

Personality and Colorectal Cancer: The Fukuoka Colorectal Cancer Study

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Objective: Although personality factors, especially emotional suppression and loss-hopelessness, have been linked to the occurrence and progression of cancer, little is reported specifically on colorectal cancer. It has also been claimed that a 'hysterical' personality characterized by exaggerated emotional expressions, egocentricity and ambivalent connection may be protective from cancer. This community-based case–control study examined whether personality factors relevant to emotional suppression or loss-hopelessness are associated with an increased risk of colorectal cancer, and whether factors related to the hysterical personality are associated with a decreased risk.

Methods: The stress inventory (SI), a self-administered questionnaire to assess the possible disease-prone and other relevant personalities in Japanese, was completed by 497 patients with newly diagnosed colorectal cancer and 809 controls randomly selected in the Fukuoka area of Japan.

Results: After controlling for age, sex and residence using a logistic regression model, none of the SI scales relevant to emotional suppression ('unfulfilled needs for acceptance', 'altruism', 'rationalizing conflicts/frustrations') or loss-hopelessness ('low sense of control', 'object-dependence/loss', 'object-dependence/happiness') was related to colorectal cancer. On the other hand, two scales representing elements of the hysterical personality, 'object-dependence/ambivalence' and 'egoism' were protectively associated with risk. Additional adjustment for body-mass index and lifestyle factors did not materially change these associations.

Conclusions: Although personalities relevant to the emotional suppression or loss-hopelessness may not be a risk factor for colorectal cancer in the Japanese population, ambivalent connection and egocentricity may be protective.

Key words: colorectal neoplasms – personality – stress, psychological – risk factors – case–control studies

INTRODUCTION

Chronic psychosocial stress is thought to affect lifestyle and the immune system (1,2), and may thus contribute to the development of cancer. Among personality factors thought

to be prone to chronic stress, special attention has been focused on two: the reaction to a loss with chronic hopeless/helpless feelings (loss-hopelessness) and the suppression or inhibition of expressing negative emotions (emotional suppression) (3–7). Some epidemiologic studies have suggested that these factors may increase the risk of cancer of all sites (8–12), lung cancer (13) and breast cancer (14), although there are other studies failing to find such associations

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(15,16). Also, it has been claimed that the 'type 3' personality characterized by exaggerated emotional expressions, egocentricity and ambivalent connection may be protective from cancer (10,17). The type 3 personality is also referred to as 'hysterical' personality, a term which we used in this paper.

Colorectal cancer is one of the most common cancers in the world (18). Although the colorectum is known to be an organ sensitive to stress (19,20), few studies have specifically examined psychosocial factors in relation to colorectal cancer risk. Although some studies have suggested a possible role of job-related stress (21–23), life events (22,24), perceived stress (25) and social support (23) in the etiology of colorectal cancer, little is known for personality factors. To date, only two studies examined the association between personality factors and colorectal cancer, and they reported a positive association with aggressive hostility (26) and a personality profile relevant to emotional suppression (27).

The Fukuoka Colorectal Cancer Study was conducted to elucidate the role of lifestyle factors and genetic susceptibility in the etiology of colorectal cancer (28). In this community-based case–control study, participants completed the stress inventory (SI) (29–31), a self-administered questionnaire developed to assess the possible disease-prone personalities in Japanese. This paper addressed a hypothesis that the SI scales relevant to emotional suppression or to loss-hopelessness are associated with an increased risk of colorectal cancer and another hypothesis that the scales related to the hysterical personality are protectively associated with the risk.

PATIENTS AND METHODS

Methodological aspects in the design and conduct of the Fukuoka Colorectal Cancer Study have been described elsewhere (28). Briefly, cases were recruited from eight large hospitals in the study area (Fukuoka City and three adjacent area), and controls were randomly selected in the community by frequency matching to the distribution of incident cases with respect to sex and 10-year age class. The study protocol was approved by the Ethics Committees of Faculty of Medical Sciences, Kyushu University and of all but two of the participating hospitals, which did not have Ethics Committees at the time of survey.

PARTICIPANTS

The cases were a consecutive series of patients with histologically confirmed incident colorectal adenocarcinomas who were admitted to two university hospitals or six affiliated hospitals for surgical treatment. Other eligibility criteria were age of 20–74 years at the time of diagnosis, residence in the study area, no prior history of partial or total removal of the colorectum, familial adenomatous polyposis or inflammatory bowel disease, mental competence to give informed consent and to complete the interview. Research nurses contacted each eligible patient, and interviewed the

patient who gave written informed consent. The nurses also asked the participating patients to complete the SI. During the survey period from October 2000 to December 2002, 544 of 669 eligible cases participated in the interview and 497 of the participants returned the SI. The participation rate was 74% (497 of 669).

Eligibility criteria for controls were the same as described for cases except for two items, i.e. having no diagnosis of colorectal cancer and age of 20–74 years at the time of selection. A total of 1500 persons were selected as control candidates by two-stage random sampling. The number of control candidates by sex and 10-year age class was determined in accordance to sex- and age-specific numbers of estimated incident cases of colorectal cancer. The first step was a random selection of 15 of 178 small areas, and then ~100 persons were randomly selected in each small area using the municipal resident registry on the basis of proportions of population in the small areas by sex and 10-year age class. A letter of invitation was sent to each candidate, and at most two additional letters of invitation were mailed to non-respondents. Of the 1500 candidates, 118 persons were excluded because of death ($n = 7$), migration from the study area ($n = 22$), undelivered mail ($n = 44$), mental incompetence ($n = 19$), history of partial or total removal of the colorectum ($n = 21$) and diagnosis of colorectal cancer after the survey ($n = 5$). Of the remaining 1382 persons, 833 participated in the interview survey, of which 809 returned the SI. The net participation rate was 59% (809 of 1382). The survey was carried out during the period from January 2001 to December 2002.

Research nurses interviewed the cases and controls in person regarding physical activity, smoking, alcohol use, parental history of colorectal cancer, dietary habit and others, using a validated, uniform questionnaire and instrument (32). The interview was done before or after the surgery at hospital wards for cases and at community halls and clinics for most of the controls; other places of interview for the controls were the work place, home and a university building.

PERSONALITY ASSESSMENT

The SI is a self-administered questionnaire used to assess the possible disease-prone and other relevant personalities in the Japanese population; its developmental procedures and psychometric properties (validity and reliability) are described elsewhere (29–31). Briefly, a pool of over 400 items was prepared with a special reference to the disease-prone/healthy personalities proposed by Grossarth-Maticcek et al. (10,33). Starting with these items, a pilot series of interview surveys was done to obtain valid items using a variety of subjects including patients with cancer or myocardial infarction. Through this procedure, items were sorted and grouped into five, and a set of 75 items were revised and selected as appropriate for the SI (29). Based on factor analysis and correlation analyses with several conventional questionnaires, the SI was again shortened into 45 items (see Appendix 1),

and 12 scales were constructed (see Appendix 2); Cronbach alphas and test–retest reliability coefficients ranged from 0.60 to 0.90 and from 0.66 to 0.82, respectively (30).

In the present analysis, we focused on three scales related to emotional suppression and three scales relevant to loss-hopelessness. The three scales sharing emotional suppression as a common construct were ‘unfulfilled needs for acceptance’, ‘altruism’ and ‘rationalizing conflicts/frustrations’. A high unfulfilled needs for acceptance score represents a situation where a person chronically has problems that he/she expects would be relieved if someone would listen, but his/her behaviors of telling such problems to others are usually suppressed and blocked. A person with a high altruism score tends to fill others’ needs first, suppressing his/her own needs. A person with a high rationalizing conflicts/frustrations score would never vent his/her anger to others, rationalizing such feelings instead. ‘Low sense of control’, ‘object-dependence/loss’ and ‘object-dependence/happiness’ are the scales relevant to loss-hopelessness. A person with a high ‘low sense of control’ score, i.e. who loses the sense of control over stressful situations, would become hopeless easily. ‘Object-dependence’ refers to a tendency to have an object (person or condition) on which one’s well-being is greatly dependent (10), and object-dependence/loss indicates that one tends to have hopeless and depressive feelings in the relationship with such an object. Object-dependence/happiness was developed as an antecedent condition in which one is apt to experience chronic hopeless feelings when encountering an important loss, and it may also be indirectly related to loss-hopelessness. We also focused on two scales, ‘object-dependence/ambivalence’ and ‘egoism’, which represented elements of the hysterical personality. The hysterical personality is characterized by exaggerated emotional expressions, egocentricity and ambivalent connection and has been suggested to be protective from cancer (10,17). A high object-dependence/ambivalence score indicates that one repeatedly experiences ‘ambivalent’ interpersonal relationships; an ambivalent person here refers to one who oscillates between idealizing an object (typically a person) which is being sought and attributing negative values to the object, devaluing it and seeking to escape from it. The egoism scale measures a self-defensive, self-interest-oriented attitude in interpersonal and social relationships. The SI answers were a six-point rating, 1–6, where 1 and 6, respectively, correspond to ‘yes’ and ‘no’, or to ‘almost always’ and ‘rarely’. The score of each scale is the average of corresponding item scores and ranges between 1 and 6.

STATISTICAL ANALYSIS

The association of personality factors with the risk of colorectal cancer was examined in terms of odds ratio (OR) and 95% confidence interval (CI). The SI scale scores were categorized using quartiles in the distribution of the controls. Adjusted ORs were estimated from multiple logistic

regression analysis, including indicator variables for gender, 5-year age class (the lowest class of <35 years) and area of residence (Fukuoka City or suburban area) as covariates. Trend of association was assessed with ordinal scores 1–4 assigned to four categories in order. In addition, the following anthropometric and lifestyle factors were also considered as potential confounders: body-mass index (BMI) at 10 years before (<25 or ≥ 25 kg/m²), smoking (0, 1–399, 400–799 or ≥ 800 cigarette-years), alcohol intake (0, 0.1–0.9, 1.0–1.9, or ≥ 2.0 U/day), type of job (sedentary or non-sedentary), non-job physical activity (0, 1–15.9 or ≥ 16 MET-h/week), vegetables intake (tertiles), fruit intake (tertiles), red meat intake (tertiles) and fish intake (tertiles). All *P*-values were two-sided and considered significant at *P* < 0.05. All analyses were done using the SAS (version 9.1; SAS Institute Inc., Cary, NC, USA).

RESULTS

Of the patients and controls, 288 (58%) of 497 and 502 (62%) of 809, respectively, were men. The respective mean ages (range) of the cases and controls were 60 (29–74) and 59 (22–75) years, respectively. Residents in Fukuoka City accounted for 61% of the cases and 65% of the controls. Two hundred and seventy nine (56%) and 207 (42%) cases had cancer at colon and rectum and the remaining 11 cases (2%) had cancer at multiple sites. Because the cases were patients undergoing surgery, advanced disease was relatively uncommon; stages III (tumor invasion to nearby organs or metastasis to lymphnodes) and IV (metastasis to distant organs) according to the 1992 TNM Classification of Malignant Tumors (International Union Against Cancer) (34) accounted for 34 and 13%, respectively. Analysis of covariance including sex, age and residence as covariates found that some of the SI scales were associated with either or both sex and age, and the pattern of association was similar between cases and controls. Notably, women tended to score higher on disclosure of negative emotions and rationalizing conflicts/frustrations and lower on egoism than men. Older persons tended to score lower on object-dependence/happiness, annoying barrier and disclosure of negative emotions, and higher on lacking emotional experiences than younger persons (data not shown).

Table 1 shows the association between colorectal cancer risk and the scales related to emotional suppression. Controlling for sex, age and resident area, none of the three relevant scales (unfulfilled needs for acceptance, altruism and rationalizing conflicts/frustrations) was positively associated with colorectal cancer risk. Additional adjustment for BMI at 10 years before and lifestyle factors including smoking, alcohol consumption, physical exercise and dietary habits did not change such associations. Table 2 shows the association with the personality scales related to loss-hopelessness. Object-dependence/happiness tended to be positively associated with colorectal cancer, but the association

was statistically barely significant with a trend $P = 0.053$. The other two, low sense of control and object-dependence/loss, were unrelated to risk. These results did not change after controlling for BMI and lifestyle factors. On the other hand, both of the scales related to the hysterical personality (object-dependence/ambivalence and egoism) were each significantly, inversely associated with colorectal cancer risk (Table 3). Adjustment for BMI and lifestyle factors changed these associations little. None of the other scales showed a clear pattern of an association with colorectal cancer, either with or without adjustment for BMI and lifestyle factors. The multivariate-adjusted OR (95% CI) of the highest versus lowest scale score was 1.12 (0.82–1.53) for object-dependence/anger, 1.19 (0.84–1.69) for annoying barrier, 0.95 (0.67–1.34) for disclosure of negative experiences and 0.87 (0.63–1.22) for lacking emotional experiences.

When we analyzed the data separately for earlier disease (stages 0, I, II) and advanced disease (stages III, IV), the inverse associations of objective dependence/ambivalence and egoism were suggested to be somewhat stronger in the latter than in the former. The multivariate-adjusted ORs (95% CI) of the highest versus lowest score of object-dependence/ambivalence were 0.69 (0.45–1.06) for earlier

Table 1. The association between colorectal cancer and personality scales relevant to emotional suppression

Personality	N		Age, sex, and residence-adjusted OR (95% CI)	Multivariate-adjusted ¹ OR (95% CI)
	Cases	Controls		
Unfulfilled needs for acceptance				
Q1	121	195	1.00 (referent)	1.00 (referent)
Q2	130	205	1.04 (0.76–1.44)	1.04 (0.75–1.44)
Q3	125	200	1.04 (0.75–1.43)	1.07 (0.77–1.49)
Q4	104	195	0.87 (0.62–1.22)	0.86 (0.61–1.21)
Trend			$P = 0.44$	$P = 0.46$
Altruism				
Q1	116	187	1.00 (referent)	1.00 (referent)
Q2	110	199	0.90 (0.65–1.25)	0.90 (0.64–1.26)
Q3	138	201	1.14 (0.83–1.58)	1.17 (0.85–1.63)
Q4	120	210	0.90 (0.65–1.24)	0.88 (0.63–1.23)
Trend			$P = 0.88$	$P = 0.85$
Rationalizing conflicts/frustrations				
Q1	133	198	1.00 (referent)	1.00 (referent)
Q2	123	222	0.84 (0.61–1.15)	0.83 (0.60–1.14)
Q3	116	213	0.82 (0.59–1.13)	0.81 (0.58–1.12)
Q4	109	161	0.99 (0.72–1.39)	1.00 (0.71–1.41)
Trend			$P = 0.84$	$P = 0.87$

Q1–Q4, quartile 1 (low)–quartile 4 (high); OR, odds ratio; CI, confidence interval; BMI, body-mass index at 10 years before. ¹Adjusted for BMI, smoking, alcohol consumption, type of job, non-job physical activity, vegetables, fruit, red meat and fish, as well as for age, sex and residence.

Table 2. The association between colorectal cancer and personality scales relevant to loss-hopelessness

Personality	N		Age, sex and residence-adjusted OR (95% CI)	Multivariate-adjusted ¹ OR (95% CI)
	Cases	Controls		
Low sense of control				
Q1	128	207	1.00 (referent)	1.00 (referent)
Q2	93	170	0.87 (0.62–1.22)	0.90 (0.64–1.26)
Q3	135	217	1.00 (0.73–1.36)	1.02 (0.74–1.40)
Q4	129	201	1.01 (0.74–1.39)	1.01 (0.73–1.39)
Trend			$P = 0.75$	$P = 0.80$
Object-dependence/loss				
Q1	100	181	1.00 (referent)	1.00 (referent)
Q2	147	205	1.30 (0.93–1.80)	1.28 (0.92–1.79)
Q3	109	206	0.96 (0.69–1.36)	0.95 (0.67–1.34)
Q4	124	205	1.12 (0.80–1.57)	1.12 (0.79–1.57)
Trend			$P = 1.00$	$P = 0.96$
Object-dependence/happiness				
Q1	124	229	1.00 (referent)	1.00 (referent)
Q2	106	188	1.10 (0.79–1.52)	1.08 (0.77–1.51)
Q3	123	199	1.16 (0.85–1.60)	1.20 (0.87–1.65)
Q4	126	178	1.38 (1.00 ² –1.91)	1.37 (0.99–1.91)
Trend			$P = 0.05^3$	$P = 0.05^3$

¹Adjusted for BMI, smoking, alcohol consumption, type of job, non-job physical activity, vegetables, fruit, red meat and fish, as well as for age, sex and residence. ²Less than unity. ³Greater than 0.05.

Table 3. The association between colorectal cancer and personality scales relevant to hysterical personality

Personality	N		Age, sex and residence-adjusted OR (95% CI)	Multivariate-adjusted ¹ OR (95% CI)
	Cases	Controls		
Object-dependence/ambivalence				
Q1	140	197	1.00 (referent)	1.00 (referent)
Q2	126	206	0.86 (0.63–1.17)	0.87 (0.63–1.19)
Q3	133	210	0.90 (0.66–1.23)	0.90 (0.66–1.24)
Q4	85	183	0.67 (0.48–0.94)	0.66 (0.47–0.93)
Trend			$P = 0.04$	$P = 0.04$
Egoism				
Q1	142	214	1.00 (referent)	1.00 (referent)
Q2	174	249	1.08 (0.80–1.44)	1.06 (0.79–1.43)
Q3	103	177	0.96 (0.69–1.35)	0.98 (0.70–1.37)
Q4	59	153	0.62 (0.43–0.90)	0.59 (0.40–0.86)
Trend			$P = 0.02$	$P = 0.01$

¹Adjusted for BMI, smoking, alcohol consumption, type of job, non-job physical activity, vegetables, fruit, red meat and fish, as well as for age, sex and residence.

disease and 0.62 (0.40–0.99) for advanced disease, and those of egoism were 0.63 (0.39–1.02) for earlier disease and 0.50 (0.44–1.12) for advanced disease.

DISCUSSION

Emotional suppression is a personality factor that has long been linked to cancer-proneness (3–7). Although not all (15,16), some epidemiologic studies have supported this notion in breast cancer (14), lung cancer (13) or cancer of all sites (8–10,12). This construct is referred to as several aspects using different terms, such as ‘repression’ (8,15,16), ‘rationality/anti-emotionality’ (13,14) or ‘type 5’ personality (10), ‘loner and emotional suppression’ (9), ‘type C’ personality (35), ‘type 1’ personality (10) and ‘emotional control’ (12,14). In an Australian community-based case–control study, Kune et al. (27) found an increased risk of colorectal cancer associated with a personality profile, characterized by repression, denial, non-expression of anger, social desirability, conflict avoidance and the suppression of reactions that may offend others. The three SI scales (unfulfilled needs of acceptance, altruism and rationalizing conflicts/frustrations) shared emotional suppression as an essential element, but the present study did not support the hypothesis that emotional suppression increases colorectal cancer risk.

Loss-hopelessness is another ‘traditional’ cancer-prone personality (3,6,7). A population-based cohort study in Finland reported that a high score on the ‘hopelessness scale’ was predictive of subsequent cancer of all sites (11). To our knowledge, no study has addressed this issue specifically for colorectal cancer. In the present study, the two scales relevant to loss-hopelessness, low sense of control and object-dependence/loss were not associated with an increased risk of colorectal cancer. The scale ‘object-dependence/happiness’ refers to a tendency to have a highly valued person on whom one’s happiness is greatly dependent. Thus, this scale was thought to be an antecedent condition from which one is apt to experience chronic hopeless feelings when encountering an important loss, leading to the characteristics represented by the object-dependence/loss scale. In this sense, it is not straightforward to interpret the results indicating that object-dependence/happiness, not object-dependence/loss, was associated with colorectal cancer. The observed association with object-dependence/happiness might suggest that after notification of cancer diagnosis, the patients had become more aware of the importance of the support from their partner or other persons and realized that such support was necessary to their happiness.

Egoism and object-dependence/ambivalence represent elements of the hysterical personality, which Grossarth-Maticzek et al. (10) proposes to be resistant against cancer. This study supported the hypothesis that these scales are protectively associated with colorectal cancer. An egocentric tendency may be of merit as a self-defense mechanism in interpersonal relations, leading in turn to the maintenance of

health. The egoism scale was originally developed as the opposite of the altruism scale (29,30), but the latter was not related to colorectal cancer here. Egoism and altruism were, however, only weakly, if any, negatively correlated with each other in the present sample (Pearson correlation coefficients were -0.02 and -0.18 in the cases and controls, respectively). Because a highly ambivalent tendency should lead to the instability of feelings, it would be rather odd if such a characteristic were to favor cancer prevention. No studies have reported explicitly on ambivalence in relation to cancer, but some have found that ‘worry’ (36), ‘anxiety’ (14) or ‘having anxiety disorder’ (37), which may represent the instability of feelings, was unrelated to cancer risk. Ambivalence as a construct of the hysterical personality refers to a special form of instability in interpersonal relationships. Thus, an ‘ambivalent’ person oscillates between the two opposite aspects of object-dependence, sometimes idealizing an object (typically a person) which is being sought and sometimes attributing negative values to the object that he/she seeks to escape from. The former aspect corresponds to the concept represented by the object-dependence/loss and object-dependence/happiness scales, which are cancer-prone, and the latter corresponds to the concept represented by the object-dependence/anger and annoying barrier scales, which are coronary heart disease-prone (see Appendix 2). Grossarth-Maticzek et al. (10) argues that ambivalence may protect one to some extent from the build-up of behavior patterns related to cancer or coronary heart disease.

The present study is subject to several drawbacks derived from its retrospective design. First, the majority of the cases had been informed of their cancer diagnosis before the time of the interview or questionnaire administration. It is possible that self-reported personality traits change after cancer diagnosis (38), and thus the differences in personality features between the cases and controls observed in the present study might be due to the psychological impact on the patients of the cancer diagnosis. In addition to the above discussed interpretation for the association with object-dependence/happiness, we cannot preclude the possibility that the patients tended to become less ambivalent and less egoistic after diagnosis. Second, the net participation rate was higher for the cases (74%) than for the controls (59%). It is possible that the cases included more submissive or altruistic persons and fewer selfish or egoistic persons. Such bias has the potential to mask the true association between altruism and colorectal cancer and to attenuate the observed association with egoism. Another limitation of the study was relevant to the instrument used for assessing personalities. Besides the elements represented by object-dependence/ambivalence and egoism, the construct of the hysterical personality involves another major element, ‘inappropriate and exaggerated expression of feelings’ (10). Because the SI does not include a scale representing this element, we could not address the question if this element was also inversely associated with colorectal cancer.

Two processes are thought to mediate the link between psychosocial factors and the development of cancer (1). Chronic

stress or personality susceptible to chronic stress are associated with unfavorable lifestyle factors, such as smoking, alcohol consumption, lack of physical activity, obesity and unhealthy eating (39–42). In the control subjects of the present study, some of the personality scores were significantly correlated with anthropometric and lifestyle factors (data not shown). For example, the low sense of control score was negatively correlated with red meat consumption, egoism was negatively correlated with fruit intake and rationalizing conflicts/frustrations was positively correlated with fruit intake. However, correlations between the individual personality scales and lifestyle factors were generally weak (the abstract values of Spearman's rank correlation coefficient < 0.1), and the associations between these personalities and colorectal cancer were not altered by the adjustment for lifestyle factors and BMI. Other mechanisms to be considered include those involving psychophysiological processes. Chronic stress may have an impact on the neuro-endocrinological network that may lead to the development of cancer via immunosuppression (2). The present data suggested that the inverse associations of colorectal cancer with ambivalence and egoism, especially the latter, were stronger for advanced disease than earlier disease. This may indicate that chronic stress is more closely related to the progression of clinical cancer than of subclinical cancer or the precancerous stage. However, we have not studied whether ambivalence, egoism or other relevant personality factors are associated with anti-cancer immune activities.

The present study is a community-based study of a fairly large scale and is among the few studies that have specifically addressed the role of personality factors on the development of colorectal cancer (26,27). We addressed an *a priori* hypothesis regarding personality as a risk factor for colorectal cancer, used a healthy community sample as controls, used validated instruments for assessing lifestyle and personality factors, and controlled for known or potential confounding factors. In addition, this is the first study suggesting the possible protective role of ambivalence and egoism on the etiology of colorectal cancer.

In conclusion, the present study did not support the hypothesis that personalities related to emotional suppression or loss-hopelessness are associated with colorectal cancer, although a possible positive association with object-dependence/happiness was not rejected. On the other hand, it suggests that ambivalent connection and egocentricity can be protective against colorectal cancer. These findings warrant further investigation.

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Conflict of interest statement

None declared.

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Appendix 1. The items of the stress inventory

- (1) Do you tend to give priority to what you want to do even when there are many demands from people around you?
- (2) Do you tend to talk to someone when you experience something heartbreaking?
- (3) Do you have any circumstances or conditions that you have been very frustrated with for a long period of time?
- (4) Do you often have feelings that change to the extremes; such as first looking at a person with much attraction, then later with distaste?
- (5) Do you under all circumstances try to control your reasoning and avoid, as much as possible, being emotional?
- (6) In your whole life, have you experienced outrage about something?
- (7) Do you find it difficult to altogether forget about things that have made you very angry?
- (8) Do you have a certain person with whom you cannot seem to develop a good relationship and who has caused you sadness and loneliness?
- (9) Is there a certain person who, although they are a thing of the past, still so frustrates or angers you that they repeatedly come to mind?
- (10) Do you tend to give up your own needs so as to get along well with others?
- (11) Do you tend to think of your happiness first?
- (12) Have you frequently had the experience of coming across an annoying matter about which you thought you might feel fine if only you could talk about it to someone, but in reality you could not?
- (13) Even towards those who behave very offensively, do you try not to confront them emotionally by trying to understand them?
- (14) Do you often see your feelings changing to the extremes by getting very upset with a certain person who is at other times very important to you?
- (15) Do you have a certain person who makes you feel that you cannot be happy unless they are happy?
- (16) Do you tend to talk to someone when you experience something difficult?

- (17) Have you frequently had the experience of being angry about something and thought that talking about it to someone would make you feel fine, but in reality you found that difficult?
- (18) Do you find it difficult to forget about things that were extremely tough on you?
- (19) Do you have a certain person with whom you know you may never establish a good relationship, but you cannot stop trying?
- (20) Is there a certain person who understands your feelings so little that you always get frustrated?
- (21) In your whole life, have you experienced jumping for joy about something?
- (22) Do you tend to give up what you really want to do in consideration of others?
- (23) Are you the kind of person who places priority on your happiness above the happiness of others?
- (24) Do you tend to talk to someone when you have something you are worried about?
- (25) Have you had many experiences in which you came suddenly to dislike a certain person, which resulted in you leaving them, even though you had previously gotten along very well with them?
- (26) Do you have any circumstances or conditions that you find deeply unpleasant because they cannot be changed?
- (27) Even if your heart is very badly hurt by someone, do you try to be calm in your thinking and try not to criticize them in an emotional manner?
- (28) Have you frequently had the experience of feeling distressed and wanting someone to share your feelings with, but in reality you found that difficult?
- (29) Do you find it rather difficult to emotionally recover after experiencing something very disappointing?
- (30) Do you have a certain person who, among those you are separated from or who have passed away, you could not forget about?
- (31) Do you time and again get upset over a certain person when you think about them?
- (32) In your whole life, have you experienced deep sorrow about something?
- (33) Do you tend to have troublesome matters on your hands often?
- (34) Even if someone does a terrible thing to you, do you try not to become emotional and try to deal with the situation within the boundaries of commonsense?
- (35) Do you try to stay away as much as possible from relationships from which you do not gain anything?
- (36) Do you often change your attitude towards a certain person who is important to you, being kind to them and then being harsh?
- (37) Do you have a certain person who makes you feel you cannot be happy without them?
- (38) Do you tend to talk to someone when you are experiencing something unpleasant?
- (39) When you are put into a position where you become very angry, do you often think that you cannot change the situation?
- (40) Do you often feel heartbroken when remembering a certain person?
- (41) Have you frequently had the experience of being distressed and thinking that talking to somebody would lighten your mind, but in reality you could not?
- (42) In your whole life, have you experienced heart thumping happiness about something?
- (43) Is there a certain person who always frustrates you because they seldom change their attitude?
- (44) Do you often feel that you cannot be yourself and behave more freely, even though you want to?
- (45) Even if someone does a terrible thing to you, are you the kind of person who cannot be emotional in front of people, even in front of family members?

Appendix 2. Brief description of the stress inventory (SI) scales and their hypothesized disease-proneness

The SI scales ¹	Brief descriptions	Disease proneness		Item No. ²
		Cancer	CHD	
Group 1: Sense of control over stressful situations				
Low sense of control ⁴	Decreased sense of control over stressful situations leading to hardship, despair, or anger.	•	•	7, 18, 29, 39
Group 2: Emotional well-being dependent on other persons and situations				
Object-dependence/loss ⁴	Having an important person who causes persistent hopelessness and depression.	•		8, 19, 30, 40
Object-dependence/happiness ⁴	Having a valued person on whom one's happiness is greatly dependent.	•		15, 37
Object-dependence/anger	Having a persecuting person who causes chronic irritation and anger.		•	9, 20, 31, 43
Annoying barrier	Having a persecuting situation that causes chronic irritation and anger.		•	3, 26
Object-dependence/ambivalence ⁵	Repeatedly experiencing ambivalent interpersonal relationships.	○	○	4, 14, 25, 36
Group 3: Telling problems to others and unfulfilled needs for acceptance by others				
Disclosure of negative experiences	A tendency to disclose one's experiences with negative feelings to others.			2, 16, 24, 38
Unfulfilled needs for acceptance ³	Chronically having unfulfilled needs for acceptance by others.	•		12, 17, 28, 41
Group 4: Self-defensiveness in conflicting interpersonal situations				
Altruism ³	An altruistic tendency, accompanied by stress, in interpersonal and social relationships.	•		10, 22, 33, 44
Egoism ⁵	A self-defensive, self-interest-oriented attitude in interpersonal and social relationships.	○	○	1, 11, 23, 35
Rationalizing conflicts/frustrations ³	An extreme tendency to rationalize one's interpersonal situations accompanied by conflicts or frustrations.	•	•	5, 13, 27, 34, 45
Group 5: Lacking experiences with strong positive and negative emotions				
Lack of emotional experiences	Lack of experiences with strong emotions such as grief, rage or delight.			6, 21, 32, 42

CHD, coronary heart disease; •, increased risk; ○, decreased risk. ¹The SI items and relevant scales were grouped into five in the process of their development. ²See Appendix 1. Scales related to ³emotional suppression, ⁴loss-hopelessness and ⁵hysterical personality.