Cardiovascular Risk in Midlife and Psychological Well-being Among Older Men

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Background: Negative and positive affects influence the prognosis in the elderly, but underlying mechanisms are obscure. We investigated whether cardiovascular disease risk in midlife is related to psychological well-being in older men (aged 69-84 years old).

Methods: A socioeconomically homogeneous volunteer sample of men, born from 1919 through 1934, was followed up for 29 years. At baseline in 1974, they were healthy but considered to be at low (n=593) or high (n=610) risk of cardiovascular diseases (repeatedly 1 or more of classic cardiovascular risk factors). From November 1, 2002, through March 31, 2003, a mailed questionnaire was used to assess psychological well-being in older survivors. Mortality up to December 31, 2002, was retrieved from national registers.

Results: During the entire follow-up, 303 men died, 127 (21.4%) and 176 (28.9%) in the low- and high-risk groups, respectively (hazard ratio, 1.54; 95% confidence interval, 1.19-2.00; P=.001). From 2002 through 2003, the response rates were 73.7% (336/456) and 71.4% (297/416) in the low- and high-risk groups, respectively (P=.45), and the mean age was 76 years. The variables related to psychological well-being were consistently better in the low-risk than in the high-risk group as they became older. The differences were observed especially in life satisfaction (P=.02), feeling of happiness (P=.001), positive life orientation as a whole (P=.04), and the Zung depression score (P=.007). The difference in the feeling of happiness between the groups prevailed (P=.01) after adjustments, including the feeling of depression.

Conclusion: Low cardiovascular risk in midlife was associated not only with better survival but also with better psychological well-being in the elderly.

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Low levels of traditional risk factors are associated with lower incidence of cardiovascular disease, lower mortality, and greater longevity.1,2 However, the concept of successful aging3 is more than the absence of disease and prolongation of life. It is also important how these extra years are spent—physically and mentally. During the past few years, increasing attention has been paid to the possible influence of cardiovascular risk in midlife on health-related quality of life in the older years.3,4 For example, in our long-term follow-up in the Helsinki Businessmen Study, we found that the survivors who were assessed to have low cardiovascular risk 3 decades earlier had better health-related quality of life (assessed with the RAND 36-Item Health Survey) than did men at high risk as they became older (on average at age 73 years).4 We renewed the mailed questionnaire study from 2002 through 2003, and because the RAND 36-Item Health Survey may give too narrow a perspective into psychological well-being, we included questions related to negative affect (depression) and positive affect (optimism, positive life orientation, happiness).5

Negative affective states are well known to associate with poorer outcomes, for example, excess mortality.5 During recent years, interest also has been growing in the independent effects of positive affect,6 which is not simply the opposite of negative affect. Positive affect was associated with less stroke,10 life satisfaction was related to long-term mortality among healthy adults,11 and positive life orientation predicted long-term survival in older people.12 The mechanisms behind these effects are not clear. Positive emotions may be a lifelong trait and promote a health-conscious lifestyle. Furthermore, results of a recent study showed that positive affect in middle-aged individuals was directly related to biological processes (cortisol output, heart rate, and fibrinogen stress re-
sponse) associated with beneficial health effects. On the other hand, positive affect may be modulated during the life course.

Our hypothesis was that the cardiovascular risk of men in midlife would be associated with negative and positive affect as they became older. Because cardiovascular risk and risk factors, as well as happiness, also depend on socioeconomic factors, the strength of our study is that our cohort is homogeneous. Consequently, the results may offer a clearer test than population studies of the effect of risk factors per se on psychological well-being.

METHODS

BASELINE EXAMINATIONS IN 1974

The cohort and examinations were described previously. A volunteer sample of initially 3490 healthy men, mostly business executives born from 1919 through 1934, had participated in structured health check-ups during the 1960s and early 1970s at the Institute of Occupational Health in Helsinki. During the visits, they received health education to improve their risk factors. They were evaluated with questionnaires, clinical examinations (including electrocardiograms), and laboratory tests in 1974. Blood pressure was measured with a mercury sphygmomanometer with the subject in a sitting position after a 10-minute rest. Heart rate was calculated from the resting electrocardiograms. Fasting serum cholesterol and triglyceride levels were measured by using standard methods.

In the present study, we corrected the 1974 cholesterol values to correspond with measurements by using modern methods. Millimoles of blood glucose per liter was measured 1 hour after a glucose load of 1 gram of glucose administered orally per kilogram of body weight. Smoking was determined on the basis of a self-reported questionnaire (number of cigarettes per day). Alcohol consumption (beer, wine, and liquor separately) was assessed with the questionnaire and calculated as grams of ethanol per week. Alcohol consumption was categorized as described previously in 3 groups: zero, moderate (1-349 g/wk), and high (>349 g/wk) consumption. In 1974, the relative body weight as a percentage, calculated as body weight in kilograms multiplied by 100 and divided by height in centimeters minus 105, was used to characterize overweight. However, body mass index, calculated as weight in kilograms divided by height in meters squared, is reported in the present analyses. In 1974, the men were asked to recall their weight at age 25, from which the weight gain up to midlife was calculated.

According to aforementioned risk factor measurements in 1974, 593 men with low and 610 men with high levels of risk factors (despite years of health education) were identified. These groups acted as control groups in a 3-year multifactorial intervention trial between 1974 and 1980.

Risk-factor status was based on the following 6 variables: (1) relative body weight (≥20%, corresponding to body mass index of 27.8), (2) smoking (>10 cigarettes per day), (3) systolic and diastolic blood pressure (>160/95 mm Hg), (4) serum cholesterol level (>7.0 mmol/L, corresponding to 6.4 mmol/L measured with modern methods), (5) serum triglyceride levels (>1.7 mmol/L), and (6) 1-hour postload glucose level (>9.0 mmol/L). To be rated at high risk, at least 1 of the 6 risk factors had to be present on 2 occasions (except only once for 1-hour glucose); otherwise, the classification was low risk. The mean number of risk factors in the high-risk group was 2.1.

All 1203 men were working, active, and healthy at baseline in 1974. None had signs of chronic diseases, they used no regular medications (such as antihypertensive or antidiabetic medications), and their electrocardiograms showed no signs of cardiac disease. Psychological well-being was not specifically assessed at that time, but the men were asked to assess their physical fitness and present health on a 5-step scale. Self-rated health was used as a covariate in multivariate models.

MORTALITY FOLLOW-UP

Total mortality of the study population up to December 31, 2002, was retrieved from the National Population Information System (available at: www.vrk.fi), which keeps registry of all Finnish residents. According to the register, assessment of vital status is reliable for people having their permanent place of residence in Finland (>95% of the present cohort) irrespective of whether they die in Finland or abroad. Moreover, assessment of vital status is also reliable for Finnish residents living permanently abroad.

THE 2000 SURVEY OF HEALTH-RELATED QUALITY OF LIFE

In 2000, we mailed a questionnaire to all survivors (remailed once for nonrespondents). The questionnaire included items on demographic variables and lifestyle, such as smoking, alcohol consumption, and physical activity. In addition, the Finnish version of the RAND 36-Item Health Survey 1.0 (practically identical to the 36-Item Short-Form Health Survey) was embedded in the questionnaire. We used the physical and mental component summaries to compare respondents and nonrespondents in the present study.

THE 2002-2003 SURVEY OF NEGATIVE AND POSITIVE AFFECT

From 2002 through 2003, we renewed our mailed questionnaire survey (remailed once for nonrespondents). The questionnaire included partly the same items as the 2000 survey (symptoms and diseases, present medications, and present weight). In addition, there were several questions about attitudes toward life, which we used in another study of the elderly, and which domains have been suggested to be major components of psychological well-being among older people. The following questions were asked: (1) Are you satisfied with your life? (yes/no), (2) Do you have zest for life? (yes/no), (3) Do you feel needed? (yes/no), (4) Do you have plans for the future? (yes/no), (5) Do you suffer from loneliness? (seldom or never/sometimes/often or always), and (6) Do you feel yourself depressed (seldom or never/sometimes/often or always). Positive life orientation was assessed to be present if the participant answered yes or seldom/never to these 6 questions, which is important because positive life orientation can predict mortality in the elderly.

The participants were asked to rate their whole life course (life experiences, fullness of life, etc) by using the Finnish school marks on a scale of 4 (worst) to 10 (best). Ten-centimeter visual analogue scales were used to assess self-rated health (0=worst, 10=best), present global happiness (0=very unhappy, 10=very happy), and personal work history (0=extremely stressful, 10=not at all stressful). Negative affect was further assessed with the Zung self-rating depression scale, widely used in epidemiological studies, embedded in the questionnaire. It consists of 20 items that were coded into a score as instructed. A Zung score below 50 points was considered normal, a score of 50 to 59 indicated mild depression, and a score of 60 to 69 indicated moderate to marked depression.
**STATISTICAL ANALYSIS**

Commercially available statistical software (NCSS, Kaysville, Utah) was used for the analyses; *t* test and nonparametric tests, where appropriate, were used to compare continuous variables, and *χ*² tests were used to compare proportions. Total mortality in the 2 study groups was compared using the Kaplan-Meier methods with the log-rank test. Multivariate analysis was used to determine independent predictors. Proportional hazards regression was used to determine hazard ratios and 95% confidence intervals. *P* < .05 was considered statistically significant.

**RESULTS**

**CHARACTERISTICS AT BASELINE IN 1974**

Baseline characteristics of the low- and high-risk groups in 1974 are shown in **Table 1**. The average levels of all risk factors and the consumption of alcohol were higher in the high-risk group than in the low-risk group. The men at high risk also had gained significantly more weight from age 25 to midlife.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low-Risk Group (n = 593)</th>
<th>High-Risk Group (n = 610)</th>
<th><em>P</em> Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>47 ± 4</td>
<td>48 ± 4</td>
<td>.02</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>24.6 ± 2.0</td>
<td>26.2 ± 2.7</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Weight gain from age 25, kg†</td>
<td>6 (2-10)</td>
<td>11 (6-16)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Resting heart rate, beats per minute</td>
<td>61 ± 10</td>
<td>65 ± 12</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Blood pressure, mm Hg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>129 ± 11</td>
<td>146 ± 19</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diastolic</td>
<td>83 ± 8</td>
<td>94 ± 11</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Serum cholesterol, mmol/L‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>5.5 ± 0.6</td>
<td>6.5 ± 1.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diastolic</td>
<td>1.10 (0.80-1.40)</td>
<td>1.60 (1.20-2.15)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>One-hour postload glucose, mmol/L†</td>
<td>6.1 (5.2-7.1)</td>
<td>7.2 (5.8-9.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Smokers, %§</td>
<td>14.7</td>
<td>37.2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Alcohol consumption, g/wk†</td>
<td>98 (42-182)</td>
<td>126 (56-252)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Conventional unit conversion factors: To convert cholesterol to milligrams per deciliter, divide by 0.0555; triglycerides to milligrams per deciliter, divide by 0.01129.

*Data are given as mean ± SD unless otherwise stated. For definition of low and high cardiovascular risk, see the “Baseline Examinations in 1974” subsection of the “Methods” section.

†Median (interquartile range).

‡Converted to modern values.¹⁷

§Defined as a present smoker irrespective of numbers of cigarettes or type of smoking (pipe, cigar, cigarettes).

**MORTALITY DURING FOLLOW-UP**

By December 31, 2002, 303 (25.2%) men had died, 21.4% (127/593) in the low-risk group and 28.9% (176/610) in the high-risk group. Unadjusted, cumulative total mortality curves are shown in the **Figure**. The relationship between mortality and risk group was investigated further by using proportional hazards regression analysis, which was adjusted for age. During the entire 29-year follow-up, the high-risk group had a 54% higher mortality than did the low-risk group (hazard ratio, 1.54; 95% confidence interval, 1.19-2.00; *P* = .001). In the entire cohort (low- and high-risk groups combined), those who died during follow-up (vs survivors) were significantly older (*P* < .001); had gained more weight up to midlife (*P* = .001); and had higher baseline serum cholesterol levels (*P* = .03), higher postload glucose levels (*P* = .002), and higher systolic blood pressure (*P* = .02).

**HEALTH-RELATED QUALITY OF LIFE OF SURVIVORS IN 2000**

Among survivors (mean ± SD age, 73 ± 4 years), the response rates in 2000 were 91.1% (448/492) and 89.1% (407/457) in the low- and high-risk groups, respectively. The mean RAND 36-Item Health Survey scores for the physical component summary were 47.7 and 44.8 in the low- and high-risk groups, respectively (*P* < .001). The mean values for the mental component summary were 53.7 and 53.4, respectively (*P* = .72).

**QUESTIONNAIRE FOLLOW-UP FROM 2002 THROUGH 2003**

From 2002 through 2003, 336 men in the low-risk group and 297 men in the high-risk group responded to our survey, giving response rates of 73.7% and 71.4%, respectively (between groups, *P* = .45). The mean age was 76 years. Nonrespondents and respondents in...
in 1974, and feeling of depression in 2002. The data further strengthen the similar socioeconomic status of the 2 groups. Despite higher mortality in the high-risk group and selective survival, the gradient in risk factors between the groups had prevailed although the differences were smaller compared with that at baseline.

Variables related to psychological well-being and attitudes toward life are shown in Table 3. Although not all differences are statistically significant, the data are consistently better in the original low-risk group compared with the high-risk group. Significant differences are seen in life satisfaction, feeling of happiness assessed with the visual analogue scale, positive life orientation as a whole, the Zung depression score, and self-rated health. In addition, the difference in the feeling of happiness between the groups prevailed after adjustment for age, years of education, self-rated health in 1974, alcohol consumption in 1974, and feeling of depression in 2002.

We further tested the difference in the feeling of happiness (visual analogue scale) with multivariate analysis. The difference between the low- and high-risk group prevailed (P = .01) after adjustment for age, years of education, self-rated health in 1974, alcohol consumption in 1974, and feeling of depression in 2002.

The main finding of the present study was that low cardiovascular risk in midlife was associated not only with lower follow-up mortality but also with better psychological well-being among the surviving older men almost 3 decades later. Although not all variables of well-being were statistically significant, the results were consistent, and significant differences were observed in measurements of depression and feeling of happiness. In addition, the difference in the feeling of happiness between the groups prevailed after adjustment for the feeling of depression.

The difference in well-being may be explained by less morbidity (hypertension, diabetes mellitus, congestive heart failure, musculoskeletal disease, chronic pulmonary disease) in the low-risk group as they became older. Furthermore, an interesting observation was the higher alcohol consumption in the high-risk group at baseline.

In the present population with a mean age of 76 years, our long-term follow-up results also may suggest a possible mediating mechanism (ie, lower cardiovascular risk) for the beneficial effect of psychological well-being on prognosis.

The differences between the low- and high-risk groups are not large, but the results should be taken to support a mechanism-effect of cardiovascular risk and its sequelae on psychological well-being. We think that the differences observed in our study do not reflect the full beneficial potential of low cardiovascular risk. There are several possible explanations for the small differences.

COMMENT

The differences related to psychological well-being and attitudes toward life are shown in Table 3. Although not all differences are statistically significant, the data are consistently better in the original low-risk group compared with the high-risk group. Significant differences are seen in life satisfaction, feeling of happiness assessed with the visual analogue scale, positive life orientation as a whole, the Zung depression score, and self-rated health. In addition, the difference in the feeling of happiness between the groups prevailed after adjustment for the feeling of depression.

The difference in well-being may be explained by less morbidity (hypertension, diabetes mellitus, congestive heart failure, musculoskeletal disease, chronic pulmonary disease) in the low-risk group as they became older. Furthermore, an interesting observation was the higher alcohol consumption in the high-risk group at baseline. However, moderate alcohol consumption did not affect the quality of life in our cohort. The inclusion of alcohol use in the multivariate analysis did not explain the difference in happiness between the groups. Irrespective of the exact underlying mechanism, the present results may indicate an important extra benefit of cardiovascular prevention in men—happier older years. Because positive life orientation protected against institutional care and mortality during a 10-year follow-up in a study in individuals 75 years and older, the full potential of low cardiovascular risk only begins to be seen in the present population with a mean age of 76 years.

Our long-term follow-up results also may suggest a possible mediating mechanism (ie, lower cardiovascular risk) for the beneficial effect of psychological well-being on prognosis.

The differences between the low- and high-risk groups are not large, but the results should be taken to support a mechanism-effect of cardiovascular risk and its sequelae on psychological well-being. We think that the differences observed in our study do not reflect the full beneficial potential of low cardiovascular risk. There are several possible explanations for the small differences.

First, the concept of low and high risk should be seen as relative, because even in the low-risk group the levels of risk factors at baseline were far from optimal and, for example, light smoking did not exclude low-risk status (Table 1). According to modern standards, the group defined as low risk in 1974 might today be considered an intermediate-risk group. Also, the selection procedure for the risk group deserves comment. To be categorized as being at high risk, the participant’s risk factors (except postload glucose) had to be higher than the predetermined limits on 2 occasions. Thus, all men in the high-risk group had risk factors repeatedly, whereas men with more labile risk factor levels were included in the low-risk group. This method of categorization probably dilutes differences between the groups. Second, the long-term follow-up of the cohort leads to selection through mortality, and those with higher levels of risk factors were more likely to die. Moreover, survivors may have uni-
Table 3. Variables of Psychological Well-being in 2003 in the Low- and High-Risk Groups Defined in 1974

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low-Risk (n = 336)</th>
<th>High-Risk (n = 297)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfied with life, yes/no</td>
<td>318/11 (96.7)</td>
<td>272/20 (93.2)</td>
<td>.02</td>
</tr>
<tr>
<td>Feeling needed, always or most of the time/at times or often</td>
<td>118/210 (38.0)</td>
<td>92/198 (31.7)</td>
<td>.13</td>
</tr>
<tr>
<td>Having plans for the future, yes/no</td>
<td>222/98 (69.4)</td>
<td>185/105 (63.8)</td>
<td>.07</td>
</tr>
<tr>
<td>Having zest for life, yes/no</td>
<td>327/4 (98.8)</td>
<td>284/9 (96.9)</td>
<td>.05</td>
</tr>
<tr>
<td>Feeling of depression, never or seldom/at times or often</td>
<td>192/138 (58.5)</td>
<td>157/134 (54.0)</td>
<td>.13</td>
</tr>
<tr>
<td>Feeling of loneliness, never or seldom/at times or often</td>
<td>288/40 (87.8)</td>
<td>257/37 (87.4)</td>
<td>.56</td>
</tr>
<tr>
<td>Positive life orientation, yes/no</td>
<td>71/265 (21.1)</td>
<td>47/250 (15.8)</td>
<td>.04</td>
</tr>
<tr>
<td>How do you rate your life course on a scale from 4 (worst) to 10 (best)†</td>
<td>6.6 (0.04)</td>
<td>6.5 (0.04)</td>
<td>.05</td>
</tr>
<tr>
<td>9-10 (excellent marks)/&lt;9</td>
<td>180/147 (55.0)</td>
<td>148/144 (50.7)</td>
<td>.14</td>
</tr>
<tr>
<td>How do you rate your work life (0 = very stressful, 10 = very unstressful)‡</td>
<td>5.4 (0.15)</td>
<td>5.1 (0.16)</td>
<td>.23</td>
</tr>
<tr>
<td>How do you rate your present happiness (0 = very unhappy, 10 = very happy)‡</td>
<td>7.7 (0.09)</td>
<td>7.3 (0.09)</td>
<td>.001</td>
</tr>
<tr>
<td>How do you rate your present health (0 = very bad, 10 = excellent)‡</td>
<td>6.5 (0.1)</td>
<td>6.0 (0.1)</td>
<td>.004</td>
</tr>
<tr>
<td>Zung score, points†</td>
<td>34.3 (0.4)</td>
<td>36.0 (0.4)</td>
<td>.007</td>
</tr>
<tr>
<td>Zung score, categorization, points</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50</td>
<td>242 (97.6)</td>
<td>205 (94.0)</td>
<td></td>
</tr>
<tr>
<td>50-59</td>
<td>6 (2.4)</td>
<td>12 (5.5)</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>0</td>
<td>0 (0.5)</td>
<td>.03</td>
</tr>
<tr>
<td>Subjective memory disturbance, yes/no</td>
<td>23/291 (7.3)</td>
<td>27/248 (9.8)</td>
<td>.14</td>
</tr>
</tbody>
</table>

*Percentages are calculated from the actual number of respondents.
†Continuous variables (mean with SE) are adjusted for age.
‡Measured by means of a 10-cm visual analogue scale.

Identified protective factors. Third, the difference in cardiovascular risk was attenuated between the groups (Table 2) because of medications and possible changes in lifestyle, such as smoking. Finally, all men were from the highest socioeconomic class, which itself is a protective factor, and almost all men were living at home with their spouses. All these factors tend to move our hypothesis toward null.

The 2002-2003 response rate in this elderly cohort was satisfactory (average 73%), and there was no significant difference between the groups. The lower response rate compared with the survey in 2000 (response rate of 90%) may be due to the aging of the cohort, with more cognitive problems, but a more probable explanation is that the 2002-2003 questionnaire was expanded substantially compared with the 2000 questionnaire. The socioeconomic homogeneity of our cohort is both a limitation and a strength of our study. On one hand, extrapolating the results to the general population and to women should be done cautiously. On the other hand, the confounding effects of social status on psychological well-being were minimized. Another clear limitation that must be taken into account when interpreting our results is that psychological well-being was not assessed at baseline in 1974. Differences between the groups may well have existed already at that time, as men at low risk rated their physical condition and general health better than men at high risk in 1974. Dispositional optimism has also been shown to be a relatively stable trait at least in elderly men. These considerations do not necessarily nullify our conclusions that low cardiovascular risk is beneficial for well-being—the perspective should be stretched out to an earlier point during the life course. It is entirely possible that genetic factors and early life phenomena primarily drive happiness and cardiovascular risk rather than intervening factors and events during a lifetime. Only lifelong studies can resolve this issue. In the present cohort, the low cardiovascular risk in midlife primarily was determined by genetic factors and lifestyle because the men had no preventive drug treatment at baseline. An important background factor is weight gain up to midlife, which was significantly lower in the low-risk group. Lower weight gain predicted better health-related quality of life in the present cohort.

An intriguing issue is whether long-term risk factor modification with modern drug treatment, such as statins for dyslipidemia, angiotensin-converting enzyme inhibitors and angiotensin receptor blockers for hypertension, and rimonabant for weight reduction, would provide the same benefit for psychological well-being.

What are the clinical implications of these results for men’s health and successful aging? With increasing life expectancy and an expanding male geriatric population worldwide, it is imperative to prevent disability and keep the physical and mental quality of the extra years as good as possible. The association of lower cardiovascular risk in midlife with happier older years could be used to stimulate better prevention and modification of risk factors early in life.

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REFERENCES