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Personality, Emotions and Coping Styles: Predictive Value for the Evolution of Cancer Patients

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This study had a twofold goal: to define differences in psychological aspects between cancer patients and a control group and to explore the predictive value of such aspects for the evolution of the disease two years later. Firstly, personality, anxiety, anger and depression were assessed in both groups. Results of *t*-analyses revealed significant group differences. In personality, cancer patients had higher levels of neuroticism and lower levels of extraversion, agreeableness and conscientiousness than the control group. In emotional variables, cancer patients had higher levels of anxiety and some aspects of anger, but there were no group differences in depression levels. Secondly, applying a quasi-prospective design, the predictive value of personality, emotions and coping styles for the evolution of cancer (favourable or unfavourable) was explored using generalized linear models and logistic regression. A four-predictor logistic model was fitted: Anger Expression-In, Resignation, Self-blame and Conscientiousness, indicating that the higher Anger Expression-in, Resignation, and Self-blame scores together with a lower Conscientiousness score, the more likely it is for patients' cancer to evolve unfavourably. These results indicate the crucial role of psychological aspects for the evolution of the disease and the need to include such aspects in the design of clinical interventions.
Keywords: personality, emotions, coping styles, cancer, predictive value.

Este estudio tiene un doble objetivo: describir las diferencias en los aspectos psicológicos entre los pacientes con cáncer y un grupo control, y explorar el posible valor predictivo de estos aspectos en la evolución de la enfermedad dos años más tarde. En primer lugar, se evaluaron en ambos grupos variables de personalidad, ansiedad, ira y depresión. Los resultados de los análisis *t* mostraron diferencias significativas entre los dos grupos. En personalidad, los pacientes con cáncer mostraron niveles más altos de neuroticismo y niveles más bajos de extraversión, afabilidad y concienciación que el grupo control. En variables emocionales, los pacientes con cáncer presentaron puntuaciones más elevadas en ansiedad y en algunos aspectos de la ira, pero no hubo diferencias entre los grupos en los niveles de depresión. En segundo lugar, aplicando un diseño cuasi-prospectivo, se analizó el valor predictivo de la personalidad, las emociones y los estilos de afrontamiento en la evolución del cáncer (favorable o desfavorable), mediante modelos lineales generalizados y de regresión logística. Se ajustó un modelo logístico de cuatro predictores: Ira interna, Resignación, Autoculpación y Concienciación, indicando que altas puntuaciones en Ira interna, Resignación, Autoculpación, junto con puntuaciones bajas en Concienciación, presentaban mayor probabilidad de relacionarse con una evolución desfavorable del cáncer. Estos resultados apoyan el papel crucial de los aspectos psicológicos en la evolución de la enfermedad y la necesidad de incluirlos en el diseño de las intervenciones clínicas.
Palabras clave: personalidad, emociones, estilos de afrontamiento, cáncer, valor predictivo.

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Potential links between diverse psychosocial factors and the incidence and evolution of cancer have generated considerable public and scientific interest. As early as the mid-1920s, psychologists were speculating about the association of psychogenic factors with cancer (Evans, 1926). Personality has long been hypothesized to play a causal role in the development and progression of cancer (Augustine, Larsen, Walker, & Fisher, 2008; Cardenal, Ortiz-Tallo, Martín, & Martínez, 2008; Heffner, Loving, Robles, & Kiecolt-Glaser, 2003; Nakaya et al., 2009; Shigehisa & Honda, 2006; Stephen, Rahn, Verhoef, & Leis, 2007; Vissoci, Vargas, & Morimoto, 2004), although recently, some authors have reported the opposite findings (Bleiker, Hendriks, Otten, Verbeek, & van der Ploeg, 2008; Dahl, 2010; Hansen, Floderus, Frederiksen, & Johansen, 2005; Nakaya et al., 2010).

Emotional factors and coping with stressful live events have also been proposed to play a predominant role in the production of health-disease (Blasco, Pallarés, Alonso, & López, 2000; Cardenal, 2001; Graves et al., 2005; Hou, Law, & Fu, 2010; Lieberman & Goldstein, 2006; Weihs, Enright, Simmens, & Reiss, 2000). Thus, emotions such as anxiety, depression and anger suppression have been related to the incidence and evolution of cancer due to their influence on the immune system and on altered biological rhythms (Giese-Davis, Conrad, Nouriani, & Spiegel, 2008). Indeed, such emotions can reduce immune-competence and consequently increase vulnerability to disease, triggering earlier relapses in people with high levels of stress or depression (Buttow et al., 2000; Giese-Davis et al., 2008; Härtl et al., 2010; Hopko et al., 2007; Palesh et al., 2007; Pinquart & Duberstein, 2010; Sephton et al., 2009; Spiegel & Giese-Davis, 2003; Talley, Molix, Schlegel, & Bettencourt, 2010; Turner-Cobb, Sephton, & Spiegel, 2001; Weihs et al., 2000). Likewise, emotional features such as emotional suppression, stoic acceptance of events (learned helplessness), and overcompensation towards other people have been proposed as risk factors for the onset and evolution of cancer (Giese-Davis et al., 2008; Greer, 1991; Sebastián, León, & Hospital, 2009).

Furthermore, the potential role of coping styles (measures of the thoughts and actions people use to handle stressful events) in the life of patients suffering from cancer has also been the subject of many studies (Cousson-Gélie, Bruchon-Schweitzer, Dilhuydy, & Mutand, 2007; Font & Cardoso, 2009; Graves et al., 2005; Stanton et al., 2000), although there is little consistent evidence that psychological coping styles play an important part in survival from or recurrence of cancer (Hardt, Gillitzer, Schneider, Fischbeck, & Thüroff, 2010; Petticrew, Bell, & Hunter, 2002).

Whereas the importance of psychological variables for the course of cancer seems obvious, so far, there are few studies that have carried out a simultaneous assessment of personality variables, emotions, and coping styles, in order to analyze the overall influence of psychosocial factors in cancer patients. Moreover, there is still a relative shortage of empirical studies that confirm the predictive role of these variables in the evolution of cancer, resulting in oncologists' reluctance to include such factors in the medical protocol of prognosis and treatment.

The aim of present study is twofold. First, to determine the differences in personality, anxiety, anger, and depression between cancer and control groups and, on the other hand, to determine whether these variables and coping strategies, measured at the moment of notification of the diagnosis, predict the evolution of the disease (favourable vs. unfavourable) two years later.

Thus, the hypothesis of the study are:

Hypothesis 1: There will be no significant differences in personality variables studied among the control and cancer groups, as recent studies conclude in this area.

Hypothesis 2: There will be significant differences in the negative emotional variables studied -anxiety, depression and anger—between the control and the cancer groups; the cancer group will show higher scores on these variables.

Hypothesis 3: In the cancer group, some of the personality factors (neuroticism or emotional stability, extroversion, openness to experience, agreeableness, and responsibility), negative emotions (anxiety, depression and anger), and styles coping analyzed, may be predictors of the evolution of cancer.

Method

Participants

Participants were 131 individuals (35 males and 96 females), ranging in age between 30 and 68 years. The control group consisted of 67 individuals (18 males and 49 females), randomly selected from 489 subjects from the same city of Spain as the group of cancer patients, provided by a company specialised in selecting data for researchers. The control group fulfilled the following criteria: not suffering from any chronic illness (diabetes, cardiovascular diseases, chronic respiratory diseases, such as asthma, osteoporosis, and other bone diseases, obesity, rheumatic, or kidney diseases, etc.), or a particularly chronic stressful event (dramatic situations, such as family bereavement, separation, or divorce, job loss, etc.), or mental disease, and reporting a healthy lifestyle based on not smoking or smoking less than 10 cigarettes per week, not taking drugs, not taking regular medication, not drinking or drinking less than 3 glasses of wine per week, and eating vegetables or fruit at least 5 times a week. Both the control group and the cancer group followed the "Mediterranean diet," because it is the popular diet of this city (Murcia, Spain). In addition to this, control group participants were matched with cancer group participants in several sociodemographic variables: age, gender, civil status, educational level, occupation and household income. These variables are described in Table 1.

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The cancer group consisted of 64 individuals (17 males and 47 females) who were selected during the first two weeks after being diagnosed. These participants suffered from various kinds of cancer (ostomy: breast, colon, bladder, gastric; non-ostomy: ovary, prostate, lung, pancreas, lymphoma, and leukaemia). The state of the cancer was taken into account using the TNM staging system with three criteria: extent of the primary tumour (T), absence or presence of regional lymph node involvement (N), and absence or presence of distant metastases (M). Moreover, the histological grade was assessed following recommendations of the American Joint Commission on Cancer for grading tumours (from stages 0 to IV). Inclusion criteria for the participants were: having been notified about the cancer diagnosis two weeks previously, having a small sized tumour, null or almost null regional lymph node involvement, absence of distant metastases, histological grade up to II, not suffering from chronic illness, chronic stress, or mental disease before diagnosis, and reporting a healthy lifestyle as defined above. Age, gender, civil status, educational level, occupation, and household income are described in Table 1. No group differences, by means of *t*-test or χ^2 test, depending on the variable scale measure, were found in these sociodemographic variables. Thus, both groups were initially homogeneous.

Two years after the initial assessment, the cancer group was classified in two groups by means of a clinical-oncologic follow-up according to their last medical control, as a function of the evolution of the disease: favourable (n = 42) and unfavourable (n = 22). The stage of the cancer, assessed with the TNM system, radiodiagnostic tests, blood tests, and other analytical aspects that the oncologic team considered suitable indicators of the evolution of the

Table 1
Sample Description (Percentage in Brackets)

	Cancer Group n = 67	Cancer Group n = 64	t/χ^2	p	Cancer Group n = 64 Favourable n = 42	Cancer Group n = 64 Unfavourable n = 22	t/χ^2	p
Age								
M	52.31	52.25	–0.04	.97	51.40	53.86	–1.06	.29
SD	8.42	8.79			9.09	8.16		
Gender								
Male	18 (26.8)	17 (26.6)	0.01	.97	9 (21.4)	8 (36.3)	1.65	.19
Female	49 (73.2)	47 (73.4)			33 (78.6)	14 (63.7)		
Civil Status								
Single	7 (10.4)	6 (9.4)	0.45	.29	4 (9.5)	2 (9.1)	0.22	.97
Married	56 (83.6)	53 (82.8)			35 (83.3)	18 (81.8)		
Separated/divorced	4 (5.9)	2 (3.2)			1 (2.4)	1 (4.5)		
Widowed	0 (0.0)	3 (4.6)			2 (4.8)	1 (4.5)		
Educational Level								
Uneducated	4 (5.9)	3 (4.6)	0.79	.93	2 (4.8)	1 (4.5)	2.15	.54
Primary	8 (11.9)	10 (15.6)			6 (14.4)	4 (18.2)		
Secondary	22 (32.8)	20 (31.3)			17 (40.4)	9 (41.0)		
High School	33 (49.4)	31 (48.5)			17 (40.4)	8 (36.3)		
Occupation								
Directors/Freelance	6 (8.9)	7 (10.9)	0.36	.30	4 (9.5)	3 (13.6)	7.45	.11
Specialised worker	32 (47.7)	29 (45.3)			16 (38.1)	8 (36.3)		
Administrative	9 (13.4)	9 (14.0)			6 (14.4)	5 (22.7)		
Operators	9 (13.4)	6 (9.4)			7 (16.6)	4 (18.2)		
Housewife/Retired	11 (16.6)	13 (20.4)			9 (21.4)	2 (9.2)		
Household Income/month								
1000-1500€	13 (19.4)	12 (18.8)	0.36	.31	10 (23.8)	2 (9.1)	2.05	.36
1500-2300€	21 (38.8)	26 (40.6)			16 (38.1)	10 (45.4)		
> 2300€	33 (49.4)	26 (40.6)			16 (38.1)	10 (45.5)		
Type of Tumour								
Ostomy (breast/colon/bladder/gastric)					28 (66.7)	14 (63.7)	0.59	.81
Non-ostomy (ovary/prostate/lung/pancreas/lymphoma/leukaemia)					14 (33.3)	8 (36.3)		

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neoplasia, was taken into account. Thus, two years after the initial diagnosis and assessment, the patients were considered to have a favourable evolution if they fulfilled the following criteria: having adequate blood parameters, not presenting high tumour marker levels, and not suffering either from relapse or metastases. Otherwise, the patients were considered to have an unfavourable evolution: the ones who, at the 2-year follow-up, had either relapsed with metastases, and the ones who were not able to normalize their blood tests (high tumoral markers). The characteristics of the two cancer groups in terms of age, gender, civil status, educational level, occupation, and household income and type of cancer are described in Table 1. No group differences in the cancer patients, using *t*-tests or χ^2 test depending on the variable measure scale, were found in these sociodemographic variables.

Procedure

The cancer patients were recruited during three months in the Hospital of Nuestra Señora de Belén, in Murcia (Spain). Assessment of sociodemographic, clinical, and psychological variables was carried out within two weeks after the diagnosis notification and before the application of any oncologic treatment. Thus, the possible effect of oncologic treatment on the psychological variables was precluded. The tests were administrated individually in a quiet room of the hospital without any interruptions, by a team of trained psychologists under the direction and supervision of the one of the authors of the article. All the participants who agreed to take part gave their written informed consent. Participants of the control groups completed the tests in the office of the researcher company.

For all participants, the assessments were performed in a two-hour session, providing the same instructions. Individuals were requested to participate in a research about association between heath and psychological variables. In all cases, psychologists' ethical principles and code of conduct were followed.

Two years after the initial assessment, a follow-up was carried out for the cancer group. Patients were classified either as favourable or unfavourable, depending on their evolution based on the criteria described in the previous section. The multidisciplinary team—physicians, psychologists, and methodologists—met regularly to monitor the progress of the investigation. The oncologist and her team also met regularly for the clinical study of each patient, making medical decisions at each stage of the project.

Materials

Personality Dimensions

The NEO-Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992; Spanish version adapted by Cordero, Pamos, & Seisdedos, 1999) was administered. The NEO-FFI is a reduced version (60 items) of the NEO Personality Inventory-Revised (NEO-PI-R; Costa & McCrae, 1992), which measures the same Big Five personality dimensions: Neuroticism (a tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, or vulnerability; α = .93), Extraversion (energy, positive emotion, surgency, and a tendency to seek stimulation in the company of others; α = .90), Openness (appreciation for art, emotion, adventure, etc.; α = .89), Agreeableness (a tendency to be compassionate and cooperative rather than suspicious and antagonistic toward others; α = .95), and Conscientiousness (a tendency to show self-discipline, aim for achievement, etc.; α = .92).

Emotions

Anxiety

The Inventory of Situations and Responses of Anxiety (ISRA, Inventario de Situaciones y Respuestas de Ansiedad, original Spanish version; Miguel-Tobal & Cano-Vindel, 1994), a 24-item scale, was employed. Three factors were considered: Cognitive Anxiety (α = .96), Physiological Anxiety (α = .98) and Motor Anxiety (α = .95).

Anger

The State-Trait Anger Inventory (STAXI; Spielberger, 1988, Spanish version adapted by Miguel-Tobal, Casado, Cano-Vindel, & Spielberger, 2001) was administered. This scale measures the intensity of anger as an emotional state (State Anger) and the disposition to experience angry feelings as a personality trait (Trait Anger). Six trait-anger factors were considered: Anger Temperament (overall angry or hot-headed temperament, α = .84), Anger Reaction (tendency to respond with anger when one feels one is being treated unfairly or being criticized by others, α = .75), Anger Expression-Out (expression of anger toward other persons or objects in the environment, α = .69), Anger Expression-In (holding in or suppressing angry feelings, α = .67), Anger Control-Out (controlling angry feelings by preventing the expression of anger toward other persons or objects in the environment, α = .87), and Anger Control-In (controlling suppressed angry feelings by calming down or cooling off, α = .81).

Depression

The Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; Spanish adaptation by Conde, Esteban, & Useros, 1976) was used to assess depression (α = .85). This inventory is considered appropriate even for the assessment of nonclinical

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populations, as it offers an accurate mental health index and is inversely related to personality variables that are typical of personal well-being such as self-esteem, emotional stability and openness.

Coping Styles

The Coping Strategies Questionnaire (CSQ; Cuestionario de Formas de Afrontamiento de Acontecimientos Estresantes; original Spanish version, Rodríguez-Marín, Terol, López-Roig, & Pastor, 1992) was administered. This 50-item questionnaire is based on the Ways of Coping Checklist (WCCL), designed by Folkman and Lazarus (1998) and Folkman, Lazarus, Gruen, and DeLongis (1986). Eleven factors were considered, which evaluate active and avoidant coping strategies (mean alphas of factors: .58). The active strategies are: Positive Thoughts (active efforts, mainly cognitive, focused on visualizing the problem positively), Seeking Social Support (seeking instrumental support, seeking people to solve the problem, etc.), Seeking Solutions (seeking information, planning, and proposing possibilities), Counting Advantages (cognitive responses to the problem by comparing it with a worse hypothetical situation or with other people's situation) and Religiosity (addressing the problem with religious practices). The avoidant strategies are: Blaming Others (blaming other people for the problem and/or its consequences), Wishful Thinking (wishing the problem and/or its consequences had not occurred), Emotional Repression (rejecting or avoiding the expression of feelings and/or thoughts about the problem to other people), Self-blame (focusing on one's own responsibility for the onset or origin of the problem), Resignation (acceptance-resignation towards the problem) and Escape (fleeing from the problem).

Considering that coping with cancer is a unique situation not comparable to other stressful life events, coping strategies were only assessed in the cancer group. The CSQ's instructions were: "Faced with this stressful or impactful event that you are undergoing (referring to cancer), how do you think that you are dealing with it?"

Statistical Analyses

In order to determine the differences in personality, anxiety, anger, and depression between the control and cancer groups, *t*-tests for independent groups were performed on the factors of the NEO-FFI, the ISRA, the STAXI and the BDI, respectively.

In order to examine whether personality, anxiety, anger, depression, and coping strategies measured at the moment of diagnosis notification predict the evolution of cancer two years later, logistic regressions were performed considering the evolution of cancer as a dichotomous outcome variable (unfavourable, coded as 0, vs. favourable, coded as 1). The procedure predicts the unfavourable category and considers the favourable category as the reference group. The analysis was performed using the generalized linear models and the logistic regression of the SPSS. Firstly, a preliminary analysis was conducted in order to select which variables were likely to be entered in the regression model. Following the recommendations of Hosmer and Lemeshow (1989), a separate univariate logistic regression analysis was conducted for each variable. From these analyses, the variables with a *p*-value associated with the chi-square statistic—as an overall model evaluation index—of less than .15 were selected to be included in the model as possible predictors (Afifi & Clark, 1996). This procedure has been followed by others authors (e.g., Rando, 2010; Rando, Blanca, & Frutos, 2000). Secondly, a modelling approach was adopted to determine the model with the best fit to the data, adding one predictor at each step. The difference in deviance was compared in several nested models, testing the change in deviance significance when a predictor was added to the model (the smaller the deviance, the better the fit). The change in deviance follows a chi-square distribution with degrees of freedom equal to the difference in the number of estimated parameters in the two nested models. If the change was significant (p .05), the predictor remained in the model; otherwise, the predictor was excluded. In the next step, a new predictor was added, and so on. Thirdly, once the best model was selected, the overall model fit, goodness-of-fit statistics, validation of predicted probabilities, and regression coefficient values were assessed, following the recommendation of Peng, Lee, and Ingersoll (2002) and of Ato, Losilla, Navarro, Palmer, and Rodrigo (2005).

Results

Differences between the cancer and the control groups

Descriptive statistics for the control and cancer groups and the results of the *t*-tests for independent groups on personality, anxiety, anger, and depression variables are presented in Table 2. Descriptive statistics of the favourable and unfavourable cancer groups in coping style variables are also described in this table.

With regard to the personality variables, the cancer group presented higher scores in Neuroticism and lower scores in Extraversion, Agreeableness, and Conscientiousness.

Concerning differences in emotions, the cancer group scored higher in Cognitive Anxiety, Physiological Anxiety, and Motor Anxiety, and in Anger Reaction, Anger Expression-in, and Anger Control-out, and lower in Anger Expression-out. The effect sizes associated with these differences are either medium or large, according to Cohen's (1988) criteria (see Table 2).

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Table 2
Psychological Differences between the Cancer and the Control Group

Variables	Groups	*M*	*SD*	*df*	*t*	*p*	*d*
Personality							
Neuroticism	Cancer Control	21.45 16.40	9.59 6.98	114.78	3.39	< .01	.60
Extraversion	Cancer Control	28.95 31.93	7.73 6.04	119.59	–2.34	.02	.41
Openness	Cancer Control	27.97 26.16	7.34 3.67	92.77	1.66	.10	.29
Agreeableness	Cancer Control	33.47 36.18	5.72 6.11	129	–2.77	< .01	.49
Conscientiousness	Cancer Control	33.18 36.49	7.19 4.86	107.67	–2.94	< .01	.52
Emotions							
Cognitive Anxiety	Cancer Control	11.05 5.66	5.62 5.52	84.15	6.99	< .01	1.23
Physiological Anxiety	Cancer Control	9.25 5.36	6.57 4.86	78.62	3.94	< .01	.69
Motor Anxiety	Cancer Control	6.77 3.87	4.16 3.84	95.31	3.17	< .01	.56
Anger Temperament	Cancer Control	7.97 8.02	3.00 2.49	129	–1.31	.19	.23
Anger Reaction	Cancer Control	10.70 8.02	3.05 2.49	107.18	3.46	< .01	0.61
Anger Expression-Out	Cancer Control	9.53 11.24	2.85 2.91	129	–5.57	< .01	.98
Anger Expression-In	Cancer Control	12.03 11.09	2.71 2.88	129	2.53	.01	.45
Anger Control-Out	Cancer Control	17.27 14.18	4.65 4.18	129	4.29	< .01	.75
Anger Control-In	Cancer Control	14.93 15.91	5.46 4.41	129	0.19	.85	.03
Depression	Cancer Control	29.05 28.68	6.20 8.87	129	1.05	.29	.18
Coping Styles (only Cancer Groups)							
Positive Thoughts	Favourable Unfavourable	17.98 18.32	4.68 4.53	62	–0.28	.78	–0.07
Seeking Social Support	Favourable Unfavourable	10.31 10.50	3.20 3.37	62	–0.22	.82	–0.05
Seeking Solutions	Favourable Unfavourable	17.50 17.09	4.50 4.68	62	0.34	.73	0.08
Counting Advantages	Favourable Unfavourable	8.24 8.05	1.39 1.84	62	0.47	.64	0.12
Religiosity	Favourable Unfavourable	6.57 7.41	2.55 2.15	62	–1.31	.019	–0.35
Blaming Others	Favourable Unfavourable	8.00 8.00	3.76 3.46	62	0.00	1.00	0
Wishful Thinking	Favourable Unfavourable	14.02 14.68	2.90 3.96	62	–0.75	.45	–0.19
Emotional Repression	Favourable Unfavourable	9.17 11.23	3.08 4.07	62	–2.27	.02	–0.57
Self-blame	Favourable Unfavourable	4.00 5.64	1.92 2.82	62	–2.74	< .01	–0.68
Resignation	Favourable Unfavourable	7.19 8.50	2.33 2.24	62	–2.16	.03	–0.57
Escape	Favourable Unfavourable	6.83 6.36	2.17 2.82	62	0.74	.46	0.18

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Prediction of the evolution of cancer

The results from separate univariate logistic regression analysis for each variable are shown in Table 3. From these analyses, Occupation, Neuroticism, Conscientiousness, Anger Expression-in, Emotional Repression, Depression, Self-blame and Resignation were selected to be included in the model as possible predictors. A theoretical criterion was followed to control the order in which a variable was entered in the model. The selected order was: Anger Expression-in, Depression, Emotional Repression, Resignation, Self-blame, Conscientiousness, Neuroticism and Occupation. This order was selected based on empirical evidence that shows a higher association of cancer progression with emotions and coping strategies (e.g., lack of emotional expression) than with personality traits (Cousson-Gélie et al., 2007; Giese-Davis, DiMiceli, Sephton, & Spiegel, 2006; Nakaya et al., 2010; Sephton et al., 2009). Occupation was entered the last, to determine whether it modulates the association with psychological variables.

The results from the selected logistic regression model are presented in Table 4. A four-predictor logistic model was fitted to the data: Anger Expression-in, Resignation, Self-blame and Conscientiousness. There is a ratio of 16 subjects per predictor, which satisfies the rule of thumb of using a minimum of 10 subjects per predictor (Peduzzi, Cocanto, & Kemper, 1996), although recent findings recommend relaxing this rule (Vittinghoff & McCulloch, 2007). Table 4 also shows the regression coefficients and odd ratios for each predictor, the overall model assessment and goodness-of-fit tests.

Lastly, in Table 5, information to validate the predicted probabilities is reported, presenting the frequency and percentage of correct classifications as a function of the predicted and observed values of the evolution of cancer.

Table 3
Chi-square Statistic and Significant p-Value from Univariate Logistic Regression on Cancer Evolution as Outcome Variable (Favourable vs. Unfavourable)

Variables	χ^2	*p*
Anger Expression-In	10.96	< .01
Emotional Repression	6.33	.01
Self-blame	6.81	< .01
Resignation	5.91	.015

Table 5
Observed and Predicted Frequency for the Selected Logistic Regression Models

	Predicted		
Observed	Unfavourable	Favourable	% Correct
Unfavourable	15	7	68.2
Favourable	4	38	90.5
Overall % correct			82.5

Table 4
Selected Model Comparison of Logistic Regression Analysis; Regression Coefficients (β), Standard Error (SE β), Wald Chi-square Statistic, and Odd Ratios ($e^{\hat{a}}$), Likelihood-ratio Test and Goodness-of-fit Tests of the Selected Regression Model

Variables	Deviance	*df*	Deviance decrement	*df*	*p*
Anger Expression-in Resignation Self-blame Conscientiousness	57.658	59	4.72	1	.03

Predictor	B	*SE* β	Wald χ^2	*p*	e^{β}
Constant	–7.05	2.77	7.74	< .01	0.001
Anger Expression-In	0.40	0.16	9.69	< .01	1.49
Resignation	0.46	0.19	4.28	.04	1.59
Self-blame	0.26	0.14	4.24	.04	1.30
Conscientiousness	–0.10	0.05	4.30	.04	0.90

Test				
Overall model evaluation	Value	χ^2	*df*	*p*
Likelihood-ratio test	24.71	4	< .001	
Goodness-of-fit tests				
Hosmer & Lemeshow	8.04	8	.43	
Nagelkerke R^2	.44			

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The results led us to the following conclusions: The likelihood ratio test was significant, which means that the predictors contribute significantly to the prediction of the evolution of cancer, and the observed value of the cancer evolution was not significantly different from the value predicted by the model. Moreover, the Nagelkerke R^2 (ranging from 0 to 1) indicates how useful the predictors are in predicting the outcome variable, and it can be considered a measure of the effect size (Bewick, Cheek, & Ball, 2005), and the value of .44 found indicates that the model is useful to predict the evolution of cancer.

Regarding the validity of the predicted probabilities, the results indicate that 82.5% of the overall predictions were correct, which is an improvement over the level of chance. The magnitude of sensitivity and specificity are considered satisfactory. However, the correct percentage of the favourable group was very high (90.5%), higher than that of the unfavourable group (68.2%). On the other hand, the regression coefficients and odds ratios indicate that the higher the Anger Expression-in, Resignation and Self-blame scores, together with lower Conscientiousness scores, the more likely it is for patients' cancer evolution to be unfavourable. When the other predictors are kept constant, the odds of having an unfavourable evolution of cancer: (a) increase by 1.49 (49%) for each point increase on the Anger Expression-in score, (b) increase by 1.59 (59%) for each point increase on the Resignation score, (c) increase by 1.30 (30%) for each point increase on the Self-blame score, and (d) decrease by 1 to .90 (10%) for each point increase on the Conscientiousness score.

Discussion

The aims of this study were to determine the differences in personality, anxiety, anger and depression between control and cancer groups, and to determine whether these variables and coping strategies, measured at the moment of diagnosis notification, predict the evolution of cancer two years later. Personality is a stable psychological variable in people, but emotions are not; instead, they are psychophysical responses to life events; and lastly, coping styles are strategies to relieve stress. Cancer is a very stressful experience, and to study how people deal with it may clarify the best ways of coping with it.

Regarding the first aim, to compare control and cancer groups, our results confirmed the existence of group differences in various aspects of personality and emotions, although the groups were statistically homogenous in sociodemographic variables, such as age, gender, civil status, occupation, and household income. With regard to the second aim, we found prospective evidence that the higher the levels of Anger Expression-in and the use of an avoidant coping style (including Resignation and Self-blame), together with lower Conscientiousness, the more likely it is for patients have an unfavourable evolution of cancer.

In our study, cancer patients showed higher levels of Neuroticism and lower levels of Extraversion, Agreeableness, and Conscientiousness when compared to the general population (with medium and large effect sizes), indicating a relationship between personality features and health/disease, in accordance with other studies (Cardenal, 2001; Wasylkiw & Fekken, 2002). Considering such personality differences together with the higher levels of anxiety and anger presented by these patients—higher scores in Cognitive Anxiety, Physiological Anxiety, Motor Anxiety, Anger Reaction, Anger Expression-in and Anger Control-out, and lower scores in Anger Expression-out—, it can be assumed that cancer patients experience high levels of arousal (Giese-Davis et al., 2008). Our results corroborate previous reports indicating that personality and negative affect (with medium effect sizes) are related to the onset and cancer course (Augustine et al., 2008; Giese-Davis et al., 2008; Pinquart & Duberstein, 2010; Shigehisa & Honda, 2006). Although different findings have been reported in prospective studies (Bleiker et al., 2008; Hansen et al., 2005; Lillberg et al., 2002; Nakaya et al., 2008; Nakaya et al., 2003; Nakaya et al., 2010; Schapiro et al., 2001), stating that such a relationship has indeed been supported by other studies may be due to their methodological limitations. When the sample is very large, it is more likely to find standardized data, and our findings may be due to sample size. The population of most of these studies was Scandinavian or Japanese, and there may have been sampling bias in Spain due to the small sample. The inclusion of potential confounding variables in our analysis, such as age, civil status, healthy lifestyle, or tumour type, allowed us to control for their possible effects, so as to avoid such limitations and thus postulate fairly reliable results. On the other hand, the measure was taken when the cancer patients had just received the news of their diagnosis, which may explain the differences in neuroticism or emotional instability with the control group, which had not suffered any emotional impact of such magnitude. These are some of the explanations and limitations of our results.

Regarding the second aim, despite that some personality aspects such as neuroticism, extraversion, openness and agreeableness, as well emotions such as anxiety and depression do not predict the favourable or unfavourable evolution of cancer, according to other studies (Bleiker et al., 2008; Nakaya et al., 2010). One aspect of personality (Conscientiousness), one aspect of the emotion of anger (Anger Expression-in), and two passive coping styles (Resignation and Self-blame) do so, indicating that the probability of an unfavourable evolution of cancer is higher if the individuals present low scores in Conscientiousness and high scores in Anger Expression-in, Resignation and Self-blame. Regarding Conscientiousness, some studies have found that patients with high Conscientiousness scores were more likely to take care of themselves after treatment (Block et al., 2007). Anger Expression-in had predictive value for

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cancer prognosis, in agreement with the conclusions of a review of the field (Buttow et al., 2000; Graves et al., 2005; Hou et al., 2010). Patients with an unfavourable prognosis showed a tendency to suppress their emotions of anger instead of expressing them. In our study, even though patients with a poorer evolution had similar levels of Anxiety and Anger Expression-out, they also had higher levels of Anger Expression-in, indicating unexpressed distress.

Our results also supported the predictive value of coping styles for the evolution of the disease, in accordance with other studies (Cousson-Gélie et al., 2007; Hardt et al., 2010; Merz et al., 2010; Nagano et al., 2008; Petticrew et al., 2002; Prasertsri, Holden, Keefe, & Wilkie, 2011). Specifically, we found that the evolution was predicted by Resignation and Self-blame, both of them avoidant or passive styles of coping. Adopting resignation as a coping style indicates that the individuals adopt an immobile attitude, believing that there is nothing they can do about the problem, whereas a self-blaming coping style indicates that they focus on their own responsibility for the onset or origin of the problem (Font & Cardoso, 2009; Rodríguez-Marín et al., 1992). Our findings follow the lines of previous studies, suggesting that people whose coping style is characterised by a fighting spirit display a better evolution of the disease, compared to those who are resigned (Cardenal, 2001; Weihs et al., 2000).

These results suggest the effectiveness of clinical interventions that use strategies to minimize suppressing feelings of anger (Anger Expression-in), resignation, and self-blame. Improving self-discipline (Conscientiousness), alleviating suppressed anger and promoting beneficial coping strategies seems to help cancer patients to cope with the disease and its effects, as well as enhancing their quality of life (Butler et al., 2009; Hou et al., 2010; Lieberman & Goldstein, 2006). Indeed, psychological interventions such as supportive-expressive group therapy, which focuses on these aspects, were effective for promoting these patients' well-being (Butler et al., 2009; Cerezo, Ortiz-Tallo, & Cardenal, 2009) and for strengthening immune-competence (McGregor & Antoni, 2009), although it is difficult to corroborate a causal relationship (Andersen et al., 2008; Stefanek, Palmer, Thombs, & Coyne, 2009).

Although our study seems to corroborate previous findings in the field of cancer and point to the importance of specific psychological factors for clinical practice with cancer patients, it has several limitations that should be taken into account, some previously discussed, such as the sample size or the moment of evaluation of the cancer group. For instance, we used a relatively small sample of cancer patients, followed-up for two years, which, although a critical period, may not be long enough to determine the evolution of the disease. Apart from that, although we controlled sociodemographic and medical variables, other kinds of factors, such as physiological, genetic, behavioural, and environmental factors (López-Martínez, 2003), may have influenced the relationships established between the psychological aspects studied and the evolution of cancer, a fact that affects the methodological strength of our findings. But 82.5% of our overall predictions were correct, and this percentage was higher in the favourable group than in the unfavourable group, which indicates that other variables should be taken into account in future studies. Our limitation is not to have contemplated other variables that may be important in the prediction of the unfavourable evolution of cancer.

Future studies should further explore the potential relationships between conscientiousness, suppressed anger (Anger Expression-in), coping styles and the evolution of the disease, also examining in detail other psychological variables and taking into account possible effects of other factors in a representative sample of cancer patients, and for a longer period of time. Nevertheless, our study highlights the crucial role of conscientiousness, suppressed anger (Anger Expression-in) and coping styles as factors that intervene in patients' attitudes towards the disease and therapy, indicating the need to take them into account in clinical decisions and practice with these patients.

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