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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 6

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

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## Abstract

**Objective:** Differences in cardiovascular disease (CVD) incidence between men and women have been widely reported. Next to sex-related (biological) characteristics, gender-related (sociocultural) characteristics may partly explain how these differences arise. In this exploratory study, we examined the associations between selected gender-related characteristics and CVD incidence.

**Methods:** We linked baseline data of 18,058 participants without CVD from the population-based, multi-ethnic HEalthy Life in an Urban Setting study (Amsterdam, the Netherlands) to CVD incidence data, based on hospital admission and death records from Statistics Netherlands in 2013-2018. Using Cox regression analyses, we studied associations of time spent on household work, doing home repairs, primary earner status, type of employment, working in a male-dominated or female-dominated occupation, and desire for emotional support with CVD incidence, stratified by sex. Analyses were adjusted for age, ethnicity, and socioeconomic status.

**Results:** In men, gender-related characteristics were not associated with higher CVD incidence. In women, homemakers had a higher hazard for CVD compared with full-time workers (HR 2.34, 95% CI 1.35 to 4.04), whereas those spending a moderate amount of time on household work had a lower hazard for CVD than those spending little time (HR 0.56, 95% CI 0.34 to 0.95).

**Conclusion:** Although we found no evidence for associations between gender-related characteristics and CVD incidence in men, being the homemaker and moderate time spent on household work appeared to be associated with CVD incidence in women. Thus, attention to gender-related characteristics might in future help to identify subgroups that may benefit from additional prevention strategies.

## Introduction

Differences in cardiovascular disease (CVD) morbidity and mortality between men and women have been widely reported across populations.<sup>1</sup> The causes of these disparities may be related to both sex (a biological concept involving physical and physiological features) or sex-related factors and gender (a sociocultural concept including socially constructed roles, expectations, behaviours, expressions and identities of men, women, and gender diverse people) or gender-related factors.<sup>1-3</sup> There is a strong advocacy within the health research field,<sup>4-6</sup> and an increasing interest within cardiovascular research,<sup>1-3</sup> for the inclusion of the gender dimension in research practices. Better understanding of the role of gender-related characteristics may help to increase our understanding of how differences between men and women in cardiovascular health arise, and may ultimately help to identify subgroups that may benefit from additional prevention strategies.

Gender is about how individuals conform to social norms and societal expectations that are different for men and women, 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.<sup>4, 5</sup> Gender may affect health-related behaviour and vulnerability to stressors different from biological sex.<sup>6</sup> Thus, gender may contribute to, for instance, differences in CVD morbidity among men, among women, and between men and women. However, studies that investigate how various gender-related characteristics impact on cardiovascular health are limited, particularly longitudinal studies.<sup>7-9</sup>

In this exploratory study, we examined the association between six gender-related characteristics and CVD incidence in men and women from the population-based HHealthy Llife in an Urban Setting (HELIUS) study.

## Methods

We set up a prospective cohort study in which we linked baseline data from the HELIUS study to follow-up data on CVD incidence from Statistics Netherlands.

### HELIUS

The HELIUS study is a multi-ethnic cohort study conducted in Amsterdam, the Netherlands.<sup>10</sup> Briefly, baseline data collection took place between 2011 and 2015 and included participants of Dutch, South-Asian Surinamese, African Surinamese,

Ghanaian, Moroccan, and Turkish origin aged 18-70 years living in Amsterdam. Potential participants were sampled with a random sampling method from the municipality registry, after stratification by ethnicity. Data were obtained by questionnaire and physical examinations (including biological samples).

### **Linkage and study population**

Questionnaire data and data from physical examinations were available for 22,165 participants, of whom we included 19,932 participants who gave permission for data linkage. Using citizen service numbers, these data were linked to hospital admission and death records, by Statistics Netherlands. Linkage was successful for 19,893 participants (99.8%).

Hospital admission data are provided to Statistics Netherlands by Dutch Hospital Data and include records on all admissions of 1 day or more to general and academic hospitals in the Netherlands that could be linked to nationwide citizen service numbers (97.3% in 2013 to 99.7% in 2018). Ambulatory contacts (outpatient contacts and emergency room visits without subsequent admission) are not included. For this study, we included all admissions between 2013 and 2018. After linkage, the cases were pseudonymized by Statistics Netherlands. Completeness of records increased from 93.9% (2013) to 99.97% (2016). Records were less complete in 2017 (75.7%) and 2018 (73.0%), potentially related to bankruptcy of a large hospital in Amsterdam in that period.

Death records include all deaths and causes of death of persons registered in the cause of death registry at Statistics Netherlands. We included all death records up to and including 2018.

We excluded participants of Javanese Surinamese (n=218), unknown Surinamese (n=237), and another/unknown ethnic origin (n=44). We also excluded participants with a history of CVD at baseline (n=1,039) or missing data on prior CVD (n=297), based on self-reported prior myocardial infarction, cerebrovascular accident, angioplasty or bypass surgery on heart or legs, resulting in a study population of 18,058 participants.

### **CVD incidence**

CVD incidence was based on 1) first registered hospital admissions for any primary diagnosis of ischaemic heart disease (International Classification of Diseases and Related Health Problems [ICD]-10 codes I20-I25), heart failure (I11, I13, I50), cerebrovascular disease (I60-I69), or peripheral artery disease (I70-I79), including aortic aneurysm (I71), after baseline measurement, and on 2) deaths due to any of

these diseases, or instantaneous death (R96.0), or death occurring in <24 hours from onset of symptoms, not otherwise specified (R96.1). For sensitivity analyses, we additionally included hypertensive disease (I10-I15) and cardiac arrhythmias (I44-I49).

### **Gender-related characteristics**

We constructed six gender-related characteristics as proxies for mechanisms related to three gender domains (gender roles, gender relations, institutionalized gender)<sup>4</sup>: 1) time spent on household work, 2) doing home repairs, 3) primary earner status, 4) type of employment, 5) working in a male- or female-dominated occupation, and 6) desire for emotional support (Supplemental Methods). We selected these characteristics *a priori* from previous literature<sup>11-14</sup> built on the implication that they are traditionally ascribed to either men or women based on social norms and expectations in contemporary Western societies<sup>4, 5</sup> and on data availability in HELIUS. Although gender norms and roles tend to be more fluid now compared with decades ago, recent studies show that traditional gender roles and gender stereotyping, such as the man as ‘the breadwinner’ and the woman as ‘the main caretaker’ within households, are still deeply embedded in contemporary societies,<sup>15, 16</sup> also in the Netherlands<sup>17</sup>. We excluded characteristics that are proximal risk factors for health outcomes and are potential mediating factors in the associations between gender-related characteristics and CVD incidence (e.g., smoking). Based on the assumption that associations between the characteristics and CVD incidence may be non-linear, all characteristics were included as categorical variables.

### **Covariables**

The covariables included sex, ethnicity, educational level, occupational level, household composition, civil status, smoking status, systolic blood pressure (SBP), total cholesterol (TC)/high-density lipoprotein cholesterol (HDL-C) ratio, and diabetes (see Supplemental Methods for details).

### **Statistical analyses**

Baseline characteristics were stratified by sex, and presented as frequencies and percentages or as arithmetic means and SD. To determine to what extent the gender-related characteristics measure similar aspects of gender, we tested correlation between the characteristics using Cramer’s V by sex.

Crude and age-standardised CVD incidence rates per 1,000 person-years were calculated stratified by sex and gender-related characteristics. Follow-up duration was determined from inclusion date within HELIUS until first CVD event, death, or

end of follow-up duration (31 December 2018). We used the age structure of the Dutch population in 2014 (midpoint of baseline data collection) as the standard.

To explore the association of the gender-related characteristics with CVD incidence, we performed Cox (proportional hazards) regression analysis with the six gender-related characteristics in separate analyses. Since there were only few missings (<5%; Table 1), we excluded participants with missing data from the analyses. The proportional hazards assumption was checked by visual inspection and tests based on Schoenfeld residuals. Crude associations were obtained by bivariate regression analyses. Then, we performed multivariable regression analyses (main analyses), adjusted for age, ethnicity, and educational level (as proxy for socioeconomic status). The analyses on time spent on household work, doing home repairs, and primary earner status were additionally adjusted for household composition; the analyses on type of employment and working in a male- or female-dominated occupation for occupational level; and the analyses on emotional support for civil status. Likelihood ratio tests were performed to compare models with and without the characteristics. All analyses were *a priori* stratified by sex. We also checked whether the associations differed between men and women by adding a statistical interaction term for sex and the gender-related characteristics to the main models.

To explore to what extent the associations were explained by conventional risk factors, we additionally adjusted for smoking status, SBP, TC/HDL-C ratio, and diabetes. Furthermore, we repeated the main analyses with the six gender-related characteristics in one mutually adjusted regression model to explore their independent associations with CVD incidence. Additionally, we repeated the main analyses with the broader CVD definition (including hypertensive disease and cardiac arrhythmias). Finally, we restricted the main analyses for time spent on doing household work, doing home repairs and primary earner status to those living with one or more adults.

All statistical analyses were performed in R studio version 3.6.2.<sup>18</sup> p-values <0.05 were regarded as statistically significant.

### **Patient and public involvement**

Although there was no specific patient or public involvement, the current study was supported by our previous findings showing that more research on sex and gender differences in CVD was perceived as relevant by people with CVD or at increased CVD risk, and next of kin.<sup>19</sup>



**Table 1.** Study population characteristics (n=18,058)

	<b>Men (n=7,645)</b>	<b>Women (n=10,413)</b>
Age (years)	44.4 (13.2)	43.6 (13.2)
Ethnicity		
Dutch	1,878 (24.6)	2,225 (21.4)
South-Asian Surinamese	1,073 (14.0)	1,415 (13.6)
African Surinamese	1,362 (17.8)	2,092 (20.1)
Ghanaian	763 (10.0)	1,208 (11.6)
Turkish	1,311 (17.1)	1,569 (15.1)
Moroccan	1,258 (16.5)	1,904 (18.3)
Time spent on household work		
0-3 h/week	3,095 (40.5)	1,602 (15.4)
>3-7.75 h/week	2,108 (27.6)	2,214 (21.3)
>7.75-16 h/week	1,697 (22.2)	3,070 (29.5)
>16 h/week	745 (9.7)	3,527 (33.9)
Doing home repairs		
Yes	2,119 (27.7)	1,157 (11.1)
No	5,526 (72.3)	9,256 (88.9)
Primary earner status		
Yes	5,298 (69.3)	5,121 (49.2)
Equal income	1,062 (13.9)	1,536 (14.8)
No	1,210 (15.8)	3,625 (34.8)
Missing	75 (1.0)	131 (1.3)
Type of employment		
Full-time	4,425 (57.9)	3,220 (30.9)
Part-time	812 (10.6)	2,216 (21.3)
Homemaker	184 (2.4)	1,577 (15.1)
Not employed	2,164 (28.3)	3,302 (31.7)
Missing	60 (0.8)	98 (0.9)
Working in a male- or female-dominated occupation		
≤25% female workers	2,479 (32.4)	373 (3.6)
26-50% female workers	2,369 (31.0)	1,677 (16.1)
51-75% female workers	1,662 (21.7)	3,671 (35.3)
≥76% female workers	286 (3.7)	2,482 (23.8)
Not applicable	459 (6.0)	1,742 (16.7)
Missing	390 (5.1)	468 (4.5)
Desire for emotional support		
Low	651 (8.5)	909 (8.7)
Medium	4,044 (52.9)	5,061 (48.6)
High	2,801 (36.6)	4,235 (40.7)
Missing	149 (1.9)	208 (2.0)

**Table 1.** Continued

	<b>Men (n=7,645)</b>	<b>Women (n=10,413)</b>
Educational level		
Never or elementary only	1,016 (13.3)	2,051 (19.7)
Low	2,145 (28.1)	2,524 (24.2)
Intermediate	2,282 (29.8)	3,011 (28.9)
High	2,151 (28.1)	2,749 (26.4)
Missing	51 (0.7)	78 (0.7)
Occupational level		
Elementary	926 (12.1)	1,518 (14.6)
Low	2,441 (31.9)	2,130 (20.5)
Intermediate	1,600 (20.9)	2,437 (23.4)
High or academic	1,960 (25.6)	2,354 (22.6)
Not applicable	425 (5.6)	1,703 (16.4)
Missing	293 (3.8)	271 (2.6)
Household composition		
Living with $\geq 1$ adults	5,656 (74.0)	7,322 (70.3)
Living without adults	1,865 (24.4)	2,877 (27.6)
Missing	124 (1.6)	214 (2.1)
Civil status		
Married/civil union/cohabiting	4,329 (56.6)	4,753 (45.6)
Unmarried/divorced/widowed	3,280 (42.9)	5,608 (53.9)
Missing	36 (0.5)	52 (0.5)
Smoking status		
Current	2,388 (31.2)	1,853 (17.8)
Former	1,961 (25.7)	1,656 (15.9)
Never	3,271 (42.8)	6,874 (66.0)
Missing	25 (0.3)	30 (0.3)
Systolic blood pressure (mmHg)		
Missing	14 (0.2)	29 (0.3)
TC/HDL-C ratio (mmol/L)		
Missing	35 (0.5)	67 (0.6)
Diabetes		
Missing	30 (0.4)	52 (0.5)

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

HDL-C, high-density lipoprotein cholesterol; TC, total cholesterol.

## Results

Around 58% of the participants were women. Mean age at inclusion was 44.4 years in men and 43.6 years in women (Table 1). As expected, the more masculine characteristics were highly prevalent among men, except doing home repairs and a

low level of desire for emotional support, whereas the more feminine characteristics were more prevalent among women. However, a small majority of women indicated that they were the primary earner of the household income. These patterns were similar across ethnic groups, with a few exceptions (Supplemental Table S1). For instance, most Turkish and Moroccan women were not the primary earner. The gender-related characteristics were weakly correlated in both men and women (Supplemental Table S2).

Mean follow-up duration was 4.8 years in men and 4.9 years in women (Table 2). A total of 194 men and 165 women developed CVD, corresponding to age-standardized CVD incidence rates of 5.4 and 3.3 per 1,000 person-years, respectively. One third of men and 15% of women had an acute myocardial infarction as first event, whereas around 20% of both men and women had a stroke as first event (Supplemental Table S3). The incidence of CVD varied across categories of gender-related characteristics (Table 3). The age-standardized incidence rate was highest among men who performed an occupation with <25% female workers and lowest among part-time working women.

**Table 2.** Number of CVD cases and CVD incidence per 1,000 person-years among men and women

	<b>Men (n=7,645)</b>	<b>Women (n=10,413)</b>
CVD cases (n)	194	165
Follow-up duration (person-years)		
Sum	36,819	50,533
Mean (SD)	4.8 (1.2)	4.9 (1.2)
Crude CVD incidence, per 1,000 person-years	5.3	3.3
Age-standardized CVD incidence (95% CI), per 1,000 person-years	5.4 (4.6-6.2)	3.4 (2.9-4.0)

CI, confidence interval; CVD, cardiovascular disease; SD, standard deviation.

In the adjusted analyses, the gender-related characteristics were not associated with CVD incidence in men (Table 4; Figure 1). In line, models did not significantly improve by the addition of the characteristics. In women, those spending a moderate amount of time on household work had a lower hazard for CVD than those spending little time (HR 0.56, 95% CI 0.34 to 0.95), while those spending much time had a similar hazard to those spending little time (HR 0.95, 95% CI 0.60 to 1.50). Furthermore, homemakers had a higher hazard for CVD compared with full-time workers (HR 2.34, 95% CI 1.35 to 4.04). Models significantly improved by the addition of type of employment and of desire for emotional support. Only the interaction term for sex and primary earner status was statistically significant (Supplemental Table S4). In line, the stratified analyses suggested a lower hazard for those not being the primary earner in men, and a higher hazard in women.

**Table 3.** Number of CVD cases and age-standardized CVD incidence per 1,000 person-years among men and women, by gender-related characteristics

	Men (n=7,645)		Women (n=10,413)	
	Number of cases	Age-standardized incidence rate (95% CI), per 1,000 person-years	Number of cases	Age-standardized incidence rate (95% CI), per 1,000 person-years
Time spent on household work				
<3 h/week	67	5.3 (3.9-6.6)	28	4.7 (2.9-6.5)
3-7.75 h/week	58	6.3 (4.6-8.1)	25	2.7 (1.6-3.8)
7.75-16 h/week	48	5.3 (3.7-6.8)	36	2.6 (1.7-3.5)
>16 h/week	21	4.5 (2.5-6.5)	76	4.1 (3.1-5.1)
Doing home repairs				
Yes	66	5.7 (4.3-7.1)	19	3.2 (1.6-4.9)
No	128	5.3 (4.3-6.2)	146	3.4 (2.8-4.0)
Primary earner status				
Yes	153	5.5 (4.6-6.4)	96	3.4 (2.7-4.1)
Equal income	x <sup>a</sup>	5.7 (3.5-7.9)	18	2.8 (1.4-4.1)
No	x <sup>a</sup>	x <sup>a</sup>	51	4.0 (2.8-5.1)
Type of employment				
Full-time	98	5.0 (3.7-6.3)	39	2.3 (1.3-3.3)
Part-time	15	4.1 (1.8-6.4)	17	1.8 (0.7-2.8)
Homemaker	x <sup>a</sup>	x <sup>a</sup>	40	5.6 (3.8-7.5)
Not employed	x <sup>a</sup>	5.6 (4.3-7.0)	68	4.0 (3.0-5.0)
Working in a male- or female-dominated occupation				
<25% female workers	75	6.4 (4.8-7.9)	x <sup>a</sup>	x <sup>a</sup>
26-50% female workers	57	5.3 (3.8-6.8)	28	4.2 (2.5-5.9)
51-75% female workers	43	5.0 (3.4-6.5)	48	2.9 (2.0-3.8)
≥76% female workers	x <sup>a</sup>	x <sup>a</sup>	43	3.3 (2.3-4.3)
Not applicable	x <sup>a</sup>	x <sup>a</sup>	x <sup>a</sup>	4.2 (2.7-5.7)
Desire for emotional support				
Low	17	4.6 (2.3-6.9)	16	3.8 (1.7-5.8)
Medium	102	5.3 (4.3-6.4)	66	2.7 (2.0-3.3)
High	73	5.7 (4.3-7.1)	83	4.5 (3.5-5.6)

CI, confidence interval; CVD, cardiovascular disease.

<sup>a</sup> Number of cases or incidence rates not reported due to small numbers (<10 cases) in at least one of the groups.

**Table 4.** Crude and adjusted associations between gender-related characteristics (in separate models<sup>a</sup>) and CVD incidence, stratified by sex

	Men (n=7,645)				p-value for LRT <sup>c</sup>
	Crude		Adjusted <sup>b</sup>		
	HR (95% CI)	p-value	HR (95% CI)	p-value	
Time spent on household work					
<3 h/week	Ref		Ref		
3-7.75 h/week	1.27 (0.89-1.81)	0.18	1.13 (0.78-1.63)	0.53	0.69
7.75-16 h/week	1.29 (0.89-1.86)	0.18	0.91 (0.62-1.36)	0.65	
>16 h/week	1.26 (0.77-2.06)	0.36	0.81 (0.48-1.35)	0.41	
Doing home repairs					
Yes	Ref		Ref		0.80
No	0.75 (0.56-1.01)	0.06	0.93 (0.68-1.26)	0.63	
Primary earner status					
Yes	Ref		Ref		0.35
Equal income	0.98 (0.67-1.45)	0.94	1.12 (0.75-1.70)	0.58	
No	0.23 (0.11-0.46)	<b>&lt;0.001</b>	0.58 (0.28-1.21)	0.15	
Type of employment					
Full-time	Ref		Ref		0.92
Part-time	0.84 (0.49-1.44)	0.52	0.90 (0.51-1.59)	0.72	
Homemaker	1.23 (0.50-3.03)	0.65	1.37 (0.55-3.40)	0.50	
Not employed	1.59 (1.17-2.14)	<b>&lt;0.01</b>	0.99 (0.69-1.40)	0.94	
Working in a male- or female-dominated occupation					
<25% female workers	Ref		Ref		0.74
26-50% female workers	0.80 (0.57-1.13)	0.20	0.98 (0.68-1.42)	0.92	
51-75% female workers	0.84 (0.58-1.23)	0.38	0.96 (0.63-1.46)	0.83	
≥76% female workers	0.94 (0.45-1.95)	0.86	0.85 (0.38-1.90)	0.70	
Not applicable	0.44 (0.19-1.00)	0.05	0.38 (0.11-1.29)	0.12	
Desire for emotional support					
Low	Ref		Ref		0.77
Medium	0.99 (0.59-1.65)	0.97	0.92 (0.54-1.57)	0.75	
High	1.04 (0.61-1.76)	0.88	1.03 (0.60-1.79)	0.90	

**Table 4.** Continued

	Women (n=10,413)				p-value for LRT <sup>c</sup>
	Crude		Adjusted <sup>b</sup>		
	HR (95% CI)	p-value	HR (95% CI)	p-value	
Time spent on household work					
<3 h/week	Ref		Ref		
3-7.75 h/week	0.64 (0.37-1.10)	0.10	0.66 (0.37-1.16)	0.15	0.07
7.75-16 h/week	0.67 (0.41-1.09)	0.11	0.56 (0.34-0.95)	<b>0.03</b>	
>16 h/week	1.25 (0.81-1.93)	0.31	0.95 (0.60-1.50)	0.81	
Doing home repairs					
Yes	Ref		Ref		
No	1.00 (0.62-1.61)	0.99	0.87 (0.53-1.43)	0.58	0.76
Primary earner status					
Yes	Ref		Ref		
Equal income	0.64 (0.39-1.06)	0.09	0.78 (0.44-1.39)	0.40	0.20
No	0.78 (0.56-1.10)	0.16	1.35 (0.88-2.09)	0.17	
Type of employment					
Full-time	Ref		Ref		
Part-time	0.66 (0.37-1.16)	0.15	0.73 (0.40-1.32)	0.30	
Homemaker	2.31 (1.48-3.60)	<b>&lt;0.001</b>	2.34 (1.35-4.04)	<b>&lt;0.01</b>	<b>&lt;0.01</b>
Not employed	1.74 (1.17-2.58)	<b>&lt;0.01</b>	1.32 (0.85-2.04)	0.21	
Working in a male- or female-dominated occupation					
<25% female workers	Ref		Ref		
26-50% female workers	1.03 (0.42-2.48)	0.96	1.13 (0.46-2.73)	0.79	
51-75% female workers	0.80 (0.34-1.87)	0.60	0.73 (0.31-1.74)	0.48	0.47
≥76% female workers	1.05 (0.45-2.46)	0.92	0.93 (0.39-2.21)	0.87	
Not applicable	1.20 (0.50-2.86)	0.68	0.67 (0.18-2.55)	0.56	
Desire for emotional support					
Low	Ref		Ref		
Medium	0.75 (0.43-1.29)	0.30	0.78 (0.45-1.36)	0.38	<b>0.047</b>
High	1.13 (0.66-1.93)	0.66	1.25 (0.73-2.14)	0.42	

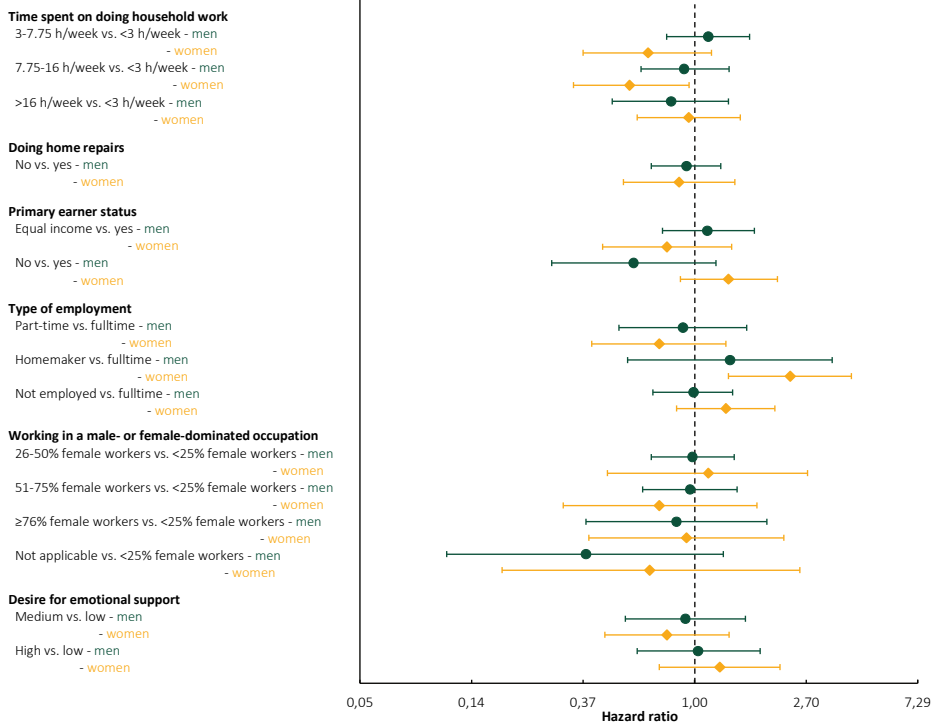
CI, confidence interval; CVD, cardiovascular disease; HR, hazard ratio; LRT, likelihood ratio test.

Statistically significant p-values are printed in bold.

<sup>a</sup> The analyses were performed for each gender-related characteristic in a separate model, i.e. not in one mutually adjusted model.

<sup>b</sup> Adjustments: age, ethnicity, educational level, and gender-related characteristic specific adjustments (the analyses on time spent on household work, doing home repairs, and primary earner status were additionally adjusted for household composition; the analyses on type of employment and working in a male- or female-dominated occupation were additionally adjusted for occupational level; and the analyses on emotional support were additionally adjusted for civil status).

<sup>c</sup> Comparing models with and without the characteristics and characteristic-specific adjustments.



**Figure 1.** Forest plot of adjusted associations between gender-related characteristics and CVD incidence for men (green dots) and women (yellow diamonds)

Conventional risk factors did not explain the associations between the gender-related characteristics and CVD incidence (Supplemental Table S5). Although the overall patterns of associations were not substantially altered by the additional analyses with the mutually adjusted model (Supplemental Table S6), with the broader definition of CVD (Supplemental Table S7), or restricted to men and women living with one or more adults (data not shown), some estimates were attenuated. For instance, the HR for homemakers changed from 2.34 to 1.92 in the mutually adjusted model.

## Discussion

In men, we did not find evidence supporting associations between gender-related characteristics and CVD incidence. In women, those spending a moderate amount of time on household work have a lower hazard for CVD than those spending little time, while homemakers have a higher hazard for CVD compared with the more masculine category of full-time workers.

Our study has limitations. First, due to the young age of the study population (age at baseline  $\leq 70$  years) and a short follow-up duration ( $\approx 5$  years), the CVD event rate and total number of events were low, potentially limiting the power of the study to demonstrate associations. Second, we may have missed CVD cases in our study population, as hospital admission data were not complete. However, the percentage of missings did not differ between men and women or by gender-related characteristics (data not shown), making it unlikely that our results were influenced. Third, we may have underestimated cumulative CVD events more in women than in men, as 1) the study population was relatively young and women tend to develop CVD at an older age, and 2) we did not include outpatient data. Associations may have been affected if the probability of hospitalization or death due to CVD differs by gender-related characteristics. Fourth, the self-reported variables used for the measurement of these characteristics were selected based on availability in HELIUS and were not collected for the purpose of measuring gender. For instance, we measured time spent on household work by the respondent alone, whereas a comparison to the partner would provide a better measure for the division of household chores and, hence, a better proxy of division of gender roles. Additionally, answers to some questions in the questionnaire may be interpreted or valued differently by men and women, and across subgroups. This may be problematic if certain subgroups are, for example, unwilling to report answers that are non-conforming to expected gender and cultural behaviours. Since there is no 'gold standard' yet for the measurement of gender-related characteristics in epidemiological studies, its operationalisation needs further validation in diverse populations. Fifth, we applied Western societal gender norms to a multi-ethnic population including people from non-Western ethnic minority groups, whose gender norms may have been influenced by different social, cultural and religious factors than the majority Dutch group. Thus, the associations of gender-related characteristics with CVD incidence may differ across ethnic groups, but numbers of CVD cases were too small to perform analyses stratified by ethnic group. We previously concluded that patterns of associations between gender-related characteristics and a different CVD outcome (estimated CVD risk) did not vary substantially across ethnic groups.<sup>7</sup> Finally, we have performed multiple statistical tests. Although adjustments for multiple comparisons are not desirable in exploratory studies,<sup>20</sup> our findings regarding associations and sex differences should be interpreted cautiously.

In men, we did not find evidence for an association between the gender-related characteristics and CVD incidence. In women, some gender-related characteristics within the domain of gender roles were associated with CVD incidence, independently of conventional risk factors. For instance, we observed that



homemakers had a 2.3 times increased risk of CVD compared with full-time workers, which is in line with previous studies on employment-related factors.<sup>21-23</sup> Homemakers are pre-eminently the main caregivers within the household and have the main responsibility for household chores. On top of this, homemakers may be more often involved in caregiving activities outside their own household, for example, for the elderly. Being a homemaker has been shown to be associated with lower psychological well-being<sup>24</sup> and psychological risk factors, such as stress and depressive symptoms, are well-known risk factors for CVD.<sup>25</sup> Although a distinction is made between homemakers and those unemployed due to the inability to work in our questionnaire, we cannot rule out the possibility that some women with poor health were self-selected into homemaking, due to health-related barriers to entry the labour market.<sup>21</sup> Furthermore, homemakers do not benefit from employment advantages, such as social support, income and self-esteem, which may positively influence the health of workers.<sup>26</sup> Male homemakers might suffer from similar problems, but the small number of male homemakers impeded confirmation.

Additionally, we observed that women spending a moderate amount of time on household work were at lower risk for CVD compared with women spending no or little time on household work. Women spending a large amount of time had a similar risk for CVD compared with women spending no or little time. This pattern hints at a U-shaped association between time spent on household work and CVD risk, which is in line with previous research.<sup>27</sup> Women who do not perform any household work, and are not conforming to their expected gender role, may do so because of health-related problems and may therefore be less healthy than women who are able to perform household work. In contrast, spending a moderate amount of time on household work may enhance physical activity of the participants, which may have several health benefits, including a lower risk of CVD.<sup>27,28</sup> Finally, women who spend a large amount of time on household work may be homemakers or carry the main responsibility for household chores, with its associated increased risk of CVD.

These combined findings indicate that women at the most masculine and most feminine end in terms of paid and unpaid labour within households (aspect of the gender roles domain) might be at higher CVD risk than women in the middle, less differentiated and perhaps more androgynous categories. The findings for primary earner status (gender roles domain) and desire for emotional support (gender relations domain) in women also hint at a U-shaped association with CVD incidence, although these associations were not statistically significant. This suggests that, for women, having more androgynous gender-related characteristics might have beneficial health effects, potentially due to the ability to effectively adapt in various contexts.<sup>29, 30</sup> Thus, these characteristics might help to identify subgroups that may

benefit from specific prevention strategies. Which combinations of factors are most relevant for identifying subgroups at highest risk remains to be investigated.

Future research into additional (combinations of) characteristics representing both different domains and aspects of domains of gender is relevant, as gender is a complex social construct and includes more domains (e.g., gender identity) and aspects of domains (e.g., childcare responsibilities) than we have taken into account.<sup>4</sup> Our selected gender-related characteristics were weakly correlated, even within domains. Thus, these various aspects of domains may be independently and differentially associated with cardiovascular health, as is also suggested by the fact that associations with CVD incidence did not change substantially after mutual adjustment for other gender-related characteristics.

In conclusion, we found no evidence for associations between gender-related characteristics and CVD incidence among men in our study. However, in women, being the homemaker was associated with higher CVD incidence, whereas spending a moderate amount of time on household work appeared to be associated with lower CVD incidence. The patterns of associations suggest that, for women, having more androgynous gender-related characteristics might be related with lower risk of CVD.

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### **Author contributions**

<b>Renee Bolijn</b>	Conceptualization, methodology, formal analysis, data curation, writing – original draft, visualization
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Yolande Appelman	Writing – review & editing
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Eric P. Moll van Charante	Writing – review & editing
Karien Stronks	Writing – review & editing
Hanno L. Tan	Methodology, writing – review & editing
Irene G.M. van Valkengoed	Conceptualization, methodology, supervision, writing – review & editing, project administration, funding acquisition

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**Supplemental Methods.** Description of included variables

Variables	Description
<b>Gender-related characteristics</b>	
Time spent on household work <sup>1,4</sup>	Based on self-reported hours per week dedicated to light/moderate (e.g., cooking, doing dishes, feeding children, vacuum cleaning, grocery shopping) or heavy household work (e.g., scrubbing floors, beating carpets, carrying heavy groceries). This variable was classified into quartiles, where being categorized into the lowest quartile (including not taking part in any of the household activities) was regarded as most masculine, whereas being categorized into the highest quartile was regarded as most feminine.
Doing home repairs <sup>3</sup>	Based on self-reported time dedicated to do-it-yourself activities around the house per week and classified into two categories (yes/no). Doing home repairs was regarded as most masculine, whereas not taking part in home repairs was regarded as most feminine.
Primary earner status <sup>1, 2, 4</sup>	Based on self-report and 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 regarded as most masculine, while not being the primary earner of the household income was regarded as most feminine.
Type of employment <sup>3, 5</sup>	Based on self-report and classified into four groups: fulltime ( $\geq 32$ h/week), part-time (12-32 h/week), homemaker (fulltime homemakers and those working $< 12$ h/week), and not employed, which includes people aspiring a paid part-time or fulltime job and identifying as unemployed workers/job-seekers or welfare recipients, as well as those not working for reasons unrelated to management of household tasks (pensioners, students, persons unable to work due to disability/illness). Being fulltime employed was regarded as most masculine, whereas being a homemaker was regarded as most feminine. The 'not employed' group was regarded as neither masculine, nor feminine.
Working in a male- or female-dominated occupation <sup>1, 6</sup>	Based on self-reported job title and job description. Participants were asked to report their previous job in case they were not working at the time. Four categories were created based on recent numbers of men and women per occupation category according to Statistics Netherlands (2019): occupations with $\leq 25\%$ female workers, 26-50% female workers, 51-75% female workers, and $\geq 76\%$ female workers. The first category was regarded as 'male-dominated occupation' and most masculine, whereas the last category was regarded as 'female-dominated occupation' and most feminine. Missings were set to "not applicable" in case of not being employed or being the homemaker.

**Supplemental Methods.** Continued

<b>Variables</b>	<b>Description</b>
<b>Gender-related characteristics</b>	
Desire for emotional support <sup>2</sup>	Based on available data on self-reported frequency of being lent a friendly ear (question 1) on a 1-4 Likert scale (ranging from 'hardly ever or never' (a) to 'often' (d)) combined with the appraisal of this frequency (question 2) on a 1-4 Likert scale (ranging from 'much less than I like' (a) to 'more than I like' (d)), and was classified into three categories. Specifically, category d in question 2 (irrespective of answer on question 1) was classified as a low desire for emotional support and was regarded as more masculine. Categories a and b in question 2 (irrespective of answer on question 1) were classified as a high desire for emotional support and were regarded as more feminine. Category c in question 2 was regarded as low (more masculine) when combined with category 1 in question 1, as medium (neither masculine nor feminine) when combined with category 2 or 3 in question 1, or as high (more feminine) when combined with category 4 in question 1.
<b>Covariables</b>	
Sex	Derived from the municipality registry and classified as man or woman, as (biological) sex could not be confirmed by e.g. sex chromosomes.
Ethnicity	Derived from the municipality registry and defined by registered country of birth, combined with the registered parental countries of birth. More specifically, a person was defined as of non-Dutch ethnic origin if he/she fulfilled one of two criteria: (1) he/she was born outside the Netherlands and has at least one parent born outside the Netherlands (first generation) or (2) he/she was born in the Netherlands but both parents were born outside the Netherlands (second generation). For the Dutch sample, we invited people who were born in the Netherlands and whose parents were born in the Netherlands. After data collection, Surinamese participants were further classified according to self-reported ethnic origin into "African", "South-Asian", "Javanese", or "other".
Educational level	Based on the highest self-reported qualification attained in the Netherlands or in the country of origin and categorized into four groups: 1) no or elementary, 2) lower vocational or lower secondary, 3) intermediate vocational or intermediate or higher secondary, and 4) higher vocational or university.
Occupational level	Classified into four groups, according to Dutch Standard Occupational Classification system for 2010: 1) elementary, 2) lower, 3) intermediate, and 4) higher or academic, based on self-reported job title and job description, including a question on fulfilling an executive function. Participants were asked to report their previous job in case they were not working at the time. Missings were set to "not applicable" in case of not being employed or being the homemaker.
Household composition	Based on self-reported number of household members and classified as living with at least one other adult or not.

**Supplemental Methods.** Continued

Variables	Description
<b>Covariables</b>	
Civil status	Based on self-report and classified into 1) married/civil union or cohabiting, and 2) unmarried/never been married, divorced, or widowed.
Smoking status	Based on self-report and classified as current, former, or never smoker.
Systolic blood pressure	Measured in duplicate using a validated automated digital blood pressure device (WatchBP Home; Microlife AG) in a seated position after $\geq 5$ minutes of rest.
TC/HDL-C ratio	Determined based on fasting lipid concentrations.
Diabetes	Participants were considered to have diabetes if they reported a diabetes diagnosis, or use of glucose-lowering medication (ATC code A10), or in case of a fasting glucose $\geq 7.0$ mmol/l.

ATC, Anatomical Therapeutic Chemical; HDL-C, high-density lipoprotein cholesterol; TC, total cholesterol.

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**Supplemental Table S1.** Number and proportion of gender-related characteristics, by sex and ethnicity

	Dutch		South-Asian		African		Turkish	Moroccan
	n=1,878	n=1,073	Surinamese	Surinamese	Surinamese	Ghanaian		
<b>Men</b>					n=1,362	n=763	n=1,311	n=1,258
Time spent on household work								
0-3 h/week	591 (31.5)	344 (32.1)	358 (26.3)	348 (45.6)	839 (64.0)	615 (48.9)		
>3-7.75 h/week	677 (36.0)	302 (28.1)	382 (28.0)	185 (24.2)	239 (18.2)	323 (25.7)		
>7.75-16 h/week	468 (24.9)	289 (26.9)	416 (30.5)	146 (19.1)	160 (12.2)	218 (17.3)		
>16 h/week	142 (7.6)	138 (12.9)	206 (15.1)	84 (11.0)	73 (5.6)	102 (8.1)		
Doing home repairs								
Yes	571 (30.4)	285 (26.6)	412 (30.2)	198 (26.0)	376 (28.7)	277 (22.0)		
No	1307 (69.6)	788 (73.4)	950 (69.8)	565 (74.0)	935 (71.3)	981 (78.0)		
Primary earner status								
Yes	1,265 (67.4)	694 (64.7)	944 (69.3)	530 (69.5)	938 (71.5)	927 (73.7)		
Equal income	402 (21.4)	156 (14.5)	159 (11.7)	105 (13.8)	117 (8.9)	123 (9.8)		
No	207 (11.0)	220 (20.5)	240 (17.6)	106 (13.9)	240 (18.3)	197 (15.7)		
Missing	4 (0.2)	3 (0.3)	19 (1.4)	22 (2.9)	16 (1.2)	11 (0.9)		
Type of employment								
Fulltime	1,196 (63.7)	641 (59.7)	715 (52.5)	433 (56.7)	751 (57.3)	689 (54.8)		
Part-time	207 (11.0)	94 (8.8)	148 (10.9)	103 (13.5)	132 (10.1)	128 (10.2)		
Homemaker	47 (2.5)	21 (2.0)	33 (2.4)	24 (3.1)	35 (2.7)	24 (1.9)		
Not employed	425 (22.6)	308 (28.7)	451 (33.1)	193 (25.3)	375 (28.6)	412 (32.8)		
Missing	3 (0.2)	9 (0.8)	15 (1.1)	10 (1.3)	18 (1.4)	5 (0.4)		



Supplemental Table S1. Continued

	South-Asian		African		Turkish	Moroccan
	Dutch	Surinamese	Surinamese	Ghanaian		
<b>Men</b>	n=1,878	n=1,073	n=1,362	n=763	n=1,311	n=1,258
Working in a male- or female-dominated occupation						
≤25% female workers	561 (29.9)	385 (35.9)	527 (38.7)	126 (16.5)	469 (35.8)	411 (32.7)
26-50% female workers	675 (35.9)	316 (29.5)	384 (28.2)	229 (30.0)	395 (30.1)	370 (29.4)
51-75% female workers	374 (19.9)	205 (19.1)	237 (17.4)	312 (40.9)	249 (19.0)	285 (22.7)
≥76% female workers	92 (4.9)	43 (4.0)	68 (5.0)	13 (1.7)	24 (1.8)	46 (3.7)
Not applicable	83 (4.4)	66 (6.2)	76 (5.6)	50 (6.6)	105 (8.0)	79 (6.3)
Missing	93 (5.0)	58 (5.4)	70 (5.1)	33 (4.3)	69 (5.3)	67 (5.3)
Desire for emotional support						
Low	67 (3.6)	100 (9.3)	141 (10.4)	122 (16.0)	104 (7.9)	117 (9.3)
Medium	1,147 (61.1)	572 (53.3)	715 (52.5)	354 (46.4)	651 (49.7)	605 (48.1)
High	653 (34.8)	387 (36.1)	494 (36.3)	262 (34.3)	516 (39.4)	489 (38.9)
Missing	11 (0.6)	14 (1.3)	12 (0.9)	25 (3.3)	40 (3.1)	47 (3.7)
<b>Women</b>	n=2,225	n=1,415	n=2,092	n=1,208	n=1,569	n=1,904
Time spent on household work						
0-3 h/week	372 (16.7)	188 (13.3)	268 (12.8)	235 (19.5)	275 (17.5)	264 (13.9)
>3-7.75 h/week	670 (30.1)	235 (16.6)	437 (20.9)	308 (25.5)	253 (16.1)	311 (16.3)
>7.75-16 h/week	704 (31.6)	449 (31.7)	682 (32.6)	361 (29.9)	401 (25.6)	473 (24.8)
>16 h/week	479 (21.5)	543 (38.4)	705 (33.7)	304 (25.2)	640 (40.8)	856 (45.0)
Doing home repairs						
Yes	305 (13.7)	x <sup>a</sup>	214 (10.2)	302 (25.0)	x <sup>a</sup>	x <sup>a</sup>
No	1,920 (86.3)	x <sup>a</sup>	1,878 (89.8)	906 (75.0)	x <sup>a</sup>	x <sup>a</sup>

Supplemental Table S1. Continued

Women	Dutch		South-Asian		African		Moroccan		
	n=2,225	n=1,415	Surinamese	Ghanaian	Turkish	Turkish	n=1,208	n=1,569	n=1,904
Primary earner status									
Yes	1,103 (49.6)	733 (51.8)	1,502 (71.8)	779 (64.5)	421 (26.8)	583 (30.6)	241 (12.7)	844 (53.8)	22 (1.2)
Equal income	447 (20.1)	226 (16.0)	191 (9.1)	165 (13.7)	266 (17.7)	241 (12.7)	1,058 (55.6)	38 (2.4)	
No	669 (30.1)	440 (31.1)	376 (18.0)	238 (19.7)	844 (53.8)	1,058 (55.6)	22 (1.2)		
Missing	6 (0.3)	16 (1.1)	23 (1.1)	26 (2.2)	38 (2.4)	22 (1.2)			
Type of employment									
Fulltime	975 (43.8)	525 (37.1)	894 (42.7)	318 (26.3)	238 (15.2)	270 (14.2)	367 (19.3)	492 (31.4)	581 (30.5)
Part-time	585 (26.3)	267 (18.9)	410 (19.6)	271 (22.4)	316 (20.1)	367 (19.3)	666 (35.0)	497 (31.7)	20 (1.1)
Homemaker	153 (6.9)	125 (8.8)	68 (3.3)	73 (6.0)	492 (31.4)	666 (35.0)	581 (30.5)	26 (1.7)	
Not employed	506 (22.7)	485 (34.3)	711 (34.0)	522 (43.2)	497 (31.7)	581 (30.5)	20 (1.1)		
Missing	6 (0.3)	13 (0.9)	9 (0.4)	24 (2.0)	26 (1.7)	20 (1.1)			
Working in a male- or female-dominated occupation									
≤25% female workers	117 (5.3)	52 (3.7)	96 (4.6)	29 (2.4)	37 (2.4)	42 (2.2)	178 (9.3)	517 (27.2)	405 (21.3)
26-50% female workers	641 (28.8)	233 (16.5)	241 (11.5)	165 (13.7)	219 (14.0)	178 (9.3)	857 (45.0)	691 (36.3)	71 (3.7)
51-75% female workers	737 (33.1)	560 (39.6)	633 (30.3)	709 (58.7)	515 (32.8)	517 (27.2)	779 (40.9)	59 (3.8)	
≥76% female workers	488 (21.9)	342 (24.2)	889 (42.5)	107 (8.9)	251 (16.0)	405 (21.3)	49 (2.6)		
Not applicable	128 (5.8)	155 (11.0)	132 (6.3)	148 (12.3)	488 (31.1)	691 (36.3)	49 (2.6)		
Missing	114 (5.1)	73 (5.2)	101 (4.8)	50 (4.1)	59 (3.8)	71 (3.7)			
Desire for emotional support									
Low	39 (1.8)	164 (11.6)	198 (9.5)	169 (14.0)	120 (7.6)	219 (11.5)	857 (45.0)	612 (39.0)	49 (2.6)
Medium	1,098 (49.3)	663 (46.9)	1,046 (50.0)	593 (49.1)	804 (51.2)	857 (45.0)	779 (40.9)	33 (2.1)	
High	1,074 (48.3)	561 (39.6)	807 (38.6)	402 (33.3)	612 (39.0)	779 (40.9)	49 (2.6)		
Missing	14 (0.6)	27 (1.9)	41 (2.0)	44 (3.6)	33 (2.1)	49 (2.6)			

<sup>a</sup> Frequencies not reported due to small numbers (<10 participants) in at least one of the groups.

**Supplemental Table S2.** Correlation coefficients (Cramer's V) between gender-related characteristics (including p-values), for men and women

	Time spent on household work	Doing home repairs	Primary earner status	Type of employment	Male- or female-dominated occupations	Desire for emotional support
<b>Men (n=7,645)</b>						
Time spent on household work	0.17***					
Doing home repairs	0.10***	0.09***				
Primary earner status	0.06***	0.04 (0.02)	0.22***			
Type of employment	0.04***	0.11***	0.17***	0.23***		
Male- or female-dominated occupations	0.04***				0.04**	
Desire for emotional support	0.04***	0.02 (0.19)	0.03**	0.03**		
<b>Women (n=10,413)</b>						
Time spent on household work	0.08***					
Doing home repairs	0.07***	0.07***				
Primary earner status	0.14***	0.05***	0.30***			
Type of employment	0.07***	0.06***	0.16***	0.30***		
Male- or female-dominated occupations	0.03**	0.01 (0.75)	0.02 (0.26)	0.03**	0.05***	
Desire for emotional support						

\*\*\* p<0.01, \*\* p<0.001

**Supplemental Table S3.** Number and proportion of incident cardiovascular diseases (including ICD-10 codes), by sex

	<b>Men (n, %)</b>	<b>Women (n, %)</b>
Angina pectoris (I20)	38 (19.6)	61 (37.0)
Acute myocardial infarction (I21)	61 (31.4)	25 (15.2)
Stroke (I60-I64)	43 (22.2)	36 (21.8)
Other, including heart failure and peripheral artery disease	52 (26.8)	43 (26.0)
<b>Total</b>	<b>194 (100)</b>	<b>165 (100)</b>

ICD, International Classification of Diseases and Related Health Problems.

**Supplemental Table S4.** P-values for statistical interaction terms between sex and the gender-related characteristics (in separate models<sup>a</sup>)

	<b>p-value for sex*gender-related characteristic term<sup>b</sup></b>
Time spent on household work	0.057
Doing home repairs	0.98
Primary earner status	<b>0.02</b>
Type of employment	0.49
Working in a male- or female-dominated occupation	0.36
Desire for emotional support	0.22

Statistically significant p-values are printed in bold.

<sup>a</sup> The analyses were performed for each gender-related characteristic in a separate model, i.e. not in one mutually adjusted model.

<sup>b</sup> Adjustments: age, ethnicity, educational level, and gender-related characteristic specific adjustments (the analyses on time spent on household work, doing home repairs, and primary earner status were additionally adjusted for household composition; the analyses on type of employment and working in a male- or female-dominated occupation were additionally adjusted for occupational level; and the analyses on emotional support were additionally adjusted for civil status).

**Supplemental Table S5.** Associations (hazard ratios) between gender-related characteristics (in separate models<sup>a</sup>) and CVD incidence, additionally adjusted for smoking status, SBP, TC/HDL-C ratio, and diabetes, stratified by sex

	Men (n=7,645) <sup>b</sup>		Women (n=10,413) <sup>b</sup>	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Time spent on household work				
<3 h/week	Ref		Ref	
3-7.75 h/week	1.10 (0.76-1.59)	0.63	0.64 (0.36-1.13)	0.12
7.75-16 h/week	0.96 (0.64-1.42)	0.82	0.55 (0.33-0.93)	<b>0.03</b>
>16 h/week	0.80 (0.48-1.35)	0.40	0.91 (0.57-1.45)	0.70
Doing home repairs				
Yes	Ref		Ref	
No	0.94 (0.69-1.28)	0.70	0.85 (0.51-1.40)	0.52
Primary earner status				
Yes	Ref		Ref	
Equal income	1.07 (0.71-1.62)	0.75	0.82 (0.46-1.48)	0.51
No	0.63 (0.30-1.31)	0.22	1.51 (0.96-2.36)	0.07
Type of employment				
Fulltime	Ref		Ref	
Part-time	0.96 (0.55-1.70)	0.90	0.78 (0.43-1.41)	0.41
Homemaker	1.44 (0.58-3.61)	0.43	2.32 (1.32-4.08)	<b>&lt;0.01</b>
Not employed	0.92 (0.65-1.31)	0.65	1.27 (0.82-1.97)	0.29
Working in a male- or female-dominated occupation				
<25% female workers	Ref		Ref	
26-50% female workers	0.95 (0.66-1.37)	0.79	1.16 (0.48-2.83)	0.74
51-75% female workers	0.97 (0.64-1.49)	0.91	0.73 (0.31-1.75)	0.48
≥76% female workers	0.83 (0.37-1.85)	0.64	0.95 (0.40-2.27)	0.91
Not applicable	0.41 (0.12-1.36)	0.14	0.70 (0.17-2.80)	0.61
Desire for emotional support				
Low	Ref		Ref	
Medium	0.93 (0.55-1.59)	0.80	0.73 (0.42-1.26)	0.26
High	1.08 (0.63-1.87)	0.78	1.19 (0.69-2.06)	0.52

CI, confidence interval; CVD, cardiovascular disease; HDL-C, high-density lipoprotein cholesterol; HR, hazard ratio; SBP, systolic blood pressure; TC, total cholesterol.

Statistically significant p-values are printed in bold.

<sup>a</sup> The analyses were performed for each gender-related characteristic in a separate model, i.e. not in one mutually adjusted model.

<sup>b</sup> Adjustments: age, ethnicity, educational level, smoking status, SBP, TC/HDL-C ratio, diabetes, and gender-related characteristic specific adjustments (the analyses on time spent on household work, doing home repairs, and primary earner status were additionally adjusted for household composition; the analyses on type of employment and working in a male- or female-dominated occupation were additionally adjusted for occupational level; and the analyses on emotional support were additionally adjusted for civil status).

**Supplemental Table S6.** Associations (hazard ratios) between gender-related characteristics (all in one model) and CVD incidence, stratified by sex

	Men (n=7,645) <sup>a</sup>		Women (n=10,413) <sup>a</sup>	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Time spent on household work				
<3 h/week	Ref		Ref	
3-7.75 h/week	1.02 (0.69-1.51)	0.92	0.68 (0.38-1.22)	0.20
7.75-16 h/week	0.91 (0.60-1.38)	0.66	0.56 (0.33-0.96)	<b>0.03</b>
>16 h/week	0.85 (0.49-1.45)	0.54	0.87 (0.54-1.41)	0.57
Doing home repairs				
Yes	Ref		Ref	
No	0.89 (0.64-1.23)	0.47	0.93 (0.54-1.58)	0.78
Primary earner status				
Yes	Ref		Ref	
Equal income	1.00 (0.64-1.55)	0.99	0.85 (0.44-1.67)	0.64
No	0.53 (0.24-1.17)	0.12	1.20 (0.68-2.12)	0.53
Type of employment				
Fulltime	Ref		Ref	
Part-time	0.97 (0.53-1.76)	0.92	0.66 (0.35-1.26)	0.21
Homemaker	1.74 (0.68-4.47)	0.25	1.92 (1.03-3.56)	<b>0.04</b>
Not employed	1.04 (0.71-1.52)	0.84	1.11 (0.69-1.78)	0.67
Working in a male- or female-dominated occupation				
<25% female workers	Ref		Ref	
26-50% female workers	1.00 (0.68-1.45)	0.98	0.94 (0.38-2.32)	0.89
51-75% female workers	0.91 (0.59-1.41)	0.68	0.73 (0.31-1.76)	0.49
≥76% female workers	0.75 (0.32-1.79)	0.52	0.93 (0.39-2.23)	0.87
Not applicable	0.31 (0.08-1.20)	0.09	0.34 (0.08-1.38)	0.13
Desire for emotional support				
Low	Ref		Ref	
Medium	1.20 (0.64-2.26)	0.58	0.70 (0.40-1.23)	0.22
High	1.40 (0.74-2.67)	0.30	1.12 (0.65-1.93)	0.69

CI, confidence interval; CVD, cardiovascular disease; HR, hazard ratio.

Statistically significant p-values are printed in bold.

For men, the model was not significantly improved by the addition of the gender-related characteristics (including characteristic-specific adjustments; likelihood ratio test (LRT) p-value = 0.82). For women, the addition of the gender-related characteristics (including characteristic-specific adjustments) improved the model significantly (LRT p-value = 0.02).

<sup>a</sup> Adjusted for age, ethnicity, educational level, gender-related characteristic specific adjustments (the analyses on time spent on household work, doing home repairs, and primary earner status were additionally adjusted for household composition; the analyses on type of employment and working in a male- or female-dominated occupation were additionally adjusted for occupational level; and the analyses on emotional support were additionally adjusted for civil status).

**Supplemental Table S7.** Associations (hazard ratios) between gender-related characteristics and CVD incidence (broader definition, including hypertensive disease and cardiac arrhythmias), stratified by sex

	Men (n=7,645) <sup>a</sup>			Women (n=10,413) <sup>a</sup>		
	HR (95% CI)	p-value	p-value for LRT <sup>b</sup>	HR (95% CI)	p-value	p-value for LRT <sup>b</sup>
Time spent on household work						
<3 h/week	Ref			Ref		
3-7.75 h/week	0.99 (0.71-1.38)	0.97	0.31	0.79 (0.49-1.29)	0.35	0.29
7.75-16 h/week	0.76 (0.53-1.09)	0.14		0.68 (0.43-1.06)	0.09	
>16 h/week	0.69 (0.43-1.10)	0.12		0.96 (0.63-1.46)	0.85	
Doing home repairs						
Yes	Ref		0.91	Ref		0.81
No	0.98 (0.74-1.29)	0.87		1.16 (0.73-1.86)	0.53	
Primary earner status						
Yes	Ref		0.78	Ref		0.35
Equal income	1.00 (0.68-1.47)	0.99		0.74 (0.45-1.20)	0.22	
No	0.76 (0.43-1.36)	0.36		1.14 (0.78-1.66)	0.50	
Type of employment						
Fulltime	Ref		0.92	Ref		<0.01
Part-time	1.00 (0.61-1.64)	0.99		0.76 (0.46-1.26)	0.29	
Homemaker	1.33 (0.58-3.06)	0.50		2.22 (1.37-3.58)	<0.01	
Not employed	1.00 (0.73-1.37)	1.00		1.22 (0.83-1.79)	0.31	
Working in a male- or female-dominated occupation						
<25% female workers	Ref		0.71	Ref		0.68
26-50% female workers	1.04 (0.74-1.45)	0.83		1.19 (0.53-2.69)	0.67	
51-75% female workers	1.00 (0.68-1.46)	1.00		0.88 (0.40-1.94)	0.75	
≥76% female workers	1.09 (0.55-2.15)	0.80		1.00 (0.45-2.23)	1.00	
Not applicable	0.41 (0.13-1.24)	0.11		0.77 (0.23-2.56)	0.67	

**Supplemental Table S7.** Continued

	<b>Men (n=7,645)<sup>a</sup></b>			<b>Women (n=10,413)<sup>a</sup></b>		
	<b>HR (95% CI)</b>	<b>p-value</b>	<b>p-value for LRT<sup>b</sup></b>	<b>HR (95% CI)</b>	<b>p-value</b>	<b>p-value for LRT<sup>b</sup></b>
Desire for emotional support						
Low	Ref			Ref		
Medium	0.81 (0.51-1.29)	0.37	0.76	0.72 (0.45-1.14)	0.16	0.05
High	0.85 (0.53-1.37)	0.52		1.06 (0.67-1.67)	0.80	

CI, confidence interval; CVD, cardiovascular disease; HR, hazard ratio; LRT, likelihood ratio test.

Statistically significant p-values are printed in bold.

<sup>a</sup> Adjusted for age, ethnicity, educational level, gender-related characteristic specific adjustments (the analyses on time spent on household work, doing home repairs, and primary earner status were additionally adjusted for household composition; the analyses on type of employment and working in a male- or female-dominated occupation were additionally adjusted for occupational level; and the analyses on emotional support were additionally adjusted for civil status).

<sup>b</sup> Comparing models with and without the characteristics and characteristic-specific adjustments.