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Persistence of socioeconomic inequalities in the knowledge of cardiovascular risk factors five years after coronary angiography

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Abstract

Background: Cardiovascular diseases are important causes of death, morbidity, and years of potential life lost in most developed countries.

Aims: The purpose of this study was to assess trends in knowledge of cardiovascular risk factors among patients five years after coronary angiography and to investigate the impact of educational level on knowledge level.

Methods: The study included 1289 of 4391 patients admitted for cardiac events in 2008/2009 at the National Institute for Cardiac Surgery and Interventional Cardiology, Luxembourg. A follow-up study was conducted by post five years later (2013/2014). Data were obtained from 1837 of the contacted patients (with 548 reported deaths) (response rate=42%). Logistic regression models were used to evaluate the association between educational level and knowledge of cardiovascular risk factors. Educational level was used as a surrogate for socioeconomic status.

Results: In total, 39.9% of patients could list at least three risk factors in 2013/2014, a much higher percentage than the 8.5% observed during the initial survey. In both sexes, knowledge of cardiovascular risk factors increased between 2008/2009 and 2013/2014. Patients with higher educational levels were more likely (odds ratio=2.33, 95% confidence interval: 1.63–3.34) to cite at least three risk factors than patients with lower education levels.

Conclusion: Knowledge level was associated with educational level, and improved for all educational groups five years after coronary angiography. Educational differences in knowledge persisted, but the gaps decreased. Improving knowledge of cardiovascular risk factors among patients with cardiovascular disease will help increase awareness and promote lifestyle changes.

Keywords

Knowledge and awareness of cardiovascular risk factors, socioeconomic inequality, cardiovascular events, follow-up, Luxembourg

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Introduction

Cardiovascular diseases (CVDs) are important causes of death, premature death, morbidity, and years of potential life lost in most developed countries.[1] Research has shown that CVDs are multifactorial disorders that result from a complex interaction of numerous lifestyle-related risk factors.[2–4] Obesity, sedentary lifestyle, smoking, and high dietary fat intake are all major independent cardiovascular (CV) risk factors.[2,4,5] Adopting healthy lifestyle

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behaviours has been shown to reduce CVD risk.[2,6] Many social, cultural, and economic factors contribute to the development, maintenance, and change of health behaviour patterns.[7] Knowledge of modifiable risk factors is a prerequisite for behavioural modification.[8] According to health behaviour models, knowledge of the negative health consequences of a behaviour is a necessary condition for behaviour change.[2] However, knowledge alone is not sufficient to promote behavioural change, and awareness of CV risk factors, intention, and self-efficacy are also essential.[3,9,10]

Knowledge of CV risk factors is often limited or relatively poor, even in patients with CVD. For example, less than one-third of patients reported knowledge of all modifiable risk factors in some studies.[8,11] In a recent study of 260 women following myocardial infarction (MI) or coronary artery bypass grafting (CABG), only a few identified hypertension (5%), hypercholesterolaemia (14%), obesity (15%) and a high-fat diet (16%) as CV risk factors.[12] Wartak et al.[13] found that patients' overall knowledge was good, with 37% of patients able to identify the effect of all seven factors. Patient knowledge was greatest for harmful factors and lowest for predictive behaviours.

Knowledge of CV risk factors can vary with the occurrence of CV events. Recent research has demonstrated greater knowledge of coronary risk factors among patients who have experienced MI than among those who have received a coronary angiography.[8] Patients' knowledge and beliefs about CVD are important because studies have demonstrated that perceived personal susceptibility can increase prevention-seeking behaviours.[13,14]

According to most studies, the level of knowledge of CV risk factors is influenced by sociodemographic factors.[13,15,16] Multivariate analysis studies have identified education,[15] age, marital status, and sex[5] as significant sociodemographic predictors of knowledge of CV risk factors. Using a multivariate model, Wartak et al.[13] found that knowledge of all seven components was positively associated with high school education or greater (odds ratio (OR) 2.43, 95% confidence interval (CI) 1.68–3.52). Additionally, knowledge of CV risk factors has been associated with an increase in health-promoting behaviour.[5,8,17] It is known that CV risk factors and the prevalence of CVD are linked to education and socioeconomic status.[6,8] More recently, it has become apparent that the risk of heart failure and mortality after MI is linked to educational level.[11,12,15–17] While the underlying mechanisms are not clear, low educational attainment is also reported as an indirect cause of CVD through its influence on lifestyle, unhealthy diets, and beliefs.[18–20]

The objective of this study was to assess trends in the knowledge of CV risk factors in patients five years after coronary angiography, and to evaluate the associations between awareness of CV risk factors and educational level.

Methods

Design

Data were derived from a follow-up study of 4391 patients who underwent coronary angiography at the National Institute for Cardiac Surgery and Interventional Cardiology (INCCI) in 2008/2009 and participated in the 'Social Determinants and Health Status - ESANDE' research project.[16] The patient selection procedure of the ESANDE study involved systematic recruitments to undergo coronary angiography, and the study was prospective in nature. The patients were contacted again in the context of the Monitoring and Dynamics of Health Status through the Risk Factors for Cardiovascular Disease (MDYNRFC) project, which aimed to assess the evolution of health status and CV risk behaviour. This follow-up study was conducted from July 2013–April 2014.

For the follow-up study, a self-completed questionnaire was sent by post. In cases in which the patient had died, the family were asked to mention the date of death on the questionnaire. In total, 1837 questionnaires were returned (with 548 notifications of patient death), resulting in a response rate of 42% of patients who participated in 2008–2009. Finally, excluding patients who died, information on 1289 patients was used in the longitudinal cohort study.

The questionnaire was composed of two parts: the first consisted of all questions used at baseline, and the second included new questions designed to measure health status dynamics and risk factors for CVD, such as smoking status, high blood pressure, hypercholesterolaemia, physical activity and relative weight, in the context of a longitudinal approach.

Ethical approval and administrative arrangements

The investigation conforms to the principles outlined in the Declaration of Helsinki, and was approved by the National Research Ethics Committee and the National Commission for Data Protection. Informed consent was obtained from all participants. The National Commission for Data Protection approved the survey design and the content of the questionnaires. This study is part of the MDYNRFC-project, and is funded by the National Research Fund.

Measures

Knowledge of CV risk factors was assessed based on unprompted responses to the survey question: 'Can you cite what are the main cardiovascular risk factors?' This question was similar to questions used in other studies, such as: 'Can you tell me what are the major causes of heart disease or heart problems?'.[3] In the study by Lynch et al.,[21] participants were asked, 'What do you think are the most important causes of heart attack and stroke?'. Our

question focused on the ability to cite five modifiable risk factors. This formulation of the question allowed us to understand or appeal to the patient's knowledge with respect to the probable causes of heart disease. We also feel that this formulation is more representative because questions with fixed answers, such as 'yes', 'no', 'true', or 'false', allow people lacking knowledge to guess the correct answer. This may overestimate patient knowledge.[22] The five most cited modifiable CV risk factors identified by the participants were smoking, diabetes, hypertension, hypercholesterolaemia and obesity. We supposed that the ability to cite a CV risk factor was evidence of knowledge of this CV risk factor.

The CV events considered were angina pectoris (AP), acute MI and ischaemic heart disease (IHD). Events were diagnosed by physicians or medical specialists in 2008/2009. The covariates used in the analysis were the available demographic variables (sex and age group), socioeconomic variables (level of education), and CV risk factors (smoking status, diabetes status, hypertension status, cholesterol status and obesity). All variables are defined in Table 1. Unfortunately, physical activity was rarely indicated by patients, and thus was not included in the five modifiable risk factors quoted by patients.

Statistical analysis

The descriptive statistical analyses were mainly stratified according to sex and education level. In the first stage, the patients' knowledge of several CV risk factors (at least three), and of each individual CV risk factor was analysed according to education level and sex. In the second stage, the patients' knowledge of the same CV risk factor was presented according to education level and stratified by diagnosis. We calculated the rate ratios of knowledge of patients with the highest educational level compared to patients with the lowest educational level (rate $\text{ratio}_{\text{highest-lowest}}$). This indicator allowed us to monitor the gap in knowledge between groups and over time. Due to the poor knowledge of CV risk factors among patients in the survey, we considered the ability to cite at least three CV risk factors as an indicator of knowledge of several CV risk factors. The cut-off of three CV risk factors as an indicator of knowledge level was determined in a post-hoc manner.

Logistic regression models were used to assess the association between educational level and knowledge of CVD risk factors adjusted by age and sex. The first model assessed the probability of citing at least three CV risk factors by educational level, adjusted by age and sex. The other models, concerning the probability of citing one CV risk factor, were adjusted by the patients' exposure to the same CV risk factor to avoid its influence on the analysis. For example, we assumed that a patient with hypertension should be able to identify it as a CV risk factor more frequently than a patient without hypertension.

We reduced potential bias by only using the data of patients who were present in 2008/2009 and 2013/2014. Comparing participants with non-participants indicated no major differences.

All data management and statistical analyses were performed using SAS (version 9.4; SAS Institute, Cary, North Carolina, USA).

Results

The distribution of sociodemographic characteristics and risk factors for CVD in the patient population in 2013/2014 is presented in Table 1. In the overall patient population, 70.7% of patients were men, 68.3% were aged 65 years and older, 10.1% were regular smokers, 29.5% had diabetes, 42.2% had hypertension, 47.2% had high cholesterol and 31.9% were obese. Women were on average older (74.0 years) than men (65.8 years). Women most frequently cited CVD risk factors such as hypertension (49.4%) and high cholesterol (51.1%), while men most frequently cited regular smoking (11.0%), diabetes (29.9%) and obesity (32.5%) (Table 1).

The distribution of risk factors for CVD according to educational level revealed the existence of a social gradient in the prevalence of diabetes, hypertension, high cholesterol and obesity both in the total patient population and in men and women separately. For example, the prevalence of diabetes was 39.9% in men with primary education as the highest level of education, 26.9% in the category 'secondary education' and 22.6% in the most highly educated participants. In women, these figures were 34.1%, 25.9% and 12.5%, respectively (Table 1).

In Table 2, the level of knowledge of risk factors generally improved in patients five years after coronary angiography, but the proportion of patients who cited various risk factors remained low, except for tobacco smoking. Among men in 2013/2014, for example, 28.9% of tertiary-educated patients cited diabetes, 39.2% obesity, 40.4% hypertension and 43.4% high cholesterol. Similarly, among women with tertiary education, 32.0% cited diabetes, 36.0% obesity, 44.0% hypertension and 44.0% high cholesterol.

The ability to quote at least three risk factors increased more in women (from 5.6% in 2008/2009 to 38.9% in 2013/2014) than in men (from 9.8% in 2008/2009 to 40.3% in 2013/2014).

The knowledge of each of the major risk factors for CVD was mainly characterised by the presence of a social gradient and the reduction of differences in the knowledge of different risk factors. Patients with tertiary education cited the various risk factors for CVD more often than those with only primary or secondary education.

Among men, decreases in these differences were observed with respect to knowledge of hypertension (7.47 to 1.50), diabetes (3.29 to 1.15), and obesity (4.02 to 1.47).

Table 1. Characteristics of patients by sex, age, cardiovascular risk factor and educational level in 2013/2014.

	Overall (%)	Education			*p*-value
		Primary	Secondary	Tertiary	
All (*n*=1289)		36.2	48.9	14.9	
Sex					
Male	70.7	62.5	71.6	86.9	<0.0001
Female	29.3	37.5	28.4	13.1	
Age, years					
54 and younger	10.8	5.2	14.2	13.6	<0.0001
55–64	21.0	16.0	23.6	24.6	
65–74	34.5	34.3	33.0	39.3	
75 and older	33.8	44.6	29.2	22.5	
Cardiovascular risk factors					
Current smokers	10.1	8.6	11.6	9.0	0.2370
Ex-smokers	53.6	52.3	54.3	53.4	0.8187
Diabetes	29.5	37.8	26.7	21.2	<0.0001
Hypertension	42.2	47.0	42.2	31.6	0.0030
High cholesterol	47.2	51.2	46.5	40.4	0.0555
Overweight	43.6	42.2	44.4	43.7	0.7853
Obese	31.9	36.0	32.4	21.3	0.0015
Men (*n*=911)		32.0	49.6	18.3	
Age, years					
54 and younger	11.1	6.6	14.5	10.2	<0.0001
55–64	23.2	17.9	25.4	26.5	
65–74	36.8	38.3	33.6	42.2	
75 and older	29.0	37.2	26.5	21.1	
Cardiovascular risk factors					
Current smokers	11.0	9.5	12.6	9.8	0.3757
Ex-smokers	62.0	66.4	61.7	54.3	0.0385
Diabetes	29.9	39.9	26.9	22.6	0.0002
Hypertension	39.3	43.5	39.4	32.7	0.1014
Overweight	46.3	46.1	47.2	43.8	0.7620
Obese	32.5	37.6	33.0	23.5	0.0092
Women (*n*=378)		46.2	47.2	6.6	
Age, years					
54 and younger	10.1	2.9	13.5	36.0	<0.0001
55–64	15.9	12.6	19.1	12.0	
65–74	28.8	27.6	31.5	20.0	
75 and older	45.2	56.9	36.0	32.0	
Cardiovascular risk factors					
Current smokers	7.8	7.1	9.1	4.0	0.5871
Ex-smokers	33.4	28.8	35.4	48.0	0.1150
Diabetes	28.5	34.1	25.9	12.5	0.0612
Hypertension	49.4	52.7	50.0	25.0	0.0411
High cholesterol	51.1	55.1	50.6	26.1	0.0349
Overweight	36.8	35.7	36.8	42.9	0.8136
Obese	30.3	33.3	30.7	4.8	0.0272

Data from the Monitoring and Dynamics of Health Status through the Risk Factors for Cardiovascular Disease (MDYNRFC) survey, 2013/2014.

Among women, the largest decreases in knowledge were for diabetes (5.52 to 1.36) and obesity (5.00 to 1.36).

In Table 3, patient knowledge of CVD risk factors varied with the diagnosis or occurrence of CV events. Patients with acute MI were more able to cite at least three CV risk factors in 2008/2009 (12.3%) and 2014 (45.9%) compared to patients with angina pectoris (10.8% and 40.4%, respectively) or IHD (7.0% and 37.3%, respectively). In 2013/2014, patients with angina pectoris had a greater tendency to identify tobacco smoking (62.6%) and diabetes (31.1%) as risk factors, while patients with acute MI identified hypertension (40.2%), high cholesterol (38.5%) and

Table 2. Trends in patient knowledge of each cardiovascular risk factor (CVRF) and socioeconomic differences in knowledge by sex and education level (%).

	Citing at least three CVRF		Tobacco		Diabetes		Hypertension		Cholesterol		Obesity	
	2008/2009	2013/2014	2008/2009	2013/2014	2008/2009	2013/2014	2008/2009	2013/2014	2008/2009	2013/2014	2008/2009	2013/2014
All	8.5	39.9	29.1	62.1	5.1	28.5	6.4	34.5	22.6	34.1	9.7	36.2
Education												
Primary	4.3	28.2	21.6	50.2	3.0	24.6	3.2	26.7	17.2	26.9	4.3	26.5
Secondary	8.8	45.5	30.8	68.7	4.9	31.3	7.0	38.4	23.3	36.5	11.2	42.7
Tertiary	18.3	50.3	42.9	69.1	11.0	29.3	12.0	40.8	34.0	43.5	18.3	38.7
Ratio tertiary/primary	***4.3***	***1.8***	***2.0***	***1.4***	***3.6***	***1.2***	***3.7***	***1.5***	***2.0***	***1.6***	***4.3***	***1.5***
Men	9.8	40.3	31.0	65.2	5.4	28.0	6.5	35.0	23.9	34.0	10.7	36.4
Education												
Primary	4.8	29.3	22.8	54.5	3.1	25.2	1.7	26.9	19.3	27.9	4.5	26.6
Secondary	9.6	43.9	32.3	70.8	5.1	29.8	7.4	38.5	23.4	34.7	12.0	42.1
Tertiary	19.3	50.6	42.8	69.3	10.2	28.9	12.7	40.4	34.3	43.4	18.1	39.2
Ratio tertiary/primary	***4.0***	***1.7***	***1.9***	***1.3***	***3.3***	***1.1***	***7.4***	***1.5***	***1.8***	***1.6***	***4.0***	***1.5***
Women	5.6	38.9	24.6	54.5	4.5	29.6	6.1	33.3	19.3	34.1	7.4	35.5
Education												
Primary	3.5	26.4	19.5	43.1	2.9	23.6	5.8	26.4	13.8	25.3	4.0	26.4
Secondary	6.7	49.4	27.0	63.5	4.5	34.8	6.2	38.2	23.0	41.0	9.0	44.4
Tertiary	12.0	48.0	44.0	68.0	16.0	32.0	8.0	44.0	32.0	44.0	20.0	36.0
Ratio tertiary/primary	***3.5***	***1.8***	***2.3***	***1.6***	***5.6***	***1.4***	***1.4***	***1.7***	***2.3***	***1.7***	***5.0***	***1.4***

Data from the Monitoring and Dynamics of Health Status through the Risk Factors for Cardiovascular Disease (MDYNRFC) survey, 2013/2014.

Table 3. Trends in patient knowledge of each cardiovascular risk factor (CVRF) and socioeconomic differences in knowledge, cardiovascular events, and education level (%).

	Citing at least three CVRF		Tobacco		Diabetes		Hypertension		Cholesterol		Obesity	
	2008/2009	2013/2014	2008/2009	2013/2014	2008/2009	2013/2014	2008/2009	2013/2014	2008/2009	2013/2014	2008/2009	2013/2014
All – pectoris angina	10.8	40.37	30.4	62.6	7.3	31.1	8.5	34.6	24.8	34.7	11.5	35.6
Education												
Primary	5.8	26.5	22.0	52.0	4.5	25.1	4.0	25.6	20.2	25.6	4.0	26.5
Secondary	11.8	47.8	33.6	68.9	6.9	35.3	9.3	39.8	25.3	38.8	15.6	41.2
Tertiary	20.7	52.9	42.5	70.1	16.1	33.3	17.2	41.4	35.6	46.0	17.2	41.4
Ratio tertiary/primary	***3.5***	***2.0***	***1.9***	***1.3***	***3.6***	***1.3***	***4.3***	***1.6***	***1.8***	***1.8***	***4.3***	***1.6***
All – acute myocardial infarction	12.3	45.9	27.9	60.7	2.5	29.5	6.6	40.2	16.4	38.5	13.9	38.5
Education												
Primary	2.3	32.6	14.0	46.5	0.0	27.9	4.7	32.6	7.0	30.2	7.0	20.9
Secondary	12.9	53.2	29.0	67.7	3.2	30.7	4.8	45.2	17.7	45.2	14.5	51.6
Tertiary	35.3	52.9	58.8	70.6	5.9	29.4	17.7	41.2	35.3	35.3	29.4	35.3
Ratio tertiary/primary	***15.1***	***1.6***	***4.2***	***1.5***	***/***	***1.0***	***3.8***	***1.3***	***5.0***	***1.2***	***4.2***	***1.7***
All – ischaemic heart disease	7.0	37.3	32.9	58.9	4.4	24.1	5.7	32.9	25.3	31.7	8.9	32.9
Education												
Primary	4.8	34.9	27.0	46.0	3.2	22.2	3.2	25.4	19.1	31.8	6.4	25.4
Secondary	5.6	34.7	34.7	65.3	4.2	20.8	5.6	36.1	27.8	27.8	6.9	43.1
Tertiary	18.2	55.6	45.5	72.7	9.1	40.9	13.6	45.5	36.4	45.5	22.7	22.7
Ratio tertiary/primary	***3.8***	***1.6***	***1.7***	***1.6***	***2.8***	***1.8***	***4.2***	***1.8***	***1.9***	***1.4***	***3.5***	***1.1***

Data from the Monitoring and Dynamics of Health Status through the Risk Factors for Cardiovascular Disease (MDYNRFC) survey, 2013/2014.

obesity (38.5%). The gaps (rate ratio) in knowledge of CVD risk factors between patients with tertiary vs primary education decreased, but they were higher in patients with IHD, diabetes (ratio rate: 1.84), hypertension (ratio rate: 1.79) or tobacco smoking (ratio rate: 1.58) compared to patients with angina pectoris or acute MI.

In Tables 4 and 5, the models for predicting knowledge of CV risk factors show that educational level was a strong predictor of knowledge of CVD risk factors, even in patients with such risks. The odds to name at least three risk factors followed a positive gradient with respect to educational level both in 2008/2009 and 2013/2014 (Table 4). Patients with tertiary or secondary education were 1.9-times (OR=1.94, 95% CI: 1.49–2.52) or 2.3-times (OR=2.33, 95% CI: 1.63–3.34) more likely to cite at least three risk factors than patients who only completed primary education in 2013/2014. The same values were 1.9-times (OR=1.87, 95% CI: 1.10–3.20) and 4.1-times (OR=4.15, 95% CI: 2.29–7.51) in 2008/2009. The association between knowledge of risk factors and educational level, adjusted for age, sex, and risk factors involved, was significant in 2008 in knowledge of risk factors between education levels were smaller in 2008/2009 and 2013/2014, with the exception of diabetes in 2013/2014. Compared to 2008/2009, the differences in knowledge of risk factors between education levels were smaller in 2013/2014.

Discussion

The results of this study demonstrated persistent socioeconomic difference in knowledge of CV risk factors and poor knowledge of CV risk factors in patients even five years after coronary angiography. However, compared to 2008/2009, patients' knowledge of CV risk factors increased significantly by 2013/2014.

Poor knowledge of CV risk factors and persistence of socioeconomic differences five years after coronary angiography

Our findings demonstrated that knowledge of CV risk factors increased during the five-year follow-up period in the entire cohort, while differences between the highest educated patients and the lowest educated patients in both men and women decreased. The ability to quote at least three risk factors increased more in women than in men in relative terms. Poor knowledge of CV risk factors was also observed in patients undergoing elective CABG, as reported by Karthik et al.[23]

Even in population-based studies, knowledge of established modifiable CVD risk factors is low, particularly among the lowest educated groups.[21] In Canada, individual knowledge of risk factors for CVD is poor, and it has been reported that older Canadians do not possess sufficient knowledge about CVD to improve their health.[1]

Except for smoking tobacco, which was reliably identified as a CV risk factor, <40% of the patients reported knowledge of diabetes, hypertension, high cholesterol, and obesity in 2013/2014. Similarly, <10% of patients (both men and women) were able to cite at least five modifiable CV risk factors (figures not shown). However, other studies have reported significant differences in the knowledge of CV risk factors between men and women.[3,8,24] For example, some studies have shown that knowledge of coronary risk factors remains relatively poor in women.[8,12,25] In a recent study of 260 women following MI or CABG, women mainly attributed their coronary heart disease to smoking (44%) and family history (40%),[12] while only a few women identified hypertension (5%), hypercholesterolaemia (14%), obesity (15%) and a high-fat diet (16%) as risk factors.[12] In contrast, our findings showed that men tended to possess better knowledge of the various CV risk factors than women, but this was not statistically significant.

In the present study, socioeconomic differences in the knowledge of risk factors among patients were still present five years after the initial assessment, although they all decreased significantly with the exception of hypertension in women. These results are useful, and will help in the development of specific and targeted intervention programmes within the context of secondary prevention.

Knowledge of CV risk factors was influenced by demographic and socioeconomic characteristics and experience with different CV risk factors

In this study, younger patients had better knowledge or awareness of CV risk factors than elderly patients in both 2008/2009 and 2013/2014. An interesting result was the lack of a significant difference between women and men both at 2008/2009 and 2013/2014. Surprisingly, our findings demonstrated a decrease in the knowledge gap between patients who had or had not experienced CV risk factors in 2013/2014 compared to 2008/2009. Importantly, our results confirmed that educational level was a strong predictor of the knowledge of risk factors for CVD, even in patients with such risks factors. Moreover, educational level was not associated with knowledge of diabetes as a CV risk factor in 2013/2014. Several studies found that socioeconomic status, and particularly education, was a strong and consistent predictor of risk factor awareness.[13,16,24,26,27] Indeed, educational level reflects living conditions during the early part of a person's life, and is associated with knowledge of CVD risk factors.[24] A study reported by Kayaniyil et al.[27] found that cardiac inpatients with lower than high school education had significantly worse knowledge of coronary heart disease risk factors. Psychosocial parameters may also play a role; patients with higher education levels are more motivated to seek information regarding healthy lifestyle habits,[26] and

Table 4. Logistic regression models for predicting knowledge of cardiovascular (CV) risk factors: socioeconomic predictors of patient knowledge of CV risk factors in 2008 and 2014.

	Probability of citing at least three risk factors				Probability of citing smoking as a risk factor[a]				Probability of citing diabetes as a risk factor[b]			
	2008/2009		2013/2014		2008/2009		2013/2014		2008/2009		2013/2014	
	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%
Age, years												
54 and younger	1.67	(0.83–3.34)	2.11	(1.41–3.14)	1.59	(1.03–2.45)	3.26	(2.00–5.29)	0.98	(0.37–2.58)	1.91	(1.20–3.02)
55–64	2.29	(1.31–4.00)	2.00	(1.45–2.77)	1.67	(1.17–2.39)	1.41	(1.01–1.97)	1.28	(0.65–2.52)	1.29	(0.87–1.89)
65–74	1.28	(0.74–2.23)	1.65	(1.24–2.19)	1.21	(0.88–1.66)	1.44	(1.08–1.90)	0.75	(0.39–1.45)	1.35	(0.97–1.88)
75 and older	ref.		ref.		ref.		ref.		ref.		ref.	
Sex												
Female	0.71	(0.43–1.19)	1.15	(0.89–1.49)	0.92	(0.69–1.24)	0.79	(0.60–1.03)	1.06	(0.57–1.95)	1.11	(0.82–1.51)
Male	ref.		ref.		ref.		ref.		ref.		ref.	
Education												
Primary	ref.		ref.		ref.		ref.		ref.		ref.	
Secondary	1.87	(1.10–3.20)	1.94	(1.49–2.52)	1.47	(1.10–1.96)	1.88	(1.45–2.44)	2.07	(1.05–4.10)	1.35	(0.99–1.83)
Tertiary	4.15	(2.29–7.51)	2.33	(1.63–3.34)	2.49	(1.71–3.63)	1.85	(1.27–2.69)	5.95	(2.77–12.81)	1.28	(0.84–1.94)

CI: confidence interval; OR: odds ratio.
Data from the Monitoring and Dynamics of Health Status through the Risk Factors for Cardiovascular Disease (MDYNRFC) survey, 2013/2014.
[a]Adjusted by smoking status; [b]adjusted by diabetes status.

Table 5. Logistic regression models for predicting knowledge of cardiovascular (CV) risk factors: socioeconomic predictors of patient knowledge of CV risk factors in 2008 and 2014 (continued).

	Probability of citing hypertension as a risk factor[a]				Probability of citing cholesterol as a risk factor[b]				Probability of citing obesity as a risk factor[c]			
	2008/2009		2013/2014		2008/2009		2013/2014		2008/2009		2013/2014	
	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%
Age, years												
54 and younger	1.22	(0.52–2.89)	1.97	(1.27–3.04)	1.36	(0.85–2.17)	2.92	(1.89–4.50)	1.68	(0.89–3.16)	1.45	(0.96–2.19)
55–64	1.99	(1.08–3.65)	1.86	(1.30–2.66)	1.66	(1.15–2.39)	1.88	(1.32–2.69)	1.90	(1.14–3.19)	1.38	(0.98–1.93)
65–74	0.99	(0.54–1.81)	1.60	(1.17–2.19)	0.92	(0.65–1.31)	1.79	(1.30–2.47)	0.93	(0.55–1.57)	1.36	(1.01–1.83)
75 and older	ref.		ref.		ref.		ref.		ref.		ref.	
Sex												
Female	1.26	(0.74–2.14)	1.09	(0.82–1.45)	0.94	(0.68–1.28)	1.30	(0.98–1.72)	0.97	(0.61–1.54)	1.07	(0.81–1.40)
Male	ref.		ref.		ref.		ref.		ref.		ref.	
Education												
Primary	ref.		ref.		ref.		ref.		ref.		ref.	
Secondary	2.36	(1.27–4.36)	1.59	(1.19–2.12)	1.40	(1.01–1.92)	1.45	(1.09–1.94)	2.72	(1.61–4.60)	2.00	(1.53–2.63)
Tertiary	5.66	(2.76–11.62)	1.88	(1.28–2.78)	2.40	(1.60–3.62)	2.07	(1.40–3.06)	5.54	(3.01–10.20)	1.71	(1.17–2.51)

CI: confidence interval; OR: odds ratio.

Data from the Monitoring and Dynamics of Health Status through the Risk Factors for Cardiovascular Disease (MDYNRFC) survey, 2013/2014.

[a]Adjusted by hypertension status; [b]Adjusted by cholesterol status; [c]adjusted by obesity status.

generally have better perception of severity, benefits and self-efficacy.[28]

The inverse relationship between the prevalence of risk factors and educational level often implies a positive relationship between the awareness of risk factors and educational level.[16] As a consequence, the knowledge and awareness of modifiable CV risk factors may be associated with healthier behaviours regarding those risk factors.[28] However, Alzaman et al.[28] found that 'the relation between awareness of the influence of a specific factor on CVD and healthy behaviour regarding that risk factor effect were modest, with a <10% difference between those who were aware vs. those who were unaware' (609). Knowledge of CV risk factors exists within a system of beliefs (incorporating psychosocial and biomedical issues), not in isolation.[21,29] Furthermore, few reports have suggested that educational attainment is an indirect cause of coronary heart disease.[20] Conversely, one study showed that education level is not predictive of knowledge of CVD.[2]

Implications of results from a secondary prevention perspective

In the context of secondary prevention, it should be expected that differences in the knowledge and awareness of CV risk factors would be reduced or disappear completely over time. Indeed, any patient, regardless of socioeconomic status, can become aware of the different risks and ways to combat them because care after a cardiac event aims to restore quality of life and maintain or improve functional capacity.[30,31] Most CVD patients benefit from a cardiac rehabilitation programme in the secondary prevention framework after a cardiac event.

The results of the present study demonstrated both improved knowledge and a reduction in differences associated with knowledge among patients five years after coronary angiography. These changes probably represent the consequences of various interventions during the five-year follow-up period. However, our findings also demonstrated poor knowledge of CV risk factors that persisted among patients despite the fact that the risk factors were prevalent in the patient group. This information should raise concerns, and needs to be addressed in order to improve outcomes in patients with CVD.[16]

The results of this study highlighted the fact that improvements in patient knowledge of CV risk factors occur slowly. Knowledge and/or awareness of CV risk factors is often not sufficient to bring about change. For example, the transtheoretical model is a heuristic model that describes the sequence of steps in successful behavioural change: (a) precontemplation (no recognition of need for or interest in change); (b) contemplation (thinking about changing); (c) preparation (planning for change); (d) action (adopting new habits); and (e) maintenance (ongoing practice of new, healthier behaviour).[7,32]

The presence of a high global CV risk in patients with lower levels of education might be attributed to poor communication between doctor and patient and/or an insufficient understanding by the patient of the importance of the proper management of CV risk factors.[33,34] This is another reason why the results of this study may prove important in the development of effective educational and secondary prevention strategies. In the future, it will be important to collect long-term data on the knowledge and awareness of risk factors within different social groups after coronary angiography. This will allow prevention programmes to be specifically targeted to help poorly educated or lower socioeconomic patients.[26]

Limitations and strengths

The results of this study are not representative of all patients with CVD in Luxembourg.[16,35] However, the INCCI is a reference national service for coronary angiography in Luxembourg. As our study was based on a relatively long-term follow-up (five years), a substantial number of patients died or did not live at their reported address at the end of this period. This could have affected the composition of our cohort, leading to bias. To avoid such bias, we concentrated our analysis on patients who were present in 2008/2009 and 2013/2014. The INCCI database is unique, combining information regarding diagnosis, CV risk factors, quality of life, lifestyle changes and health status. Much of the data are self-reported or measured by physicians or medical specialists (specifically in 2008/2009). In a past study,[16] we observed that patient knowledge of CV risk factors was very poor in all socioeconomic groups, and was particularly modified by education level. Education level was used as a proxy for socioeconomic status based on previous reports.[35,36] However, as mentioned previously, knowledge alone is only a pre-requisite for behavioural changes.[2,24] Consequently, future research should examine the relationship between knowledge, risk perception, self-efficacy and behaviour change.[2] The use of a non-validated questionnaire to assess knowledge was also a limitation, and future studies may benefit from the development of a validated questionnaire.[27]

Implications for practice

- Many patients were unable to recall cardiovascular (CV) risk factors
- Knowledge improved in all social groups
- Knowledge was lower in patients with a lower education
- Counselling and preventive interventions are needed

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Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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