Socioeconomic factors in coronary artery disease – Results from the SPIRR-CAD study

Kristina Orth-Gomér[a,b,*], Hans-Christian Deter[b], Anna-Sophia Grün[b], Christoph Herrmann-Lingen[c], Christian Albus[d], Alexandra Bosbach[c], Karl-Heinz Ladwig[e], Joram Ronel[f], Wolfgang Söllner[g], Martina de Zwaan[h], Katja Petrowski[i], Cora Weber[b,*], for the SPIRR-CAD Study Group

[a] Dept of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden
[b] Dept. of Psychosomatics and Psychotherapy, Charité Universitaetsmedizin, Campus Benjamin Franklin, Berlin, Germany
[c] Dept. of Psychosomatic Medicine and Psychotherapy, University of Goettingen Medical Centre, German Centre for Cardiovascular Research, Partner Site Goettingen, Germany
[d] Dept. of Psychosomatics and Psychotherapy, University of Cologne, Germany
[e] Inst. of Epidemiology, Helmholtz Zentrum Muenchen, German Research Centre for Environmental Health
[f] Dept. of Psychosomatic Medicine and Psychotherapy, University Hospital Rechts der Isar, Technische Universitaet Muenchen, Germany
[g] Dept. of Psychosomatic Medicine and Psychotherapy, Paracelsus Medical University, Nuremberg General Hospital, Germany
[h] Dept. of Psychosomatic Medicine and Psychotherapy, Hannover Medical School, Germany
[i] Dept. of Psychotherapy and Psychosomatics, Technical University of Dresden, Germany

ARTICLE INFO

ABSTRACT

Low socio-economic status (SES) has been associated with an increased coronary risk in Western countries. All stress experiences are more pronounced in low SES patients with stress emanating from problems with family, job, or money.

The SPIRR-CAD study offered an excellent opportunity to examine these risk factors in German speaking mildly and medium depressed patients. In the SPIRR CAD study, a German multi centre randomized clinical trial of 450 male and 120 female coronary patients, we examined the standard and psychosocial risk factor profiles in relation to SES, as assessed by educational level. All differences in risk factors between low and high SES were in the inverse direction. Of standard risk factors, only smoking was socially graded and more common in low SES. Of psychosocial factors and emotions, exhaustion showed the strongest and most consistent inverse social gradient, but also anger, anxiety and depression were socially graded. The findings suggest that in German patients, as in other national groups, social gradients in CHD risk are considerable. They can be ascribed to both psychosocial and to standard risk factors. In the present two years follow-up, the prospective significance of psychological and social risk factors was analyzed showing that emotional factors played an important role, in that low and high SES patients differed in the expected direction. However, the differences were not statistically significant and therefore firm conclusions from follow up were not possible.

Trial registration: ISRCTN 76240576; NCT00705965

1. Introduction

Low socio-economic status is associated with an increased risk of coronary disease in Western countries [1–5]. The inverse socio-economic gradients found in the early White Hall studies in London were clear and convincing. Coronary heart disease was more frequent in low SES with a similar dose response gradient across all social strata [6]. Such gradients have been reconfirmed in many studies in various populations from the UK, the US, the Netherlands, and Scandinavian countries [7–9].

However, these gradients have been less intensively studied in German speaking countries. It has been pointed out that the proportion of students who graduate from secondary school and thereby are allowed to pursue academic studies is low within the German educational system. It has even been claimed that the difference between the very rich and the very poor is larger in Germany than anywhere else except

---

the USA [11]. It has been argued that if it was possible to raise the general educational level of the entire population, one might also improve the coronary health status by providing education on a broader basis.

In this secondary analysis within a randomized controlled trial, the aim of our post hoc study was to examine the impact of social, clinical, and psychological factors regarding the social gradient in German CAD patients. The research questions were not pre-specified. They were based on previous experience [1].

Although it has been found that socio-economic characteristics were predictive of health events in Germany as described for other countries [11] little is known about the process that leads to the socio-economic differences and the mechanisms of the SES health gradients. To shed light on this issue we separately examined how standard risk factors, medical prognostic markers, and negative emotions are related to the social gradient in depressed CAD patients from a German multicentre trial.

2. Material and Methods

The SPIRR-CAD trial is a randomised, controlled, two-parallel-arm, superiority trial comparing a stepwise psychotherapy intervention with one individual information session complementing usual care [12,13]. It was designed to evaluate the intervention on measures of depression. After 18 months depressive symptoms significantly decreased in both intervention and control groups.

2.1. Patients

The trial offered an excellent opportunity to examine this issue as patients from ten different German university centres were included. Patients were recruited through standard procedures. Inclusion criteria were: documented CAD and a recent coronary angiogram, mild to moderate depression (HADS > 7), consent to join an RCT on psychotherapy vs. usual care for depressive symptoms. Exclusion criteria were: Inability to speak German, severe heart failure (New York Heart Association Class IV), scheduled cardiac surgery within the next 3 months, severe depressive episodes according to the Structured Clinical Interview for DSM-IV other severe or life-threatening physical or mental illness.

As shown previously [13], a total of 18,542 patients had to be screened in order to randomise the target of 570 patients into the trial.

2.2. Socio-economic classification

Education is the most basic SES component since it shapes future occupational opportunities and earning potential. It also provides knowledge and life skills that allow better educated persons to gain more ready access to information and resources to promote health [14].

In order to characterise SES three factors are usually considered: educational level, occupational level, and income [14].

Of those factors the educational level is the most frequently used. In the SPIRR-CAD study the baseline examination included detailed information on educational socio-economic features, including types of schools visited and highest examinations passed as well as specific occupational training completed. These items were classified into three SES groups as follows:

1. low SES – mandatory education or less and without qualified specific vocational training.
2. middle SES – pre-academic education, more than mandatory education but less than academic, including qualified occupational training.
3. high SES – academic education, (abitur/baccalaureat) and university education or occupational training.(thirteen or more years of schooling).

Table 1
Baseline measures educational level and socio-economic indicators (sex, income, education years, financial stress).

	Low SES (n = 42)	Middle SES (n = 354)	High SES (n = 127)	P
	N (%)/M	N (%)/M	N (%)/M	
Age	58.0 ± 10.3	58.6 ± 9.5	61.0 ± 9.0	0.033
Female sex	17 (41%)	69 (20%)	20 (16%)	0.002
Low income < 1500 €/ mo (n = 493)	25 (66%)	123 (37%)	23 (19%)	0.001
Length of education ≤ 9 years (n = 504)	33 (81%)	201 (59%)	2 (2%)	0.001
Severe financial stress (n = 491)	16 (42%)	103 (31%)	21 (18%)	0.004

We used educational level as a proxy measure for SES as it is a measure consistently applied in national and international surveys [15]. Data on occupational level were not available in all SPIRR-CAD patients, but income levels were ascertained. Low income was defined as family income of < 1500,- Euros per month. Educational level was compared with monthly income levels. We expected that low income would be most common in the low and least common in the high SES groups, which was confirmed (see Table 1). The low SES group patients had only mandatory education and they had not completed professional training. Although small in numbers, the low SES group (n = 42) represents an important sociological group in the German society. We recognise that the high standard risk and the psychosocial risk in all three groups was decisive for their participation in the study, and it may have decreased the willingness and motivation in the low SES group to participate in the screening procedure and the RCT.

The number of middle SES subjects is so high because it is a very heterogeneous group including men and women who have not gone to university but been well educated in occupational schools and intensely trained for an occupation. Outside the university there are several ways to obtain an excellent occupational training (Second Occupational Pathway).

In a systematic literature review of techniques used to measure influences of confounding matching was introduced. We controlled in this way for age and gender.

2.3. Psychosocial and clinical measures

Psychosocial measures used in SPIRR-CAD have been previously described [13]. The following psychological questionnaires were used for the present analyses:

● The Hospital Anxiety and Depression Scale (HADS ([16]). The cut-off of 8 and above was used to provide caseness of depression.
● The Hamilton Depression Scale [17],
● Structured Clinical Interview for DSM-IV (SCID: [18]),
● The Freiburg Coping Inventory (FCI; [19]), a comprehensive measure of coping styles,
● The Maastricht Questionnaire for Vital Exhaustion [20],
● The ENRICHD Social Support Instrument (ESSI; [21]),
● The 6-item General Self-efficacy Scale [22],
● The MMPI cynicism scale [23],
● The Interheart stress items: Stress at work, in family, and financial stress [24–26].

In addition, nutritional and exercise habits were ascertained by adhoc items. Clinical variables were obtained from standardised patient interviews and medical records.

2.4. Statistical methods

Statistical analyses were conducted using SPSS for Windows (Version 24.0. Armonk, NY: IBM Corp. released 2010). Graphics were also created using this software. Descriptive statistics show percent and count frequencies for categorical variables, continuous variables are presented as mean and standard deviation.

Group differences between low, middle, and high SES were tested using univariate analysis of variance (ANOVA) including covariates. If data were insufficient to meet all requirements of the ANOVA procedure the non-parametric the Kruskal-Wallis procedure was used [27]. Furthermore a matched age/gender analysis across the three SES groups was performed on a sub sample of 42 patients from each SES group.

Cross-tabulations and chi-square statistics were used for testing distributions of categorical data across SES strata. p-Values refer to the asymptotic p-value when criteria were fulfilled. In cases of small or unequal sample sizes Fisher's exact test was applied. Internal non response was found to be highly variable. In those rare patients who had missing values of > 10% multiple imputation, a statistical procedure to replace missing values was used. All p-values were two-tailed, statistical significance was considered at the level of p < 0.05.

3. Results

3.1. Socio economic status

Social gradients were defined by means of educational characteristics (see Table 1). A total of 570 patients, 75 years or younger, were included of whom 120 were women (22%). Mean age differed significantly by SES: the very low SES patients were on average 58 years old, whereas subjects of the middle SES group was on average 58.8 years old, and the academics had an average age of 61 years (see Table 2 and Fig. 1).
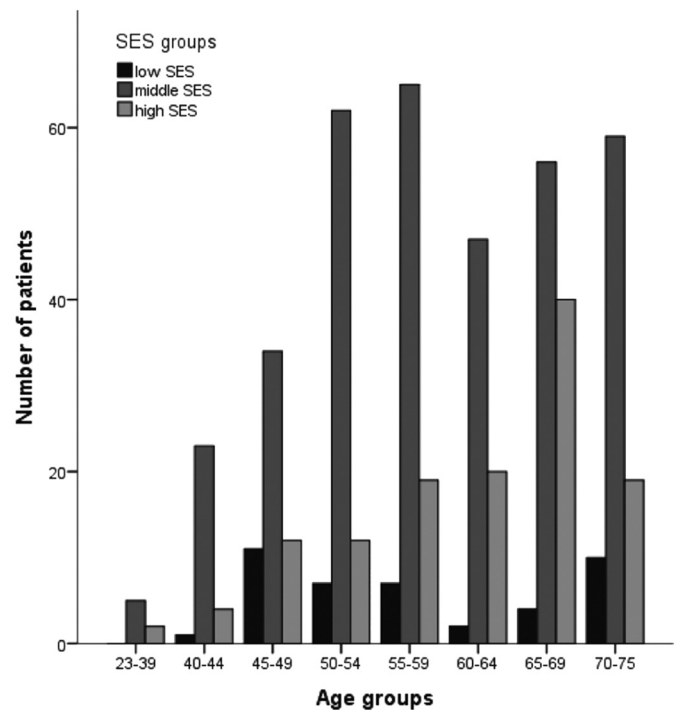

Fig. 1. Socioeconomic distribution in age class

Women (mean age 60.3 ± 8.6 years) were insignificantly older than men (mean age 58.9 ± 9.7 years; p = 0.15). The distribution of age differed in men and women (Fig. 1).

Table 2
Baseline prognostic factors: severity of heart disease and standard coronary risk factors.[*]

	Low SES	Middle SES	High SES	P[**]
	N(%)/M	N(%)/M	N(%)/M	
Standard coronary risk factors				
Hypertension (n = 514)	36 (92%)	308 (88%)	110 (89%)	0.759
Diabetes (n = 507)	7 (17%)	91 (25%)	30 (25%)	0.428
Hyperlipidemia (n = 499)	37 (95%)	292 (87%)	108 (88%)	0.383
Smoking (n = 519)	18 (43%)	121 (35%)	24 (19%)	0.002
Body Mass Index (n = 511)	28.3 ± 4.0	28.6 ± 5.0	28.0 ± 4.6	0.560
Physical exercise < 15 min/day (n = 523)	14 (33%)	97 (27%)	28 (22%)	0.295
Intake of fruit ≤ 1 ×/day (n = 523)	25 (60%)	166 (47%)	50 (39%)	0.066
Severity of heart disease				
Coronary vessels diseased (n = 499)				0.691
1	11 (28%)	88 (26%)	27 (22%)	
2	10 (25%)	113 (34%)	42 (34%)	
3	19 (48%)	135 (40%)	54 (44%)	
Number of previous MI (n = 487)				
0	18 (46%)	147 (45%)	59 (50%)	
1	18 (46%)	155 (47%)	50 (42%)	0.914
2 or more	3 (8%)	27 (8%)	10 (8%)	
Ejection fraction (n = 169)	51.5 ± 11.2 (n = 13)	51.3 ± 13.6 (n = 120)	50.8 ± 13.9 (n = 36)	0.960
NYHA classes (n = 503)				0.073
I	11 (27%)	123 (36%)	48 (40%)	
II	20 (49%)	154 (45%)	54 (45%)	
III	8 (20%)	62 (18%)	17 (14%)	
IV	2 (5%)	1 (0%)	1 (1%)	
Presence of medical comorbidities (n = 518)				0.006
No secondary diagnosis	16 (38%)	142 (41%)	72 (57%)	
1 or more secondary diagnoses	26 (62%)	207 (59%)	55 (43%)	

NYHA: New York Heart Association; CCI: Charlson Comorbidity Index.

[*] Missing values in these tables were registered in the total sample (523), but not in the individual three groups. They can be deducted from the individual total number of each sub group: Low SES (n = 42) Middle SES (n = 354) High SES (n = 127).

[**] The p-values are from Chi or Fisher's exact test (qualitative data) or Kruskal-Wallis test (quantitative data).

3.2. Distribution of SES

We found that about a quarter (n = 128, 26%) of patients had an academic education and thus constituted the high SES group. Forty-two patients (8%) had only mandatory education and were considered the low SES group. They had spent the legally prescribed minimum number of years at school - mostly they had gone to school for nine years, but they had not graduated or finished school with a diploma of any kind.

The largest group, middle social class (n = 351, 66%) was heterogeneous. These patients had a more extensive education than the low SES group, but they did not have a college or university academic education. Typically they had graduated from vocational school and had occupational training as an important part of their education. The middle class had a broad variety of schooling experiences. They had completed their education with relevant graduation, apprenticeship or technical school with graduation as master craftsmen.

3.2.1. Standard risk factors

The standard risk factor distribution was inconclusive (Table 2). Hypertension and hyperlipidemia were frequent, but distribution did not statistically differ in the three groups. Physical exercise habits did not differ between social groups, they were equally rare in low, middle, and high SES. There were more smokers among low SES patients (p = 0.002), but that was the only risk factor to discriminate significantly among the groups. However, it did not appear in the matched comparison.

3.2.2. Prognostic cardiac markers

Prognostic medical factors are presented in Table 2. Men and women of low SES were more severely ill (NYHA, p = 0.073, presence of medical comorbidities, p = 0.006) compared to subjects of high SES. They did not differ in the number of affected coronary vessels (one, two, or three coronary arteries had shown angiographic signs of clinically significant obstruction), number of previous myocardial infarctions nor ejection fraction. The medical therapy after discharge of the hospital at baseline of the study was equivalent in the three groups and so was the medication after 18 months (based on patient reports). Self-reported adherence to pharmacological prescriptions did not differ between SES groups nor did the attendance rate at the group meetings differ (fewer in low SES groups, not significant).

3.2.3. Psychological factors

In contrast, the psychological/emotional findings were more closely related to SES. Depression scores were highest in the lowest SES group (HADS 11.5 vs. 10.1, p = 0.02) and so was vital exhaustion (30.0 vs. 23.5, p = 0.003, Table 3b). The matching did not show any differences in the major outcomes by SES levels.

With age and gender as covariates interrelations were about the same. Furthermore, the self-assessed general strategies to cope with stressful factors encountered in life differed significantly across SES groups. Low educated patients, in particular those who had only reached the minimum level required, were low in self efficacy (p = 0.003). They did not cope with their illness in an active way (p < 0.001). They preferred to wish for a change, rather than doing something about it (p < 0.001) whereas academics reported they were going for a change on their own initiative. Other coping styles were not relevant to this issue (FCI, Table 3b).

Social support differed substantially across SES groups. The proportion of patients with satisfactory emotional support was lowest in the low SES group. In general, men were cohabiting, whereas women lived alone (Table 3a). Perceived social support differed by social categories and gender, low educated women had the least support, academic men had the most.

There was also an association with gender and coronary disease, in that low SES men had more often a history of myocardial infarction (56,4%) as compared to women (38.3%). In the low SES group, 57% of

men but only 31% of women had an AMI (p < 0.01). Low SES women had poor availability to practical social support, for example they could not easily get anyone to help in times of illness (actually one of the ESSI items). 44% of low SES women but only 21% of high SES men (p < 0.001) lived alone. About a quarter of low SES subjects but only 9% of high SES patients were divorced (p < 0.001) (Table 3a). Low SES subjects also had more problems falling asleep (Table 3c).

In summary, low SES was associated with financial difficulties (Table 1) and in a broad concept with social isolation in an emotional, physical, and social sense.

Table 3a
Baseline prognostic factors related to family life.

	Low SES (n = 42)	Middle SES (n = 354)	High SES (n = 127)	p
	N (%)/M	N (%)/M	N (%)/M	
Stress at work (Interheart) (n = 260)	12 (63%)	111 (65%)	40 (57%)	0.526
Stress in family (Interheart) (n = 492)	17 (47%)	132 (39%)	39 (32%)	0.195
Marital status (n = 522)				
Married, living together	21 (50%)	231 (65%)	89 (70%)	
Married, not living together	–	20 (6%)	8 (6%)	
Widowed	3 (7%)	23 (7%)	3 (2%)	
Divorced or separated	10 (24%)	43 (12%)	11 (9%)	
Never married	8 (19%)	36 (10%)	16 (13%)	0.039
Marital Stress in family life (SMSS)				
Co-habiting (living together with a partner, n = 380)	6.5 ± 2.9	5.7 ± 3.7	5.9 ± 3.5	0.357
Living alone (512)				
All	16 (40%)	87 (25%)	29 (23%)	0.088
Male	9 (38%)	59 (21%)	22 (21%)	0.164
Female	7 (44%)	28 (42%)	7 (35%)	0.818
Social support (ESSI) (n = 522)	17.4 ± 6.1	18.5 ± 5.1	19.8 ± 4.7	0.002
Low social support (ESSI)	23 (55%)	151 (43%)	33 (26%)	0.001

Table 3b
Emotional coronary risk factors.

	Low SES (n = 42)	Middle SES (n = 354)	High SES (n = 127)	p
	N (%)/M	N (%)/M	N (%)/M	
Negative affect				
Major depression (SCID) (n = 523)	23 (55%)	128 (36%)	37 (29%)	0.011
Depressive symptoms (HADS) (n = 521)	11.5 ± 3.3	10.3 ± 2.4	10.1 ± 2.4	0.020
Depression observer rating (Hamilton) (n = 521)	12.9 ± 6.9	11.4 ± 6.6	10.0 ± 5.8	0.032
Vital exhaustion (Maastricht) (n = 516)	30.0 ± 8.7	25,8 ± 10.5	23.5 ± 10.7	0.003
Vital exhaustion scale value > 19	37 (88%)	255 (73%)	76 (61%)	0.001
Mental fatigue (Maastricht) (n = 521)	15.7 ± 4.0	13.5 ± 5.3	12.8 ± 5.6	0.013
Hostility/anger/cynicism (MMPI) (n = 519)	15.6 ± 4.3	12.9 ± 5.3	10.5 ± 5.4	0.001
Coping with illness (FCI)				
Depressive coping (n = 501)	12.2 ± 3.9	12.0 ± 3.6	11.5 ± 3.9	0.145
Active coping (n = 505)	13.4 ± 4.2	15.3 ± 4.3	16.7 ± 3.8	0.001
Denial/wishful thinking (n = 504)	8.3 ± 3.1	7.5 ± 2.7	6.5 ± 2.7	0.001
Anxiety (HADS) (n = 515)	10.7 ± 4.2	10.5 ± 3.5	9.7 ± 3.6	0.087
Self efficacy (GSE-6) (n = 517)	15.5 ± 3.5	16.8 ± 3.0	17.4 ± 2.8	0.005

Table 3c
Baseline prognostic factors: sleep and restitution.

	Low SES (n = 42)	Middle SES (n = 354)	High SES (n = 127)	p
	N (%)/M	N (%)/M	N (%)/M	
Duration of sleep (EQ) (n = 520)				0.797
6 h or less	20 (49%)	157 (45%)	55 (43%)	
7 h	11 (27%)	91 (26%)	29 (23%)	
8 h or more	10 (24%)	104 (30%)	43 (34%)	
Problems falling asleep (EQ) (n = 519)				0.001
Often	15 (37%)	118 (34%)	25 (20%)	
Sometimes	17 (42%)	173 (49%)	58 (46%)	
Never/hardly ever	9 (22%)	60 (17%)	44 (35%)	
Problems sleeping through (EQ) (n = 519)				0.659
Often	24 (59%)	175 (50%)	64 (50%)	
Sometimes	10 (24%)	128 (37%)	46 (36%)	
Never/hardly ever	7 (17%)	48 (14%)	17 (13%)	

Explanatory notes, see Table 2.

3.3. Longitudinal study of socio-economic status

Finally, we followed all patients for two years in average, in order to examine the risk of getting a new clinical event of coronary disease (recurrence). Four types of recurrent events were recorded (mortality from all causes, mortality from cardiac causes, clinical events from all causes, major cardiac events (MACE)). Although most of these analyses yielded results in the expected direction, none of these were significantly more common in low SES patients.

As the follow up was limited to two years, short and long term prognostic effects of other clinical parameters could not be evaluated.

4. Discussion

In this randomised controlled trial with mild and moderately depressed CAD patients we studied social gradients in emotional factors, in standard risk factors and in their impact within the two year medical follow-up period of the study group. These patterns can have consequences for the development of new preventive measures, which are discussed below.

Social gradients in psychological/emotional characteristics were considerable, whereas associations of standard coronary risk factors with SES were inconsistent. Only smoking habits were worse in the low SES group. Nutrition, BMI, hypertension, diabetes, and hyperlipidemia did not differ between SES groups. Exercise habits were slightly worse in low SES, with borderline statistical significance.

Depressive symptoms as assessed by either the HADS, by the SCID interview or by the Hamilton Depression Scale differed across SES groups as did depressive coping on the comprehensive Freiburg measure of coping style (all p < 0.001). In addition, the Vital Exhaustion scale scores were more pronounced particularly in women of the low SES category (p < 0.001). The exact content of the HADS depression scale on the one hand and the vital exhaustion scale on the other is a complex issue. It has been said that symptoms of depression in heart patients are more focused on bodily symptoms and less generalised to the patient's psychosocial situation [28]. In contrast, we found here that both the HADS which mainly assesses cognitive-affective symptoms and the Maastricht questionnaire which mainly measures physical exhaustion were related to SES. We actually found that social gradients in psychosocial measures were all in the same direction, and the negative emotions were significantly stronger in low SES patients. The well known buffer effects of social support and an active coping style were particularly poor in low SES women in whom these effects were underscored by their marital status. Any marital status leading to women living alone was found to be harmful [24]. The social gradient was strongest for divorce: almost one third of low SES patients but only 8% of academic patients were divorced.

In a previous psycho-cardiac intervention trial which looked for similar risk factors the association of SES with smoking, sedentary life style, serum-lipids, and BMI was stronger than the ones observed here, whereas associations of SES with health-related quality of life, lack of social support, and unhealthy coping style were almost identical [29,30]. Thus, we feel that associations of SES with psychosocial measures and scales widely agree between studies while the associations with medical variables are less consistent. Given the increased psychosocial burden in low SES patients psychosocial risk factors should receive specific attention in this group. This may require adapted approaches to behavioral interventions.

4.1. SES gradients during follow up

Previous studies found that social inequalities lead to a poorer prognosis of CAD [31,32]. However, we could not confirm these findings in a longitudinal two year follow-up evaluation of the SPIRR-CAD data. At this early stage we only conducted a simple and straight forward clinical evaluation. Mortality was too low at this time-point to draw clear conclusions.

It is probable that a longer follow-up time will also show an adverse prognostic effect of low SES that has been described in previous research [33,34]. Lack of emotional social support and living by oneself without the healthy support from a thriving family may indeed accelerate the disease process and make patients more vulnerable.

4.2. Prevention measures

Social gradients in emotional factors are stronger and more consistent than social gradients in standard risk factors as discussed above. This is important and has consequences for which kind of preventive measures should be used. There is little empirical information on this subject of preventive strategies. In general we know indirectly that the advice is usually prepared for and by the well educated. The low educated, however, will need special attention and novel methods [34].

It has even been suggested that cognitive therapies and drugs against depression may use the same biological pathways and cause similar changes in behavior and neurochemistry [33]. "We cannot write off Freud just yet" was the conclusion of the NIH clinical director Markus Heilig according to life style change without examination of psychological mechanisms.

Other things than satisfaction with the actual health status, motivation for lifestyle change, and active coping style may also be important in life. It may not be self-evident and completely clear that coronary health is always everyone's first priority. People may be aware of their healthy hearts in different ways: "A good health is the most precious stone in the crown of life but it remains concealed and is not discovered until it has been lost in the turmoil and stresses of life" [34].

A coronary attack affects patients in work site and family life. Whether caused by a woman's heart disease or that of her husband [10], the initiative to change both the nutritional and exercise habits is an important task. Individuals and families therefore play an important role in the prevention of heart diseases in all SES classes [34]. High SES patients may need less specific attention in preventive programs. It has been suggested that these on average highly competent patients will get the appropriate information and support by themselves and that any initiative "from above" may disturb that process [35]. On the contrary, information and support should be provided for low SES patients in order to decrease emotional distress, depressive symptoms, exhaustion, and anxiety and to promote an active coping style and social support. However, we are not aware of methods that impact low SES related factors to help in addition to addressing depression/anxiety. Low SES factors tend to be seen as given variables which cannot be tackled by

common methods or therapies. In our view this should be defined as an essential challenge for the future to improve health management capabilities of these patients. One way could be to decrease loneliness and strengthen the social basis [36]. In such a context it would be more meaningful to reduce depression than tell the patients to stop smoking.

4.3. Limitations

Conclusiveness of these findings is limited. The definition and categorisation of SES should be accounted for in the conclusions to be drawn. In this paper we have examined the SES gradients in cardiologic and psychological dimensions of CAD and found that social gradients were stronger with regard to emotions than with regard to behavioral risk factors. The findings are related to our definition of SES and to this German sample.

Categorisation of SES is a sensitive issue, many dimensions of SES are described and education is the most often used criterion for SES. Although small in numbers the low SES patients represent an important sociological group in the German society, possibly a selection effect through the screening. The middle group is a large and heterogeneous group of patients who are well educated, but did not go to university. Creating other subgroups of SES with a more equal distribution of these groups produced smaller differences between groups.

The intervention in the original trial did not impact SES, instead depressive patients were targeted. We do not know if they are representative of all German CAD patients.

Our findings suggest that social differences in emotions, coping abilities and self efficacy are important. However, the direction of causality remains unclear: One could imagine that psychological reactions have influenced or have been triggered by socioeconomic hardships. Independent of causality, appropriate measures and strategies need to be developed for low SES patients. More attention should be paid to low SES in future intervention trials.

4.4. Conclusion

Successful preventive medicine in low SES is a widely debated field. Psychosocial adaptation and health behavior patterns in low SES patients and families may be quite different from those found in high SES. The main interest of the high SES family is usually set on maintaining good health and living a long life. The low SES family may have different life perspectives and may not have the same priorities in life. It might be true that for citizens with low SES responding to immediate emotional and social needs is more important than reflecting long-term perspectives as longevity. The findings of our study might support such a view. Scientists and researchers agree that low SES is one of the most highly ranked priorities in today's public health. The socio-economic issue is growing in importance. Based on our results we suggest that it may be as important to treat negative emotions as to modify standard risk factors in order to dampen social inequalities in heart disease.

References

[1] S.P. Wamala, M.A. Mittleman, K. Schenck-Gustafsson, K. Orth-Gomér, Potential explanations for the educational gradient in coronary heart disease: a population-based case-control study of Swedish women, Am. J. Public Health 89 (3) (1999 Mar) 315–321 (Erratum in: Am J Public Health 1999 May; 89(5):785).

[2] S.L. Syme, Social class and cardiovascular disease, in: K. Orth-Gomér, N. Schneiderman (Eds.), Behavioral medicine approaches to cardiovascular disease prevention, Laurence Earlbaum Assoc.publ., Mahwah, New Jersey, 1996, pp. 43–50.

[3] J. Lynch, G.D. Smith, M. Hillemeier, M. Shaw, T. Raghunathan, G. Kaplan, Income inequality, the psychosocial environment, and health: comparisons of wealthy nations, Lancet 358 (9277) (2001 Jul 21) 194–200.

[4] P. Puska, Community interventions in cardiovascular disease prevention, in: K. Orth-Gomér, N. Schneiderman (Eds.), Behavioral Medicine Approaches to Cardiovascular Disease Prevention, Laurence Earlbaum. Assoc.publ., Mahwah, New Jersey, 1996, pp. 237–262 1996.

[5] K. Orth-Gomér, C. Leineweber, Multiple stressors and coronary disease in women.

[6] G. Rose, M.G. Marmot, Social class and coronary heart disease, Br. Heart J. 45 (1) (1981 Jan) 13–19.

[7] M.A. Winkleby, D.E. Julius, E. Frank, S.P. Fortmann, Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease, Am. J. Public Health 82 (6) (1992 Jun) 816–820.

[8] M.A. Albert, R.J. Glynn, J. Buring, P.M. Ridker, Impact of traditional and novel risk factors on the relationship between socioeconomic status and incident cardiovascular events, Circulation 114 (2006) 2619–2626.

[9] D.A. Alter, B. Franklin, D.T. Ko, Socioeconomic status, functional recovery, and long-term mortality among patients surviving acute myocardial infarction, PLoS One 8 (2013) e65130.

[10] N.K. Wenger, Coronary heart disease in women: Evolution of our knowledge, in: K. Orth-Gomer, N. Schneiderman, V. Vaccarino, H.C. Deter (Eds.), Psychosocial Stress and Cardiovascular Disease in Women. Concepts, Findings, Future directions, Springer International Publishing, Heidelberg, New York, 2015, pp. 13–25.

[11] T. Piketty, Capital in the 21th Century, Harvard Univ. Press., Cambridge, 2014, pp. 1–656.

[12] C. Albus, M.E. Beutel, H.C. Deter, K. Fritzsche, M. Hellmich, J. Jordan, J. Juenger, C. Krauth, K.H. Ladwig, M. Michal, M. Mueck-Weymann, K. Petrowski, B. Pieske, J. Ronel, W. Soellner, C. Waller, C. Weber, C. Herrmann-Lingen, A stepwise psychotherapy intervention for reducing risk in coronary artery disease (SPIRR-CAD) - rationale and design of a multicenter, randomized trial in depressed patients with CAD, J. Psychosom. Res. 71 (4) (2011) 215–222.

[13] C. Herrmann-Lingen, M.E. Beutel, A. Bosbach, H.C. Deter, K. Fritzsche, M. Hellmich, J. Jordan, J. Jünger, K.H. Ladwig, M. Michal, K. Petrowski, B. Pieske, J. Ronel, W. Söllner, A. Stöhr, C. Weber, M. de Zwaan, C. Albus, for the SPIRR-CAD Study Group, A Stepwise Psychotherapy Intervention for Reducing Risk in Coronary Artery Disease (SPIRR-CAD): Results of an Observer-Blinded, Multicenter, Randomized Trial in Depressed Patients With Coronary Artery Disease, Psychosom. Med. 78 (2016) 704–715.

[14] L.E. Hinkle Jr., L.H. Whitney, E.W. Lehman, J. Dunn, B. Benjamin, R. King, A. Plakun, B. Flehinger, Occupation, education, and coronary heart disease. Risk is influenced more by education and background than by occupational experiences, in the Bell System, Science 161 (3838) (1968 Jul 19) 238–246.

[15] J. Stamler, The prevention and control of epidemic coronary heart disease: scientific foundations and strategic approaches, Int. J. Cardiol. 4 (2) (1983 Sep) 207–215.

[16] C. Herrmann, International experiences with the Hospital Anxiety and Depression Scale - a review of validation data and clinical results, J. Psychosom. Res. 42 (1997) 17–41.

[17] M. Hamilton, Development of a rating scale for primary depressive illness, Brit J. Soc. Clin. Psychol. 6 (1967) 278–296.

[18] H.U. Wittchen, M. Zaudig, T. Fydrich, Strukturiertes Interview für DSM-IV (SKID I und SKID-II), Hogrefe, Göttingen, 1997.

[19] F.A. Muthny, Freiburger Fragebogen zur Krankheitsverarbeitung, Testmappe, Weinheim, Beltz, 1989.

[20] A. Appels, P. Hoppener, P. Mulder, A questionnaire to assess premonitory symptoms of myocardial infarction, Int. J. Cardiol. 17 (1987) 15–24.

[21] L.F. Berkman, J. Blumenthal, M. Burg, et al., Effects of treating depression and low perceived social support on clinical events after myocardial infarction: the Enhancing Recovery in Coronary Heart Disease Patients (ENRICHD) Randomized Trial, JAMA 289 (2003) 3106–3116.

[22] M. Romppel, C. Herrmann-Lingen, R. Wachter, et al., A short form of the General Self-Efficacy Scale (GSE-6): Development, psychometric properties and validity in an intercultural non-clinical sample and a sample of patients at risk for heart failure, GMS Psycho. Soc. Med. 10 (Doc01) (2013), http://dx.doi.org/10.3205/psm000091.

[23] J.N. Butcher, W.G. Dahlstrom, J.R. Graham, A. Tellegen, B. Kaemmer, Minnesota Multiphasic Personality Inventory (MMPI-2). Manual for administration and scoring, University of Minnesota Press, Minneapolis, 1989.

[24] S. Yusuf, S. Hawken, S. Ounpuu, T. Dans, A. Avezum, F. Lanas, L. Lisheng, I.N.T.E.R.H.E.A.R.T. Study Investigators, Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART Study): Case-control study, Lancet 364 (9438) (2004) 937–952.

[25] S.P. Wamala, M.A. Mittleman, M. Horsten, K. Schenck-Gustafsson, K. Orth-Gomér, Job stress and the occupational gradient in coronary heart disease risk in women. The Stockholm Female Coronary Risk Study, Soc. Sci. Med. 51 (4) (2000 Aug) 481–489.

[26] K. Orth-Gomér, S.P. Wamala, M. Horsten, K. Schenck-Gustafsson, N. Schneiderman, M.A. Mittleman, Marital stress worsens prognosis in women with coronary heart disease: The Stockholm Female Coronary Risk Study, JAMA 284 (23) (2000 Dec 20) 3008–3014.

[27] K.J. Rothmann, S. Greenland, T.L. Lash, Modern Epidemiology, 3rd ed., Lippincott Williams and Wilkins, Philadelphia, 2008.

[28] P. de Jonge, J. Ormel, R.H. van den Brink, J.P. van Melle, T.A. Spijkermann, A. Kuiper, … A.H. Scheene, Symptom dimensions of depression following myocardial infarction and their relationship with somatic health status and cardiovascular prognosis, Am. J. Psych. 163 (2006) 138–144.

[29] K. Orth-Gomér, N. Schneiderman, H. Wang, C. Walldin, M. Bloom, T. Jernberg, Stress reduction prolongs life in women with coronary disease: The Stockholm Women's Intervention Trial for Coronary Heart Disease (SWITCHD), Cir. Cardiovasc. Qual. Outcomes 2 (2009) 25–32.

[30] N. Schneiderman, K. Orth-Gomer, G. Burell, Gender considerations in psychosocial-behavioral interventions for coronary heart disease, in: K. Orth-Gomer, et al. (Ed.), Psychosocial Stress and Cardiovascular Disease in Women, Concepts, Findings,

The Stockholm Female Coronary Risk Study, Biol. Psychol. 69 (1) (2005 Apr) 57–66 (Epub 2005 Jan 23).

Future Perspectives, Springer International Publishing, Heidelberg, New York, 2015, pp. 209–233.

[31] L. Welin, G. Tibblin, K. Svärdsudd, B. Tibblin, S. Ander-Peciva, B. Larsson, L. Wilhelmsen, Prospective study of social influences on mortality. The study of men born in 1913 and 1923, 1 (8434) (1985; Apr 20) 915–918.

[32] J.S. House, K.R. Landis, D. Umberson, Social relationship and health, Science 41 (1988) 40–45.

[33] M. Heilig, All in the mind? New molecular insights might bridge the gap between the effects of psychiatric therapy and drugs, EMBO 10 (4) (2009) 322–325.

[34] Orth-Gomer, K Perski, A Textbook of Preventive Medicine, Lund, Studentlitteratur, 2009.

[35] J. Stamler, Personal communication, (2000).

[36] K.P. Wilkinson, The Community in Rural America, Greenwood Press, Westport, CT, 1991.