

Life satisfaction and cardiovascular disease risk in Poland

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Abstract

Introduction: Cardiovascular disease is the most common cause of death. Life satisfaction is a predictor of morbidity and mortality, irrespectively of objective measures of health status. The aim of the study was to evaluate the relationship between life satisfaction (LS) and cardiovascular disease risk (CVD) assessed with the Framingham Risk Score (FRS) in Polish adults.

Material and methods: Past, present and projected LS were estimated. The FRS reflecting 10-year CVD risk was calculated from health indices and lifestyle parameters. Relationships between LS and FRS were tested by two-way analysis of variance in 489 men and 591 women, 40–50 years of age.

Results: Subjects with a reduction in LS over time had a higher FRS compared to peers with an improvement in LS. The relationship between current LS and FRS had a J-shape in men; FRS was lowest in men with an LS of 5–7 (average LS), slightly higher in men with an LS of 8–10 (highest LS), and highest in men with an LS of 1–4 (lowest LS). Among women, there was an inverse linear relationship between LS and FRS: the higher the LS, the lower FRS. There was a strong linear relationship between predicted LS and CVD risk. Highest risk was evident in subjects with low LS in whom low LS was predicted over the next five years.

Conclusions: Low LS (dissatisfaction) thus has a long-term negative effect on CVD risk in Polish adults of both sexes.

Key words: Framingham Risk Score, lifestyle, cholesterol, blood pressures, body mass index.

Introduction

Cardiovascular disease (CVD) is a major public health problem that has reached epidemic proportions in the western European countries. Recent estimates of the World Health Organization [1] indicate that every year 17 million people globally die of CVD, mainly heart attack and stroke. By 2015, 20 million people will die of CVD annually. At the same time, CVD mortality has steadily declined in Western Europe and in some new European Union countries over the past 30 years [1].

The origin of CVD is multifactorial. Classical risk factors such as hypertension, diabetes mellitus, high alcohol consumption, dyslipidaemia and smoking may explain about 60% of the variance in CVD risk [2]. It is assumed that the remaining 40% of variance includes a variety of psychological factors such as anger, social isolation and type A behaviour, all of which have been associated with increased morbidity and mortality from coronary artery disease (CAD) [3]. There is also a large body of evidence suggesting that stress, including occupational stress, may be related

to the development of CVD independently of classical risk factors [4, 5]. When assessing the effect of psychological factors on CVD risk, it is important to consider the total spectrum of mental well-being.

Life satisfaction (LS), an indicator of subjective well-being, is a persistent characteristic that is not related to mood changes over consecutive days [6, 7]. Life satisfaction can be used as a barometer for determining how an individual adapts to his/her current life situation. The effect of life satisfaction on cardiovascular condition has not been studied enough, especially in context of the change of life satisfaction during life. It is not known whether retrospective, current and prospective LS has an effect on CVD risk.

Therefore, the purpose of this study was to determine the impact of past, current and projected LS upon CVD risk in Polish adult men and women.

Material and methods

We analyzed data for subjects examined during the Program for the Prevention of Cardiovascular Disease carried out in 2007 by the Health Department in the Municipal Council in Wrocław in cooperation with the Institute of Anthropology of the Polish Academy of Sciences. All inhabitants of Wrocław 40 to 50 years of age were invited to participate in the screening programme. The response rate was approximately 25%. Unfortunately, we are not able to assess whether and to what extent this material had selective character. Men and women included in the study did not suffer from any essential chronic diseases and on physical examination they presented no pathologies. We studied an ethnically homogeneous group with no national, linguistic, religious or racial minorities. Fundamental exclusion criteria included: not being an inhabitant of the city of Wrocław, Lower Silesia, Poland and taking serious medications. The final sample used for analysis included an anthropologically homogeneous group of 489 men and 591 women.

The standard clinical visit for each subject included the following: cardiologist consultation; resting electrocardiogram; assessment of vital signs, including resting systolic and diastolic blood pressures; measurement of fatness using the BMI (weight [kg]/(height [m])² and WHR (waist circumference [cm]/maximal hip circumference [cm]); basic laboratory tests, including fasting plasma levels of glucose, total cholesterol (TCH), low-density-lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) and triglycerides (TG); a questionnaire regarding the information on social status of the participant and his/her family, educational level, professional career, and selected elements of lifestyle. The standard laboratory tests

were performed by a certified medical laboratory using Cobas Integra System by Roche.

Information on health status and lifestyle was used to derive a Framingham Risk Score (FRS) for each individual. The FRS incorporates age, sex, LDL-C, HDL-C, systolic and diastolic blood pressures, presence of diabetes mellitus, and smoking status. Total FRS values were calculated separately for men and women (range of values: minimum: -17; maximum: 25). The index was developed on the Framingham Heart Study Cohort and was designed to predict the 10-year risk of major adverse coronary events, including mortality due to CAD, combined with non-fatal myocardial infarction [8, 9].

The Self-Anchoring Self-Esteem Scale (SASES), also termed the Cantril Ladder or Life Satisfaction (LS), was used to assess psychological status. The SASES is an adaptation of the Self-Anchoring Striving Scale [7]. Life satisfaction measured by the Cantril Ladder is stable over time and is generally resistant to temporal fluctuations [10]. It is a relatively simple and easy tool to use. It does not interfere with the privacy of subjects. SASES may be slightly more sensitive to temporal changes in self-esteem LS compared with other scales that estimate LS, e.g., the Rosenberg scale [11].

Life satisfaction can be used as a global and domain-specific indicator. The latter permits the weighting of different domains of LS – work, health, leisure, wealth, etc., according to an individual's personal value system. This measure of LS is more subjective and is multidimensional. Cantril [7] proposed that overall life satisfaction can be assessed as the difference between the expectations and satisfactions of respondents. Because subjects are free to indicate any type of characteristic important to self-esteem, it can be used as a barometer for determining how an individual can adapt to his/her life, illness and/or negative bad events. Low self-esteem of LS can be an indicator of the extent to which an individual is suffering from poor mental health and low quality of life or is adjusting or adapting poorly to his/her illness experience [11]. In the present analyses, LS was used as a global indicator.

The methodology proposed by Cantril [7, 11] was used for estimating physiological well-being. It requires individuals to subjectively define high and low endpoints of a 10-point scale (ladder) prior to providing numerical ratings. Life satisfaction was self-estimated by the Cantril Ladder. The protocol uses an illustrated scale with ten levels accordingly: "Imagine that the highest level represents the best life satisfaction, while the lowest level represents the worst life satisfaction. Which level, in your opinion, is in agreement with your current life at the time of the interview?" Participants were also asked to provide retrospective ratings for the past 5 years and prospectively for 5 years into the future,

relative to present LS. This methodology permits an estimate of temporal change in LS, i.e., decrease, increase or stable [12]. LS scores were classified as follows: LS 8–10, major satisfaction; LS 5–7, average satisfaction; and LS 1–4, dissatisfaction.

Two additional variables were derived to describe changes in LS over time: change between the past (5 years ago) and the present (time of study), and projected change into the future (next 5 years) from the present. The present analysis not only considered the direction of change in Cantril scores over time, but also the level of LS at the time of study.

We hypothesised that health consequences associated with a reduction in LS by at least 3 points depend on initial LS estimated for 5 years ago. The change category was established on the basis of LS estimated for the past 5 years and at the time of study. Change in LS was grouped into 15 categories. For example: category 1 included subjects who were dissatisfied 5 years ago and remained at the same level of LS (LS 1–4 points), but their current LS is lower than 5 years ago; category 2 included subjects who were and remained dissatisfied (LS 1–4), but currently had an LS the same as it was 5 years ago.

Statistical analysis

Three series of analyses of variance were done to test the hypotheses that there is a sex difference in the strength of relationships between CVD risk (FRS) and respectively, past LS, present LS, and predicted LS. Chi-square (χ^2) was used to test the significance of sex differences in socioeconomic status and lifestyle. The significance of differences in anthropometric and physiological variables between separate categories of Cantril scores was assessed with a one-way analysis of variance. Relationships between LS and FRS were tested by sex-

specific two-way analysis of variance. Statistical analysis was performed using Statistica 10.0 and p values ≤ 0.05 were considered as statistically significant.

Results

Means and standard deviations for anthropometric and physiological variables for men and women classified into three groups by current assessment of LS were analysed. Differences in total TCH and LDL-C were significant in men by current LS (for TCH $F = 5.1$, $p \leq 0.01$; for LDL-C $F = 2.9$, $p \leq 0.05$), while none of the variables differed in women by current LS. However, FRS differed significantly in both men and women by current LS (respectively: $F = 5.26$, $p \leq 0.01$; $F = 6.46$, $p \leq 0.001$); differences were greater in women than in men. The relationship between LS and FRS had a J-shape in men. The FRS was highest (4.3) for men with low LS, lowest (2.7) for men with average LS, and intermediate (3.0) for men with high LS. Among women, the relationship between LS and FRS was linear and inverse. The FRS declined with an increase in LS: 1.92 (low LS), 1.06 (average LS) and 0.42 (high LS).

There were independent effects of sex and changes in LS over time on CVD risk (Table I). Women had lower FRS, on average, than men in all categories of current LS. Subjects in whom LS declined over time had higher FRS compared to peers who in whom LS improved over time. Subjects, particularly men, without change in LS had higher CVD risk compared to those in whom LS declined over the past 5 years. More detailed analyses showed that FRS was dependent on initial LS estimated for the past 5 years. Men with past LS > 7 and present LS < 5 had higher FRS by almost 5 points than men in whom LS increased from low (LS: 1–4) to high (LS: 8–10) over the past 5 years

Table I. Results of a two-way analysis of variance where sex and (a) change in LS over time: 5 years ago \rightarrow time of the study, (b) present LS, and (c) change in LS over time: time of the study \rightarrow in next 5 years were determinants of FRS

Variable	Mean squares	F test	Value of p
a)			
1. Sex	1080.59	55.52	≤ 0.001
2. Change over time in LS: 5 years ago \rightarrow time of study	99.07	5.09	0.006
Interaction	19.66	1.01	0.37
b)			
1. Sex	1178.48	60.94	≤ 0.001
2. LS at time of study	159.53	8.25	≤ 0.001
Interaction	58.01	3.00	0.05
c)			
1. Sex	760.77	40.08	≤ 0.001
2. Change over time in LS: time of study \rightarrow in next 5 years	205.83	10.83	≤ 0.001
Interaction	24.12	1.27	0.28

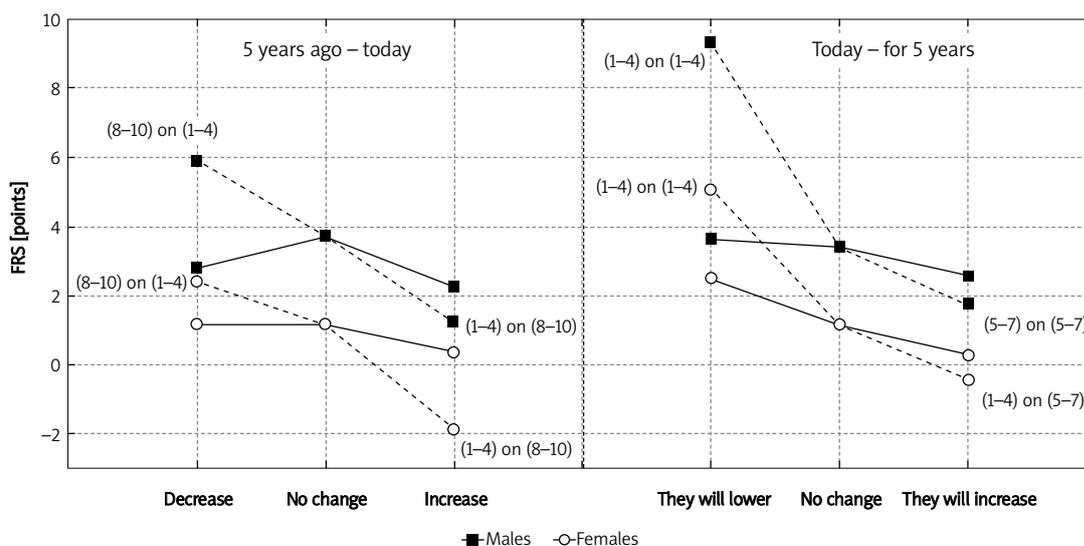


Figure 1 Mean FRS in prespecified categories of changes over time in LS (from past 5 years to the time of the study and from time of study to the next 5 years) in men and women

(Figure 1 – the dashed line). Similar results were noted in women (Figure 1).

Sex and current Cantril scores significantly influenced FRS (Table I). The effect of sex on FRS was seven times greater than the effect of current LS ($F = 60.94, p \leq 0.001$ and $F = 8.25, p \leq 0.001$, respectively). Men with the lowest current LS had FRS two times higher compared to women with the same level of current LS. Women with $LS > 7$ had higher FRS by more than 3 points than men in the same category. In men, the relationship between current LS and FRS had a J-shape, i.e. men with average LS had the lowest FRS, those with high LS had slightly higher FRS, while those with low LS had the highest FRS. The corresponding relationship was inverse and linear in women.

The results of the third series of analyses (Table I) revealed a strong relationship between predicted LS and CVD risk ($F = 10.83, p \leq 0.001$). The association was linear in both sexes, with a more distinct pattern in women. Irrespective of sex, the highest CVD risk was present in subjects with low LS who predicted a further lowering of LS in the forthcoming 5 years. The lowest CVD risk was found in men with average LS at the time of study who declared that their LS would improve slightly (and not reach a high level). Among women, the lowest CVD risk occurred in those who predicted a change in LS from low to average (Figure 1). The dashed line in Figure 1 shows the mean FRS trends in a few prespecified categories of changes over time in LS in males and females.

Discussion

This study provides prospective evidence that self-reported low LS is associated with increased

CVD risk in the general adult population of Wrocław, Poland. The results highlight relationships between LS at three time points (past, present and future LS) and CVD risk among middle-aged adults. The results are apparently novel.

The results indicate that men with better LS have, paradoxically, higher estimated CVD risk compared to those with average or mid-range LS. This might be related to the observation that LS in men results mainly from professional position, educational level and income [13] and the lowest quartile of happiness is associated with poverty [14]. Men at the highest levels of the Cantril Ladder and having a high professional position are at the same time exposed to long-lasting stress of great magnitude. For women, LS is related mainly to social status, marital status, family life, etc.; as such, high LS is not accompanied by daily stress associated with professional life. Also, women may also be less likely to develop a Framingham type A behaviour than men [15]. On the other hand, the social gradient for coronary heart disease mortality is stronger in women than in men so that psychosocial rather than economic factors affect women more adversely than men [16]. It may be proposed, therefore, that Polish men with high LS have higher professional positions which are related to chronic exposure to stress, which in turn contributes to unfavourable CVD risk. Polish women with high LS, on the other hand, are largely satisfied with their status in life.

Projected LS affects CVD risk to a greater extent than past LS in men and women. Neurologists and psychologists suggest that past and future events evoke similar patterns of brain activation [17] so that recall of the past and projection into the future may rely on similar mechanisms [18]. Other authors

have confirmed a major role for prediction of LS in determining CVD risk [19], which is consistent with observations in Polish adults. It has also been suggested that location of a person's attitude with respect to an experienced event is more strongly directed to future prediction than to past recollection [19]. The results for Polish adults suggesting that prediction of improvement in LS in the forthcoming 5 years was related to a reduction in CVD risk may have some basis in the preceding observations of others. Representations of positive events are associated with a greater feeling of re- or pre-experiencing [20]. It may be concluded that optimistic thinking about the future and imaging about possible future events can contribute to a reduction in CVD risk in adult men and women.

Sex differences in the relationship between LS and CVD risk observed in the present study may be explained by the results of other authors. According to Penninx *et al.* [21], older men with minor depression had a higher risk of mortality by 1.8 times (95% CI: 1.35–2.39) than men without minor depression, whereas women of the same age with and without minor depression did not differ in mortality. Depression was also a predictor of stroke in risk-adjusted models for men and women [22], but the odds ratio was only of borderline significance in women (RR = 1.52, 95% CI: 0.97–2.38, $p = 0.07$). Sex differences in response to pain were also associated with LS in post-stroke patients [23]. Among patients with a previous stroke, each 1-point increase on a pain rating scale was associated with an 18% and 11% decrease in odds of being satisfied in men and women, respectively. It has also been suggested that physiological, behavioural and psychological adaptation is poorer in men than in women [24]. Women apparently have increased vulnerability to stressful stimuli during the first months after an adverse life event compared to men, but at the same time adapt more quickly to the stress. However, men generally have rather limited coping strategies for stressful life events compared to women [25]. It may be reasonable to assume, therefore, that Polish men are more sensitive to stressful life stimuli than Polish women. This may explain, in part, why men have higher CVD risk irrespective of LS.

Life satisfaction is related to other health indicators such as self-reported health status, adverse psychosocial status and health behaviours [26]. Life satisfaction is also associated with other potential health hazards, such as poor health behaviours or living alone [27]. It means that negative perceptions of different aspects of life may predispose some individuals to unhealthy behaviours. These observations and suggestions are supported by the results of this study of Polish adults. In the present study, the prevalence of health hazard behaviours

(e.g. smoking cigarettes, frequently drinking alcohol, drinking coffee) among men and women with low LS is significantly higher than in those with high LS. Therefore this may lead to lower health status.

Subjective LS and CVD risk are presumably causally related. However, the mechanisms underlying the potential relationships remain unclear. They may be partially linked to autonomic imbalance with a predominance of sympathetic tone [22]. On the other hand, it can be hypothesized that high life satisfaction may act to promote a healthy life style through increased physical activity, motivation for self-care, increased social support, reduced hazardous health behaviours, and perhaps other aspects of lifestyle. This behaviour pattern may also stimulate physiological systems to improve health status [28].

In conclusion, the measure of life dissatisfaction at the population level may serve as a general health risk factor. LS as an early indicator of poor health prognosis should be considered a useful tool in programmes of health promotion, in prevention strategies and clinical practice. Information about the level of LS can help in detecting a target subgroup from the general healthy population who are characterized by low subjective well-being and a high risk of CVD disease. It might enable the introduction of early interventions in order to prevent a probable accumulation of various hazardous health behaviours over the lifetime with subsequently unfavourable CVD consequences.

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