 54% mulheres
- 8 países: Dinamarca, Bélgica, Rússia, Itália, Japão, China, Uruguai e Polônia.
- Tempo: 11,4 a

Métodos

- MAPA:
 - medidas a cada 30 min durante todo o dia ou
 - 15 a 20 min vigília; 30 a 60 min sono
- Vigília - 10:00 AM to 8:00 PM in (EURO E SUL-AMERICA) e 8:00 AM to 6:00 PM (ASIA)
- Sono 12:00 AM to 6:00 AM (EURO E SUL-AMERICA) 10:00 PM to 4:00 AM (ASIA)
- Razão medida da PA noturna pela diurna

Formas de medição do *morning surge*

- **Sleep-through morning surge**
 - diferença entre a PA da manhã (média PA duas horas após acordar) e a menor medida noturna (a média da menor PA e 2 leituras precedendo imediatamente e após o menor valor)
- **Preawakening morning surge**
 - diferença entre a PA da manhã (média PA duas horas após acordar) e PA antes de acordar (média pressão duas horas antes de acordar)

- A relação entre as complicações cardiovasculares e elevação matinal da pressão arterial não foi linear; foi utilizado o desvio da média da população para estimar o risco étnico e sexo-específicos.

Resultados

Características dos participantes

- 5465 participantes - 3023 Euro (53.6%), 1723 Asia (30.5%), and 899 SUL-AMERICA (15.9%)
- 3048 ♀ (54.0%)

Resultados

- 2305 (40.8%) HAS - 1188 (21.1%) tto antihipertensivo
- Média 24 h PAS 123,3+-13.5 mm Hg e PAD 73.7 +- 8.6 mm Hg
- 785 mortes e 611 eventos cardiovasculares fatais não fatais

Table 1. Baseline Characteristics of the Participants Categorized According to the 90th Percentile of the Systolic Sleep-Through Morning Surge

Characteristics	Sleep-Through Morning Surge		<i>P</i>
	<37.0 mm Hg*	≥37.0 mm Hg*	
Total, n	5075	570	
European	2718 (53.6)	305 (53.5)	0.99
Asian	1550 (30.5)	173 (30.3)	0.92
South American	807 (15.9)	92 (16.1)	0.90
Women	2739 (54.0)	309 (54.2)	0.93
Antihypertensive treatment	992 (19.6)	196 (34.4)	<0.0001
Smokers	1503 (29.6)	187 (32.8)	0.12
Using alcohol	2390 (47.1)	277 (48.6)	0.51
Diabetes mellitus	334 (6.6)	51 (9.0)	0.04
Cardiovascular disorders	348 (6.9)	56 (9.8)	0.01
Age, y	52.5±14.6	57.7±14.5	<0.0001
Body mass index, kg/m ²	25.1±4.2	25.7±4.6	0.001
Conventional SBP, mm Hg	128.7±19.3	138.0±21.7	<0.0001
Ambulatory SBP, mm Hg			
24-hour	122.6±13.4	129.7±13.3	<0.0001
Daytime	128.9±14.3	137.6±14.2	<0.0001
Nighttime	111.8±14.4	112.4±15.0	0.35
Nighttime through	105.6±13.9	101.2±13.8	<0.0001
Preawakening	112.2±15.9	117.9±18.3	<0.0001
After awakening	123.7±15.4	145.8±15.2	<0.0001
Night:day ratio of SBP	0.87±0.08	0.82±0.08	<0.0001
Serum cholesterol, mmol/L	5.55±1.19	5.68±1.15	0.01

The 90th percentiles were determined after stratification for ethnicity and sex. Data are No. (%) or mean±SD. SBP indicates systolic blood pressure. *P* values are for the difference between the 2 groups.

*Mean value of the cutoff point across ethnicities and sex weighted for the No. of participants in each of the strata.

- Em todos os participantes, a **Sleep-through morning surge** e **Preawakening morning surge** tiveram a média de 20.7 ± 12.9 e 13.1 ± 11.9 mm Hg.

Diferença da medida pelo sexo

- Os valores médios da PA do **Sleep-through morning surge** foram menores nas mulheres do que nos homens europeus (40.9 versus 43.2 mm Hg; $P=0.003$) e sul americanos (38.8 versus 41.5 mm Hg; $P=0.041$); o contrário ocorreu entre os asiáticos (52.4 versus 50.1 mm Hg; $P=0.064$).
- Para o **Preawakening morning surge**, as diferenças entre homens e mulheres mostrou-se semelhante: 26,8 versus 29,2 milímetros Hg ($P=0.062$), 22,5 versus 26,9 milímetros Hg ($P=0.059$), e 30,6 versus 27,4 milímetros Hg ($P=0.13$) nos europeus, sul-americanos e asiáticos, respectivamente.

Resultados

- Mortalidade -

- 785 mortes (13.7 per 1000 person years),
- 611 complicações cardiovasculares fatais ou não fatais (11.0 per 1000 person-years).
- 287 mortes de causa cardiovascular e 473 não cardiovascular
- 25 mortes por causa desconhecida
- 281 AVC (fatal em 69 pctes; 140 AVCi, 70 AVCH, desconhecido em 71 casos)

Resultados

- Eventos cardíacos -

- 317 participantes
- Fatal em 102
- 47 IAM fatal e 88 não fatal
- 20 morte súbita, 10 mortes por doença isquêmica do coração
- 25 IC fatal e 84 não fatal
- 43 casos RM percutânea ou cirúrgica

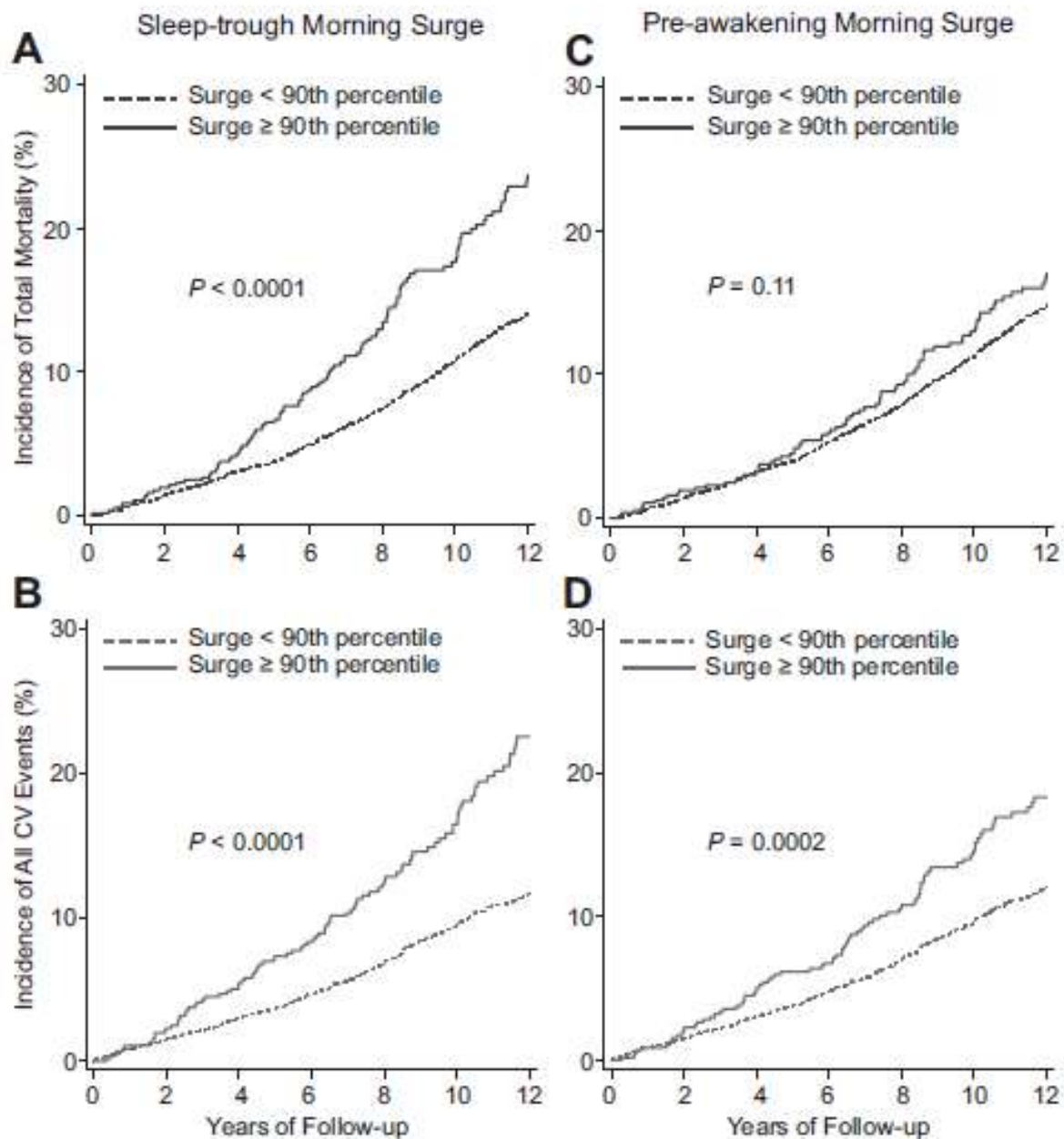


Figure 1. Cumulative incidence of total mortality (A and C) and all cardiovascular (CV) events (B and D) in subjects categorized according to the 90th percentile of the sleep-through (A and B) and the preawakening (C and D) morning surge in systolic blood pressure. P values are for the differences between the 2 groups by the log-rank test.

- Os resultados da ascensão diastólica matinal da PA foram semelhantes aos da PA sistólica.
- A elevação matinal da pressão arterial varia com a diferença entre a pressão arterial diurna e noturna.

Table 2. Multivariable-Adjusted Hazard Ratios for the Sleep-Through and Preawakening Morning Surge in Systolic Blood Pressure

Outcomes (No. of Events)	Sleep-Through Surge (≥ 37.0 mm Hg)		Preawakening Surge (≥ 28.0 mm Hg)	
	Adjusted	Fully Adjusted	Adjusted	Fully Adjusted
Mortality				
All causes (785)	1.18 (0.99 to 1.42)	1.32 (1.09 to 1.59)†	1.11 (0.91 to 1.35)	1.23 (1.00 to 1.51)*
Cardiovascular (287)	1.06 (0.78 to 1.43)	1.18 (0.87 to 1.61)	1.08 (0.78 to 1.51)	1.22 (0.87 to 1.71)
Noncardiovascular (473)	1.28 (1.01 to 1.61)*	1.42 (1.11 to 1.80)†	1.13 (0.87 to 1.46)	1.23 (0.95 to 1.61)
Fatal and nonfatal events				
All cardiovascular (611)	1.18 (0.97 to 1.44)	1.30 (1.06 to 1.60)*	1.31 (1.06 to 1.61)†	1.45 (1.17 to 1.80)‡
Cardiac (317)	1.36 (1.04 to 1.78)*	1.52 (1.15 to 2.00)†	1.52 (1.14 to 2.01)†	1.69 (1.26 to 2.27)‡
Coronary (228)	1.35 (0.98 to 1.85)	1.45 (1.04 to 2.03)*	1.50 (1.08 to 2.09)*	1.64 (1.16 to 2.49)†
Cerebrovascular (281)	0.89 (0.65 to 1.23)	0.95 (0.68 to 1.32)	1.04 (0.75 to 1.44)	1.13 (0.81 to 1.58)
Infarction (140)	0.79 (0.49 to 1.27)	0.85 (0.52 to 1.39)	1.26 (0.82 to 1.92)	1.46 (0.93 to 2.30)
Hemorrhage (70)	1.57 (0.90 to 2.73)	1.46 (0.81 to 2.63)	1.18 (0.64 to 2.18)	1.11 (0.59 to 2.11)

Hazard ratios (95% CIs) express the risk in the top decile of the sleep-through or preawakening morning surge in systolic blood pressure compared with the overall risk in the whole study population. The Cox models included cohort, sex, age, body mass index, smoking and drinking, serum cholesterol, history of cardiovascular disease, diabetes mellitus, antihypertensive drug treatment, 24-hour systolic blood pressure, and 9 design variables coding for the deciles. In fully adjusted models, the systolic night:day blood pressure ratio was additionally included in the Cox model. The cause of death was unknown in 25 cases.

* $P < 0.05$ hazard ratio significance.

† $P < 0.01$ hazard ratio significance.

‡ $P < 0.001$ hazard ratio significance.

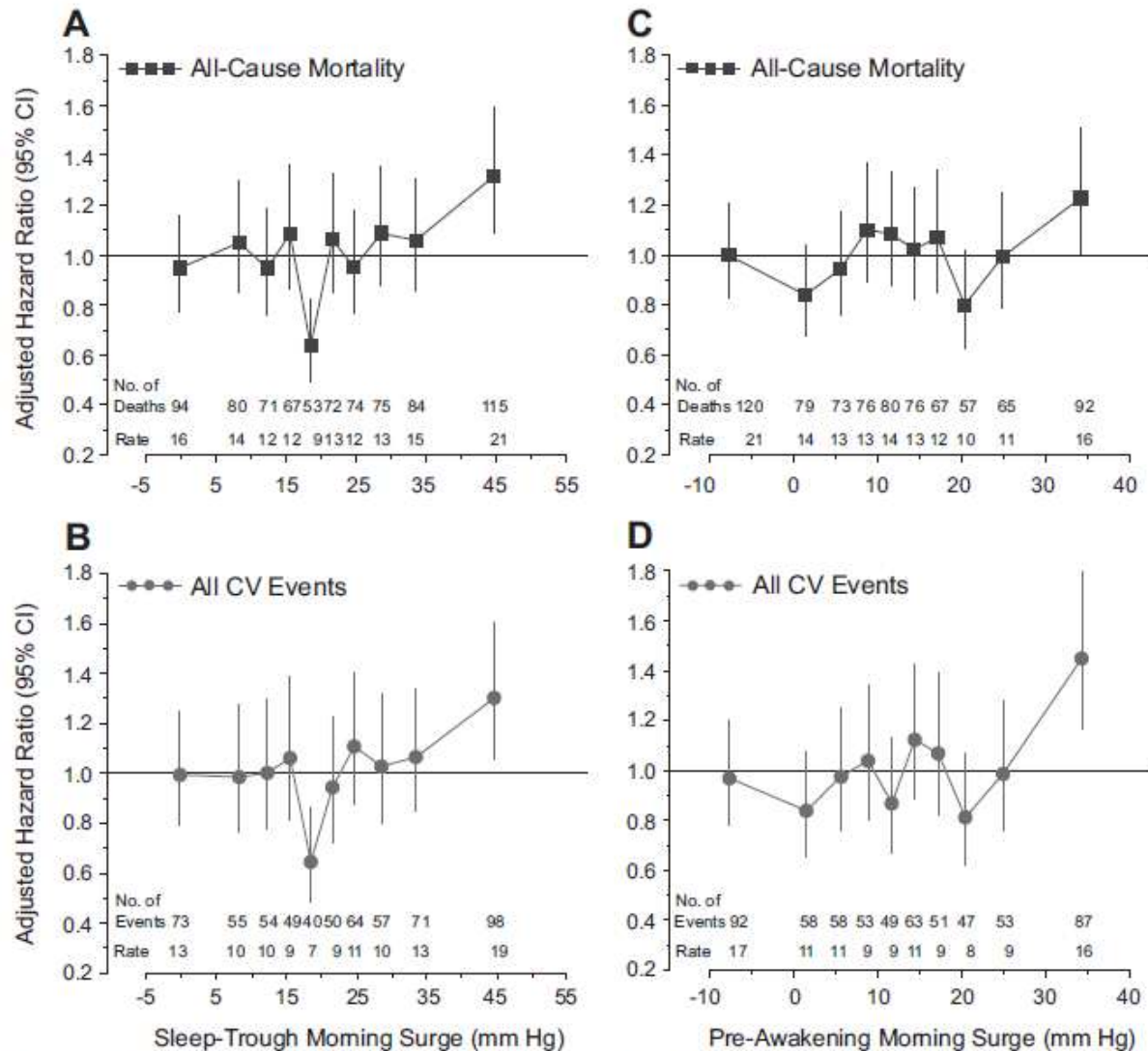


Figure 2. Multivariable-adjusted hazard ratios (95% CIs) for all-cause mortality (A and C) and for all fatal combined with nonfatal cardiovascular (CV) events (B and D) by ethnic- and sex-specific deciles of the sleep-through (A and B) and the preawakening (C and D) morning surge in systolic blood pressure in 5645 subjects. The hazard ratios express the risk in deciles compared with the average risk in the whole study population and were adjusted for cohort, sex, age, body mass index, smoking and drinking, serum cholesterol, history of cardiovascular disease, diabetes mellitus, antihypertensive drug treatment, 24-hour systolic blood pressure, and the systolic night:day blood pressure ratio. The number of events and incidence rates (events per 1000 person-years) are also given for each decile.

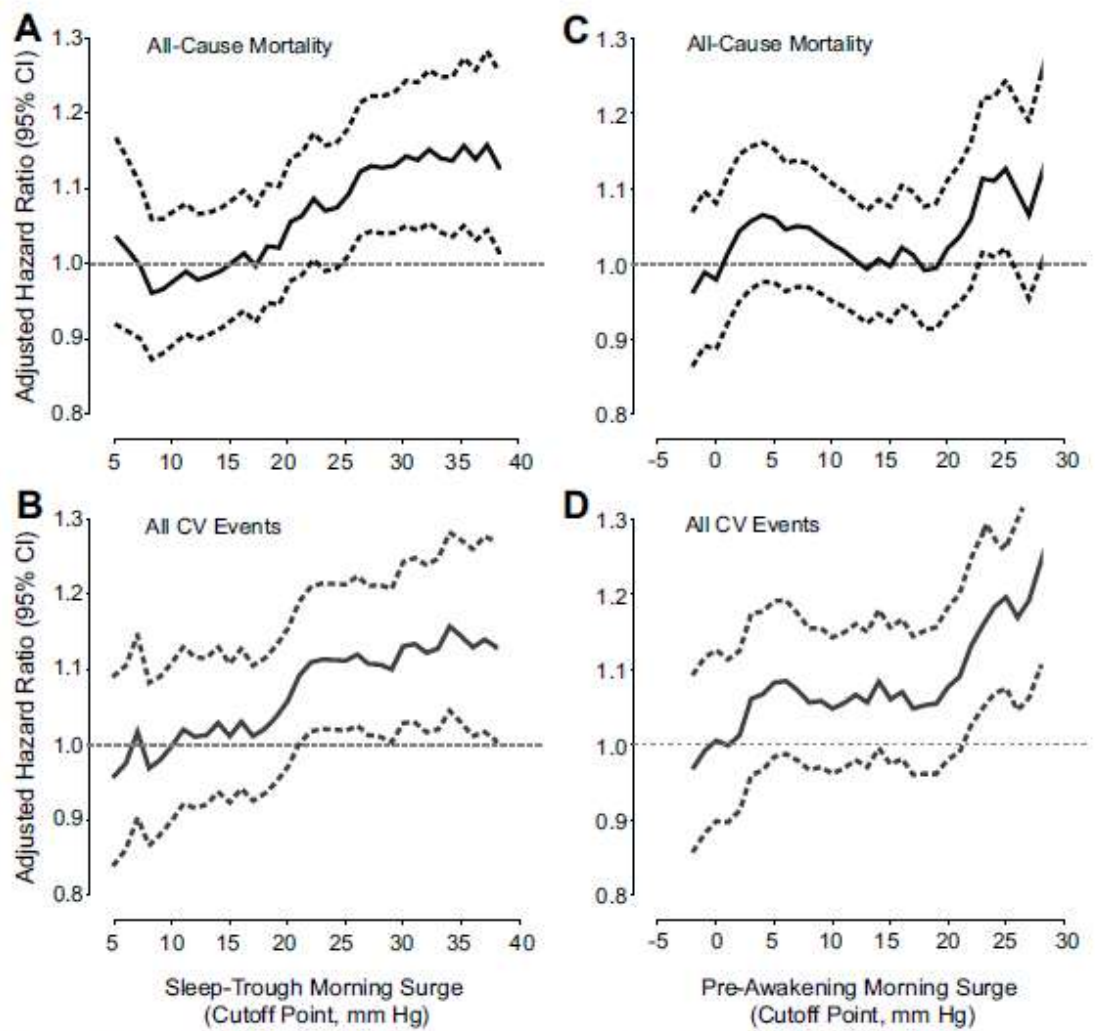


Figure 3. Multivariable-adjusted hazard ratios (solid lines) and their 95% CIs (dashed lines) for all-cause mortality (A and C) and for all fatal combined with nonfatal cardiovascular (CV) events (B and D) by cutoff points ranging from the fifth to 95th percentile for the sleep-through (A and B) and preawakening (C and D) morning surge in systolic blood pressure in 5645 subjects. The hazard ratios express the risk in subjects whose morning surge exceeds the cutoff point compared with the average risk in the whole study population. The hazard ratios were adjusted for cohort, sex, age, body mass index, smoking and drinking, serum cholesterol, history of cardiovascular disease, diabetes mellitus, antihypertensive drug treatment, 24-hour systolic blood pressure, and the systolic night:day blood pressure ratio.

Discussão

- A ascensão matinal da pressão arterial superior ao percentil 90 foi um importante e independente preditor de mortalidade e eventos cardiovasculares
- O MAPA permite testar a hipótese de que a variação diurna na incidência de complicações cardiovasculares varia com mudanças nos níveis da pressão arterial.

Table 3. Multivariable-Adjusted Hazard Ratios for the Sleep-Through and Preawakening Morning Surge in Systolic Blood Pressure According to Baseline Characteristics

Stratification	All-Cause Mortality				All Cardiovascular Events		
	At Risk, n	Deaths, n	Sleep-Through MS (≥ 37.0 mm Hg)	Preawakening MS (≥ 28.0 mm Hg)	Events, n	Sleep-Through MS (≥ 37.0 mm Hg)	Preawakening MS (≥ 28.0 mm Hg)
All participants	5645	785	1.32 (1.09 to 1.59)†	1.23 (1.00 to 1.51)*	611	1.30 (1.06 to 1.60)*	1.45 (1.17 to 1.80)‡
Women	3048	321	1.15 (0.86 to 1.54)	1.20 (0.88 to 1.64)	251	1.07 (0.78 to 1.49)	1.34 (0.96 to 1.87)
Men	2597	464	1.45 (1.14 to 1.86)†	1.28 (0.98 to 1.68)	360	1.49 (1.14 to 1.95)†	1.54 (1.15 to 2.05)†
<60 years	3558	134	1.27 (0.75 to 2.15)	1.22 (0.75 to 2.01)	151	1.35 (0.86 to 2.12)	1.36 (0.88 to 2.08)
≥ 60 years	2087	651	1.31 (1.07 to 1.61)†	1.22 (0.98 to 1.53)	460	1.28 (1.01 to 1.62)*	1.46 (1.14 to 1.88)†
No history of CVD	5241	660	1.28 (1.04 to 1.58)*	1.18 (0.94 to 1.47)	501	1.23 (0.98 to 1.56)	1.46 (1.16 to 1.85)†
History of CVD	404	125	1.74 (1.10 to 2.77)*	1.83 (1.10 to 3.04)*	110	1.64 (1.01 to 2.66)*	1.71 (0.99 to 2.94)
Untreated	4457	464	1.22 (0.93 to 1.58)	1.16 (0.89 to 1.51)	332	1.11 (0.82 to 1.51)	1.41 (1.06 to 1.87)*
Treated	1188	321	1.43 (1.09 to 1.89)*	1.35 (0.98 to 1.87)	279	1.46 (1.09 to 1.95)*	1.49 (1.07 to 2.08)*
Normotensive	3340	290	1.55 (1.11 to 2.16)*	1.27 (0.92 to 1.76)	178	1.54 (1.01 to 2.34)*	1.61 (1.11 to 2.34)*
Hypertensive	2305	495	1.28 (1.02 to 1.61)*	1.25 (0.96 to 1.63)	433	1.26 (0.99 to 1.60)	1.39 (1.07 to 1.82)*
Nonsmokers	3955	485	1.08 (0.84 to 1.39)§	0.91 (0.68 to 1.23)§	389	1.12 (0.86 to 1.47)	1.21 (0.90 to 1.62)
Smokers	1690	300	1.75 (1.31 to 2.33)‡§	1.79 (1.34 to 2.39)‡§	222	1.59 (1.14 to 2.22)†	1.84 (1.32 to 2.56)‡
Nondrinkers	2978	409	1.15 (0.87 to 1.51)	1.13 (0.84 to 1.51)	318	1.06 (0.78 to 1.43)§	1.32 (0.98 to 1.78)
Drinkers	2667	376	1.48 (1.14 to 1.91)†	1.36 (1.02 to 1.81)*	293	1.62 (1.22 to 2.14)‡§	1.64 (1.20 to 2.24)†
European	3023	408	1.38 (1.06 to 1.80)*	1.24 (0.93 to 1.65)	304	1.53 (1.15 to 2.05)†	1.83 (1.36 to 2.45)‡
Asian	1723	319	1.37 (1.03 to 1.84)*	1.24 (0.91 to 1.70)	234	1.17 (0.83 to 1.66)	1.26 (0.88 to 1.81)
South American	899	58	0.67 (0.28 to 1.60)	1.14 (0.51 to 2.59)	73	1.05 (0.56 to 1.96)	1.08 (0.54 to 2.13)

MS indicates the morning surge in systolic blood pressure. Hazard ratios (95% CIs) express the risk in the top decile compared with the average risk in the whole study population. The Cox models included cohort, sex, age, body mass index, smoking and drinking, serum cholesterol, history of cardiovascular disease, diabetes mellitus, antihypertensive drug treatment, 24-hour systolic blood pressure, 9 design variables coding for the deciles, and the systolic night:day blood pressure ratio.

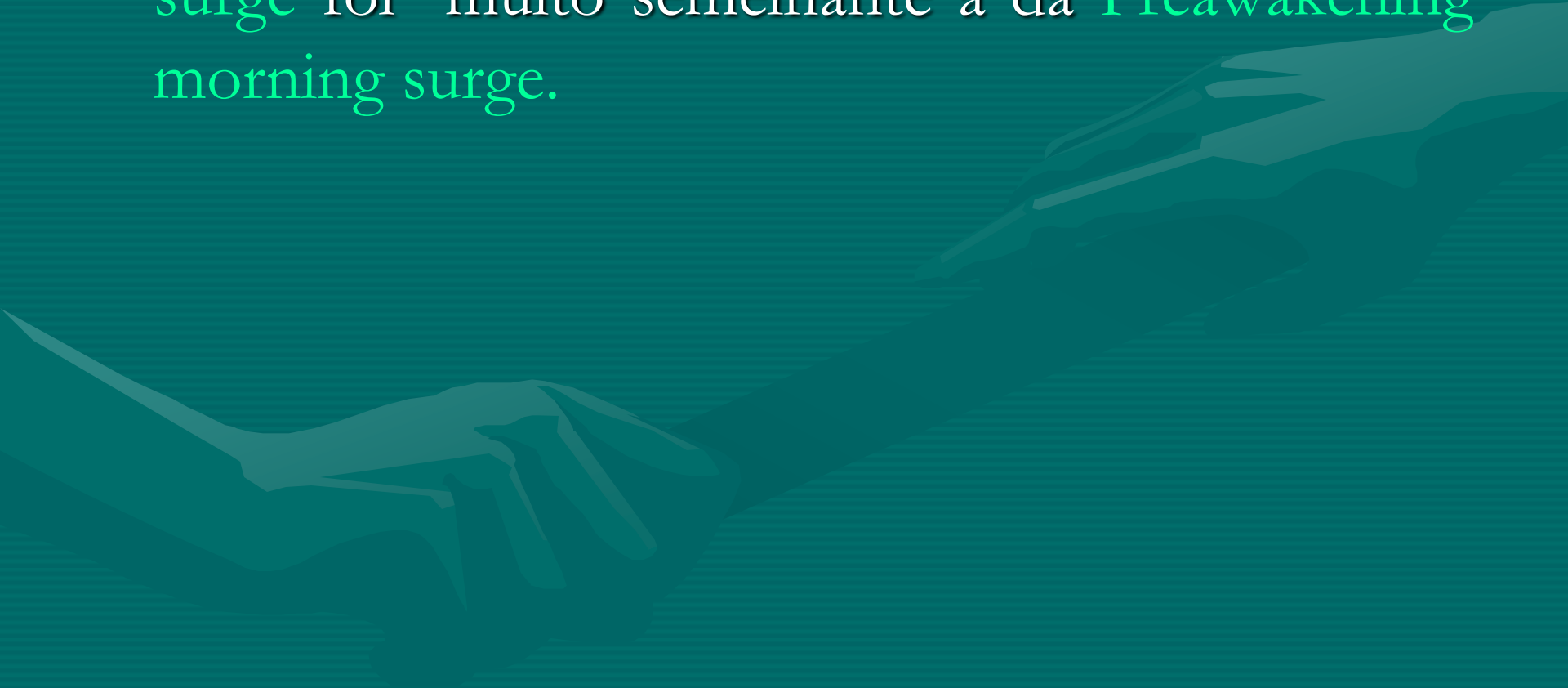
* $P < 0.05$ hazard ratio significance.

† $P < 0.01$ hazard ratio significance.

‡ $P < 0.001$ hazard ratio significance.

§Heterogeneity between corresponding subgroups ($P \leq 0.04$).

- O valor preditivo da **Sleep-through morning surge** foi muito semelhante à da **Preawakening morning surge**.



- Embora tanto a elevação sistólica e diastólica matinal da pressão arterial preverem risco, o estudo sugere usar apenas a ascensão na PAS, como um indicador de risco.

Limitações do estudo

- Nenhum dos estudos incluídos foi desenhado prospectivamente para avaliar o risco associado à elevação matinal da pressão arterial.
- Mais Europeus
- Não explica os mecanismos pelo qual o pico matinal se comporta como preditor independente de mortalidade e eventos cardiovasculares.