Perceived Level of Life Enjoyment and Risks of Cardiovascular Disease Incidence and Mortality

The Japan Public Health Center–Based Study

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Background—Perceived level of life enjoyment, a positive psychological condition that reflects the ability to engage pleasurably with the environment, may relate to risks of cardiovascular disease. This prospective cohort study attempted to examine the effects of perceived level of life enjoyment on cardiovascular disease incidence and mortality among Japanese community residents.

Methods and Results—Subjects were 88,175 Japanese men and women 40 to 69 years of age who were free of cardiovascular disease at baseline and followed up for a median of 12.0 years and were included in the Japan Public Health Center–Based (JPHC) Study Cohort. Data about psychological conditions and other confounding variables were obtained through self-administered questionnaires. Information on incidence and mortality for cardiovascular disease was collected through registered hospitals and public health centers. The multivariable hazard ratios of cardiovascular disease incidence for men in the high versus low perceived levels of life enjoyment group were 1.22 (95% confidence interval, 1.01 to 1.47) for stroke and 1.23 (95% confidence interval, 1.05 to 1.44) for total cardiovascular disease. As for mortality, Japanese men with low perceived level of life enjoyment showed increased risk: hazard ratios of 1.75 (95% confidence interval, 1.28 to 2.38) for stroke, 1.91 (95% confidence interval, 1.30 to 2.81) for coronary heart disease and 1.61 (95% confidence interval, 1.32 to 1.96) for total cardiovascular disease. For women, however, the perceived level of life enjoyment was not associated with risks of cardiovascular disease incidence or mortality.

Conclusion—A lower perceived level of life enjoyment was found to be associated with higher risks of cardiovascular disease incidence and mortality among middle-aged men, suggesting a protective role of positive psychological conditions on cardiovascular disease. (Circulation. 2009;120:956-963.)

Key Words: cardiovascular diseases ■ incidence ■ happiness ■ mortality ■ risk factors

Although convincing mechanisms remain unclear, large numbers of studies have shown that negative psychological conditions are associated with higher risks of cardiovascular disease incidence and mortality. For instance, associations of depressive symptoms with the incidence of and mortality from coronary heart disease have been well documented. Moreover, associations between signs of a lack of emotional well-being such as anger, hostility, anxiety, and hopelessness and risk of cardiovascular disease have been reported.

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In contrast, fewer studies have examined the association between positive psychological conditions and cardiovascular health prospectively. Dispositional optimism was associated with lower total cardiovascular disease mortality. Optimistic exploratory style and emotional vitality also showed an inverse association with the incidence of coronary heart disease, whereas positive affect was associated with lower risk of stroke incidence. Another study found that trait optimism was associated with reduced progression of atherosclerosis as evaluated by carotid ultrasound. Furthermore, among cardiovascular patients, positive life orientation and positive expectation enhanced recovery after myocardial infarction and heart transplantation. Optimism also has been associated with recovery from coronary artery bypass graft surgery within 6 months. These previous studies,

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however, were conducted mainly on specialized samples of older populations and cardiovascular patients. Thus, little evidence has been available for possible associations between positive psychological conditions and cardiovascular disease incidence and mortality among middle-aged persons living in communities. Moreover, no such studies have been conducted in Asia. Because positive psychological conditions and their effect on health may vary in different cultures, we sought to examine the association between positive psychological conditions and cardiovascular incidence and mortality in a large-scale Japanese cohort study.

Perceived level of life enjoyment can be regarded as a positive psychological condition that reflects a level of pleasurable engagement with the environment. We investigated the association between perceived level of life enjoyment and cardiovascular health prospectively in a large-scale follow-up study of middle-aged Japanese men and women. Our a priori hypothesis was that perceived level of life enjoyment is associated with the incidence of and mortality from cardiovascular disease, independently of traditional risk factors.

Methods

Study Population and Baseline Questionnaire Survey

This study is based on data from a 12-year follow-up survey of a cohort of community-dwelling Japanese adults. The study cohorts were obtained from the Japan Public Health Center–Based Prospective (JPHC) Study, which was consisted of 2 cohorts. Cohort 1 was initiated in 1990; cohort 2 was initiated in 1993 in 27 administrative districts throughout the nation. More detailed information is given elsewhere. The present study was conducted in the 2 cohorts combined. Cohort 1 consisted of 54,498 community residents who were 40 to 59 years of age at baseline when they registered at 14 districts; cohort 2 included 62,398 subjects who were 40 to 69 years of age at baseline when they registered at 13 administrative districts. A baseline self-administered questionnaire was distributed to all the registered residents in 1990 for cohort 1 and in 1993 to 1994 for cohort 2. Of a total of 116,896 residents, 95,383 residents responded to the questionnaire and were included in the study cohort. Overall response rate was 81.6%. Among the registered population, 223 residents were excluded because of non-Japanese nationality, late response rate was 81.6%. Among the registered population, 223 residents were excluded because of non-Japanese nationality, late response rate was 81.6%.

Cardiovascular Disease (MONICA) project, which requires evidence from ECGs, cardiac enzymes, and/or autopsy. In the absence of a diagnosis of myocardial infarction, deaths that occurred within 1 hour from symptom onset were regarded as sudden cardiac deaths. Coronary heart disease was diagnosed as myocardial infarction and sudden cardiac deaths. Stroke was confirmed according to the criteria of the National Survey of Stroke, which requires the presence of focal neurological deficits of sudden or rapid onset lasting at least 24 hours or until death. All registered hospitals were equipped with computer tomographic scans and/or magnetic resonance scans. A definite diagnosis was based on examination of computer tomographic or magnetic resonance images and/or autopsy.

Residence status, including survival, was confirmed through the residential registry. Inspection of the resident registry is available to anyone under the resident registration law. Information on cause of death was obtained from the death certificate, provided by the Ministry of Health, Labor, and Welfare with the permission of the Ministry of Internal Affairs and Communications. All death certificates in Japan are submitted to a local government office and forwarded to the Public Health Center in the area of residence. Mortality data are then sent to the Japan Ministry of Health, Labor, and Welfare and coded for National Vital Statistics, in which cause of death is defined according to the International Classification of Disease, 10th revision (ICD-10). Registration of deaths is mandatory in Japan under the Family Registration Law, and death certificates are obtained from the Japan Ministry of Health, Labor, and Welfare and coded for National Vital Statistics, in which cause of death is defined according to the International Classification of Disease, 10th revision (ICD-10).

Statistical Analysis

Person-years were counted from the date of the return of the baseline questionnaire until one of the following end points. For the analysis of cardiovascular incidence and death, person-years were censored at the date of disease diagnosis, the date of emigration from the study area, the date of death, or the end of study period, whichever came first. For persons lost to follow-up, the last confirmed date of their presence in the study area was used as the date of censoring.

ANCOVA and Chi² tests were used to compare sex-specific age-adjusted mean values and proportions of lifestyle-related and psychosocial risk factors. The outcomes for this study were defined as cardiovascular incidence and deaths during the total follow-up period. Furthermore, to evaluate reverse causation, the mortality data...
excluding deaths occurring 1 to 6 years (before the median of follow-up) from baseline also were analyzed.

Hazard ratios (HRs) and their 95% confidence intervals (CIs) were calculated after adjustment for age and other potential confounding factors with Cox proportional-hazard models. Confounding variables for model 1 were socioeconomic background and lifestyle-related factors: age (years), occupation (unemployed, blue-collar worker, white-collar worker, and other worker), body mass index (kg/m²), smoking status (never, former, or current), physical activity (<1 d/mo, 1 to 3 d/mo, or ≥1 d/wk), ethanol intake (nondrinker and ex-drinker, less than weekly, or ≥300 g/wk), history of diabetes mellitus (yes/no), history of hypertension (yes/no), and participation in health screening during the past year (yes/no). For model 2, we further adjusted for psychological factors such as perceived level of stress (low, moderate, or high) and type A characteristics (score of 0 to 8). To check for effect modification, we stratified analyses according to perceived mental stress (higher/lower) and type A characteristics (yes/no). All analyses were conducted with the SAS statistical package version 9.1 (SAS Institute Inc, Cary, NC).

**Results**

Table 1 shows baseline characteristics of sex-specific age-adjusted cardiovascular risk factors and relevant psychosocial factors according to 3 categories of perceived level of life enjoyment. In total, 17,399 men (41.3%) perceived their level of enjoyment of life as high, 21,057 (50.0%) as medium, and 3,633 (8.6%) as low. For women, the respective numbers were 18,425 (40.0%), 23,384 (50.7%), and 4,277 (9.3%).

Men and women with higher levels of life enjoyment were older, were more likely to have history of hypertension, had a higher body mass index, were less likely to be heavy alcohol drinkers, were more likely to engage in physical activity, were more likely to experience health screenings, and were less likely to be blue-collar workers. In addition, they had a lower level of perceived stress and a lower proportion of high type A characteristics. Furthermore, men with higher levels of life enjoyment were less likely to be current smokers and to be unemployed. The proportion with a history of diabetes mellitus did not vary by level of life enjoyment among either sex.

During the median follow-up of 12.0 years, among 42,089 men and 46,086 women, a total of 35,23 (22,37 men, 12,86 women) had newly diagnosed cardiovascular disease, and 1,860 (1,220 men, 640 women) cardiovascular deaths were documented. Among 3,523 incident cases, 2,786 strokes (1,688 men, 1,098 women) and 686 coronary heart diseases (522 men, 164 women) were observed. Among 1,860 fatal cases, 812 stroke deaths (502 men, 310 women) and 412 coronary heart disease deaths (297 men, 115 women) were observed.

Table 2 shows the HRs for the incidence of and mortality from cardiovascular disease according to the 3 levels of life enjoyment. First, in terms of cardiovascular incidence, compared with men having a high level of perceived life enjoyment, men with a low level of life enjoyment had an approximately 1.5-fold higher age-adjusted risk of stroke, coronary heart disease, and total cardiovascular disease. After adjustment for cardiovascular risk factors and psychosocial variables, those associations were weakened but remained statistically significant for stroke and total cardiovascular disease. The multivariable HRs for total cardiovascular incidence in the highest versus lowest level of life enjoyment group were 1.22 (95% CI, 1.01 to 1.47) for stroke and 1.23 (95% CI, 1.05 to 1.44) for total cardiovascular disease among men. However, after adjustment for cardiovascular risk factors and psychosocial factors, multivariable HRs for coronary heart disease were no longer statistically significant among men (HR, 1.28; 95% CI, 0.93 to 1.77). The level of life enjoyment was not associated with the incidence among women.

### Table 1. Age-Adjusted Means and Proportions of Baseline Characteristics According to Perceived Level of Life Enjoyment

<table>
<thead>
<tr>
<th>Variable</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of Life Enjoyment</strong></td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>At risk, n</td>
<td>17,399</td>
<td>21,057</td>
</tr>
<tr>
<td>Mean age, y</td>
<td>53.1</td>
<td>50.6</td>
</tr>
<tr>
<td>History of hypertension, %</td>
<td>19.5</td>
<td>18.0</td>
</tr>
<tr>
<td>History of diabetes mellitus, %</td>
<td>6.8</td>
<td>5.8</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>23.5</td>
<td>23.2</td>
</tr>
<tr>
<td>Heavy alcohol drinkers, %</td>
<td>30.7</td>
<td>31.5</td>
</tr>
<tr>
<td>Physical activity, %</td>
<td>14.5</td>
<td>10.3</td>
</tr>
<tr>
<td>Participation in health screening, %</td>
<td>80.0</td>
<td>80.2</td>
</tr>
<tr>
<td>Current smokers, %</td>
<td>56.8</td>
<td>67.8</td>
</tr>
<tr>
<td>Occupation, %</td>
<td>Unemployed</td>
<td>0.8</td>
</tr>
<tr>
<td>Blue-collar workers</td>
<td>24.8</td>
<td>44.4</td>
</tr>
<tr>
<td>White-collar workers</td>
<td>69.2</td>
<td>53.0</td>
</tr>
<tr>
<td>High mental stress, %</td>
<td>15.0</td>
<td>24.0</td>
</tr>
<tr>
<td>High type A characteristics, %</td>
<td>19.0</td>
<td>20.3</td>
</tr>
</tbody>
</table>

*Heavy alcohol drinker, ≥300 g/wk.

†Physical activity, participation in sports ≥1 d/wk.

‡High type A characteristics, score or 5 to 8 of a possible 8.
In terms of mortality, men with a low level of life enjoyment had an ≈2-fold higher age-adjusted risk of stroke, coronary heart disease, and mortality from total cardiovascular disease compared with men with a high level of life enjoyment. After adjustment for cardiovascular risk factors and psychosocial variables, those associations were weakened slightly but remained statistically significant. The multivariable HRs for total cardiovascular mortality in the highest versus lowest level of life enjoyment group were 1.75 (95% CI, 1.28 to 2.38) for stroke, 1.91 (95% CI, 1.30 to 2.81) for coronary heart disease, and 1.61 (95% CI, 1.32 to 1.96) for total cardiovascular disease among men. The level of life enjoyment was not associated with the mortality among women.

Furthermore, to examine reverse causation for perceived level of life enjoyment and disease development among men, multivariable HRs of mortality resulting from cardiovascular disease were examined with early deaths excluded (Table 3).
Table 3. Sex-Specific Age- and Multivariable-Adjusted HRs and 95% CIs of Cardiovascular Disease Mortality According to Perceived Level of Life Enjoyment With Deaths That Occurred After 1 to 6 Years From Baseline (Men Only) Excluded

<table>
<thead>
<tr>
<th>Mortality</th>
<th>Level of Life Enjoyment</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Stroke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At risk</td>
<td>17 399</td>
<td>21 057</td>
</tr>
<tr>
<td>Person-y</td>
<td>202 514</td>
<td>266 917</td>
</tr>
<tr>
<td>Cases, n</td>
<td>184</td>
<td>257</td>
</tr>
<tr>
<td>Multivariable HR</td>
<td>1.00</td>
<td>1.25 (1.02–1.53)*</td>
</tr>
<tr>
<td>Deaths within 1 y excluded</td>
<td>177</td>
<td>243</td>
</tr>
<tr>
<td>Deaths within 2 y excluded</td>
<td>167</td>
<td>226</td>
</tr>
<tr>
<td>Deaths within 3 y excluded</td>
<td>152</td>
<td>210</td>
</tr>
<tr>
<td>Deaths within 4 y excluded</td>
<td>141</td>
<td>191</td>
</tr>
<tr>
<td>Deaths within 5 y excluded</td>
<td>132</td>
<td>172</td>
</tr>
<tr>
<td>Deaths within 6 y excluded</td>
<td>116</td>
<td>153</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases, n</td>
<td>111</td>
<td>146</td>
</tr>
<tr>
<td>Multivariable HR</td>
<td>1.00</td>
<td>1.20 (0.92–1.56)</td>
</tr>
<tr>
<td>Deaths within 1 y excluded</td>
<td>110</td>
<td>141</td>
</tr>
<tr>
<td>Deaths within 2 y excluded</td>
<td>108</td>
<td>131</td>
</tr>
<tr>
<td>Deaths within 3 y excluded</td>
<td>102</td>
<td>123</td>
</tr>
<tr>
<td>Deaths within 4 y excluded</td>
<td>93</td>
<td>113</td>
</tr>
<tr>
<td>Deaths within 5 y excluded</td>
<td>87</td>
<td>105</td>
</tr>
<tr>
<td>Deaths within 6 y excluded</td>
<td>84</td>
<td>100</td>
</tr>
<tr>
<td>Total cardiovascular disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases, n</td>
<td>473</td>
<td>606</td>
</tr>
<tr>
<td>Multivariable HR</td>
<td>1.00</td>
<td>1.15 (1.01–1.31)*</td>
</tr>
<tr>
<td>Deaths within 1 y excluded</td>
<td>456</td>
<td>576</td>
</tr>
<tr>
<td>Deaths within 2 y excluded</td>
<td>437</td>
<td>544</td>
</tr>
<tr>
<td>Deaths within 3 y excluded</td>
<td>402</td>
<td>513</td>
</tr>
<tr>
<td>Deaths within 4 y excluded</td>
<td>375</td>
<td>471</td>
</tr>
<tr>
<td>Deaths within 5 y excluded</td>
<td>353</td>
<td>433</td>
</tr>
<tr>
<td>Deaths within 6 y excluded</td>
<td>320</td>
<td>398</td>
</tr>
</tbody>
</table>

Multivariable HRs: age, occupation, body mass index, smoking status, physical activity, alcohol consumption, history of diabetes mellitus and hypertension, participation in health screening during the past year, perceived mental stress, and type A characteristics.

*P<0.05; †P<0.01; ‡P<0.001.
After the exclusion of deaths that occurred after 1 to 6 years from baseline, the multivariable HRs for stroke, coronary heart disease, and total cardiovascular diseases were weakened slightly but remained statistically significant for stroke and total cardiovascular disease. The association with mortality resulting from coronary heart disease was no longer statistically significant after the exclusion of deaths within 6 years after baseline, but the number of deaths became small. Additionally, to understand the mechanisms for life enjoyment and cardiovascular incidence and mortality, we analyzed potential effect modification by perceived level of mental stress and type A characteristics among men. The associations between life enjoyment and incidence and mortality among men did not differ by perceived mental stress or type A characteristics and had no significant interaction (not shown).

Discussion
In the large population-based prospective study of Japanese middle-aged residents reported here, we found inverse associations between perceived level of life enjoyment and cardiovascular disease incidence and mortality among men but not among women. Adjustment for psychosocial factors did not substantially alter the association of life enjoyment with cardiovascular disease, except for coronary heart disease incidence; this association with coronary heart disease incidence became weak.

Our finding of a gender difference is consistent with the results from previous prospective studies. Positive affect was associated with a reduction in stroke incidence independently of the effects of negative affect among men but not women. Dispositional optimism was associated with cardiovascular mortality among men but not women. To understand the mechanisms of the gender differences, different ways of reacting to psychological conditions between men and women may provide some explanation. Laboratory challenges of cold press and/or physiological stress have shown that men exhibit greater responses in heart rate and/or blood pressure than women, along with a larger activation of the hypothalamic-pituitary-adrenal axis. In an observational study, men tended to receive favorable effects on cardiovascular health from social support compared with women.

Although mechanisms underlying the gender difference remain to be explained, to the best of our knowledge, this is the first prospective study of middle-aged Japanese men and women to evaluate gender-specific associations of perceived level of life enjoyment with the risk of cardiovascular disease incidence and mortality in a community setting. However, this study has several limitations. First, we evaluated perceived level of life enjoyment by a self-administrated single item rather than a validated scale. This measure of perceived level of life enjoyment was devised for our study without independent measurements of its reliability or validity. However, the level of life enjoyment correlates with conceptually related measurements (the Optimism-Pessimism Scale and the Subjective Happiness Scale) used for other samples, and it predicted outcomes in expected ways. Furthermore, we evaluated the sense of life enjoyment at 1 point in time with a self-anchoring scale, but psychological state is generally a changeable factor required to assess transitions. Thus, the association between perceived level of life enjoyment and the risk of cardiovascular disease incidence and mortality would be weakened as a result of nondifferential misclassifications, and the real associations would be stronger. The second is limited information on negative psychological conditions, especially depressive symptoms as well-known potential risk factors for cardiovascular disease. A major concern is that these observed associations were simply confounded by negative psychological states because depressive symptoms are reported to be inversely correlated with positive psychological conditions and associated with risks of cardiovascular disease. In the present study, however, the association of perceived level of life enjoyment with stroke incidence and mortality and coronary heart disease mortality remained statistically significant after adjustment for a set of negative psychological conditions such as perceived level of stress and type A characteristics, including level of hostility. It has been reported that level of perceived stress and depressive symptoms are highly correlated. Furthermore, we found no effect modification of the association between level of life enjoyment and cardiovascular mortality and incidence by stress level or type A characteristics. Third, we made multiple comparisons to examine the life enjoyment and cardiovascular disease associations, so type I errors are likely to occur. However, most of the associations among men were highly statistically significant in dose-responses fashions, as we expected a priori. Finally, residual confounding or an unmeasured third variable could account for associations between perceived level of life enjoyment and risk of cardiovascular disease incidence and mortality.

Despite these limitations, the strengths of our study are its prospective design and large sample size, yielding good statistical power to detect the associations of sense of life enjoyment with cardiovascular disease incidence and mortality stratified by gender. We excluded subjects who died of cardiovascular disease 1 to 6 years from baseline to reduce a potential effect of preexisting illness and disease, which may lower the level of life enjoyment. However, the results did not change substantially, supporting that the inverse causality was unlikely.

As for mechanisms underlying the association between positive psychological conditions and cardiovascular disease, biological and psychosocial pathways have been proposed hypothetically. A biological pathway explains the effect of positive psychological conditions of stimulating biological systems through central nervous system activation of autonomic, neuroendocrine, and inflammatory processes. Social and behavioral models have proposed several pathways such as health behaviors, stress buffering, broadening social resources (ie, social support), and undoing the effect of negative conditions (ie, type A characteristics, negative emotions, and depressive symptom). One of the well-known theories for understanding positive psychological condition is the broaden-and-build theory of positive emotions. This theory assumes that positive emotions broaden an individual’s attention, thinking, behavioral patterns, and momentary thought-action repertoires. It allows individuals to enrich their resources in multiple domains, including
physical, cognitive, and social domains, to help them engage in health-promoting behaviors. Cognitive effects of positive emotions have been linked to increases in dopamine levels in the anterior cingulated cortex, thereby enhancing one’s ability to make efforts to change and modify one’s environment to be healthier and to adjust to a healthy environment. In our study, persons with the highest level of life enjoyment were likely to have healthier lifestyles such as refraining from smoking, engaging in physical activities, and participating in health screening, which was consistent with a previous report of a positive association between dispositional optimism and healthy lifestyles. After adjustment for those health-related lifestyles, the associations between positive psychological conditions and cardiovascular disease incidence and mortality were slightly weakened but remained statistically significant. Thus, those associations were explained in part by healthier lifestyles, but other mechanisms mentioned before also were suggested.

In the present study, persons with a lower level of perceived life enjoyment had a higher level of perceived mental stress and type A characteristics. It is hypothesized that psychological stress activates the sympathetic-adrenal-medullary system and the hypothalamic-pituitary-adrenocortical axis and that the lack of positive emotion leads to long-term activation of these axes, which enhances elevation of serum cortisol and catecholamine levels, resulting in elevated blood pressures and the progression of atherosclerosis. After adjustment for perceived mental stress and type A characteristics, the associations between perceived level of life enjoyment and cardiovascular disease incidence and mortality were attenuated but remained statistically significant for stroke incidence and mortality and for coronary heart disease mortality. Because perceived stress and type A characteristics could not fully account for these relationships, the possible existence of other pathways warrants further investigation.

Conclusion

Although further studies are needed to explain the gender difference and mechanisms accounting for positive psychological conditions and cardiovascular disease, we found that a lower level of life enjoyment was associated with higher risks of cardiovascular disease incidence and mortality among middle-aged men.

Acknowledgment

We thank all staff members in each study area and in the central office (see Reference 22) for their painstaking efforts to conduct the baseline survey and follow-up.

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Disclosures

None.

References


**CLINICAL PERSPECTIVE**

Although relationships between negative psychological conditions and risk of cardiovascular disease incidence and mortality have been well documented, little is known about associations between positive psychological conditions and the risk of disease. Perceived level of life enjoyment, a positive psychological condition that reflects the ability to engage pleasurably with the environment, may relate to risks of cardiovascular disease. This community-based prospective study of 90,000 Japanese men 40 to 69 years of age showed that lower sense of life enjoyment was associated with higher risks of cardiovascular disease incidence and mortality. The multivariable hazard ratios of cardiovascular disease incidence for men in the low versus high perceived levels of life enjoyment group were 1.22 (95% confidence interval, 1.01 to 1.47) for stroke and 1.23 (95% confidence interval, 1.05 to 1.44) for total cardiovascular disease. As for mortality, Japanese men with low perceived level of life enjoyment showed increased risk: hazard risks of 1.75 (95% confidence interval, 1.28 to 2.38) for stroke, 1.91 (95% confidence interval, 1.30 to 2.81) for coronary heart disease, and 1.61 (95% confidence interval, 1.32 to 1.96) for total cardiovascular disease. The inverse association did not change substantially when cardiovascular deaths that occurred after the first to sixth year from baseline were excluded. For women, perceived level of life enjoyment was not associated with risks of cardiovascular disease incidence and mortality. Our findings suggest a protective role of positive psychological conditions on cardiovascular disease among middle-aged men.
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