SUPPLEMENTAL MATERIAL

Supplementary file 1: Cardiovascular health metrics in CoLaus/HypnoLaus.

Smoking status was adapted from the American Heart Association criteria, as time since smoking cessation was not available. Ideal smoking status was assigned to subjects that never smoked.

Body mass index (BMI) was categorized according to AHA criteria, with ideal BMI corresponding to a value <25 kg/m^2.

Physical activity was assessed by the physical activity frequency questionnaire (PAFQ), which has been validated in the population of Geneva [1]. This self-reported questionnaire assesses the type and duration of 70 kinds of (non)professional activities and sports during the previous week. We summed up the duration of all walking items including slow cycling and considered fast/uphill walking as vigorous activity together with all other sports assessed in the questionnaire. We counted the frequency of sports (incl. fast/uphill walking) per week and categorized subjects as having ideal physical activity, when subjects reported to either walk more than one hour daily or practicing sports at least three times per week.

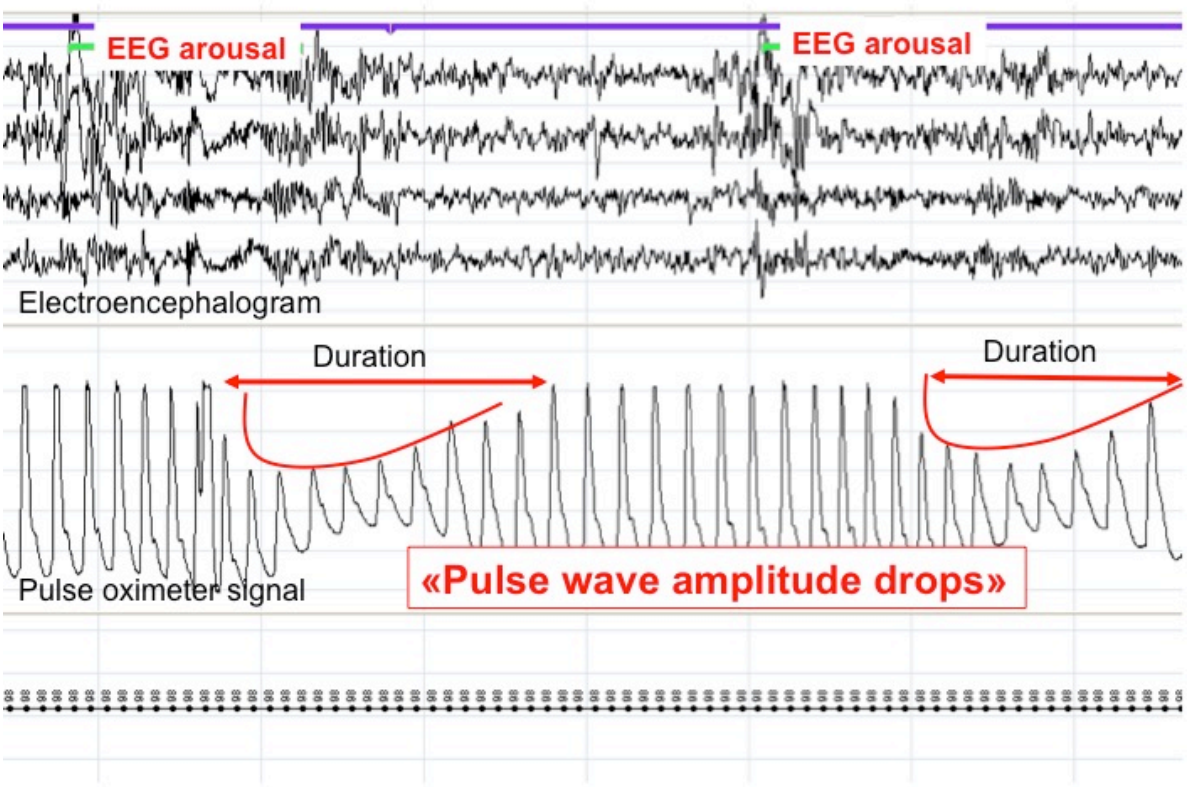
Dietary intake was assessed using a self-administered, semi-quantitative food frequency questionnaire (FFQ) [2], which has been validated in the Geneva population [2,3]. Briefly, this FFQ assesses the frequency of 97 different food items of the previous 4 weeks [4]. We adapted the diet measure from the AHA criteria [5] as sodium intake was not available in CoLaus. Hence, the diet metric was constructed from the intake of fruits and vegetables, fiber, fish and sugar-sweetened beverages. Subjects reporting to consume at least 787 g/day fruits and vegetables, at least 85g/day of fiber-rich whole grains, at least 198 g/week fish and less than 153 ml/day of sugar-sweetened beverages were considered as having an ideal diet.

Ideal ***total cholesterol*** and ideal ***fasting plasma glucose*** were defined as untreated values <5.18 mmol/L and <5.55 mmol/L, respectively. Ideal ***blood pressure*** was defined as untreated values <120 mm Hg and <80 mm Hg for systolic and diastolic blood pressure, respectively. All three biological measures correspond to the AHA criteria.

Supplementary table 1: CVH metrics as defined by AHA and as used in CoLaus/HypnoLaus.

Metric		Poor	Intermediate	Ideal
Smoking status				
AHA		Current smoker	Former smoker, <12 months	Never or quit >12 months
CoLaus		Current smoker	Former smoker	Never smoker
Body mass index				
AHA		≥30 kg/m^2	25–29.9 kg/m^2	<25 kg/m^2
CoLaus		≥30 kg/m^2	25–29.9 kg/m^2	<25 kg/m^2
Physical activity				
AHA		None	1–149 min/week moderate intensity **or** 1–74 min/week vigorous intensity **or** 1–149 min/week moderate + vigorous	≥150 min/week moderate intensity **or** ≥75 min/week vigorous intensity **or** ≥150 min/week moderate + vigorous
CoLaus		<1 h/ daily, <1 sports weekly	<1 h/day walking **and** 1-2 times sports weekly	≥1 h/day **or** thrice sports weekly
Healthy diet score				
AHA	fruits/veg. ≥ 4.5 cups/day fish ≥twice 3.5oz/week fiber-rich whole grains≥3 oz/day sodium <1500 mg/day sw. beverages ≤ 36 oz/week	0–1 ideal components	2–3 ideal components	4–5 ideal components
CoLaus	fruits/veg. ≥ 787.5 g/day fish ≥198 g/week fiber-rich whole grains ≥85 g/day sw. beverages ≤1064 ml/week	0–1 ideal components	2–3 ideal components	4 ideal components
Total cholesterol				
AHA		≥240 mg/dL	200–239 mg/dL **or** treated to goal	<200 mg/dL
CoLaus		≥6.22 mmol/L	5.18-6.21 mmol/L **or** <5.18 mmol/L on medications	<5.18 mmol/L free of medication
Blood pressure				
AHA		SBP ≥140 **or** DBP ≥90 mm Hg	SBP 120–139 **or** DBP 80–89 mm Hg **or** treated to goal	SBP <120 **and** DBP<80 mm Hg
CoLaus		SBP ≥140 **or** DBP ≥90 mm Hg	SBP 120–139 **or** DBP 80–89 mm Hg **or** <120/80 mm Hg on medication	SBP <120 **and** DBP<80 mm Hg free of medication
Fasting plasma glucose				
AHA		≥ 126 mg/dL	100–125 mg/dL **or** treated to goal	<100 mg/dL
CoLaus		≥ 6.99 mmol/L	5.55-6.98 mmol/L **or** <5.55 mmol/L on medication	< 5,55 mmol/L free of medication

Supplementary figure 1: Measurement of pulse wave amplitude drops of at least >30% of baseline pulse wave amplitude



EEG: Electroencephalography

Supplementary file 2: Covariates.

Education level was categorized as low (mandatory education or apprenticeship), intermediate (high school diploma) and high (university diploma). Depressive status was measured with the previously validated 20-item CES-D questionnaire, and subjects were considered as presenting a depressive status when having a sum score of at least 17 for men and 23 for women[6]. Alcohol consumption was categorized as never/less than daily, one or two glasses per day and three or more glasses per day. Consumption of prescribed and over the counter sleep medications was self-reported (yes/no).

Supplementary table 2: Characteristics of the included and excluded subjects.

	Included (n=1826)	**Excluded (n=336)**	**p-value**
Male gender	880 (48.2)	176 (52.4)	0.158
Age (years)*	56.6 ± 10.1	63.8 ± 10.9	<0.001
Education level			<0.001
Low	897 (49.1)	210 (62.9)	
Middle	513 (28.1)	76 (22.8)	
High	416 (22.8)	48 (14.4)	
Living alone	756 (40.9)	139 (43.4)	0.387
Alcohol			0.027
Never/rare	337 (21.6)	70 (26.6)	
1-2 drinks/day	1200 (76.7)	184 (70.0)	
≥3 drinks/day	27 (1.7)	9 (3.4)	
Depression	242 (14.2)	42 (19.6)	0.035
Sleeping pills	261 (14.3)	78 (23.2)	<0.001

N (%) or * mean ± SD. P-values from Pearson chi2 or ANOVA when appropriate

Supplementary table 3: Results of sensitivity analyses for multivariate linear regression: effect of sleep characteristics on cardiovascular health measured as continuous variable ranging from 0-7 and 0-14.

	Cardiovascular health (0-7)		**Cardiovascular health (0-14)**	
	Beta	**p-value**	**Beta**	**p-value**
Total sleep time				
6-8h (ref.)	0		0	
<6h	-0.015	0.485	-0.021	0.352
>8h	-0.016	0.454	-0.014	0.537
Stage 1	**-0.069**	**0.002**	**-0.087**	**<0.001**
Stage 2	0.001	0.969	-0.009	0.667
Slow wave sleep	**0.049**	**0.024**	**0.059**	**0.008**
Rapid eye movement	0.005	0.807	0.028	0.212
Sleep efficiency	-0.015	0.513	-0.021	0.363
Arousal index[§]	**-0.104**	**<0.001**	**-0.124**	**<0.001**
Autonomic arousal index[§]	0.023	0.297	**0.063**	**0.006**
Autonomic arousal duration	**-0.043**	**0.048**	-0.014	0.523
Periodic limb movement index	-0.030	0.176	**-0.061**	**0.008**
Apnea/hypopnea index[‖]	**-0.184**	**<0.001**	**-0.218**	**<0.001**
Oxygen desaturation index[‖]	**-0.201**	**<0.001**	**-0.239**	**<0.001**
Mean oxygen saturation (SpO_2)	**0.241**	**<0.001**	**0.280**	**<0.001**
SpO_2<90*	**-0.111**	**<0.001**	**-0.139**	**<0.001**
Subj. sleep duration[1]				
6-8h (ref.)	0		0	
<6h	**-0.056**	**0.008**	**-0.046**	**0.034**
>8h	-0.041	0.055	**-0.054**	**0.013**
Excessive daytime sleepiness [2]	-0.011	0.621	-0.024	0.288

[§] divided by 5; [‖] divided by 10; [1] N=1811 [2] N=1750

* Percentage of total sleep time spent under a 90% oxygen saturation threshold

Results are expressed as standardized regression coefficients

Supplementary table 4: Results of sensitivity analyses for multinomial logistic regressions: Effects of sleep characteristics on behavioral CVH constructed without BMI 1) and no adjustment 2) with adjustment for BMI.

	Behavioral CVH without BMI (poor=ref)				**Behavioral CVH without BMI (poor=ref) – adjusted for BMI**			
	Intermediate		**Ideal**		**Intermediate**		**Ideal**	
	RRR	**p-value**	**RRR**	**p-value**	**RRR**	**p-value**	**RRR**	**p-value**
Total sleep time								
6-8h (ref.)	1		1		1		1	
<6h	0.97 (0.69 - 1.36)	0.853	**0.63 (0.43 - 0.91)**	**0.014**	0.96 (0.68 - 1.35)	0.818	0.62 (0.43 - 0.91)	0.013
>8h	0.69 (0.44 - 1.07)	0.094	0.72 (0.46 - 1.14)	0.162	0.71 (0.45 - 1.10)	0.121	0.75 (0.47 - 1.19)	0.222
Stage1	0.98 (0.96 – 1.00)	0.082	0.98 (0.96 – 1.00)	0.062	0.99 (0.97 - 1.01)	0.203	0.99 (0.96 - 1.01)	0.188
Stage2	1.00 (0.99 - 1.02)	0.812	1.01 (0.99 - 1.02)	0.487	1.00 (0.99 - 1.02)	0.805	1.01 (0.99 - 1.02)	0.466
Slow wave sleep	1.01 (0.99 - 1.03)	0.228	1.01 (0.99 - 1.03)	0.504	1.01 (0.99 - 1.03)	0.411	1.00 (0.98 - 1.02)	0.829
Rapid eye movement	1.00 (0.98 - 1.03)	0.954	1.00 (0.98 - 1.03)	0.831	1.00 (0.98 - 1.03)	0.976	1.00 (0.98 - 1.03)	0.882
Sleep efficiency	0.99 (0.98 - 1.01)	0.517	0.99 (0.98 - 1.01)	0.531	0.99 (0.98 - 1.01)	0.457	0.99 (0.98 - 1.01)	0.468
Arousal index§	0.98 (0.91 - 1.05)	0.490	0.98 (0.91 - 1.05)	0.500	1.00 (0.93 - 1.07)	0.999	1.01 (0.93 - 1.08)	0.859
Autonomic arousal index§	1.01 (0.97 - 1.04)	0.742	1.03 (1.00 - 1.07)	0.085	1.00 (0.97 - 1.04)	0.890	1.03 (0.99 - 1.06)	0.145
Autonomic arousal duration	0.98 (0.93 - 1.03)	0.388	1.01 (0.96 - 1.06)	0.843	0.99 (0.94 - 1.03)	0.575	1.01 (0.96 - 1.07)	0.596
Periodic limb movement index	1.00 (0.99 – 1.00)	0.360	1.00 (0.99 - 1.01)	0.907	1.00 (0.99 - 1.00)	0.539	1.00 (0.99 - 1.01)	0.632
Apnea/hypopnea index‖	0.92 (0.84 – 1.00)	0.060	0.91 (0.83 - 1.01)	0.063	0.96 (0.88 - 1.06)	0.447	0.98 (0.88 - 1.08)	0.678
Oxygen desaturation index‖	**0.89 (0.81 - 0.97)**	**0.011**	**0.90 (0.81 - 0.99)**	**0.036**	0.94 (0.85 - 1.03)	0.192	0.98 (0.88 - 1.09)	0.653
Mean oxygen saturation (SpO_2)	1.07 (0.98 - 1.16)	0.140	**1.20 (1.10 - 1.32)**	**<0.001**	1.01 (0.92 - 1.11)	0.774	**1.14 (1.03 - 1.26)**	**0.013**
SpO_2<90*	1.00 (0.99 - 1.01)	0.485	**0.98 (0.96 - 0.99)**	**0.001**	1.00 (0.99 - 1.01)	0.884	**0.98 (0.97 - 0.99)**	**0.009**
Subj. sleep duration[1]								
6-8h (ref.)	1		1		1		1	
<6h	0.72 (0.45 - 1.15)	0.174	**0.57 (0.34 - 0.96)**	**0.033**	0.75 (0.47 - 1.20)	0.229	0.60 (0.36 - 1.01)	0.053
>8h	0.87 (0.53 - 1.43)	0.582	0.71 (0.41 - 1.22)	0.213	0.90 (0.54 - 1.49)	0.677	0.74 (0.43 - 1.28)	0.285
Excessive daytime sleepiness [2]	1.05 (0.67 - 1.65)	0.831	0.87 (0.54 - 1.40)	0.560	1.07 (0.68 - 1.69)	0.764	0.89 (0.55 - 1.44)	0.637

§ divided by 5; ‖ divided by 10; [1] N=1811 [2] N=1750

* Percentage of total sleep time spent under a 90% oxygen saturation threshold

Supplementary table 5: Results of sensitivity analyses for multinomial logistic regressions: Effect of sleep characteristics on global CVH with adjustment for 1) depression, sleeping pills and alcohol (n=1469) and 2) all sleep characteristics (n=1741).

	Global CVH (poor=ref) †				**Global CVH (poor=ref) ǂ**			
	Intermediate		**Ideal**		**Intermediate**		**Ideal**	
	RRR	**p-value**	**RRR**	**p-value**	**RRR**	**p-value**	**RRR**	**p-value**
Total sleep time								
6-8h (ref.)	1		1		1		1	
<6h	1.00 (0.76 - 1.33)	0.992	0.70 (0.43 - 1.15)	0.160	1.04 (0.77 - 1.40)	0.810	0.73 (0.43 - 1.22)	0.226
>8h	1.04 (0.71 - 1.54)	0.828	0.98 (0.55 - 1.73)	0.945	1.06 (0.75 - 1.51)	0.727	1.12 (0.67 - 1.89)	0.664
Stage1	0.99 (0.97 - 1.01)	0.319	0.98 (0.94 - 1.01)	0.207	0.82 (0.18 - 3.83)	0.805	0.66 (0.09 - 4.79)	0.682
Stage2	0.99 (0.98 – 1.00)	0.178	1.00 (0.98 - 1.02)	0.956	0.83 (0.18 - 3.84)	0.808	0.66 (0.09 - 4.82)	0.686
Slow wave sleep	1.02 (1.00 - 1.03)	0.043	1.01 (0.99 - 1.04)	0.285	0.83 (0.18 - 3.86)	0.813	0.67 (0.09 - 4.84)	0.690
Rapid eye movement	1.01 (0.98 - 1.03)	0.589	1.00 (0.96 - 1.03)	0.924	0.82 (0.18 - 3.82)	0.804	0.65 (0.09 - 4.71)	0.669
Sleep efficiency	1.00 (0.98 - 1.01)	0.506	1.00 (0.97 - 1.02)	0.737	1.00 (0.98 - 1.01)	0.828	0.99 (0.97 - 1.02)	0.463
Arousal index§	**0.92 (0.87 - 0.98)**	**0.009**	**0.85 (0.76 - 0.95)**	**0.004**	1.04 (0.96 - 1.13)	0.348	0.92 (0.81 - 1.06)	0.260
Autonomic arousal index§	1.00 (0.98 - 1.03)	0.909	1.02 (0.97 - 1.06)	0.422	0.99 (0.96 - 1.01)	0.319	1.01 (0.97 - 1.05)	0.664
Autonomic arousal duration	**0.94 (0.91 - 0.98)**	**0.004**	0.99 (0.93 - 1.06)	0.851	**0.94 (0.91 - 0.98)**	**0.005**	0.95 (0.89 - 1.02)	0.188
Periodic limb movement index	**0.99 (0.99 – 1.00)**	**0.026**	1.00 (0.98 - 1.01)	0.457	**0.99 (0.99 – 1.00)**	**0.038**	1.00 (0.99 - 1.01)	0.874
Apnea/hypopnea index‖	**0.78 (0.71 - 0.86)**	**<0.001**	**0.61 (0.49 - 0.76)**	**<0.001**	0.87 (0.69 - 1.09)	0.225	1.02 (0.66 - 1.58)	0.930
Oxygen desaturation index‖	**0.74 (0.67 - 0.82)**	**<0.001**	**0.51 (0.39 - 0.67)**	**<0.001**	0.87 (0.68 - 1.11)	0.267	**0.58 (0.35 - 0.97)**	**0.037**
Mean oxygen saturation (SpO_2)	**1.35 (1.24 - 1.47)**	**<0.001**	**1.79 (1.54 - 2.09)**	**<0.001**	**1.27 (1.15 - 1.41)**	**<0.001**	**1.59 (1.35 - 1.87)**	**<0.001**
SpO_2<90*	**0.97 (0.95 - 0.98)**	**<0.001**	**0.84 (0.75 - 0.94)**	**0.004**	1.00 (0.99 - 1.02)	0.500	1.00 (0.94 - 1.06)	0.971
Subj. sleep duration[1]								
6-8h (ref.)	1		1		1		1	
<6h	0.66 (0.43 - 1.01)	0.056	0.53 (0.26 - 1.10)	0.089	0.74 (0.50 - 1.10)	0.140	0.57 (0.29 - 1.14)	0.113
>8h	0.97 (0.62 - 1.53)	0.905	0.40 (0.15 - 1.07)	0.068	1.03 (0.68 - 1.56)	0.893	0.42 (0.18 - 1.02)	0.054
Excessive daytime sleepiness[2]	1.06 (0.75 - 1.51)	0.726	0.68 (0.38 - 1.22)	0.197	1.06 (0.76 - 1.48)	0.714	0.83 (0.50 - 1.40)	0.490

§divided by 5; ‖ divided by 10; [1] 1) N=1461 [2] 1) N= 1428

† adjusting for depression, sleeping pills and alcohol; ǂ adjusting for all sleep characteristics; * Percentage of total sleep time spent under a 90% oxygen saturation threshold

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