

A Prospective Japanese Study of the Association between Personality and the Progression of Lung Cancer

Jun Nagano¹, Yukito Ichinose², Hiroshi Asoh², Jiro Ikeda², Akira Ohshima³, Nobuyuki Sudo⁴
and Chiharu Kubo⁴

Abstract

Objective To examine predictive values for the effect of the “Type 1” (hopeless and emotion-suppressive, cancer prone), “Type 4” (autonomous, healthy), and “Type 5” (rational/antiemotional, cancer prone) personalities proposed by Grossarth-Maticek on the prognosis of lung cancer patients.

Methods 68 lung cancer patients were scored on the Types 1, 4, and 5 personality scales of the Short Interpersonal Reactions Inventory and were followed until the date of death or were censored at a maximum of 5.7 years after entry.

Results The stage at diagnosis tended to be higher in patients with a high Type 1 or a low Type 4 score. A univariate Cox proportional hazards model showed that a high tendency toward Type 1 or Type 5 was related to an increased hazard of death. Adjustment for age, performance status, and stage, however, attenuated the relation to Type 1, leaving only Type 5 as a significantly related personality factor.

Conclusion A high Type 5 tendency may predict poor survival in lung cancer patients, whereas Types 1 and 4 may not be independent predictors.

Key words: prospective study, lung cancer, personality, stress, survival

(DOI: 10.2169/internalmedicine.45.1453)

INTRODUCTION

Lung cancer is one of the most common cancers worldwide (1). In Japan, the mortality rate from lung cancer has constantly increased from the late 1900s, and now is the leading cause of cancer death for men and the second leading cause for women (2). The cure rate of lung cancer is poor and has little improved in the past two decades, especially for patients with advanced disease (3).

Several psychosocial factors have been linked to the onset and progression of cancer (4-6). Hopelessness/helplessness and suppression of negative emotions are personality factors that have been associated with cancer in previous prospective studies, especially studies examining their effects on cancer progression, although much more research will be necessary before a definite conclusion can be made (4). The

above factors have been linked to cancer progression mainly in studies of breast cancer (7-11) or cancer of mixed sites (12, 13). However, little has been reported on lung cancer, except for recent studies of a personality relevant to emotional suppression (14) and of optimism, which may be the opposite of hopelessness/helplessness (15).

Grossarth-Maticek and colleagues conceptualized a disease-prone/healthy personality theory including a notion of six personality types, “Type 1” to “Type 6” (see Appendix) (16-19). This theory began with four types, Types 1 to 4, with the other two types added later (17). Types 1, 4, and 5, which include either one or both emotional suppression and hopelessness/helplessness as elements, have been linked to cancer. Type 1 is an “object dependent” personality that has a highly valued object (person or condition) through which well-being is chronically swayed toward hopelessness/helplessness and depression by withdrawal of the ob-

¹ Institute of Health Science, Kyushu University, Fukuoka, ² Department of Thoracic Oncology, National Kyushu Cancer Center, Fukuoka, ³ Department of Psycho-oncology, National Kyushu Cancer Center, Fukuoka and ⁴ Department of Psychosomatic Medicine, Kyushu University Graduate School of Medical Sciences, Fukuoka

Received for publication May 8, 2005; Accepted for publication October 22, 2005

Reprint requests should be addressed to Jun Nagano, Institute of Health, Science, Kyushu University, 6-1 Kasuga-koen, Kasuga, Fukuoka 816-8580

ject. It is also characterized by altruistic behaviors and inhibition when expressing negative emotions and personal needs. Type 4 is an “autonomous” personality, the opposite of object dependence, and expresses personal needs in appropriate ways to obtain wellbeing. Type 5 is characterized by an extreme tendency toward “rational and antiemotional” reactions to stress, which also is an aspect of suppression of negative emotions. In cohort studies that began in Yugoslavia in the 1960s and in West Germany in the 1970s, Type 1 was shown to be prone to cancer, Type 4 was the most healthy and resistant to diseases, including cancer and cardiovascular disease (16), and Type 5 (17), as is its original concept of the rationality/antiemotional (R/A) personality (20) was also prone to cancer. Not many studies have so far independently addressed the relation between these personalities and cancer risk (21-25), and no study has explored their possible relations with cancer progression.

In 1998, lung cancer patients hospitalized in a regional cancer center in Japan were asked to complete a Japanese version of the Short Interpersonal Reactions Inventory (SIRI) (26). The SIRI is a self-report questionnaire that consists of six scales corresponding to Types 1 to 6 (17). This data was used as part of a case-control study to examine the associations between Types 1 to 6 and the risks of lung cancer and myocardial infarction (24). The results failed to support the hypothesis that Types 1 and 5 were positively associated and Type 4 was inversely associated with lung cancer risk. These findings, however, did not exclude the possibility that Types 1 and 5 increase, while Type 4 decreases, the hazard of death in lung cancer patients. In view of the paucity of data on personality and lung cancer progression (14, 15), we studied the relationships of Types 1 to 6 personalities and the survival of lung cancer patients over a follow-up period of up to 5.7 years.

METHODS

Subjects

Eligible lung cancer patients in a consecutive series were asked to participate in the study during their admission to the National Kyushu Cancer Center in Japan from February to December 1998. Criteria for enrollment were age of 70 years or under and not too severely ill to complete a self-administered questionnaire without assistance. Participating patients were asked to complete a set of questionnaires including the SIRI. The results of a case-control study using the baseline data of these subjects were reported previously (24). Follow-up was terminated in January 2004, and data was censored at that time. Demographic and clinical data were obtained from medical records.

The Short Interpersonal Reactions Inventory (SIRI)

The SIRI is a self-administered questionnaire developed to measure the 6 Grossarth-Maticek personality types (17).

Table 1. Demographic, Behavioral, and Clinical Characteristics of the Subjects (N=68)

Characteristics		%
Gender	Male	74
	Female	26
Age	<40 years	3
	40-49 years	18
	50-59 years	41
	60+ years	38
Education	Junior high school	22
	High school	46
	Junior college or equivalent	10
	College or higher	22
Marital status	Married	75
	Not married	25
Smoking	Never	26
	Past	3
	Current	71
Time since diagnosis	0-4 weeks	49
	5-8 weeks	34
	9-12 weeks	7
	13+ weeks	10
Histology	Small cell carcinoma	15
	Non-small cell carcinoma	85
Performance status	0	74
	1	21
	2	6
Stage	I	29
	II	4
	IIIA	16
	IIIB	19
	IV	31

All the participants completed a Japanese version of the SIRI, for which psychometrical reliability and validity were reported elsewhere (26). The SIRI contains 70 items with a dichotomous answer, “yes” or “no”, of which 10 items correspond to each of the six types, except for Type 4 which is represented by 20 items, including 10 reverse items. The score for each type is the number of positive responses, except for the Type 4 score which is divided by two so that all types reflect a score between 0 and 10.

Analysis

Survival was measured from the date of recruitment through the date of death or was censored at the last contact date for surviving patients. Demographic, behavioral, and clinical factors including sex, age (continuous), marital status (married, not married), education years (12 years or less, 13 years or over), smoking status (current smoker, never/past smoker), time since diagnosis (0-4 weeks, 5+ weeks), histology (small cell carcinoma, other types), and stage (ordinal) were considered as known or potential risk factors for death in the lung cancer patients. Associations

Table 2. Association Between Personality Factors and Demographic, Behavioral, and Clinical factors

Characteristics	Grossarth-Maticek personality												
	Score N	Type 1			p ^a	Type 4			p ^a	Type 5			p ^a
		0-3	4-5	6+		0-6.5	7-8	8.5+		0-5	6-7	8+	
Male (%)	56	85	86	0.0243	86	71	63	0.26	58	81	83	0.11	
Age, mean (years)	54.4	59.5	56.1	0.13 ^b	54.5	56.0	59.2	0.21 ^b	52.2	57.1	61.2	0.0021 ^b	
Marital status: married (%)	70	75	81	0.70	62	79	84	0.23	71	85	67	0.34	
Education years 13+ (%)	33	20	43	0.29	38	36	21	0.46	42	19	39	0.19	
Current smoker (%)	56	85	76	0.07	76	68	68	0.79	63	77	72	0.53	
Time since diagnosis, mean (weeks)	7.4	7.4	9.5	0.55 ^c	10.1	7.4	6.6	0.39 ^c	10.1	7.4	6.3	0.49 ^c	
Histology: small cell carcinoma (%)	7	10	24	0.22	14	7	21	0.38	13	12	17	0.88	
Performance status 1-2 (%)	26	15	38	0.24	29	29	21	0.82	21	19	44	0.13	
Early stage disease (stage I) (%)	41	45	0	0.0004 ^d	10	36	42	0.0449 ^d	29	27	33	0.94 ^d	

^aP-values were based on the chi-square test, ^banalysis of variance, ^cKruskal-Wallis test, or ^dFisher's exact test.

between these factors and the SIRI scores were examined by either the student's t-test or one-way analysis of variance, as appropriate. A univariate or multivariate Cox proportional hazards model was used to examine the associations between a factor(s) of interest and survival. Of these demographic and clinical variables, those found to be associated with survival with a p-value <0.1 on univariate analysis were adjusted for each other in a multivariate model. Factors related to survival with a p-value <0.1 in the multivariate model were then retained as variables to be considered in exploring the relationship of the SIRI scores with survival. According to the SIRI scores, the subjects were categorized into tertiles. Hazard ratios of death with a 95% confidence interval for the intermediate and highest score categories were estimated in comparison with the lowest category, and a linear trend of association was tested, with or without adjustment for covariates as determined above. Computations were done using the SAS software (UNIX version release 8.2, SAS Institute Inc.). Reported p-values were two-sided, and p-values less than 0.05 were regarded as statistically significant.

RESULTS

Of the 101 eligible patients, 95 agreed to participate in the study and signed a written consent form. For the present longitudinal analyses, 25 patients who at entry were admitted for a second or later admission for the treatment of relapse or re-growth of the disease were excluded. Data on survival status were obtained for the remaining 70 patients who were in their first admission. Also included were two patients who had been transferred from another hospital for the purpose of radiotherapy. Of these 70, two were excluded who had at first been strongly suspected of having primary lung carcinoma, but the diagnosis was not confirmed on further examinations. All patients had been informed of their

diagnosis before the time of recruitment.

Demographic, behavioral, and clinical characteristics of the subjects and their associations with the personality variables at baseline

Table 1 summarizes demographic, behavioral, and clinical characteristics of the studied patients. Nearly 80% of the patients were 50 years or older at entry, and 74% were male. Approximately 30% had an education of junior college or higher, 13+ years, 75% were married and living with their spouse, and 71% were current smokers. Time from the cancer diagnosis through recruitment was 12 weeks or less for most (90%) patients. Most (85%) patients had a histological diagnosis of non-small cell carcinoma, 95% were at the Eastern Cooperative Oncology Group performance status (PS) of 0 or 1, and fewer than 30% had an early stage disease according to the International Staging System (27). During the follow-up period, 40 patients died and 28 were censored. The median time of survival was 0.8 (range 0.2-5.4) years for diseased subjects, and the median follow-up was 5.1 (range 4.7-5.7) years for survivors.

Table 2 shows the personality scores in relation to demographic and clinical characteristics at baseline. The percentage of men in the lowest Type 1 category was lower than that of the higher two categories. Age tended to increase linearly as the Type 5 score increased. Marital status, education level, smoking status, time since diagnosis, histology, and PS were not associated with any of the three personality types. Regarding the disease stage, there were notable associations. None of the patients in the high Type 1 category were diagnosed as having an early stage disease (stage I), while more than 40% were in stage I in the lower two Type 1 categories. Conversely, the low Type 4 category included a smaller percentage of early-stage patients than the two higher Type 4 categories. These associations of disease stage with Types 1 and 4 were statistically significant. Type 5 was

Table 3. Association Between Personality and the Hazard of Death of Lung Cancer Patients

Scale	Score	N	Unadjusted (crude) HR		Adjusted HR ^a	
			HR (95%CI)	p trend	HR (95%CI)	p trend
Type 1	0-3	27	1.00 (ref.)		1.00 (ref.)	
	4-5	20	0.74 (0.31-1.79)		0.51 (0.20-1.26)	
	6+	21	3.26 (1.59-6.69)	0.0021	1.73 (0.80-3.73)	0.16
Type 2	0-1	34	1.00 (ref.)		1.00 (ref.)	
	2-3	18	1.18 (0.60-2.34)		0.98 (0.48-2.00)	
	4+	16	1.27 (0.87-1.86)	0.18	0.97 (0.64-1.48)	0.90
Type 3	0-1	18	1.00 (ref.)		1.00 (ref.)	
	2-3	25	0.63 (0.28-1.42)		0.86 (0.38-1.95)	
	4+	25	0.95 (0.44-2.06)	0.96	1.08 (0.48-2.40)	0.83
Type 4	0-6.5	21	1.00 (ref.)		1.00 (ref.)	
	7-8	28	0.70 (0.35-1.42)		0.63 (0.29-1.35)	
	8.5+	19	0.57 (0.25-1.31)	0.18	0.65 (0.27-1.55)	0.29
Type 5	0-5	24	1.00 (ref.)		1.00 (ref.)	
	6-7	26	1.75 (0.79-3.86)		2.20 (0.96-5.03)	
	8+	18	3.21 (1.41-7.30)	0.0054	2.79 (1.13-6.86)	0.0221
Type 6	0	24	1.00 (ref.)		1.00 (ref.)	
	1	22	0.94 (0.43-2.08)		0.75 (0.32-1.74)	
	2+	22	1.36 (0.65-2.81)	0.42	1.07 (0.49-2.34)	0.85

HR: hazard ratio; CI: confidence interval. ^aAdjusted for age, performance status, and stage.

not related to the stage at baseline. None of the other scores of Types 2, 3, and 6 were appreciably associated with any demographic or clinical characteristic at baseline (data not shown).

To search for reasons that would explain the relation between stage and Types 1 and 4, we studied the charts for any two factors that may represent health-care behaviors that had led to diagnosis. First, we classified the cues to diagnosis into three categories, “asymptomatic and found by check-up”, “found by symptoms such as cough and chest pain”, and “incidental, e.g., found when patient saw a doctor for reasons unrelated to cancer”. Second, we calculated the time that it took from the cue to the time of diagnosis. These factors were examined in relation to the Type 1 and 4 categories. However, no two factors were significantly associated with those personalities (data not shown).

The personality factors and survival at follow-up

Of the demographic, behavioral, and clinical factors, gender ($p=0.0287$), age ($p=0.088$), PS ($p<0.0001$), and stage ($p<0.0001$) were related to survival by univariate analyses, while education level, marital status, smoking status, time since diagnosis, and histology were not. A multivariate Cox proportional hazards model including gender, age, PS, and stage revealed that increasing age ($p=0.0226$), poorer PS ($p<0.0018$), and a more advanced stage ($p<0.0001$) were associated with a higher hazard of death, whereas gender was no longer predictive of prognosis ($p=0.11$). Therefore, age,

PS, and stage were adjusted for in the subsequent analyses of the personality factors.

Table 3 shows the associations of the personality factors with the survival of lung cancer patients. In the univariate analyses, the highest Type 1 category was significantly associated with an increased hazard of death when compared with the lowest category. The crude hazard of death significantly increased as the score of Type 5 increased. When age, PS, and stage were adjusted, however, the association with Type 1 personality became unclear, and only the positive association of Type 5 to survival remained significant. The adjusted hazard ratio of death for the patients in the high Type 5 category was approximately 2.8 as compared to that of the low category. Types 2, 3, and 6 were not materially associated with survival with or without adjustment for the covariates. In Fig. 1, the Kaplan-Meier survival curves are shown according to the three categories of Type 5 scores.

DISCUSSION

This study addressed the question of whether or not the personalities proposed by Grossarth-Maticek, especially the Type 1, 4, and 5 personalities which have been associated with cancer risk in healthy populations (16, 17, 20), can be predictive of the prognosis of lung cancer patients. Univariate analyses found a high tendency for Types 1 and 5 to be related to an increased hazard of death, but adjustment for other risk factors attenuated the relation to Type 1, leaving

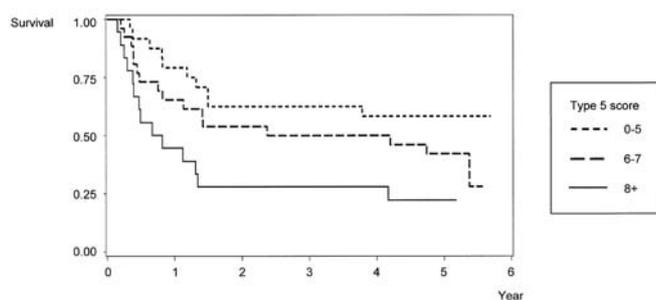


Figure 1. Survival curves of lung cancer patients according to low, medium, or high Type 5 scores

only Type 5 as a significant, independent predictor of survival for lung cancer patients.

The Type 5 personality, characterized by “rational and antiemotional” reactions to stress, was formerly called the R/A personality and later re-conceptualized into the six type personalities. The R/A represents an extreme tendency to rationalize conflicts or frustrations and to suppress emotional reactions as represented by the SIRI item “when people make emotional demands on me, I usually react only rationally, never emotionally”, and can be considered a form of the suppression of negative emotions. Few studies have independently examined this unique personality construct in association with cancer risk. A cohort study in the Netherlands examined the rationality and the antiemotionality factors separately, and found that a high antiemotionality score was associated with an increased risk of breast cancer (28). A cohort study in Japan, however, found that the risk of mortality from cancer of men scoring in the middle range of the R/A scale was lower than for those scoring low on the scale (25). To our knowledge, no previous data is available on the association between the Type 5 and R/A personalities and cancer progression.

Regarding the suppression/expression of negative emotions as a more common construct, several studies have examined this personality factor in relation to cancer progression. Most focused on breast cancer, and some (7, 10, 11), albeit not all (8, 9), agreed that suppressing or controlling negative emotions worsened the prognosis of breast cancer patients. To the contrary, “expression of negative affect” (7) and “expressing emotions” (10) were associated with a better prognosis in breast cancer. As for lung cancer, Nakahara et al found that a better survival was associated with a personality characterized by high “Free Child” and low “Adapted Child” scores (14).

Significant associations were found between the stage at baseline and the scores of Types 1 and 4. None of the patients with an early stage disease were categorized into the high Type 1 category, and only a few into the low Type 4 category. It is possible that people with a high Type 1 or a low Type 4 tendency may be much more negative than others toward taking a lung cancer screening, or that these people may be more hesitant to visit a clinic for further exami-

nation after preliminary tests indicating lung cancer. Supplemental analyses, however, did not yield evidence to support these hypotheses, which may have accounted for the associations between baseline stage and Types 1 and 4. Other hypotheses may include the possibility that the chances of cancer progression from an early to an advanced stage are higher in people with a high Type 1 or low Type 4 tendency, or that the cancer progression is more rapid, thereby creating a lower chance of having a disease discovered at an earlier stage.

It should be noted that all of the present study participants had been informed of their diagnosis before they completed the SIRI. In a population-based prospective study in the Netherlands, Bleiker et al examined the possible differences in personality traits between before and after a diagnosis of breast cancer. They found a significant decrease in the “rationality”, “emotional expression-out”, and “emotional-control” scores from before to after the diagnosis (29). In the present sample, although the scores for the personalities were not related to the time since diagnosis to entry, it is impossible to preclude the possibility that the patients’ personalities as measured by the SIRI had changed between before and just after the diagnosis. The present associations of Type 5 with survival and Types 1 and 4 with stage at baseline may not be able to be generalized to lung cancer patients for whom a diagnosis has not yet been made or who are unaware of the diagnosis.

The present study has several limitations. The small sample size did not allow analyses with stratification by factors such as stage, gender, and histology (small cell carcinoma or non-small cell carcinoma), although the association between the Type 5 personality and survival may differ according to these factors. In addition, the mechanisms which may explain the observed association with the Type 5 personality were not clarified. Patients with different personalities may differently decide on the choice of treatments, or respond differently to a certain treatment regimen, and such diversity may affect the clinical course. The present study could not consider the possible effects of such complex treatment factors. Also, it did not examine immunological parameters that might link personality factors with survival of lung cancer patients (30-32). Nevertheless, this is the first report specifically addressing if Types 1, 4, and 5 can be of prognostic value for persons suffering from a malignancy, and would confer evidence to the notion that personality factors are related to the prognosis of lung cancer.

In summary, the current prospective data suggested that a stronger Type 5 tendency may increase the hazard of death of lung cancer patients. Types 1 and 4 personalities were not an independent risk factor for death, although they might be associated with the stage at diagnosis. The current findings should be confirmed in future studies of a larger scale that examine behavioral and biological factors that would explain the association between the Type 5 personality and cancer progression.

We appreciate the efforts of all the patients who participated in the study, and those of Yumiko Ohshima (National Kyushu Cancer Center) for assistance in data collection. This study was sup-

ported in part by Grant-in-Aid for Scientific Research No. 15590601 from the Japan Ministry of Education, Culture, Sports, Science, and Technology.

References

- Parkin D, Whelan S, Ferlay J, Thomas D. Cancer Incidence in Five Continents. International Agency for Research on Cancer. **VIII**. Lyon, 2003.
- Kuroishi T, Hirose K, Takezaki T, Tominaga S, Tajima K. Cancer mortality in Japan (1950-2000). In: Cancer Mortality and Morbidity Statistics. Japan and the World-2004. Tajima K, Kuroishi T, Oshima A, Eds. S. Karger AG, Basel, 2004: 1-93.
- Ajiki W, Tsukuma H, Oshima A. Trends in cancer incidence and survival in Osaka. In: Cancer Mortality and Morbidity Statistics. Japan and the World-2004. Tajima K, Kuroishi T, Oshima A, Eds. S. Karger AG, Basel, 2004: 137-163.
- Garssen B, Goodkin K. On the role of immunological factors as mediators between psychosocial factors and cancer progression. *Psychiatry Res* **85**: 51-61, 1999.
- Petticrew M, Bell R, Hunter D. Influence of psychological coping on survival and recurrence in people with cancer: systematic review. *BMJ* **325**: 1066, 2002.
- Dalton SO, Boesen EH, Ross L, Schapiro IR, Johansen C. Mind and cancer. Do psychological factors cause cancer? *Eur J Cancer* **38**: 1313-1323, 2002.
- Jensen MR. Psychobiological factors predicting the course of breast cancer. *J Pers* **55**: 317-342, 1987.
- Giraldi T, Rodani MG, Cartei G, Grassi L. Psychosocial factors and breast cancer: a 6-year Italian follow-up study. *Psychother Psychosom* **66**: 229-236, 1997.
- Watson M, Haviland JS, Greer S, Davidson J, Bliss JM. Influence of psychological response on survival in breast cancer: a population-based cohort study. *Lancet* **354**: 1331-1336, 1999.
- Reynolds P, Hurley S, Torres M, Jackson J, Boyd P, Chen VW. Use of coping strategies and breast cancer survival: results from the Black/White Cancer Survival Study. *Am J Epidemiol* **152**: 940-949, 2000.
- Weihl KL, Enright TM, Simmens SJ, Reiss D. Negative affectivity restriction of emotions, and site of metastases predict mortality in recurrent breast cancer. *J Psychosom Res* **49**: 59-68, 2000.
- Ringdal GI, Gotestam KG, Kaasa S, Kvinnsland S, Ringdal K. Prognostic factors and survival in a heterogeneous sample of cancer patients. *Br J Cancer* **73**: 1594-1599, 1996.
- Schulz R, Bookwala J, Knapp JE, Scheier M, Williamson GM. Pessimism, age, and cancer mortality. *Psychol Aging* **11**: 304-309, 1996.
- Nakahara Y, Mochizuki Y, Miyamoto Y, et al. Mental state as a possible independent prognostic variable for survival in patients with advanced lung carcinoma. *Cancer* **94**: 3006-3015, 2002.
- Schofield P, Ball D, Smith JG, et al. Optimism and survival in lung carcinoma patients. *Cancer* **100**: 1276-1282, 2004.
- Grossarth-Maticek R, Eysenck HJ, Vetter H. Personality type, smoking habit and their interaction as predictors of cancer and coronary heart disease. *Pers Individ Diff* **9**: 479-495, 1988.
- Grossarth-Maticek R, Eysenck HJ. Personality, stress and disease: description and validation of a new inventory. *Psychol Rep* **66**: 355-373, 1990.
- Grossarth-Maticek R, Eysenck HJ. Personality, stress, and motivational factors in drinking as determinants of risk for cancer and coronary heart disease. *Psychol Rep* **69**: 1027-1043, 1991.
- Grossarth-Maticek R, Eysenck HJ, Rakic L. Central nervous system and cancer. In: Anticarcinogenesis and radiation protection 2, Nygaard OF, Upton AC, Eds. Plenum Press, New York, 1991: 429-435.
- Grossarth-Maticek R, Bastiaans J, Kanazir DT. Psychosocial factors as strong predictors of mortality from cancer, ischaemic heart disease and stroke: the Yugoslav prospective study. *J Psychosom Res* **29**: 167-176, 1985.
- Schmitz PG. Personality, stress-reactions and disease. *Person Individ Diff* **13**: 683-691, 1992.
- Amelang M. Using personality variables to predict cancer and heart disease. *Eur J Pers* **11**: 319-342, 1997.
- Kumano H, Kuboki T, Orii Y, et al. The investigation of the discriminant validity of the measurement of Type C personality using the Japanese brief version of the Short Interpersonal Reactions Inventory (SIRI33). *Shin-shin Igaku (Jpn J Psychosom Med)* **41**: 593-599, 2001.
- Nagano J, Sudo N, Kubo C, Kono S. Lung cancer, myocardial infarction, and the Grossarth-Maticek personality types: a case-control study in Fukuoka. *Japan. J Epidemiol* **11**: 281-287, 2001.
- Hirokawa K, Nagata C, Takatsuka N, Shimizu H. The relationships of a rationality/antiemotionality personality scale to mortalities of cancer and cardiovascular disease in a community population in Japan. *J Psychosom Res* **56**: 103-111, 2004.
- Nagano J, Sudo N, Kubo C, Kono S. Reliability and validity of the Japanese version of the Short Interpersonal Reactions Inventory. *Koudou Igaku Kenkyu (Jpn J Behav Med)* **7**: 104-116, 2001.
- Mountain CF. A new international staging system for lung cancer. *Chest* **89**: 225S-233S, 1986.
- Bleiker EM, van der Ploeg HM, Hendriks JH, Leer JW, Kleijn WC. Rationality, emotional expression and control: psychometric characteristics of a questionnaire for research in psycho-oncology. *J Psychosom Res* **37**: 861-872, 1993.
- Bleiker EM, van der Ploeg HM, Ader HJ, van Daal WA, Hendriks JH. Personality traits of women with breast cancer: before and after diagnosis. *Psychol Rep* **76**: 1139-1146, 1995.
- Biondi M. Effects of stress on immune functions: an overview. In: Psychoneuroimmunology, 3rd ed, vol 2. Ader R, Felten D, Cohen N Eds. Academic Press, San Diego, San Francisco, New York, Boston, London, Sydney, Tokyo, 2001: 189-226.
- Fujisawa T, Yamaguchi Y. Autologous tumor killing activity as a prognostic factor in primary resected nonsmall cell carcinoma of the lung. *Cancer* **79**: 474-481, 1997.
- Nakamura H, Saji H, Ogata A, et al. Immunologic parameters as significant prognostic factors in lung cancer. *Lung Cancer* **37**: 161-169, 2002.

Appendix. Summarized Characteristics of the Grossarth-Maticcek Personality Types and Traits to which they are Prone

Personality	Characteristics	Proneness
Type 1	Dependence on withdrawn objects: - one's well-being is dependent on a withdrawn, highly-valued object (person or situation), - chronically experience hopeless/helpless and depressive feelings, - altruistic behavior and inhibition to express negative emotions and personal needs.	To cancer
Type 2	Dependence on disturbing objects: - one's well-being is constantly threatened by a disturbing, annoying objects (person or situation), - chronically experience feelings of anger, hostility, aggression, and excitement, - feel that frustrating situations are unavoidable.	To cardiovascular disease
Type 3	Ambivalent behavior: - oscillate between the positive and negative aspects of an object (person or situation), - sometimes idealize the object, sometimes devalue it, and fail to reach any integration, - express one's emotion and needs in inadequate and ambivalent ways.	To chronic anxiety
Type 4	Autonomic behavior: - maintain autonomy by flexibly regulating distance to objects (person or situation), e.g., letting a withdrawing object go or keeping distance from an annoying object, - self-regulate behaviors, including expression of emotions and needs, so that they lead to the achievement and maintenance of well-being.	To being healthy
Type 5	Rational and antiemotional behavior: - constantly cope with stress by appeals to reason and logic, never to emotional behaviors, - suppress emotional reactions and behave rationally even in frustrating interpersonal communications.	To cancer, cardiovascular disease, and depression
Type 6	Antisocial behavior: - egocentric, antisocial, and psychopathic behaviors, - express emotions and needs in inadequate and non-conforming ways.	To criminal behaviors and drug addiction