

Socioeconomic Differences in Psychosocial Factors Contributing to Coronary Heart Disease: A Review

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Published online: 24 May 2008
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Abstract Psychosocial factors have been shown to play an important role in the aetiology of coronary heart disease (CHD). A strong association between CHD and socioeconomic status (lower-level education, poor financial situation) has also been well established. Socioeconomic differences may thus also have an effect on psychosocial risk factors associated with CHD, and socioeconomic disadvantage may negatively affect the later prognosis and quality of life of cardiac patients. The aim of this study was to review the available evidence on socioeconomic differences in psychosocial factors which specifically contribute to CHD. A computer-aided search of the Medline and PsycINFO databases resulted in 301 articles in English published between 1994 and 2007. A comprehensive screening process identified 12 empirical studies which described the socioeconomic differences in CHD risk factors. A review of these studies showed that socioeconomic status (educational grade, occupation or income) was adversely associated with psychosocial factors linked to CHD. This association was evident in the case of

hostility and depression. Available studies also showed a similar trend with respect to social support, perception of health and lack of optimism. Less consistent were the results related to anger and perceived stress levels. Socioeconomic disadvantage seems to be an important element influencing the psychosocial factors related to CHD, thus, a more comprehensive clarification of associations between these factors might be useful. More studies are needed, focused not only on well-known risk factors such as depression and hostility, but also on some lesser known psychosocial factors such as Type D and vital exhaustion and their role in CHD.

Keywords Coronary heart disease · Psychosocial factors · Socioeconomic differences · Review

A more systematic and interdisciplinary attitude to coronary heart disease (CHD) has gained ground recently. Attention has also been focused on the role of psychosocial factors and increasing socioeconomic differences in the aetiology and prognosis of CHD (Albus et al., 2005; Bobak, Pikhart, Rose, Hertzman, & Marmot, 2000; Kop, 2003; Rosengren et al., 2004). Evidence suggests that in addition to the traditional biomedical risk factors (cholesterol, hypertension, blood pressure) there are other important determinants of CHD (Danahauer, Oliveira, Myll, Berra, & Haskell, 2004; EUROASPIRE Group, 2001; Krantz & McCeney, 2002; Williams & Schneiderman, 2002).

Various psychosocial factors have been shown to be related to different aspects of the cardiovascular disease process. Depression is associated with increased cardiovascular morbidity and mortality, both aetiologically and in terms of prognosis, being a known risk factor for the

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development of cardiovascular disease, as well as an independent predictor of poor prognosis following a cardiac event (Brummett, Boyle, Siegler, Williams, Mark et al., 2005; Carney, Freedland, & Sheps, 2004; Kemp, Malhotra, Franco, Tesar, & Bronson, 2003; Sirois & Burg, 2003). Hostility and anger are assumed to increase the risk of CHD through stress-induced cardiovascular and neuroendocrine hyperreactivity and health risk behaviors (Boyle et al., 2004; Krantz & McCeney, 2002; Sparagon, Friedman, Breall, Goodwin, Fleischmann, et al., 2001). Lack of social support has been related to health-risk behavior, psychological distress, cardiac symptoms, an increased risk of recurrent cardiac events and mortality (Barefoot et al., 2000; Pedersen, Middel, & Larsen, 2002). Lack of optimism (Lynch, Kaplan, & Shema, 1997; Shen, McCreary, & Myers, 2004) and perceived stress (Heslop, Smith, Carroll, Macleod, Hyland et al., 2001; Kop, 1997) are also connected with increased cardiovascular mortality and morbidity. A greater negative self-perception of health has been found to be an important predictor of general and cardiovascular mortality and morbidity even after adjustment for the influence of other risk factors (Rodríguez-Artalejo et al., 2005), vital exhaustion is a substantial predictor of myocardial infarction within an 18-month period before the cardiac event (Kop, 1997; Schuitemaker, Dinant, van der Pol, & Appels, 2004), and Type D personality has been associated with higher numbers of reinfarction and higher mortality rates among cardiac patients (Denollet, 2005; Pedersen & Denollet, 2004).

A strong association between CHD and socioeconomic status (SES, e.g. low education, low income level) has also been well established. Enduring socioeconomic disadvantage is linked to a higher risk of cardiovascular mortality and morbidity, as well as increased behavioral and medical risk factors—smoking, excessive weight, sedentary lifestyle, heavy alcohol use, higher blood pressure and higher levels of cholesterol (Baker, Mead, & Campbell, 2002; Bucher & Ragland, 1995; Cappuccio, Oakeshott, Strazzullo, & Kerry, 2002; Ferrie, Shipley, Stansfeld, Smith, & Marmot, 2003; Lynch, 2001).

In summary, it has been found that both psychosocial factors and socioeconomic position are significantly related to CHD. However, less is known about the association between psychosocial factors and socioeconomic position and the possible causal pathways with respect to CHD. Usually the effect of both psychosocial factors and socioeconomic position are perceived as independently related to the clinical outcome: CHD. However, it is more probable that an interplay exists and a strong interaction between psychosocial factors and SES might partly explain the complexity of associations in the aetiology of CHD. For example, evidence suggests that the impact of low SES may be linked to an increased risk of CHD via

a psychosocial mechanism (Step toe, 2005; Williams, 1994; Williams & Schneiderman, 2002) such as hostility or depression. As low SES in childhood and adulthood has been associated with high levels of cynical hostility and increased cardiovascular risk (Haukkala, 2002; Pulkki, Kivimäki, Elovainio, Viikari, Keltikangas et al., 2003). Depression and anxiety seem to be more prevalent in groups with a lower SES and may later produce acute or chronic physiological changes, increasing the risk of CHD (Lorant, Deliège, Eaton, Robert, Philippot et al., 2003; Lynch et al., 1997; Rosengren et al., 2004; Step toe, 2005). A possible theoretical model can be proposed as follows: if SES is related to CHD and also to the psychosocial factors associated with the latter, then socioeconomic position might thus influence CHD via a psychosocial mechanism (see Fig. 1).

The relationship between SES, psychosocial factors and CHD is complex as it is likely that SES contributes to the development of CHD through areas not related or indirectly related to psychosocial pathways. Lower SES is often associated with such factors as inadequate health insurance, less preventive care, poor diet and poor health care which may result in high stress and gives rise to symptoms such as depression, anxiety and hostility. It is also very probable, to the extent that SES and psychosocial factors are related, that both psychosocial factors and CHD are partially influenced by SES factors (for example, the stress of living in poverty and poor health care). Chronic negative psychosocial factors might also affect socioeconomic position. For example, long-term depression may result in loss of employment, and thus depression can lead to both a CHD endpoint and a lower SES.

Recognizing the importance of these complexities, we limited our focus to one part of these complex relationships as the importance of psychosocial factors and socioeconomic position in the aetiology and prognosis of CHD has already been well established. Thus, in our review we focused on the less-explored aspect of the relationship, i.e. the association between SES and psychosocial factors in CHD.

The review focuses on socioeconomic differences related to the following factors affecting CHD: hostility,

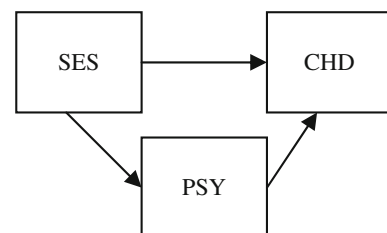


Fig. 1 Possible relationships between socioeconomic status (SES), coronary heart disease (CHD) and psychological factors (PSY)

depression, anxiety, social support, anger, perceived stress, self-rated health and lack of optimism. The selected articles reported study results from different European countries and the US and among both males and females (five articles study both genders, two study men only, and two include women only). Most of the studies were carried out as extensive population-based prospective surveys with baseline examination and follow-up assessments, and participants were randomly selected from the population, or a representative sample of the population was used (see Table 1).

Methods

Search Strategy

A computer-assisted literature search of the Medline and PsycINFO databases was conducted to identify the publications relevant to this study. The following search limitations were set: English language abstracts of articles from the years 1994 to 2007. Three query terms or phrases were used when searching for relevant publications: cardiovascular or CHD and risk factors, psychological factors or psychosocial factors, and socioeconomic or social class or sociodemographic factors. The search based on these queries combined by ‘and’ resulted in 346 hits, with 88 hits in the Medline database and 258 in the PsycINFO database.

The second step focused on the exclusion of articles which treated SES and psychosocial factors as independent factors as these publications did not explore the associations between these variables of interest. Such articles were of course carefully assessed in order to find any (even sporadic and brief) mentions of reported associations between SES and psychosocial factors before exclusion. In fact, in most of the articles that were included in our review, sociodemographic variables were treated as possible confounders or covariates in the statistical model, thus it was necessary in our search strategy to look not for the ‘basic’ or ‘main’ findings of the studies, but for the results which were reported as ‘additive’, or confounding. A single research psychologist assessed all the abstracts. This step resulted in thirteen publications. Despite only including search queries for psychosocial or psychological risk factors, our search strategy also identified a number of articles focusing on sociodemographic differences in behavioral risk factors (such as lack of physical activity, diet or smoking). As this topic falls outside the aim of our review, these studies were also omitted.

In two cases our search strategy identified more than one article referring to the results of the same prospective study—we found two articles referring to ‘Whitehall II’

and two articles referring to the ‘Kuopio’ study. We decided to choose only one article concerned with each of these studies, that with the most comprehensive treatment of socioeconomic differences. In order to extend the scope of an article, additional screening based on author’s name and a manual search of the bibliography of retrieved papers was undertaken by a trained librarian. This process identified two more publications. The completed screening process resulted in 12 relevant articles consisting of empirical studies.

Participants and Design of Studies

The number of participants in the selected studies varied from 308 to 13,104. In most studies, data were obtained by having participants complete a battery of self-reported questionnaires, as well as by performing a clinical examination of their health status. Eight articles referred to results of studies carried out as extensive population-based prospective surveys, with baseline examinations and one or more follow-up assessments (Carroll, Smith, Sheffield, Shipley, & Marmot, 1997; Everson et al., 1997; Ferrie et al., 2003; Gallo, Matthews, Kuller, Sutton-Tyrrell, & Edmundowicz, 2001; Lynch et al., 1997; Pulkki et al., 2003; Rose, Kumlin, Dimberg, Bengtsson, Orth-Gomer et al., 2006). Four studies used a cross-sectional design (Emmelin, Nafziger, Stenlund, Weinehall, & Wall, 2006; Gehi, Haas, Pipkin, & Whooley, 2005; Haukalla, 2002; Heslop et al., 2001). In most studies selected for review, participants were chosen as a representative selection from the population. In two cases, participants were patients already diagnosed with CHD (Gehi et al., 2005; Rutledge et al., 2003).

Indicators of Socioeconomic Status and the Psychosocial Measures Used in Studies

The most frequently used indicators of *SES* in the studies were occupational status (Carroll et al., 1997; Haukalla, 2002; Heslop et al., 2001; Rose et al., 2006; Rutledge et al., 2003), level of income (Everson et al., 1997; Gehi et al., 2005; Haukalla, 2002; Lynch et al., 1997; Rutledge et al., 2003) and education (Emmelin et al., 2006; Gallo et al., 2001; Gehi et al., 2005; Haukalla, 2002; Pulki et al., 2003; Rutledge et al., 2003). Perceived job insecurity and financial insecurity were also measured (Ferrie et al., 2003), as was social mobility during life, classified into four categories: stable high, upwardly mobile, downwardly mobile and stable low (Pulkki et al., 2003) (see Table 1).

The following questionnaires were used to measure *anger*: Spielberger’s Trait Anger Scale (Spielberger et al., 1988, used in Gallo et al., 2001; Haukalla, 2002) and the Anger Expression Scale (Spielberger et al., 1985, used in

Table 1 Description of study size, design and measures

Authors and country	Participants	Study design	Psychosocial measures	Indicators of socioeconomic status
Ferrie et al. (2003), UK	10,308 London-based civil servants (the Whitehall II study)	Longitudinal	SF-36 (self-reported health perception) General Health Questionnaire	Perceived job insecurity Financial insecurity
Carroll et al. (1997), UK	1,091 men from the Whitehall II study (every fourth male)	Longitudinal	Cook-Medley Hostility Scale	Six employment grade categories (three manual, three non-manual)
Everson et al. (1997), Finland	2,125 men from Kuopio region in Eastern Finland (KUOPIO study)	Longitudinal	Cynical Distrust Scale	Income level
Gallo et al. (2001), USA	308 randomly selected women (University of Pittsburgh Healthy women study)	Longitudinal	Cook-Medley Hostility Scale Beck Depression Inventory Spielberger Scales Cohen Perceived Stress Scale Interpersonal Support Evaluation List	Education
Haukkala (2002), Finland	3,403 adults from Helsinki (stratified random sample)	Cross-sectional	Cynical Distrust Scale Spielberger's Trait Anger Scale	Education Household income Occupation
Heslop et al. (2001), UK	6,832 cohort of Scottish adults from different work fields	Cross-sectional	Reeder Stress Inventory	Six employment grade categories
Lynch et al. (1997), USA	Representative sample of 1,124 adults (Alameda County study)	Longitudinal	Cook-Medley Hostility Scale Depression Scale (based on DSM III) Scales on functional status Life Orientation Test	Economic hardship (total household income lower than 200% of the federal poverty level)
Pulkki et al. (2003), Finland	1,219 randomly selected young people (Cardiovascular risk in young Finns study)	Longitudinal	Cynical Hostility Scale (derived from MMPI)	Education Four categories of social mobility
Rutledge et al. (2003), UK	743 women with chest pain referred for coronary angiography (WISE study)	Longitudinal	Beck Depression Inventory Cook-Medley Hostility Scale Spielberger's Anger Expression Scale Cohen's Social Network Scale	Household income Occupation Education
Rose et al. (2006), Sweden	954 automotive workers	Longitudinal	Psychological General Well-being Inventory	Occupational status (blue collar versus white collar)
Emmelin et al. (2006), Sweden, USA	5,461 adults in Sweden, 7,643 adults in USA	Cross-sectional	General question on self-rated health	Education
Gehi et al. (2005), USA	940 participants with CHD	Cross-sectional	Computerized Diagnostic Interview Schedule-I Patients health question	Education Income

Rutledge et al., 2003). *Hostility* was assessed with the Cook-Medley Hostility scale (Cook & Medley, 1954, used in Carroll et al., 1997; Gallo et al., 2001; Lynch et al., 1997; Rutledge et al., 2003) and the Cynical Distrust Scale (Greenglas & Julkunen, 1989, used in Everson et al., 1997; Haukkalla, 2002). The Cynical Hostility Scale derived from the Minnesota Multiphasic Personality Inventory was also used (Hathaway & McKinley, 1940, used in Pulkki et al., 2003).

Cohen's Social Network Scale was employed to measure *social support* (Cohen et al., 1997, used in Rutledge et al., 2003), as was the Interpersonal Support Evaluation List (Cohen et al., 1985, used in Gallo et al., 2001).

In order to evaluate *depression and anxiety*, the following measures were used: Beck Depression Inventory (BDI) (Beck et al., 1978, used in Gallo et al., 2001; Rutledge et al., 2003), General Health Questionnaire (GHQ) (Goldberg, 1972, used in Ferrie et al., 2003), Psychological General Well-being Inventory (Dupuy, 1984, used in Rose et al., 2006) and Spielberger's Anxiety Scale (Spielberger et al., 1966, used in Gallo et al., 2001). A self-reported 12-item scale based on the DSM-III-R diagnostic symptom criteria for a depressive episode was used in the Alameda County study (Lynch et al., 1997). A computerized Diagnostic Interview Schedule for measuring depression was used in the study by Gehi et al. (2005).

The Reeder Stress Inventory (Reeder et al., 1968, used in Heslop et al., 2001) and Cohen's Perceived Stress Scale (Cohen et al., 1983, used in Gallo et al., 2001) were employed for measuring perceived *stress*.

For the evaluation of *health perception*, the SF-36 questionnaire was used (Ware, Kosinski & Keller, 1994, used in Ferrie et al., 2003). Self-reported difficulties with cognitive functioning were assessed by four Likert-type questions in the study by Lynch et al. (1997).

The Life Orientation Test (Scheier et al., 1994, used in Lynch et al., 1997) was used for measuring lack of *optimism* about the future.

Table 1 provides information on the study size, design, indicators of socioeconomic status and the psychosocial measures used in the studies.

Results

Hostility was the most often monitored psychosocial trait in the articles selected for this review. Seven articles found significant differences in relation to SES. All studies confirmed that participants from the lowest socioeconomic group had higher hostility scores than participants from the highest socioeconomic group. This association was reported for different indicators of socioeconomic position: occupational grade (Carroll et al., 1997), education (Gallo

et al., 2001; Haukkalla, 2002; Rutledge et al., 2003) and level of income (Everson et al., 1997; Haukkalla, 2002; Rutledge et al., 2003). In the study by Haukkalla (2002), the association was only found in male participants.

Furthermore, two studies observed an effect of long-term disadvantaged SES on hostility. Lynch et al. (1997) found that people with three episodes of economic hardship (between 1965 and 1983) had five times greater probability of being cynically hostile in 1994, compared to participants with no history of economic hardship. In the article by Pulkki et al. (2003), participants with 'stable low' SES (that is, low status in childhood and adulthood) had significantly higher mean scores of cynical hostility in comparison to 'stable high' participants, while the mean scores of participants with 'upwardly and downwardly mobile' SES lay in between.

Socioeconomic variations regarding *depression and anxiety* were reported in six articles. The direction of the association was the same as in the case of hostility: lower SES was connected with higher depression and anxiety. This adverse association was found using various indicators of SES: level of income (Gehi et al., 2005; Rutledge et al., 2003), occupational grade (Ferrie et al., 2003) and education (Gallo et al., 2001; Gehi et al., 2005; Rutledge et al., 2003). The effect of long-term disadvantaged SES on depression was reported by Lynch et al. (1997). Compared to participants with no history of economic hardship, people with three episodes of hardship (between 1965 and 1983) had three times greater probability of meeting the DSM-III-R criteria for depression in 1994. The only exception was Rose et al. (2006), who found no relationship between education and depression, as well as higher anxiety levels among higher educated participants in their study.

Results for *social support, perception of health and lack of optimism* confirmed the previous trend—the lower the SES of the participants, the worse were their scores on psychosocial factors, as reported by the articles. Differences based on SES in social support were mentioned in two studies (Gallo et al., 2001; Rutledge et al., 2003). Participants with a low SES (education or income) reported significantly fewer social contacts and a worse social network compared to participants with a higher level education or income.

Results from the study by Ferrie et al. (2003) showed significant socioeconomic differences between the lowest versus the highest employment grade with respect to the self-rated health of women. Perception of health was also associated with a long-term disadvantaged SES (Lynch et al., 1997): people with three episodes of economic hardship between 1965 and 1983 had greater self-reported difficulties with cognitive functioning in 1994 compared to people with no history of economic hardship. In the study

by Emmelin et al. (2006), low education was associated with poor self-rated health, but only among US participants. No significant relationship was found among Swedish adults.

An association between lack of optimism and history of economic hardship was also found. Participants who experienced three episodes of economic hardship between 1965 and 1983 had worse scores on the optimism test in 1994 compared to people with no history of economic hardship (Lynch et al., 1997).

Socioeconomic differences in *anger* and *perceived stress* were less consistent than those of other psychosocial factors. In the study by Haukalla (2002), participants with a basic education or lower income had significantly lower scores on the Anger Expression Scale (which means lower anger expression) compared to participants with a university degree or higher income, however, this was found only in male participants. In contrast, Rutledge et al. (2003) and Gallo et al. (2001) reported that various SES groups did not differ significantly with respect to anger expression scores.

Heslop et al. (2001) reported that a greater proportion of men in lower social-class categories scored lower in their perceived stress scores, and conversely, a greater proportion of men in higher social class categories had higher perceived stress scores. However, in the article by Gallo et al. (2001), no differences related to education were found in the perceived stress scores. Table 2 lists results with respect to socioeconomic differences for all articles.

Table 3 presents the mediating effects linking the psychosocial factors, SES and risk of CHD as observed in the 12 studies reviewed in this article.

Discussion

This review focuses on socioeconomic differences in the following factors related to CHD: hostility, depression, anxiety, social support, anger, perceived stress, self-rated health and lack of optimism. Results showed that SES (educational grade, occupation or income) was adversely associated with psychosocial factors related to CHD. This association was evident in the case of hostility and depression. The studies available also showed a similar trend with respect to social support, perception of health and lack of optimism. Less consistent were the results related to anger and perceived stress.

It is possible that SES is one of the predictors of psychosocial risk in CHD. As we proposed in our introduction, if socioeconomic position is related to CHD and also to psychosocial factors, socioeconomic position might thus influence CHD via a psychosocial mechanism. Based on this review of the literature, it seems that socioeconomic

disadvantage has a significant adverse effect on psychosocial factors linked to CHD. However, another important question is whether the predictive value of the psychosocial risk factors in relation to cardiac outcomes is reduced or eliminated when socioeconomic factors are included in the risk models. We were not able to address this question in our review as the studies in this field do not explore the relationship between sociodemographic variables and psychosocial risk factors in this way. In only two articles (Everson et al., 1997; Heslop et al., 2001) was SES reported to be a significant covariant in the relationship between psychosocial characteristics (hostility and perceived stress), attenuating the relationship between psychosocial factors and the risk of CHD. However, studies did explore whether psychological factors contributed to the relationship between SES and CHD risk. This assumption was only partially confirmed, with most authors concluding that psychosocial factors contribute to, but do not fully explain, the relationship between SES and CHD risk. However, the pervasive and consistent trend of an adverse association between SES and psychosocial risk factors for CHD shows that more research exploring the possible causal relationships between SES, CHD and psychosocial factors is needed, and the assumption that SES might influence CHD via a psychosocial mechanism might also have some validity.

No articles were found which examined socioeconomic differences with respect to other factors linked to CHD, such as vital exhaustion or Type D. The influence of these factors is probably less known, leading to a smaller number of studies about their role in CHD being published, even though they appear to have a strong association with the aetiology and prognosis of CHD (Denollet, 2005; Pedersen & Denollet, 2004; Schuitemaker et al., 2004).

One of the factors which might also influence the heterogeneity of studies in this review is a publication bias in epidemiological studies—there is greater likelihood of a positive study being published rather than a negative one, and thus a greater impact of these positive studies after publication. We are also aware of the fact that different scales for measuring the psychological concepts were used in the studies included in this review, which made the comparison of studies difficult. However, even when these effects are presented, the validity of the associations found was supported by the consistency of results found in studies selected for review. The prospective design and representative selection of participants contributed to high-quality methodology in most of the articles used in the review. That different studies of different populations found the same associations supports the consistency of results and strength of the reported associations. For instance, higher levels of hostility were found in the UK (Carrol et al., 1997; Rutledge et al., 2003), Finland (Everson et al., 1997;

Table 2 Main findings of studies selected for review

Authors and country	Findings: differences between the highest versus the lowest socioeconomic groups in terms of psychosocial factors	
Carroll et al. (1997), UK	↓Hostility	$F/1.1088/ = 52.14^{***}$
Everson et al. (1997), Finland	↓Hostility	***
Ferrie et al. (2003), UK	↓Anxiety	Diff = 1.26**
	↓Depression	Diff = 0.54**
	↑Perception of health	OR = 3.74***
Gallo et al. (2001), USA	↓Hostility	$F(1.259) = 9.00^{***}$
	↓Depression	$F(1.298) = 3.25^*$
	↓Anxiety	$F(1.284) = 4.16^{**}$
	↑Social support	$F(1.298) = 7.79^{***}$
	0 Anger	
Haukkala (2002), Finland	↓Hostility	In men***
	↓Anger	In men***
Heslop et al. (2001), UK	↑Stress	In men***
Lynch et al. (1997), USA	↓Hostility	OR = 5.09***
	↓Depression	OR = 4.56***
	↑Perception of health	OR = 3.74***
	↓Lack of optimism	OR = 5.68***
Pulkki et al. (2003), Finland	↓Hostility	***
Rutledge et al. (2003), UK	↓Hostility	***
	↓Depression	***
	↑Social support	***
	0 Anger	
Rose et al. (2006), Sweden	↑Anxiety	**
	0 Depression	
	0 Positive well-being	
	↓Self control	**
	↓General health	**
	0 Vitality	
Emmelin et al. (2006), Sweden, USA	↓Perception of health	***
Gehi et al. (2005), USA	↓Depression	***

Note: * $p < .05$, ** $p < .01$,
*** $p < .001$

F = F test results, OR = odds ratio, Diff = difference

↓ = negative association (higher socioeconomic group had lower scores in given factor)

↑ = positive association (higher socioeconomic group had higher scores in given factor)

0 = no association between given factor and socioeconomic status

Haukkala, 2002; Pulkki et al., 2003) and the US (Gallo et al., 2001; Lynch et al., 1997) among both males and females. Similarly, socioeconomic variations in depression and anxiety were reported in different countries and among both males and females (Ferrie et al., 2003; Gallo et al., 2001; Lynch et al., 1997; Rutledge et al., 2003). Moreover, the effect of long-term disadvantaged SES on these psychosocial factors was observed (Lynch et al., 1997; Pulkki et al., 2003), which also supported the validity of the associations found.

However, our review also reveals some inconsistencies in the results. These may have arisen due to weaknesses in study design and the measurement of psychosocial factors. The study by Haukkala (2002) on hostility and anger, and the article by Heslop et al. (2001) concerning perceived stress, used cross-sectional designs and thereby do not allow the possibility of a causal interpretation of

associations between the variables. This might contribute to findings that were less clear regarding socioeconomic differences in perceived stress and anger. Some contrasting results with respect to these factors could also be caused by disparities in the assessment and measurement of perceived stress and anger, as these concepts are hard to define consistently. The study by Heslop et al. (2001) surprisingly reported a positive association between SES and stress (higher SES group reported higher stress exposure). As the authors concluded, this probably reflects the variations in discourse patterns concerning stress (stress is more common in the vocabulary of higher social-class groups), rather than variations in stress exposure. Some evidence for this appeared in the stress scores for younger men—they did not show positive relationship with social class as did the whole sample. The characteristics of participants might have affected the results in the studies by Rutledge et al.

Table 3 Findings: association of socioeconomic status (SES) and psychosocial factors with risk of heart disease (CHD)

Authors and country	Findings: association of socioeconomic status (SES) and psychosocial factors with risk of heart disease (CHD)
Carroll et al. (1997), UK	Hostility is to a limited extent a mediator in the SES-CHD association
Everson et al. (1997), Finland	SES is a significant mediator in the hostility-CHD association
Ferrie et al. (2003), UK	Interrelationships between SES, CHD and psychosocial factors were not explored
Gallo et al. (2001), USA	Psychosocial factors (hostility, depression, anxiety, social support) contribute to, but do not fully explain the SES-CHD relationship
Haukkala (2002), Finland	Interrelationships between SES, CHD and psychosocial factors were not explored
Heslop et al. (2001), UK	SES attenuates the stress-CHD relationship
Lynch et al. (1997), USA	Interrelationships between SES, CHD and psychosocial factors were not explored
Pulkki et al. (2003), Finland	No support for the mediating effect of hostility in the SES-CHD relationship
Rutledge et al. (2003), UK	Psychosocial factors (hostility, depression, social support) contribute to, but do not fully explain the SES-CHD relationship
Rose et al. (2006), Sweden	Interrelationships between SES, CHD and psychosocial factors were not explored
Emmelin et al. (2006), Sweden, USA	SES predicted poor self-rated health independently of CHD risk factors (among US participants)
Gehi et al. (2005), USA	Interrelationships between SES, CHD and psychosocial factors were not explored

(2003) and Gallo et al. (2001), which reported no significant differences in anger scales related to educational grade or income level. The groups of participants in these studies consisted of middle-aged women only, and it is probable that the expression of anger might be gender determined (possibly in compliance with social standards) and may differ in particular age categories.

One of the weaknesses of the present study is the fact that we did not provide a quantitative review of the articles selected as there was too much heterogeneity in the way SES and psychosocial factors were measured to consider combining the results of these studies in a meta-analysis. Another limitation that needs to be mentioned is the quite broad definition of psychosocial factors in our paper, which allowed us to review a wide range of studies, but also leaves a lot of possible interpretations of found associations.

Conclusions and Implications

This literature review suggests that SES (as defined by educational grade, occupation or income) is adversely associated with psychosocial risk factors linked to CHD. This association was evident in the case of hostility and depression. The studies also showed similar trends in social support, perception of health and lack of optimism. Less consistent results were demonstrated with respect to anger and perceived stress.

Our results suggest some challenges for future research in the field of psychosocial aspects of CHD. First, a more comprehensive clarification of the associations between sociodemographic variables and psychosocial factors would be useful to determine to what extent the predictive value of

the psychosocial risk factors in relation to cardiac outcomes is reduced when socioeconomic factors are included in the risk models. Second, more studies, focused not only on well-known risk factors such as depression and hostility, but also on some less discussed psychosocial factors such as Type D and vital exhaustion and their role in CHD, are needed, as is an examination of the possible interrelationships between these factors and sociodemographic variables.

The importance of the socioeconomic perspective for research into cardiovascular disease is becoming more evident, and interventions in this field should also be guided by an integrative approach which includes not only conventional biomedical factors but also psychological and socioeconomic characteristics. For instance, the international findings of the Interheart study and consistent evidence across countries for an association between socioeconomic disadvantage and psychosocial risk factors in CHD provide evidence of the universal pervasiveness of psychosocial and socioeconomic risk factors. While the impact of treating psychosocial factors or reducing socioeconomic burden on improving cardiovascular prognosis in patients is unclear, it has been shown that such interventions significantly improve patients' quality of life. Thus, clinically oriented intervention strategies focused on reducing cardiovascular mortality and morbidity and improving the quality of life by addressing psychosocial factors at all levels—from primary to tertiary prevention—should be targeted with respect to socioeconomic conditions.

Acknowledgement This work was supported by the Slovak Research and Development Agency under Contract No. APVV-20-038305.

References

- Albus, C., DeBacker, G., Bages, N., Deter, H. C., Herrmann-Lingen, C., Oldenburg, B., et al. (2005). Psychosocial factors in coronary heart disease—scientific evidence and recommendations for clinical practice. *Gesundheitswesen*, *67*, 1–8.
- Baker, D., Mead, N., & Campbell, S. (2002). Inequalities in morbidity and consulting behavior for socially vulnerable groups. *British Journal of General Practice*, *52*, 124–130.
- Barefoot, J. C., Brummett, B. H., Clapp-Channing, N. E., Siegler, I. C., Vitaliano, P. P., Williams, R. B., et al. (2000). Moderators of the effect of social support on depressive symptoms in cardiac patients. *American Journal of Cardiology*, *86*, 438–442.
- Bobak, M., Pikhart, H., Rose, R., Hertzman, C., & Marmot, M. (2000). Socioeconomic factors, material inequalities and perceived control in self-rated health: Cross sectional data from seven post-communist countries. *Social Sciences and Medicine*, *51*, 1343–1350.
- Boyle, S. H., Williams, R. B., Mark, D. B., Brummett, B. H., Siegler, I. C., Helms, M. J., et al. (2004). Hostility as a predictor of survival in patients with coronary artery disease. *Psychosomatic Medicine*, *66*, 629–632.
- Brummett, B. H., Boyle, S. H., Siegler, I. C., Williams, R. B., Mark, D. B., & Barefoot, J. C. (2005). Ratings of positive and depressive emotion as predictors of mortality in coronary patients. *International Journal of Cardiology*, *100*, 213–216.
- Bucher, H. C., & Ragland, D. R. (1995). Socioeconomic indicators and mortality from coronary heart disease and cancer: A 22-year follow-up of middle-aged men. *American Journal of Public Health*, *85*, 1231–1236.
- Cappuccio, F. P., Oakeshott, P., Strazzullo, P., & Kerry, S. M. (2002). Application of Framingham risk estimates to ethnic minorities in United Kingdom and implications for primary prevention of heart disease in general practice: Cross sectional population based study. *British Medical Journal*, *325*, 1271–1276.
- Carney, R. M., Freedland, K. E., & Sheps, D. S. (2004). Depression is a risk factor for mortality in coronary heart disease. *Psychosomatic Medicine*, *66*, 799–801.
- Carroll, D., Smith, G. D., Sheffield, D., Shipley, M. J., & Marmot, M. G. (1997). The relationship between socioeconomic status, hostility, and blood pressure reactions to mental stress in men: Data from the Whitehall II Study. *Health Psychology*, *16*, 131–136.
- Danhauer, S. C., Oliveira, B., Myll, J., Berra, K., & Haskell, W. (2004). Successful dietary changes in a cardiovascular risk reduction intervention are differentially predicted by biopsychosocial characteristics. *Preventive Medicine*, *39*, 783–790.
- Denollet, J. (2005). DS14: Standard assessment of negative affectivity, social inhibition, and Type D personality. *Psychosomatic Medicine*, *67*, 89–97.
- Emmelin, M., Nafziger, A. N., Stenlund, H., Weinehall, L., & Wall, S. (2006). Cardiovascular risk factor burden has a stronger association with self-rated poor health in adults in the US than in Sweden, especially for the lower educated. *Scandinavian Journal of Public Health*, *34*, 140–149.
- EUROASPIRE I, II Group. (2001). Clinical reality of coronary prevention guidelines: A comparison of EUROASPIRE I and II in nine countries. European Action on Secondary Prevention by Intervention to Reduce Events. *Lancet*, *357*, 995–1001.
- Everson, S. A., Kauhanen, J., Kaplan, G. A., Goldberg, D. E., Julkunen, J., Tuomilehto, J., et al. (1997). Hostility and increased risk of mortality and acute myocardial infarction: The mediating role of behavioral factors. *American Journal of Epidemiology*, *146*, 142–151.
- Ferrie, J. E., Shipley, M. J., Stansfeld, S. A., Smith, G. D., & Marmot, M. (2003). Future uncertainty and socioeconomic inequalities in health: The Whitehall II study. *Social Science and Medicine*, *57*, 637–646.
- Gallo, L. C., Matthews, K. A., Kuller, L. H., Sutton-Tyrrell, K., & Edmundowicz, D. (2001). Educational attainment and coronary and aortic calcification in postmenopausal women. *Psychosomatic Medicine*, *63*, 925–935.
- Gehi, A., Haas, D., Pipkin, S., & Whooley, M. A. (2005). Depression and medication adherence in outpatients with coronary heart disease: Findings from the heart and soul study. *Archives of Internal Medicine*, *165*, 2508–2513.
- Haukkala, A. (2002). Socio-economic differences in hostility measures: A population based study. *Psychology and Health*, *17*, 191–202.
- Heslop, P., Smith, G. D., Carroll, D., Macleod, J., Hyland, F., & Hart, C. (2001). Perceived stress and coronary heart disease risk factors: The contribution of socio-economic position. *British Journal of Health Psychology*, *6*, 167–178.
- Kemp, D. E., Malhotra, S., Franco, K. N., Tesar, G., & Bronson, D. L. (2003). Heart disease and depression: Don't ignore the relationship. *Cleveland Clinic Journal of Medicine*, *70*, 745–761.
- Kop, W. J. (2003). The integration of cardiovascular behavioral medicine and psychoneuro-immunology: New developments based on converging research. *Brain Behavior and Immunity*, *17*, 233–237.
- Kop, W. J. (1997). Acute and chronic psychological risk factors for coronary syndromes: Moderating effects of coronary artery disease severity. *Journal of Psychosomatic Research*, *43*, 167–181.
- Krantz, M. S., & McCeney, M. K. (2002). Effects of psychological and social factors on organic disease: A critical assessment of research on coronary heart disease. *Annual Review of Psychology*, *53*, 341–369.
- Lorant, V., Deliège, D., Eaton, W., Robert, A., Philippot, P., & Ansseau, M. (2003). Socioeconomic inequalities in depression: A meta-analysis. *American Journal of Epidemiology*, *157*, 98–112.
- Lynch, J. (2001). Socioeconomic factors in the behavioral and psychosocial epidemiology of cardiovascular disease. In N. Schneidemen, M. A. Speers, J. M. Silva, H. Tomes, & J. H. Gentry (Eds.), *Integrating behavioral and societal sciences with public health* (pp. 51–70). Washington: APA.
- Lynch, J. W., Kaplan, G. A., & Shema, S. J. (1997). Cumulative impact of sustained economic hardship on physical, cognitive, psychological and social functioning. *The New England Journal of Medicine*, *337*, 1889–1895.
- Pedersen, S. S., & Denollet, J. (2004). Validity of the Type D personality construct in Danish post-MI patients and healthy controls. *Journal of Psychosomatic Research*, *57*, 265–272.
- Pedersen, S. S., Middel, B., & Larsen, M. L. (2002). The role of personality variables and social support in distress and perceived health in patients following myocardial infarction. *Journal of Psychosomatic Research*, *53*, 1171–1175.
- Pulkki, L., Kivimäki, M., Elovainio, M., Viikari, J., Keltikangas, M., & Järvinen, L. (2003). Contribution of socioeconomic status to the association between hostility and cardiovascular risk behaviors: A prospective cohort study. *American Journal of Epidemiology*, *158*, 736–742.
- Rodríguez-Artalejo, F., Guallar-Castillón, P., Pascual, C. R., Otero, C. M., Montes, A. O., García, A. N. et al. (2005). Health-related quality of life as a predictor of hospital readmission and death among patients with heart failure. *Archives of Internal Medicine*, *165*, 1274–1279.
- Rose, G., Kumlin, L., Dimberg, L., Bengtsson, C., Orth-Gomer, K., & Cai, X. (2006). Work-related life events, psychological well-being and cardiovascular risk factors in male Swedish automotive workers. *Occupational Medicine*, *56*, 386–392.
- Rosengren, A., Hawken, S., Ôunpuu, S., Sliwa, K., Zubaid, M., Almahmeed, W. A., et al. (2004). Association of psychosocial

- risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study). *Lancet*, *364*, 953–962.
- Rutledge, T., Reis, S. E., Olson, M., Owens, J., Kelsey, S. F., Pepine, C. J., et al. (2003). Socioeconomic status variables predict cardiovascular disease risk factors and prospective mortality risk among women with chest pain: The WISE Study. *Behavior Modification*, *27*, 54–67.
- Shen, B. J., McCreary, C. P., & Myers, H. F. (2004). Independent and mediated contributions of personality, coping, social support, and depressive symptoms to physical functioning outcome among patients in cardiac rehabilitation. *Journal of Behavioral Medicine*, *27*, 39–62.
- Schuitmaker, G. E., Dinant, G. J., van der Pol, G. A., & Appels, A. (2004). Assessment of vital exhaustion and identification of subjects at increased risk of myocardial infarction in general practice. *Psychosomatics*, *45*, 414–418.
- Sirois, B. C., & Burg, M. M. (2003). Negative emotion and coronary heart disease: A review. *Behavior Modification*, *27*, 83–102.
- Sparagon, B., Friedman, M., Breall, W. S., Goodwin, M. L., Fleischmann, N., & Ghandour, G. (2001). Type A behavior and coronary atherosclerosis. *Atherosclerosis*, *156*, 145–149.
- Stephoe, A. (2005). Psychophysiology. In M. G. Marmot & P. Elliott (Eds.), *Coronary heart disease epidemiology: From aetiology to public health* (pp. 432–447). New York: Oxford University Press.
- Williams, R. B., & Schneiderman, N. (2002). Resolved: Psychosocial interventions can improve clinical outcomes in organic disease. *Psychosomatic Medicine*, *64*, 552–555.
- Williams, R. B. (1994). Neurobiology, cellular and molecular biology, and psychosomatic medicine. *Psychosomatic Medicine*, *56*, 308–315.