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The association between self-reported lifestyle changes and health-related quality of life in coronary patients: the EUROASPIRE III survey

Delphine De Smedt[1], Els Clays[1], Lieven Annemans[1,2], Hedwig Boudrez[1], Johan De Sutter[1,3], Frank Doyle[4], Catriona Jennings[5], Kornelia Kotseva[5], Andrzej Pająk[6], Sofie Pardaens[1], Christof Prugger[7], David Wood[5] and Dirk De Bacquer[1]

Abstract

Background: Patients with coronary heart disease often suffer from an impaired health-related quality of life (HRQoL). A healthier lifestyle not only extends individuals' lengths of life but might also improve their HRQoL. The aim of this study was to explore the relation between self-reported lifestyle changes and HRQoL in European coronary patients.

Methods: Data on 8745 coronary patients, from 22 countries, participating in the EUROASPIRE III survey (2006–2007) were used. These patients hospitalized for coronary artery bypass graft, percutaneous coronary intervention, acute myocardial infarction, or myocardial ischaemia were interviewed and examined at least 6 months and no later than 3 years after their hospital admission to gather information on their HRQoL, self-reported lifestyle changes, and risk factors.

Results: Significantly better HRQoL scores were found in ex-smokers compared to current smokers. Patients who made an attempt to increase their physical activity level had a better HRQoL compared to those who had not made an attempt. Furthermore dietary changes were associated with HRQoL, with better outcomes in patients who tried to reduce fat and salt intake and increase fish, fruit, and vegetable intake. The intention to change behaviour was not associated with HRQoL.

Conclusions: Better HRQoL scores were found in those coronary patients who adopted a healthier lifestyle. The actual lifestyle changes – smoking cessation, increasing physical activity, and adopting a healthy diet – and not the intention to change are associated with better HRQoL outcomes.

Keywords

Coronary heart disease, diet, health-related quality of life, lifestyle changes, physical activity, smoking

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Introduction

Even though cardiovascular disease (CVD) mortality rates have fallen rapidly in many European countries in the latest decades, CVD continues to be the number one cause of morbidity and mortality.[1,2] Many risk factors contribute to the development of CVD. In addition to unchangeable risk factors such as age, family history, gender, and geographical area, the progress of CVD is driven by several modifiable risk factors.[3] Unhealthy lifestyle habits such as smoking, physical inactivity,

[1]Ghent University, Gent, Belgium
[2]Vrije Universiteit Brussel, Brussel, Belgium
[3]AZ Maria Middelares Hospital Gent, Gent, Belgium
[4]Royal College of Surgeons in Ireland, Dublin, Ireland
[5]Imperial College London, London, UK
[6]Jagiellonian University Medical College, Krakow, Poland
[7]University of Münster, Münster, Germany

Corresponding author:
Delphine De Smedt, Ghent University, De Pintelaan 185 BlokA-2, Gent, 9000, Belgium.
Email: Delphine.desmedt@ugent.be

and unhealthy eating habits have a major influence on the development of CVD; hence, guidelines on CVD prevention have stressed the importance of adopting a healthy lifestyle both in high-risk patients as well as in CVD patients.[2,4–7]

According to several studies in the general population, the uptake of a healthier lifestyle – such as ceasing smoking, becoming physically active, and developing healthy eating habits – will not only extend the length of life but also improve the health-related quality of life (HRQoL).[8–10] HRQoL is a comprehensive concept referring to the individual's physical, emotional, and social wellbeing.[11] Coronary patients often suffer from an impaired HRQoL; hence, many of them consider HRQoL equally important as the length of life. Patients and their caregivers as well as policy makers have a particular interest in finding ways to improve patients' overall wellbeing.[11] However, evidence regarding the direct association between lifestyle changes and HRQoL in coronary patients is scarce. Some studies report on the association between HRQoL and smoking cessation, weight loss, or physical activity; however, to our knowledge, no study has investigated the association of lifestyle changes in coronary patients with various HRQoL measures in a systematic manner.[12–17]

The aim of our study was to explore the relation between several self-reported lifestyle changes and HRQoL in coronary patients using data from a large European cohort. Knowledge about this association may lead to an increased motivation in patients to change their behaviour. Moreover, the outcomes of this study can be important for decision makers in defining priorities related to their prevention policy. We hypothesized that coronary patients who have not made an attempt to change their behaviour in order to adopt a healthier lifestyle would have a poorer HRQoL.

Methods

Study population and data collection

This study is based on data collected during the EUROASPIRE III survey (European Action on Secondary and Primary Prevention through Intervention to Reduce Events). Details of the study have been described extensively elsewhere.[18] Briefly, the EUROASPIRE III survey, conducted during 2006–07 under the auspices of the European Society of Cardiology Euro Heart Survey Programme, was a cross-sectional study to determine whether the European recommendations on CVD prevention were being followed in everyday clinical practice across 22 European countries (76 hospital centres): Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Romania, Russian Federation, Slovenia, Spain, The Netherlands, Turkey, and the UK. Patients aged between 18 and 80 years, hospitalized for coronary artery bypass graft, percutaneous coronary intervention, acute myocardial infarction, or myocardial ischaemia but without evidence of myocardial infarction – hereafter referred to as the recruiting diagnosis – were retrospectively identified from diagnostic registers, hospital discharge lists or other sources. In total, 8966 patients (participation rate 73%) were interviewed and examined at least 6 months and no later than 3 years after their initial hospital admission. The present study included only those patients for which HRQoL information was available ($n = 8745$).

Data collection was conducted by trained research staff using standardized methods and instruments. Patient medical records from the initial hospital admission were reviewed, to collect – among others – information on their initial diagnosis, waist circumference, body weight, and height. At the time of interview and examination (on average 1.24 years after the recruiting diagnosis), physical measurements were performed in light indoor clothes without shoes using calibrated measuring equipment. In addition, information was obtained on risk factors and adopted lifestyle changes.

During the interview, data were gathered on smoking history and smoking cessation attempts undertaken since the initial hospital admission. Likewise, information on dietary steps (reducing salt intake, reducing fat intake, increasing fish intake, increasing fruit and vegetable intake) taken since the initial hospital admission to eat healthier and to reduce their body weight were collected. Additionally, several questions were asked regarding patients' physical activity level and the attempts undertaken to increase their physical activity level. Patient were asked to describe their self-perceived physical activity level on the following scale: no physical activity; light physical activity; vigorous physical activity for 20 minutes, 2 or 3 times a week; or vigorous physical activity for 20 minutes $\geq$3 times a week. Furthermore, they completed the short form International Physical Activity Questionnaire (IPAQ) allowing the categorization of patients according to their physical activity score. In addition, information about their future intention to change was gathered. The questions as asked during the interview can be found in Appendix 1 (available online).

Body mass index (BMI) was calculated as the patient's weight in kilograms divided by the squared height in metres. The WHO classes were used for classification: normal range was defined as BMI $<24.9\,kg/m^2$; overweight was defined as BMI 25–$29.9\,kg/m^2$, and obesity as BMI $\geq 30\,kg/m^2$.[19] Central

obesity was defined as waist circumference ≥102 cm in men and ≥88 cm in women.[20] Smokers were those who reported to be a current smoker or who had a carbon monoxide in breath value exceeding 10 ppm at the time of the interview. IPAQ classes were calculated according to the guidelines for data processing and analysis.[21] A low IPAQ score was defined as no activity or some activity reported but not enough to meet the other categories. A moderate IPAQ score was defined as 3 or more days of vigorous-intensity activity of at least 20 minutes per day, or 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day, or 5 or more days of any combination of walking, moderate-intensity, or vigorous-intensity activities achieving a minimum total physical activity of at least 600 MET-minutes/week. Metabolic equivalent (MET) is a common outcome measure used to express the energetic expenditure of different physical activities.[22] A high IPAQ score was defined as vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week or 7 or more days of any combination of walking, moderate- or vigorous- intensity activities accumulating at least 3000 MET-minutes/week.

To assess patients' HRQoL, three self-administered questionnaires were given to the patients during the interview: the EuroQoL-5D (EQ-5D), the 12-item short form health survey (SF-12v2), and the Hospital Anxiety and Depression Scale (HADS). Though it should be noted that the latter does not fully meet the HRQoL definition, since the measure merely covers psychological issues. Questionnaires were administered in the countries' official language. Validity of these scales in this sample has been reported previously.[23]

The EQ-5D contains a self-classifier using five dimensions, with three response categories each, to assess patients' health status: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression; from which an EQ-$5D_{index}$ score can be calculated (with 1 representing perfect health, 0 representing death, and <0 representing a health state perceived worse than death). In addition, patients were asked to indicate their current health status on a visual analogue scale (EQ-VAS) ranging from 0 (worst imaginable) to 100 (best imaginable).[24] The current analysis only makes use of the VAS, as the normality assumptions for the EQ-$5D_{index}$ were not met.

The SF-12v2 is a shortened version of the SF-36 consisting of 12 Likert scale questions, covering eight dimensions: general health, physical functioning, role-physical, bodily pain, vitality, social functioning, role-emotional, and mental health. Both physical (PCS-12) and mental functioning (MCS-12) component scores, ranging between 0 and 100, were calculated using a common scoring algorithm, with lower scores representing worse and higher scores representing better health.[25] The SF-12v2 was not administered in Hungary.

The HADS contains seven items related to anxiety and seven to depression, each with a 4-point response scale. Item scores can be added to obtain the summary scores on anxiety (HADS-A) and depression (HADS-D) separately. The total score on each subscale ranges between 0 and 21 with higher scores representing worse outcomes.[26]

Statistical analysis

All analyses are based on generalized linear mixed models in order to account for the clustering of patients within countries. HRQoL differences between groups were tested using multiple linear regression models. Potential confounding caused by differences in age, gender, diagnostic category, education, cardiovascular history, and diabetes was adjusted for all models. Results are shown for men and women together, since the interaction term with the different items was non-significant. Significance levels were set at $p < 0.05$. All statistical analyses were performed using the IBM SPSS statistical software (version 20.0).

Results

The main characteristics of the patients included are shown in Table 1. Data on 6523 men (74.6%) and 2222 women (25.4%) were available for analysis. Patients' age (mean ± SD) was 63.2 ± 9.5 years. At the time of the recruiting diagnosis, patients' BMI was 28.3 ± 4.4 kg/m^2, 30.5% of patients were obese, 44.9% were central obese, and 30.2% reported smoking. At the time of the interview, patients' BMI was 28.9 ± 4.5 kg/m^2, 35.4% were obese, 16.9% were still smoking, and 11.7% reported no physical activity.

In those patients being overweight or obese at the time of the recruiting diagnosis, 77.0 % reported ever being offered weight advice by a doctor or health professional, 68.2% of all patients reported having ever received personal advice on increasing physical activity, 92.0% had been ever advised on a healthy diet, and 87.7% of patients smoking at the time of the recruiting diagnosis had been ever offered smoking advice.

Since the recruiting diagnosis, 81.8% of smokers made an attempt to quit smoking in order to reduce their risk of recurrent coronary heart disease, 90.2% of patients tried to eat healthier by reducing salt, sugar, or fat intake and increasing fish, fruit, and vegetable intake, and 58.6% of patients took steps to increase their physical activity level.

Table 1. Patient characteristics

	Men ($n = 6523$)	Women ($n = 2222$)	All ($n = 8745$)
Age (years)	62.3 ± 9.5	65.9 ± 8.9	63.2 ± 9.5
Recruiting diagnosis			
CABG	20.6 (1343/6523)	17.1 (380/2222)	19.7 (1723/8745)
PCI	43.1 (2809/6523)	35.3 (784/2222)	41.1 (3593/8745)
AMI	19.1 (1248/6523)	20.7 (460/2222)	19.5 (1708/8745)
Ischaemia	17.2 (1123/6523)	26.9 (598/2222)	19.7 (1721/8745)
Education			
Primary education	22.5 (1459/6487)	33.5 (740/2211)	25.3 (2199/8698)
Secondary education	57.3 (3717/6487)	54.8 (1212/2211)	56.7 (4929/8698)
High education	20.2 (1311/6487)	11.7 (259/2211)	18.1 (1570/8698)
Diabetes	22.6 (1461/6461)	29.9 (659/2207)	24.5 (2120/8668)
History of stroke	4.1 (268/6507)	5.7 (127/2216)	4.5 (395/8723)
Recurrent CHD after recruiting diagnosis	14.1 (912/6490)	11.4 (251/2208)	13.4 (1163/8698)
At time of recruiting diagnosis			
BMI (kg/m^2)	28.2 ± 4.2	28.9 ± 4.8	28.3 ± 4.4
Obesity	28.5 (789/2764)	36.1 (352/974)	30.5 (1141/3738)
Central obesity	38.6 (468/1211)	61.3 (284/463)	44.9 (752/1674)
Smoking	33.8 (2201/6508)	19.6 (434/2215)	30.2 (2635/8723)
At time of interview			
BMI (kg/m^2)	28.6 ± 4.2	29.7 ± 5.2	28.9 ± 4.5
Obesity	32.2 (2093/6500)	44.8 (990/2210)	35.4 (3083/8710)
Central obesity	41.6 (2681/6440)	70.4 (1546/2196)	48.9 (4227/8636)
Smoking	19.0 (1236/6507)	10.9 (242/2218)	16.9 (1478/8725)
Self-reported PA			
No PA weekly	10.8 (696/6428)	14.4 (316/2193)	11.7 (1012/8621)
Light PA in most weeks	56.3 (3618/6428)	63.0 (1381/2193)	58.0 (4999/8621)
Vigorous PA, ≥20 min, once or twice/week	17.5 (1122/6428)	13.3 (291/2193)	16.4 (1413/8621)
Vigorous PA, ≥20 min, ≥3 times a week	15.4 (992/6428)	9.3 (205/2193)	13.9 (1197/8621)
IPAQ moderate/high			
Low	22.3 (774/3476)	31.9 (360/1129)	24.6 (1134/4605)
Moderate	38.8 (1350/3476)	39.1 (442/1129)	38.9 (1792/4605)
High	38.9 (1352/3476)	29.0 (327/1129)	36.5 (1679/4605)
Lifestyle advice			
Smoking cessation (in prior smokers)	88.3 (1935/2191)	84.5 (364/431)	87.7 (2299/2622)
Diet	92.4 (5989/6479)	90.9 (2011/2213)	92.0 (8000/8692)
Weight (if prior BMI >25 kg/m^2)	75.7 (1607/2122)	80.5 (616/765)	77.0 (2223/2887)
Physical activity	69.2 (4467/6457)	65.3 (1439/2204)	68.2 (5906/8661)
Lifestyle changes to reduce risk of heart disease (%)			
Trying to stop smoking (in prior smokers)	81.2 (1713/2110)	84.9 (348/410)	81.8 (2061/2520)
Trying to eat healthier	89.7 (5645/6291)	91.6 (1963/2143)	90.2 (7608/8434)
Trying to increase physical activity	59.9 (3792/6327)	54.9 (1175/2142)	58.6 (4967/8469)
HRQoL at interview			
HADS-A	5.48 ± 3.80	7.24 ± 4.16	5.93 ± 3.97
HADS-D	4.75 ± 3.54	6.01 ± 3.86	5.07 ± 3.67
EQ-5D$_{index}$	0.78 ± 0.23	0.69 ± 0.25	0.76 ± 0.24
EQ-VAS	67.85 ± 18.59	62.22 ± 18.94	66.42 ± 18.84
PCS-12	43.20 ± 10.02	38.82 ± 9.84	42.14 ± 10.15
MCS-12	49.93 ± 9.96	46.75 ± 10.64	49.15 ± 10.22

Values are mean ± SD or % (*n*/total). AMI, acute myocardial infarction; BMI, body mass index; CABG, coronary artery bypass graft; CHD, coronary heart disease; EQ-5D$_{index}$, EuroQoL overall score; EQ-VAS, EuroQoL visual analogue scale; HADS, Hospital Anxiety and Depression Scale; HADS-A, HADS-D, HADS anxiety; HADS depression, IPAQ, International Physical Activity Questionnaire; MCS-12, SF-12 mental functioning; PA, physical activity; PCI, percutaneous coronary intervention; PCS-12, SF-12 physical functioning; SF-12, the 12-item short form health survey.

Smoking

HRQoL scores were significantly worse in smokers compared to non-smokers, with ex-smokers (both patients who stopped smoking before or after the recruiting diagnosis) having HRQoL values leaning towards the scores of never smokers (Table 2). Patients who had made an attempt to quit smoking since the recruiting diagnosis, had a better HRQoL score (HADS-D, EQ-VAS, PCS-12) compared to those who did not undertake an attempt to quit. However, as can bee seen from Table 2 the smoking status at the time of interview was responsible for these HRQoL differences. Indeed, whether or not a cessation attempt was made had no impact on the HRQoL outcomes in those still smoking at the time of the interview. A closer look into the quitters' HRQoL indicated that the time since smoking cessation (<6 months vs. >6 months) did not have an influence on their self-perceived mental, physical, and overall wellbeing. Patients still smoking at the interview,who had the intention to quit smoking in the following 6 months did not differ in HRQoL scores from those who did not consider smoking cessation.

Physical activity

A better HRQoL was reported in patients who had made an attempt to increase their physical activity compared to those who had not made such an

Table 2. Association between health-related quality of life and smoking cessation

	HADS-A	HADS-D	EQ-VAS	PCS-12	MCS-12
Complete sample					
Smoking history[a]					
Ever smoker ($n=3058$)	6.72 ± 0.22	5.68 ± 0.22	62.62 ± 1.36	38.52 ± 0.78	47.99 ± 0.67
Prior smoker ($n=1279$)	6.73 ± 0.24	5.78 ± 0.24	62.26 ± 1.41	38.77 ± 0.81	48.05 ± 0.71
Smoker ($n=1478$)	7.21 ± 0.24	6.48 ± 0.24	60.73 ± 1.41	37.81 ± 0.80	46.32 ± 0.71
Never smoker ($n=2896$)	6.70 ± 0.22	5.85 ± 0.22	63.68 ± 1.35	39.58 ± 0.77	47.37 ± 0.67
p-values	<0.000	<0.001	<0.000	<0.001	<0.001
Smoking at time of recruiting diagnosis					
Smoking cessation attempt					
Yes ($n=2061$)	7.01 ± 0.34	6.12 ± 0.31	62.11 ± 1.64	39.89 ± 0.96	46.84 ± 0.93
No ($n=459$)	7.30 ± 0.38	6.54 ± 0.34	59.77 ± 1.83	38.41 ± 1.05	45.75 ± 1.03
p-values	0.160	0.030	0.018	0.004	0.054
Smoking status at interview					
Still smoking – no cessation attempt ($n=376$)	7.32 ± 0.38	6.65 ± 0.35	60.61 ± 1.85	38.59 ± 1.07	45.38 ± 1.05
Still smoking – cessation attempt ($n=915$)	7.38 ± 0.34	6.54 ± 0.31	60.91 ± 1.68	39.22 ± 0.99	45.69 ± 0.95
Prior smoker ($n=1279$)[a]	6.83 ± 0.34	5.83 ± 0.31	62.22 ± 1.65	40.05 ± 0.97	47.38 ± 0.93
p-values	0.004	<0.001	0.177	0.021	<0.001
Prior smokers[a]					
Quit time					
<6 months before interview ($n=173$)	6.75 ± 0.50	6.01 ± 0.45	62.39 ± 2.49	39.60 ± 1.34	49.22 ± 1.31
>6 months before interview ($n=1077$)	7.02 ± 0.42	6.15 ± 0.38	62.26 ± 2.14	40.48 ± 1.17	48.21 ± 1.11
p-values	0.392	0.620	0.930	0.264	0.223
Smoking at the time of interview					
Intention to quit smoking					
Yes ($n=652$)	7.70 ± 0.50	6.37 ± 0.43	59.04 ± 2.20	37.48 ± 1.30	45.22 ± 1.36
No ($n=354$)	7.18 ± 0.53	6.25 ± 0.46	61.08 ± 2.34	38.67 ± 1.38	46.38 ± 1.45
p-values	0.064	0.629	0.120	0.073	0.126

Values are mean ± SE adjusted for age, gender, diagnostic category, education, diabetes, recurrent coronary heart disease, and history of stroke.; [a]Ever smoker, patients who have ever smoked but who where former smokers at the time of the recruiting diagnosis; prior smoker, patients who where smoking at the time of the recruiting diagnosis, but were former smokers at the time of the interview; smoker, patients still smoking at the time of interview; never smokers, patients who have never smoked.; EQ-$5D_{index}$, EuroQoL overall score; ED-VAS, EuroQoL visual analogue scale; HADS, Hospital Anxiety and Depression Scale; HADS-A, HADS anxiety; HADS-D, HADS depression; MCS-12, SF-12 mental functioning; PCS-12, SF-12 physical functioning; SF-12, the 12-item short form health survey.

Table 3. Association between health-related quality of life and physical activity changes

	HADS-A	HADS-D	EQ-VAS	PCS-12	MCS-12
Complete sample					
Attempt to increase physical activity					
Yes ($n=4967$)	6.57 ± 0.22	5.56 ± 0.22	64.17 ± 1.33	39.90 ± 0.75	48.02 ± 0.66
No ($n=3502$)	7.14 ± 0.22	6.31 ± 0.22	60.69 ± 1.34	37.50 ± 0.75	46.82 ± 0.67
p-values	<0.001	<0.001	<0.001	<0.001	<0.001
Physical activity level based on single question[a]					
No physical activity ($n=1012$)	7.62 ± 0.24	7.22 ± 0.24	55.53 ± 1.43	34.01 ± 0.84	44.93 ± 0.70
Light physical activity in most weeks ($n=4999$)	6.83 ± 0.22	5.90 ± 0.22	62.53 ± 1.34	38.81 ± 0.80	47.57 ± 0.64
Vigorous PA ≥20 min, ≤2/week ($n=1413$)	6.20 ± 0.24	5.14 ± 0.24	67.21 ± 1.41	41.75 ± 0.83	48.71 ± 0.69
Vigorous PA ≥20 min, ≥3/week ($n=1197$)	6.02 ± 0.24	4.90 ± 0.24	68.36 ± 1.43	42.44 ± 0.83	49.33 ± 0.70
p-values	<0.001	<0.001	<0.001	<0.001	<0.001
IPAQ					
Low ($n=1134$)	7.21 ± 0.29	6.67 ± 0.29	57.21 ± 2.09	35.99 ± 1.02	46.20 ± 0.86
Moderate ($n=1792$)	6.24 ± 0.29	5.48 ± 0.29	63.65 ± 2.08	39.64 ± 1.02	49.31 ± 0.85
High ($n=1679$)	6.01 ± 0.30	5.09 ± 0.30	67.94 ± 2.10	41.03 ± 1.03	50.90 ± 0.87
p-values	<0.001	<0.001	<0.001	<0.001	<0.001
Change in physical activity according to IPAQ classes					
Change in PA + low IPAQ ($n=515$)	7.02 ± 0.32	6.49 ± 0.31	58.55 ± 2.10	37.57 ± 1.03	46.56 ± 0.90
No change in PA + low IPAQ ($n=591$)	7.51 ± 0.32	6.95 ± 0.31	54.93 ± 2.09	33.90 ± 1.03	45.71 ± 0.90
Change in PA + moderate/high IPAQ ($n=2093$)	5.90 ± 0.30	5.09 ± 0.29	66.74 ± 2.01	40.83 ± 0.99	50.23 ± 0.84
No change in PA + moderate/high IPAQ ($n=1264$)	6.59 ± 0.30	5.66 ± 0.30	62.74 ± 2.04	38.82 ± 1.00	49.39 ± 0.86
p-values	<0.001	<0.001	<0.001	<0.001	<0.001
Physically inactive patients[b]					
Intention to become PA (if normal weight)					
Yes ($n=200$)	7.32 ± 0.49	5.80 ± 0.44	63.63 ± 2.43	41.12 ± 1.22	47.04 ± 1.25
No ($n=736$)	7.05 ± 0.42	6.30 ± 0.38	62.36 ± 2.14	37.87 ± 1.07	46.85 ± 1.07
p-values	0.399	0.096	0.409	<0.001	0.834
Intention to become PA (if overweight or obese)					
Yes ($n=1098$)	6.69 ± 0.29	6.00 ± 0.26	63.69 ± 1.47	39.10 ± 0.82	47.63 ± 0.79
No ($n=3315$)	7.01 ± 0.27	6.28 ± 0.25	60.29 ± 1.40	37.65 ± 0.79	46.64 ± 0.74
p-values	0.025	0.035	<0.001	<0.001	0.009

Values are mean ± SE adjusted for age, gender, educational level, recruiting diagnosis, diabetes, history of stroke, and coronary recurring events.; [a]Which of the following four best describes your level of activity outside work?; [b]Physically inactive <3–5 times/week, 20–60 min/session.; EQ-$5D_{index}$, EuroQoL overall score; ED-VAS, EuroQoL visual analogue scale; HADS, Hospital Anxiety and Depression Scale; HADS-A, HADS anxiety; HADS-D, HADS depression; IPAQ, International Physical Activity Questionnaire; MCS-12, SF-12 mental functioning; PCS-12, SF-12 physical functioning; SF-12, the 12-item short form health survey.

attempt (Table 3). The actual physical activity level reported during the interview was significantly associated with HRQoL. A positive relation between HRQoL outcomes and the amount of exercise was seen both with the results of the validated IPAQ instrument as well as with the results of a single question, asking about the patients' self-perceived physical activity level. A combined parameter including IPAQ class and increasing physical activity revealed significant differences across groups, with the lowest HRQoL reported in patients in the lowest IPAQ class who have not made any attempt to become physically active, whereas those having a moderate or high IPAQ level who declared to have made an attempt to increase their physical activity reported the highest HRQoL. At interview, in patients with a normal weight not yet exercising regularly, no significant difference was found in HRQoL (except for PCS-12) between those willing to become physically active, versus those not willing to become physically active. In contrast, patients being overweight or obese at interview with the intention to exercise regularly in the near future reported a higher HRQoL compared to those with no intention to become regularly physically active.

Table 4. Association between health-related quality of life and dietary changes

	HADS-A	HADS-D	EQ-VAS	PCS-12	MCS-12
Complete sample					
Body mass index at interview					
Normal ($n = 1572$)	6.84 ± 0.23	5.92 ± 0.23	62.89 ± 1.38	39.45 ± 0.78	47.13 ± 0.69
Overweight ($n = 4055$)	6.68 ± 0.22	5.72 ± 0.22	63.53 ± 1.34	39.59 ± 0.76	47.80 ± 0.66
Obese ($n = 3083$)	6.90 ± 0.22	6.04 ± 0.22	61.89 ± 1.34	37.92 ± 0.76	47.39 ± 0.66
p-values	0.052	0.001	0.001	<0.001	0.056
Weight changes between recruiting diagnosis and interview					
≥5% weight loss ($n = 763$)	6.78 ± 0.26	6.01 ± 0.25	62.87 ± 1.55	39.08 ± 0.84	46.91 ± 0.76
±5% weight change ($n = 4066$)	6.66 ± 0.23	5.77 ± 0.23	63.23 ± 1.45	39.46 ± 0.79	47.61 ± 0.69
≥5% weight gain ($n = 1496$)	6.71 ± 0.25	5.95 ± 0.24	61.93 ± 1.50	38.56 ± 0.82	47.67 ± 0.73
p-values	0.746	0.115	0.070	0.012	0.209
Attempt to eat healthier					
Change in fat intake					
Yes ($n = 7376$)	6.77 ± 0.22	5.83 ± 0.22	62.94 ± 1.33	38.99 ± 0.76	47.57 ± 0.65
No ($n = 1285$)	6.99 ± 0.24	6.24 ± 0.24	61.04 ± 1.42	37.95 ± 0.80	47.02 ± 0.70
p-values	0.070	<0.001	0.001	0.001	0.083
Reduction in salt intake					
Yes ($n = 6150$)	6.77 ± 0.22	5.79 ± 0.22	63.19 ± 1.35	39.08 ± 0.76	47.58 ± 0.65
No ($n = 2417$)	6.93 ± 0.23	6.08 ± 0.23	61.74 ± 1.39	38.44 ± 0.78	47.25 ± 0.68
p-values	0.108	0.001	0.002	0.010	0.202
Increase in fish intake					
Yes ($n = 5818$)	6.67 ± 0.22	5.73 ± 0.22	63.73 ± 1.35	39.12 ± 0.76	47.71 ± 0.65
No ($n = 2815$)	7.08 ± 0.22	6.21 ± 0.23	60.90 ± 1.37	38.33 ± 0.77	47.09 ± 0.67
p-values	<0.001	<0.001	<0.001	0.001	0.012
Increase in fruit and vegetable intake					
Yes ($n = 6765$)	6.73 ± 0.22	5.78 ± 0.22	63.18 ± 1.34	39.10 ± 0.76	47.55 ± 0.65
No ($n = 1886$)	6.95 ± 0.23	6.19 ± 0.23	61.24 ± 1.39	38.32 ± 0.79	47.36 ± 0.68
p-values	0.034	<0.001	<0.001	0.003	0.492
Overweight and obese patients					
Intention to lose weight					
Yes ($n = 3226$)	6.90 ± 0.23	5.92 ± 0.22	62.21 ± 1.33	38.35 ± 0.79	47.66 ± 0.68
No ($n = 3524$)	6.78 ± 0.23	5.91 ± 0.22	62.31 ± 1.33	39.16 ± 0.79	47.39 ± 0.68
p-values	0.233	0.915	0.835	0.001	0.313

Values are mean ± SE adjusted for age, gender, educational level, recruiting diagnosis, diabetes, history of stroke, and coronary recurring events.; EQ-$5D_{index}$, EuroQoL overall score; ED-VAS, EuroQoL visual analogue scale; HADS, Hospital Anxiety and Depression Scale; HADS-A, HADS anxiety; HADS-D, HADS depression; MCS-12, SF-12 mental functioning; PCS-12, SF-12 physical functioning; SF-12, the 12-item short form health survey.

Body weight and healthy diet

BMI was significantly associated with HRQoL, with obese patients having inferior HRQoL outcomes (Table 4). At interview, among patients who were still overweight or obese, those with the intention to lose weight in the upcoming months did not differ significantly in HRQoL (except for PCS-12) from those who did not have any intention to lose weight. With regard to actual weight change, no significant difference was found in HRQoL outcomes (except for PCS-12) between those who had lost weight (≥5% weight loss), maintained their weight level (±5% weight change), or gained weight (≥5% weight gain) between the recruiting diagnosis and the interview. HRQoL differed significantly between those who had taken steps to adopt a healthier diet, compared to those who did not. Patients reducing fat intake, reducing salt intake, increasing fish intake, or increasing fruit and vegetable intake had higher HRQoL values; however, the effects on the psychological dimensions was sometimes non-significant (MCS-12, HADS-A).

Discussion

The aim of the current study was to investigate the relationship between self-reported lifestyle changes and HRQoL in coronary patients, using a large cohort originating from 22 European countries. Higher HRQoL scores were found in coronary patients who adopted a healthier lifestyle – by ceasing smoking, developing healthier eating habits, or increasing their physical activity – even after adjustment for other patient characteristics.

Furthermore, no significant differences were found in HRQoL outcomes between patients considering smoking cessation versus those not intending to quit. It is thus unlikely that those willing to quit smoking had a higher initial HRQoL allowing them to find the motivation to quit. Nonetheless, it remains possible that ex-smokers differ from current smokers in several unmeasured characteristics, so these results should be interpreted with caution. In patients with a normal body weight, no differences were found between those intending to become more regularly physically active versus those without this intention. Likewise, overweight and obese patients considering weight loss did not differ in HRQoL compared with the non-intenders (except PCS-12), whereas overweight and obese patients intending to become physically active reported a higher HRQoL compared to those without this intention. Not surprisingly, the greatest HRQoL differences were found in the items capturing the current physical health status (PCS-12). After all, physical activity constitutes a component of HRQoL. Patients experiencing problems with their physical health, due to pain/discomfort for instance, may be less likely to become physically active. These findings support the hypothesis of a vicious circle, where overweight and obese people who often experience difficulties in walking or climbing stairs, for example, are less inclined to become physically active, thus leading to an increase in weight, which again leads to less exercise.[27] Therefore, implementing multimodal interventions, focussing both on exercise, diet, and weight may be necessary.

Lower HRQoL scores were found in smokers compared to non-smokers (both never smokers and former smokers). These results confirm the observations found in several studies conducted in the general population; however, for coronary patients, conflicting results have been found.[8,12,14,15,17,17] Even though patients who made an attempt to quit smoking had a higher HRQoL compared to those who did not, no significant difference could be found between attempters and non-attempters still smoking at interview, suggesting that only successful smoking cessation attempts will lead to a HRQoL increase. Furthermore, our results imply that HRQoL outcomes rapidly improve once patients stop smoking, because time since smoking cessation did not have an influence on HRQoL. Likewise, a study in the general population by Piper et al.[8] showed that HRQoL improved quickly (1 year) after smoking cessation and that this improvement was sustained for at least 3 years. Within the Nurses' Health Study, HRQoL scores improved gradually with longer time since quitting.[28]

In complete agreement with past research both in the general population as well as in coronary patients, our results have shown that, based on both subjective as well as standardized measures (IPAQ), low physical activity levels are associated with worse HRQoL scores.[16,29] Conform the observations made by Martin et al.,[30] our findings suggest that the improvements in HRQoL outcomes are associated with the amount of physical activity; however, the largest increase was seen between low and moderate IPAQ scores and a significant but lower effect was found between moderate and high IPAQ. Actions related with an increase in physical activity as well as the actual physical activity levels were associated with better HRQoL outcomes. These components seem to reinforce one another, with the highest HRQoL scores seen in patients residing in the highest IPAQ class, who had, moreover, made an attempt to increase their physical activity.

In accordance with the literature, BMI was inversely associated with HRQoL.[13,15] In contrast, regarding weight changes ($\geq$5% weight loss; $\pm$5% weight change; $\geq$5% weight gain) between recruiting diagnosis and interview, no significant between-group differences were observed. In the general population, similar results were found, allowing us to conclude that the act of exercising and healthy eating behaviour themselves, and not merely losing weight, are aligned with a better HRQoL.[30] Finally, dietary changes are associated with better HRQoL outcomes. Results from the SUN project have also found an important association between adherence to Mediterranean diet (consumption of fruit, vegetables, and fish and olive oil and reduction of meat and dairy intake) and better SF-36 scores.[10]

Little is know about the clinical relevance of these differences in HRQoL, since no general consensus is available on what is perceived as a meaningful difference. Some authors have suggested half a standard deviation as the minimal important difference (MID),[31] while others have proposed a 3–5-point change for the SF-12[32], a MID of 0.074 for EQ-5D,[33] and a MID of 1.5 for HADS.[34] When applying these rules, no clinical relevance could be found for most associations, with the exception of physical activity, with several items exceeding the MID.

The limitations of our study have to be acknowledged in order to interpret the results correctly.

A potential for recall bias exists, since most data were self-reported. Furthermore, there is potential confounding by social desirability bias. Patients may have overestimated their behavioural changes in order to present a more social acceptable image of themselves. In addition, patients included are not always representative for a country's coronary patients, since data from selected geographical areas were used. Also, the included questions did not allow assessment of the degree to which an attempt was made to alter their behaviour. In addition, a cross-sectional study design was used, making it difficult to assess directionality of the association between HRQoL and lifestyle changes. However, the lack of association between the intention to accept a healthier lifestyle and patients' HRQoL most likely indicates that the lifestyle changes induce better HRQoL outcomes and not the other way round. A longitudinal assessment as well as a more detailed questionnaire in order to gather information on the 'stage of change' is needed in order to better understand the direction of the relationship between lifestyle changes and HRQoL. Furthermore, it is unclear whether these benefits in HRQoL are sustained over time or whether the gains are associated with a one-time benefit inherent to the change itself; hence, further research should focus on the long-term gains in HRQoL. The main strengths of our study are its large sample, including patients across Europe, and its ability to control for various confounders.

Notwithstanding the limitations, out results reveal HRQoL gains associated with adopting a healthier lifestyle. The actual self-reported lifestyle changes – ceasing smoking, increasing physical activity, and adopting a healthy diet – and not the intention to change are associated with better HRQoL outcomes. Research has indicated that smokers may have concerns about the effect of smoking cessation on their weight, life satisfaction, and HRQoL.[35] Likewise, inactive or obese patients do not always see which benefits could be given by their dietary and physical activity lifestyle changes. Doctors and other healthcare professionals should emphasize these improvements in patients' quality of life in order to convince more patients to change their behaviour. Furthermore, these findings can be important for decision makers when setting the priorities related to their prevention policy.

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Conflict of interest

None.

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