

# Factors associated with health-related quality of life in patients with coronary heart disease

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## Abstract

Coronary heart disease (CHD) contributes to decreased health-related quality of life (HRQOL). This review article investigates the factors that can affect the HRQOL in CHD patients. A literature search from PubMed and EBSCO databases was performed until March 2021 with predetermined keywords. The review of 15 included articles showed that many factors that can affect the HRQOL by using EQ-5D instrument in CHD patients, such as education, gender, comorbidity, percutaneous coronary intervention (PCI)/coronary artery bypass graft (CABG) intervention, patient-physician interaction, obesity, physical activity, numbers of medication, smoking, self-efficacy, social/family life, alcohol drinking, income, employment, and behavioral risk factor profile. The top three factors associated with HRQOL in CHD patients were education, gender, and comorbidity. Therefore, we should pay more attention to CHD patients with lower education levels, females, and comorbidity.

## Keywords

factors, health-related quality of life, coronary heart disease, EQ-5D

## Introduction

Coronary heart disease (CHD), also called ischemic heart disease or coronary artery disease, is the biggest killer globally, responsible for 16% of total deaths. Since 2000, the most significant increase in fatalities has been for this disease, rising by more than 2 million to 8.9 million deaths in 2019 (WHO 2020). In 2019, it was estimated that 197.2 million people were living with CHD (Virani et al. 2021).

CHD contributes to decreased health-related quality of life (HRQOL) (Mensah et al. 2019). WHO defines quality of life as “individual perceptions of their position in life in the context of the culture and value systems in

which they live and in relation to their goals, expectations, standards and concerns” (WHO 1998). HRQOL can be defined as “how well a person functions in their life and their health perspective in the physical, mental and social domains” (Karimi and Brazier 2016). Some studies showed that CHD patients had poor HRQOL than healthy controls. Recent research focused on taking HRQOL assessment due to CHD therapy (Srivastava et al. 2017). Significant improvement occurred in HRQOL assessment as the leading indicator for outcome and benefit of cardiovascular patient therapy (Ski and Thompson 2010). HRQOL assessment on CHD is essential because it aims to extend life, relieve symptoms, and impro-

ve function and ability to participate in daily activities (Unsar et al. 2007).

In cardiovascular disease patients, recent study showed that poor HRQOL was influenced by older age, low household income, unemployment, limited activity, poor perceived health, and depression (Lim 2022). This review article investigates the factors that can affect the HRQOL in CHD patients specifically. The result of this review article is expected to be used as an information and a strategy for improving HRQOL in CHD patients.

## Methods

The literature search was performed using the PubMed dan EBSCO (Academic Search Complete and CINAHL Plus with Full Text) databases until March 2021. Search strategies included the use of the following terms: (“coronary artery disease” or “coronary heart disease” or “ischemic heart disease”) AND (“health-related quality of life” or “quality of life”) AND (factor or predictor) AND (EQ5D or EQ-5D) NOT Review. After that, articles were selected and filtered by inclusion criteria: English-language articles, papers published in the last ten years (2010–2020), and full text. Meanwhile, the exclusion criteria: are not original research and unrelated topic/outcome.

## Results and discussion

Fig. 1 shows the PRISMA flow diagram of article selection progress. A total of 60 articles consisting of 43 from PubMed and 17 from EBSCO were obtained using predetermined

keywords. After removing duplicates, 49 articles were obtained. In the full text screened of 49 articles, 34 articles were excluded. Therefore, 15 articles met the inclusion criteria.

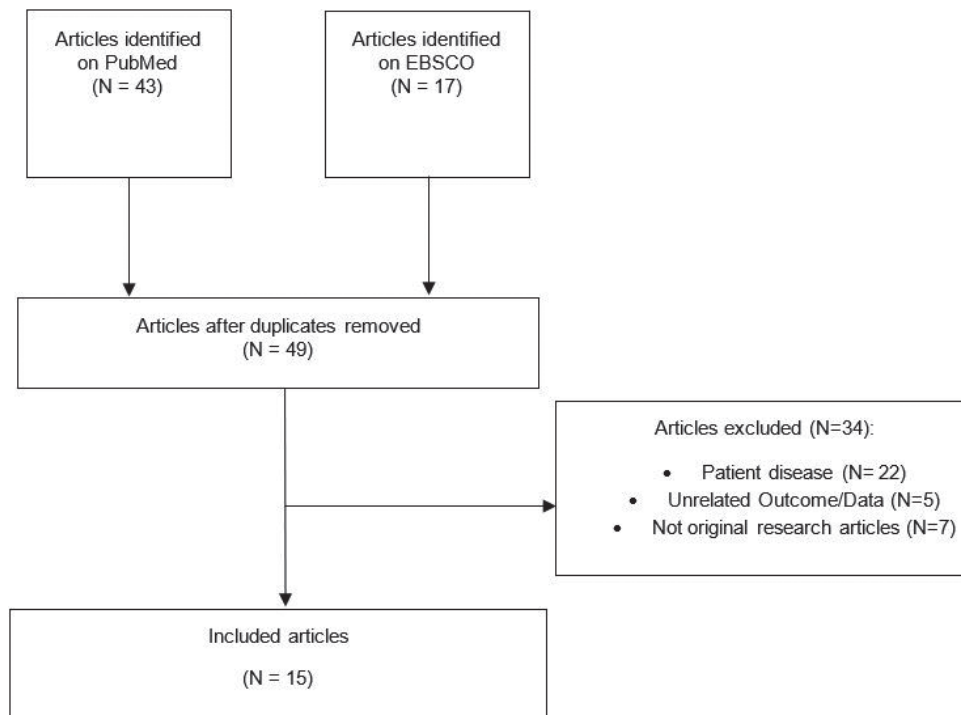
Table 1 shows 15 articles on factors associated with HRQOL in CHD patients. The studies were conducted worldwide with a number of patients more than 45,000 patients. In these studies, HRQOL was measured using the EQ-5D instrument.

**Table 1.** List of included articles.

Authors	Site of Research	Number of Patients	Instrument
Nicolau et al. 2020	Global	8968	EQ-5D-3L
Barham et al. 2019	Palestine	275	EQ-5D-5L
De Smedt et al. 2020	Europe	7567	EQ-5D-5L
Yan et al. 2018	Hongkong	1957	EQ-5D-3L
Baron et al. 2017	Global	1905	EQ-5D-3L
Tušek-Bunc and Petek 2016	Slovenia	423	EQ-5D-3L
Zajac et al. 2016	Poland	78	EQ-5D
Wang et al. 2015	China	1928	EQ-5D-3L
Lee et al. 2015	Korea	708	EQ-5D-3L
De Smedt et al. 2015	Europe	3775	EQ-5D-3L
De Smedt et al. 2013	Europe	8996	EQ-5D
Kramer et al. 2012	Germany	290	EQ-5D-3L
Ose et al. 2012	Europe	3505	EQ-5D-3L
Oreopoulos et al. 2010	Canada	5362	EQ-5D
Wijesundera et al. 2014	Canada	525	EQ-5D-3L

## Factors associated with HRQOL in patients with CHD

Table 2 shows the outcomes of 15 included articles. Each article showed the factors associated with HRQOL in patients with CHD. It showed the result of the EQ-5D instrument from each factor and how it affects the patient's HRQOL.



**Figure 1.** PRISMA flow diagram of the literature search.

**Table 2.** The outcome of each included articles.

Authors	Factors associated with HRQOL in patients	Outcome	Conclusion
Baron et al. 2017	PCI and CABG intervention	EQ-5D index score increased after patient got the intervention Improvement in EQ-5D index score in PCI group (baseline: 0.789)1 month: 0.09712 months: 0.08036 months: 0.0971Improvement in EQ-5D index score in CABG group (baseline: 0.791)1 month: 0.01612 months: 0.08936 months: 0.085	HRQOL improves after the intervention
Barham et al. 2019	Self-efficacy	Higher levels of self-efficacy (OR 1.10) associated with higher EQ-5D index score*Self-efficacy measured by SCSES (Sullivan's Cardiac Self-Efficacy Scale)	Higher levels of efficacy predicted good HRQOL
	Patient-physician interaction	Good patient-physician interaction associated (OR 1.11) with higher EQ-5D index score*Patient-physician interaction measured by PEPPi-5 (5-item Perceived Efficacy in Patient-Physician)	Good patient-physician interaction predicted good HRQOL
	Numbers of medication	EQ-5D index score decreased when patient had more higher numbers of medicationNumber of medications in ORI-3: Ref4-6: 0.54 ≥ 7: 0.23	Higher numbers of medication predicted poor HRQOL
De Smedt et al. 2020	Age	Older patients performed worse compared to younger patients on EQ-5D dimensions, except on the anxiety/depression dimension	Older age predicted poor HRQOL
	Gender	Females had worse outcomes compared to males on all EQ-5D dimensions	Female predicted poor HRQOL
	Education	Lower educated patients reported more problems on EQ-5D dimensions compared to higher educated patients	Lower education predicted poor HRQOL
	Behavioral risk factor profile (obesity, smoking, physical activity)	Patients with behavioral risk factors were more likely to have severe or extreme problems on EQ-5D dimensions	Behavioral risk factor profile predicted poor HRQOL
De Smedt et al. 2015	Gender	Females had lower EQ-VAS score than males.The difference in EQ-VAS score on female patients was -8.32 compared to general population. Meanwhile, males score was -5.24	Female predicted poor HRQOL
De Smedt et al. 2013	Age	Older patients had lower EQ-VAS score (coefficient $\beta = -0.183$ )	Older age predicted poor HRQOL
	Gender	Females had lower EQ-VAS score (coefficient $\beta = -2.878$ )	Female predicted poor HRQOL
	Education	EQ-VAS score decreased when patient had lower education levelEducation level in coefficient $\beta$ Primary education: -0.2046Secondary education: RefHigh education: 0.2635	Lower education level predicted poor HRQOL
	Physical activity	Patients with lower physical activity (< 20 min, 3×/week) had lower EQ-VAS score (coefficient $\beta = -4.384$ )	Lower physical activity predicted poor HRQOL
	Smoking	Smoking had lower EQ-VAS score (coefficient $\beta = -2.062$ )	Smoking predicted poor HRQOL
	Body weight (Central Obesity)	Central obesity had lower EQ-VAS score (coefficient $\beta = -1.887$ )	Central obesity predicted poor HRQOL
	Comorbidity (Diabetes)	EQ-VAS score decreased when patients had diabetes (coefficient $\beta = -2.911$ )	Diabetes predicted poor HRQOL
Kramer et al. 2012	Gender	Females had lower EQ-VAS score (coefficient = -6.45)	Female predicted poor HRQOL
	Education	Higher education had higher EQ-VAS score (coefficient = 3.33)	Higher education predicted good HRQOL
	Employed	Unemployed patients had lower EQ-VAS score (coefficient = -3.73)	Not having employment predicted poor HRQOL
Lee et al. 2015	Age	Older patients had lower EQ-5D index score (coefficient = -0.004)	Older age predicted poor HRQOL
	Gender	Females had lower EQ-5D index score (coefficient = -0.039)	Female predicted poor HRQOL
	Education	Lower education level had lower EQ-5D index score (coefficient = -0.016)	Lower education level predicted poor HRQOL
	Comorbidity (Stroke, Noncardiovascular disease)	Patients with stroke had lower EQ-5D index score (coefficient $\beta = -0.080$ ) and lower EQ-VAS score (coefficient = -5.113)Patient with noncardiovascular disease had lower EQ-5D index score (coefficient = -0.051)	Stroke and noncardiovascular disease predicted poor HRQOL
Nicolau et al. 2020	Comorbidity (Diabetes)	Patients with diabetes had lower EQ-5D index score (0.82) than those without diabetes (0.86)	Diabetes predicted poor HRQOL
Oreopoulos et al. 2010	Body weight (Obesity)	Patients with obesity had lower EQ-5D index scoreEQ-5D index score between groups Normal: 0.890Overweight: 0.887Mild obesity: 0.871Moderate obesity: 0.869Severe obesity: 0.852	Obesity predicted poor HRQOL
Ose et al. 2012	Patient-physician relationship	Good medication adherence had higher EQ-5D index score (coefficient = 0.0195)More positive evaluations of physician's clinical behavior had higher EQ-5D index score (coefficient = 0.0282) Good medication adherence is influenced by interaction between patient and physician.Good evaluation is indicating a good patient-physician relationship	Good patient-physician interaction associated with higher HRQOL
	Gender	Female had lower EQ-5D score (coefficient = -0.0543)	Female predicted poor HRQOL
	Education	Lower education ( $\leq 9$ years in school) had lower EQ-5D score (coefficient = -0.0381)	Lower education level predicted poor HRQOL
Tušek-Bunc and Petek 2016	Comorbidity (heart failure, peripheral artery disease)	Patients with heart failure disease had lower EQ-5D index score level (OR = 0.45) and lower EQ-VAS score (coefficient = -6.27)Patients with peripheral artery disease had lower EQ-5D index score level (OR = 0.32)	Heart failure and peripheral artery disease predicted poor HRQOL
	Family physician visit frequency	Higher physician visit frequency had lower EQ-5D index score level (OR = 0.62) and lower EQ-VAS score (coefficient = -2.98)	Higher physician visit frequency predicted poor HRQOL
	Education	Higher years of education had higher EQ-5D index score level (OR = 1.85)	Higher years of education predicted good HRQOL
Wang et al. 2015	Age	Older patients had lower EQ-5D index score (coefficient = -0.017)	Older age predicted poor HRQOL
	Comorbidity (diabetes, stroke)	Patients with diabetes had lower EQ-VAS (coefficient = -3.709)Patients with stroke had lower EQ-VAS (coefficient = -3.082)	Diabetes and stroke predicted poor HRQOL
	Body weight	Patients with obesity had more problems on mobility dimension (OR = 1.632) and pain/discomfort dimension (OR = 1.633).	Obesity predicted poor HRQOL
	House hold income	Patients with higher household income had higher EQ-5D index score (coefficient = 0.012)	Higher household income predicted good HRQOL
	Social/family life (Family population, Marital status)	Patients with higher family population had higher EQ-5D index score (coefficient = 0.013) and higher EQ-VAS score (coefficient = 2.150)Married patients had higher EQ-VAS index score (coefficient = 2.597)	Big family and being married predicted good HRQOL
	Smoking	Smoking had more problems on mobility dimension (OR = 1.983), self-care (OR = 2.592), usual activities (OR = 2.613) and pain/discomfort dimension (OR = 1.971)	Smoking predicted poor HRQOL
	Alcohol drinking	Alcohol drinking had higher EQ-5D index score (coefficient = 0.012) and higher EQ-VAS score (coefficient = 1.581)	Alcohol drinking predicted good HRQOL
	Physical activity	Higher physical activity had higher EQ-5D index score (coefficient = 0.021) and higher EQ-VAS score (coefficient = 3.104)	Higher physical activity predicted good HRQOL
	Education	High education had less problems on self-care (OR = 0.575)	High education predicted good HRQOL

Authors	Factors associated with HRQOL in patients	Outcome	Conclusion
Wijeyesundera et al. 2014	Revascularization (CABG/ PCI intervention)	Patients with revascularization had EQ-5D index score improvement (from 0.741 into 0.882) after 1-year measurement	Revascularization predicted good HRQOL
Yan et al. 2018	PCI intervention	Patients with PCI intervention had EQ-VAS score improvement after 36 months measurement EQ VAS score between group1. Age group < 65 years Baseline: 50.16 months: 71.212 months: 71.236 months: 72.92. Age group 65–74 years Baseline: 51.66 months: 70.912 months: 71.136 months: 72.82. Age group > 74 years Baseline: 52.66 months: 70.512 months: 71.236 months: 72	PCI intervention predicted good HRQOL
Zajac et al. 2016	PCI intervention	PCI in patients after previous CABG improved HRQOL in 1-year measurement PCI SVG group EQ-5D index score increased from 0.66 into 0.70 EQ-VAS score increased from 64.7 into 69.3 PCI NA group EQ-5D index score increased from 0.65 into 0.72 EQ-VAS score increased from 64.4 into 70.5 Control group EQ-5D index score increased from 0.66 into 0.67 EQ-VAS score increased from 64.1 into 64.9	PCI intervention predicted good HRQOL

After we collected the outcomes from all included articles, we identified factors associated with HRQOL in patients with CHD described below:

## Education level

Seven of 15 included articles identified higher education as a factor that improved HRQOL in CHD patients. EQ-5D index score was higher in higher education patients. Tušek-Bunc and Petek (2016) observed that every 1-level increase in education would increase the EQ-5D index score level by 1.85 times. A similar result was also found by Lee et al. (2015) and Ose et al. (2012) that education level was positively associated with EQ-5D index score. Besides the EQ-5D index score, education level is also related to the EQ VAS score. De Smedt et al. (2013) and Kramer et al. (2012) stated that patients with lower education levels had lower EQ-VAS scores. In EQ-5D dimensions, De Smedt et al. (2020) also identified that education, in general, gave more problems to all dimensions. Wang et al. (2015) showed that education specifically affects the self-care dimension as a protective factor between all EQ-5D dimensions. A possible explanation regarding higher education level patients having better HRQOL is that patients can have a deeper understanding of the disease and its treatment so that they are more concerned about their health and obedient to treatment (Ghimire et al. 2017; Zare et al. 2020; Endalew et al. 2021).

## Gender

Based on six articles, females had worse HRQOL in CHD patients. Compared to the males, female patients generally had more problems in all EQ-5D dimensions. Female patients also had lower EQ-5D index scores and EQ-VAS. EQ-5D index score could be lower than 0.0543 in female patients, according to Ose et al. (2012). In addition, Lee et al. (2015) found that the score could decrease by 0.039. Furthermore, De Smedt et al. (2015) observed that the EQ-VAS score of female patients could be lower than 2.878. Hormonal status (menopause) and physiological difference (smaller coronary arteries) in women might be the reasons why they had lower HRQOL (Hess et al. 2012; De Smedt et al. 2015).

## Comorbidity

Five articles showed comorbidity associated with worse HRQOL in CHD patients. Three of them studied diabetes. According to Nicolau et al. (2020), CHD patients with diabetes had lower EQ-5D index scores than patients without diabetes. Apart from reducing the EQ-5D index score, De Smedt et al. (2013) and Wang et al. (2015) found that diabetes decreased the EQ-VAS score. Other comorbidities are also associated with worse HRQOL such as heart failure, stroke, peripheral artery disease, and non-cardiovascular diseases (Lee et al. 2015; Wang et al. 2015; Tušek-Bunc and Petek 2016). Comorbidity in patients made them experience a load of symptoms from each disease simultaneously, causing a negative effect on HRQOL (Djärv et al. 2012).

## Age

Four articles found that older age was associated with poor HRQOL in CHD patients. Older patients, in general, gave worse results on all EQ-5D dimensions than younger patients, except for the anxiety/depression dimension. Wang et al. (2015) observed that aging in patients could decrease their EQ-5D index score. Similar results were also found by Lee et al. (2015) about this negative association between age and EQ-5D index score. Meanwhile, De Smedt et al. (2013) found that older patients had lower EQ-VAS scores. Aging causes decreased body function consisting of a decrease in physical and mental function, which cannot be avoided (WHO 2021) so that it can cause health problems in the elderly that can impact the HRQOL.

## PCI/CABG Intervention

Four articles stated that percutaneous coronary intervention (PCI)/coronary artery bypass graft (CABG) intervention could improve HRQOL in CHD patients. Wijeyesundera et al. (2014) found that patients who got revascularization (PCI/CABG intervention) had more improvement in the EQ-5D score index compared to the control group after 12 months. Yan et al. (2018) also found that PCI intervention was still able to give improvement after 36 months. A similar result was also reported by Baron et al. (2017) that the EQ-5D index score of CHD

patients who got PCI/CABG intervention had improved after measurements (at one month, 24 months, and 36 months). Additionally, an improvement in EQ-5D score index and EQ-VAS score after measurement at 12 months was found by Zajac et al. (2016) in CHD patients who previously got CABG and then got PCI intervention. HRQOL improved after PCI/CABG intervention because it directly alleviates the symptoms (angina) experienced by patients (Wijeyesundera et al. 2014; Zajac et al. 2016; Baron et al. 2017; Yan et al. 2018).

### Body weight/obesity

In 3 articles, obesity was positively associated with poor HRQOL in CHD patients. Orepoulos et al. (2010) observed that obese patients had lower EQ-5D index scores than regular patients. De Smedth et al. (2013) showed that patients with central obesity could decrease their EQ-VAS score by 1.887 compared to patients without central obesity. Wang et al. (2015) stated that obese patients had more problems with mobility dimension and pain/discomfort dimension. Obesity affects physical function (the ability to carry out daily activities) and might be the reason why the HRQOL decreases in obese patients (De Smedt et al. 2013).

### Patient-physician interaction

Three articles showed that interaction between CHD patients and their physicians could affect patients' HRQOL. Barham et al. (2019) found that good patient-physician interaction could improve the EQ-5D index score. Ose et al. (2012) found that good medication adherence affected by good interaction between patient and physician could increase the EQ-5D index score. Furthermore, they also found that a good evaluation of physician clinical behavior indicating good interaction could increase the EQ-5D index score (Ose et al. 2012; Barham et al. 2019). Meanwhile, Tušek-Bunc and Petek (2016) found that patients with higher physician visit frequency had lower EQ-5D index scores and EQ-VAS scores. Better HRQOL is found in patients who have good interaction with physicians because it can result in better health outcomes by identifying diagnoses and seeking appropriate treatment plans. In secondary prevention and chronic care, a good relationship between physician and patient is the basis for carrying out risk factor management, medication adherence, and lifestyle interventions that lead to an improvement in patient's HRQOL (Ose et al. 2012).

### Physical activity

Two articles showed that physical activity was positively associated with good HRQOL. According to Wang et al. (2015), in CHD patients with more physical activity, their EQ-5D index scores could increase by 0.0021, while EQ-VAS scores could increase by 3.104. De Smedt et al.

(2013) also found that patients with less activity (under 20 minutes, 3×/week) had lower EQ-VAS scores. According to NIH, physical activity can strengthen the heart muscle and widen capillaries (NIH, 2022) so that it might cause better HRQOL in patients with more physical activity.

### Smoking

Two articles showed that smoking was positively associated with poor HRQOL. Wang et al. (2015) found that smoking history had a negative effect on EQ-5D dimensions. Additionally, De Smedt et al. (2013) found that smoking could decrease the EQ-VAS score by 2.062. Poor HRQOL in smoker patients can be due to the effect of smoking that can speed up the clogging and narrowing of coronary arteries (CDC 2020). Besides, chemicals in tobacco smoke can increase blood pressure (nicotine) and reduce the supply of oxygen to the heart (carbon monoxide) (Victorian Government's Department of Health, 2022).

### Self-efficacy

Barham et al. (2019) observed that a higher self-efficacy level in CHD patients was positively associated with good HRQOL. An increased level of self-efficacy (in Sullivan's Cardiac Self-Efficacy Scale score) could increase the EQ-5D index score by 1.10 times. A patient's beliefs in their ability to adhere to medication and follow a healthy lifestyle can affect the outcome of treatment. If people lack the self-efficacy to do something, they won't do it the best way, even if they can. So that may be the reason for patients with a higher level of self-efficacy will get better treatment results and ultimately a better HRQOL.

### Social/family life

Wang et al. (2015) found that family population and marital status were positively associated with good HRQOL. Patients with big families had higher EQ-5D index scores and EQ-VAS scores. Meanwhile, married patients had higher EQ-VAS scores.

### Alcohol drinking

Wang et al. (2015) found that alcohol drinking is positively associated with good HRQOL. Alcohol drinking could increase the EQ-5D index score and EQ-VAS score. Moderate alcohol intake is related to improved HDL-cholesterol, fibrinogen, and markers of glucose metabolism, implicating reduced CHD risk of moderate drinkers.

### Income

Wang et al. (2015) found that higher household income is positively associated with good HRQOL. Patients with higher household incomes had higher EQ-5D index scores. Patients with lower income may have a limited ability

to obtain effective treatments, which may improve their clinical outcomes. Such conditions may ultimately result in poor HRQL (Wang et al. 2019).

## Numbers of medication

Barham et al. (2019) observed that higher numbers of medications in CHD patients were negatively associated with good HRQOL. An increased number of medications could make the EQ-5D index score worse. Polypharmacy is associated with increases in many adverse outcomes, including adverse drug reactions, drug-to-drug interactions, a drug to disease interactions, non-adherence, falls, cognitive impairment, hospital admission, and mortality (Valenza et al. 2017).

## Employment

Kramer et al. (2012) observed that employed patients had higher EQ-VAS score than unemployed patients. In unemployed patients, the EQ-VAS score could be lower than 3.73.

## References

- Barham A, Ibraheem R, Zyoud SH (2019) Cardiac self-efficacy and quality of life in patients with coronary heart disease: a cross-sectional study from Palestine. *BMC Cardiovasc Disord* 19(1): 290. <https://doi.org/10.1186/s12872-019-01281-7>
- Baron SJ, Chinnakondapalli K, Magnuson EA, Kandzari DE, Puskas JD, Ben-Yehuda O, van Es GA, Taggart DP, Morice MC, Lembo NJ, Brown 3<sup>rd</sup> WM, Banning A, Simonton CA, Kappetein AP, Sabik JF, Serruys PW, Stone GW, Cohen DJ, EXCEL Investigators (2017) Quality-of-Life After Everolimus-Eluting Stents or Bypass Surgery for Left-Main Disease: Results From the EXCEL Trial. *Journal of the American College of Cardiology* 70(25): 3113–3122. <https://doi.org/10.1016/j.jacc.2017.10.036>
- CDC (2020) Heart Disease and Stroke. [https://www.cdc.gov/tobacco/basic\\_information/health\\_effects/heart\\_disease/index.htm](https://www.cdc.gov/tobacco/basic_information/health_effects/heart_disease/index.htm) [March 1, 2022]
- De Smedt D, Clays E, Annemans L, Doyle F, Kotseva K, Pajåk A, Prugger C, Jennings C, Wood D, De Bacquer D (2013) Health related quality of life in coronary patients and its association with their cardiovascular risk profile: results from the EUROASPIRE III survey. *International Journal of Cardiology* 168(2): 898–903. <https://doi.org/10.1016/j.ijcard.2012.10.053>
- De Smedt D, Clays E, Annemans L, Pardaens S, Kotseva K, De Bacquer D (2015) Self-reported health status in coronary heart disease patients: a comparison with the general population. *European Journal of Cardiovascular Nursing* 14(2): 117–25. <https://doi.org/10.1177/1474515113519930>
- De Smedt D, Kotseva K, De Backer G, Wood D, Van Wilder L, De Bacquer D (2020) EQ-5D in coronary patients: what are they suffering from? Results from the ESC EORP European Survey of Cardiovascular Disease Prevention and Diabetes (EUROASPIRE IV) Registry. *Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation* 29(4): 1037–1046. <https://doi.org/10.1007/s11136-019-02334-2>
- Djärv T, Wikman A, Lagergren P (2012) Number and burden of cardiovascular diseases in relation to health-related quality of life in a cross-sectional population-based cohort study. *BMJ Open* 2(5): e001554. <https://doi.org/10.1136/bmjopen-2012-001554>
- Endalew H, Liyew B, Baye Z, Ewunetu Tarekegn G (2021) Health-Related Quality of Life and Associated Factors among Myocardial Infarction Patients at Cardiac Center, Ethiopia. *BioMed Research International* 2021: 1–15. <https://doi.org/10.1155/2021/6675267>
- Garry G (undated) Improving the Quality of Life as We Age. <https://www.mentalhelp.net/blogs/improving-the-quality-of-life-as-we-age/> [March 1, 2022]
- Ghimire S, Pradhananga P, Baral B, Shrestha N (2017) Factors Associated With Health-Related Quality of Life among Hypertensive Patients in Kathmandu, Nepal. *Frontiers in Cardiovascular Medicine* 4: 69. <https://doi.org/10.3389/fcvm.2017.00069>
- Hess R, Thurston RC, Hays RD, Chang CC, Dillon SN, Ness RB, Bryce CL, Kapoor WN, Matthews KA (2012) The impact of menopause on health-related quality of life: results from the STRIDE longitudinal study. *Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation* 21(3): 535–544. <https://doi.org/10.1007/s11136-011-9959-7>
- Karimi M, Brazier J (2016) Health, Health-Related Quality of Life, and Quality of Life: What is the Difference? *Pharmacoeconomics* 34(7):645–649. <https://doi.org/10.1007/s40273-016-0389-9>
- Kramer L, Hirsch O, Schlössler K, Träger S, Baum E, Donner-Banzhoff N (2012) Associations between demographic, disease related, and treatment pathway related variables and health related quality of life in primary care patients with coronary heart disease. *Health and quality of life outcomes* 10: 78. <https://doi.org/10.1186/1477-7525-10-78>

## Behavioral risk factor profile

De Smedt et al. (2020) showed that patients' poor behavioral risk factor profile (obesity, smoking, physical activity) was likely to have severe/extreme problems on EQ-5D dimensions.

## Conclusion

Based on 15 included articles, the top three factors associated with HRQOL in CHD patients were education, gender, and comorbidity. Therefore, we should pay more attention to CHD patients with lower education levels, females, and comorbidity. Additionally, other factors are also no less important (such as age, PCI/CABG Intervention, patient-physician interaction, obesity, physical activity, numbers of medication, smoking, self-efficacy, social/family life, alcohol drinking, income, employment, and behavioral risk factor profile that need to be considered in strategy and effort to improve the HRQOL patients.

- Lee HT, Shin J, Lim YH, Kim KS, Kim SG, Kim JH, Lim HK (2015) Health-related quality of life in coronary heart disease in Korea: the Korea National Health and Nutrition Examination Survey 2007 to 2011. *Angiology* 66(4): 326–332. <https://doi.org/10.1177/0003319714533182>
- Lim JH (2022) Predictors of health-related quality of life in Koreans with cardiovascular disease. *Osong Public Health and Research Perspectives* 13(1): 62–70. <https://doi.org/10.24171/j.phrp.2021.0286>
- Mensah GA, Roth GA, Fuster V (2019) The Global Burden of Cardiovascular Diseases and Risk Factors: 2020 and Beyond. *Journal of the American College of Cardiology* 74(20): 2529–2532. <https://doi.org/10.1016/j.jacc.2019.10.009>
- Nicolau JC, Brieger D, Owen R, Furtado RHM, Goodman SG, Cohen MG, Simon T, Westermann D, Granger CB, Grieve R, Yasuda S, Chen J, Hedman K, Mellström C, Brandrup-Wognsen G, Pocock SJ (2020) Diabetes association with self-reported health, resource utilization, and prognosis post-myocardial infarction. *Clinical cardiology* 43(12): 1352–1361. <https://doi.org/10.1002/clc.23476>
- NIH (undated) Physical Activity and Your Heart. <https://www.nhlbi.nih.gov/health-topics/physical-activity-and-your-heart> [March 1, 2022]
- Oreopoulos A, Padwal R, McAlister FA, Ezekowitz J, Sharma AM, Kalantar-Zadeh K, Fonarow GC, Norris CM (2010) Association between obesity and health-related quality of life in patients with coronary artery disease. *International journal of obesity* 34(9): 1434–1441. <https://doi.org/10.1038/ijo.2010.73>
- Ose D, Rochon J, Campbell SM, Wensing M, van Lieshout J, Uhlmann L, Freund T, Szecsenyi J, Ludt S (2012) Secondary prevention in patients with coronary heart diseases: what factors are associated with health status in usual primary care? *PLoS ONE* 7(12): e51726. <https://doi.org/10.1371/journal.pone.0051726>
- Ski CF, Thompson DR (2010) Quality of life in cardiovascular disease: what is it and why and how should we measure it? *European Journal of Cardiovascular Nursing* 9(4): 201–202. <https://doi.org/10.1016/j.ejcnurse.2010.08.002>
- Srivastava S, Shekhar S, Bhatia MS, Dwivedi S (2017) Quality of Life in Patients with Coronary Artery Disease and Panic Disorder: A Comparative Study. *Oman medical journal* 32(1): 20–26. <https://doi.org/10.5001/omj.2017.04>
- Tušek-Bunc K, Petek D (2016) Comorbidities and characteristics of coronary heart disease patients: their impact on health-related quality of life. *Health and quality of life outcomes* 14(1): 159. <https://doi.org/10.1186/s12955-016-0560-1>
- Unsar S, Sut N, Durna Z (2007) Health-related quality of life in patients with coronary artery disease. *The Journal of cardiovascular nursing* 22(6): 501–507. <https://doi.org/10.1097/01.JCN.0000297382.91131.8d>
- Valenza PL, McGinley TC, Feldman J, Pritiben Patel P, Cornejo K, Liang N, McNaughton RA (2017) Dangers of Polypharmacy. In: MS Firstenberg, SP Stawicki (Eds) *Vignettes in Patient Safety Volume 1*. intechopen. <https://doi.org/10.5772/intechopen.69169>
- Victorian Government's Department of Health (2022) Smoking and Heart Disease. <https://www.betterhealth.vic.gov.au/health/healthy-living/smoking-and-heart-disease> [March 1, 2022]
- Virani SS, Alonso A, Aparicio HJ, Benjamin EJ, Bittencourt MS, Callaway CW, Carson AP, Chamberlain AM, Cheng S, Delling FN, Elkind MSV, Evenson KR, Ferguson JF, Gupta DK, Khan SS, Kissela BM, Knutson KL, Lee CD, Lewis TT, Liu J, Loop MS, Lutsey PL, Ma J, Mackey J, Martin SS, Matchar DB, Mussolino ME, Navaneethan SD, Perak AM, Roth GA, Samad Z, Satou GM, Schroeder EB, Shah SH, Shay CM, Stokes A, VanWagner LB, Wang NY, Tsao CW, American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee (2021) Heart Disease and Stroke Statistics-2021 Update: A Report From the American Heart Association. *Circulation* 143(8): e254–e743. <https://doi.org/10.1161/CIR.0000000000000950>
- Wang L, Wu YQ, Tang X, Li N, He L, Cao Y, Chen DF, Hu YH (2015) Profile and Correlates of Health-related Quality of Life in Chinese Patients with Coronary Heart Disease. *Chinese medical journal* 128(14): 1853–1861. <https://doi.org/10.4103/0366-6999.160486>
- Wang Y, Huang L, Zhou LX (2019) Correlation between exercise, personal income level, and health-related quality of life in patients with newly diagnosed stable angina. *Military Medical Research* 6(1): 36. <https://doi.org/10.1186/s40779-019-0226-5>
- WHO (1998) Programme on mental health: WHOQOL user manual, 2012 revision. World Health Organization. <https://apps.who.int/iris/handle/10665/77932>
- WHO (2020) Top 10 causes of death. <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death> [May 5, 2021]
- WHO (2021) Ageing and health. <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health> [March 1, 2022]
- Wijesundera HC, Qiu F, Fefer P, Bennell MC, Austin PC, Ko DT (2014) Association between the appropriateness of coronary revascularization and quality of life in patients with stable ischemic heart disease. *BMC cardiovascular disorders* 14: 137. <https://doi.org/10.1186/1471-2261-14-137>
- Yan BP, Chan LLY, Lee VWY, Yu CM, Wong MCS, Sanderson J, Reid CM (2018) Sustained 3-Year Benefits in Quality of Life After Percutaneous Coronary Interventions in the Elderly: A Prospective Cohort Study. *Value in health: the journal of the International Society for Pharmacoeconomics and Outcomes Research* 21(4): 423–431. <https://doi.org/10.1016/j.jval.2017.10.004>
- Zajac P, Życiński P, Qawoq H, Jankowski Ł, Peruga J, Wcisło T, Pagórek P, Peruga JZ, Kasprzak JD, Plewka M (2016) Outcomes of percutaneous coronary intervention in patients after previous coronary artery bypass surgery. *Kardiologia polska* 74(4): 322–330. <https://doi.org/10.5603/KP.a2015.0199>
- Zare F, Ameri H, Madadzadeh F, Reza Aghaei M (2020) Health-related quality of life and its associated factors in patients with type 2 diabetes mellitus. *SAGE open medicine* 8: 2050312120965314. <https://doi.org/10.1177/2050312120965314>