REPORTS

Personality Factors and Breast Cancer Development: a Prospective Longitudinal Study

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Background: **It has been estimated that approximately 25% of all breast cancers in women can be explained by currently recognized somatic (i.e., hereditary and physiologic) risk factors. It has also been hypothesized that psychological factors may play a role in the development of breast cancer.** ***Purpose:*** **We investigated the extent to which personality factors, in addition to somatic risk factors, may be associated with the development of primary breast cancer.** ***Methods:*** **We employed a prospective, longitudinal study design. From 1989 through 1990, a personality questionnaire was sent to all female residents of the Dutch city of Nijmegen who were 43 years of age or older. This questionnaire was sent as part of an invitation to participate in a population-based breast cancer screening program. Women who developed breast cancer among those who returned completed questionnaires were compared with women without such a diagnosis in regard to somatic risk factors and personality traits, including anxiety, anger, depression, rationality, anti-emotionality (i.e., an absence of emotional behavior or a lack of trust in one's own feelings), understanding, optimism, social support, and the expression and control of emotions. Conditional logistic regression analysis was used to identify variables that could best explain group membership (i.e., belonging to the case [breast cancer] or the control [without disease] group).** ***Results:*** **Personality questionnaires were sent to 28 940 women, and 9705 (34%) were returned in such a way that they could be used for statistical analyses. Among the 9705 women who returned useable questionnaires, 131 were diagnosed with breast cancer during the period from 1989 through 1994. Seven hundred seventy-one age-matched control subjects (up to six per case patient) were selected for the analyses. Three variables were found to be statistically significantly associated with an increased risk of breast cancer: 1) having a first-degree family member with breast cancer (versus not having an affected first-degree relative, odds ratio [OR] = 4.05; 95% confidence interval [CI] = 1.76-9.31); 2) nulliparity (i.e., having no children) (versus having had a child before the age of 30 years, OR = 2.67; 95% CI = 1.26-5.68); and 3) a relatively high score on the personality scale of anti-emotionality (versus a low score, OR = 1.19; 95% CI = 1.05-1.35).** ***Conclusions and Implications:*** **With the exception of a weak association between a high score on the anti-emotionality scale and the development of breast cancer, no support was found for the hypothesis that personality traits can differentiate between groups of women with and without breast cancer. We recommend that this study be continued and that other studies be encouraged to explore possible relationships between personality factors and the risk of breast cancer. [J Natl Cancer Inst 1996;88: 1478-82]**

In The Netherlands, breast cancer is the most common type of cancer among women. If current incidence patterns continue, one of every 10 women will be diagnosed with this disease during her lifetime (*1*). A number of factors have been described that increase the risk of breast cancer, including having a first-degree relative with breast cancer (*2,3*), early menarche (*4,5*), late menopause (*6*), late age at first childbirth (*5,7*), nulliparity (*7,8*), and being overweight in postmenopausal women (*9*). It has been estimated that only about 25% of all breast cancers can be explained by the currently recognized risk factors (*10*). Recently, genetic factors [BRCA1 (*11*) and BRCA2 (*12*)] have been identified, and it is estimated that between 5% and 10% of breast cancers can be attributed to these factors (*13*). The etiology of a large proportion of breast cancers is therefore still unexplained, and additional risk factors remain to be identified. A number of studies (*14-19*) have investigated the relationship between personality traits and the development of cancer. To date, the results of these studies are inconsistent. For example, some authors (*20*) have reported that depressive women are more prone to develop breast cancer, others (*21*) have reported the opposite relationship, and still others (*22-24*) have failed to establish any effect of depression as a risk factor or a protective factor. These contradictory results can be partly explained by the different research designs. For instance, it has been recommended that personality traits be measured before the detection of disease, since it has been shown that knowledge of being a cancer patient may affect the self-report of personality traits (*25,26*). Also, quasiprospective studies (i.e., studies in which personality investigations are carried out on subjects with a suspicious lesion prior to a definite cancer

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diagnosis) may be limited by the possible effect of social interactions occurring during medical consultations prior to psychological examination (*27*). Prospective studies are thus required to avoid the methodologic problems that have been evident in earlier studies (*14,18,22,23*). Only a few prospective studies aimed at investigating associations between personality traits and the subsequent detection of breast cancer have been carried out. The prospective study by Hagnell (*28*) started with 2550 subjects. After an average follow-up time of 10 years, nine women with breast cancer remained in the study. The sample size of case patients was too small to draw reliable conclusions. Hahn and Petitti (*29*) studied a cohort of 8932 women, of whom 117 had developed breast cancer after 10-14 years. They found no significant associations between breast cancer development and depression, repression/sensitization, or lying scores on the Minnesota Multiphasic Personality Inventory, a questionnaire designed to provide an objective assessment of some major personality characteristics affecting personal and social adjustment (*29*). In a study described by Scherg (*30*), 2874 subjects completed questionnaires just prior to a breast cancer screening. When comparing 75 women who were diagnosed as having breast cancer with 75 control subjects, it was found that the cancer patients showed, among other things, less anxiety, less pronounced Type A behavior, and more social desirability. However, Scherg (*18*) could not replicate these results in the 11-year follow up of 48 women with newly detected breast cancers. To summarize the literature, a number of studies have been performed that have resulted in contradictory and inconclusive results, partly due to the use of a retrospective or quasi-prospective design, a small sample size, or a nonspecific outcome variable such as "cancer." Only the results of large prospective studies can add to our knowledge of the relationship between psychological factors and breast cancer development. Thus far, the results of two studies have been informative. Additional prospective studies are needed to confirm these results.

In this study, a prospective design was used to investigate whether psychological factors, in addition to the known somatic risk factors, are associated with the development of breast cancer and, if so, to what extent. Of special interest were those personality traits that measure the expression and control of (negative) emotions. These characteristics were found more often in cancer patients than in persons free of cancer in previous studies (*16,21,31-35*), and they are sometimes termed the characteristics of a "cancer-prone personality" (*36*).

Methods

Subjects and Procedures

In the present study, we worked closely with the population-based breast cancer screening program of the Dutch city of Nijmegen. All female residents of this city aged 43 years and older (n = 28 940) were invited to participate in the program from 1989 through 1990. In addition to this invitation, the women also received a personality questionnaire. They were asked, on a voluntary basis, to complete the questionnaire at home and return it to the municipal health center before the screening. The breast cancer screening (a mammogram) was conducted at this center. All of the women invited for the screening were later invited to subsequent screening rounds, which took place every 2 years. A case–control design was used, in which the case group consisted of women with newly detected breast cancer, diagnosed from 1989 through 1994. Women who were diagnosed earlier as having breast or other cancers were excluded. Women with lobular carcinoma *in situ* were not considered as case patients in this study. Those women who were diagnosed between two screening rounds by sources other than the screening program (i.e., the interval cancers) were also included in the study. In this way, complete registration of new case patients was obtained. A control group was selected from among the women free of cancer who had returned a completed psychological questionnaire. For each case patient, up to six control subjects were selected in such a way that the control subjects matched the corresponding case patients with respect to age at the moment of screening. Matching was considered to be important, since age was found to be a confounding variable [i.e., age is related to the independent variables in this study (*37*) as well as to the dependent variable, breast cancer incidence (*10*)].

Psychological Questionnaire

The Self-Assessment Questionnaire-Nijmegen (SAQ-N) was especially constructed for use in this study (*38*). The SAQ-N is characterized by an assessment of traits (as opposed to states) and can be easily completed by a large population. It is composed of 11 questionnaires (that we call "scales") that are internationally recognized, measuring a range of personality traits that reflect relatively enduring dispositions of an individual. The following dispositions are measured (Cronbach's alpha and the test–retest reliability are in parentheses): anxiety (α = .92, r = .82) (*39,40*), anger (α = .85, r = .79) (*41,42*), depression (α = .81, r = .80) (*43,44*), rationality (α = .76, r = .64) (*34,45,46*), antiemotionality (i.e., an absence of emotional behavior or a lack of trust in one's own feelings) (α = .68, r = .64) (*34,45,46*), understanding (i.e., understanding others, in spite of negative feelings) (α = .67, r = .59) (*34,45,46*), optimism (α = .84, r = .76) (*47,48*), social support (α = .82, r = .65) (*49*), emotional expression-in (i.e., feelings are held in or suppressed) (α = .79, r = .65) (*46,50,51*), emotional expression-out (i.e., feelings are directed toward other people or objects) (α = .86, r = .67) (*46,50,51*), and emotional control (i.e., control of outward expression of feelings) (α = .86, r = .63) (*46,50,51*). The general question is: "How do you usually feel or behave?" The response format employs a four-point scale of frequency: 1 = almost never, 2 = sometimes, 3 = often, and 4 = almost always. A low mean score on each scale indicates a low frequency of the self-reported trait.

Somatic Variables

In the study, known risk factors were called somatic variables, as opposed to the psychological variables. Information about somatic variables was obtained from questionnaires that were sent at each screening round to all women invited to the screening program. Having a first-degree relative (mother or sister) with breast cancer was included as a risk factor for breast cancer. The reference (low-risk) category was not having a first-degree relative with breast cancer. An early age at menarche (≤12 years) had menarche at greater than 12 years of age as the low-risk reference category. A late age at menopause (≥53 years) had menopause at age less than 53 years as the reference category. Being overweight was defined as having a Quetelet index [weight in kilograms divided by square of height in meters (52)] greater than or equal to 27.5, with the reference category being a Quetelet index of less than 27.5. For some women, the information on these somatic variables was unknown. To prevent a decrease in sample size, this missing information was grouped into the category "unknown" and was compared with the low-risk reference category. The variable "parity status" consisted of four categories: 1) first parity before the age of 30 years, 2) first parity after the age of 29 years, 3) nulliparity, and 4) unknown. The first category is the low-risk category, and it was used as the reference.

Statistical Analyses

Conditional logistic regression analyses were used to build a model with variables that could best explain group membership (belonging to the case or the control group) (*53*). The Epidemiological GRaphics, Estimation, and Testing package (EGRET) (*54*) was used to perform the analyses. Both psychological variables and somatic risk factors were assessed. First, the case group and a control group of equal size were used to build the model by use of a forward stepwise selection method. The model was then tested for confirmation using the case group and a different, age-matched, control group. Reported P values are two-sided.

Results

Sample Population

In 1989 and 1990, the total number of women invited to the breast cancer screening program was 28 940; however, the participation of 17 159 (59%) individuals was actually recorded. Among the personality questionnaires distributed, 9705 (34%) were returned in such a way that they could be used for statistical analyses; among the useable questionnaires, 95% were returned by women who attended the screening for breast cancer. From 1989 through 1994, breast cancer was detected in 131 of the 9705 women. For each case patient a maximum of six age-matched control subjects was found, resulting in an initial control group population of 786 women. However, 13 control subjects were found to be selected twice for different case patients, and two others were later diagnosed with breast cancer. Exclusion of these 15 women left a control group population of 771 individuals.

Model Building

Matched pairs were formed from the 131 case patients and a control group of equal size. Since a control subject was missing for one case patient,[1] 130 matched pairs were formed. First, the following somatic variables were included in the analysis: family history of breast cancer, early menarche, late menopause, being overweight, and parity status. By use of a forward stepwise selection method, the model found to predict group membership best included two variables: having a family history of breast cancer (versus no family history, odds ratio [OR] = 3.49; 95% confidence interval [CI] = 1.58-7.72) and parity status (nulliparity versus first parity before the age of 30, OR = 2.69; 95% CI = 1.30-5.58).

Investigating the separate contribution of personality factors to the prediction of group membership, all 11 scales of the SAQ-N were included in the analysis: anxiety, anger, depression, rationality, anti-emotionality, understanding, optimism, social support, emotional expression-in, emotional expression-out, and emotional control. With the use of forward stepwise conditional logistic regression analysis, only one of the 11 scales was selected for the model: anti-emotionality (OR = 1.16; 95% CI = 1.04-1.30).

The model resulting from conditional logistic regression analysis of both somatic and psychological variables is shown in Table 1. The two somatic variables and the one psychological variable identified above maintained their significant contributions to the model. When the model in Table 1 was compared with the model that included only the somatic variables "family history of breast cancer" and "parity status," it was found that the model that added the psychological scale "anti-emotionality" (Table 1) yielded a significant improvement in the fit of the data (difference in deviance: Likelihood Ratio Statistic = 8.32, degrees of freedom = 1; two-sided P<.005). None of the other variables, somatic or psychological, could improve the fit of the model.

In a second analysis, the model shown in Table 1 was fitted using data from all case patients (n = 131) and a different age-matched control group (n = 641), with (usually) five control subjects per case patient. It was found that, with the use of the second control group, the three variables maintained their significant contributions to the prediction of breast cancer (*see* Table 2).

Discussion

In this study, we employed a prospective, longitudinal study design to investigate whether variables previously described as being part of a cancer-prone personality are associated with the development of primary breast cancer. Having a family history of breast cancer and nulliparity were found to be modestly associated with breast cancer development. In addition, a high score on the anti-emotionality scale showed a weak association with breast cancer risk. One may question why women who are less prone to report that they "trust their feelings" and "let their behavior be influenced by their emotions" (two examples of items in the anti-emotionality scale, *see* Appendix) are, on average, at higher risk of developing breast cancer. Holland (*55*) suggests two approaches to explaining a possible association between psychological factors and cancer development. In the first approach, it is posited that psychological variables may influence health behavior, thus having an effect on cancer risk. This explanation suggests that women with high anti-emotionality scores should also exhibit behavior that, in turn, would increase the risk of breast cancer development. When studying the relationships between the anti-emotionality scale and measured somatic risk factors (such as being overweight and parity status), no statistically significant associations were found. In the second approach, it is posited that psychological variables have an effect on the internal milieu (i.e., on hormone secretion and immunologic parameters), altering cancer risk and survival through an effect on tumor growth. The latter explanation suggests a need for research into the psychoneuroimmunology of cancer. A third approach in explaining a possible association between psychological factors and cancer development is proposing that one, yet unknown, factor (possibly hormonal or genetic) may be responsible for the increased risk of breast cancer as well as for an increased chance of having a certain personality trait.

Since 34% of the invited women participated in the study, it can be argued

Table 1. Model obtained from conditional logistic regression analysis that included measurements of personality traits and somatic factors to predict the development of breast cancer among 130 case patients and 130 age-matched control subjects

Variable	Odds ratio	95% confidence interval	P*
Family history (yes versus no)	4.05	1.76-9.31†	.001
Parity status			
First parity before the age of 30 y‡	1.00	—	—
First parity after the age of 29 y	1.84	0.81-4.18	.147
Nulliparity	2.67	1.26-5.68†	.011
Unknown	1.15	0.45-2.92	.766
Anti-emotionality (increasing)	1.19	1.05-1.35†	.006

*P values are two-sided.
†Odds ratio is statistically significantly different from one.
‡Reference group.

Table 2. Model obtained from conditional logistic regression analysis that included measurements of personality traits and somatic factors to predict the development of breast cancer among 131 case patients and 641 age-matched control subjects

Variable	Odds ratio	95% confidence interval	P*
Family history (yes versus no)	1.88	1.17-3.03†	.009
Parity status			
First parity before the age of 30 y‡	1.00	—	—
First parity after the age of 29 y	1.29	0.73-2.27	.384
Nulliparity	2.32	1.39-3.89†	.001
Unknown	0.62	0.28-1.40	.252
Anti-emotionality (increasing)	1.09	1.01-1.18†	.029

*P values are two-sided.
†Odds ratio is statistically significant different from one.
‡Reference group.

that selection due to nonresponse may have occurred. However, in prospective cohort studies, bias due to nonresponse is presumed to be absent, since there are no cases of disease at the time that the questionnaires are completed (*56*).

Another question is whether one should consider ORs on the order of 1.19 (95% CI = 1.05-1.35) of substantial importance. We agree that the association with the anti-emotionality scale is rather weak, and it may be argued that an OR of 1.2 is at the limits of reliability for an epidemiologic study. Therefore, the association between anti-emotionality and breast cancer risk is essentially a negative result. Furthermore, one may ask whether the observed association can be attributed to chance. Since 11 personality scales were included in the analyses, we could expect one statistically significant difference at the $P<.05$ level. However, by testing the model with a different control group, a small but statistically significant association was found again, partly supporting the view that it was not a chance finding.

To exclude the possibility that some women detected with breast cancer during the first 2 years of the study (when questionnaires were completed about 2 weeks before a possible diagnosis) may have been influenced by the knowledge of having a suspicious lesion, we performed an additional analysis. The final model was tested excluding those women who had a palpable tumor at diagnosis from 1989 through 1990. Conditional logistic regression analysis with 116 case patients and their 682 control subjects showed that the three variables (family history, nulliparity, and anti-emotionality) maintained their significant contributions to the model.

What are the practical implications of our results? It must be emphasized that we have reported associations that do not necessarily imply causality. The results of this study do not have direct practical implications in the sense that we are in a position to advise women to trust their feelings or to let their behavior be influenced by their emotions. Nor can practical assistance be given to the general practitioner who wants to estimate the risk of breast cancer in a particular woman. It has been reported that the known risk factors for breast cancer do not provide guidance for primary prevention (*57*). The same can be concluded as far as psychological factors are concerned. Nevertheless, the results of this study do have certain theoretical implications that suggest that further investigations into the concept of anti-emotionality are needed.

No evidence was found of an association between the other 10 personality traits (anxiety, anger, depression, rationality, understanding, optimism, social support, emotional expression-in, emotional expression-out, and emotional control) and the development of breast cancer. In the current study, particular attention was paid to the possible association between the expression and control of (negative) emotions and breast cancer, since earlier studies (*15,20,21,30-34*) indicated that this factor might play an important role. The suppression of negative emotions and difficulty in expressing emotions were also traits that were suggested to be characteristics of the cancer-prone personality (*36*), which might predispose a subject to develop cancer. However, in our prospective study, we were not able to replicate these hypothesized differences between women with breast cancer and their corresponding control subjects. We conclude that no indications were found to suggest that personality traits increase the risk of developing breast cancer, with the exception of the weak association with anti-emotionality. We recommend that the present study be continued for at least 5 years to investigate whether the reported results continue to show (non)significant associations in a new sample. Also, other studies with the same and other designs must be encouraged to explore the relationships between personality factors and the risk of breast cancer.

Appendix

The anti-emotionality scale consists of the following statements that are interspersed among the 98 items in the Self-Assessment Questionnaire-Nijmegen:

1) In important situations, I trust my feelings.
2) I trust my feelings.
3) I respond emotionally to people.
4) My behavior is influenced by my emotions.

These statements elicit responses according to the format: "almost never," "sometimes," "often," or "almost always."

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Notes

[1]One particular case patient was assigned five (instead of six) control subjects, and, as a consequence of the matching procedure (1:1), this patient was matched to its nonexistent control subject. Thus, a pair was formed for which the control was missing. This matched pair could not, therefore, be used in the conditional logistic regression analysis.

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