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Differences in cardiovascular disease risk between men and women in a multi-ethnic population

Let's talk about sex and gender

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Chapter 5

Associations between gender-related characteristics and estimated cardiovascular disease risk in a multi-ethnic population: The HELIUS study

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Gender-related characteristics and disparities in estimated cardiovascular disease risk in a multi-ethnic general population: The HELIUS study

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Abstract

Background: Differences in cardiovascular disease (CVD) risk between men and women have been widely reported. However, risk differences by gender-related characteristics (sociocultural characteristics) have been poorly studied, although these characteristics may associate with cardiovascular health. We explored associations of three gender-related characteristics with estimated CVD risk in men and women within various ethnic groups.

Methods: We used baseline data of 9,185 participants of six ethnic groups of the HELIUS study (Amsterdam, the Netherlands), aged 40-65 years, without CVD and diabetes. We studied the associations of three gender-related characteristics (time per week doing household work, primary earner status, performing a male- or female-dominated occupation) with CVD risk as estimated with SCORE algorithm using linear regression analyses. Analyses were stratified by sex, and adjusted for age and socioeconomic status. Next, we explored whether associations differed across ethnic groups.

Results: Individuals who were no primary earners had a 6% (beta 0.94; 95% CI 0.88-1.01; men) and 8% (beta 0.92; 95% CI 0.90-0.95; women) lower CVD risk than primary earners. Performing a female-dominated versus male-dominated occupation was associated with a 7% lower CVD risk in women (beta 0.93; 95% CI 0.88-0.99), but not in men. Time spent on household work was not associated with CVD risk. These associations were mostly consistent across ethnic groups.

Conclusion: Masculine gender-related characteristics were associated with a higher estimated CVD risk across ethnic groups, specifically, being the primary earner (men and women) and performing a male-dominated occupation (women). Our findings may in future help to identify specific high-risk groups.

Introduction

Differences in cardiovascular disease (CVD) incidence and risk factors between men and women have been widely reported across populations.¹⁻³ The causes of these disparities are still poorly understood, but may be related to biological (sex) and social (gender) processes.^{4, 5} Studies on how CVD risk varies by gender are particularly limited, resulting in potentially missed opportunities to take the gender dimension into account in the design of CVD prevention strategies.^{4, 6} Better understanding of the occurrence of gender disparities in CVD risk may help to identify specific subgroups at risk of CVD that are potentially missed by current prevention strategies.^{7, 8}

While 'sex' refers to biologically determined differences, the term 'gender' refers to the effects of the social norms and societal expectations that are different for men and women. Gender is about how individuals conform to these norms and expectations, and how this influences the way they perceive and present themselves, their attitudes and experiences, and which behaviours they exhibit in families, workplace, and society.⁹⁻¹² This distinction between sex and gender is well-established and widely acknowledged in social sciences,¹³⁻¹⁵ but has been largely neglected in health research.^{9, 10, 16-18} This distinction is important since sex and gender may affect health-related behaviour and vulnerability to stressors differently.¹⁶⁻¹⁸ Thus, gender may contribute to differences in CVD occurrence among men, among women, and between men and women.

In patients with premature acute coronary syndrome (ACS), Pelletier and colleagues created a composite score for gender based on several proxies for gender (e.g., primary earner status, time spent on doing household work).¹⁹ They observed that a feminine gender score was associated with a higher presence of CVD risk factors¹⁹ and with recurrence of ACS and major adverse cardiac events,²⁰ independently of sex. However, in the general population, higher femininity scores (as measured by the Bem Sex-Role Inventory [BSRI])²¹ were associated with lower risk of coronary heart disease (CHD) mortality in men, but not in women.²² These contrasting results show that more research is needed to understand the role of gender in differences in CVD risk, in general populations specifically.

Individual experiences with gender may differ across groups, as is suggested by the theoretical framework of intersectionality. This framework states that multiple social factors (e.g., gender, ethnicity, socioeconomic status (SES), sexual orientation) intersect at an individual level, potentially influencing individual experiences differently than would have been expected from evidence on single social factors.²³

For instance, an American study found that stereotypical gender characteristics (e.g., for men: leadership skills; for women: caring) were more often attributed to white men and women than to men and women of ethnic minority origin.²⁴ Yet, studies on the variation of gender differences between ethnic groups in relation to cardiovascular health are lacking.

In this population-based study, we explored differences in estimated CVD risk according to gender, as assessed by three gender-related characteristics (time spent on doing household work, primary earner status, and performing a male- or female-dominated occupation) in men and women in a multi-ethnic population in the Netherlands. These characteristics were selected based on previous literature.^{19, 25} They reflect roles that were traditionally ascribed to either men or women in contemporary western societies.⁹⁻¹¹ Additionally, we examined whether these associations differed between ethnic groups.

Methods

We used baseline data from the HEalthy Life in an Urban Setting (HELIUS) study, a multi-ethnic cohort study conducted in Amsterdam, the Netherlands. The HELIUS study has been described in detail elsewhere.^{26, 27} Briefly, baseline data collection took place between 2011 and 2015 and included people aged 18-70 years from six ethnic groups (those of Dutch, South-Asian Surinamese, African Surinamese, Ghanaian, Moroccan, and Turkish origin) living in Amsterdam. Participants were randomly sampled from the municipality registry, stratified by ethnicity. Data were obtained by questionnaire and physical examinations (including biological samples). The HELIUS study has been approved by the AMC Ethical Review Board. All participants provided written informed consent.

Estimated CVD risk

In accordance to current guidelines of the European Society of Cardiology (ESC),²⁸ CVD risk was estimated via the Systematic COronary Risk Evaluation (SCORE) algorithm based on total cholesterol/high-density lipoprotein cholesterol (TC/HDL) ratio for low-risk countries.²⁹ This algorithm estimates the 10-year risk of mortality due to CHD or stroke based on age, sex, systolic blood pressure (BP), TC/HDL ratio, and smoking status (yes/no) among those aged 40–65 years without prior CVD or diabetes.

Smoking status and prior CVD were assessed by questionnaire. Systolic BP was measured in duplicate using a validated automated digital BP device (WatchBP

Home; Microlife AG) in a seated position after ≥ 5 minutes of rest. Fasting blood samples were drawn, and glucose and TC/HDL were determined. Participants were considered to have diabetes if they reported a diabetes diagnosis, or use of glucose-lowering medication (Anatomical Therapeutic Chemical [ATC] code A10), or in case of a fasting glucose ≥ 7.0 mmol/l.

Gender-related characteristics

We studied three characteristics that serve as proxies for the concept of gender, which we conceive as the extent to which individuals conform to gender roles (reflecting the social norms applied to men and women that influence their everyday actions, expectations, and experiences).¹⁰ We selected characteristics that reflect roles that can be traditionally ascribed to either men (henceforth: masculine gender-related characteristics) or women (henceforth: feminine gender-related characteristics) in contemporary western societies.⁹⁻¹¹ Although gender equality is currently under debate and gender norms and roles tend to be more fluid compared to decades ago, recent studies show that traditional gender roles and gender stereotyping, such as the man as ‘the breadwinner’ of the household and the woman as ‘the main caretaker’ of the household, are still deeply embedded in contemporary societies,³⁰⁻³² also in the Netherlands.^{33, 34} We selected three characteristics based on previous literature^{19, 25} and availability in HELIUS: time spent on doing household work, primary earner status, and performing a male- or female-dominated occupation.

Time spent on doing household work was classified into quartiles based on the self-reported total number of hours dedicated to light/moderate household work (e.g., cooking, doing dishes, feeding children, vacuum cleaning, or grocery shopping) and heavy household work (e.g., scrubbing floors, beating carpets, carrying heavy groceries): 0-3 hours/week, >3-8 hours/week, >8-16 hours/week, and >16 hours/week. Being categorized into the lowest quartile (including not taking part in any of the household activities) was defined as a masculine gender-related characteristic. Conversely, being categorized into the highest quartile was defined as a feminine gender-related characteristic, as household activities are usually considered as part of the caretaking tasks of women, according to traditional gender roles.

Primary earner status was classified into three groups: yes, equal income, and no (my partner, my parents, or someone else is/are primary earner(s)). Being the primary earner of the household income was defined as a masculine gender-related characteristic, as it reflects the financial responsibility that is usually assigned to men, according to traditional gender roles. Conversely, not being the primary earner of the household income was defined as a feminine gender-related characteristic.

Having an equal income was neither defined as a masculine nor a feminine gender-related characteristic.

Performing a male- or female-dominated occupation refers to the proportion of men and women in a given occupation and was based on self-reported occupation. Using the most recent numbers of men and women per occupation category according to Statistics Netherlands, we created four categories: occupations with $\leq 25\%$ female workers, 26-50% female workers, 51-75% female workers, and $\geq 76\%$ female workers. The first category was defined as 'male-dominated occupation' and as a masculine gender-related characteristic, whereas the last category was defined as 'female-dominated occupation' and as a feminine gender-related characteristic.

Ethnicity

Ethnicity was defined by the individual's country of birth combined with the parental countries of birth.³⁵ A participant was defined as belonging to one of the included ethnic minority groups if the participant was born in the specified country and has at least one parent that was born in the same country, or if both parents were born abroad. The origin of the participant was defined as the country of birth of the mother if both parents were born in different countries. Surinamese participants were further classified according to self-reported ethnic origin into "African", "South-Asian", "Javanese", or "other". For the Dutch sample, we invited people who were born in the Netherlands and whose parents were also born in the Netherlands.

Covariables

We used educational level as a proxy for SES. Educational level was based on the highest qualification attained, either in the Netherlands or in the country of origin, and categorized into four groups: 1) no or elementary schooling, 2) lower vocational or lower secondary schooling, 3) intermediate vocational or intermediate or higher secondary schooling, and 4) higher vocational schooling or university. Occupational level was based on job title and job description, including a question on fulfilling an executive function, and classified into four groups, according to Dutch Standard Occupational Classification system for 2010: 1) elementary, 2) lower, 3) intermediate, and 4) higher or academic. Household composition was classified as living with at least one other adult or not.

Study population

Baseline data were available for 22,165 participants. We excluded those of Javanese Surinamese (n=233) or unknown Surinamese (n=267) origin and those with another/unknown ethnic origin (n=48), due to low statistical power. Next, we excluded participants due to not being eligible for CVD risk estimation based on age below 40

years (n=7,684), age above 65 years (n=885), prior CVD (n=2,200) or missing data on prior CVD (n=44), or the presence of diabetes (n=1,449) or missing data on the presence of diabetes (n=48). Then, we excluded participants with missing data on components of SCORE risk factors (n=60) or on at least two out of three gender-related characteristics (n=61). Finally, we excluded one participant with improbably low cholesterol values (TC: 1.960 mmol/l; HDL: 0.080 mmol/l), resulting in a study population of 9,185 participants.

Statistical analyses

Baseline characteristics were expressed as means (standard deviations [SD]) or frequencies (percentages) by sex, in the total population and by ethnic group. Gender-related characteristics were presented using cross-tabulation by sex and correlation between the characteristics was tested using Cramer's V (measures correlation between categorical variables). Geometric mean estimated CVD risk with 95% confidence interval (CI) were presented by sex and gender-related characteristics, adjusted for age, in the total population and by ethnic group.

Due to non-linear associations, we performed multivariable linear regression analyses to examine the association of the three gender-related characteristics separately with log-transformed estimated CVD risk in men and women in the total population. We adjusted for age, ethnicity, and educational level. In the analyses of time spent on doing household work and primary earner status, we additionally adjusted for household composition (whether participants lived with other adults or not). Moreover, we additionally adjusted the analyses of performing a male- or female-dominated occupation for occupational level. Then, we stratified the analyses by ethnic group. To explore whether the associations differed across ethnic groups, we added a statistical interaction term for each gender-related characteristic and ethnicity on an additive scale. All statistical analyses were performed in R studio version 1.1.453.³⁶ p-values <0.05 were regarded as statistically significant.

To explore the contribution of the separate SCORE factors in the associations of the gender-related characteristics with SCORE, we repeated the main analyses with systolic BP, TC/HDL ratio, and smoking status (yes/no) as outcome.

Results

Mean age was 51.1 years (SD 6.7) in men and 50.6 years (SD 6.7) in women. Masculine gender-related characteristics were highly prevalent among men: the majority of men spent 3 hours or less per week on household work, was primary earner of the household income, and performed a male-dominated occupation (Table 1). Feminine gender-related characteristics were more prevalent among women: most women spent 16 hours or more per week on doing household work and performed an occupation with 51-75% female workers. However, a small majority of women indicated that they were the primary earner of the household income. These patterns varied somewhat across ethnic groups. For instance, most Ghanaian men performed an occupation with 51-75% female workers. Additionally, most Turkish and Moroccan women were not the primary earner. Supplemental Table S1 shows further baseline characteristics of the study population. The three gender-related characteristics were weakly correlated in both men and women (Supplemental Table S2).

Some masculine gender-related characteristics were associated with estimated CVD risk (Table 2). Not being the primary earner of the household income was associated with a 6% (beta 0.94; 95% CI 0.88-1.01) and 8% (beta 0.92; 95% CI 0.90-0.95) lower exponentiated CVD risk in men and women, respectively, compared to being the primary earner. Performing a female-dominated occupation was associated with a 7% lower exponentiated CVD risk in women (beta 0.93; 95% CI 0.88-0.99), but not in men (beta 1.01; 95% CI 0.93-1.10), compared to performing a male-dominated occupation. In both men and women, time per week spent on doing household work was not associated with CVD risk.

We found similar associations across ethnic groups without substantial differences in the patterns, but with a few exceptions in single estimates (Table 3). For instance, Turkish men who spent more than 16 hours per week on doing household work had a 18% lower exponentiated CVD risk compared to those spending 3 hours or less per week on doing household work (beta 0.82; 95% CI 0.69-0.98). Among other groups of men, this ranged from a 4% lower exponentiated CVD risk in Moroccan men to a 9% higher exponentiated CVD risk in South-Asian Surinamese men.

Table 1. Frequencies and percentages of three gender-related characteristics, stratified by sex and ethnic group

Men	Total n=3,860	South-Asian			African			Moroccan n=528
		Dutch n=1,008	Surinamese n=458	Surinamese n=810	Ghanaian n=485	Turkish n=571		
Time spent on doing household work								
0-3 hours/week	1,434 (37.2)	297 (29.5)	127 (27.7)	195 (24.1)	225 (46.4)	353 (61.8)	237 (44.9)	
>3-8 hours/week	1,202 (31.1)	423 (42.0)	146 (31.9)	247 (30.5)	121 (24.9)	115 (20.1)	150 (28.4)	
>8-16 hours/week	798 (31.1)	217 (21.5)	121 (26.4)	222 (27.4)	81 (16.7)	66 (11.6)	91 (17.2)	
>16 hours/week	426 (11.0)	71 (7.0)	64 (14.0)	146 (18.0)	58 (12.0)	37 (6.5)	50 (9.5)	
Primary earner status (missing: n=18)								
Yes	3,024 (78.7)	706 (70.1)	345 (75.3)	650 (80.8)	383 (80.1)	485 (85.2)	455 (86.5)	
Equal income	594 (15.5)	223 (21.1)	82 (17.9)	103 (12.8)	70 (14.6)	65 (11.4)	51 (9.7)	
No	224 (5.8)	78 (7.7)	31 (6.8)	51 (6.3)	25 (5.2)	19 (3.3)	20 (3.8)	
Performing a male- or female-dominated occupation (missing: n=317)								
≤25% female workers	1,308 (36.9)	310 (33.0)	184 (43.4)	353 (47.8)	90 (20.0)	212 (41.1)	159 (33.5)	
26-50% female workers	1,194 (33.7)	354 (37.7)	137 (32.3)	218 (29.5)	140 (31.0)	197 (38.2)	149 (31.2)	
51-75% female workers	893 (25.2)	217 (23.1)	87 (20.5)	124 (16.8)	212 (47.0)	102 (19.8)	151 (31.8)	
≥76% female workers	148 (4.2)	57 (6.1)	16 (3.8)	44 (6.0)	9 (2.0)	5 (1.0)	17 (3.6)	

Table 1. Continued

	South-Asian					African		Moroccan
	Total	Dutch	Surinamese	Ghanaian	Turkish	Surinamese	Moroccan	
Women	n=5,325	n=1,269	n=694	n=705	n=650	n=1,266	n=741	
Time spent on doing household work								
0-3 hours/week	560 (10.5)	138 (10.9)	51 (7.3)	115 (16.3)	76 (11.7)	123 (9.7)	57 (7.7)	
>3-8 hours/week	1,247 (23.4)	404 (31.8)	138 (19.9)	207 (29.4)	91 (14.0)	313 (24.7)	94 (12.7)	
>8-16 hours/week	1,538 (28.9)	417 (32.9)	211 (30.4)	201 (28.5)	149 (22.9)	393 (31.0)	167 (22.5)	
>16 hours/week	1,980 (37.2)	310 (24.4)	294 (42.4)	182 (25.8)	334 (51.4)	437 (34.5)	423 (57.1)	
Primary earner status (missing: n=37)								
Yes	3,007 (56.9)	652 (51.5)	421 (61.1)	527 (75.7)	200 (31.2)	963 (76.6)	244 (33.0)	
Equal income	837 (15.8)	242 (19.1)	121 (17.6)	85 (12.2)	139 (21.7)	138 (11.0)	112 (15.2)	
No	1,444 (27.3)	371 (29.3)	147 (21.3)	84 (12.1)	303 (47.2)	156 (12.4)	383 (51.8)	
Performing a male- or female-dominated occupation (missing: n=1,006)								
≤25% female workers	217 (5.0)	71 (6.0)	32 (5.2)	18 (3.0)	20 (5.1)	65 (5.6)	11 (3.1)	
26-50% female workers	857 (19.8)	344 (29.2)	118 (19.3)	97 (15.9)	103 (26.3)	145 (12.4)	50 (13.9)	
51-75% female workers	1,941 (44.9)	436 (36.9)	283 (46.2)	453 (74.4)	204 (52.0)	381 (32.7)	199 (51.1)	
≥76% female workers	1,304 (30.2)	329 (27.9)	179 (29.2)	41 (6.7)	65 (16.6)	575 (49.3)	115 (31.9)	

Data are presented as frequencies (percentages).

Table 2. Age-adjusted geometric mean estimated CVD risk by sex, and gender-related characteristics and association between exponentiated estimated CVD risk and gender-related characteristics, stratified by sex

	Geometric mean (95% CI) ^a	Beta (95% CI) ^b	p-value ^c
Men (n=3,860)			
Time spent on doing household work			
0-3 hours/week	1.16 (1.13-1.19)	1	NA
>3-8 hours/week	1.10 (1.07-1.13)	0.99 (0.95-1.03)	0.64
>8-16 hours/week	1.11 (1.07-1.15)	0.98 (0.94-1.02)	0.31
>16 hours/week	1.13 (1.08-1.19)	0.99 (0.93-1.03)	0.44
Primary earner status			
Yes	1.14 (1.12-1.16)	1	NA
Equal income	1.09 (1.05-1.14)	0.98 (0.94-1.02)	0.37
No	1.07 (1.00-1.14)	0.94 (0.88-1.01)	0.09
Performing a male- or female-dominated occupation			
≤25% female workers	1.17 (1.14-1.20)	1	NA
26-50% female workers	1.15 (1.12-1.18)	1.02 (0.98-1.06)	0.29
51-75% female workers	1.06 (1.02-1.09)	0.95 (0.91-0.99)	0.02
≥76% female workers	1.07 (0.99-1.16)	1.01 (0.93-1.10)	0.82
Women (n=5,325)			
Time spent on doing household work			
0-3 hours/week	0.24 (0.23-0.25)	1	NA
>3-8 hours/week	0.24 (0.23-0.25)	1.01 (0.97-1.06)	0.49
>8-16 hours/week	0.24 (0.24-0.25)	1.01 (0.97-1.05)	0.74
>16 hours/week	0.25 (0.25-0.25)	1.02 (0.98-1.06)	0.35
Primary earner status			
Yes	0.25 (0.25-0.26)	1	NA
Equal income	0.24 (0.23-0.24)	0.94 (0.91-0.98)	<0.01
No	0.23 (0.23-0.24)	0.92 (0.90-0.95)	<0.001
Performing a male- or female-dominated occupation			
≤25% female workers	0.26 (0.25-0.28)	1	NA
26-50% female workers	0.23 (0.22-0.24)	0.91 (0.86-0.97)	<0.01
51-75% female workers	0.25 (0.24-0.25)	0.91 (0.86-0.97)	<0.01
≥76% female workers	0.24 (0.24-0.25)	0.93 (0.88-0.99)	0.03

CI, confidence interval; CVD, cardiovascular disease; NA, not applicable.

^a Adjusted for age.

^b Adjusted for age, ethnicity, educational level, household composition (only in analyses on time spent on doing household work and primary earner status), occupational level (only in analyses on performing a male- or female-dominated occupation).

^c p-values are given for the beta coefficients. p-values <0.05 were regarded statistically significant and are marked in bold.

Table 3. Age-adjusted geometric mean estimated CVD risk, stratified by sex, ethnic group, and gender-related characteristics, and the association between exponentiated estimated CVD risk and gender-related characteristics, stratified by sex and ethnic group

	Dutch		
	Geometric mean ^a	Beta (95% CI) ^b	p-value ^c
Men			
Time spent on doing household work			
0-3 hours/week	1.19	1	NA
>3-8 hours/week	1.19	1.01 (0.94-1.08)	0.80
>8-16 hours/week	1.19	0.99 (0.91-1.08)	0.78
>16 hours/week	1.22	0.99 (0.88-1.13)	0.91
Primary earner status			
Yes	1.22	1	NA
Equal income	1.13	0.97 (0.90-1.04)	0.38
No	1.13	0.94 (0.84-1.06)	0.29
Performing a male- or female-dominated occupation			
≤25% female workers	1.25	1	NA
26-50% female workers	1.18	1.02 (0.95-1.11)	0.56
51-75% female workers	1.17	0.98 (0.90-1.07)	0.73
≥76% female workers	1.18	1.02 (0.89-1.18)	0.75
Women			
Time spent on doing household work			
0-3 hours/week	0.24	1	NA
>3-8 hours/week	0.24	0.98 (0.91-1.07)	0.69
>8-16 hours/week	0.24	0.97 (0.89-1.05)	0.41
>16 hours/week	0.25	0.97 (0.89-1.06)	0.46
Primary earner status			
Yes	0.25	1	NA
Equal income	0.24	0.87 (0.81-0.94)	<0.001
No	0.23	0.90 (0.84-0.96)	<0.01
Performing a male- or female-dominated occupation			
≤25% female workers	0.26	1	NA
26-50% female workers	0.23	0.85 (0.76-0.95)	<0.01
51-75% female workers	0.25	0.89 (0.80-0.99)	0.03
≥76% female workers	0.24	0.89 (0.80-0.99)	0.04

Table 3. Continued

	South-Asian Surinamese		
	Geometric mean ^a	Beta (95% CI) ^b	p-value ^c
Men			
Time spent on doing household work			
0-3 hours/week	1.20	1	NA
>3-8 hours/week	1.17	1.00 (0.89-1.13)	0.99
>8-16 hours/week	1.11	0.96 (0.84-1.08)	0.48
>16 hours/week	1.30	1.09 (0.93-1.26)	0.30
Primary earner status			
Yes	1.20	1	NA
Equal income	1.12	0.93 (0.82-1.05)	0.24
No	1.15	0.93 (0.77-1.13)	0.47
Performing a male- or female-dominated occupation			
≤25% female workers	1.14	1	NA
26-50% female workers	1.30	1.01 (0.89-1.15)	0.89
51-75% female workers	1.11	1.07 (0.83-1.39)	0.59
≥76% female workers	1.07	1.17 (1.05-1.31)	<0.01
Women			
Time spent on doing household work			
0-3 hours/week	0.29	1	NA
>3-8 hours/week	0.29	1.03 (0.90-1.19)	0.64
>8-16 hours/week	0.29	1.01 (0.88-1.15)	0.91
>16 hours/week	0.30	1.00 (0.87-1.14)	0.95
Primary earner status			
Yes	0.31	1	NA
Equal income	0.27	1.03 (0.93-1.13)	0.61
No	0.29	0.95 (0.87-1.04)	0.30
Performing a male- or female-dominated occupation			
≤25% female workers	0.34	1	NA
26-50% female workers	0.28	1.08 (0.91-1.28)	0.37
51-75% female workers	0.30	1.04 (0.89-1.22)	0.65
≥76% female workers	0.30	1.01 (0.86-1.19)	0.92

Table 3. Continued

	African Surinamese		
	Geometric mean ^a	Beta (95% CI) ^b	p-value ^c
Men			
Time spent on doing household work			
0-3 hours/week	1.38	1	NA
>3-8 hours/week	1.31	0.97 (0.89-1.06)	0.53
>8-16 hours/week	1.41	1.03 (0.94-1.13)	0.48
>16 hours/week	1.36	0.99 (0.89-1.09)	0.77
Primary earner status			
Yes	1.36	1	NA
Equal income	1.48	1.06 (0.95-1.17)	0.29
No	1.29	0.92 (0.80-1.06)	0.25
Performing a male- or female-dominated occupation			
≤25% female workers	1.40	1	NA
26-50% female workers	1.36	0.98 (0.90-1.06)	0.56
51-75% female workers	1.27	0.92 (0.83-1.02)	0.11
≥76% female workers	1.42	1.05 (0.90-1.23)	0.53
Women			
Time spent on doing household work			
0-3 hours/week	0.28	1	NA
>3-8 hours/week	0.28	1.00 (0.92-1.09)	0.98
>8-16 hours/week	0.28	1.02 (0.94-1.11)	0.57
>16 hours/week	0.28	1.02 (0.94-1.11)	0.58
Primary earner status			
Yes	0.28	1	NA
Equal income	0.29	0.97 (0.90-1.05)	0.44
No	0.28	0.85 (0.79-0.91)	<0.001
Performing a male- or female-dominated occupation			
≤25% female workers	0.27	1	NA
26-50% female workers	0.30	0.93 (0.82-1.05)	0.24
51-75% female workers	0.29	0.93 (0.83-1.03)	0.16
≥76% female workers	0.27	0.96 (0.86-1.07)	0.44

Table 3. Continued

	Ghanaian		
	Geometric mean ^a	Beta (95% CI) ^b	p-value ^c
Men			
Time spent on doing household work			
0-3 hours/week	1.01	1	NA
>3-8 hours/week	1.05	1.04 (0.95-1.15)	0.39
>8-16 hours/week	0.99	0.97 (0.87-1.08)	0.60
>16 hours/week	1.04	1.02 (0.90-1.16)	0.78
Primary earner status			
Yes	1.03	1	NA
Equal income	0.97	0.96 (0.86-1.07)	0.46
No	0.93	0.91 (0.77-1.09)	0.31
Performing a male- or female-dominated occupation			
≤25% female workers	1.04	1	NA
26-50% female workers	1.09	1.07 (0.95-1.20)	0.29
51-75% female workers	0.98	0.97 (0.86-1.10)	0.66
≥76% female workers	0.89	0.86 (0.63-1.19)	0.38
Women			
Time spent on doing household work			
0-3 hours/week	0.19	1	NA
>3-8 hours/week	0.19	1.04 (0.95-1.13)	0.45
>8-16 hours/week	0.18	0.99 (0.90-1.08)	0.77
>16 hours/week	0.19	1.03 (0.94-1.13)	0.56
Primary earner status			
Yes	0.19	1	NA
Equal income	0.18	0.94 (0.85-1.03)	0.17
No	0.17	0.89 (0.81-0.98)	0.01
Performing a male- or female-dominated occupation			
≤25% female workers	0.20	1	NA
26-50% female workers	0.19	0.98 (0.81-1.19)	0.86
51-75% female workers	0.19	0.92 (0.77-1.10)	0.37
≥76% female workers	0.18	0.98 (0.79-1.22)	0.84

Table 3. Continued

	Turkish		
	Geometric mean ^a	Beta (95% CI) ^b	p-value ^c
Men			
Time spent on doing household work			
0-3 hours/week	1.03	1	NA
>3-8 hours/week	0.96	0.96 (0.85-1.07)	0.44
>8-16 hours/week	0.94	0.98 (0.85-1.13)	0.77
>16 hours/week	0.81	0.82 (0.69-0.98)	0.03
Primary earner status			
Yes	0.99	1	NA
Equal income	1.03	1.05 (0.91-1.20)	0.52
No	1.04	1.10 (0.86-1.39)	0.45
Performing a male- or female-dominated occupation			
≤25% female workers	1.02	1	NA
26-50% female workers	1.01	0.99 (0.89-1.10)	0.85
51-75% female workers	0.93	0.93 (0.81-1.07)	0.33
≥76% female workers	0.68	0.69 (0.43-1.11)	0.12
Women			
Time spent on doing household work			
0-3 hours/week	0.17	1	NA
>3-8 hours/week	0.17	1.10 (0.96-1.26)	0.18
>8-16 hours/week	0.17	1.04 (0.92-1.17)	0.57
>16 hours/week	0.18	1.06 (0.95-1.19)	0.29
Primary earner status			
Yes	0.17	1	NA
Equal income	0.17	0.98 (0.89-1.09)	0.75
No	0.17	0.97 (0.88-1.06)	0.44
Performing a male- or female-dominated occupation			
≤25% female workers	0.19	1	NA
26-50% female workers	0.17	0.81 (0.64-1.02)	0.08
51-75% female workers	0.17	0.78 (0.62-0.99)	0.04
≥76% female workers	0.17	0.84 (0.66-1.07)	0.16

Table 3. Continued

	Moroccan		
	Geometric mean^a	Beta (95% CI)^b	p-value^c
Men			
Time spent on doing household work			
0-3 hours/week	0.95	1	NA
>3-8 hours/week	0.92	0.99 (0.90-1.08)	0.81
>8-16 hours/week	0.86	0.93 (0.83-1.03)	0.18
>16 hours/week	0.90	0.96 (0.84-1.10)	0.56
Primary earner status			
Yes	0.93	1	NA
Equal income	0.85	0.90 (0.79-1.03)	0.12
No	0.87	0.89 (0.73-1.09)	0.27
Performing a male- or female-dominated occupation			
≤25% female workers	0.95	1	NA
26-50% female workers	0.94	0.98 (0.88-1.08)	0.66
51-75% female workers	0.87	0.92 (0.81-1.03)	0.15
≥76% female workers	0.90	1.02 (0.80-1.31)	0.86
Women			
Time spent on doing household work			
0-3 hours/week	0.16	1	NA
>3-8 hours/week	0.15	0.99 (0.88-1.11)	0.81
>8-16 hours/week	0.16	1.05 (0.94-1.17)	0.41
>16 hours/week	0.17	1.08 (0.98-1.20)	0.12
Primary earner status			
Yes	0.16	1	NA
Equal income	0.17	1.05 (0.96-1.15)	0.30
No	0.17	1.02 (0.96-1.09)	0.54
Performing a male- or female-dominated occupation			
≤25% female workers	0.15	1	NA
26-50% female workers	0.15	0.93 (0.73-1.20)	0.58
51-75% female workers	0.16	1.01 (0.79-1.29)	0.96
≥76% female workers	0.17	1.07 (0.84-1.37)	0.57

CI, confidence interval; CVD, cardiovascular disease; NA, not applicable.

^a Adjusted for age.

^b Adjusted for age, educational level, household composition (only in analyses on time spent on doing household work and primary earner status), occupational level (only in analyses on performing a male- or female-dominated occupation).

^c p-values are given for the beta coefficients. p-values <0.05 were regarded statistically significant and are marked in bold.

In addition, there was little statistical evidence for effect modification by ethnicity with most measures of effect close to 0.00 (Supplemental Tables S3a-c). The interaction terms did not statistically improve the models for time spent on doing household work (men: $p=0.60$; women: $p=0.89$) or performing male- or female-dominated occupations (men: $p=0.49$; women: $p=0.28$) in men and women, and primary earner status in men ($p=0.39$), but did for primary earner status in women ($p<0.001$; Supplemental Table S3b). Although the CVD risk in women with an equal income did somewhat differ across ethnic groups, the overall observation of primary earners having a higher CVD risk than those who are no primary earner was similar in women across ethnic groups.

In the repeated analyses, the patterns of the association of masculine gender-related characteristics with higher exponentiated CVD risk were largely consistent for the separate SCORE factors in women, predominantly for smoking (Supplemental Tables S4-S6). In men, these patterns were less clear and less consistent. For instance, masculine gender-related characteristics were associated with a higher TC/HDL ratio, but also with a lower odds of smoking.

Discussion

Masculine gender-related characteristics, particularly being the primary earner and performing a male-dominated occupation, are associated with a higher estimated CVD risk. These characteristics are mainly associated with CVD risk in women. Additionally, the associations are largely consistent across ethnic groups.

Our study has limitations. First, due to the cross-sectional design of this study, we cannot rule out that the gender-related characteristics are influenced by participants' CVD risk profile. Participants with poorer health may be less likely to be primary earners, which implies that the protective effect of primary earner status may be underestimated. Additionally, participants with poorer health may spend less time on doing household work. However, poorer health may also increase the likelihood of being unemployed and therefore of spending more time on doing household work. Longitudinal studies on CVD incidence may be more insightful on the effects of gender-related characteristics. Second, the self-reported gender characteristics may be susceptible to social desirability bias. For instance, men and women may report more hours than actually spent on doing household work due to the social pressure for contributing to household chores. We are unsure whether and how this may have influenced our findings. Third, the measurement of our gender-related characteristics may be somewhat suboptimal, since the variables used were not

collected for the purpose of measuring gender. For instance, a ratio for time spent on doing household work compared to the partner is potentially a better measure for the division of household chores within a household and, hence, a better proxy of division of gender roles. Furthermore, two out of three variables (primary earner status and performing male- or female-dominated occupations) were based on occupation-related aspects. These variables may be influenced by the healthy worker effect, the phenomenon that healthy individuals are more likely to be represented in the workforce compared to sicker or less able individuals.³⁷ Therefore, extrapolations based on these variables might not fully reflect gender differences in the general population.³⁸

Overall, we observed that masculine gender-related characteristics were associated with CVD risk. This may be related to a less healthy lifestyle and greater stress among those with masculine gender. Indeed, masculinity and masculine gender roles (e.g., measured by surveys on conformity to masculine and feminine norms) have been associated with unhealthy lifestyle behaviours, such as smoking and high alcohol consumption.^{39, 40} This is in line with the findings of our additional analyses that masculine gender-related characteristics are associated with a higher odds of smoking, although we observed this mainly in women. Future studies could formally examine whether these unhealthy lifestyle behaviours pose a pathway between the association of masculine-related characteristics and higher CVD risk. In addition, masculinity (measured by the BSRI), independently of sex, has been shown to predict a high allostatic load, which refers to the long-term consequences of chronic exposure to stress on the body.⁴¹ A high allostatic load, in turn, has been associated with CVD.⁴²

Our findings were in contrast to a Scottish study, which found that, in a general population, higher femininity scores were associated with a lower risk of CHD mortality in men only and that masculinity scores were unrelated to CHD mortality.²² The Scottish study used the BSRI²¹ to measure a person's self-perceived gender identity. However, this measure might not converge with that person's gender roles and behaviour.⁴³ Another explanation is that gender-related characteristics may relate differently to the incidence, awareness, treatment, and outcome of disease. For instance, gender differences in mortality may partly reflect gender differences in CVD management (including health care access and utilization),⁴⁴ and these patterns may differ from population differences in risk for incident CVD. This may also explain why our findings on CVD risk were not in line with a Canadian study, which found that, in patients managed for premature ACS, feminine gender (as measured using similar gender-related characteristics) was associated with recurrent ACS and major adverse cardiac events.²⁰

Interestingly, not all three gender-related characteristics were equally associated in women and men. Whereas primary earner status was associated with CVD risk in both women and men, performing a male- or female-dominated occupation was predominantly associated with CVD risk in women. Since mainly women who performed a male-dominated occupation had a higher CVD risk, this suggests that other mechanisms may play a role here, primarily affecting women. For instance, women employed in a male-dominated occupations may be more exposed to power relations that result in discrimination or even sexual harassment.⁴⁵ Both discrimination and sexual harassment have been associated with poorer health outcomes through, amongst others, risk factors related to unhealthy behaviour (e.g., smoking) and to physiological stress responses (e.g., high BP).^{46, 47} This is consistent with our observations of a higher odds of smoking and higher systolic BP among women with a male-dominated occupation.

Although we observed substantial differences in the distribution of the gender-related characteristics across ethnic groups, the association between the gender-related characteristics and CVD risk was largely consistent. It is possible that we missed actual differences due to small sample sizes, as may be suggested by large confidence intervals. However, our findings may also indicate that, in our context (general population in Amsterdam, the Netherlands) and using these gender-related characteristics, the effect of gender disparities may be more universal than initially expected.

Different aspects of gender (i.e., gender roles, institutionalized gender, gender relations, gender identity) may influence cardiovascular health differently with different underlying mechanisms.¹⁰ This is supported by our finding that the gender-related characteristics were weakly correlated and differently associated with CVD risk and the separate CVD risk factors. In addition, we should note that we did not take into account gender identity and gender relations. We therefore encourage future research on the development and implementation of practical gender measures incorporating all aspects of gender.

In conclusion, our findings provide additional evidence on the relevance of gender for cardiovascular health. Masculine gender-related characteristics were associated with a higher estimated CVD risk, particularly among women. This suggests that the gender dimension may be specifically relevant for CVD risk in women. We encourage future studies to examine whether gender-related characteristics also associate with CVD incidence and with other important CVD risk factors not included in the SCORE algorithm, e.g., diabetes and chronic kidney disease. If confirmed in future research,

the value of gender-related characteristics for the identification of CVD risk groups for targeted prevention strategies should be further investigated.

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Supplemental Table S1. Baseline characteristics of the study population (n=9,185), stratified by sex and ethnic group

	Total	South-Asian			African		Turkish	Moroccan
		Dutch	Surinamese	Ghanaian	Surinamese	Ghanaian		
Men	n=3,860	n=1,008	n=458	n=810	n=485	n=571	n=528	
Age (years)	51.1 (6.7)	52.5 (7.4)	50.1 (6.4)	52.6 (6.6)	51.1 (6.1)	48.7 (5.6)	49.7 (6.4)	
Educational level (missing: n=25)								
Never or elementary only	584 (15.2)	25 (2.5)	52 (11.4)	50 (6.2)	91 (18.9)	183 (32.1)	183 (35.1)	
Low	1,229 (32.0)	149 (14.9)	169 (37.0)	357 (44.4)	227 (47.2)	188 (33.0)	139 (26.7)	
Intermediate	961 (25.1)	223 (22.3)	119 (26.0)	232 (28.9)	126 (26.2)	123 (21.6)	138 (26.5)	
High	1,061 (27.7)	605 (60.4)	117 (25.6)	165 (20.5)	37 (7.7)	76 (13.3)	61 (11.7)	
Occupational level (missing: n=248)								
Elementary	577 (16.0)	9 (0.9)	36 (8.3)	66 (8.7)	265 (59.3)	85 (16.4)	116 (24.1)	
Low	1,218 (33.7)	125 (12.8)	153 (35.3)	169 (22.3)	21 (4.7)	61 (11.8)	45 (9.4)	
Intermediate	815 (22.6)	247 (25.4)	131 (30.3)	334 (44.0)	126 (28.2)	269 (51.9)	211 (43.9)	
High or academic	1,002 (27.7)	593 (60.9)	113 (26.1)	190 (25.0)	35 (7.8)	103 (19.9)	109 (22.7)	
Living with ≥1 adults (missing: n=73)	2,731 (72.1)	711 (71.0)	339 (75.0)	410 (52.0)	332 (71.7)	485 (86.3)	454 (87.3)	
Smoking status								
Current	1,159 (30.0)	222 (22.0)	166 (36.2)	370 (45.7)	38 (7.8)	227 (39.8)	136 (25.8)	
Past	1,128 (29.2)	453 (44.9)	91 (19.9)	186 (23.0)	58 (12.0)	170 (29.8)	170 (32.2)	
Never	1,573 (40.8)	333 (33.0)	201 (43.9)	254 (31.4)	389 (80.2)	174 (30.5)	222 (42.0)	
Systolic BP (mmHg)	132.3 (16.7)	130.6 (16.0)	132.3 (16.6)	135.2 (17.3)	140.9 (17.5)	128.0 (14.7)	128.1 (14.4)	
TC/HDL ratio (mmol/L)	4.2 (1.4)	4.2 (1.3)	4.8 (1.4)	3.8 (1.2)	3.6 (1.1)	4.9 (1.5)	4.5 (1.2)	

Supplemental Table S1. Continued

	Total	South-Asian				African		Turkish	Moroccan
		Dutch	Surinamese	Ghanaian	Surinamese	Ghanaian	Turkish		
Women	n=5,325	n=1,269	n=694	n=1,266	n=705	n=650	n=741		
Age (years)	50.6 (6.7)	52.6 (7.2)	51.0 (6.4)	51.9 (6.5)	48.6 (5.6)	48.1 (5.8)	49.0 (6.4)		
Educational level (missing: n=32)									
Never or elementary only	1,256 (23.7)	41 (3.2)	97 (14.1)	55 (4.4)	311 (44.6)	334 (51.9)	418 (56.6)		
Low	1,443 (27.3)	225 (17.8)	284 (41.2)	437 (34.7)	254 (36.4)	123 (19.1)	120 (16.3)		
Intermediate	1,294 (24.4)	271 (21.4)	174 (25.2)	447 (35.5)	120 (17.2)	132 (20.5)	150 (20.3)		
High	1,300 (24.6)	728 (57.5)	135 (19.6)	320 (25.4)	12 (1.7)	55 (8.5)	50 (6.8)		
Occupational level (missing: n=889)									
Elementary	941 (21.2)	26 (2.1)	89 (14.1)	58 (4.9)	476 (77.8)	153 (38.6)	139 (36.9)		
Low	993 (22.4)	188 (15.2)	203 (32.2)	314 (26.4)	91 (14.9)	107 (27.0)	90 (23.9)		
Intermediate	1,274 (28.7)	324 (26.3)	218 (34.6)	511 (43.0)	35 (5.7)	87 (22.0)	99 (26.3)		
High or academic	1,228 (27.7)	695 (56.4)	120 (19.0)	305 (25.7)	10 (1.6)	49 (12.4)	49 (13.0)		
Living with ≥1 adults (missing: n=106)	3,676 (70.4)	827 (65.5)	479 (70.0)	754 (60.9)	417 (62.5)	562 (87.5)	637 (87.7)		
Smoking status									
Current	874 (16.4)	271 (21.4)	122 (17.6)	284 (22.4)	17 (2.4)	163 (25.1)	17 (2.3)		
Past	1,008 (18.9)	562 (44.3)	63 (9.1)	243 (19.2)	40 (5.7)	83 (12.8)	17 (2.3)		
Never	3,443 (64.7)	436 (34.4)	509 (73.3)	739 (58.4)	648 (91.9)	404 (62.2)	707 (95.4)		
Systolic BP (mmHg)	128.0 (18.4)	122.2 (16.3)	129.5 (19.9)	132.2 (18.0)	137.8 (18.8)	124.5 (16.8)	122.9 (15.9)		
TC/HDL ratio (mmol/L)	3.4 (1.1)	3.3 (1.1)	3.8 (1.1)	3.3 (1.0)	3.1 (0.8)	3.8 (1.1)	3.6 (1.0)		

BP, blood pressure; HDL, high-density lipoprotein cholesterol; TC, total cholesterol.

Data are presented as means (standard deviations) or frequencies (percentages).

Supplemental Table S2. Distribution of time spent on doing household work by primary earner status and performing a male- or female-dominated occupation, and distribution of primary earner status by performing a male- or female-dominated occupation, stratified by sex

		Time spent on doing household work															
		Men						Women									
		>3-8 hours/week		>8-16 hours/week		>16 hours/week		0-3 hours/week		>3-8 hours/week		>8-16 hours/week		>16 hours/week			
Primary earner status^a	Yes	1,169 (82.0)	928 (77.3)	609 (76.9)	318 (75.0)	366 (65.9)	825 (66.6)	880 (57.6)	936 (47.6)	1,068 (38.3)	935 (33.6)	675 (24.2)	108 (3.9)	1,068 (38.3)	935 (33.6)	675 (24.2)	108 (3.9)
	Equal income	187 (13.1)	208 (17.3)	130 (16.4)	69 (16.3)	85 (15.3)	199 (16.1)	256 (16.8)	297 (15.1)	366 (65.9)	85 (15.3)	104 (18.7)	19 (4.4)	366 (65.9)	85 (15.3)	104 (18.7)	19 (4.4)
	No	69 (4.8)	65 (5.4)	53 (6.7)	37 (8.7)	104 (18.7)	215 (17.4)	392 (25.7)	733 (37.3)	19 (4.4)	104 (18.7)	19 (4.4)	85 (6.5)	19 (4.4)	104 (18.7)	19 (4.4)	85 (6.5)
Performing a male- or female-dominated occupation^b	≤25% female workers	485 (36.7)	391 (35.6)	283 (38.8)	149 (37.9)	98 (22.6)	248 (22.8)	245 (18.7)	266 (17.9)	485 (36.7)	391 (35.6)	283 (38.8)	149 (37.9)	485 (36.7)	391 (35.6)	283 (38.8)	149 (37.9)
	26-50% female workers	440 (33.3)	387 (35.2)	242 (33.2)	125 (31.8)	98 (22.6)	248 (22.8)	245 (18.7)	266 (17.9)	440 (33.3)	387 (35.2)	242 (33.2)	125 (31.8)	440 (33.3)	387 (35.2)	242 (33.2)	125 (31.8)
	51-75% female workers	355 (26.9)	257 (23.4)	182 (24.9)	99 (25.2)	206 (47.6)	474 (43.6)	576 (43.9)	685 (46.0)	355 (26.9)	257 (23.4)	182 (24.9)	99 (25.2)	355 (26.9)	257 (23.4)	182 (24.9)	99 (25.2)
	≥76% female workers	41 (3.1)	64 (5.8)	23 (3.2)	20 (5.1)	110 (25.4)	309 (28.5)	406 (30.9)	479 (32.2)	41 (3.1)	64 (5.8)	23 (3.2)	20 (5.1)	41 (3.1)	64 (5.8)	23 (3.2)	20 (5.1)

		Primary earner status					
		Men			Women		
		Yes	Equal income	No	Yes	Equal income	No
Performing a male- or female-dominated occupation^c	≤25% female workers	1,068 (38.3)	177 (32.5)	57 (29.4)	150 (5.8)	36 (5.2)	31 (3.1)
	26-50% female workers	935 (33.6)	187 (34.3)	71 (36.6)	493 (19.0)	166 (23.9)	195 (19.7)
	51-75% female workers	675 (24.2)	150 (27.5)	57 (29.4)	1,131 (43.6)	298 (42.9)	488 (49.2)
	≥76% female workers	108 (3.9)	31 (5.7)	9 (4.6)	821 (31.6)	195 (28.1)	278 (28.0)

Data are presented as frequencies (percentages).

^a Cramer's V: 0.05, p<0.01 (men); 0.14, p<0.001 (women).

^b Cramer's V: 0.04, p=0.03 (men); 0.05, p<0.001 (women).

^c Cramer's V: 0.05, p=0.02 (men); 0.06, p<0.001 (women).

Supplemental Table S3a. Assessment of effect modification by ethnicity in the association of time spent on household work with log-transformed estimated CVD risk, stratified by sex

	Men				Women			
	Measure of effect modification on		Measure of effect modification on		Measure of effect modification on		Measure of effect modification on	
	Beta (95% CI)	p-value ^a	beta (95% CI)	p-value ^b	Beta (95% CI)	p-value ^a	beta (95% CI)	p-value ^b
Time spent on household work								
Dutch								
0-3 hours/week	0	NA	Reference	NA	0	NA	Reference	NA
>3-8 hours/week	0.01 (-0.06; 0.08)	0.87	NA	NA	-0.01 (-0.09; 0.07)	0.77	NA	NA
>8-16 hours/week	-0.01 (-0.09; 0.07)	0.83	NA	NA	-0.03 (-0.11; 0.05)	0.42	NA	NA
>16 hours/week	0.00 (-0.12; 0.13)	0.95	NA	NA	-0.02 (-0.10; 0.07)	0.69	NA	NA
South-Asian Surinamese								
0-3 hours/week	0.22 (0.12; 0.32)	<0.001	NA	NA	0.15 (0.02; 0.28)	0.03	NA	NA
>3-8 hours/week	0.21 (0.12; 0.31)	<0.001	-0.02 (-0.15; 0.12)	0.81	0.19 (0.09; 0.29)	<0.001	0.05 (-0.10; 0.20)	0.52
>8-16 hours/week	0.17 (0.07; 0.27)	<0.01	-0.04 (-0.19; 0.10)	0.55	0.16 (0.07; 0.25)	<0.001	0.05 (-0.10; 0.20)	0.53
>16 hours/week	0.30 (0.16; 0.43)	<0.001	0.07 (-0.12; 0.26)	0.48	0.15 (0.06; 0.23)	<0.001	0.02 (-0.13; 0.16)	0.83
African Surinamese								
0-3 hours/week	0.07 (-0.01; 0.16)	0.10	NA	NA	0.12 (0.02; 0.22)	0.02	NA	NA
>3-8 hours/week	0.04 (-0.04; 0.12)	0.32	-0.04 (-0.15; 0.08)	0.51	0.12 (0.04; 0.21)	<0.01	0.01 (-0.11; 0.13)	0.86
>8-16 hours/week	0.09 (0.01; 0.18)	0.03	0.03 (-0.10; 0.15)	0.65	0.15 (0.07; 0.23)	<0.001	0.06 (-0.05; 0.18)	0.29
>16 hours/week	0.05 (-0.05; 0.14)	0.35	-0.03 (-0.19; 0.13)	0.70	0.14 (0.06; 0.22)	<0.001	0.04 (-0.08; 0.15)	0.53

Supplemental Table S3a. Continued

Time spent on household work	Men				Women			
	Measure of effect modification on		Measure of effect modification on		Measure of effect modification on		Measure of effect modification on	
	Beta (95% CI)	p-value ^a	additive scale: beta (95% CI)	p-value ^b	Beta (95% CI)	p-value ^a	additive scale: beta (95% CI)	p-value ^b
Ghanaian								
0-3 hours/week	-0.08 (-0.17; 0.00)	0.06	NA	NA	0.09 (-0.02; 0.19)	0.10	NA	NA
>3-8 hours/week	-0.03 (-0.13; 0.07)	0.56	0.04 (-0.08; 0.17)	0.49	0.12 (0.02; 0.21)	0.01	0.04 (-0.08; 0.16)	0.52
>8-16 hours/week	-0.11 (-0.23; 0.01)	0.08	-0.02 (-0.17; 0.13)	0.80	0.06 (-0.03; 0.16)	0.17	0.01 (-0.12; 0.13)	0.89
>16 hours/week	-0.06 (-0.20; 0.08)	0.39	0.02 (-0.17; 0.20)	0.86	0.11 (0.01; 0.20)	0.03	0.04 (-0.09; 0.16)	0.59
Turkish								
0-3 hours/week	0.19 (0.12; 0.27)	<0.001	NA	NA	0.06 (-0.06; 0.18)	0.33	NA	NA
>3-8 hours/week	0.15 (0.05; 0.25)	<0.01	-0.05 (-0.17; 0.07)	0.42	0.14 (0.03; 0.25)	0.01	0.10 (-0.05; 0.25)	0.21
>8-16 hours/week	0.16 (0.03; 0.29)	0.01	-0.02 (-0.18; 0.13)	0.75	0.09 (-0.01; 0.19)	0.08	0.06 (-0.08; 0.20)	0.39
>16 hours/week	-0.01 (-0.17; 0.15)	0.90	-0.21 (-0.41; -0.01)	0.04	0.12 (0.03; 0.20)	<0.01	0.07 (-0.06; 0.21)	0.27
Moroccan								
0-3 hours/week	-0.00 (-0.09; 0.08)	0.97	NA	NA	-0.13 (-0.26; 0.00)	0.049	NA	NA
>3-8 hours/week	0.00 (-0.10; 0.10)	1.00	0.00 (-0.12; 0.12)	0.95	-0.14 (-0.25; -0.03)	0.01	0.00 (-0.16; 0.16)	1.00
>8-16 hours/week	-0.07 (-0.18; 0.05)	0.25	-0.06 (-0.20; 0.09)	0.44	-0.09 (-0.18; 0.01)	0.08	0.08 (-0.07; 0.22)	0.31
>16 hours/week	-0.04 (-0.18; 0.11)	0.63	-0.04 (-0.23; 0.16)	0.70	-0.07 (-0.15; 0.02)	0.11	0.08 (-0.06; 0.22)	0.27

CI, confidence interval; CVD, cardiovascular disease; NA, not applicable.

Adjusted for age, educational level, and household composition.

^a p-values are given for the beta coefficients. p-values <0.05 were regarded statistically significant and are marked in bold.^b p-values are given for the beta coefficients of the measure of effect modification on an additive scale. p-values <0.05 were regarded statistically significant and are marked in bold.

Supplemental Table S3b. Assessment of effect modification by ethnicity in the association of primary earner status with log-transformed estimated CVD risk, stratified by sex

	Men				Women			
	Measure of effect modification on		Measure of effect modification on		Measure of effect modification on		Measure of effect modification on	
	Beta (95% CI)	p-value ^a	additive scale: beta (95% CI)	p-value ^b	Beta (95% CI)	p-value ^a	additive scale: beta (95% CI)	p-value ^b
Primary earner status								
Dutch								
Yes	0	NA	Reference	NA	0	NA	Reference	NA
Equal income	-0.05 (-0.12; 0.02)	0.16	NA	NA	-0.16 (-0.22; -0.10)	<0.001	NA	NA
No	-0.08 (-0.19; 0.04)	0.18	NA	NA	-0.12 (-0.17; -0.06)	<0.001	NA	NA
South-Asian								
Surinamese								
Yes	0.21 (0.15; 0.27)	<0.001	NA	NA	0.12 (0.07; 0.18)	<0.001	NA	NA
Equal income	0.14 (0.03; 0.26)	0.01	-0.01 (-0.15; 0.12)	0.86	0.14 (0.06; 0.23)	<0.001	0.18 (0.08; 0.28)	<0.001
No	0.16 (-0.01; 0.34)	0.06	0.03 (-0.18; 0.24)	0.77	0.07 (-0.01; 0.15)	0.08	0.06 (-0.03; 0.16)	0.18
African Surinamese								
Yes	0.04 (-0.01; 0.09)	0.14	NA	NA	0.12 (0.07; 0.16)	<0.001	NA	NA
Equal income	0.13 (0.03; 0.23)	0.01	0.14 (0.02; 0.26)	0.03	0.11 (0.03; 0.18)	<0.01	0.15 (0.05; 0.24)	<0.01
No	-0.01 (-0.15; 0.12)	0.85	0.02 (-0.15; 0.20)	0.80	-0.02 (-0.10; 0.05)	0.55	-0.02 (-0.11; 0.07)	0.66

Supplemental Table S3b. Continued

	Men				Women			
	Beta (95% CI)	p-value ^a	Measure of effect modification on additive scale: beta (95% CI)	p-value ^b	Beta (95% CI)	p-value ^a	Measure of effect modification on additive scale: beta (95% CI)	p-value ^b
Primary earner status								
Ghanaian								
Yes	-0.08 (-0.15; -0.02)	0.01	NA	NA	0.08 (0.02; 0.13)	<0.01	NA	NA
Equal income	-0.12 (-0.24; 0.00)	0.048	0.01 (-0.13; 0.15)	0.86	-0.01 (-0.11; 0.09)	0.81	0.07 (-0.04; 0.19)	0.21
No	-0.18 (-0.37; 0.02)	0.07	-0.02 (-0.24; 0.20)	0.86	-0.06 (-0.16; 0.04)	0.23	-0.02 (-0.13; 0.09)	0.76
Turkish								
Yes	0.14 (0.08; 0.20)	<0.001	NA	NA	0.08 (0.01; 0.15)	0.03	NA	NA
Equal income	0.19 (0.06; 0.31)	<0.01	0.10 (-0.04; 0.24)	0.17	0.04 (-0.04; 0.12)	0.30	0.12 (0.02; 0.23)	0.02
No	0.22 (0.00; 0.44)	0.046	0.16 (-0.08; 0.40)	0.20	0.03 (-0.03; 0.10)	0.33	0.07 (-0.02; 0.16)	0.12
Moroccan								
Yes	-0.03 (-0.09; 0.03)	0.39	NA	NA	-0.15 (-0.21; -0.08)	<0.001	NA	NA
Equal income	-0.13 (-0.27; 0.01)	0.06	-0.05 (-0.21; 0.10)	0.49	-0.12 (-0.20; -0.03)	<0.01	0.19 (0.08; 0.30)	<0.001
No	-0.14 (-0.36; 0.08)	0.22	-0.04 (-0.29; 0.21)	0.77	-0.14 (-0.20; -0.08)	<0.001	0.12 (0.04; 0.21)	<0.01

CI, confidence interval; CVD, cardiovascular disease; NA, not applicable.

Adjusted for age, educational level, and household composition.

^a p-values are given for the beta coefficients. p-values <0.05 were regarded statistically significant and are marked in bold.^b p-values are given for the beta coefficients of the measure of effect modification on an additive scale. p-values <0.05 were regarded statistically significant and are marked in bold.

Supplemental Table S3c. Assessment of effect modification by ethnicity in the association of performing a male- or female-dominated occupation with log-transformed estimated CVD risk, stratified by sex

	Men				Women			
	Measure of effect modification on		Measure of effect modification on		Measure of effect modification on		Measure of effect modification on	
	Beta (95% CI)	p-value ^a	beta (95% CI)	p-value ^b	Beta (95% CI)	p-value ^a	beta (95% CI)	p-value ^b
Performing a male- or female-dominated occupation								
Dutch								
≤25% female workers	0	NA	Reference	NA	0	NA	Reference	NA
26-50% female workers	0.00 (-0.07; 0.08)	0.94	NA	NA	-0.17 (-0.28; -0.07)	<0.01	NA	NA
51-75% female workers	-0.03 (-0.12; 0.05)	0.41	NA	NA	-0.13 (-0.23; -0.03)	0.01	NA	NA
≥76% female workers	-0.01 (-0.15; 0.13)	0.86	NA	NA	-0.13 (-0.23; -0.02)	0.02	NA	NA
South-Asian Surinamese								
≤25% female workers	0.12 (0.03; 0.21)	<0.01	NA	NA	0.00 (-0.17; 0.17)	0.97	NA	NA
26-50% female workers	0.28 (0.19; 0.38)	<0.001	0.16 (0.03; 0.29)	0.02	0.09 (-0.03; 0.21)	0.15	0.26 (0.07; 0.45)	<0.01
51-75% female workers	0.14 (0.02; 0.25)	0.02	0.05 (-0.10; 0.20)	0.51	0.03 (-0.07; 0.14)	0.53	0.16 (-0.02; 0.34)	0.08
≥76% female workers	0.17 (-0.07; 0.40)	0.17	0.05 (-0.22; 0.33)	0.70	0.01 (-0.10; 0.12)	0.87	0.13 (-0.05; 0.32)	0.16
African Surinamese								
≤25% female workers	0.04 (-0.04; 0.11)	0.35	NA	NA	0.10 (-0.04; 0.24)	0.17	NA	NA
26-50% female workers	0.03 (-0.05; 0.12)	0.47	-0.01 (-0.12; 0.10)	0.89	0.00 (-0.11; 0.12)	0.95	0.08 (-0.08; 0.24)	0.34
51-75% female workers	-0.02 (-0.13; 0.08)	0.63	-0.03 (-0.16; 0.10)	0.70	-0.01 (-0.11; 0.10)	0.92	0.03 (-0.12; 0.18)	0.72
≥76% female workers	0.11 (-0.04; 0.26)	0.16	0.09 (-0.12; 0.29)	0.41	0.03 (-0.07; 0.13)	0.59	0.06 (-0.09; 0.21)	0.45

Supplemental Table S3c. Continued

	Men				Women			
	Measure of effect modification on		Measure of effect modification on		Measure of effect modification on		Measure of effect modification on	
	Beta (95% CI)	p-value ^a	beta (95% CI)	p-value ^b	Beta (95% CI)	p-value ^a	beta (95% CI)	p-value ^b
Performing a male- or female-dominated occupation								
Ghanaian								
≤25% female workers	-0.11 (-0.23; 0.00)	0.059	NA	NA	-0.03 (-0.24; 0.18)	0.79	NA	NA
26-50% female workers	-0.06 (-0.16; 0.04)	0.24	0.05 (-0.10; 0.20)	0.51	-0.06 (-0.19; 0.07)	0.39	0.14 (-0.09; 0.38)	0.22
51-75% female workers	-0.18 (-0.28; -0.08)	<0.001	-0.03 (-0.18; 0.12)	0.70	-0.10 (-0.21; 0.02)	0.10	0.06 (-0.16; 0.28)	0.56
≥76% female workers	-0.16 (-0.47; 0.16)	0.33	-0.03 (-0.39; 0.32)	0.86	-0.07 (-0.23; 0.09)	0.37	0.08 (-0.17; 0.33)	0.51
Turkish								
≤25% female workers	0.15 (0.06; 0.23)	<0.01	NA	NA	0.14 (-0.08; 0.36)	0.22	NA	NA
26-50% female workers	0.13 (0.04; 0.21)	<0.01	-0.02 (-0.14; 0.10)	0.70	-0.04 (-0.17; 0.08)	0.51	-0.01 (-0.25; 0.23)	0.93
51-75% female workers	0.05 (-0.06; 0.16)	0.37	-0.06 (-0.20; 0.08)	0.40	-0.05 (-0.17; 0.06)	0.36	-0.06 (-0.30; 0.17)	0.59
≥76% female workers	-0.23 (-0.65; 0.18)	0.27	-0.37 (-0.81; 0.07)	0.10	-0.01 (-0.15; 0.13)	0.89	-0.02 (-0.27; 0.22)	0.85
Moroccan								
≤25% female workers	-0.04 (-0.14; 0.05)	0.39	NA	NA	-0.29 (-0.56; -0.02)	0.04	NA	NA
26-50% female workers	-0.06 (-0.16; 0.04)	0.23	-0.02 (-0.15; 0.11)	0.76	-0.33 (-0.48; -0.18)	<0.001	0.13 (-0.16; 0.43)	0.38
51-75% female workers	-0.14 (-0.24; -0.04)	<0.01	-0.06 (-0.20; 0.08)	0.39	-0.28 (-0.40; -0.17)	<0.001	0.14 (-0.15; 0.42)	0.34
≥76% female workers	0.00 (-0.24; 0.25)	0.97	0.06 (-0.23; 0.34)	0.69	-0.17 (-0.30; -0.05)	<0.01	0.24 (-0.04; 0.53)	0.09

CI, confidence interval; CVD, cardiovascular disease; NA, not applicable.

Adjusted for age, educational level, and occupational level.

^a p-values are given for the beta coefficients. p-values <0.05 were regarded statistically significant and are marked in bold.^b p-values are given for the beta coefficients of the measure of effect modification on an additive scale. p-values <0.05 were regarded statistically significant and are marked in bold.

Supplemental Table S4. Age-adjusted mean systolic BP, stratified by sex and gender-related characteristics, and association between systolic BP and gender-related characteristics, stratified by sex

	Mean (95% CI) ^a	Beta (95% CI) ^b	p-value ^c
Men (n=3,860)			
Time spent on doing household work			
0-3 hours/week	132.5 (131.6-133.3)	0	NA
>3-8 hours/week	132.3 (131.4-133.2)	0.33 (-0.92-1.59)	0.60
>8-16 hours/week	131.7 (130.6-132.9)	-0.68 (-2.10-0.74)	0.35
>16 hours/week	133.3 (131.7-134.8)	-0.02 (-1.79-1.75)	0.98
Primary earner status			
Yes	132.5 (131.9-133.0)	0	NA
Equal income	132.4 (131.1-133.7)	-0.32 (-1.77-1.13)	0.67
No	130.7 (128.6-132.9)	-2.19 (-4.38-0.00)	0.05
Performing a male- or female-dominated occupation			
≤25% female workers	132.4 (131.6-133.3)	0	NA
26-50% female workers	132.5 (131.6-133.5)	0.48 (-0.82-1.77)	0.47
51-75% female workers	132.2 (131.2-133.3)	-0.71 (-2.22-0.81)	0.36
≥76% female workers	131.3 (128.6-133.9)	-0.05 (-2.86-2.76)	0.97
Women (n=5,325)			
Time spent on doing household work			
0-3 hours/week	127.3 (125.8-128.8)	0	NA
>3-8 hours/week	128.1 (127.1-129.1)	1.79 (0.11-3.47)	0.04
>8-16 hours/week	127.6 (126.7-128.5)	1.35 (-0.28-2.98)	0.11
>16 hours/week	128.4 (127.6-129.2)	2.02 (0.42-3.63)	0.01
Primary earner status			
Yes	129.1 (128.5-129.7)	0	NA
Equal income	126.8 (125.6-128.0)	-0.29 (-1.71-1.13)	0.69
No	126.3 (125.4-127.2)	-0.29 (-1.55-0.97)	0.66
Performing a male- or female-dominated occupation			
≤25% female workers	128.4 (126.0-130.8)	0	NA
26-50% female workers	125.4 (124.2-126.6)	-2.22 (-4.75-0.32)	0.09
51-75% female workers	129.2 (128.5-130.0)	-2.21 (-4.63-0.22)	0.07
≥76% female workers	127.6 (126.6-128.6)	-0.84 (-3.30-1.62)	0.50

BP, blood pressure; CI, confidence interval; NA, not applicable.

^a Adjusted for age.

^b Adjusted for age, ethnicity, educational level, household composition (only in analyses on time spent on doing household work and primary earner status), occupational level (only in analyses on performing a male- or female-dominated occupation).

^c p-values are given for the beta coefficients. p-values <0.05 were regarded statistically significant and are marked in bold.

Supplemental Table S5. Age-adjusted mean TC/HDL ratio, stratified by sex and gender-related characteristics, and association between TC/HDL ratio and gender-related characteristics, stratified by sex

	Mean (95% CI) ^a	Beta (95% CI) ^b	p-value ^c
Men (n=3,860)			
Time spent on doing household work			
0-3 hours/week	4.4 (4.3-4.5)	0	NA
>3-8 hours/week	4.1 (4.1-4.2)	-0.15 (-0.25; -0.05)	<0.01
>8-16 hours/week	4.2 (4.1-4.3)	-0.07 (-0.18; 0.05)	0.27
>16 hours/week	4.1 (4.0-4.2)	-0.12 (-0.26; 0.02)	0.10
Primary earner status			
Yes	4.3 (4.2-4.3)	0	NA
Equal income	4.1 (4.0-4.2)	-0.13 (-0.25; -0.01)	0.03
No	4.2 (4.0-4.3)	-0.10 (-0.28; 0.08)	0.26
Performing a male- or female-dominated occupation			
≤25% female workers	4.3 (4.2-4.4)	0	NA
26-50% female workers	4.3 (4.2-4.4)	0.02 (-0.08; 0.13)	0.68
51-75% female workers	4.1 (4.0-4.2)	-0.12 (-0.24; 0.00)	0.06
≥76% female workers	4.1 (3.9-4.4)	-0.05 (-0.28; 0.18)	0.67
Women (n=5,325)			
Time spent on doing household work			
0-3 hours/week	3.4 (3.4-3.5)	0	NA
>3-8 hours/week	3.3 (3.2-3.4)	-0.09 (-0.19; 0.01)	0.09
>8-16 hours/week	3.4 (3.3-3.4)	-0.05 (-0.15; 0.05)	0.29
>16 hours/week	3.6 (3.5-3.6)	-0.01 (-0.11; 0.09)	0.85
Primary earner status			
Yes	3.4 (3.4-3.4)	0	NA
Equal income	3.4 (3.4-3.5)	-0.06 (-0.15; 0.02)	0.15
No	3.5 (3.5-3.6)	-0.09 (-0.17; -0.01)	0.02
Performing a male- or female-dominated occupation			
≤25% female workers	3.5 (3.3-3.6)	0	NA
26-50% female workers	3.3 (3.2-3.4)	-0.15 (-0.30; 0.01)	0.06
51-75% female workers	3.4 (3.4-3.5)	-0.06 (-0.21; 0.09)	0.44
≥76% female workers	3.4 (3.3-3.5)	-0.05 (-0.20; 0.10)	0.48

CI, confidence interval; HDL, high-density lipoprotein cholesterol; NA, not applicable; TC, total cholesterol.

^a Adjusted for age.

^b Adjusted for age, ethnicity, educational level, household composition (only in analyses on time spent on doing household work and primary earner status), occupational level (only in analyses on performing a male- or female-dominated occupation).

^c p-values are given for the beta coefficients. p-values <0.05 were regarded statistically significant and are marked in bold.

Supplemental Table S6. Age-adjusted prevalence of smoking, stratified by sex and gender-related characteristics, and association between smoking and gender-related characteristics, stratified by sex

	N (%)^a	OR (95% CI)^b	p-value^c
Men (n=3,860)			
Time spent on doing household work			
0-3 hours/week	391 (26.9)	1	NA
>3-8 hours/week	369 (30.7)	1.27 (1.05-1.53)	0.01
>8-16 hours/week	250 (31.3)	1.15 (0.93-1.42)	0.18
>16 hours/week	149 (35.2)	1.17 (0.91-1.51)	0.23
Primary earner status			
Yes	920 (30.5)	1	NA
Equal income	170 (29.0)	1.19 (0.96-1.47)	0.12
No	62 (26.2)	0.99 (0.71-1.37)	0.95
Performing a male- or female-dominated occupation			
≤25% female workers	455 (34.7)	1	NA
26-50% female workers	365 (30.4)	1.02 (0.85-1.23)	0.81
51-75% female workers	215 (24.2)	0.84 (0.67-1.05)	0.13
≥76% female workers	43 (27.4)	1.17 (0.78-1.75)	0.44
Women (n=5,325)			
Time spent on doing household work			
0-3 hours/week	95 (16.4)	1	NA
>3-8 hours/week	201 (16.1)	0.89 (0.67-1.19)	0.42
>8-16 hours/week	248 (16.3)	0.89 (0.68-1.18)	0.42
>16 hours/week	330 (16.6)	0.97 (0.74-1.27)	0.81
Primary earner status			
Yes	593 (19.8)	1	NA
Equal income	109 (12.9)	0.56 (0.44-0.72)	<0.001
No	166 (11.2)	0.48 (0.38-0.60)	<0.001
Performing a male- or female-dominated occupation			
≤25% female workers	61 (28.7)	1	NA
26-50% female workers	179 (21.1)	0.77 (0.45-1.11)	0.16
51-75% female workers	297 (15.3)	0.56 (0.40-0.80)	<0.01
≥76% female workers	237 (18.3)	0.60 (0.42-0.85)	<0.01

CI, confidence interval; NA, not applicable; OR, odds ratio.

^a Adjusted for age.^b Adjusted for age, ethnicity, educational level, household composition (only in analyses on time spent on doing household work and primary earner status), occupational level (only in analyses on performing a male- or female-dominated occupation).^c p-values are given for the ORs. p-values <0.05 were regarded statistically significant and are marked in bold.