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Ethnic differences in metabolic cardiovascular risk among normal weight individuals: Implications for cardiovascular risk screening. The HELIUS study

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Abstract *Background and aims:* Cardiovascular disease (CVD) risk factors may occur among a substantial proportion of normal weight individuals, particularly among some ethnic minorities. It is unknown how many of these individuals would be missed by commonly applied eligibility criteria for cardiovascular risk screening. Thus, we aim to determine cardiovascular risk and eligibility for cardiovascular risk screening among normal weight individuals of different ethnic backgrounds.

Methods and results: Using the HELIUS study (Amsterdam, The Netherlands), we determined cardiovascular risk among 6910 normal weight individuals of Dutch, South-Asian Surinamese, African Surinamese, Ghanaian, Moroccan and Turkish background. High cardiovascular risk was approximated by high metabolic risk based on blood pressure, HDL, triglycerides and fasting glucose. Eligibility criteria for screening were derived from Dutch CVD prevention guidelines and include age $\geq$ 50 y, family history of CVD, or current smoking. Ethnic group comparisons were made using logistic regression. Age-adjusted proportions of high metabolic risk ranged from 12.6% to 38.4% (men) and from 2.7% to 11.5% (women). This prevalence was higher among most ethnic minorities than the Dutch, especially among women. For most ethnic groups, 79.9% −86.7% of individuals with high metabolic risk were eligible for cardiovascular risk screening. Exceptions were Ghanaian women (58.8%), Moroccan men (70.9%) and Moroccan women (45.0%), although age-adjusted proportions did not differ between groups.

Conclusion: Even among normal weight individuals, high cardiovascular metabolic risk is more common among ethnic minorities than among the majority population. Regardless of ethnicity, most normal weight individuals with increased risk are eligible for cardiovascular risk screening.

Introduction

Cardiovascular disease (CVD) risk factors such as hypertension or dyslipidemia are associated with increased risk of short-term and long-term CVD incidence and mortality [1]. Timely identification of individuals with cardiovascular risk factors is important to enable targeted lifestyle intervention and appropriate pharmacological interventions [1].

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Although obesity is a strong indicator for the occurrence of cardiovascular risk factors, studies have shown that 10–37% of normal weight individuals are at increased risk of CVD as well [2–8]. It is unknown to what extent these normal weight individuals are eligible for cardiovascular risk screening according to established CVD prevention guidelines and, thus, would be identified and treated preventively for their increased cardiovascular risk. According to CVD prevention guidelines, screening for cardiovascular risk factors is reserved for individuals perceived to be potentially at risk to develop CVD [1,9]. For example, guidelines in the Netherlands recommend to offer cardiovascular risk screening to those who smoke, are overweight, or have a family history of CVD (FH) [9]. Thus, among normal weight individuals, other factors than obesity need to be present to be eligible for screening [1,9].

The proportion of normal weight individuals at risk of CVD may vary between countries [2–8,10]. For instance, Asian studies report a higher prevalence of metabolic syndrome among normal weight individuals than studies from the USA [2–5,7,8]. The proportion of normal weight individuals at risk of CVD may also vary between ethnic groups residing within the same country. If this proportion is higher among certain ethnic minority groups, this may necessitate lower thresholds to initiate cardiovascular risk screening among normal weight individuals from these ethnic groups. However the necessity of these ethnic-specific recommendations is yet unknown.

In this study, we aim to examine the occurrence of high metabolic risk (as a proxy for cardiovascular risk) among normal weight individuals of different ethnic backgrounds residing in the Netherlands. In addition, we aim to investigate whether normal weight individuals with high metabolic risk are eligible for cardiovascular risk screening, despite the absence of overweight, based on other eligibility criteria for cardiovascular risk screening (i.e. FH, smoking status and being at least 50 years of age).

Methods

Data were obtained from the baseline data collection of the HELIUS study, a large-scale, multi-ethnic cohort study on health and health care utilization among different ethnic groups living in Amsterdam, the Netherlands. The aims and design of the HELIUS study have been published elsewhere [11]. In brief, data-collection took place from 2011 to 2015. Participants between 18 and 70 years of age living in Amsterdam were randomly sampled, stratified by ethnicity, via the municipality register. A total of 90,019 subjects were contacted and 49,952 subjects responded either by card or after a home visit by an ethnically matched interviewer. Of these, 24,789 agreed to participate [11]. Data were obtained among Dutch, South-Asian Surinamese, African Surinamese, Ghanaian, Turkish and Moroccan origin participants. The study protocols were approved by the AMC Ethical Review Board, and all participants provided written informed consent.

Ethnicity

Ethnicity was defined according to the country of birth of the participant as well as that of his/her parents [12]. A participant was considered as of non-Dutch ethnic origin if he/she was born abroad and has at least one parent born abroad (first generation); or he/she was born in the Netherlands but both his/her parents were born abroad (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, Participants of Surinamese ethnic origin were further classified according to self-reported ethnic origin.

Metabolic risk

Similar to earlier studies regarding metabolic cardiovascular risk among normal weight individuals, we used the clustering of metabolic cardiovascular risk factors as a proxy for cardiovascular risk [4,5,8,13,14]. To do so, we defined high metabolic risk based on similar criteria to the Adult Treatment Panel III (ATP III) definition of metabolic syndrome but without the abdominal obesity criterion [15]. Thus, we defined high metabolic risk as having at least two of the following criteria: high triglycerides ($\geq$150 mg/dL), low HDL cholesterol ($<$40 mg/dL for men, $<$50 mg/dL for women), high fasting glucose ($\geq$100 mg/dL), and high blood pressure (BP; $\geq$130/85 mmHg). Using medication related to a criterion was considered as a fulfillment of the respective criterion.

Study variables

Self-reported CVD (i.e. self-reported myocardial infarction or stroke), smoking status, and FH defined as either cardiovascular disease or unexplained sudden death among a first degree family member (both before the age of 60) were assessed via questionnaire. Socioeconomic status was estimated by self-reported education, defined as 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.

Weight was measured in light clothing using a Seca 877 scale to the nearest 0.1 kg. Height was measured without shoes using a portable stadiometer (Seca 217) to the nearest 0.1 cm. Waist circumference was measured at the level midway between the lower rib margin and the iliac crestBP was measured using a validated automated digital BP device (WatchBP Home; Microlife AG) on the left arm in a seated position after the person had been seated for at least 5 min. All physical measurements were performed in duplicate and the mean of the two measurements was used in the analyses. Fasting blood samples were drawn, and glucose was determined with an enzymatic spectrophotometric (UV) method (Roche Diagnostics, Japan). Total and HDL cholesterol and triglycerides were determined by

enzymatic colorimetric spectrophotometry (Roche Diagnostics, Japan).

Participants were asked to bring their prescribed medications to the research location. Medications were categorized using the Anatomical Therapeutic Chemical (ATC) classification system. BP-lowering medication included centrally acting anti-hypertensives (ATC code C02), diuretics (ATC code C03), beta-blockers (ATC code C07), calcium channel blockers (ATC code C08), and agents acting on renin-angiotensin-aldosterone system (ATC code C09). Lipid-lowering medication was classified by ATC code C10. Glucose-lowering medication was classified by ATC code A10.

Eligibility criteria for cardiovascular risk screening

Eligibility criteria for cardiovascular risk screening were defined in accordance to the current Dutch cardiovascular risk management guidelines [9]. Criteria available for this study were currently smoking, FH, and being at least fifty years of age.

Study population

Both questionnaire and physical examination data was available among 22,165 participants [11]. Of these participants, 7236 were potentially eligible for this study based on a normal weight (in this study defined as a BMI of 18−25 kg/m^2) and no self-reported prior CVD. From this group, we excluded participants with a Javanese Surinamese (n = 101), 'other/unknown Surinamese' (n = 84) or unknown/other ethnicity (n = 13) due to insufficient statistical power. We subsequently excluded participants with missing data regarding metabolic risk factors (n = 48), FH (n = 65), smoking status (n = 12), or waist circumference (n = 3), resulting in a study population of 6910 individuals.

Statistical analyses

Analyses were stratified by sex. Median age, prevalence of other baseline characteristics, and crude prevalence of metabolic risk and metabolic risk factors were calculated per ethnic group. Then, the age-adjusted prevalence of high metabolic risk was calculated and compared between ethnic groups using binary logistic regression analyses. To explore whether differences in high metabolic risk were related to ethnic differences in socioeconomic status, we fitted a regression model adjusted for educational level.

Next, for each ethnic group we calculated the prevalence of the eligibility criteria for cardiovascular risk screening (i.e. currently smoking, being at least 50 years of age, and a positive FH). Furthermore, we determined the proportion of participants who would be eligible based on either age or FH, and based on any eligibility criterion. Ethnic differences in eligibility were tested with age-adjusted binary logistic regression analyses.

To explore whether the chance of being missed (i.e. not fulfilling eligibility criteria while being at high metabolic risk) was different for those with a high-normal BMI (23−25 kg/m^2) compared with those with a low-normal BMI (18−23 kg/m^2), we performed a stratified analysis. A similar exploration was conducted for the occurrence of abdominal obesity as measured by waist-to-height ratio, by stratifying for waist-to-height ratio $\geq$0.5 and $<$0.5. Ethnic differences were not formally tested in these final analyses due to insufficient statistical power.

Results

Turkish participants, Moroccan participants and Ghanaian women were younger than the other groups (Table 1). Moroccan and Ghanaian participants smoked less frequently. The prevalence of abdominal obesity and high metabolic risk was highest among South-Asian Surinamese. South-Asian Surinamese, African Surinamese and Ghanaians showed the highest rates of increased BP, whereas South-Asian Surinamese, Turkish and Moroccan participants showed the highest rates of low HDL-cholesterol. Increased fasting glucose was particularly common among South-Asian Surinamese.

Among men, the age-adjusted prevalence of high metabolic risk among ranged from 12.6% among African Surinamese to 38.4% among South-Asian Surinamese (Table 2). Relative to the Dutch, ethnic minority men had similar or higher odds for high metabolic risk, particularly South-Asian Surinamese. ORs did not change substantially after additional adjustment for SES. The distribution of individual components of high metabolic risk differed between ethnic groups (Table S1).

Compared with men, women had lower age-adjusted prevalences of high metabolic risk, ranging from 2.7% among the Dutch to 11.5% among South-Asian Surinamese (Table 2). The odds of high metabolic risk was substantially higher among almost all ethnic minority women compared to the Dutch. For Ghanaian, Turkish and Moroccan women, the ORs attenuated after adjustment for SES. Similar to men, the distribution of individual components of high metabolic risk differed between ethnic groups (Table S1).

The most common criterion for cardiovascular risk screening differed between ethnic groups (Table 3). Relative to the Dutch, FH was less common among African Surinamese, Ghanaian and Turkish participants, while the proportion with FH was similar among South-Asian Surinamese and Moroccan participants. Being at least 50 years of age was a less common criterion among Turkish and Moroccan participants relative to the other ethnic groups, especially among women. Smoking was common among South-Asian Surinamese, African Surinamese, and Turkish participants, but uncommon among Ghanaian participants, South-Asian Surinamese women and Moroccan women.

For most ethnic groups, the proportion of participants with high metabolic risk who fulfilled at least one criterion was between 79.9% and 86.7% (Table 3, Fig. 1). Exceptions were Ghanaian women (58.8%), Moroccan men (70.9%)

Table 1 Characteristics of the study population with a normal BMI[a], by sex and ethnicity.

	Dutch	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish	Moroccan
Men						
N	1017	491	560	265	329	426
Age (median)	42.0	44.0	50.0	45.0	32.0	35.0
Age (interquartile range)	32.0; 55.0	29.0; 54.0	34.0; 57.0	35.5; 53.0	23.5; 46.0	26.75; 47.25
Educational level[b] (%)						
Lowest	1.8	10.4	5.2	14.6	15.7	19.4
Second lowest	7.6	29.0	37.6	42.5	27.4	19.2
Second highest	20.7	31.9	37.9	29.9	35.1	39.1
Highest	69.9	28.6	19.2	13.0	21.8	22.3
BMI kg/m^2 (mean ± SD)	22.6 ± 1.6	22.7 ± 1.7	22.6 ± 1.7	23.1 ± 1.5	22.9 ± 1.7	22.7 ± 1.7
BMI 23–25 kg/m^2 (% yes)	47.3	52.1	50.7	57.4	57.8	50.5
Abdominal obesity (% yes)	22.4	47.7	22.7	33.2	30.7	31.7
Smoking status (% yes)	24.8	40.3	48.6	7.1	42.9	31.0
Family history of CVD[c] (% yes)	21.0	34.8	18.4	11.3	25.2	12.7
Age ≥ 50 (% yes)	34.8	34.4	50.4	38.5	17.9	21.1
Women						
N	1485	525	553	201	436	622
Age (median)	41.0	44.0	43.0	33.0	30.0	28.0
Age (interquartile range)	30.0; 53.0	31.0; 51.0	31.0; 52.0	22.0; 43.0	23.0; 37.0	23.0; 36.0
Educational level[b] (%)						
Lowest	1.7	9.4	1.6	27.1	9.3	9.6
Second lowest	8.3	31.1	23.6	30.7	16.7	14.6
Second highest	18.6	29.0	41.7	29.1	40.6	44.8
Highest	71.4	30.5	33.2	13.1	33.4	31.0
BMI kg/m^2 (mean ± SD)	21.9 ± 1.7	22.4 ± 1.8	22.6 ± 1.7	22.8 ± 1.7	22.3 ± 1.8	22.3 ± 1.8
BMI 23–25 kg/m^2 (% yes)	31.1	43.6	46.5	55.2	39.0	41.2
Abdominal obesity (% yes)	20.3	50.5	25.9	32.8	27.8	29.7
Smoking status (% yes)	22.6	21.9	29.5	6.0	33.3	9.5
Family history of CVD[c] (% yes)	22.2	41.5	23.5	11.4	29.8	13.8
Age ≥ 50 (% yes)	32.6	32.0	33.3	15.4	5.5	5.5

[a] Normal body mass index (BMI; 18–25 kg/m^2).
[b] Lowest = never been to school or elementary schooling only, second lowest = lower vocational schooling or lower secondary schooling, second highest = intermediate vocational schooling or intermediate/higher secondary schooling (general), highest = higher vocational schooling or university.
[c] Family history of cardiovascular disease, defined as cardiovascular disease or unexplained sudden death among a first degree relative before the age of 60.

and Moroccan women (45.0%). When smoking was not considered as an eligibility criterion, fewer participants with high metabolic risk were eligible for cardiovascular risk screening, especially among Turkish participants and Moroccan men. Similar patterns were observed among participants without high metabolic risk, but with an overall lower proportion of participants with eligibility criteria (Table S2).

Table 2 The prevalence and odds ratio (95% confidence interval) of high metabolic risk among participants with a normal BMI[a], by sex and ethnicity.

	Dutch	South-Asian Surinamese	*p-value*	African Surinamese	*p-value*	Ghanaian	*p-value*	Turkish	*p-value*	Moroccan	*p-value*
Men											
Prevalence (%)	20.0	41.1		20.5		23.8		17.9		18.5	
Age adjusted Prevalence (%)	15.1	38.4		12.6		18.9		21.6		19.7	
Age adjusted OR[b]	(ref)	3.5 (2.7; 4.6)	<0.001	0.8 (0.6; 1.1)	0.145	1.3 (0.9; 1.8)	0.115	1.6 (1.1; 2.2)	0.013	1.4 (1.0; 1.9)	0.041
Age & SES[c] adjusted OR[b]	(ref)	3.1 (2.3; 4.1)	<0.001	0.7 (0.5; 1.0)	0.034	1.1 (0.8; 1.6)	0.591	1.3 (0.9; 1.9)	0.121	1.2 (0.8; 1.6)	0.393
Women											
Prevalence (%)	6.7	20.8		13.2		8.5		4.6		3.2	
Age adjusted Prevalence (%)	2.7	11.5		6.4		7.7		5.8		4.1	
Age adjusted OR[b]	(ref)	4.7 (3.4; 6.5)	<0.001	2.5 (1.8; 3.5)	<0.001	3.0 (1.7; 5.5)	<0.001	2.2 (1.3; 3.8)	0.003	1.5 (0.9; 2.6)	0.106
Age & SES[c] adjusted OR[b]	(ref)	3.2 (2.3; 4.7)	<0.001	2.1 (1.5; 3.0)	<0.001	1.2 (0.6; 2.4)	0.510	1.3 (0.7; 2.3)	0.351	0.8 (0.4; 1.4)	0.458

[a] Normal body mass index (BMI; 18–25 kg/m^2).
[b] Odds ratio.
[c] Socioeconomic status (SES) as determined by educational level.

Table 3 The proportion eligible for cardiovascular risk screening[a] among participants with a normal BMI[b] but high metabolic risk, by sex and ethnicity.

High metabolic risk	Dutch	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish	Moroccan
Men						
N	204	202	115	63	59	79
Smoking status (% yes)	26.5	47.5**	41.7**	4.8**	50.9**	31.2
FH[c] (% yes)	36.3	45.5	24.4**	9.5**	42.4	13.9**
Age $\geq$ 50 (% yes)	60.3	56.7	70.0	58.7	45.8	46.8
FH[c] and/or age $\geq$ 50 (% yes)	71.6	75.7	77.4	65.1	64.4	53.2*
Any eligibility criterion (% yes)	79.9	86.6	86.7	66.7*	83.1	70.9
No eligibility criterion (% yes)	20.1	13.4	13.3	33.3*	16.9	29.1
Women						
N	99	109	73	17	20	20
Smoking status (% yes)	30.3	18.4*	27.4*	11.8*	55.0	5.0
FH[c] (% yes)	39.4	53.2*	37.0	6.9*	45.0	5.0*
Age $\geq$ 50 (% yes)	69.7	68.8	72.6	58.8	35.0	40.0
FH[c] and/or age $\geq$ 50 (% yes)	78.8	80.8	78.1	58.8	60.0	40.0*
Any eligibility criterion (% yes)	84.9	85.3	82.2	58.8*	80.0	45.0*
No eligibility criterion (% yes)	15.1	14.7	17.8	41.2*	20.0	55.0*

*: $p < 0.05$ different than the Dutch, adjusted for age. **: $p < 0.01$ different than the Dutch, adjusted for age.
[a] Based on the occurrence of family history of CVD, age $\geq$ 50, and/or smoking status.
[b] Normal body mass index (BMI; 18–25 kg/m^2).
[c] Family history of cardiovascular disease, defined as cardiovascular disease or unexplained death among a first degree relative before the age of 60.

Finally, we did not observe a consistent pattern in the prevalence of eligibility between participants with a BMI between 18 and 23 kg/m^2 and those with a BMI 23–25 kg/m^2 (Table S3). However the proportion of individuals with normal BMI that were eligible for screening did appear to be consistently higher among those who were abdominally obese than those who were not, regardless of ethnicity.

Discussion

This study showed that the prevalence of high metabolic risk among normal weight individuals is higher among various ethnic minority groups, especially among South-Asian Surinamese, relative to the Dutch. Regardless of ethnicity, most normal weight individuals with high metabolic risk are eligible for cardiovascular risk screening in the Netherlands. The proportion eligible does not vary consistently between categories of normal, BMI but was higher among those with abdominal obesity. This study has limitations. First, selection bias may have occurred due to non-response. Although non-response analyses showed minimal differences in several socioeconomic characteristics, we cannot rule out that non-responders differed from participants in metabolic risk profile (for a detailed discussion see Ref. [11]).

Second, due to the cross-sectional design, we used a prevalent measure reflecting cardiovascular risk (i.e. high metabolic risk) instead of CVD incidence. Although the association between CVD incidence and the clustering of risk factors included in our definition of high metabolic risk has been well established (even among normal weight individuals), longitudinal studies on the incidence rates of CVD may be more informative for targeting preventive policies to normal weight individuals at high risk [6,8,13,14].

Third, two of the measures used to classify eligibility for cardiovascular risk screening were based on self-report (i.e. smoking status and FH). Reporting bias may have occurred. For example, smoking status may have been underestimated due to social desirability bias, which may have resulted in an underestimation of eligibility for cardiovascular risk screening. In addition, the accuracy of this self-reported data may differ between ethnic groups, for example due to ethnic differences in socioeconomic status [16,17]. However, if such inaccuracies did occur, we expect these inaccuracies to also occur in daily clinical practice. Our study would then reflect this practice, including this bias.

Finally, some eligibility criteria included in the Dutch guidelines for CVD prevention were not available for our study (e.g. patient request for screening) [9]. Therefore, we may have underestimated eligibility for cardiovascular risk screening. Our results regarding BP lowering treatment among Ghanaians suggests that this may indeed be the case (Table S4). We found that 23.8% of Ghanaian men and 28.6% of Ghanaian women who were not eligible for cardiovascular risk screening despite a high metabolic risk did receive BP-lowering medication, despite the absence of an indication for cardiovascular risk screening as defined by our study.

Studies have found that ethnic differences in cardiovascular risk cannot be fully explained by obesity [18–21]. Our study confirms these findings by showing that ethnic differences in metabolic risk occur even in a normal weight population. Based on the observed higher occurrence of increased BP, fasting glucose and low HDL in certain ethnic groups, we find it likely that ethnic disparities in overall estimated cardiovascular risk occur among normal weight populations as well [22]. Our results indicate that, for Ghanaian and Turkish women, the differences with the Dutch may be related to a lower relative educational level. Among other ethnic groups, other factors such as genetic predisposition or age of onset of CVD risk may further explain why ethnic differences in cardiovascular risk occur [23,24].

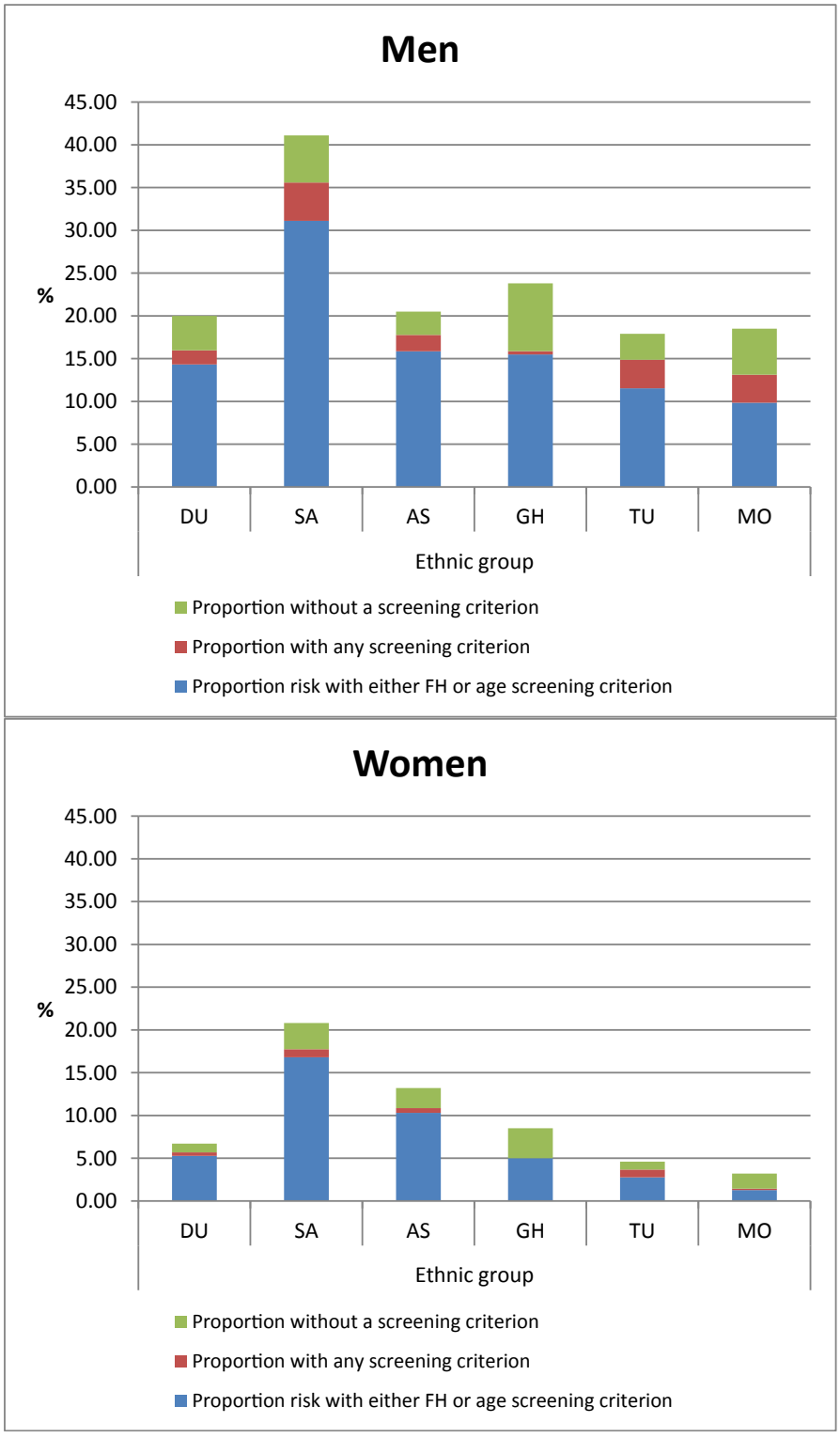

Figure 1 The prevalence of high metabolic risk with and without any eligibility criterion[a] for cardiovascular screening among normal weight participants, by sex and ethnic group. a: based on the occurrence of family history of CVD (FH), age > 50, and/or smoking status, b: FH, age > 50, and/or positive smoking status, DU, Dutch; SA, South-Asian Surinamese; AS, African Surinamese; GH, Ghanaian; TU, Turkish; MO, Moroccan.

Studies have reported higher risk of CVD among South-Asian migrants relative to majority populations and even other migrant groups [22,25]. Our study shows a pattern among normal weight individuals that is consistent with these earlier findings. The higher prevalence of these risk factors among South-Asian Surinamese may be especially important considering the potentially stronger detrimental effects of cardiovascular risk than in other ethnic

groups, reflected in a stronger association with cardiovascular risk factors and CVD incidence among South-Asian Surinamese [1].

We observed larger ethnic differences in metabolic risk in women than in men. Studies in the general population (including overweight individuals) have also found that ethnic differences in estimated cardiovascular risk (i.e. based on systolic BP, total cholesterol/HDL ratio, diabetes status, and smoking status) were larger among women than among men [22]. Possible explanations include a higher prevalence of certain disorder of pregnancy and stronger associations between these disorders and cardiovascular risk among some ethnic minority groups relative to ethnic majority groups [26].

Our results showed that, based on Dutch CVD prevention guidelines, most normal weight individual with high metabolic cardiovascular risk are eligible for cardiovascular risk screening. Relative to Dutch guidelines, European recommendations for screenings eligibility are more inclusive [1,9]. For example, European guidelines already recommend cardiovascular risk screening at a minimum age of 40 among men [1]. Therefore, we expect that countries adhering to the European guidelines will find a similar or higher proportion of normal weight individuals with high metabolic risk to be eligible for cardiovascular risk screening.

There is some debate as to whether ethnic-specific BMI cut-off points should be used among selected ethnic populations, e.g. among South-Asian populations [27–30]. We observed a particularly high prevalence of high cardiovascular risk in South-Asian Surinamese participants, with no indication that eligibility for cardiovascular risk screening among normal weight, differed between normal BMI categories. Consequently, our results confirm earlier findings, but provide no further argument for ethnic specific BMI cut-offs based on eligibility for cardiovascular risk screening.

In contrast, we found that among normal weight individuals with high metabolic risk, the proportion eligible for cardiovascular risk screening was higher among those who were abdominally obese than among those who were not abdominally obese. Identification of normal weight individuals with high metabolic risk is important regardless of abdominal adiposity, as high metabolic risk may increase cardiovascular risk even in the absence of both abdominal obesity and increased BMI [6]. Therefore, more research may be appropriate to determine whether lower thresholds for cardiovascular risk screening among normal weight individuals without abdominal obesity are warranted.

Conclusion

About 15% of Dutch normal weight men and 2.5% of Dutch normal weight women may show a high metabolic cardiovascular risk. These percentages are higher among most ethnic minority groups, particularly in South-Asian Surinamese. Most of the normal weight individuals with high metabolic risk are eligible for cardiovascular risk screening according to current guidelines, regardless of ethnicity.

Conflicts of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.numecd.2018.09.004.

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