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ORIGINAL ARTICLE

Good general health and lack of family history influence the underestimation of cardiovascular risk: a cross-sectional study

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Aims Underestimation of cardiovascular risk may interfere with prevention of cardiovascular diseases (CVDs). We investigate whether general health and family history of myocardial infarction (MI) are associated with underestimation of perceived cardiovascular risk, and if the participants' calculated risk modifies that association.

Methods and results The analysis sample consisted of 526 individuals, 50–64 years old, from a population-based cohort study. Information on general health (poor/fairly good, good, and very good/excellent), family history of MI, and self-perceived risk relative to others of similar age and sex were collected though a web-based survey. Participants were categorized into underestimation ($n = 162$, 31%), accurate estimation ($n = 222$, 42%), and overestimation ($n = 142$, 27%) of cardiovascular risk by comparing calculated Systematic Coronary Risk Estimation (SCORE) with self-perceived risk. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for underestimation vs. accurate estimation of cardiovascular risk were computed using logistic regression ($n = 384$). Very good general health (OR 2.60, 95% CI 1.10–6.16) and lack of family history (OR 2.27, 95% CI 1.24–4.18) were associated with underestimation of cardiovascular risk. The associations were modified by the participants' calculated risk level; the association was stronger for high-risk individuals; without family history OR 22.57 (95% CI 6.17–82.54); with very good/excellent health OR 15.78 (95% CI 3.73–66.87).

Conclusion A good general health and the lack of family CVD history can obscure the presence of other risk factors and lead to underestimation of cardiovascular risk, especially for high-risk individuals. It is, therefore, crucial to address the fact that the development of CV disease may be silent and multifactorial.

Keywords Cardiovascular diseases • Prevention • Risk perception • General health • Family history of MI

Implications for practice

- Patient tends to disregarded risk factors if they feel fine.
- Use cardiovascular disease (CVD) risk calculators that include several risk factors.
- Identify those who underestimate their CVD risk.
- Communicate that CVD often is symptom free.
- Communicate that CVD risk is multifactorial.

Introduction

The European guidelines on prevention in clinical practice recommend an assessment of a patient's total cardiovascular risk.[1] To be successful in prevention and treatment of cardiovascular diseases (CVD's), it is crucial to mobilize the patient. The individual's perceived susceptibility of risk is an important aspect explaining health behaviour.[2] Patients that accurately perceived their risk as high

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reported higher compliance to secondary prevention interventions.[3] Therefore, risk perception is a crucial aspect in preventing and treating CVD. However, perception of cardiovascular risk might be obstructed by the fact that CVDs are perceived as an abstract concept due to the silent development and the multiple risk factors that accumulate throughout the course of life.[4]

The tendency of individuals to perceive themselves to be at lower risk of a clinical event than the average person is well-studied in the field of cardiovascular risk perception, both in patients and in the general population.[3,5,6] Understanding what factors influence the underestimation of risk is crucial to be able to design optimal risk communication messages and to target the individuals most likely to underestimate their cardiovascular risk. Factors related to our preunderstanding of cardiovascular risk factors, e.g. education and health literacy can influence our risk perception and are therefore important to include when studying underestimation of risk.[7,8]

In our earlier qualitative work, family history and general health were related to perceived cardiovascular risk. As long as one 'felt healthy', there was nothing to worry about.[9] Having a family history of CVD and poor general health have been associated with high perceived cardiovascular risk in prior studies.[8,10–12] How these factors influence the underestimation of cardiovascular risk has not been investigated to the same extent. A study conducted in the USA found that good general health and absence of family history of myocardial infarction (MI) were associated with underestimation of cardiovascular risk.[5] However, previous studies have not taken into account factors related to understanding of health information, such as level of education, health literacy, and numeracy, which could be possible confounders to these associations.

We focus on the general population that is relatively healthy but still can have several risk factors that may lead to CVDs later in life. It is, therefore, important to study this population from a public health perspective.

In this study, we aimed to study the associations of general health and family history of MI with underestimation of cardiovascular risk in a Swedish population, taking factors related to understanding of health information into account. We also wanted to investigate if the associations are modified by the participants' calculated cardiovascular risk level.

Methods

Design and study population

This was a cross-sectional analysis of data collected through the Swedish CArdioPulmonary BioImage Study (SCAPIS).[13] The participants in SCAPIS were randomly selected from the Swedish population with the purpose of creating a cohort for the study of CVD and chronic obstructive pulmonary disease (COPD). Inclusion criteria were age 50–64 years, and exclusion criteria were inability to understand written and spoken Swedish for informed consent. This study was an add-on study to SCAPIS enabled by the opportunity to add questions about cardiovascular risk perception to the original SCAPIS web-based questionnaire. The data collection with these additional questions was for convenience reasons limited to the period February–March 2017. Based on power calculations, 615 participants were deemed sufficient for the analysis. After 615 participants had responded to the extended questionnaire, the add-on questions were removed. A flowchart of the study population is shown in *Figure 1*. Total number in final analysis was 526. Total serum cholesterol concentrations, systolic blood pressure (the average from two measurements, from the arm with highest systolic blood pressure, taken with subject lying down using an automatic device), and waist circumference were measured in the SCAPIS health examinations. The remaining information was self-reported and collected through a web-based questionnaire that the participants answered at home.

The investigation conforms with the principles outlined in the 'Declaration of Helsinki' (*Br Med J* 1964;ii:177). The study was approved by the Uppsala Regional Ethical Review Board (Reg. no. 2016/256).

Measures of calculated cardiovascular risk and self-perceived risk

Cardiovascular risk was calculated using the 2015 Systematic Coronary Risk Estimation (SCORE), validated for the Swedish population.[14] SCORE calculates the 10-year risk of fatal CVD for apparently healthy individuals 40–65 years old, based on sex, age, total cholesterol, systolic blood pressure, and smoking status.

According to SCORE, a calculated risk of <1% is considered as low, 1–4% as moderate, 5–9% as high, and >9% as very high risk. Participants with diabetes type 2 ($n = 23$), established CVD ($n = 34$), systolic blood pressure ≥180 mmHg ($n = 2$), and total cholesterol >8 mmol/L ($n = 13$) are per definition considered as high risk. In this study population, men had a calculated SCORE risk of 1–10% and women had a calculated SCORE risk of 0–3%. Based on the difference in distribution between men and women and to make the calculated and the self-perceived risks comparable, the participants were divided into three new categories based on the calculated SCORE risk: low (1% for men and 0% for women), moderate (2–4% for men and 1% for women), or high risk (5–10% for men and 2–3% for women).

Self-perceived risk was assessed on a 7-point Likert scale using the question 'Compared to other people of the same age and sex as you, how do you perceive your risk of having a heart attack in the next 10 years?' Self-perceived risk was collapsed into three categories: lower

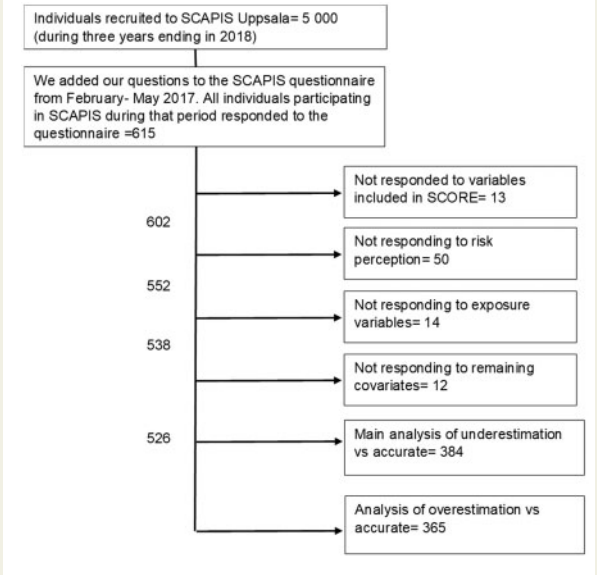

Figure 1 Flowchart of studypopulation

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than others (1–3 points), same as others (4 points), and higher than others (5–7 points).

Based on the distribution of the calculated CVD risk and the self-perceived MI risk among the 552 participants with information on both, 168 (30.4%) of the participants were classified as having underestimated risk perception (perceived risk lower than calculated risk), 231 (41.8%) as having accurate risk perception (perceived risk in agreement with calculated risk), and 153 (27.7%) as having overestimated risk perception (perceived risk higher than calculated) (*Table 1*).

Exposures

General health was assessed through the question 'In general, would you say your health is: excellent, very good, good, somewhat good, or poor?'. Family history of MI included parents or siblings and was not age specific. Medical background was assessed by asking about treatment for or diagnosis of CVD, diabetes, hypertension, or high cholesterol before participating in SCAPIS.

Covariates

Sociodemographic variables included sex, age, education level (graduated from primary school, high school, or university), and country of birth. Health literacy (HL) was measured using the validated Swedish version of the Communicative and Critical Health Literacy Scale, a five-item, five-point Likert scale.[15] Participants who answered 'strongly agree' or 'agree' on all items were categorized as having sufficient HL, while the others were categorized as having problematic/inadequate HL. Numeracy was assessed by using the Short three-item Version of Subjective Numeracy Scale, a three-item, five-point Likert scale, from which a mean summary score was calculated.[16]

Smoking was dichotomized into 'daily or occasional smoking' and 'stopped smoking or never smoked'. Physical activity was measured using the question: how often do you work out? The five-point item was conflated into 'never or seldom', '1–2 times/week', and '2 times/week or more'.

Waist circumference was measured in centimetres and used to compute abdominal obesity: >87 cm for women and >101 cm for men as suggested by e.g. the World Health Organization.

Self-perceived stress was dichotomized into low level of stress ('never experienced stress', 'experienced some periods of stress', and 'experienced a period of stress the last 5 years') and high level of stress ('constant stress the last year' and 'constant stress the last 5 years').

Statistical analysis

The statistical analyses were restricted to the 526 subjects with complete information on exposures ($n = 77$ missing) and covariates ($n = 12$ missing) and who were classified as accurate ($n = 222$), underestimated ($n = 162$), or overestimated ($n = 142$) risk perception. Descriptive statistics are presented with mean and standard deviation for continuous variables and as frequencies for categorical variables. The association of (i) general health and (ii) family history with underestimation of CVD risk was estimated as odds ratios (ORs) and 95% confidence intervals (CIs) using logistic regression analyses. A separate analysis was also conducted for overestimating CVD risk. Accurate risk perception was the reference category in all analyses. Confounders were explored and selected based on directed acyclic graphs (DAG's). Model 1 included age and sex. Model 2 additionally included education, health literacy, numeracy, smoking, physical activity, abdominal obesity, stress, (self-reported) hypertension, high cholesterol, diabetes, and CVD. Family history was also included as a covariate in Model 2 with general health as exposure.

Effect modification of the associations by the individual's calculated SCORE risk level was investigated by combining SCORE with general health or family history into two new categorical variables using a joint reference category in logistic regression. We then calculated the relative excess risk due to interaction (RERI), where a RERI = 0 indicates no effect modification.[17] All analyses were performed using SPSS 25 and Stata 15.

Results

The study population consisted of 53% women and 10.4% of the participants were not born in Sweden. Characteristics of the participants are presented in *Table 2*, stratified by general health and family history of MI. Those with excellent or very good health were more likely to be highly educated, have higher health literacy, and have fewer CVD risk factors. Participants with family history of MI more often perceived their risk as higher compared to participants without family history. They also had higher blood pressure and more commonly reported CVDs or diabetes. The associations of (i) general health and (ii) family history with underestimation of risk were estimated in separate logistic regressions models, shown in *Table 3*. Participants with a very good or excellent self-perceived general health were more likely to underestimate their cardiovascular risk compared to participants with bad or fairly good general health (adjusted OR 2.60, 95% CI 1.10–6.16). Participants without a family history of CVD were

Table 1 Distribution of participants who underestimate risk, overestimate risk, and accurately estimate risk according to calculated cardiovascular risk (SCORE) and self-perceived risk

Self-perceived risk	Calculated cardiovascular risk (SCORE)			Total
	Low risk Men: SCORE 1% Women: 0%	Moderate risk Men: SCORE 2–4% Women: 1% risk	High risk[a] Men: SCORE 5–10% Women: SCORE 2–3%	
Lower than others	A 93 (16.8)	U 101 (18.3)	U 26 (4.7)	220 (39.9)
Same as others	O 69 (12.5)	A 99 (17.9)	U 41 (7.4)	209 (37.9)
Higher than others	O 40 (7.2)	O 44 (8.0)	A 39 (7.1)	123 (22.3)
N (%)	202 (36.6)	244 (44.2)	106 (19.2)	552 (100)

A, accurate risk perception; O, overestimating risk; U, underestimating risk.
[a]Participants with total cholesterol >8 mmol/L, systolic blood pressure ≥180, self-reported CVD, or self-reported diabetes were included in the high-risk category.

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Table 2 Descriptive data of participants (526)

	General health			Family history of MI	
	Fairly good, poor	Good	Excellent, very good	Yes	No
	N = 98	*N* = 183	*N* = 245	*N* = 133	*N* = 393
Age, years	57.7 (4.5)	57.6 (4.3)	58.1 (4.5)	57.9 (4.3)	57.8 (4.5)
Sex					
Female	57 (58.2)	90 (49.2)	132 (53.9)	62 (46.6)	217 (55.3)
Highest educational level					
Compulsory school	9 (89.2)	19 (10.4)	10 (4.1)	7 (5.3)	31 (7.0)
Secondary school	53 (54.1)	81 (44.3)	88 (35.9)	61 (45.9)	161 (41.0)
University	36 (36.7)	83 (45.4)	147 (60.0)	65 (48.9)	201 (51.1)
Not born in Sweden	15 (15.3)	21 (11.5)	18 (7.3)	22 (16.5)	32 (8.1)
Health literacy					
Problematic/inadequate	52 (53.1)	78 (42.6)	72 (29.4)	56 (42.1)	146 (37.2)
Numeracy	3.7 (1.0)	3.7 (.9)	4.0 (.8)	3.9 (.8)	3.8 (.9)
Total cholesterol (mmol/L)	5.7 (1.2)	5.5 (1.0)	5.6 (1.0)	5.5 (1.1)	5.6 (1.0)
Systolic blood pressure (mmHg)	127.5 (15.3)	126.4 (15.0)	123.2 (17.3)	128.2 (15.7)	124.1 (16.3)
Self-reported hypertension	38 (38.8)	45 (24.6)	38 (15.5)	29 (21.8)	92 (23.4)
Self-reported high cholesterol	14 (14.3)	24 (13.1)	23 (9.4)	25 (18.8)	36 (9.2)
Self-reported diabetes	7 (7.1)	10 (5.5)	3 (1.2)	9 (6.8)	11 (2.8)
Self-reported CVD	10 (10.2)	16 (8.7)	4 (1.6)	9 (6.8)	21 (5.3)
General health					
Poor	8 (1.5)	—	—	2 (1.5)	6 (1.5)
Fairly good	90 (17.1)	—	—	26 (19.5)	64 (16.3)
Good	—	183 (34.8)	—	52 (39.1)	131 (33.3)
Very good	—		174 (33.1)	42 (31.6)	
Excellent	—	—	71 (13.5)	11 (8.3)	132 (33.6)
		—			60 (15.3)
Family history of myocardial infarction	28 (28.6)	52 (28.4)	53 (21.6)	133 (100)	–
Abdominal obesity	73 (74.5)	115 (62.8)	89 (36.3)	75 (56.4)	202 (51.4)
Body mass index, kg/m^2	29.0 (5.0)	28.0 (3.9)	25.7 (3.4)	27.5 (4.0)	27.0 (4.2)
Smoker	15 (15.3)	12 (6.6)	17 (6.9)	10 (7.5)	34 (8.7)
Self-perceived stress					
High level	40 (40.8)	35 (19.1)	33 (13.5)	28 (21.1)	80 (20.4)
How often do you exercise?					
Never or seldom (vs. 1/week or more)	78 (79.6)	97 (53.0)	88 (35.9)	67 (50.4)	196 (49.9)
Risk perception					
Lower than others	12 (12.2)	59 (32.2)	142 (58.0)	31 (23.3)	182 (46.3)
Same as others	45 (45.9)	78 (42.6)	71 (29.0)	45 (34.9)	149 (37.9)
Higher than others	41 (41.8)	46 (25.1)	32 (13.1)	57 (42.9)	62 (15.8)
SCORE women					
Low risk 0%	21 (36.8)	37 (41.1)	45 (34.1)	19 (30.6)	84 (38.7)
Moderate risk 1–4%	24 (42.1)	44 (48.9)	81 (61.4)	33 (53.2)	116 (53.5)
High risk 5–9%	12 (21.1)	9 (10.0)	6 (4.5)	10 (16.1)	17 (7.8)
Very high risk >9%	—	—	—	—	—
SCORE men					
Low risk 0%	—	—	—	—	—
Moderate risk 1–4%	31 (75.6)	70 (75.3)	100 (88.5)	55 (77.5)	146 (83.0)
High risk 5–9%	10 (24.4)	22 (23.7)	13 (11.5)	16 (22.5)	29 (16.5)
Very high risk >9%	—	1 (1.1)	—	—	1 (0.6)

Continuous variables are expressed as mean (standard deviation), categorical as number (percentages).
CVD, cardiovascular disease; SCORE, Systematic Coronary Risk Estimation.

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more likely to underestimate their cardiovascular risk compared to participants with a family history (adjusted OR 2.27, 95% CI 1.24–4.18). The complete regression models are presented in Supplementary material online, indicating that older participants, smokers, and participants with previous experiences of CVD were more likely to underestimate their risk. However, since the models were not designed to evaluate these variables as exposures, the results should be interpreted with caution. We also estimated the associations of general health and family history of MI on overestimation of cardiovascular risk. Those with very good general health, compared with poor/fairly good health, (OR 0.26, 95% CI 0.12–0.55) and those without family history of CVD, compared with family history, (OR 0.44, 95% CI 0.25–0.76) were less likely to overestimate their CV risk (*Table 3*).

Table 3 The association of general health and family history with underestimation and with overestimation of cardiovascular risk

Underestimation of CVD risk				
	N	***N* underestimating CV risk**	**Model 1**	**Model 2**
			OR (95% CI)	**OR (95% CI)**
General health				
Poor/fairly good	56	17	1.00 (ref)	1.00 (ref)
Good	127	48	1.80 (0.87–3.69)	1.59 (0.68–3.69)
Very good/excellent	201	97	3.00 (1.51–5.97)	2.60 (1.10–6.16)
Family history				
Yes	83	24	1.00 (ref)	1.00 (ref)
No	301	138	2.33 (1.32–4.10)	2.27 (1.24–4.18)
Overestimation of CVD risk				
	N	***N* overestimating CV risk**	**Model 1**	**Model 2**
			OR (95% CI)	**OR (95% CI)**
General health				
Poor/fairly good	81	42	1.00 (ref)	1.00 (ref)
Good	136	56	0.59 (0.34–1.06)	0.50 (0.25–1.00)
Very good/excellent	148	44	0.34 (0.19–0.61)	0.26 (0.12–0.55)
Family history				
Yes	109	50	1.00 (ref)	1.00 (ref)
No	256	92	0.54 (0.33–0.87)	0.44 (0.25–0.76)

Each analysis was made restricted to those with the outcome and those with accurate estimation of their cardiovascular risk, $N = 384$ for underestimation and $N = 365$ for overestimation. Model 1 included: age and sex. Model 2 included: age, sex, education, health literacy, numeracy, smoking, physical activity, abdominal obesity, stress, (self-reported) hypertension, high cholesterol, diabetes, and CVD. Family history was also included in Model 2 for general health.
CI, confidence interval; OR, odds ratio.

Table 4 Effect modification by calculated SCORE risk for the association of general health and family history for underestimation of cardiovascular risk using a common reference category

	SCORE moderate risk 1–4%			**SCORE high risk 5–9%**		
General health	***N***	***N* Underestimating CV risk**	**OR (95% CI)**	***N***	***N* Underestimating CV risk**	**OR (95% CI)**
Poor/fairly good	43	9	1.00 (ref)	32	8	5.45 (1.24–23.86)
Good	93	29	1.60 (0.49–5.20)	47	18	9.64 (2.19–42.46)
Very good/excellent	131	83	3.65 (1.14–11.72)	38	14	15.78 (3.73–66.87)
Family history						
Yes	56	17	1.00 (ref)	38	7	2.53 (0.73–8.83)
No	208	104	2.03 (0.84–4.89)	75	33	22.57 (6.17–82.54)

Odds ratios (ORs) and 95% confidence intervals (CIs) were adjusted for age, sex, education, health literacy, smoking, physical activity, abdominal obesity, stress, (self-reported) hypertension, high cholesterol, diabetes, and cardiovascular disease. Family history was also included as a covariate in the analysis of general health and SCORE. Low-risk individuals were not included since they per definition cannot underestimate their risk.

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The participants' calculated risk level (SCORE) modified the associations of general health and family history with underestimation of CVD risk (*Table 4*). Thus, the combination of having a high SCORE risk and excellent/very good health ($n = 14$) or no family history ($n = 33$) was associated with a much higher likelihood of underestimating cardiovascular risk compared to having estimated moderate risk. However, the CIs for the estimates for effect modification were very wide, indicating uncertainty in the measurement (RERI: 7.68, 95% CI -9.35 to 24.71 for excellent/very good health and RERI: 19.01, 95% CI -7.52 to 45.53 for no family history).

Discussion

In this population-based study of men and women, individuals with very good/excellent general health and those without a family history of MI were more likely to underestimate their cardiovascular risk, compared with participants with a bad or fairly good general health and without a family history. These associations were modified by the participants risk level measured by SCORE; high-risk participants were more likely to underestimate their risk compared to participants with moderate risk.

Poor general health and family history of CVD have both been associated with high perceived cardiovascular risk also in past studies[8,10–12] and were associated with underestimation of cardiovascular risk in a US population.[5] This study confirms these results and demonstrates that the associations are independent of factors related to understanding of health information, including health literacy and numeracy, factors that were not taken into account in previous studies. Consequently, it seems that lay people take general health and family history of CVD into account when assessing their own cardiovascular risk, while disregarding other risk factors. This can be explained by the fact that lay people use their own personal experiences and perceptions when assessing risks.[18] Walter *et al.*[19] explained perceived risk due to family history beyond causal beliefs and instead in terms of witnessing the illness or death of a family member as personal life event attached to negative emotions like fear or grief. Familiarity, personal significance and emotional attachment make the risk more cognitively available (easier to recall and imagine) to the individual, resulting in a higher perceived risk.[20]

Cardiovascular disease risk is also more likely to be underestimated due to the fact that it too high extent is controllable by the individual through modifiable risk factors, which makes it less dreaded than risk that is not controllable, and is therefore perceived as lower.[21] Also, life style factors are somewhat voluntary and reflect the way we prefer to live our lives and it is more likely to dismiss the risks of behaviours that are liked.[22] There is also the belief that risky behaviours can be compensated by healthy behaviours.[23] Even if individuals are aware of the negative impact of being a smoker they may believe that they can compensate for the increased risk by for example being physically active.

The associations of general health and family history of CVD with underestimation of cardiovascular risk remained stable when adjusting for health literacy, numeracy, educational level, and self-perceived knowledge of cardiovascular risk factors. This indicates that the associations cannot be explained by the lack of knowledge or ability to understand the risk, but rather the inability to apply that knowledge to themselves, which has also been suggested in previous studies.[12,24] How the participants feel in general seems to override other existing information regarding risk factors. Therefore, the solution to the problem cannot merely be to provide more information to the person.

Including questions on family history of CVD and general health is relevant for cardiovascular risk assessment. Family history of premature CVD reflects both genetic traits and living conditions, such as life style and environmental factors shared within a family,[1] and can influence the adoption of a healthy life style and adherence to cholesterol lowering medication.[25] Likewise, a poor general health is associated with cardiovascular events and death[26] and can motivate individuals to take preventive action since wanting to feel better is a common reason for taking action to prevent CVD.[27] However, hypertension and hypercholesterolaemia are symptom-free conditions and cardiovascular risk factors do not necessarily affect self-perceived health.[28] The absence of a family history and a good general health should thus be seen as possible obstacles to treatment and prevention of CVDs, since these individuals are much more likely to underestimate their cardiovascular risk. Therefore, rather than educating the public about cardiovascular risk factors, risk information should be individualized and emphasize the fact that the progress of CVD's is 'silent' and multifactorial. Risk estimation tools, such as SCORE, can be helpful when communicating CVD risk, since it includes several risk factors. SCORE also offers the possibility to communicate 'heart age' to younger patients, who have a low total 10-year risk but a high relative risk.[1] A 40-year-old smoker may have the same risk level as a 60-year-old without any risk factors. It can also be used to present comparative risk, where the patient's risk level is compared to a person of the same age and sex, without any modifiable risk factors. Using comparative risk together with personal risk has been shown to influence risk perceptions.[29] Interventions that include self-monitoring of, e.g. blood pressure may help to compensate for the lack of symptoms, making the risk more concrete and present in daily life.[30]

Our results also show that those with good self-perceived general health and lack of family history of CVD were less likely to overestimate their cardiovascular risk. However, in this study, we chose to focus on the underestimation, since underestimation of risk is associated to non-adherence to treatment[3] and can therefore create a clinical problem, which is probably not the case for those overestimating their risk. Furthermore, those who have a poor general health and a family history of CVD that overestimate their cardiovascular risk relative to their calculated SCORE risk may in reality in fact have an accurate risk perception, since general health and family history of CVD influence cardiovascular risk and are not included in SCORE.

Strengths and limitations

The study uses cross-sectional data, which bring limitations regarding the causal path to risk perception. The fact that the majority of the study population was highly educated and born in Sweden also puts restraints on the generalizability, although not necessarily the internal validity,[31] of the findings. However, the study consisted of a random sample of the general population and adjusted for education and other potential confounders, which is a strength of the study. The use of web-based questionnaires may obstruct participation for

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individuals with lacking computer access. However, participants were given the opportunity to fill out the questionnaire at the test centre, minimizing the effect of using a web-based questionnaire.

SCORE is a risk chart designed as a didactic tool for clinical practice, in situations where physicians have the possibility to take other risk factors and co-morbidities into account, which was not possible in this study. The actual risk level might therefore not have been captured properly, implying that the participants' cardiovascular risks were estimated as lower compared to in clinical practice, leading to an underestimation of the association. In this study, we do not know the causes to why the respondents perceived their general health as poor; it is possible that different co-morbidities in fact influence underestimation of CVD risk to different extents. In populations with a decreasing mortality rate, these risk estimates will automatically overestimate the risk level due to the fact that they are based on data from cohorts from the past. However, the Swedish 2015 SCORE version was recently validated for the Swedish population, which showed that it slightly overestimated the number of deaths (predicted/observed 1.3), the sensitivity was 76% and the specificity was 75%.[14] Despite its flaws still appears to be the best available option to use in this study. The distribution of SCORE in our study sample is similar to that in the population-based MONICA study,[14] shown in Supplementary material online, *Table S1*.

The methods used to measure risk perception in previous studies varies. Some have used relative risk measures[3,11] (e.g. lower or higher than others), others absolute risk measures (e.g. low vs. high),[5,6,12] and some have combined measures.[8] Different wordings, such as chance,[3] risk,[6] or likelihood,[5,12] and time frames are also used (e.g. next years,[6] 5 years,[3,11] 10 years,[12] and lifetime[5,8]), but the tendency to underestimate CVD risk do not seem to differ. However, in a study, where they used an analogue scale with 0–100% there was a tendency to overestimate CVD risk and the mean level of self-perceived risk was 30.5%.[10] Since a numerical value do not provide any information about what the respondent think of the number in terms of being low or high, it did not appear appropriate for our study. We chose to use a relative measure of risk perception in this study, with an explicit question to avoid that for example a woman assesses her personal risk compared to an older man. The relative measure is also appropriate since the calculated CVD risk (SCORE) is sex and age dependent.

Conclusion

A good general health and the lack of a family history of MI obscures the presence of other risk factors which can lead to underestimation of an individual's cardiovascular risk, especially regarding high-risk individuals. The influence of these factors cannot be explained by differences in understanding of health information. It is, therefore, crucial to address the fact that the development of CVD's is silent when communicating cardiovascular risk in clinical practice and in public health campaigns. Furthermore, risk communication should acknowledge that lay people extensively use family history of CVD to assess their own risk of illness. Family history can represent an enabling factor for prevention when present, but be an obstacle when it is lacking.

Supplementary material

Supplementary material is available at *European Journal of Cardiovascular Nursing* online.

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References

1. Piepoli MF, Hoes AW, Agewall S, *Albus C, Brotons C, Catapano AL, Cooney MT, Corrà U, Cosyns B, Deaton C, Graham I, Hall MS, Hobbs FDR, Løchen ML, Löllgen H, Marques-Vidal P, Perk J, Prescott E, Redon J, Richter DJ, Sattar N, Smulders Y, Tiberi M, van der Worp HB, van Dis I, Verschuren WMM, Binno S, ESC Scientific Document Group*. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts): developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). *Eur J Prev Cardiol* 2016;**23**:Np1–Np96.
2. Carpenter CJ. A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Commun* 2010;**25**:661–669.
3. Thakkar J, Heeley EL, Chalmers J, Chow CK. Inaccurate risk perceptions contribute to treatment gaps in secondary prevention of cardiovascular disease. *Intern Med J* 2016;**46**:339–346.
4. van Steenkiste B, van der Weijden T, Timmermans D, Vaes J, Stoffers J, Grol R. Patients' ideas, fears and expectations of their coronary risk: barriers for primary prevention. *Patient Educ Couns* 2004;**55**:301–307.
5. Petr EJ, Ayers CR, Pandey A, de Lemos JA, Powell-Wiley TM, Khera A, Lloyd-Jones DM, Berry JD. Perceived lifetime risk for cardiovascular disease (from the Dallas Heart Study). *Am J Cardiol* 2014;**114**:53–58.
6. Katz M, Laurinavicius AG, Franco FGM, Conceicao RD, Carvalho JAM, Pesaro AEP, Wajngarten M, Santos RD. Calculated and perceived cardiovascular risk in asymptomatic subjects submitted to a routine medical evaluation: the perception gap. *Eur J Prev Cardiol* 2015;**22**:1076–1082.
7. Williams MV, Baker DW, Parker RM, Nurss JR. Relationship of functional health literacy to patients' knowledge of their chronic disease. A study of patients with hypertension and diabetes. *Arch Intern Med* 1998;**158**:166–172.
8. Hwang WJ, Hong O, Kim MJ. Factors associated with blue-collar workers' risk perception of cardiovascular disease. *J Korean Acad Nurs* 2012;**42**:1095–1104.
9. Grauman Å, Hansson M, James S, Veldwijk J, Höglund A. Exploring research participants' perceptions of cardiovascular risk information-Room for improvement and empowerment. *Patient Educ Couns* 2019;**102**:1528–1534.
10. Frijling BD, Lobo CM, Keus IM, Jenks KM, Akkermans RP, Hulscher MEJL, Prins A, van der Wouden JC, Grol RPTM. Perceptions of cardiovascular risk among patients with hypertension or diabetes. *Patient Educ Couns* 2004;**52**:47–53.
11. Meischke H, Sellers DE, Robbins ML, Goff DC, Daya MR, Meshack A, Taylor J, Zapka J, Hand MM. Factors that influence personal perceptions of the risk of an acute myocardial infarction. *Behav Med* 2000;**26**:4–13.
12. Claassen L, Henneman L, Nijpels G, Dekker J, Marteau T, Timmermans D. Causal beliefs and perceptions of risk for diabetes and cardiovascular disease, The Netherlands. *Prev Chronic Dis* 2011;**8**:A130.
13. Bergström G, Berglund G, Blomberg A, Brandberg J, Engström G, Engvall J, Eriksson M, de Faire U, Flinck A, Hansson MG, Hedblad B, Hjelmgren O, Janson C, Jernberg T, Johnsson Å, Johansson L, Lind L, Löfdahl C-G, Melander O, Östgren CJ, Persson A, Persson M, Sandström A, Schmidt C, Söderberg S, Sundström J, Toren K, Waldenström A, Wedel H, Vikgren J, Fagerberg B, Rosengren A. The Swedish CArdioPulmonary BioImage Study: objectives and design. *J Intern Med* 2015;**278**:645–659.
14. Karjalainen T, Adiels M, Björck L, Cooney M-T, Graham I, Perk J, Rosengren A, Söderberg S, Eliasson M. An evaluation of the performance of SCORE Sweden 2015 in estimating cardiovascular risk: the Northern Sweden MONICA Study 1999-2014. *Eur J Prev Cardiol* 2017;**24**:103–110.
15. Wangdahl JM, Martensson LI. The communicative and critical health literacy scale–Swedish version. *Scand J Public Health* 2014;**42**:25–31.

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16. McNaughton CD, Cavanaugh KL, Kripalani S, Rothman RL, Wallston KA. Validation of a short, 3-item version of the subjective numeracy scale. *Med Decis Making* 2015;**35**:932–936.
17. Knol MJ, VanderWeele TJ, Groenwold RHH, Klungel OH, Rovers MM, Grobbee DE. Estimating measures of interaction on an additive scale for preventive exposures. *Eur J Epidemiol* 2011;**26**:433–438.
18. Garvin T. Analytical paradigms: the epistemological distances between scientists, policy makers, and the public. *Risk Anal* 2001;**21**:443–456.
19. Walter FM, Emery J. 'Coming down the line'– patients' understanding of their family history of common chronic disease. *Ann Fam Med* 2005;**3**:405–414.
20. Tversky A, Kahneman D. Judgment under uncertainty: heuristics and biases. *Science* 1974;**185**:1124–1131.
21. Klein CTF, Helweg-Larsen M. Perceived control and the optimistic bias: a meta-analytic review. *Psychol Health* 2002;**17**:437–446.
22. Alhakami AS, Slovic P. A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Anal* 1994;**14**:1085–1096.
23. Rabia M, Knauper B, Miquelon P. The eternal quest for optimal balance between maximizing pleasure and minimizing harm: the compensatory health beliefs model. *Br J Health Psychol* 2006;**11**:139–153.
24. Erhardt L, Hobbs FD. Public perceptions of cardiovascular risk in five European countries: the react survey. *Int J Clin Pract* 2002;**56**:638–644.
25. Claassen L, Henneman L, van der Weijden T, Marteau TM, Timmermans DRM. Being at risk for cardiovascular disease: perceptions and preventive behavior in people with and without a known genetic predisposition. *Psychol Health Med* 2012;**17**:511–521.
26. Haring R, Feng Y-S, Moock J, Völzke H, Dörr M, Nauck M, Wallaschofski H, Kohlmann T. Self-perceived quality of life predicts mortality risk better than a multi-biomarker panel, but the combination of both does best. *BMC Med Res Methodol* 2011;**11**:103.
27. Mosca L, Mochari H, Christian A, Berra K, Taubert K, Mills T, Burdick KA, Simpson SL. National study of women's awareness, preventive action, and barriers to cardiovascular health. *Circulation* 2006;**113**:525–534.
28. Ko Y, Boo S. Self-perceived health versus actual cardiovascular disease risks. *Jpn J Nurs Sci* 2016;**13**:65–74.
29. Waldron C-A, van der Weijden T, Ludt S, Gallacher J, Elwyn G. What are effective strategies to communicate cardiovascular risk information to patients? A systematic review. *Patient Educ Couns* 2011;**82**:169–181.
30. Ciccone MM, Aquilino A, Cortese F, Scicchitano P, Sassara M, Mola E, Rollo R, Caldarola P, Giorgino F, Pomo V, Bux F. Feasibility and effectiveness of a disease and care management model in the primary health care system for patients with heart failure and diabetes (Project Leonardo). *Vasc Health Risk Manag* 2010;**6**:297–305.
31. Rothman KJ, Gallacher JE, Hatch EE. Why representativeness should be avoided. *Int J Epidemiol* 2013;**42**:1012–1014.

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