

Risk factor awareness in a coronary population and the association with health-related quality of life outcomes

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Abstract

Objectives The purpose of this study was to investigate the risk factor level awareness in coronary patients and to assess its associations with health-related quality of life (HRQoL)/psychological distress.

Methods Data on 8,743 coronary patients from 22 European countries, interviewed and examined at least 6 months after their acute event was available.

Results 81.7 % of patients indicated to be aware of their own blood pressure level, whereas only 46.6 % of patients indicated to be aware of their cholesterol level. Furthermore, 43.7 % of patients were aware of their blood glucose level, whereas in diabetes patients blood glucose level awareness reached 81.8 %. Risk factor level awareness was significantly associated with HRQoL/psychological distress, with patients being unaware of their risk factor levels having worse outcomes. The relationship between

awareness and HRQoL/psychological distress seemed to be partly mediated by the attempt of patients to adopt a healthier behaviour.

Conclusions Health care workers should be encouraged to inform their patients about the importance of their coronary risk factors, the actual level and their personal target.

Keywords Coronary heart disease · Awareness · Health-related quality of life

Introduction

The major causes responsible for developing coronary heart disease (CHD) in addition to increasing age and genetic predisposition are elevated cholesterol level, high blood pressure, smoking, obesity, diabetes, physical inactivity and psychosocial stress (Perk et al. 2012). Therefore, in addition to optimized medical treatment, behavioural changes towards a healthier lifestyle are recommended. Smoking cessation, a healthy diet and an increase in physical activity are known to have a positive influence on CHD risk factors and consequently help to reduce the risk for a coronary event (Perk et al. 2012). Many coronary patients, however, are unable to list the risk factors associated with CHD (Redfern et al. 2007). According to a study performed in the UK by Karthik et al. (2006) about half of coronary artery disease (CAD) patients identify smoking (53.6 %) and high cholesterol (55.3 %) as a risk factor. Blood pressure and family history were identified as a risk factor by only two in five patients (43 and 42.5 %, respectively) and no more than 14.5 and 13.6 % of patients know that diabetes and obesity are risk factors for CHD. Furthermore, they observed that only one in two patients taking CHD medication have knowledge about its role in

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their treatment (Karthik et al. 2006). Moreover, few CHD patients are aware about their own risk factor profile. In a US study, Cheng et al. (2005a, b) found that two-thirds of CAD patients were aware of their own blood pressure and only 45.3 % of patients reported to be aware of their cholesterol level. Similar results were found in the general population, with only 51 % of US citizens being aware of their own cholesterol level (Nash et al. 2003).

This lack of patient awareness could result in low adherence to lifestyle changes and prescribed medication. A better knowledge and understanding of CHD risk factors as well as patients' knowledge about their own coronary heart disease risk factors correlates with improved patient behaviour, both concerning self-reported lifestyle changes as well as medication adherence, which can lead to better cardiovascular outcomes (increase in survival, decrease in cardiac events) (Alm-Roijer et al. 2004). According to Grover et al. (2007) discussing the coronary risk profile with the patient is associated with a small but measurable improvement in the efficacy of lipid therapy. Recently, however, in addition to the more objective clinical measures, many patients consider the health-related quality of life (HRQoL) equally important. HRQoL is a multidimensional concept assessing the effect of a disease, its treatment and symptoms on patients' physical, emotional and social well-being. Prior studies have found an association between impaired HRQoL, anxiety, depression and worse long-term cardiovascular outcomes (Kurdyak et al. 2011; Spertus et al. 2002; Thombs et al. 2008).

The purpose of the current study is twofold. First, we wanted to investigate the risk factor awareness in a large European sample of coronary patients. Second, we hypothesized that risk factor awareness in CHD patients will be associated with an improved HRQoL and with less psychological distress. Furthermore, we wanted to examine whether such an association is mediated by lifestyle changes or yet another mechanism. This issue has not yet been addressed previously.

Methods

Data collection

Data were extracted from the EUROpean Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE III) study, a cross-sectional survey performed in 2006–2007 across 22 European countries: 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 United Kingdom (UK). More details on this survey can be found

elsewhere (Kotseva et al. 2009). Briefly, patients aged between 18 and 80 years, hospitalized for coronary artery bypass graft (CABG), percutaneous coronary intervention (PCI), acute myocardial infarction (AMI) or myocardial ischemia, were retrospectively identified from diagnostic registers, hospital discharge lists or other sources.

Patients were invited for interview and physical examination. Data collection was organized in a standardized way by trained research staff. In total, 8,966 patients (participation rate 73 %) were interviewed and examined at least 6 months and not later than 3 years after their initial hospital admission (median 1.24 years).

The following information was obtained: personal and demographic details, medical and in particular cardiovascular history, family history of CHD, reported lifestyle, lifestyle changes and risk factor management related to exercise, diet, smoking and medical treatment. Patients were also asked "Whose care are you currently (in the last 3 months) under for your cardiac condition". Weight, height, waist circumference, blood pressure (BP), heart rate, breath carbon monoxide, serum total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), triglycerides, low-density lipoprotein cholesterol (LDL-C), blood glucose and glycated haemoglobin (HbA1c) in patients with diabetes were measured. The risk factor targets used were based on the European guidelines on cardiovascular prevention (Perk et al. 2012). Raised BP was defined as systolic blood pressure (SBP)/diastolic blood pressure (DBP) $\geq 140/90$ mmHg ($\geq 130/80$ mmHg in patients with diabetes). Raised TC was defined as TC ≥ 4.5 mmol/L. Raised blood glucose was defined as blood glucose ≥ 6.1 mmol/L. Low physical activity was defined as < 20 min moderate physical activity, three times a week. Central obesity was defined as waist circumference $> 102/88$ cm (men/women).

In addition, patients were asked to complete three validated self-administered measures to assess their HRQoL and psychological distress: the EuroQoL-5D (EQ-5D), the 12-item short-form health survey (SF-12), and the Hospital Anxiety and Depression Scale (HADS) (De Smedt et al. 2013b). The EQ-5D is a commonly used, easy to complete, standardized instrument to measure health status, containing a descriptive part (EQ_{index}) and a visual analogue scale (EQ-VAS). The former covers five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression, with three response categories each (no problems, some problems, or severe problems). The answers on these dimensions provide a simple descriptive profile from which an index score can be calculated, with 1 representing perfect health, 0 representing death and < 0 representing a health state perceived worse than death. The EQ-VAS is a 20-cm vertical scale on which the patient is asked to indicate how good or bad their current health status is,

ranging between 0 (worst imaginable) and 100 (best imaginable) (Rabin et al. 2013). The SF-12 (second version) emerges from the SF-36, but includes only 12 Likert scale questions, covering eight dimensions: general health, physical functioning, role physical, bodily pain, vitality, social functioning, role emotional and mental health. Both a physical functioning (PCS-12) and mental functioning (MCS-12) component score, ranging between 0 and 100, can be calculated using a norm-based scoring algorithm. Lower scores represent worse and higher scores represent better self-perceived HRQoL outcomes (Ware et al. 2002). The SF-12 was not administered in Hungary. The HADS instrument finally merely covers psychological issues, and it is useful in assessing the mental health status of patients. It contains seven items related to anxiety and seven related 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 (Zigmond and Snaith 1983).

Furthermore, risk factor level awareness was assessed during interview. Patients were asked the following questions: “Are you aware of your latest blood pressure/total cholesterol/blood glucose level? YES/NO”.

Statistical analyses

Risk factor level awareness variables were investigated both as separate items and as a combination of variables. The combined variable incorporates BP, TC and blood glucose level awareness. Hence patients could be aware on 0, 1, 2 or 3 risk factor levels. The first was labelled as unaware, whereas the latter three were categorized as aware of at least one risk factor. A ‘yes’ answer without a value being specified was considered as a missing value. Descriptive analyses were performed to gain knowledge about gender and country-specific risk factor level awareness rates. Chi-square tests and the Kruskal–Wallis tests were used to assess characteristics associated with

awareness. Furthermore, a multilevel linear model, with HRQoL as continuous outcome, was used to account for the clustering of patients within countries (random effect). No interaction with gender was seen; hence instead of performing the analyses separately for males and females, gender was included as covariate in the analyses. Initial adjustment for age, gender, education and country was carried out and further adjustment for lifestyle changes was applied (fixed effect). Analyses were performed using IBM SPSS version 21. Significance levels were set at $P < 0.05$.

Results

Of the 8,966 eligible patients, 8,743 patients provided valid HRQoL/psychological distress and awareness information. Their mean age was 63.2 years (SD 9.5), 74.6 % were males, and 25.3 % had only received low education. At the time of the interview 24.5 % patients had diabetes, 35.4 % were obese and 49.0 % were central obese, 16.9 % were smoking, 69.7 % reported a low physical activity level, 51.3 % had a raised TC and 56.1 % had a raised BP, 79.7 and 70.5 % were taking lipid-lowering and antihypertensive medication, respectively.

According to the patients, risk factor measurement since index hospitalization was not always done: 96.6 % of patients had indicated that their BP was measured, 87.4 % of patients stated that their TC was measured and 80.1 and 94.4 % of the complete sample and the diabetes patients, respectively, reported that their blood glucose was measured since their index hospitalization.

Risk factor level awareness among patients was highest with regard to BP, with 81.7 % of patients indicating to be aware of their own level. With regard to cholesterol only 46.6 % of patients indicated to be aware of their own TC level. Furthermore, 43.7 % of the complete sample was aware of their blood glucose level, whereas in diabetes patients blood glucose level awareness reached 81.8 % (Table 1).

Table 1 Risk factor level awareness in coronary patients, stratified by age and gender (Europe, 2006–2007)

| | ALL, % aware (n) | MALE, % aware (n) | | P value* | FEMALE, % aware (n) | | P value* |
|------------------------|--------------------|---------------------------|---------------------------|----------|-----------------------|-------------------------|----------|
| | | ≤65 years | >65 years | | ≤65 years | >65 years | |
| TC level | 46.6 (4,076/8,743) | 48.0 (1,826/3,803) | 44.8 (1,217/2,719) | 0.009 | 49.9 (471/943) | 44.0 (562/1,278) | 0.005 |
| BP level | 81.7 (7,143/8,743) | 80.7 (3,069/3,803) | 83.0 (2,257/2,719) | 0.019 | 81.8 (771/943) | 81.8 (1,046/1,278) | 0.989 |
| BG level | 43.7 (3,824/8,743) | 40.3 (1,532/3,803) | 45.2 (1,229/2,719) | <0.001 | 46.9 (442/943) | 48.6 (621/1,278) | 0.433 |
| BG level (if diabetes) | 81.8 (1,734/2,120) | 82.9 (655/790) | 82.3 (552/671) | 0.745 | 84.6 (225/266) | 76.8 (302/393) | 0.015 |

In bold: significant difference between gender, categorized by age

TC total cholesterol, BP blood pressure, BG blood glucose

* Significance between age groups

Table 2 Risk factor level awareness in coronary patients across Europe (Europe, 2006–2007)

| | TC-level, % aware (n) | BP-level, % aware (n) | BG-level, % aware (n) | Perfectly aware, % aware (n) |
|--------------------|-----------------------|-----------------------|-----------------------|------------------------------|
| Country | | | | |
| Belgium | 39.6 (111/280) | 87.1 (244/280) | 18.9 (53/280) | 8.9 (25/280) |
| Bulgaria | 25.1 (135/538) | 78.4 (422/538) | 33.3 (179/538) | 15.8 (85/538) |
| Croatia | 35.1 (158/450) | 84.4 (380/450) | 43.8 (197/450) | 23.1 (104/450) |
| Cyprus | 59.9 (260/434) | 86.4 (375/434) | 66.6 (289/434) | 52.3 (227/434) |
| Czech Republic | 48.0 (228/475) | 87.4 (415/475) | 45.3 (215/475) | 30.7 (146/475) |
| Finland | 60.3 (143/237) | 75.5 (179/237) | 41.8 (99/237) | 30.8 (73/237) |
| France | 56.4 (171/303) | 94.7 (287/303) | 54.5 (165/303) | 40.9 (124/303) |
| Germany | 38.5 (212/550) | 80.4 (442/550) | 31.5 (173/550) | 16.0 (88/550) |
| Greece | 78.3 (94/120) | 74.2 (89/120) | 64.2 (77/120) | 56.7 (68/120) |
| Hungary | 42.5 (194/457) | 91.5 (418/457) | 63.5 (290/457) | 33.5 (153/457) |
| Ireland | 47.8 (184/385) | 23.1 (89/385) | 15.3 (59/385) | 2.9(11/385) |
| Italy | 50.9 (192/377) | 97.1 (366/377) | 49.9 (188/377) | 34.7 (131/377) |
| Latvia | 57.6 (299/519) | 91.1 (473/519) | 47.8 (248/519) | 39.3 (204/519) |
| Lithuania | 53.7 (273/508) | 95.7 (486/508) | 38.8 (197/508) | 25.6 (130/508) |
| Poland | 48.8 (245/502) | 92.0 (462/502) | 52.6 (264/521) | 36.1 (181/502) |
| Romania | 53.0 (276/521) | 91.2 (475/521) | 49.5 (258/521) | 39.7 (207/521) |
| Russian Federation | 66.7 (273/409) | 94.4 (386/409) | 68.0 (278/409) | 62.8 (257/409) |
| Slovenia | 57.0 (167/293) | 93.5 (274/293) | 57.3 (168/293) | 41.0 (120/293) |
| Spain | 23.6 (119/505) | 84.2 (425/505) | 37.8 (191/505) | 11.1 (56/505) |
| The Netherlands | 47.1 (105/223) | 66.8 (149/223) | 22.0 (49/223) | 11.2 (25/223) |
| Turkey | 26.3 (88/335) | 58.2 (195/335) | 34.6 (116/335) | 16.7 (56/335) |
| United Kingdom | 46.3 (149/322) | 34.8 (112/322) | 22.0 (71/322) | 8.1 (26/322) |
| Gender | | | | |
| Male | 46.7 (3043/6523) | 81.6 (5326/6523) | 42.3 (2761/6523) | 27.9 (1820/6523) |
| Female | 46.5 (1033/2222) | 81.8 (1817/2222) | 47.8 (1063/2222) | 30.5 (677/2222) |
| Age | | | | |
| ≤65 years | 48.4 (2297/4746) | 80.9 (3840/4746) | 41.6 (1974/4746) | 28.0 (133/4746) |
| >65 years | 44.5 (1779/3999) | 82.6 (3303/3999) | 46.3 (1850/3999) | 29.2 (1167/3999) |

TC total cholesterol, BP blood pressure, BG fasting glucose, Perfectly aware aware on TC, BP and FG level

No consistent distinction in awareness rates could be observed across age groups. Furthermore, in those patients aged 65 years or younger, risk level awareness did not differ substantially between males and females, except for blood glucose. In those patients aged above 65 years, females were more likely to be aware of their blood glucose level, except in diabetes patients where males were more aware about their level (Table 1).

Furthermore, a great variation in awareness can be seen across countries (Table 2). The lowest patient awareness was seen in Ireland and the UK with the proportion of patients being aware on at least one out of three risk factor levels amounting to 61.3 and 63.4 %, respectively. Only 2.9 % of Irish and 8.1 % of UK patients were perfectly aware on all three risk factors. In contrast, more than half of the Russian (62.8 %), Greek (56.7 %) and Cypriot (52.3 %) patients were fully aware on all three risk factors.

Additionally, a within country variation is observed with great awareness on some risk factors and very low awareness on others. In Belgium, for example, a high proportion of patients were aware of his/her own blood pressure level (87.1 %), whereas a minority of patients were aware of their blood glucose level (18.9 %). Similarly, the blood pressure awareness in Spanish patients (84.2 %) is high, whereas less than 1 in 4 patients is aware on their total cholesterol level (23.6 %). Likewise, although the awareness on blood pressure and blood glucose in Irish (23.1 and 15.3 %, respectively) and UK patients (34.8 and 22.0 %, respectively) is very low the proportion of patients being aware on their total cholesterol level is rather average (47.8 and 46.3 %).

Information on the patient characteristics in relation to their awareness can be found in Table 3. A greater proportion of revascularization (PCI and CABG) as recruiting diagnosis is seen in those patients more aware. Patients

Table 3 Characteristics of awareness (Europe, 2006–2007)

| | Unaware <i>n</i> = 1,081 | Aware on 1 risk factor level <i>n</i> = 2,778 | Aware on 2 risk factor levels <i>n</i> = 2,387 | Aware on 3 risk factor levels <i>n</i> = 2,497 | |
|---------------------------------------------|-----------------------------|--------------------------------------------------|---------------------------------------------------|---------------------------------------------------|------------------|
| Male, % (<i>n</i>) | 73.9 (799/1,081) | 76.9 (2,136/2,778) | 74.0 (1,767/2,387) | 72.9 (1,820/2,497) | <i>P</i> = 0.007 |
| Age, mean (SD) | 63.1 (10.6) | 62.9 (9.7) | 63.3 (9.0) | 63.5 (9.2) | <i>P</i> = 0.406 |
| RD: revascularization, % (<i>n</i>) | 54.8 (592/1,081) | 59.1 (1,642/2,778) | 63.4 (1,514/2,387) | 62.7 (1,566/2,497) | <i>P</i> < 0.001 |
| Low education, % (<i>n</i>) | 35.8 (385/1,074) | 28.2 (778/2,759) | 23.9 (567/2,374) | 18.8 (469/2,490) | <i>P</i> < 0.001 |
| Diabetes, % (<i>n</i>) | 12.1 (129/1,069) | 12.4 (342/2,750) | 35.8 (850/2,376) | 32.3 (799/2,472) | <i>P</i> < 0.001 |
| Blood glucose, mean (SD) | 6.6 (2.0) | 6.69 (1.78) | 7.41 (2.66) | 7.23 (2.37) | <i>P</i> < 0.001 |
| BMI, mean (SD) | 28.6 (4.6) | 28.7 (4.4) | 29.2 (4.5) | 28.9 (4.4) | <i>P</i> = 0.003 |
| Obese, % (<i>n</i>) | 32.6 (351/1,077) | 34.4 (952/2,766) | 37.3 (886/2,375) | 35.9 (894/2,490) | <i>P</i> = 0.030 |
| Central obesity, % (<i>n</i>) | 45.2 (483/1,068) | 47.5 (1,300/2,738) | 53.1 (1,255/2,364) | 48.3 (1,189/2,464) | <i>P</i> < 0.001 |
| Low physical activity level, % (<i>n</i>) | 75.5 (793/1,051) | 68.6 (1,882/2,742) | 67.3 (1,585/2,355) | 70.8 (1,750/2,472) | <i>P</i> < 0.001 |
| TC, mean (SD) | 4.6 (1.3) | 4.7 (1.2) | 4.7 (1.2) | 4.7 (1.2) | <i>P</i> = 0.097 |
| Raised TC, % (<i>n</i>) | 47.9(487/1,016) | 52.1 (1,369/2,627) | 50.6 (1,132/2,239) | 52.7 (1,260/2,393) | <i>P</i> = 0.056 |
| Lipid-lowering medication, % (<i>n</i>) | 75.4 (807/1,071) | 75.7 (2,089/2,761) | 81.0 (1,925/2,377) | 84.8 (2,115/2,493) | <i>P</i> < 0.001 |
| SBP, mean (SD) | 138.3 (21.0) | 140.5 (21.4) | 141.7 (20.7) | 139.6 (19.6) | <i>P</i> < 0.001 |
| DBP, mean (SD) | 81.7 (12.0) | 82.9 (12.2) | 83.1 (11.7) | 82.7 (11.0) | <i>P</i> = 0.004 |
| Raised BP, % (<i>n</i>) | 50.0 (539/1,079) | 53.3 (1,478/2,773) | 60.6 (1,445/2,383) | 57.5 (1,434/2,492) | <i>P</i> < 0.001 |
| Antihypertensive medication, % (<i>n</i>) | 57.1 (609/1,067) | 71.4 (1,976/2,768) | 72.7 (1,731/2,382) | 73.2 (1,821/2,489) | <i>P</i> < 0.001 |
| Smoking, % (<i>n</i>) | 24.9 (268/1,078) | 20.1 (555/2,766) | 13.9 (332/2,384) | 12.9 (323/2,496) | <i>P</i> < 0.001 |
| Cardiac rehabilitation, % (<i>n</i>) | 59.9 (276/461) | 73.1 (934/1,277) | 81.3 (943/1,158) | 80.9 (792/979) | <i>P</i> < 0.001 |
| Under cardiologist care, % (<i>n</i>) | 61.4 (662/1,079) | 67.9 (1,883/2,773) | 69.5 (1,657/2,385) | 76.9 (1,919/2,494) | <i>P</i> < 0.001 |
| Under GP care, % (<i>n</i>) | 54.9 (592/1,079) | 54.3 (1,507/2,773) | 54.5 (1,299/2,385) | 48.5 (1,209/2,494) | <i>P</i> < 0.001 |
| Under no care, % (<i>n</i>) | 5.4 (58/1,079) | 2.7 (76/2,773) | 2.3 (55/2,385) | 1.3 (33/2,494) | <i>P</i> < 0.001 |

RD recruiting diagnosis, BMI body mass index, TC total cholesterol, SBP systolic blood pressure, DBP diastolic blood pressure, BP blood pressure, GP general practitioner

with diabetes, obesity, a raised TC or raised BP were more aware of their own levels. Similarly, patients taking anti-hypertensive medication or lipid-lowering medication were more aware of their own levels. Patients not aware of their own levels were more likely to be less educated, to be smokers and to be less physically active.

Multilevel analyses revealed a significant association between awareness and HRQoL/psychological distress (Table 4). Patients not aware of their own risk factor levels reported lower HRQoL/psychological distress outcomes compared to those being partially or fully aware. Especially the MCS-12 and HADS scales seem to be significantly associated with awareness, whereas no gradual effect was seen on the physical component (PCS-12).

More detailed analyses of individual awareness variables revealed a significant association between HRQoL/psychological distress and TC level awareness both in patients with an elevated TC (≥ 4.5 mmol/L) as well as in patients on cholesterol target (< 4.5 mmol/L), with better outcomes in patients who are aware about their cholesterol level. Likewise, a significant association was found between HRQoL/psychological distress and BP level awareness, with the exception of MCS-12, PCS-12 and

HADS-A in patients with elevated BP. Blood glucose awareness did not seem to be associated with HRQoL/psychological distress, neither in those on target or above target. In patients with diabetes, however, a significant association between blood glucose awareness and the EQ-5D index, MCS-12, HADS-D was found (Table 5). Additional analyses for lifestyle changes resulted in a reduction of the mean effect size; however, significant associations remained mostly significant except for the EQ-VAS.

Discussion

The importance of lifestyle changes and medication compliance is well known in cardiovascular disease prevention (Perk et al. 2012; Rasmussen et al. 2007). In order to change behaviour, knowledge of CHD risk factors is essential (Nash et al. 2003) and improved illness understanding and risk factor awareness have been shown to correlate with increased compliance to lifestyle changes and medication intake (Alm-Roijer et al. 2004; Baroletti and Dell'Orfano 2010). Patients who are involved in their medical care report less discomfort, greater alleviation of

Table 4 Association awareness and health-related quality of life/psychological distress (Europe, 2006-2007)

| | MCS-12 | | PCS-12 | | EQ-VAS | | HADS-A | | HADS-D | |
|---------|---------------------------|------------------|--------------|---------|--------------|---------|-------------|---------|-------------|---------|
| | Mean (SE) | P value | Mean (SE) | P value | Mean (SE) | P value | Mean (SE) | P value | Mean (SE) | P value |
| Unaware | 47.74 (0.69) ^a | REF ^c | 41.37 (0.80) | REF | 64.92 (1.42) | REF | 6.26 (0.21) | REF | 5.76 (0.24) | REF |
| 1 aware | 48.29 (0.62) | 0.186 | 42.35 (0.74) | 0.014 | 66.98 (1.30) | 0.006 | 5.82 (0.21) | 0.001 | 5.28 (0.22) | 0.001 |
| 2 aware | 48.92 (0.63) | 0.006 | 41.95 (0.74) | 0.156 | 66.46 (1.31) | 0.045 | 5.79 (0.21) | 0.001 | 5.01 (0.22) | <0.001 |
| 3 aware | 49.27 (0.63) | 0.001 | 42.00 (0.74) | 0.133 | 67.25 (1.31) | 0.003 | 5.74 (0.24) | 0.001 | 4.91 (0.22) | <0.001 |
| | $P < 0.001^b$ | | $P = 0.083$ | | $P = 0.019$ | | $P = 0.004$ | | $P < 0.001$ | |

MCS-12 mental functioning component score, PCS-12 physical functioning component score, EQ-VAS EuroQoL-5D Visual Analogue Scale, HADS-A hospital anxiety and depression scale-anxiety score, HADS-D hospital anxiety and depression scale-depression score

^a Adjusted means

^b P values adjusted for age, gender, education, country

^c Post hoc paired comparison

symptoms, more improvement in their general medical condition, less concern with their illnesses, a greater sense of control of their illnesses and more satisfaction with their physicians (Brody et al. 1989). Hence patients should be empowered to take charge of their own health, also known as ‘patient empowerment’. Empowerment in patients with long-term conditions has been defined as: “an enabling process or outcome arising from communication with the health care professional and a mutual sharing of resources over information relating to illness, which enhances the patient’s feelings of control, self-efficacy, coping abilities and ability to achieve change over their condition” (Small et al. 2013). Four milestones can be considered in the evolution to patient empowerment. The first step is to make patients aware of their condition and to inform them. There is a change from passive to active participation in the disease treatment. When the patient is aware about his/her own health status, proper action plans and guidance can result in better adherence to treatment plans and consequently better health outcomes (Calvillo et al. 2013).

Our study results have shown insufficient risk factor level awareness among coronary patients, especially with regard to their own TC and blood glucose level and target. Those patients not aware about any of their risk factor levels, were more likely to have a lower education, to be less active physically or to be a smoker, whereas those aware on some or all of their own risk factor levels were more likely to have diabetes, to be obese, to have a raised TC, to have a raised BP or to have a high blood glucose. Hence, according to our results, patients with increased risk factor levels are more likely to be aware of their TC, BP or blood glucose level. Although not included in our analyses it is important to mention the possible influence of frequency of risk factor measurements as discussed by others (Macedo et al. 2005; Alves et al. 2012). Previously, researchers have discussed the association between

hypertension awareness and the frequency of blood pressure measurements.

Furthermore, risk factor level awareness was associated with HRQoL and psychological distress, independent from patients’ risk factor profile. In patients on target as well as in patients above target, awareness was associated with better outcomes. The relationship between awareness and HRQoL seems to be partly mediated by the attempt of patients to adopt a healthier behaviour. Patients with a greater awareness are more likely to have made attempts to improve their lifestyle. And lifestyle improvements have been shown to improve patients’ HRQoL/psychological distress outcomes (De Smedt et al. 2013a; Ludt et al. 2011). Nevertheless, there also seems to be a direct association between awareness and HRQoL, particularly with the mental component. Patients more aware report less anxiety and depression and score better on their mental and emotional well-being regardless of whether they change their lifestyle behaviour. Due to the cross-sectional design of the EUROASPIRE III survey, the causality of this association could not be explored. Awareness of their own risk factor levels might result in less mental distress and a better self-perceived health status. One possible explanation for this hypothesis might be that patient involvement in their care and awareness of their risk factor profile could possibly affect their illness perception and sense of control. Poor illness perception and low sense of control have been associated with worse physical and mental HRQoL (Lau-Walker et al. 2009; Stafford et al. 2009). Hence, in addition to improved adherence to lifestyle changes, a better sense of control might also lead to a decrease in anxiety (French et al. 2005). However, there could just as well exist a reverse causality, with better HRQoL/psychological distress ensuring a greater interest of patients in their own risk factor profile. Most likely, some interplay exists between the above described pathways reinforcing one another.

Table 5 Association between health-related quality of life/psychological distress and risk factor level awareness stratified by risk profile (mean (standard error)) (Europe, 2006–2007)

| | % (N) | EQ-VAS | MCS-12 | PCS-12 | HADS-A | HADS-D |
|------------------------|--------------------|-------------------------------|------------------|------------------|------------------|------------------|
| <i>Complete sample</i> | | | | | | |
| TC <4.5 | | | | | | |
| Not aware TC level | 54.3 (2,187/4,028) | 66.292 (1.325) ^a | 48.227 (0.576) | 42.738 (0.699) | 5.906 (0.219) | 4.714 (0.207) |
| Aware TC level | 45.7 (1,841/4,028) | 68.204 (1.328) | 49.608 (0.578) | 41.552 (0.698) | 6.375 (0.218) | 5.335 (0.206) |
| | | <i>P</i> = 0.002 ^b | <i>P</i> < 0.001 | <i>P</i> < 0.001 | <i>P</i> < 0.001 | <i>P</i> < 0.001 |
| | | <i>P</i> = 0.357 ^c | <i>P</i> = 0.032 | <i>P</i> = 0.039 | <i>P</i> = 0.029 | <i>P</i> = 0.006 |
| TC ≥4.5 | | | | | | |
| Not aware TC level | 52.4 (2,228/4,249) | 65.339 (1.351) | 47.718 (0.699) | 41.576 (0.773) | 6.557 (0.220) | 5.568 (0.219) |
| Aware TC level | 47.6 (2,021/4,249) | 66.882 (1.351) | 48.978 (0.698) | 42.158 (0.773) | 6.310 (0.220) | 5.018 (0.219) |
| | | <i>P</i> = 0.008 | <i>P</i> < 0.001 | <i>P</i> = 0.058 | <i>P</i> = 0.043 | <i>P</i> < 0.001 |
| | | <i>P</i> = 0.130 | <i>P</i> < 0.001 | <i>P</i> = 0.214 | <i>P</i> = 0.028 | <i>P</i> = 0.003 |
| BP <140/90 (130/80) | | | | | | |
| Not aware BP level | 20.1 (769/3,832) | 65.527 (1.521) | 47.547 (0.709) | 41.712 (0.827) | 6.744 (0.269) | 5.720 (0.265) |
| Aware BP level | 79.9 (3,063/3,832) | 67.880 (1.381) | 48.974 (0.616) | 42.536 (0.755) | 6.099 (0.233) | 4.835 (0.235) |
| | | <i>P</i> = 0.005 | <i>P</i> = 0.002 | <i>P</i> = 0.065 | <i>P</i> < 0.001 | <i>P</i> < 0.001 |
| | | <i>P</i> = 0.193 | <i>P</i> = 0.044 | <i>P</i> = 0.255 | <i>P</i> = 0.014 | <i>P</i> = 0.003 |
| BP ≥140/90 (130/80) | | | | | | |
| Not aware BP level | 16.9 (830/4,897) | 64.294 (1.431) | 48.102 (0.737) | 41.148 (0.811) | 6.467 (0.246) | 5.668 (0.253) |
| Aware BP level | 83.1 (4,067/4,897) | 66.112 (1.287) | 48.806 (0.651) | 41.744 (0.741) | 6.251 (0.210) | 5.190 (0.223) |
| | | <i>P</i> = 0.021 | <i>P</i> = 0.109 | <i>P</i> = 0.155 | <i>P</i> = 0.181 | <i>P</i> = 0.002 |
| | | <i>P</i> = 0.309 | <i>P</i> = 0.789 | <i>P</i> = 0.789 | <i>P</i> = 0.296 | <i>P</i> = 0.267 |
| BG <6.1 mmol/L | | | | | | |
| Not aware FG level | 67.1 (1,380/2,057) | 67.723 (1.464) | 48.382 (0.672) | 43.065 (0.857) | 6.355 (0.282) | 5.111 (0.235) |
| Aware FG level | 32.9 (677/2,057) | 67.343 (1.542) | 48.964 (0.727) | 41.989 (0.896) | 6.356 (0.301) | 4.912 (0.255) |
| | | <i>P</i> = 0.668 | <i>P</i> = 0.249 | <i>P</i> = 0.024 | <i>P</i> = 0.995 | <i>P</i> = 0.265 |
| | | <i>P</i> = 0.511 | <i>P</i> = 0.574 | <i>P</i> = 0.029 | <i>P</i> = 0.766 | <i>P</i> = 0.851 |
| BG ≥6.1 mmol/L | | | | | | |
| Not aware FG level | 50.2 (2,224/4,434) | 66.263 (1.302) | 48.05 (0.642) | 42.197 (0.715) | 6.198 (0.222) | 5.372 (0.222) |
| Aware FG level | 49.8 (2,210/4,434) | 65.554 (1.305) | 48.545 (0.644) | 41.408 (0.717) | 6.342 (0.222) | 5.313 (0.223) |
| | | <i>P</i> = 0.587 | <i>P</i> = 0.126 | <i>P</i> = 0.008 | <i>P</i> = 0.228 | <i>P</i> = 0.592 |
| | | <i>P</i> = 0.190 | <i>P</i> = 0.519 | <i>P</i> = 0.012 | <i>P</i> = 0.286 | <i>P</i> = 0.199 |
| <i>If diabetes</i> | | | | | | |
| BG < 6.1 mmol/L | | | | | | |
| Not aware FG level | 22.5 (29/129) | 60.268 (4.335) | 44.241 (2.303) | 42.034 (2.520) | 6.601 (0.822) | 6.998 (0.742) |
| Aware FG level | 77.5 (100/129) | 64.714 (2.694) | 46.810 (1.361) | 39.760 (1.823) | 6.326 (0.501) | 5.330 (0.417) |
| | | <i>P</i> = 0.293 | <i>P</i> = 0.276 | <i>P</i> = 0.297 | <i>P</i> = 0.743 | <i>P</i> = 0.037 |
| | | <i>P</i> = 0.584 | <i>P</i> = 0.468 | <i>P</i> = 0.158 | <i>P</i> = 0.642 | <i>P</i> = 0.154 |
| BG ≥ 6.1 mmol/L | | | | | | |
| Not aware FG level | 17.6 (241/1,367) | 61.507 (1.863) | 44.840 (0.918) | 39.082 (1.055) | 6.885 (0.325) | 6.584 (0.309) |
| Aware FG level | 82.4 (1,126/1,367) | 62.658 (1.480) | 47.728 (0.662) | 39.475 (0.881) | 6.473 (0.226) | 5.739 (0.215) |
| | | <i>P</i> = 0.411 | <i>P</i> = 0.000 | <i>P</i> = 0.584 | <i>P</i> = 0.153 | <i>P</i> = 0.002 |
| | | <i>P</i> = 0.104 | <i>P</i> = 0.000 | <i>P</i> = 0.370 | <i>P</i> = 0.047 | <i>P</i> = 0.005 |

TC total cholesterol, BP blood pressure, BG Blood glucose, EQ-VAS EuroQoL-5D visual analogue scale, MCS-12 mental functioning component score, PCS-12 physical functioning component score, HADS-A hospital anxiety and depression scale-anxiety score, HADS-D hospital anxiety and depression scale-depression score

^a Adjusted means for age, gender, education and country

^b *P* values adjusted for age, gender, education and country

^c *P* values adjusted for age, gender, education, attempt to increase physical activity, attempt to quit smoking, attempt to eat healthier and country

Within our knowledge this is the first study to assess the association between awareness and HRQoL/psychological distress in coronary patients. Some studies have already investigated risk factor awareness in the general population; however, various definitions of awareness have been used making comparison difficult. In the general population, hypertensive patients who were aware of their elevated BP had worse HRQoL outcomes, compared to those persons unaware of their hypertension (Korhonen et al. 2011; Mena-Martin et al. 2003). This result can be largely attributed to the labelling effect, which can induce anxiety and depression because of the awareness of the elevated coronary and mortality risks associated with hypertension (Mena-Martin et al. 2003). Likewise, a higher sick leave is reported in persons aware of their hypertension status (Leynen et al. 2006). In the current analyses, however, there was no labelling effect, since all patients included in EUROASPIRE III were already aware of their coronary condition.

Although the EUROASPIRE survey is a unique database with information collected in a standardized way from a large sample of coronary patients across 22 European countries, our study also has some noteworthy limitations. First of all, as already mentioned, it is not possible to assess causality due to the study design; hence longitudinal studies are needed to draw conclusions about the directionality between risk factor level awareness and HRQoL/psychological distress. Second, those patients participating in the study are most likely those patients interested in their own health. Whether patients are interested in their own health or not is likely to be a determinant in the awareness of risk factor levels and targets. Therefore, the above-reported insufficient risk factor level awareness rates might be an underestimation. We were not able to adjust for the time since last measurement; hence this could potentially have had an influence on the result. Adjusting for the time since hospitalization, however, did not alter the results significantly. In addition, it could be questioned whether awareness was measured in the best possible way. The question was translated in different languages, potentially resulting in small differences causing variation in interpretation across different patients. Further research should focus on how awareness can be assessed adequately. Furthermore, we were not able to adjust for income or socioeconomic status, since these variables were not collected. Likewise, the organisation of the health care system in a given country will have a substantial influence on the risk factor level awareness rates. Finally, it should be mentioned that patients are not a representative sample of all patients with CHD in each country, since they were identified from selected geographical areas and cardiac centres; hence caution is required when generalizing these results.

In conclusion, risk factor awareness among coronary patients is still suboptimal. An important finding, since this has been shown to be associated with worse compliance with medication and lifestyle changes. Furthermore risk factor level awareness seems to be associated with improved HRQoL and psychological distress. Future research should aim to investigate the directionality of this association using longitudinal follow up studies. Are patients with a better health status and less emotional distress more interested in their risk factor profile? Or does knowledge about their own risk factor profile result in improved HRQoL outcomes?

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