SECTION 9

Psychological Factors and Mortality in the Japan Collaborative Cohort Study for Evaluation of Cancer (JACC)

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Abstract

Psychological factors may have an influence on disease processes and therefore they were investigated in the Japan Collaborative Cohort Study. Overall there were very few consistent associations with cancer death. Persons with 'ikigai', defined as 'that which most makes one's life seem worth living', demonstrated decreased risk of mortality from all causes, ischemic heart disease (IHD) and cerebrovascular disease (CVD).There was no consistent link with being quick to judge, although those answering no to quick judgement were at increased risk of all cause, IHD and CVD mortality. psychological stress was related to a slightly elevated risk of all cause death, IHD in men and CVD in women. However, a sense of hurry was linked to a slightly reduced risk for mortality from all causes and CVD. Persons who were likely to be angry had an increased risk for mortality from all causes. In women not likely to be angry there were also positive links to death from cancers like breast. Joyfulness was associated with decreased mortality, especially from CVD. A feeling of being trusted was also protective, again particularly for CVD.

Introduction

Psychological factors may have an influence on disease processes and therefore they were investigated in the Japan Collaborative Cohort Study.

Subjects and Methods

In order to assess associations between psychological factors and risk of mortality from all causes, all cancers, site-specific cancers, ischemic heart disease (IHD), and cerebrovascular disease (CVD), a questionnaire and follow-up approach was adopted. Table 1 shows eight questions about psychological factors and their possible answers used in the JACC study. Self-reported psychological factors include ikigai (concept of well-being among Japanese people), quick judgment, psychological stress, sense of hurry, anger, joyfulness, feeling of being trusted and fulfillment, and three or four possible answers

were provided for each item. We excluded 1,014 persons with a previous history of cancer at the baseline survey and 24,361 persons in 12 of the 45 study areas in which the baseline questionnaire did not include questions about these factors. Furthermore, we excluded persons who did not answer each question from the analysis of each item. Therefore, the numbers of subjects, observed person-years and total and cause-specific deaths in each Table are different. We classified answers to each item into three categorical variables by combining positive answers such as 'definitely yes' and 'yes' when four possible answers were given. The group of persons who reported 'maybe yes' was defined as the reference group.

Results

Ikigai (concept of well-being among Japanese people)
Ikigai is a Japanese word that is considered to express well-being. There is no term fully comparable with ikigai

Table 1. Questions of Psychological Factors and their Possible Answers used in the JACC Study

Psychological factor	Question	Answer
Ikigai (concept of well-being)	Do you have 'ikigai' in your life?	definitely yes, yes, maybe yes, no
Quick judgment	Are you quick to judge?	yes, maybe yes, no
Psychological stress	Do you feel stress during your daily life?	definitely yes, yes, maybe yes, no
Sense of hurry	Do you hurry to complete your daily work?	definitely yes, yes, maybe yes, no
Anger	Are you likely to be angry?	yes, maybe yes, no
Joyfulness	Do you enjoy your life?	definitely yes, yes, maybe yes, no
Feeling of being trusted	Do you feel you are trusted by someone?	definitely yes, yes, maybe yes, no
Fulfillment	Do you wish to have your life again?	definitely yes, yes, maybe yes, no

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Table 2. Age-adjusted Hazard Ratios[#] and 95 percent Confidence Intervals for Selected Causes of Death According to Ikigai (Concept of well-being)

			Do you have 'ikigai' in your life?		
			definitely yes or yes	maybe yes	no
Men	ICD10	No. of subjects	16,046	13,223	2,462
Observed person-years			199,877	159,993	28,742
Total deaths		6,506	0.80 (0.76, 0.84)**	1.00	1.33 (1.22, 1.45)**
All cancer deaths	C00-97	2,511	0.92 (0.85, 1.00)[+]	1.00	1.10 (0.95, 1.29)
Esophagus	C15	110	0.81 (0.55, 1.21)	1.00	1.14 (0.56, 2.32)
Stomach	C16	498	0.88 (0.73, 1.06)	1.00	1.09 (0.77, 1.54)
Colon	C18	150	0.93 (0.66, 1.31)	1.00	1.79 (1.03, 3.11)*
Rectum	C19-20	115	0.79 (0.54, 1.17)	1.00	1.05 (0.51, 2.17)
Liver	C22	262	0.72 (0.55, 0.94)*	1.00	0.95 (0.61, 1.50)
Gall bladder	C23	41	1.18 (0.60, 2.30)	1.00	1.92 (0.66, 5.56)
Pancreas	C25	151	1.18 (0.83, 1.67)	1.00	0.83 (0.41, 1.69)
Lung	C33-34	580	1.02 (0.86, 1.22)	1.00	1.06 (0.76, 1.47)
Prostate	C61	112	0.93 (0.62, 1.40)	1.00	1.12 (0.55, 2.29)
Kidney	C64	33	1.32 (0.64, 2.74)	1.00	1.06 (0.23, 4.88)
Urinary Tract	C65-67	60	1.03 (0.59, 1.79)	1.00	1.57 (0.64, 3.84)
Non-Hodgkin's lymphoma	C82-85	55	0.71 (0.40, 1.25)	1.00	1.56 (0.63, 3.85)
Multiple myeloma	C90	27	1.63 (0.73, 3.67)	1.00	0.89 (0.11, 6.99)
Myeloid leukemia	C92	32	1.87 (0.89, 3.97)	1.00	NA
Ischemic heart disease	I20-25	428	0.76 (0.62, 0.94)**	1.00	1.09 (0.77, 1.56)
Cerebrovascular disease	I60-69	859	0.79 (0.69, 0.92)**	1.00	1.49 (1.18, 1.88)**
Women		No. of subjects	19,015	21,724	4,175
Observed person-years			241,698	271,240	51,890
Total deaths		4,557	0.90 (0.84, 0.96)**	1.00	1.32 (1.20, 1.45)**
All cancer deaths	C00-97	1,492	1.01 (0.90, 1.13)	1.00	1.06 (0.88, 1.27)
Esophagus	C15	19	1.08 (0.40, 2.91)	1.00	0.83 (0.16, 4.22)
Stomach	C16	249	0.98 (0.75, 1.28)	1.00	0.86 (0.54, 1.37)
Colon	C18	149	0.98 (0.70, 1.39)	1.00	0.78 (0.42, 1.48)
Rectum	C19-20	62	1.21 (0.69, 2.12)	1.00	2.00 (0.95, 4.24)[+]
Liver	C22	138	0.96 (0.66, 1.39)	1.00	1.08 (0.61, 1.92)
Gall bladder	C23	61	1.33 (0.77, 2.30)	1.00	1.58 (0.69, 3.62)
Pancreas	C25	159	0.80 (0.56, 1.12)	1.00	0.89 (0.50, 1.57)
Lung	C33-34	171	0.98 (0.71, 1.35)	1.00	0.90 (0.50, 1.60)
Breast	C50	62	0.63 (0.35, 1.13)	1.00	1.37 (0.63, 2.99)
Cervix Uteri	C53	25	1.05 (0.44, 2.49)	1.00	2.17 (0.67, 7.11)
Kidney	C64	12	1.75 (0.53, 5.77)	1.00	1.31 (0.15, 11.3)
Urinary Tract	C65-67	20	0.81 (0.30, 2.20)	1.00	1.21 (0.30, 4.89)
Non-Hodgkin's lymphoma	C82-85	43	1.17 (0.60, 2.29)	1.00	2.56 (1.08, 6.07)*
Multiple myeloma	C90	32	1.50 (0.71, 3.17)	1.00	0.68 (0.14, 3.18)
Myeloid leukemia	C92	17	1.55 (0.57, 4.26)	1.00	0.74 (0.09, 6.35)
Ischemic heart disease	I20-25	305	0.77 (0.59, 0.99)*	1.00	1.05 (0.73, 1.51)
Cerebrovascular disease	I60-69	750	0.87 (0.74, 1.03)[+]	1.00	1.37 (1.09, 1.71)**

[#]Adjusted for age and area of study. ** $p < 0.01$; * $p < 0.05$; [+] $p < 0.1$ NA: not applicable

in English. In this study, we defined ikigai as 'that which most makes one's life seem worth living' and defined persons with ikigai as those with positive psychological well-being.

Among persons with ikigai who reported 'definitely yes' or 'yes', the risk for mortality from all causes (hazard ratios, HR = 0.80 for men and HR = 0.90 for women) was decreased compared with that for persons who reported 'maybe yes', whereas persons without ikigai who reported 'no' had high risk for mortality from all causes in both sexes (HR = 1.33 for men and HR = 1.32 for women). The risk of mortality from IHD was also decreased among persons with ikigai in both sexes (HR = 0.76 for men, HR = 0.77 for women). Reduced risks for mortality from CVD among persons with ikigai were observed for men (HR = 0.79) and with borderline significance among women (HR = 0.87), whereas high risk was noted for those without ikigai in both sexes (HR = 1.49 for men and HR = 1.37 for women). The associations between ikigai and mortality from all cancers and site-specific cancers were inconsistent. For men, low risk of liver cancer among those with ikigai and high risk of colon cancer among those without ikigai were observed. For women, a high risk of non-Hodgkin's lymphoma among those without ikigai was noted.

Quick judgment

Persons who reported no quick judgment had increased risks for mortality from all causes (HR = 1.25 for men and HR = 1.23 for women) and CVD (HR = 1.56 for men and HR = 1.42 for women) compared with the risks for those who reported 'maybe yes' in both sexes. There was

Table 3. Age-adjusted Hazard Ratios# and 95 percent Confidence Intervals for Selected Causes of Death According to Quick Judgment

			Are you quick to judge?		
			yes	maybe yes	no
Men	ICD10	No. of subjects	9,971	20,012	2,939
Observed person-years			123,860	244,727	34,295
Total deaths		6,833	0.98 (0.93, 1.04)	1.00	1.25 (1.16, 1.35)**
All cancer deaths	C00-97	2,634	1.05 (0.96, 1.14)	1.00	0.94 (0.82, 1.08)
Esophagus	C15	116	1.26 (0.83, 1.90)	1.00	1.26 (0.69, 2.29)
Stomach	C16	515	1.02 (0.84, 1.24)	1.00	0.73 (0.52, 1.03)+
Colon	C18	161	0.90 (0.63, 1.29)	1.00	0.68 (0.37, 1.27)
Rectum	C19-20	118	0.84 (0.55, 1.28)	1.00	0.76 (0.38, 1.53)
Liver	C22	268	1.02 (0.78, 1.34)	1.00	0.96 (0.63, 1.47)
Gall bladder	C23	42	0.77 (0.36, 1.65)	1.00	1.06 (0.41, 2.76)
Pancreas	C25	158	1.05 (0.73, 1.51)	1.00	1.24 (0.76, 2.04)
Lung	C33-34	623	1.07 (0.89, 1.28)	1.00	1.21 (0.94, 1.56)
Prostate	C61	111	1.10 (0.73, 1.67)	1.00	0.34 (0.13, 0.94)*
Kidney	C64	34	1.98 (0.98, 3.99)+	1.00	0.79 (0.18, 3.44)
Urinary Tract	C65-67	62	1.05 (0.59, 1.87)	1.00	1.35 (0.63, 2.92)
Non-Hodgkin's lymphoma	C82-85	57	0.55 (0.27, 1.10)+	1.00	0.83 (0.33, 2.10)
Multiple myeloma	C90	30	1.34 (0.61, 2.94)	1.00	1.27 (0.37, 4.36)
Myeloid leukemia	C92	32	1.63 (0.79, 3.36)	1.00	0.41 (0.06, 3.10)
Ischemic heart disease	I20-25	446	0.97 (0.78, 1.21)	1.00	0.97 (0.70, 1.34)
Cerebrovascular disease	I60-69	901	0.97 (0.82, 1.13)	1.00	1.56 (1.29, 1.88)**
Women		No. of subjects	10,480	30,542	5,667
Observed person-years			133,268	384,538	69,488
Total deaths		4,754	0.98 (0.91, 1.06)	1.00	1.23 (1.14, 1.33)**
All cancer deaths	C00 -97	1,567	1.08 (0.97, 1.23)	1.00	0.99 (0.85, 1.15)
Esophagus	C15	20	1.45 (0.50, 4.20)	1.00	1.01 (0.28, 3.63)
Stomach	C16	261	0.99 (0.72, 1.34)	1.00	0.86 (0.59, 1.25)
Colon	C18	158	0.77 (0.50, 1.18)	1.00	1.04 (0.67, 1.63)
Rectum	C19 -20	66	1.48 (0.81, 2.71)	1.00	2.10 (1.14, 3.88)*
Liver	C22	146	1.45 (0.99, 2.12)+	1.00	1.19 (0.74, 1.92)
Gall bladder	C23	66	1.28 (0.71, 2.31)	1.00	1.38 (0.70, 2.70)
Pancreas	C25	161	0.86 (0.58, 1.28)	1.00	0.78 (0.48, 1.30)
Lung	C33-34	175	1.14 (0.79, 1.64)	1.00	1.10 (0.70, 1.71)
Breast	C50	67	1.11 (0.63, 1.97)	1.00	0.86 (0.39, 1.93)
Cervix Uteri	C53	23	2.44 (1.00, 5.93)+	1.00	1.63 (0.45, 5.87)
Kidney	C64	14	0.33 (0.04, 2.53)	1.00	0.93 (0.20, 4.24)
Urinary Tract	C65-67	21	0.57 (0.16, 1.99)	1.00	0.56 (0.13, 2.48)
Non-Hodgkin's lymphoma	C82-85	48	2.55 (1.38, 4.73)**	1.00	1.32 (0.54, 3.26)
Multiple myeloma	C90	33	0.89 (0.38, 2.11)	1.00	0.61 (0.18, 2.05)
Myeloid leukemia	C92	17	0.64 (0.18, 2.27)	1.00	NA
Ischemic heart disease	I20-25	321	0.98 (0.74, 1.30)	1.00	0.89 (0.65, 1.23)
Cerebrovascular disease	I60-69	778	0.95 (0.79, 1.15)	1.00	1.42 (1.18, 1.70)**

#Adjusted for age and area of study. ** $p < 0.01$; * $p < 0.05$; + $p < 0.1$ NA: not applicable

no significant association between quick judgment and all cancer deaths. Furthermore, there were inconsistent associations with risks for mortality from site-specific cancers. Among men who reported no quick judgment, reduced risk of prostate cancer was observed. For women, high risk of rectal cancer among those who reported no quick judgment and high risk of non-Hodgkin's lymphoma among those who had quick judgment were found.

Psychological stress

Risk for mortality from all causes was slightly increased with high level of psychological stress (those who reported 'definitely yes' or 'Yes') in both sexes (HR = 1.09 for men and HR = 1.10 for women). For IHD, men with a low level of stress had a decreased risk (HR = 0.71). The risk of mortality from CVD was 1.32-fold higher for women with a high level of stress. For all cancers and site-specific cancers, there were inconsistent associations with levels of psychological stress. Among men with a high level stress, reduced risk of liver cancer was observed. Women with a high level of stress had high risk of liver cancer and low risk of lung cancer, whereas those with a low level of stress, in contrasst, had high risk of uterine cervical cancer.

Sense of hurry

Persons who hurry to complete their daily work had a slightly reduced risk for mortality from all causes (HR = 0.93 for men and HR = 0.92 for women) compared with the risk for those who reported 'maybe yes', whereas those who do not hurry had an increased risk for mortality from all causes in both sexes (HR = 1.24 for men and HR =

Table 4. Age-adjusted Hazard Ratios[#] and 95 percent Confidence Intervals for Selected Causes of Death According to Psychological Stress

			Do you feel stress during your daily life?		
			definitely yes or yes	maybe yes	no
Men	ICD10	No. of subjects	7,283	19,261	5,366
Observed person-years			90,898	235,349	64,579
Total deaths		6,539	1.09 (1.02, 1.16)*	1.00	0.94 (0.88, 1.00)*
All cancer deaths	C00-97	2,514	0.94 (0.84, 1.05)	1.00	0.93 (0.84, 1.03)
Esophagus	C15	109	0.56 (0.30, 1.04)[+]	1.00	0.81 (0.49, 1.36)
Stomach	C16	486	0.87 (0.67, 1.14)	1.00	1.03 (0.82, 1.29)
Colon	C18	151	0.99 (0.63, 1.55)	1.00	1.21 (0.81, 1.81)
Rectum	C19-20	119	0.77 (0.46, 1.31)	1.00	0.85 (0.52, 1.38)
Liver	C22	265	0.98 (0.72, 1.35)	1.00	0.61 (0.43, 0.86)**
Gall bladder	C23	41	0.91 (0.37, 2.23)	1.00	0.48 (0.18, 1.28)
Pancreas	C25	147	1.17 (0.74, 1.84)	1.00	1.39 (0.93, 2.06)
Lung	C33-34	613	0.93 (0.73, 1.17)	1.00	1.01 (0.82, 1.25)
Prostate	C61	113	1.08 (0.62, 1.88)	1.00	1.03 (0.65, 1.63)
Kidney	C64	33	0.75 (0.28, 2.01)	1.00	0.55 (0.18, 1.61)
Urinary Tract	C65-67	60	0.85 (0.39, 1.84)	1.00	0.74 (0.37, 1.47)
Non-Hodgkin's lymphoma	C82-85	56	1.47 (0.76, 2.84)	1.00	0.96 (0.46, 2.02)
Multiple myeloma	C90	29	0.98 (0.36, 2.71)	1.00	1.27 (0.50, 3.21)
Myeloid leukemia	C92	32	1.27 (0.55, 2.94)	1.00	0.53 (0.16, 1.79)
Ischemic heart disease	I20-25	430	0.88 (0.67, 1.17)	1.00	0.71 (0.55, 0.93)*
Cerebrovascular disease	I60-69	855	1.17 (0.96, 1.42)	1.00	1.12 (0.94, 1.32)
Women		No. of subjects	9,100	28,288	7,837
Observed person-years			114,798	356,096	97,817
Total deaths		4,566	1.10 (1.01, 1.19)*	1.00	0.98 (0.91, 1.06)
All cancer deaths	C00 -97	1,501	1.04 (0.90, 1.20)	1.00	1.04 (0.91, 1.18)
Esophagus	C15	19	1.95 (0.68, 5.63)	1.00	0.42 (0.09, 1.94)
Stomach	C16	252	0.92 (0.64, 1.32)	1.00	1.00 (0.73, 1.38)
Colon	C18	146	1.49 (0.98, 2.25)[+]	1.00	0.96 (0.62, 1.50)
Rectum	C19-20	62	1.15 (0.58, 2.27)	1.00	1.33 (0.70, 2.50)
Liver	C22	142	1.73 (1.15, 2.62)**	1.00	1.27 (0.84, 1.94)
Gall bladder	C23	63	1.10 (0.54, 2.22)	1.00	1.26 (0.69, 2.32)
Pancreas	C25	156	0.94 (0.61, 1.46)	1.00	0.66 (0.42, 1.05)[+]
Lung	C33-34	175	0.57 (0.34, 0.95)*	1.00	1.08 (0.74, 1.58)
Breast	C50	65	0.83 (0.42, 1.64)	1.00	1.23 (0.66, 2.30)
Cervix Uteri	C53	23	0.76 (0.21, 2.71)	1.00	2.57 (1.03, 6.38)*
Kidney	C64	12	1.15 (0.24, 5.51)	1.00	1.01 (0.21, 4.77)
Urinary Tract	C65-67	21	0.76 (0.22, 2.61)	1.00	NA
Non-Hodgkin's lymphoma	C82-85	46	1.11 (0.52, 2.37)	1.00	0.82 (0.36, 1.90)
Multiple myeloma	C90	32	0.89 (0.30, 2.65)	1.00	1.78 (0.80, 3.94)
Myeloid leukemia	C92	18	0.76 (0.16, 3.52)	1.00	1.93 (0.68, 5.49)
Ischemic heart disease	I20-I25	300	1.16 (0.84, 1.61)	1.00	0.88 (0.66, 1.19)
Cerebrovascular disease	I60-I69	755	1.32 (1.09, 1.60)**	1.00	0.91 (0.75, 1.10)

[#]Adjusted for age and area of study. ** $p < 0.01$; * $p < 0.05$; [+] $p < 0.1$ NA: not applicable

1.29 for women). For CVD, similar relationships to all-cause mortality risk were observed among men (HR = 0.86 for those who hurry to complete their work and HR = 1.43 for those who do not), whereas for women, high risk was observed among those who do not hurry to complete their daily work (HR = 1.43). For all cancers and site-specific cancers, there was either no significant or no consistent association with sense of hurry.

Anger

Persons who were likely to be angry had an increased risk for mortality from all causes (HR = 1.09; for men and HR = 1.18 for women) compared with the risk for those who reported 'maybe yes' in both sexes. Among women who were not likely to be angry, high risks for mortality from all causes (HR = 1.08), all cancers (HR = 1.16), gallbladder cancer (HR = 2.60), breast cancer (HR = 1.99) and multiple myeloma (HR = 2.18) were observed. Men who were not likely to be angry had an increased risk for mortality from CVD (HR = 1.22).

Joyfulness

Persons with joyfulness who reported 'definitely yes' or 'yes' had a decreased risk for mortality from all causes (HR = 0.86 for men and 0.87 for women) compared with the risk for those who reported 'maybe yes', whereas those without joyfulness had an increased risk for mortality from all causes in both sexes (HR = 1.28 for men and HR = 1.25). Reduced risks for mortality from CVD among persons with joyfulness were observed among men (HR = 0.83) and with borderline significance among women (HR = 0.87), whereas high risk for mortality from CVD

Table 5. Age-adjusted Hazard Ratios[#] and 95 percent Confidence Intervals for Selected Causes of Death According to Sense of Hurry

			Do you hurry to complete your daily work?		
			definitely yes or yes	maybe yes	no
Men	ICD10	No. of subjects	16,437	13,551	2,677
Observed person-years			204,316	165,662	30,800
Total deaths		6,693	0.93 (0.88, 0.98)**	1.00	1.24 (1.15, 1.34)**
All cancer deaths	C00-97	2,590	0.97 (0.89, 1.05)	1.00	1.00 (0.87, 1.14)
Esophagus	C15	112	1.09 (0.74, 1.62)	1.00	1.11 (0.58, 2.18)
Stomach	C16	508	0.99 (0.82, 1.19)	1.00	1.01 (0.74, 1.38)
Colon	C18	156	0.75 (0.54, 1.05)+	1.00	1.03 (0.60, 1.76)
Rectum	C19-20	119	0.87 (0.60, 1.26)	1.00	0.57 (0.26, 1.27)
Liver	C22	263	0.97 (0.75, 1.25)	1.00	0.84 (0.54, 1.32)
Gall bladder	C23	40	1.09 (0.58, 2.05)	1.00	NA
Pancreas	C25	156	1.12 (0.80, 1.57)	1.00	1.29 (0.77, 2.16)
Lung	C33-34	156	1.04 (0.87, 1.23)	1.00	1.20 (0.92, 1.56)
Prostate	C61	112	0.92 (0.62, 1.37)	1.00	0.80 (0.41, 1.56)
Kidney	C64	34	0.63 (0.31, 1.30)	1.00	0.75 (0.22, 2.58)
Urinary Tract	C65-67	61	1.21 (0.70, 2.11)	1.00	1.55 (0.71, 3.40)
Non-Hodgkin's lymphoma	C82-85	55	1.03 (0.59, 1.79)	1.00	0.80 (0.28, 2.34)
Multiple myeloma	C90	30	0.89 (0.43, 1.83)	1.00	NA
Myeloid leukemia	C92	32	1.23 (0.60, 2.53)	1.00	0.45 (0.06, 3.43)
Ischemic heart disease	I20-25	431	0.97 (0.79, 1.19)	1.00	1.28 (0.94, 1.73)
Cerebrovascular disease	I60-69	877	0.86 (0.74, 0.99)*	1.00	1.43 (1.17, 1.74)**
Women		No. of subjects	20,587	21,616	4,286
Observed person-years			262,673	271,005	51,890
Total deaths		4,683	0.92 (0.86, 0.98)**	1.00	1.29 (1.18, 1.40)**
All cancer deaths	C00-97	1,552	0.96 (0.86, 1.06)	1.00	1.10 (0.93, 1.30)
Esophagus	C15	20	1.60 (0.64, 4.01)	1.00	0.45 (0.06, 3.69)
Stomach	C16	261	0.79 (0.61, 1.03)+	1.00	0.98 (0.66, 1.46)
Colon	C18	156	0.91 (0.65, 1.28)	1.00	1.04 (0.62, 1.73)
Rectum	C19-20	65	1.72 (1.00, 2.95)+	1.00	1.80 (0.81, 4.00)
Liver	C22	142	1.25 (0.87, 1.78)	1.00	1.09 (0.63, 1.90)
Gall bladder	C23	65	1.12 (0.66, 1.90)	1.00	1.37 (0.64, 2.96)
Pancreas	C25	159	0.82 (0.59, 1.15)	1.00	0.77 (0.44, 1.34)
Lung	C33-34	159	0.94 (0.69, 1.29)	1.00	0.99 (0.59, 1.65)
Breast	C50	67	0.66 (0.38, 1.14)	1.00	1.78 (0.90, 3.52)+
Cervix Uteri	C53	24	0.95 (0.38, 2.35)	1.00	2.87 (0.97, 8.54)+
Kidney	C64	14	0.79 (0.26, 2.43)	1.00	0.64 (0.08, 5.16)
Urinary Tract	C65 -67	19	0.47 (0.15, 1.50)	1.00	1.95 (0.65, 5.92)
Non-Hodgkin's lymphoma	C82 -85	49	0.70 (0.38, 1.26)	1.00	0.48 (0.14, 1.60)
Multiple myeloma	C90	33	0.67 (0.32, 1.44)	1.00	0.91 (0.30, 2.76)
Myeloid leukemia	C92	18	0.39 (0.12, 1.24)	1.00	1.07 (0.29, 4.04)
Ischemic heart disease	I20-25	315	0.79 (0.62, 1.01)+	1.00	0.91 (0.64, 1.27)
Cerebrovascular disease	I60 -69	761	1.00 (0.85, 1.17)	1.00	1.43 (1.17, 1.76)**

[#]Adjusted for age and area of study. ** p < 0.01; * p < 0.05; + p < 0.1   NA: not applicable

was observed among those without joyfulness in both sexes (HR = 1.92 for men and HR = 1.40 for women). There was no consistent association for all cancer and site-specific cancer deaths. Among men with joyfulness, high risk for myeloid leukemia and low risk for non-Hodgkin's lymphoma were observed. For women, reduced risk for colon cancer was observed among those with joyfulness, whereas high risks for liver and uterine cervical cancer were observed among those without joyfulness.

Being trusted

Persons with a feeling of being trusted had a decreased risk for mortality from all causes (HR = 0.89 for men and HR = 0.81 for women) compared with the risk for those who reported 'maybe yes', whereas those without a feeling of being trusted had an increased risk for mortality from all causes (HR = 1.19 for men and HR = 1.17 for women). For CVD, similar relationships to all-cause mortality risk were observed in both sexes: HRs were 0.80 for men with a feeling of being trusted and 1.52 for men without a feeling of being trusted, and the respective HRs were 0.77 and 1.33 for women. There was no consistent association between feeling of being trusted and mortality from all cancer and site-specific cancers. For men, the risk of lung cancer was decreased among those with a feeling of being trusted and the risk of multiple myeloma was increased among those without a feeling of being trusted. For women, the risk of pancreas cancer was decreased among those with a feeling of being trusted and the risk of uterine cervical cancer was increased among those with and those without a feeling of being trusted.

Table 6. Age-adjusted Hazard Ratios[#] and 95 percent Confidence Intervals for Selected Causes of Death According to Anger

			Are you likely to be angry?		
			yes	maybe yes	no
Men	ICD10	No. of subjects	6,934	20,858	3,480
Observed person-years			84,968	255,027	41,788
Total deaths		6,294	1.09 (1.04, 1.17)**	1.00	1.06 (0.98, 1.14)
All cancer deaths	C00-97	2,440	1.02 (0.92, 1.12)	1.00	1.03 (0.91, 1.17)
Esophagus	C15	110	1.00 (0.61, 1.63)	1.00	1.46 (0.86, 2.46)
Stomach	C16	483	1.02 (0.81, 1.29)	1.00	1.08 (0.83, 1.42)
Colon	C18	149	0.87 (0.56, 1.35)	1.00	1.39 (0.89, 2.19)
Rectum	C19-20	109	1.00 (0.61, 1.63)	1.00	1.66 (1.00, 2.77)[+]
Liver	C22	232	1.07 (0.78, 1.46)	1.00	0.79 (0.50, 1.24)
Gall bladder	C23	39	1.29 (0.60, 2.78)	1.00	1.06 (0.40, 2.81)
Pancreas	C25	145	1.12 (0.76, 1.66)	1.00	0.53 (0.28, 1.02)[+]
Lung	C33-34	575	0.97 (0.78, 1.20)	1.00	0.97 (0.75, 1.26)
Prostate	C61	102	1.08 (0.64, 1.80)	1.00	1.28 (0.74, 2.22)
Kidney	C64	33	1.00 (0.43, 2.36)	1.00	1.00 (0.34, 2.92)
Urinary Tract	C65-67	56	0.93 (0.46, 1.87)	1.00	0.96 (0.43, 2.16)
Non-Hodgkin's lymphoma	C82-85	57	0.56 (0.25, 1.25)	1.00	1.09 (0.51, 2.34)
Multiple myeloma	C90	30	1.33 (0.55, 3.22)	1.00	2.08 (0.81, 5.33)
Myeloid leukemia	C92	32	0.98 (0.42, 2.30)	1.00	0.52 (0.12, 2.20)
Ischemic heart disease	I20-25	406	1.08 (0.85, 1.39)	1.00	1.10 (0.82, 1.48)
Cerebrovascular disease	I60-69	818	1.15 (0.97, 1.38)	1.00	1.22 (1.00, 1.49)*
Women		No. of subjects	5,839	31,664	6,776
Observed person-years			73,044	397,083	83,274
Total deaths		4,399	1.18 (1.08, 1.29)**	1.00	1.08 (1.00, 1.17)*
All cancer deaths	C00-97	1,454	1.10 (0.94, 1.30)	1.00	1.16 (1.02, 1.33)*
Esophagus	C15	17	0.89 (0.20, 3.94)	1.00	0.23 (0.03, 1.78)
Stomach	C16	243	1.20 (0.83, 1.74)	1.00	0.85 (0.60, 1.22)
Colon	C18	152	1.15 (0.70, 1.90)	1.00	1.39 (0.94, 2.05)
Rectum	C19-20	62	0.49 (0.18, 1.35)	1.00	0.58 (0.26, 1.28)
Liver	C22	126	1.53 (0.95, 2.47)[+]	1.00	0.95 (0.58, 1.55)
Gall bladder	C23	63	0.72 (0.25, 2.02)	1.00	2.60 (1.53, 4.42)**
Pancreas	C25	146	0.92 (0.53, 1.58)	1.00	1.06 (0.70, 1.62)
Lung	C33-34	166	0.88 (0.53, 1.46)	1.00	1.10 (0.74, 1.64)
Breast	C50	60	1.17 (0.55, 2.53)	1.00	1.99 (1.09, 3.65)*
Cervix Uteri	C53	24	0.33 (0.04, 2.48)	1.00	1.65 (0.65, 4.22)
Kidney	C64	14	1.45 (0.31, 6.72)	1.00	1.40 (0.38, 5.19)
Urinary Tract	C65-67	19	0.47 (0.06, 3.56)	1.00	0.74 (0.21, 2.55)
Non-Hodgkin's lymphoma	C82-85	47	0.63 (0.22, 1.78)	1.00	0.84 (0.37, 1.90)
Multiple myeloma	C90	30	0.33 (0.04, 2.45)	1.00	2.18 (1.00, 4.74)*
Myeloid leukemia	C92	16	0.63 (0.08, 4.90)	1.00	1.90 (0.64, 5.66)
Ischemic heart disease	I20-25	298	1.17 (0.82, 1.68)	1.00	1.04 (0.78, 1.39)
Cerebrovascular disease	I60-69	718	1.06 (0.83, 1.35)	1.00	1.09 (0.91, 1.31)

[#]Adjusted for age and area of study. ** $p < 0.01$; * $p < 0.05$; [+] $p < 0.1$

Fulfillment

Generally, the association between fulfillment and mortality was inconsistent. Men who had no fulfillment had decreased risks for all cancer deaths and non-Hodgkin's lymphoma, whereas those who had fulfillment had a decreased risk for myeloid leukemia. For women, a high risk for lung cancer was observed among those who had fulfillment.

Discussion

In this chapter, we have shown sex-specific age-adjusted hazard ratios of mortality from all causes, all cancers, site-specific cancers, IHD and CVD according to negative psychological factors, including psychological stress, anger and time urgency (quick judgment and sense

of hurry), and positive psychological factors, including ikigai, joyfulness, feeling of being trusted and fulfillment.

Psychological stress is considered to be associated with increased risks for diseases, especially for cardiovascular disease (Greenwood et al., 1996; Harmsen et al., 2006; Truelsen et al., 2003). In the present analysis, psychological stress was shown to be associated with the risk of all-cause mortality in both sexes. In addition, men with a low level of stress had a decreased risk of mortality from IHD and women with a high level of stress had an increased risk of mortality from CVD. In previous detailed analysis, Iso et al. examined the association between psychological stress and cardiovascular disease using data obtained in the JACC study until the end of 1997 (average follow-up period of 7.9 years) and found that women who reported a high level of stress had a higher risk for

Table 7. Age-adjusted Hazard Ratios[#] and 95 percent Confidence Intervals for Selected Causes of Death According to Joyfulness

			Do you enjoy your life?		
			definitely yes or yes	maybe yes	no
Men	ICD10	No. of subjects	12,416	17,523	1,228
Observed person-years			151,636	214,467	14,545
Total deaths		6,241	0.86 (0.82, 0.91)**	1.00	1.28 (1.12, 1.46)**
All cancer deaths	C00-97	2,415	0.96 (0.89, 1.05)	1.00	0.93 (0.73, 1.19)
Esophagus	C15	110	0.89 (0.60, 1.32)	1.00	1.34 (0.54, 3.35)
Stomach	C16	474	0.94 (0.78, 1.13)	1.00	0.85 (0.47, 1.51)
Colon	C18	147	0.82 (0.59, 1.16)	1.00	1.03 (0.42, 2.55)
Rectum	C19-20	109	0.76 (0.51, 1.14)	1.00	1.13 (0.41, 3.10)
Liver	C22	233	0.89 (0.68, 1.16)	1.00	1.17 (0.59, 2.30)
Gall bladder	C23	39	0.90 (0.47, 1.74)	1.00	0.88 (0.12, 6.56)
Pancreas	C25	142	1.03 (0.73, 1.45)	1.00	0.96 (0.35, 2.63)
Lung	C33-34	571	1.00 (0.84, 1.18)	1.00	0.73 (0.41, 1.29)
Prostate	C61	100	1.14 (0.77, 1.69)	1.00	NA
Kidney	C64	33	1.02 (0.51, 2.07)	1.00	0.99 (0.13, 7.43)
Urinary Tract	C65-67	54	1.41 (0.82, 2.41)	1.00	NA
Non-Hodgkin's lymphoma	C8 -85	56	0.53 (0.29, 0.97)*	1.00	1.43 (0.44, 4.65)
Multiple myeloma	C90	29	1.11 (0.52, 2.38)	1.00	2.35 (0.53, 10.4)
Myeloid leukemia	C92	32	2.50 (1.19, 5.23)*	1.00	1.64 (0.21, 12.7)
Ischemic heart disease	I20-25	400	0.94 (0.77, 1.15)	1.00	0.78 (0.40, 1.51)
Cerebrovascular disease	I60-69	810	0.83 (0.72, 0.96)*	1.00	1.92 (1.39, 2.63)**
Women		No. of subjects	16,638	25,498	1,980
Observed person-years			207,243	319,773	24,377
Total deaths		4,354	0.87 (0.82, 0.93)**	1.00	1.25 (1.08, 1.43)**
All cancer deaths	C00 -97	1,438	1.03 (0.92, 1.14)	1.00	0.88 (0.66, 1.17)
Esophagus	C15	17	1.09 (0.41, 2.90)	1.00	NA
Stomach	C16	241	1.20 (0.93, 1.56)	1.00	0.69 (0.31, 1.57)
Colon	C18	148	0.69 (0.49, 0.99)*	1.00	0.45 (0.14, 1.41)
Rectum	C19 -20	62	0.74 (0.42, 1.30)	1.00	1.04 (0.32, 3.38)
Liver	C22	126	0.87 (0.60, 1.27)	1.00	2.05 (1.06, 3.98)*
Gall bladder	C23	63	1.62 (0.97, 2.68)[+]	1.00	0.98 (0.23, 4.13)
Pancreas	C25	147	0.90 (0.64, 1.25)	1.00	0.17 (0.02, 1.21)[+]
Lung	C33-34	162	1.18 (0.86, 1.62)	1.00	1.21 (0.56, 2.61)
Breast	C50	59	1.23 (0.72, 2.08)	1.00	0.39 (0.05, 2.87)
Cervix Uteri	C53	24	1.38 (0.58, 3.26)	1.00	3.88 (1.08, 14.0)*
Kidney	C64	14	0.59 (0.16, 2.17)	1.00	3.36 (0.72, 15.7)
Urinary Tract	C65 -67	18	1.10 (0.42, 2.89)	1.00	1.71 (0.22, 13.5)
Non-Hodgkin's lymphoma	C82-85	46	0.71 (0.37, 1.34)	1.00	0.91 (0.22, 3.82)
Multiple myeloma	C90	28	1.22 (0.57, 2.63)	1.00	0.99 (0.13, 7.49)
Myeloid leukemia	C92	16	1.74 (0.62, 4.83)	1.00	2.00 (0.24, 16.3)
Ischemic heart disease	I20 -25	290	0.84 (0.66, 1.08)	1.00	1.16 (0.67, 2.00)
Cerebrovascular disease	I60-69	717	0.87 (0.74, 1.02)[+]	1.00	1.40 (1.01, 1.94)*

[#]Adjusted for age and area of study. ** p < 0.01; * p < 0.05; [+] p < 0.1   NA: not applicable

mortality from stroke and IHD than did women who reported a low level of stress after adjustment for cardiovascular risk factors (Iso et al., 2002). They also showed that men who reported a moderate or high level of stress had an increased risk for mortality from IHD (Iso, et al., 2002).

It has been shown that anger trait and its coping styles (expression or suppression of anger), which are included in Type A behavior pattern, could predict all-cause mortality and cardiovascular disease (Everson et al., 1999; Harburg et al., 2003; Hemingway et al., 1999; Williams et al., 2002; Wilson et al., 2003). Previous studies have also shown that suppression of anger is associated with an increased risk for cancer mortality, especially among women (Harburg, et al., 2003; Scheier et al., 1995). The present analysis showed a high risk of mortality from all causes, but not from IHD, among persons who are likely to be angry in both sexes and also among women who are not likely to be angry. In addition, the risk of mortality from CVD was increased among men who are not likely to be angry. Furthermore, a trend for increase in the risk for cancer death was observed among women, but not among men, who are not likely to be angry.

Although time urgency is also one of components of Type A behavior pattern, there is little information on the association of time urgency with mortality. One case-control study showed that time urgency was associated with a dose-response increase in risk of non-fatal myocardial infarction (Cole et al., 2001). According to another prospective study, time urgency seems to be associated with a decreased risk of cancer (Sturmer et al., 2006). However, the present analysis showed high risks

Table 8. Age-adjusted Hazard Ratios# and 95 percent Confidence Intervals for Selected Causes of Death According to Feeling of Being Trusted

			Do you feel you are trusted by someone ?		
			definitely yes or yes	maybe yes	no
Men	ICD10	No. of subjects	8,258	19,324	3,482
Observed person-years			101,470	236,868	41,097
Total deaths		6,227	0.89 (0.84, 0.95)**	1.00	1.19 (1.11, 1.28)**
All cancer deaths	C00-97	2,412	0.92 (0.84, 1.01)+	1.00	0.98 (0.87, 1.12)
Esophagus	C15	110	1.47 (0.96, 2.24)+	1.00	1.40 (0.80, 2.43)
Stomach	C16	473	0.85 (0.68, 1.06)	1.00	0.94 (0.71, 1.25)
Colon	C18	149	0.87 (0.59, 1.28)	1.00	1.15 (0.71, 1.87)
Rectum	C19-20	110	1.05 (0.68, 1.62)	1.00	0.96 (0.52, 1.78)
Liver	C22	231	0.83 (0.61, 1.12)	1.00	0.88 (0.57, 1.36)
Gall bladder	C23	39	0.96 (0.44, 2.07)	1.00	1.20 (0.49, 2.94)
Pancreas	C25	140	0.91 (0.60, 1.37)	1.00	1.22 (0.76, 1.97)
Lung	C33-34	568	0.78 (0.64, 0.96)*	1.00	0.87 (0.67, 1.14)
Prostate	C61	101	0.94 (0.60, 1.48)	1.00	0.55 (0.25, 1.20)
Kidney	C64	33	1.16 (0.54, 2.50)	1.00	1.08 (0.37, 3.19)
Urinary Tract	C65-67	57	0.91 (0.49, 1.69)	1.00	0.98 (0.43, 2.21)
Non-Hodgkin's lymphoma	C82-85	55	0.94 (0.49, 1.78)	1.00	1.43 (0.68, 3.00)
Multiple myeloma,	C90	30	1.27 (0.54, 3.00)	1.00	2.52 (1.02, 6.23)*
Myeloid leukemia	C92	32	1.59 (0.78, 3.24)	1.00	NA
Ischemic heart disease	I20-25	401	0.94 (0.74, 1.18)	1.00	1.07 (0.79, 1.44)
Cerebrovascular disease	I60-69	804	0.80 (0.67, 0.96)*	1.00	1.52 (1.27, 1.83)**
Women		No. of subjects	9,634	28,465	5,770
Observed person-years			118,626	358,732	71,007
Total deaths		4,315	0.81 (0.75, 0.88)**	1.00	1.17 (1.08, 1.27)**
All cancer deaths	C00-97	1,438	0.90 (0.79, 1.03)	1.00	1.04 (0.89, 1.21)
Esophagus	C15	19	N.A	1.00	1.45 (0.51, 4.09)
Stomach	C16	246	0.98 (0.72, 1.35)	1.00	1.16 (0.81, 1.65)
Colon	C18	151	0.80 (0.52, 1.24)	1.00	1.31 (0.85, 2.02)
Rectum	C19-20	60	0.84 (0.42, 1.69)	1.00	1.19 (0.59, 2.39)
Liver	C22	124	1.07 (0.70, 1.64)	1.00	1.05 (0.62, 1.78)
Gall bladder	C23	62	1.32 (0.74, 2.36)	1.00	1.01 (0.47, 2.17)
Pancreas	C25	146	0.61 (0.38, 0.97)*	1.00	0.95 (0.59, 1.54)
Lung	C33-34	161	0.93 (0.63, 1.36)	1.00	0.83 (0.50, 1.37)
Breast	C50	60	0.78 (0.40, 1.52)	1.00	0.71 (0.30, 1.66)
Cervix Uteri	C53	23	2.62 (1.00, 6.85)*	1.00	3.43 (1.21, 9.71)*
Kidney	C64	12	0.77 (0.16, 3.57)	1.00	0.50 (0.06, 3.99)
Urinary Tract	C65-67	17	0.21 (0.03, 1.59)	1.00	0.32 (0.04, 2.42)
Non-Hodgkin's lymphoma	C82-85	47	0.42 (0.16, 1.09)+	1.00	1.30 (0.62, 2.74)
Multiple myeloma	C90	28	1.05 (0.41, 2.68)	1.00	1.43 (0.52, 3.92)
Myeloid leukemia	C92	16	0.23 (0.03, 1.73)	1.00	0.78 (0.18, 3.51)
Ischemic heart disease	I20-25	278	1.01 (0.75, 1.35)	1.00	0.82 (0.58, 1.17)
Cerebrovascular disease	I60-69	705	0.77 (0.63, 0.95)*	1.00	1.33 (1.10, 1.62)**

#Adjusted for age and area of study. ** $p < 0.01$; * $p < 0.05$; + $p < 0.1$ NA: not applicable

for mortality from all causes and from CVD among persons who had no quick judgment and no sense of hurry. For our subjects, quick judgment and sense of hurry to complete daily work may express positive attitudes toward their life rather than time urgency as negative psychological factors. According to univariate correlation analysis among eight psychological factors, quick judgment was positively correlated with feeling of being trusted, ikigai, sense of hurry and joyfulness in both sexes, whereas sense of hurry was positively correlated with quick judgment, psychological stress, anger and feeling of being trusted in both sexes (data not shown).

Some previous studies have suggested that positive psychological factors, such as well-being, life satisfaction and optimism, contribute to reduction of the risk for all-cause mortality and cardiovascular disease (Blazer et al.,

2004; Giltay et al., 2004; Koivumaa-Honkanen et al., 2000; Ostir et al., 2001). In the present analysis, positive psychological factors, such as ikigai, joyfulness and feeling of being trusted, were associated with decreased risks for mortality from all causes and from CVD. Seki showed that the presence of ikigai decreased the risk for mortality from all causes after adjustment for sex, age and previous medical histories among elderly people aged 60 to 74 years by using seven-year follow-up data in one area of the JACC study (Seki, 2001). Sakata et al, using 10-year follow-up data in another area of the JACC study, demonstrated that the absence of ikigai was associated with increased risks for cardiovascular disease and stroke among men and heart disease among women after adjustment for age, smoking and drinking status, prevalence of history of hypertension (Sakata et al., 2002).

Table 9. Age-adjusted Hazard Ratios[#] and 95 percent Confidence Intervals for Selected Causes of Death According to Fulfillment

			Do you wish to have your life again?		
			definitely yes or yes	maybe yes	no
Men	ICD10	No. of subjects	8,258	14,235	8,192
Observed person-years			98,417	174,741	101,434
Total deaths		6,125	0.99 (0.93, 1.05)	1.00	1.05 (0.98, 1.12)
All cancer deaths	C00 - C97	2,375	0.99 (0.90, 1.09)	1.00	0.89 (0.80, 0.99)*
Esophagus	C15	108	0.96 (0.62, 1.49)	1.00	0.76 (0.46, 1.26)
Stomach	C16	464	1.10 (0.89, 1.35)	1.00	0.88 (0.69, 1.12)
Colon	C18	147	0.78 (0.53, 1.14)	1.00	0.75 (0.49, 1.14)
Rectum	C19-20	109	0.88 (0.56, 1.40)	1.00	1.09 (0.69, 1.73)
Liver	C22	225	1.05 (0.77, 1.43)	1.00	1.07 (0.77, 1.49)
Gall bladder	C23	39	1.09 (0.53, 2.26)	1.00	1.13 (0.50, 2.56)
Pancreas	C25	141	1.06 (0.73, 1.55)	1.00	0.88 (0.57, 1.36)
Lung	C33 -34	560	0.95 (0.78, 1.15)	1.00	0.95 (0.77, 1.18)
Prostate	C61	95	1.04 (0.65, 1.64)	1.00	1.05 (0.62, 1.79)
Kidney	C64	33	1.35 (0.64, 2.85)	1.00	0.65 (0.24, 1.80)
Urinary Tract	C65 -67	56	1.44 (0.81, 2.56)	1.00	0.86 (0.40, 1.86)
Non-Hodgkin's lymphoma	C82 -85	56	0.77 (0.42, 1.40)	1.00	0.41 (0.18, 0.93)*
Multiple myeloma	C90	29	1.24 (0.52, 2.95)	1.00	1.21 (0.49, 2.97)
Myeloid leukemia	C92	32	0.35 (0.13, 0.93)*	1.00	0.44 (0.17, 1.18)
Ischemic heart disease	I20 -25	393	0.89 (0.71, 1.13)	1.00	0.98 (0.76, 1.26)
Cerebrovascular disease	I60 -69	795	0.98 (0.84, 1.16)	1.00	1.11 (0.93, 1.33)
Women		No. of subjects	9,717	19,454	14,698
Observed person-years			119,418	242,998	185,820
Total deaths		4,318	0.99 (0.92, 1.07)	1.00	1.03 (0.96, 1.10)
All cancer deaths	C00 -97	1,421	1.08 (0.95, 1.23)	1.00	0.97 (0.85, 1.09)
Esophagus	C15	18	0.85 (0.26, 2.80)	1.00	0.88 (0.29, 2.63)
Stomach	C16	239	1.04 (0.76, 1.43)	1.00	0.96 (0.71, 1.30)
Colon	C18	150	1.05 (0.70, 1.58)	1.00	1.06 (0.73, 1.53)
Rectum	C19 -20	59	0.98 (0.51, 1.91)	1.00	0.90 (0.50, 1.64)
Liver	C22	122	1.20 (0.75, 1.90)	1.00	1.42 (0.94, 2.13)+
Gall bladder	C23	62	1.22 (0.68, 2.20)	1.00	0.76 (0.40, 1.42)
Pancreas	C25	144	1.11 (0.75, 1.65)	1.00	0.75 (0.50, 1.12)
Lung	C33-34	159	1.54 (1.06, 2.23)*	1.00	1.04 (0.71, 1.53)
Breast	C50	57	0.85 (0.39, 1.84)	1.00	1.43 (0.81, 2.53)
Cervix Uteri	C53	23	1.52 (0.56, 4.10)	1.00	1.05 (0.39, 2.83)
Kidney	C64	14	1.60 (0.36, 7.16)	1.00	2.49 (0.73, 8.55)
Urinary Tract	C65 -67	18	0.33 (0.07, 1.48)	1.00	0.52 (0.17, 1.60)
Non-Hodgkin's lymphoma	C82 -85	45	0.58 (0.26, 1.27)	1.00	0.51 (0.24, 1.05)+
Multiple myeloma	C90	29	1.32 (0.59, 2.96)	1.00	0.37 (0.12, 1.12)+
Myeloid leukemia	C92	16	1.27 (0.35, 4.57)	1.00	1.40 (0.45, 4.36)
Ischemic heart disease	I20-25	293	1.08 (0.81, 1.45)	1.00	1.05 (0.80, 1.37)
Cerebrovascular disease	I60 -69	710	0.93 (0.77, 1.13)	1.00	1.00 (0.84, 1.18)

[#]Adjusted for age and area of study. * $p < 0.05$; + $p < 0.1$

Furthermore, they showed that women who had no feeling of being trusted had increased risks for cardiovascular disease, heart disease and CVD (Sakata et al., 2002).

Evidence that psychological factors such as personal traits and emotions are risk factors for cancer remains sparse (Dalton et al., 2002; Garssen, 2004; Kubzansky et al., 2000). This might be related to the fact that cancer comprises a heterogeneous group of diseases of multiple etiologies that vary in their tissue of origin, cell type, biological behavior, anatomic site, and degree of differentiation (Kubzansky et al., 2000). Our findings suggest that the association between psychological factors and mortality from all cancers is ambiguous. The roles of psychological factors associated with mortality from site-specific cancers are also inconsistent, although statistical significant associations were found with cancers in several sites. In analysis using data from one local area of the JACC study, Sakata et al. found no significant associations of psychological stress, ikigai and feeling of being trusted with all-cancer death in agreement with our findings (Sakata et al., 2002). However, in previous detailed analysis, Kojima et al. found a significant association between dichotomized levels of stress and risk for mortality from colon cancer in women, but not in men (Kojima et al., 2005). The present analysis showed a borderline significant association with increased risk of colon cancer among women with high levels of stress compared with those with moderate levels of stress (those who responded 'maybe yes'). This discrepancy may be explained by the difference in the classification of stress levels and the reference group. It was earlier found that women with ikigai and/or had quick judgment had a

significantly lower risk of breast cancer incidence (Wakai et al., 2007). However, the present analysis was unable to examine the effects of psychological factors on cancer incidence, because the end point here was death. There was no significant association between psychological factors and risk of mortality from breast cancer, but mechanisms associated cancer development and death might differ.

Our findings should be interpreted carefully because there are several limitations in the present analysis. First, in the JACC study, each psychological factor was assessed by a single simple question. In addition, the validity and reliability of these questions were not examined. Each psychological factor used in this study is clearly a complex affective state. Therefore, as discussed (Kojima et al., 2005), our results should be confirmed using more sophisticated methods. Second, hazard ratios in the present analysis were adjusted for only age and other confounding factors could be operating. Lifestyle factors, such as smoking and drinking status, daily diet and exercise, are well known to contribute to morbidity and mortality. Socioeconomic factors, such as job status, marital status and education level, may also impact on diseases. Third, the extent of physical illness may affect psychological factors. In the present analysis, we did not consider the influence of physical illness other than cancer. We also included subjects who died just after the baseline survey. Therefore, our findings from the present analysis may be due to reverse causation.

In conclusion, the present analysis using data from the JACC study until the end of 2003 demonstrated that negative psychological factors, such as psychological stress and anger, are associated with high risk for mortality from all causes and cardiovascular disease. We also showed that positive psychological factors, such as ikigai, joyfulness and feeling of being trusted, contribute to reduced risk. However, our findings suggest that there are inconsistent associations between psychological factors and mortality from all cancers and site-specific cancers.

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