

Correction: Contribution of short sleep duration to ethnic differences in cardiovascular disease: results from a cohort study in the Netherlands

Anujoo K, Agyemang C, Snijder MB, *et al.* Contribution of short sleep duration to ethnic differences in cardiovascular disease: results from a cohort study in the Netherlands. *BMJ Open* 2017;**7**:e017645. doi: 10.1136/bmjopen-2017-017645

Following a review of published research by researchers of the HELIUS study, conducted at the Universitair Medische Centra UMC (formerly Academic Medical Center AMC), University of Amsterdam, the authors wish to bring to your notice, a slight change in the results of a study that was published in *BMJ Open*.

Researchers of the HELIUS study discovered unintended errors in the coding of the original ROSE questionnaire, which was used to calculate three variables of cardiovascular disease (CVD) used in the study referenced above. The affected variables include Angina, Intermittent claudication, and the derived prevalent CVD variable (which additionally includes the unaffected variable myocardial infarction). The error led to a slight over-estimation of CVD prevalence in the various ethnic groups studied ([table 1](#)), and by extension, affected the prevalence ratios (PR) ([table 2](#)), and results of contributions of sleep to CVD in the concerned ethnic groups investigated ([table 3](#)).

Table 1 Characteristics of study population by ethnicity

	Dutch n=4495	South-Asian Surinamese n=2933	African- Surinamese n=4039	Ghanaians n=2181	Turks n=3395	Moroccans n=3687
Age (years)	46.2 (45.7 to 46.6)	45.5 (45.0 to 46.0)	47.9 (47.6 to 48.3)	44.7 (44.3 to 45.2)	40.4 (39.9 to 40.8)	40.4 (40.0 to 40.8)
Men (%)	45.8 (44.4 to 47.3)	45.3 (43.5 to 47.1)	39.0 (37.5 to 40.5)	39.4 (37.3 to 41.4)	45.4 (43.7 to 47.0)	38.9 (37.4 to 40.5)
Sleep duration (hours)	7.2 (7.21 to 7.27)	6.8 (6.70 to 6.81)	6.5 (6.49 to 6.58)	6.5 (6.38 to 6.55)	6.9 (6.92 to 7.04)	7.0 (6.99 to 7.09)
Short sleep (% yes)	16.2 (15.1 to 17.2)	39.4 (37.6 to 41.1)	45.6 (44.0 to 47.1)	44.2 (42.2 to 46.3)	29.5 (27.9 to 30.9)	27.0 (25.6 to 28.4)
Angina (% yes)	1.07 (0.81 to 1.41)	3.56 (2.95 to 4.30)	2.78 (2.32 to 3.34)	2.46 (1.89 to 3.21)	4.09 (3.48 to 4.82)	2.75 (2.27 to 3.33)
Myocardial infarction (% yes)	3.20 (2.69 to 3.72)	11.4 (10.3 to 12.6)	8.44 (7.58 to 9.30)	6.69 (5.64 to 7.74)	12.2 (11.1 to 13.3)	10.1 (9.14 to 11.1)
Intermittent claudication (% yes)	0.25 (0.14 to 0.44)	0.58 (0.36 to 0.93)	0.32 (0.19 to 0.56)	0.23 (0.10 to 0.55)	0.65 (0.43 to 0.98)	0.54 (0.35 to 0.84)
Prevalence CVD (%)	4.30 (3.74 to 4.93)	14.5 (13.2 to 15.8)	10.8 (9.85 to 11.8)	8.93 (7.79 to 10.2)	16.0 (14.8 to 17.3)	12.9 (11.9 to 14.0)
Hypertension (% yes)	29.5 (28.2 to 30.9)	42.4 (40.6 to 44.2)	50.2 (48.7 to 51.7)	55.8 (53.4 to 57.9)	29.1 (27.6 to 30.4)	24.4 (22.9 to 25.7)
Diabetes (% yes)	3.58 (3.03 to 4.12)	19.4 (17.9 to 20.8)	12.0 (11.0 to 13.0)	11.4 (10.1 to 12.8)	10.2 (9.14 to 11.2)	11.4 (10.3 to 12.4)
BMI (kg/m ²)	24.7 (24.6 to 24.9)	26.3 (26.1 to 26.5)	27.8 (27.6 to 28.0)	28.4 (28.2 to 28.6)	28.5 (28.3 to 28.7)	27.6 (27.4 to 27.7)
WHR	0.88 (0.87 to 0.88)	0.92 (0.92 to 0.93)	0.89 (0.89 to 0.90)	0.90 (0.90 to 0.91)	0.90 (0.90 to 0.91)	0.89 (0.89 to 0.90)
Dyslipidaemia (% yes)	29.9 (28.5 to 31.2)	41.7 (39.9 to 43.4)	24.0 (22.7 to 25.3)	20.1 (18.4 to 21.7)	40.8 (39.1 to 42.4)	27.6 (26.1 to 29.0)
TC >6.22 mmol/L	15.3 (14.2 to 16.3)	11.7 (10.5 to 12.8)	9.73 (8.82 to 10.6)	10.5 (9.21 to 11.8)	8.84 (7.89 to 9.79)	4.83 (4.14 to 5.52)
HDL-C <1.04 mmol/L	9.77 (8.90 to 10.6)	22.9 (21.4 to 24.5)	11.0 (10.0 to 11.9)	6.75 (5.69 to 7.79)	26.5 (24.9 to 27.9)	18.7 (17.4 to 19.9)
LDL-C >4.14 mmol/L	13.7 (12.7 to 14.7)	14.3 (13.0 to 15.5)	10.5 (9.58 to 11.5)	10.6 (9.35 to 11.9)	10.1 (9.09 to 11.1)	5.86 (5.10 to 6.62)
TG <1.69 mmol/L	11.9 (10.9 to 12.8)	16.9 (15.5 to 18.2)	5.67 (4.96 to 6.38)	3.35 (2.59 to 4.10)	20.1 (18.8 to 21.5)	10.6 (9.59 to 11.6)
Depressive symptoms (%)	6.99 (6.24 to 7.73)	18.4 (16.9 to 19.8)	10.6 (9.67 to 11.6)	9.08 (7.87 to 10.3)	22.8 (21.3 to 24.2)	20.3 (18.9 to 21.6)
Education						
First and second category (%)	17.3 (16.2 to 18.4)	47.8 (46.0 to 49.6)	40.8 (39.3 to 42.3)	68.0 (66.1 to 70.0)	55.9 (54.3 to 57.6)	48.7 (47.1 to 50.3)
Third category (%)	21.7 (20.5 to 22.9)	29.0 (27.4 to 30.7)	35.9 (34.4 to 37.4)	25.6 (23.7 to 27.4)	28.7 (27.1 to 30.2)	33.3 (31.8 to 34.9)



	Dutch n=4495	South-Asian Surinamese n=2933	African- Surinamese n=4039	Ghanaians n=2181	Turks n=3395	Moroccans n=3687
Fourth category (%)	60.9 (59.5 to 62.4)	23.2 (21.6 to 24.7)	23.2 (21.9 to 24.5)	6.37 (5.34 to 7.40)	15.4 (14.2 to 16.6)	17.9 (16.7 to 19.2)
Occupation						
Elementary (%)	1.65 (1.27 to 2.02)	9.48 (8.42 to 10.5)	6.29 (5.54 to 7.04)	53.7 (51.6 to 55.8)	14.9 (13.7 to 16.1)	12.9 (11.9 to 14.0)
Lower (%)	14.1 (13.1 to 15.1)	30.7 (29.0 to 32.3)	31.9 (30.4 to 33.3)	20.2 (18.5 to 21.8)	30.5 (28.9 to 32.1)	24.8 (23.4 to 26.2)
Medium (%)	21.9 (20.7 to 23.2)	27.4 (25.8 to 29.0)	32.3 (30.9 to 33.8)	7.79 (6.67 to 8.92)	18.8 (17.5 to 20.1)	21.1 (19.8 to 22.3)
Higher (%)	36.4 (35.0 to 37.8)	16.1 (14.8 to 17.5)	17.8 (16.6 to 19.0)	2.57 (1.90 to 3.23)	8.45 (7.52 to 9.39)	11.5 (10.5 to 12.5)
Scientific (%)	19.9 (18.7 to 21.0)	4.67 (3.91 to 5.43)	2.62 (2.13 to 3.12)	0.87 (0.48 to 1.26)	3.21 (2.62 to 3.80)	2.36 (1.87 to 2.85)
Shift work (%)	19.4 (18.2 to 20.5)	21.9 (20.4 to 23.4)	26.8 (25.4 to 28.1)	17.1 (15.5 to 18.7)	14.0 (12.9 to 15.2)	14.7 (13.6 to 15.9)
Smoking status						
Never smoked (% yes)	37.1 (35.7 to 38.5)	57.9 (56.2 to 59.7)	48.9 (47.4 to 50.5)	86.7 (85.3 to 88.1)	47.4 (45.7 to 49.1)	73.9 (72.5 to 75.3)
Ex-smoker (% yes)	38.1 (36.7 to 39.5)	13.7 (12.5 to 14.9)	19.3 (18.1 to 20.5)	8.30 (7.14 to 9.46)	18.3 (17.0 to 19.6)	12.7 (11.6 to 13.8)
Current smoker (% yes)	24.6 (23.4 to 25.9)	27.9 (26.3 to 29.6)	31.2 (29.8 to 32.7)	4.49 (3.62 to 5.36)	33.6 (32.0 to 35.2)	13.0 (11.9 to 14.1)
Achieving Dutch norm for physical activity (% yes)	75.5 (74.3 to 76.8)	53.2 (51.4 to 54.9)	61.2 (59.7 to 62.7)	54.2 (52.1 to 56.3)	42.5 (40.8 to 44.2)	47.2 (45.6 to 48.8)
Alcohol intake (% yes)	91.2 (90.4 to 92.0)	56.7 (54.9 to 58.5)	68.8 (67.4 to 70.2)	48.1 (45.9 to 50.2)	22.9 (21.5 to 24.3)	7.18 (6.35 to 8.02)

Data are presented as means and percentages with 95% CI.
 BMI, body mass index; CVD, cardiovascular disease; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglyceride; WHR, waist to hip ratio.

Table 2 PRs for the relationship between sleep duration (short sleep vs healthy sleep) and the prevalence of CVD by ethnicity

	Dutch, n=4495	South-Asian Surinamese, n=2933	African- Surinamese, n=4039	Ghanaians, n=2181	Turks, n=3395	Moroccans, n=3687
	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)
Short sleep						
Crude	2.23 (1.66 to 3.00)*	1.68 (1.41 to 2.00)*	1.58 (1.32 to 1.89)*	1.47 (1.12 to 1.92)**	1.58 (1.35 to 1.85)*	1.47 (1.23 to 1.75)*
Model 1	1.95 (1.45 to 2.62)*	1.60 (1.34 to 1.91)*	1.61 (1.34 to 1.94)*	1.59 (1.21 to 2.08)**	1.53 (1.31 to 1.79)*	1.43 (1.20 to 1.71)*
Model 2	1.74 (1.28 to 2.36)*	1.52 (1.28 to 1.82)*	1.53 (1.27 to 1.84)*	1.60 (1.22 to 2.10)**	1.48 (1.26 to 1.73)*	1.44 (1.20 to 1.71)*

Model 1: adjusted for age and sex.
 Model 2: adjusted for model 1 plus BMI, WHR, hypertension, diabetes, dyslipidaemia, smoking, alcohol consumption and physical activity.
 *P < 0.001, **P < 0.05.
 BMI, body mass index; CVD, cardiovascular disease; PRs, prevalence ratios; WHR, waist to hip ratio.

Table 3 Prevalence ratio(s) for ethnic differences in prevalence CVD, adjusting for short sleep and CVD risk factors separately, and simultaneously

Ethnic group	Confounders (model 1)	Confounders+short sleep (model 2)		Confounders+CVD risk factors (model 3)		Confounders+short sleep, CVD risk factors (model 4)		Difference in (%) reduction between model 4 and model 3
	PR (95% CI)	PR(95% CI)	Reduction PR total short sleep (%)*	PR(95% CI)	Reduction PR total CVD risk factors (%)†	PR(95% CI)	Reduction PR total short sleep, total CVD risk factors (%)‡	
Dutch	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
South-Asian Surinamese	3.38 (2.87 to 3.98)*	3.02 (2.56 to 3.56)*	15	3.00 (2.51 to 3.57)*	16	2.72 (2.28 to 3.24)	28	12
African Surinamese	2.41 (2.05 to 2.85)*	2.11 (1.78 to 2.49)*	21	2.09 (1.76 to 2.49)*	23	1.86 (1.57 to 2.22)*	39	16
Ghanaians	2.10 (1.73 to 2.54)*	1.83 (1.51 to 2.23)*	25	2.04 (1.66 to 2.52)*	5	1.83 (1.48 to 2.25)*	25	19
Turks	4.02 (3.44 to 4.71)*	3.72 (3.17 to 4.35)*	10	3.27 (2.73 to 3.92)*	24	3.10 (2.59 to 3.72)*	30	6
Moroccans	3.18 (2.71 to 3.73)*	2.97 (2.53 to 3.49)*	10	3.10 (2.57 to 3.73)*	4	2.96 (2.45 to 3.56)*	10	6

Confounders (model 1)		Confounders+short sleep (model 2)		Confounders+CVD risk factors (model 3)		Confounders+short sleep, CVD risk factors (model 4)		Difference in (%) reduction between model 4 and model 3
Ethnic group	PR (95% CI)	PR(95% CI)	Reduction PR total short sleep (%)*	PR(95% CI)	Reduction PR total CVD risk factors (%)†	PR(95% CI)	Reduction PR total short sleep, total CVD risk factors (%)‡	Difference in reduction (%)§

Model 1: Confounders: Adjusted for age and gender. Model 2: Adjusted for age, gender and short sleep. Model 3: Adjusted for age, gender and CVD risk factors. Model 4: Adjusted for age, gender, CVD risk factors AND short sleep.

*p < 0.001.

†Contribution of short sleep: Reduction in PR (%) between model 1 and model 2.

‡Contribution of CVD risk factors: Reduction in PR (%) between model 1 and model 3.

§Contribution of both CVD risk factors and short sleep: Reduction in PR (%) between model 1 and model 4.

¶Contribution of short sleep independent of CVD risk factors; Difference in PR reduction (%) between model 3 and model 4. CVD, cardiovascular disease.

The error has now been corrected, and adjusted results are presented in the attached file (as shown above) while other results of the study remain unaffected.

However, it is worthy to note that the error does not change the overall results and conclusion of the study. Also, the pattern of the key findings remains unchanged. We regret any inconvenience this may/may have cause(d), but we are glad to report this error to maintain research integrity. This correction has been communicated to all authors of the published paper, and they gave their consent to effect these corrections.

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BMJ Open 2022;**12**:e017645corr1. doi:10.1136/bmjopen-2017-017645corr1

