

## Psychological Factors and Mortality Risk in a Rural Area of Japan

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### ABSTRACT

**Background** The purpose of this study is to assess the association between psychological factors and mortality risk from all causes.

**Methods** We used follow-up data for 4,181 persons from 40 to 79 years over a period of 17.6 years from one part of the Japan Collaborative Cohort Study (JACC Study). The status of the individuals comprising the data of the study as of the end of December 2006 was determined from their registration cards and death records. We calculated the proportions of selected variables among 5 psychological factors by sex. Cox's proportional hazards model was used to evaluate the associations between psychological factors and mortality risk from all causes. Data were adjusted for age, medical history, education, job status, marital status, drinking, smoking, physical activity, sleeping duration, body mass index and breakfast.

**Results** During the follow-up period, a total of 791 deaths were recorded. Men who reported feelings of being trusted had a decreased risk for mortality risk from all causes compared with the risk of those who reported “maybe”, whereas those without feelings of being trusted had increased risk for mortality risk from all causes.

**Conclusion** This study suggests that the absence of feelings of being trusted increases the risk of all causes of mortality among middle-aged and elderly men in a rural area. Our findings suggest that interpersonal relationships comprise an important factor in longevity.

**Key words** feeling of being trusted; long-term cohort study; mortality risk; psychological factor; survival analysis

Some previous studies have suggested that positive psychological factors, such as well-being, life satisfaction and optimism, contribute to reduction of mortality risk from all causes.<sup>1–14</sup> In Japan, *ikigai* is a Japanese word that is considered to express one's personal well-being.<sup>1</sup>

To our knowledge, there is no equivalent term in English. *Ikigai* is defined in Japanese dictionaries as something to live for, the joy and goal of living, a life worth living, and the happiness and benefit of being alive. It is also understood to be a comprehensive concept including not only pleasure and happiness but also the meaning of one's life and self-realization.<sup>2, 3</sup> In the present study, we defined *ikigai* as “that which most makes one's life seem worth living” and defined persons with *ikigai* as those with a positive sense of psychological well-being. Previous studies<sup>1–9</sup> suggested that lack of *ikigai* was associated with increased mortality risk from all causes. Psychological stress is considered to be associated with increase risks for disease, especially for cardiovascular disease.<sup>15–18</sup> Time urgency is also one of components of the Type A behavior pattern, but there is little information on the association of time urgency with mortality risk.<sup>19</sup> Information on the association time urgency with mortality is also little.<sup>1</sup>

Only 2 investigations<sup>1, 4</sup> have looked at the relationship between the feeling of being trusted and mortality risk. These studies suggested that in those who had no feeling of being trusted, mortality risk of all causes increased. However, the adjusted confounding factors were less in both studies. Tanno and Sakata<sup>1</sup> adjusted for age and residence of confounding factors the subject. Sakata et al.<sup>4</sup> adjusted age, smoking status, drinking status and past hypertension.

The purpose of the present study is to assess the association between psychological factors and mortality risk from all causes. This research attempted to clarify the level of influence of various psychological factors after multivariate adjustment on mortality risk from all causes, on the basis of a long-term cohort study.

### SUBJECTS AND METHODS

The present study began in 1989 in Nichinan Town, an agricultural community located in the southwest area of Tottori Prefecture. About 90% of the town is forest. The birth rate is low while longevity progresses.<sup>20</sup> The main industries of the town are agriculture and construction accounting for about 50% of the economy of the town, the local labor force being mainly engaged in these occupations. At that time, the town had a total population

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Abbreviations: BMI, body mass index; HR, hazard ratio; JACC Study, the Japan Collaborative Cohort Study

of 7,943, of whom 26.3% aged 65 years or older. By 2005, because of the steadily declining birth rate and aging, the town population had decreased to 44.9% of the 1989 level according to the national census.<sup>21</sup>

We used 17.6-year follow-up data (1,979 men and 2,430 women from 40 to 79 years) from one area of the Japan Collaborative Cohort Study (JACC Study).<sup>11, 12, 22, 23</sup> The status of the individuals comprising the data of the study at the end of December 2006 was determined from their registration cards and death records. To conserve personal information, the names of all individuals were coded. Privacy concerns were noted and the study was approved by the Ethics Committee of Tottori University (approval number, 1380).

### Survey items and classifications

The baseline survey contents in 1989 were elicited by self-administered questionnaire: medical history (stroke, hypertension, myocardial infarction, kidney disease, liver disease, cholecystitis or cholelithiasis, diabetes mellitus, gastric ulcer or duodenal ulcer, tuberculosis or pleurisy or cancer), eating habits, movement, rest, health condition, psychological condition, drinking habit, smoking habit, height, weight, marriage history, school education and occupation. In the present study, we used the following items out of the above; psychological factors, medical history, alcohol use status, smoking status, physical activity, sleep duration, body mass index (BMI), breakfast, education level, job status and marital status. Psychological factors involved getting data on “*ikigai*,” “psychological stress,” “sense of hurry,” “a feeling of being trusted” and “life satisfaction.” *Ikigai* was assessed through the subject’s response to the question “Do you have *ikigai* in your life?” We classified the items related to *ikigai* into 2 categories by combining positive answers such as “definitely yes” and “yes” into one category and negative answers such as “maybe yes” and “unknown” into the other because the answers are similar. The negative category formed the reference group for *ikigai*.

Psychological stress was assessed through the subject’s response to the question “Do you feel stress during your daily life?” The sense of hurry was assessed through the subject’s response to the question “Do you hurry to complete your daily work?” The feeling of being trusted was assessed through the subject’s response to the question “Do you feel you are trusted by someone?” Life satisfaction was assessed through the subject’s response to the question “Do you wish you could live your life over again?” We classified answers to these 4 items into 3 categories by combining positive answers such as “definitely yes” and “yes” into one category, negative answers such as “no” and “maybe yes” to another.

The group of “maybe yes” was defined as the reference group.

The responses related to medical history (stroke, hypertension, myocardial infarction, kidney disease, liver disease, cholecystitis or cholelithiasis, diabetes mellitus, gastric ulcer or duodenal ulcer, tuberculosis or pleurisy or cancer) were classified into 2 categories: “yes” or “no.” Alcohol use status was classified into 3 categories: “current drinker,” “past drinker” or “non-drinker.” Smoking status was also classified into 3 categories: “current smoker,” “past smoker” or “non-smoker.” Physical activity was classified into 2 categories: “exercise  $\geq$  1 h/week” or “exercise rarely.” Sleep duration was classified into 3 categories: “ $<$  7 h,” “ $\geq$  7 h and  $<$  9 h,” “ $\geq$  9 h.” BMI was classified into 3 categories: “ $<$  18.5,” “ $\geq$  18.5 and  $<$  25,” “ $\geq$  25.” Breakfast was classified into 2 categories: “I eat” and “I rarely eat.”

About social factors, education was classified into 2 categories: “age at graduation of  $<$  18 years” or “higher age at final graduation”. Job was classified into 3 categories: “unemployed” (including “housewife”), “employee” (including “office worker” and “self-employed”) or “farmer” (including “contracted worker”). Marital status was classified into 2 categories: “living with a spouse” or “other” (single, divorced or widowed).

### Statistical analysis

We excluded 227 persons who died within 5 years after the study began. As for persons transferring, the period to transfer was analyzed as a pursuit period. We calculated the proportions of the selected variables for the 5 psychosocial factors by sex at baseline. The above-mentioned categorical variables were compared using a chi-squared test between each psychological factor by sex. We calculated Spearman’s correlation coefficient for each psychological factor at baseline. Cox’s proportional hazards model was used to evaluate the associations between each psychological factor and mortality risk from all causes. Data were adjusted for age, medical history, education, job status, marital status, drinking status, smoking status, physical activity, sleep duration, BMI and breakfast by sex. We used IBM SPSS Statistics Ver.19 (IBM, Chicago, IL) for analysis.

### RESULTS

During the follow-up period (average 15.7 years; total 65,660.5 person years), a total of 791 deaths (482 men and 309 women) were recorded. Tables 1 to 5 show selected baseline characteristics of the subjects according to the psychological factors by sex. Each psychological factor was observed significant differences mutually. The relations with items other than psychological factors

**Table 1. Selected baseline characteristics of the subjects according to *ikigai* by sex**

		<i>Ikigai</i>							
		Men		Women					
		Maybe yes or unknown	Definitely yes or yes	Maybe yes or unknown	Definitely yes or yes				
		<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)
Age, yr	40–49	156	(47.1)	175	(52.9)*	248	(62.5)	149	(37.5)*
	50–59	322	(55.6)	257	(44.4)	483	(66.1)	248	(33.9)
	60–69	280	(52.0)	258	(48.0)	459	(72.5)	174	(27.5)
	70–79	138	(60.0)	92	(40.0)	240	(71.0)	98	(29.0)
Medical history	Absence	304	(49.6)	309	(50.4)	558	(66.0)	287	(34.0)
	Existence	238	(54.0)	203	(46.0)	264	(68.4)	122	(31.6)
Drinking status	Never	154	(58.8)	108	(41.2)*	939	(69.5)	412	(30.5)**
	Past	86	(61.9)	53	(38.1)	25	(73.5)	9	(26.5)
	Current	647	(51.5)	610	(48.5)	271	(60.0)	181	(40.0)
Smoking status	Never	205	(50.2)	203	(49.8)	1140	(67.4)	552	(32.6)
	Past	234	(55.2)	190	(44.8)	20	(74.1)	7	(25.9)
	Current	434	(53.4)	379	(46.6)	40	(72.7)	15	(27.3)
Physical activity	Exercise rarely	689	(55.6)	550	(44.4)**	1151	(69.3)	511	(30.7)*
	Exercise ≥ 1 h/week	149	(43.2)	196	(56.8)	151	(62.1)	92	(37.9)
Sleep duration, h	≥ 7 and < 9	604	(52.0)	557	(48.0)*	923	(67.9)	437	(32.1)**
	< 7	153	(51.5)	144	(48.5)	367	(64.4)	203	(35.6)
	≥ 9	115	(62.5)	69	(37.5)	98	(84.5)	18	(15.5)
BMI	≥ 18.5 and < 25	648	(52.1)	595	(47.9)	969	(67.2)	474	(32.8)
	< 18.5	46	(64.8)	25	(35.2)	69	(69.0)	31	(31.0)
	≥ 25	139	(51.7)	130	(48.3)	276	(68.5)	127	(31.5)
Breakfast	Eat rarely	88	(57.1)	66	(42.9)	155	(68.0)	73	(32.0)
	Eat	808	(53.0)	716	(47.0)	1275	(68.1)	596	(31.9)
Education	Age at graduation of < 18 years	553	(53.2)	486	(46.8)	844	(68.8)	382	(31.2)
	Higher age at final graduation	263	(54.6)	219	(45.4)	467	(67.5)	225	(32.5)
Job status	Unemployed	176	(66.2)	90	(33.8)**	602	(71.4)	241	(28.6)*
	Employed-worker or self-employed worker	351	(47.4)	389	(52.6)	480	(63.8)	272	(36.2)
	Farmer	300	(52.4)	273	(47.6)	180	(65.5)	95	(34.5)
Marital status	Single, divorced or widowed	76	(69.1)	34	(30.9)**	224	(73.4)	81	(26.6)*
	Living with a spouse	624	(49.8)	629	(50.2)	884	(65.6)	463	(34.4)
Psychological stress	Maybe yes	598	(56.0)	470	(44.0)*	949	(69.3)	421	(30.7)**
	Definitely yes or yes	203	(50.2)	201	(49.8)	316	(70.7)	131	(29.3)
	No	79	(44.1)	100	(55.9)	108	(50.0)	108	(50.0)
Sense of hurry	Maybe yes	418	(59.5)	284	(40.5)**	719	(74.0)	252	(26.0)**
	Definitely yes or yes	378	(45.3)	457	(54.7)	570	(61.0)	365	(39.0)
	No	85	(70.2)	36	(29.8)	121	(70.3)	51	(29.7)
Feeling of being trusted	Maybe yes	593	(54.9)	487	(45.1)**	910	(69.3)	403	(30.7)**
	Definitely yes or yes	71	(24.7)	217	(75.3)	102	(38.9)	160	(61.1)
	No	222	(76.0)	70	(24.0)	374	(79.4)	97	(20.6)
Life satisfaction	Maybe yes	441	(58.8)	313	(41.2)**	632	(71.7)	249	(28.3)**
	Definitely yes or yes	104	(28.8)	257	(71.2)	138	(44.2)	174	(55.8)
	No	329	(62.4)	198	(37.6)	616	(72.6)	233	(27.4)

BMI, body mass index.

\* $P < 0.05$ .\*\* $P < 0.001$ .

are shown below. As for *ikigai*, significant differences were observed in the category of age, drinking status, physical activity, sleep duration, job status and marital status among men and women (Table 1). As for psychological stress, the same results as *ikigai* among women (Table 2). As for sense of hurry, significant differences were observed in the category of age, drinking status, job status and marital status among men and women (Table 3). As for feeling of being trusted, there was no

significant difference in the category of age among both men and women (Table 4). As for life satisfaction, significant differences were observed in the category of age and job status among men and women (Table 5). There were observed significant differences between 5 psychological factors and job status among men and women. Only among women, significant differences were observed between 5 psychological factors and marital status. Table 6 shows correlation coefficients between

**Table 2. Selected baseline characteristics of the subjects according to psychological stress by sex**

		Psychological stress											
		Men			Women								
		Maybe	Definitely	No	Maybe	Definitely	No						
		yes	yes or yes		yes	yes or yes							
		<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)		
Age, yr	40–49	190	(57.1)	117	(35.1)	26	(7.8)**	236	(58.7)	137	(34.1)	29	(7.2)**
	50–59	371	(63.6)	166	(28.5)	46	(7.9)	507	(69.0)	164	(22.3)	64	(8.7)
	60–69	371	(69.3)	97	(18.1)	67	(12.6)	451	(70.9)	113	(17.8)	72	(11.3)
	70–79	159	(69.1)	28	(12.2)	43	(18.7)	229	(69.0)	39	(11.7)	64	(19.3)
Medical history	Absence	395	(64.1)	147	(23.9)	74	(12.0)	582	(68.2)	177	(20.8)	94	(11.0)
	Existence	285	(64.0)	120	(27.0)	40	(9.0)	254	(65.5)	100	(25.8)	34	(8.7)
Drinking status	Never	179	(68.1)	49	(18.6)	35	(13.3)	960	(70.8)	259	(19.1)	136	(10.1)**
	Past	86	(62.8)	34	(24.8)	17	(12.4)	19	(55.9)	9	(26.5)	6	(17.6)
	Current	814	(64.7)	319	(25.3)	126	(10.0)	260	(57.1)	137	(30.1)	58	(12.8)
Smoking status	Never	268	(65.7)	91	(22.3)	49	(12.0)	1134	(67.0)	369	(21.8)	189	(11.2)
	Past	275	(64.6)	100	(23.5)	51	(11.9)	20	(74.1)	4	(14.8)	3	(11.1)
	Current	524	(64.7)	210	(25.9)	76	(9.4)	31	(54.4)	21	(36.8)	5	(8.8)
Physical activity	Exercise rarely	794	(64.0)	322	(26.0)	124	(10.0)*	1123	(66.8)	383	(22.8)	174	(10.4)*
	Exercise ≥ 1 h/week	228	(66.1)	69	(20.0)	48	(13.9)	166	(69.5)	38	(15.9)	35	(14.6)
Sleep duration, h	≥ 7 and < 9	753	(64.8)	279	(24.0)	130	(11.2)	957	(69.8)	268	(19.5)	146	(10.7)**
	< 7	182	(61.1)	91	(30.5)	25	(8.4)	353	(62.0)	160	(28.1)	56	(9.9)
	≥ 9	128	(70.3)	31	(17.0)	23	(12.7)	74	(64.9)	15	(13.2)	25	(21.9)
BMI	≥ 18.5 and < 25	823	(66.1)	289	(32.2)	133	(10.7)	964	(66.7)	318	(22.0)	163	(11.3)
	< 18.5	46	(64.8)	16	(22.5)	9	(12.7)	70	(69.3)	19	(18.8)	12	(11.9)
	≥ 25	164	(60.1)	80	(29.3)	29	(10.6)	280	(68.3)	88	(21.5)	42	(10.2)
Breakfast	Eat rarely	99	(63.9)	42	(27.1)	14	(9.0)	147	(64.2)	54	(23.6)	28	(12.2)
	Eat	992	(65.0)	366	(24.0)	168	(11.0)	1276	(68.0)	399	(21.3)	201	(10.7)
Education	Age at graduation of < 18 years	676	(64.4)	255	(24.3)	118	(11.3)	850	(69.2)	244	(19.9)	134	(10.9)
	Higher age at final graduation	310	(64.7)	123	(25.7)	46	(9.6)	455	(65.4)	169	(24.3)	72	(10.3)
Job status	Unemployed	182	(68.4)	47	(17.7)	37	(13.9)*	593	(70.8)	138	(16.5)	107	(12.7)**
	Employed-worker or self-employed worker	470	(63.1)	195	(26.2)	80	(10.7)	488	(64.4)	195	(25.7)	75	(9.9)
	Farmer	367	(64.7)	147	(25.9)	53	(9.4)	189	(66.8)	75	(26.5)	19	(6.7)
Marital status	Single, divorced, or widowed	70	(65.4)	20	(18.7)	17	(15.9)	181	(59.7)	70	(23.1)	52	(17.2)**
	Living with a spouse	798	(63.7)	322	(25.7)	132	(10.6)	927	(68.7)	300	(22.2)	122	(9.1)
<i>Ikigai</i>	Maybe yes or unknown	598	(68.0)	203	(23.0)	79	(9.0)*	949	(69.1)	316	(23.0)	108	(7.9)**
	Definitely yes or yes	470	(61.0)	201	(26.0)	100	(13.0)	421	(63.8)	131	(19.8)	108	(16.4)
Sense of hurry	Maybe yes	523	(74.4)	101	(14.4)	79	(11.2)**	739	(76.0)	136	(14.0)	98	(10.0)**
	Definitely yes or yes	489	(58.4)	280	(33.5)	68	(8.1)	576	(61.5)	288	(30.8)	72	(7.7)
	No	69	(57.5)	22	(18.3)	29	(24.2)	96	(55.2)	25	(14.4)	53	(30.4)
Feeling of being trusted	Maybe yes	747	(69.0)	223	(20.6)	112	(10.4)**	949	(71.6)	260	(19.6)	116	(8.8)**
	Definitely yes or yes	156	(53.6)	102	(35.1)	33	(11.3)	147	(55.9)	79	(30.0)	37	(14.1)
	No	175	(60.6)	79	(27.3)	35	(12.1)	289	(61.8)	106	(22.6)	73	(15.6)
Life satisfaction	Maybe yes	531	(70.8)	152	(20.3)	67	(8.9)**	644	(73.3)	157	(17.9)	77	(8.8)**
	Definitely yes or yes	227	(62.4)	83	(22.8)	54	(14.8)	220	(70.1)	38	(12.1)	56	(17.8)
	No	305	(57.4)	167	(31.5)	59	(11.1)	521	(60.9)	250	(29.2)	85	(9.9)

BMI, body mass index.

\* $P < 0.05$ .\*\* $P < 0.001$ .

psychological factors by sex. Correlations were found among each of the psychological factors, but the strength of the association was weak.

Table 7 shows the age-adjusted and multivariate-adjusted hazard ratios (HRs) and 95% confidence levels of all causes mortality risk according to the 5 psychological factors among men, and Table 8 shows among women, in each follow-up period.

### *Ikigai*

For men who reported “definitely yes” or “yes” in response to the question of whether they had *ikigai*, their risk for mortality from all causes after adjusting for age, the multivariate statistic (age-adjusted HR = 0.64, multivariate HR = 0.76) decreased compared with that for men who reported “maybe” or “no.” However, the risk-adjusted multivariate HR was not significant ( $P > 0.05$ ).

**Table 3. Selected baseline characteristics of the subjects according to sense of hurry by sex**

		Sense of hurry											
		Men			Women								
		Maybe	Definitely		Maybe	Definitely							
		yes	yes or yes	No	yes	yes or yes	No						
		<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)						
Age, yr	40–49	142	(42.9)	177	(53.5)	12	(3.6)**	180	(44.4)	207	(51.2)	18	(4.4)**
	50–59	231	(39.4)	323	(55.0)	33	(5.6)	335	(44.7)	369	(49.2)	46	(6.1)
	60–69	246	(45.1)	257	(47.2)	42	(7.7)	331	(50.7)	269	(41.2)	53	(8.1)
	70–79	105	(44.9)	93	(39.7)	36	(15.4)	171	(49.1)	115	(33.0)	62	(17.9)
Medical history	Absence	266	(43.0)	314	(50.8)	38	(6.2)	418	(48.5)	394	(45.7)	50	(5.8)*
	Existence	186	(41.7)	225	(50.4)	35	(7.9)	177	(45.2)	177	(45.2)	38	(9.6)
Drinking status	Never	127	(48.1)	115	(43.6)	22	(8.3)*	697	(50.3)	568	(41.0)	120	(8.7)**
	Past	62	(44.6)	61	(43.9)	16	(11.5)	14	(41.2)	16	(47.1)	4	(11.7)
	Current	527	(41.4)	667	(52.4)	80	(6.2)	169	(36.6)	260	(56.3)	33	(7.1)
Smoking status	Never	180	(44.1)	201	(49.3)	27	(6.6)	810	(47.0)	771	(44.7)	142	(8.3)
	Past	184	(43.0)	213	(49.8)	31	(7.2)	11	(40.7)	12	(44.4)	4	(14.9)
	Current	341	(41.4)	420	(51.0)	63	(7.6)	19	(32.8)	29	(50.0)	10	(17.2)
Physical activity	Exercise rarely	521	(41.9)	623	(50.1)	99	(8.0)	798	(46.8)	765	(44.9)	142	(8.3)
	Exercise ≥ 1 h/week	146	(42.2)	181	(52.3)	19	(5.5)	118	(48.4)	104	(42.6)	22	(9.0)
Sleep duration, h	≥ 7 and < 9	503	(43.1)	590	(50.5)	75	(6.4)	665	(47.7)	629	(45.1)	101	(7.2)**
	< 7	118	(39.3)	159	(53.0)	23	(7.7)	258	(44.4)	271	(46.6)	52	(9.0)
	≥ 9	82	(43.4)	86	(45.5)	21	(11.1)	54	(45.4)	43	(36.1)	22	(18.5)
BMI	≥ 18.5 and < 25	532	(42.6)	628	(50.2)	90	(7.2)	679	(46.1)	690	(46.9)	103	(7.0)*
	< 18.5	33	(45.2)	31	(42.5)	9	(12.3)	55	(51.4)	40	(37.4)	12	(11.2)
	≥ 25	112	(40.9)	148	(54.0)	14	(5.1)	189	(45.8)	180	(43.6)	44	(10.6)
Breakfast	Eat rarely	69	(44.8)	81	(52.6)	4	(2.6)	114	(47.5)	111	(46.3)	15	(6.2)
	Eat	655	(42.4)	769	(49.8)	119	(7.8)	903	(47.1)	849	(44.3)	164	(8.6)
Education	Age at graduation of < 18 years	457	(43.2)	529	(50.0)	72	(6.8)	608	(48.2)	555	(44.0)	99	(7.8)
	Higher age at final graduation	194	(40.1)	249	(51.4)	41	(8.5)	316	(44.5)	325	(45.8)	69	(9.7)
Job status	Unemployed	118	(44.7)	104	(39.4)	42	(15.9)**	412	(48.1)	333	(38.9)	111	(13.0)**
	Employed-worker or self-employed worker	303	(40.3)	402	(53.5)	46	(6.2)	359	(46.6)	378	(49.1)	33	(4.3)
	Farmer	251	(43.7)	296	(51.6)	27	(4.7)	116	(40.7)	153	(53.7)	16	(5.6)
Marital status	Single, divorced or widowed	50	(46.3)	40	(37.0)	18	(16.7)**	129	(41.9)	131	(42.5)	48	(15.6)**
	Living with a spouse	510	(40.4)	667	(52.9)	84	(6.7)	631	(46.4)	632	(46.4)	98	(7.2)
<i>Ikigai</i>	Maybe yes or unknown	418	(47.5)	378	(42.9)	85	(9.6)**	719	(51.0)	570	(40.4)	121	(8.6)**
	Definitely yes or yes	284	(36.6)	457	(58.8)	36	(4.6)	252	(37.7)	365	(54.6)	51	(7.7)
Psychological stress	Maybe yes	523	(48.4)	489	(45.2)	69	(6.4)**	739	(52.3)	576	(40.8)	96	(6.9)**
	Definitely yes or yes	101	(25.1)	280	(69.5)	22	(5.4)	136	(30.3)	288	(43.1)	25	(26.6)
	No	79	(44.9)	68	(38.6)	29	(16.5)	98	(43.9)	72	(32.3)	53	(23.8)
Feeling of being trusted	Maybe yes	492	(45.1)	537	(49.2)	63	(5.7)**	683	(50.7)	589	(43.7)	75	(5.6)**
	Definitely yes or yes	94	(32.1)	188	(64.2)	11	(3.7)	88	(33.2)	166	(62.6)	11	(4.2)
Life satisfaction	No	125	(43.1)	117	(40.3)	48	(16.6)	216	(44.8)	179	(37.1)	87	(18.1)
	Maybe yes	318	(41.8)	390	(51.4)	52	(6.8)*	475	(53.0)	365	(40.7)	57	(6.3)**
	Definitely yes or yes	156	(42.4)	195	(53.0)	17	(4.6)	124	(38.9)	169	(53.0)	26	(8.1)
	No	231	(43.6)	247	(46.6)	52	(9.8)	383	(43.8)	403	(46.1)	88	(10.1)

BMI, body mass index.

\* $P < 0.05$ .\*\* $P < 0.001$ .

Women respondents showed no significant results ( $P > 0.05$ ) for any of the above adjustments.

### Psychological stress

No significant association was found between psychological stress and mortality risk from all causes for both sexes across all of the adjustments described above.

### Sense of hurry

Respondents who reported that they had a sense of hurry in completing their daily work had a reduced risk of mortality from all causes after adjusting for age (HR = 0.78) compared with those who reported “maybe.” However, multivariate analyses were not significant ( $P > 0.05$ ) in men. In addition, there was no significant association ( $P > 0.05$ ) between sense of hurry and mortality risk from all causes among women.



**Table 4. Selected baseline characteristics of the subjects according to feeling of being trusted by sex**

		Feeling of being trusted					
		Men			Women		
		Maybe	Definitely		Maybe	Definitely	
		yes	yes or yes	No	yes	yes or yes	No
		<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Age, yr	40–49	216 (65.3)	62 (18.7)	53 (16.0)	261 (65.3)	57 (14.3)	82 (20.4)
	50–59	380 (65.0)	103 (17.6)	102 (17.4)	469 (63.9)	100 (13.6)	165 (22.5)
	60–69	362 (66.7)	84 (15.5)	97 (17.8)	424 (65.1)	73 (11.2)	154 (23.7)
	70–79	143 (60.1)	45 (18.9)	50 (21.0)	211 (62.4)	36 (10.7)	91 (26.9)
Medical history	Absence	415 (67.6)	108 (17.6)	91 (14.8)	570 (66.9)	107 (12.6)	175 (20.5)
	Existence	276 (62.0)	94 (21.1)	75 (16.9)	242 (61.9)	63 (16.1)	86 (22.0)
Drinking status	Never	159 (60.7)	44 (16.8)	59 (22.5)	904 (65.9)	160 (11.7)	307 (22.4)*
	Past	93 (66.4)	25 (17.9)	22 (15.7)	15 (44.1)	5 (14.7)	14 (41.2)
	Current	837 (65.7)	222 (17.4)	215 (16.9)	293 (63.8)	72 (15.7)	94 (20.5)
Smoking status	Never	270 (66.2)	69 (16.9)	69 (16.9)	1111 (65.1)	223 (13.1)	373 (21.8)*
	Past	273 (63.6)	81 (18.9)	75 (17.5)	17 (63.0)	4 (14.8)	6 (22.2)
	Current	534 (65.0)	138 (16.8)	150 (18.2)	26 (45.6)	9 (15.8)	22 (38.6)
Physical activity	Exercise rarely	805 (64.8)	202 (16.3)	235 (18.9)*	1069 (63.3)	209 (12.4)	412 (24.3)*
	Exercise ≥ 1 h/week	229 (66.0)	75 (21.6)	43 (12.4)	163 (67.6)	37 (15.4)	41 (17.0)
Sleep duration, h	≥ 7 and < 9	765 (65.4)	215 (18.4)	190 (16.2)**	908 (65.6)	167 (12.1)	309 (22.3)*
	< 7	195 (65.4)	56 (18.8)	47 (15.8)	345 (61.1)	89 (15.8)	131 (23.1)
	≥ 9	116 (61.0)	18 (9.5)	56 (29.5)	74 (62.2)	6 (5.0)	39 (32.8)
BMI	≥ 18.5 and < 25	803 (64.2)	231 (18.5)	216 (17.3)	937 (64.4)	182 (12.5)	337 (23.1)
	< 18.5	46 (62.2)	8 (10.8)	20 (27.0)	72 (67.9)	11 (10.4)	23 (21.7)
	≥ 25	186 (68.4)	47 (17.3)	39 (14.3)	258 (63.1)	62 (15.2)	89 (21.7)
Breakfast	Eat rarely	103 (66.5)	29 (18.7)	23 (14.8)	143 (60.9)	27 (11.5)	65 (27.6)
	Eat	998 (64.7)	265 (17.2)	279 (18.1)	1222 (64.7)	239 (12.7)	427 (22.6)
Education	Age at graduation of < 18 years	684 (65.1)	185 (17.6)	182 (17.3)	803 (64.7)	161 (13.0)	278 (22.3)
	Higher age at final graduation	314 (64.1)	83 (16.9)	93 (19.0)	440 (62.9)	90 (12.9)	170 (24.2)
Job status	Unemployed	173 (63.6)	31 (11.4)	68 (25.0)**	529 (62.5)	96 (11.3)	222 (26.2)*
	Employed-worker or self-employed worker	482 (64.3)	158 (21.1)	110 (14.6)	494 (65.3)	111 (14.7)	152 (20.0)
	Farmer	366 (64.7)	97 (17.1)	103 (18.2)	189 (66.8)	35 (12.4)	59 (20.8)
Marital status	Single, divorced or widowed	70 (64.2)	10 (9.2)	29 (26.6)*	176 (58.1)	28 (9.2)	99 (32.7)**
	Living with a spouse	806 (63.9)	254 (20.1)	201 (16.0)	881 (65.3)	193 (14.3)	275 (20.4)
<i>Ikigai</i>	Maybe yes or unknown	593 (66.9)	71 (8.0)	222 (25.1)**	910 (65.7)	102 (7.3)	374 (27.0)**
	Definitely yes or yes	487 (62.9)	217 (28.0)	70 (9.1)	403 (61.1)	160 (24.2)	97 (14.7)
Psychological stress	Maybe yes	747 (69.3)	156 (14.5)	175 (16.2)**	949 (68.5)	147 (10.6)	289 (20.9)**
	Definitely yes or yes	223 (55.2)	102 (25.2)	79 (19.6)	260 (58.4)	79 (17.8)	106 (23.8)
	No	112 (62.2)	33 (18.3)	35 (19.5)	116 (51.3)	37 (16.4)	73 (32.3)
Sense of hurry	Maybe yes	492 (69.2)	94 (13.2)	125 (17.6)**	683 (69.2)	88 (8.9)	216 (21.9)**
	Definitely yes, or yes	537 (63.8)	188 (22.3)	117 (13.9)	589 (63.1)	166 (17.8)	179 (19.1)
	No	63 (51.6)	11 (9.0)	48 (39.4)	75 (43.4)	11 (6.4)	87 (50.2)
Life satisfaction	Maybe yes	533 (70.2)	106 (14.0)	120 (15.8)**	613 (68.8)	93 (10.4)	185 (20.8)**
	Definitely yes or yes	225 (61.1)	116 (31.5)	27 (7.4)	216 (68.1)	69 (21.8)	32 (10.1)
	No	319 (59.8)	68 (12.8)	146 (27.4)	502 (58.0)	99 (11.4)	265 (30.6)

BMI, body mass index.

\* $P < 0.05$ .\*\* $P < 0.001$ .**Feeling of being trusted**

Men who had feeling of being trusted had a decreased mortality risk from all causes compared with those who reported “maybe,” whereas in those who lacked the feeling of being trusted, mortality risk from all causes increased (age-adjusted HR = 1.59, multivariate HR = 1.67). However, there was no significant difference among women.

**Life satisfaction**

There was no significant association between feeling of life satisfaction and mortality risk from all causes for both sexes across all adjustments as described above.

**Table 5. Selected baseline characteristics of the subjects according to life satisfaction by sex**

		Life satisfaction											
		Men			Women								
		Maybe	Definitely		Maybe	Definitely							
		yes	yes or yes	No	yes	yes or yes	No						
		<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)						
Age, yr	40–49	143	(42.8)	56	(16.8)	135	(40.4)**	166	(41.5)	45	(11.3)	189	(47.2)**
	50–59	291	(50.3)	101	(17.5)	186	(32.2)	299	(40.5)	108	(14.6)	331	(44.9)
	60–69	225	(42.1)	150	(28.0)	160	(29.9)	297	(46.2)	98	(15.2)	248	(38.6)
	70–79	109	(47.0)	65	(28.0)	58	(25.0)	146	(43.1)	72	(21.2)	121	(35.7)
Medical history	Absence	278	(45.6)	130	(21.3)	202	(33.1)	388	(45.5)	130	(15.3)	334	(39.2)*
	Existence	215	(48.3)	94	(21.1)	136	(30.6)	168	(43.2)	43	(11.1)	178	(45.7)
Drinking status	Never	130	(50.4)	45	(17.4)	83	(32.2)	603	(44.2)	210	(15.4)	550	(40.4)
	Past	52	(37.7)	39	(28.3)	47	(34.0)	16	(47.1)	1	(2.9)	17	(50.0)
	Current	579	(45.8)	281	(22.2)	403	(32.0)	180	(39.3)	65	(14.2)	213	(46.5)
Smoking status	Never	192	(47.8)	90	(22.4)	120	(29.8)	738	(43.4)	253	(14.9)	708	(41.7)
	Past	181	(42.7)	95	(22.4)	148	(34.9)	16	(57.1)	4	(14.3)	8	(28.6)
	Current	380	(46.4)	175	(21.4)	264	(32.2)	17	(30.9)	9	(16.4)	29	(52.7)
Physical activity	Exercise rarely	576	(46.8)	247	(20.0)	409	(33.2)*	722	(43.0)	238	(14.2)	721	(42.8)
	Exercise ≥ 1 h/week	145	(42.0)	95	(27.5)	105	(30.5)	98	(40.3)	42	(17.3)	103	(42.4)
Sleep duration, h	≥ 7 and < 9	541	(46.7)	250	(21.6)	368	(31.7)	611	(44.6)	204	(14.9)	556	(40.5)
	< 7	122	(40.9)	71	(23.8)	105	(35.3)	226	(39.2)	89	(15.5)	261	(45.3)
	≥ 9	90	(48.1)	42	(22.5)	55	(29.4)	45	(39.1)	22	(19.1)	48	(41.8)
BMI	≥ 18.5 and < 25	567	(45.8)	283	(22.8)	389	(31.4)	617	(42.6)	219	(15.1)	614	(42.3)
	< 18.5	37	(50.7)	11	(15.1)	25	(34.2)	43	(40.6)	12	(11.3)	51	(48.1)
	≥ 25	116	(42.8)	58	(21.4)	97	(35.8)	179	(44.1)	62	(15.3)	165	(40.6)
Breakfast	Eat rarely	72	(46.2)	32	(20.5)	52	(33.3)	97	(41.8)	34	(14.7)	101	(43.5)
	Eat	696	(45.7)	340	(22.3)	487	(32.0)	811	(43.0)	289	(15.3)	788	(41.7)
Education	Age at graduation of < 18 years	491	(46.9)	227	(21.7)	328	(31.4)	532	(42.9)	181	(14.6)	527	(42.5)
	Higher age at final graduation	216	(44.8)	95	(19.7)	171	(35.5)	305	(43.6)	110	(15.7)	285	(40.7)
Job status	Unemployed	112	(41.8)	65	(24.3)	91	(33.9)*	382	(45.0)	149	(17.6)	317	(37.4)**
	Employed-worker or self-employed worker	340	(46.1)	187	(25.3)	211	(28.6)	316	(41.8)	101	(13.4)	339	(44.8)
	Farmer	265	(46.2)	100	(17.5)	208	(36.3)	101	(35.9)	39	(13.9)	141	(50.2)
Marital status	Single, divorced or widowed	45	(40.5)	20	(18.0)	46	(41.5)	110	(36.3)	31	(10.2)	162	(53.5)**
	Living with a spouse	585	(46.7)	268	(21.4)	401	(31.9)	593	(44.1)	215	(16.0)	538	(39.9)
<i>Ikigai</i>	Maybe yes or unknown	441	(50.5)	104	(11.9)	329	(37.6)**	632	(45.6)	138	(10.0)	616	(44.4)**
	Definitely yes or yes	313	(40.8)	257	(33.5)	198	(25.7)	249	(38.0)	174	(26.5)	233	(35.5)
Psychological stress	Maybe yes	531	(50.0)	227	(21.4)	305	(28.6)**	644	(46.5)	220	(15.9)	521	(37.6)**
	Definitely yes or yes	152	(37.8)	83	(20.6)	167	(41.6)	157	(35.3)	38	(8.5)	250	(56.2)
	No	67	(37.2)	54	(30.0)	59	(32.8)	77	(35.3)	56	(25.7)	85	(39.0)
Sense of hurry	Maybe yes	318	(45.1)	156	(22.1)	231	(32.8)*	475	(48.4)	124	(12.6)	383	(39.0)**
	Definitely yes or yes	390	(46.9)	195	(23.4)	247	(29.7)	365	(39.0)	169	(18.0)	403	(43.0)
	No	52	(43.0)	17	(14.0)	52	(43.0)	57	(33.3)	26	(15.2)	88	(51.5)
Feeling of being trusted	Maybe yes	533	(49.5)	225	(20.9)	319	(29.6)**	613	(46.1)	216	(16.2)	502	(37.7)**
	Definitely yes or yes	106	(36.6)	116	(40.0)	68	(23.4)	93	(35.6)	69	(26.5)	99	(37.9)
	No	120	(41.0)	27	(9.2)	146	(49.8)	185	(38.4)	32	(6.6)	265	(55.0)

BMI, body mass index.

\* $P < 0.05$ .\*\* $P < 0.001$ .

## DISCUSSION

In this study of Japanese men and women from 40 to 79 years, those who denied a feeling of being trusted showed an increased mortality risk from all causes. However, among both men and women who reported having *ikigai*, psychological stress, sense of hurry or life satisfaction, the relationship to mortality risk from all

causes was not significant.

Previous studies<sup>1–9</sup> reported that the presence of *ikigai* decreased mortality risk from all causes. But, the present study did not support the results of these studies, presumably because the adjusted confounders in the studies<sup>1, 2, 4–9</sup> were less than in our study. Sone et al.<sup>3</sup> followed up 43,391 Japanese adults over 7 years, and

**Table 6. Correlation coefficients between psychological factors by sex**

		Psychological stress	Sense of hurry	Feeling of being trusted	Life satisfaction
Men	<i>Ikigai</i>	-0.003	0.167**	0.304**	0.223**
	Psychological stress		0.211**	0.046	-0.084**
	Sense of hurry			0.163**	0.063**
	Feeling of being trusted				0.229**
Women	<i>Ikigai</i>	-.093**	0.122**	0.226**	0.152**
	Psychological stress		0.218**	0.044*	-0.152**
	Sense of hurry			0.169**	0.023
	Feeling of being trusted				0.163**

\*  $P < 0.05$ .\*\*  $P < 0.001$ .**Table 7. Age-adjusted and multivariate HRs and 95% CIs for death according to psychological factors among men**

	Alive		Dead				
	<i>n</i>	(%)	<i>n</i>	(%)	Observed person-years	HR [95% CI]	Multivariate HR
Do you have “ <i>ikigai</i> ” in your life?	1,239	(100.0)	439	(100.0)			
Maybe yes or unknown	620	(50.0)	276	(62.9)	2,996	1.00	1.00
Definitely yes or yes	619	(50.0)	163	(37.1)	1,855	0.64 [0.53–0.78]**	0.76 [0.56–1.04]
Do you feel stress during your daily life?	1,249	(100.0)	432	(100.0)			
Maybe yes	794	(63.6)	297	(68.7)	3,321	1.00	1.00
Definitely yes or yes	327	(26.2)	81	(18.8)	895	0.97 [0.76–1.24]	0.85 [0.57–1.26]
No	128	(10.2)	54	(12.5)	559	1.01 [0.76–1.34]	0.95 [0.59–1.53]
Do you hurry to complete your daily work?	1,255	(100.0)	442	(100.0)			
Maybe yes	515	(41.0)	209	(47.3)	2,297	1.00	1.00
Definitely yes or yes	660	(52.6)	190	(43.0)	2,154	0.78 [0.65–0.94]*	0.80 [0.58–1.09]
No	80	(6.4)	43	(9.7)	426	1.20 [0.87–1.65]	0.73 [0.40–1.33]
Do you feel you are trusted by someone?	1,249	(100.0)	448	(100.0)			
Maybe yes	830	(66.5)	271	(60.5)	3,034	1.00	1.00
Definitely yes or yes	225	(18.0)	69	(15.4)	763	0.81 [0.63–1.05]	0.76 [0.50–1.16]
No	194	(15.5)	108	(24.1)	1,133	1.59 [1.28–1.97]**	1.67 [1.13–2.45]*
Do you wish you could live your life over again?	1,240	(100.0)	439	(100.0)			
Maybe yes	574	(46.3)	194	(44.2)	2,154	1.00	1.00
Definitely yes or yes	255	(20.6)	117	(26.7)	1,320	1.10 [0.89–1.36]	1.10 [0.75–1.61]
No	411	(33.1)	128	(29.1)	1,352	1.04 [0.84–1.28]	0.97 [0.67–1.39]

BMI, body mass index; CI, confidence interval; HR, hazard ratio.

† Multivariate HR was adjusted for age, medical history‡ (yes or no), education (age at graduation of &lt; 18 years or higher age at final graduation), job status (unemployed, employed or farmer), marital status (living with a spouse or other), drinking status (current drinker, past drinker or non-drinker), smoking status (current smoker, past smoker or non-smoker), physical activity (exercise ≥ 1 h/week or exercise rarely), sleep duration (&lt; 7 h, ≥ 7 and &lt; 9 h, ≥ 9 h), BMI (&lt; 18.5, ≥ 18.5 and &lt; 25, ≥ 25) and breakfast (eat or eat rarely).

‡ Medical history: stroke, hypertension, myocardial infarction, kidney disease, liver disease, cholecystitis or cholelithiasis, diabetes mellitus, gastric ulcer or duodenal ulcer, tuberculosis or pleurisy or cancer.

\*  $P < 0.05$ .\*\*  $P < 0.001$ .

found that the mortality risk of all causes was significantly higher among subjects who had no *ikigai* after adjustment of age, sex, marital status, education, job, self-rated health, perceived mental stress, physical function, BMI, smoking, alcohol consumption, time spent walking, sleep duration and medical history. The study had a larger number of subjects, a larger number of decedents and more adjusted confounding factors than the present study. The reason for the different results may be

explained by the difference in classification of levels of psychological factors and the reference group.

As for psychological stress, sense of hurry and life satisfaction, the classification of levels of psychological factors in a prior study<sup>1</sup> was the same as in the present study. But our study did not support their results except age-adjusted sense of hurry among men and women. The cause may be the difference of number of adjusted confounding factors in the analysis.



**Table 8. Age-adjusted and multivariate HRs and 95% CIs for death according to psychological factors among women**

	Alive		Dead				
	n	(%)	n	(%)	Observed person-years	HR [95% CI] Age-adjusted HR	Multivariate HR
Do you have “ <i>ikigai</i> ” in your life?	1,832	(100.0)	268	(100.0)			
Maybe yes or unknown	1,243	(67.8)	187	(69.8)	2,097	1.00	1.00
Definitely yes or yes	589	(32.2)	81	(30.2)	912	0.99 [0.76–1.29]	1.10 [0.67–1.78]
Do you feel stress during your daily life?	1,841	(100.0)	265	(100.0)			
Maybe yes	1,233	(67.0)	190	(71.7)	2,155	1.00	1.00
Definitely yes or yes	416	(22.6)	38	(14.3)	420	0.90 [0.63–1.28]	0.84 [0.43–1.63]
No	192	(10.4)	37	(14.0)	398	0.98 [0.69–1.40]	1.04 [0.56–1.95]
Do you hurry to complete your daily work?	1,883	(100.0)	274	(100.0)			
Maybe yes	885	(47.0)	133	(48.5)	1,467	1.00	1.00
Definitely yes or yes	865	(45.9)	95	(34.7)	1,086	0.82 [0.64–1.05]	0.82 [0.50–1.33]
No	133	(7.1)	46	(16.8)	520	1.46 [1.06–2.02]*	0.79 [0.38–1.61]
Do you feel you are trusted by someone?	1,851	(100.0)	273	(100.0)			
Maybe yes	1,201	(64.9)	164	(60.1)	1,821	1.00	1.00
Definitely yes or yes	237	(12.8)	30	(11.0)	360	0.82 [0.56–1.20]	1.33 [0.67–2.62]
No	413	(22.3)	79	(28.9)	903	1.07 [0.78–1.46]	1.54 [0.93–2.53]
Do you wish you could live your life over again?	1,857	(100.0)	264	(100.0)			
Maybe yes	801	(43.1)	107	(40.5)	1,226	1.00	1.00
Definitely yes or yes	275	(14.8)	48	(18.2)	517	1.07 [0.78–1.46]	1.24 [0.61–2.54]
No	781	(42.1)	109	(41.3)	1,204	1.18 [0.92–1.50]	1.35 [0.83–2.20]

BMI, body mass index; CI, confidence interval; HR, hazard ratio.

† Multivariate HR was adjusted for age, medical history‡ (yes or no), education (age at graduation of < 18 years or higher age at final graduation), job status (unemployed, employed or farmer), marital status (living with a spouse or other), drinking status (current drinker, past drinker or non-drinker), smoking status (current smoker, past smoker or non-smoker), physical activity (exercise ≥ 1 h/week or exercise rarely), sleep duration (< 7 h, ≥ 7 and < 9 h, ≥ 9 h), BMI (< 18.5, ≥ 18.5 and < 25, ≥ 25) and breakfast (eat or eat rarely).

‡ Medical history: stroke, hypertension, myocardial infarction, kidney disease, liver disease, cholecystitis or cholelithiasis, diabetes mellitus, gastric ulcer or duodenal ulcer, tuberculosis or pleurisy or cancer.

\*  $P < 0.05$ .

We found associations between feeling of being trusted and mortality risk from all causes only among men. According to Tanno and Sakata,<sup>1</sup> the mortality risk from all causes for those who had no feeling of being trusted increased 1.19 times for men and 1.17 times for women compared with the risk for those who reported “maybe” to the feeling of being trusted. Sakata et al.<sup>4</sup> showed that only among women, the mortality risk from all causes in those who had no feeling of being trusted increased compared with in those who had. We included some adjustment factors such as life style habits and social factors to our analysis, and found more meaningful results relevant to feeling of being trusted and mortality risk.

The mechanism which underlies the preventive effects of feeling of being trusted on mortality risk remains unclear. However, we have identified some possible explanations. There are domestic and international reports on the effectiveness of talking and visiting with friends and others through the participation in neighborhood and other social activities on preventing the

aggravation of longevity prognoses.<sup>24–28</sup> During the 6-year interval, having poor self-rated health and poor social roles were identified as significant predictors for total mortality among both men and women.<sup>26</sup> In addition, an 8-year follow-up study that surveyed 519 homebound elderly people aged 65 and over reported that male elderly individuals who did not leave their home for travel, picnics or brief outings had a higher mortality risk compared with those who did go out regularly. As for women, because they often assume the roles of both housewife and mother, it is predicted that compared with males, continued opportunities for interactions with others are beneficial until the individual becomes senile.<sup>27</sup> The feeling of being trusted, along with having opportunities for interpersonal relationships and certain roles, is considered an important factor in enjoying and sustaining a healthy end-of-life period. In addition, to prevent isolation or loneliness of individuals who retired, community’s support is considered necessary in maintaining interpersonal relations and having certain roles, especially among men.

There are several limitations to this study. First, the feeling of being trusted was evaluated by a single question. Thus, because of the lack of contextual information available to the respondents, we feel that the question could be interpreted in both positive and negative ways. Therefore, the reliability and validity of the questions used in the present study should be more carefully evaluated. Second, because we assessed only one point in time, changes in psychological status were not evaluated. A previous study on the association between changes in *ikigai* and mortality risk over a period of 6 years, however, showed that the loss of *ikigai* during the 6-year interval resulted in an increased risk of mortality.<sup>7</sup> Therefore, such possible effects of changes in psychological status over time need to be considered when evaluating our present results. In addition, because psychological factors used in the present study were weak in correlation, the factors should be further investigated with regard to the effects of mortality risk, independently.

In conclusion, the present results suggest that the absence of feeling of being trusted increases the mortality risk of all causes among middle-aged and elderly men in rural areas. Our findings further suggest that interpersonal relationships comprise an important factor in having a long life.

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## REFERENCES

- 1 Tanno K, Sakata K. Psychological factors and mortality in the Japan Collaborative Cohort Study for Evaluation of Cancer (JACC). *Asian Pac J Cancer Prev*. 2007;8 Suppl:113-22. PMID: 18260710.
- 2 Tanno K, Sakata K, Ohsawa M, Onoda T, Itai K, Yaegashi Y, et al. Associations of *ikigai* as a positive psychological factor with all-cause mortality and cause-specific mortality among middle-aged and elderly Japanese people: findings from the Japan Collaborative Cohort Study. *J Psychosom Res*. 2009;67(Pt 1):67-75. PMID: 19539820.
- 3 Sone T, Nakaya N, Ohmori K, Shimazu T, Higashiguchi M, Kakizaki M, et al. Sense of life worth living (*ikigai*) and mortality in Japan: Ohsaki Study. *Psychosom Med*. 2008;70:709-15. PMID: 18596247.
- 4 Sakata K, Yoshimura N, Tamaki J, Hashimoto T. [Associations between *ikigai*, stress, and feeling of being trusted and mortality from cardiovascular disease and cancer]. *Kosei No Shihyo*. 2002;49:14-8. Japanese.
- 5 Seki N. Relationships between walking hours, sleeping hours, meaningfulness of life (*ikigai*) and mortality in the elderly: prospective cohort study. *Nihon Eiseigaku Zasshi*. 2001;56:535-40. Japanese with English abstract. PMID: 11519188
- 6 Nakanishi N, Nakura I, Nagano K, Yoneda H, Takatorige T, Shinsho F, et al. Mortality in relation to the type of household among elderly people living in a community. *J Epidemiol*. 1998;8:65-72. PMID: 9575698.
- 7 Nakanishi N, Fukuda H, Tataru K. Changes in psychosocial conditions and eventual mortality in community-residing elderly people. *J Epidemiol*. 2003;13:72-9. PMID: 12675115.
- 8 Yoshioka T, Iwai N, Ohshiro H, Kurozawa Y, Morita S. A cohort study of lifestyle in a rural area—Relationship between mortality and lifestyle—Yonago Igaku Zasshi. 1997;48:164-70. Japanese with English abstract.
- 9 Tanigaki S, Hosoda T, Kurozawa Y. Factors related to successful aging in a community elderly population. *Yonago Igaku Zasshi*. 2005;56:177-87. Japanese with English abstract.
- 10 Blazer DG, Hybels CF. What symptoms of depression predict mortality in community-dwelling elders? *J Am Geriatr Soc*. 2004;52:2052-6. PMID: 15571541.
- 11 Koivumaa-Honkanen H, Honkanen R, Viinamaki H, Heikkila K, Kaprio J, Koskenvuo M. Self-reported life satisfaction and 20-year mortality in healthy Finnish adults. *Am J Epidemiol*. 2000;152:983-91. PMID: 11092440.
- 12 Pitkala KH, Laakkonen ML, Strandberg TE, Tilvis RS. Positive life orientation as a predictor of 10-year outcome in an aged population. *J Clin Epidemiol*. 2004;57:409-14. PMID: 15135844.
- 13 Ostir GV, Markides KS, Black SA, Goodwin JS. Emotional well-being predicts subsequent functional independence and survival. *J Am Geriatr Soc*. 2000;48:473-8. PMID: 10811538.
- 14 Giltay EJ, Geleijnse JM, Zitman FG, Hoekstra T, Schouten EG. Dispositional optimism and all-cause and cardiovascular mortality in a prospective cohort of elderly Dutch men and women. *Arch Gen Psychiatry*. 2004;61:1126-35. PMID: 15520360.
- 15 Greenwood DC, Muir KR, Packham CJ, Madeley RJ. Coronary heart disease: a review of the role of psychosocial stress and social support. *J Public Health Med*. 1996;18:221-31. PMID: 8816321.
- 16 Harmsen P, Lappas G, Rosengren A, Wilhelmsen L. Long-term risk factors for stroke: twenty-eight years of follow-up of 7457 middle-aged men in Goteborg, Sweden. *Stroke*. 2006;37:1663-7. PMID: 16728686.
- 17 Truelsen T, Nielsen N, Boysen G, Gronbaek M. Self-reported stress and risk of stroke: the Copenhagen City Heart Study. *Stroke*. 2003;34:856-62. PMID: 12637696.
- 18 Iso H, Date C, Yamamoto A, Toyoshima H, Tanabe N, Kikuchi S, et al. Perceived mental stress and mortality from cardiovascular disease among Japanese men and women: the Japan Collaborative Cohort Study for Evaluation of Cancer Risk Sponsored by Monbusho (JACC Study). *Circulation*. 2002;106:1229-36. PMID: 12208798.
- 19 Cole SR, Kawachi I, Liu S, Gaziano JM, Manson JE, Buring JE, et al. Time urgency and risk of non-fatal myocardial infarction. *Int J Epidemiol*. 2001;30:363-9. PMID: 11369743.
- 20 National census: Time series data (Tottori Prefecture ) [Internet]. Japan: Tottori Prefecture Web Site; [cited 2014 Jan 8]. Available from: <http://www.pref.tottori.lg.jp/174413.htm>.

- 21 Nichinan Town Official Web Site [internet]. Japan: Statistical materials about Nichinan Town. Available from: [http://www.town.nichinan.tottori.jp/system/site/upload/live/318/atc\\_1267204728.pdf](http://www.town.nichinan.tottori.jp/system/site/upload/live/318/atc_1267204728.pdf).
- 22 Tamakoshi A, Yoshimura T, Inaba Y, Ito Y, Watanabe Y, Fukuda K, et al. Profile of the JACC Study. *J Epidemiol.* 2005;15 Suppl 1:S4-8. PMID: 15881191.
- 23 Ohno Y, Tamakoshi A; JACC Study Group. Japan collaborative cohort study for evaluation of cancer risk sponsored by Monbusho (JACC Study). *J Epidemiol.* 2001;11:144-50. PMID: 11512570.
- 24 Okado J, Hoshi T. [Influence of the life prognosis on the elderly people by social network]. *Kosei No Shihyo.* 2002;49:19-23. Japanese.
- 25 Hoshi T, Kurimori S, Ino Y, Takahashi T, Hasegawa T, Tomoyama G, et al. [Relation of the pleasure relevant to plants, the actual condition of ikigai (definite aim in life) and subjective health among a urban area-residing elderly people]. *Kosei No Shihyo.* 2002; 56(Pt 4):16-21. Japanese.
- 26 Ishizaki T, Kai I, Imanaka Y. Self-rated health and social roles as predictor for 6-year total mortality among a non-disabled older Japanese population. *Arch Gerontol Geriatr.* 2006;42:91-9. PMID: 16046010.
- 27 Tomoyama G, Hoshi T, Saito M. Relation between personal interactions and life expectancy for the aged residing in mountainous areas. *Gunma Kenritsu Tankidaigaku Kiyō.* 2010;5:1-9. Japanese with English abstract.
- 28 Bleslow L, Berkman L. *Health and ways of living—The Alameda County Study—*. New York: Oxford University Press; 1983. Morimoto K, translator. Tokyo: HBJ; 1989. 207 p. Japanese.