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Abstract

Presymptomatic DNA testing for autosomal dominant hereditary breast/ovarian cancer (HBOC) became an option after the identification of the *BRCA1* and *BRCA2* genes in 1994-1995. Healthy female mutation carriers have a high lifetime risk for breast cancer (56-87%) or ovarian cancer (10-60%) and may opt for intensive breast and ovary surveillance or prophylactic surgery (mastectomy/oophorectomy).

We studied general and cancer related distress in 85 healthy women with a 25% or 50% risk of being carrier of a *BRCA1/BRCA2* gene mutation and 66 partners in the six to eight week period between genetic counselling/blood sampling and disclosure of the test result. Questionnaire and interview data are analysed. Associations are explored between levels of distress and (1) expected consequences of being identified as a mutation carrier, (2) personality traits, (3) sociodemographic variables, and (4) experiences related to HBOC.

Mean pre-test anxiety and depression levels in women at risk of being a carrier and partners were similar to those of a normal Dutch population. In about 25% of those at risk of being a carrier and 10% of the partners, increased to high levels of general and cancer related distress were found. Increased levels of distress were reported by women who (1) anticipated an increase in problems after an unfavourable test outcome, (2) considered prophylactic mastectomy if found to be mutation carrier, (3) had an unoptimistic personality, (4) tended to suppress their emotions, (5) were younger than 40 years, and (6) were more familiar with the serious consequences of HBOC. Recently obtained awareness of the genetic nature of cancer in the family was not predictive of distress.

The majority of the women and their partners experienced a relatively calm period before the disclosure of the test result and seemed to postpone distressing thoughts until the week of disclosure of the result. The low distress levels may partly be explained by the use of strategies to minimise the emotional impact of a possibly unfavourable test outcome. However, a minority reported feeling very distressed. Several factors were found to be predictive for increased distress levels.

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Genetic testing for subjects at risk for being a carrier in hereditary breast/ovarian cancer (HBOC) families became possible because of the identification of two breast cancer susceptibility genes, *BRCA1* and *BRCA2*, in 1994.[1 2] Healthy female mutation carriers have a lifetime risk for breast cancer of 56-87% and for ovarian cancer of 10-60%.[3] They may opt for either intensive surveillance or prophylactic surgery (mastectomy and/or oophorectomy). In the Daniel den Hoed Cancer Institute, Rotterdam, prophylactic mastectomy is often performed together with breast reconstruction, mainly using silicone implants. For male mutation carriers, risks for cancer are only slightly increased.[4]

Because presymptomatic testing for HBOC is a new development with far reaching consequences for test applicants and their families, it is important to monitor the psychological impact of this test in the pre- and post-test period. Psychological evaluation became part of our programme for presymptomatic testing for HBOC since its start in 1994.[5] The main reasons for women to opt for presymptomatic DNA testing are to obtain certainty about (1) having an increased risk of developing cancer or not, (2) the need for future intensive surveillance and/or prophylactic interventions, and (3) the possibility of having passed the gene to their offspring.[6] The demand for this test in those at risk of being a carrier for HBOC seems to be stronger than in those at risk for other late onset genetic disorders.[7 8]

Up until now, only a few studies have analysed psychological functioning in the weeks before receiving *BRCA1*/*BRCA2* test results.[6 7 9 10] These studies showed average pre-test distress levels to be "similar to those of a normal population"; however, the variability in distress levels was high. A first evaluation of pre-test functioning in 24 healthy subjects applying for *BRCA1*/*BRCA2* testing in our centre showed that disease related distress was lower than those in at risk for Huntington's disease, but higher than in those at risk for familial adenomatous polyposis coli (a type of hereditary colon cancer).[6] The low psychological distress in these subjects at risk for HBOC was explained by the intensive attention from

researchers and (onco)geneticists towards this first tested group.

Subjects in previous studies had been aware of the genetic nature of cancer in the family for a long time and had usually been involved in previous genetic studies to identify the family specific gene mutation.[6 7 9 10] Therefore, one should be careful in generalising the results. The long term adaptation to the emotional impact of belonging to a HBOC family might explain the low distress levels.[7] At the moment, analysis of the familial *BRCA1* or *BRCA2* mutation allows genetic testing of larger numbers of at risk carriers, who sometimes have only limited experience with cancer in relatives, or a short term awareness of the genetic susceptibility in their family. Our study is the first psychological study on genetic testing for HBOC, in which the latter type of subjects at risk are represented.

In 1995 the present study was started, including psychological assessments from pre-test to one year follow up in women at 25 or 50% risk of being a *BRCA1*/*BRCA2* mutation carrier participating in presymptomatic testing and their partners. Partners were included in the study because the increased risk of developing cancer for their wives, the option of prophylactic mastectomy, and the genetic risk for offspring are all of major concern for them as well. Women with a personal history of breast or ovarian cancer were not included; they are likely to carry the family specific mutation and may therefore experience the testing period differently.[9] Besides, the medical implications of the test result may be different for those with and without a history of cancer. Psychological implications of presymptomatic *BRCA1*/*BRCA2* testing for male risk carriers for HBOC will be addressed in another paper.

Here, we present the psychological functioning of subjects at risk of being a carrier and their partners in the six to eight week waiting period between genetic counselling/blood sampling and disclosure of the test result. The aim of the study is twofold. Firstly, we wanted to improve our understanding of the emotional impact of waiting for a *BRCA1*/*BRCA2* test result. Secondly, we wanted to identify subjects at risk who might need additional support during the pre-test period by examining associations between distress levels and relevant predictive variables, such as sociodemographic factors and personality traits.[10 11] Besides these factors, we also assessed the expected consequences of an unfavourable test result and experiences with cancer in the family.

Study population

Between December 1995 and April 1998, 118 healthy women with a 25% or 50% risk of having inherited a *BRCA1* or *BRCA2* gene mutation, who requested genetic testing at the Department of Clinical Genetics, University Hospital Rotterdam, were asked to participate in the psychological study. After one or more genetic counselling sessions, these women all decided to provide a blood sample. Eighty five of them (72%) completed the pre-test assessment, eight (7%) declined after having completed either a questionnaire or an interview, and 25 (21%) decided not to participate. A reluctance to discuss emotions was the reason most often mentioned for declining (further) participation in the study. Most of the women who declined stated experiencing no problems, some feared discussing their feelings, and a minority did not want to complete questionnaires. The 85 women who participated belonged to 33 different HBOC families. Of the 76 partners of the participating at risk carriers, 66 (86%) joined the study.

Procedure

THE GENETIC COUNSELLING PROCEDURE

The option of determining gene mutation carrier status could be provided after previous studies on blood samples from one or more affected relatives. These family studies took one to three years. If *BRCA1*/*BRCA2* mutation testing became informative in a family, subjects who participated in these previous studies were informed by the clinical geneticist about the genetic nature of the disease and the possibility of testing. They, in turn, could inform other relatives. At risk subjects interested in further information or subsequent genetic testing were invited for genetic counselling. One or more individual sessions followed with the clinical geneticist or genetic nurse, depending on the previous knowledge and on the extent to which there were still doubts about having the test done. Subjects were informed about *BRCA1*/*BRCA2* related cancer risks and about general population risks for breast and ovarian cancer. They explained that if a woman had inherited the mutation, her risk for cancer varied from 60 to 80% for breast cancer, from 20 to 60% for ovarian cancer, and was 5% for peritoneal cancer. It was also discussed that it was not yet possible to give more family tailored risk estimations, but that risks for ovarian cancer at the lower end of the range were more likely in families in which ovarian cancer had not (yet) occurred (usually in the case of a *BRCA2* mutation). Furthermore, subjects were informed about the efficacy of regular surveillance and prophylactic surgery. Possible adverse psychosocial sequelae were extensively discussed and they were informed about the availability of clinical psychologists. If a woman at risk decided on testing, a blood sample was drawn. After blood sampling, an appointment was made for disclosure of the test result, which took place six to eight weeks later in a session with the clinical geneticist or genetic nurse.

THE PSYCHOLOGICAL STUDY

The protocol for this study was modelled on the protocol of previous psychological studies on presymptomatic testing for Huntington's disease in The Netherlands.[12] After blood sampling, subjects were asked to participate in the psychological study. If a woman agreed to participate, she was introduced to the psychologist (LNL), who provided information about the psychological follow up study and gave questionnaires to complete at home. The pre-test interview was scheduled, which usually took

place in the weeks following blood sampling either at home, at the Department of Clinical Genetics, or at a regional hospital (77%), but sometimes, for practical reasons, directly after blood sampling (14%) or by telephone (9%).

Variables

OUTCOME VARIABLES

General distress

The Hospital Anxiety and Depression Scale (HAD) was administered, which consists of two subscales of seven items assessing the level of anxiety and depression.[13 14] Questions have four answer options, yielding scores ranging from 0 to 21 for each subscale. A score of higher than 10 is an indication of clinical anxiety or depression, scores from 8 to 10 on either subscale are indicative of "borderline" Anxiety or Depression. Validity and reliability are found to be good.[15] To enable comparison of general distress with the normal population, the Symptom Checklist was used.[16] This questionnaire has norm tables for a Dutch female and male population.[17]

Cancer related distress

The Impact of Event Scale (IES), assessing the impact of a distressing experience, was used.[18] The "Intrusion" (seven items) and "Avoidance" scale (eight items), measure becoming overwhelmed by thoughts and feelings about a distressing experience and a tendency to avoid these thoughts and feelings. "Breast/ovarian cancer" was taken as the distressing event. To enable comparison with results from previous studies on genetic testing in our centre, similar response categories were used (never, sometimes, often, or continuously). These response categories differed from those of the original IES.[6] The score range for intrusion is 0-35, for avoidance 0-40.

PREDICTIVE VARIABLES

Sociodemographic and pedigree information

Data were obtained on age, marital status, offspring (number, gender, and age), educational level, and the genetic risk (25% or 50%) of being a mutation carrier.

The decision to be tested

In the interview, women were asked how long it took them to decide to have a genetic test and what their major reasons were to have it performed.

Expected consequences of an unfavourable test result

An attitude questionnaire, which was adapted from previous studies by our group,[19] monitored the expected emotional consequences of either test result. Subjects at risk and partners could indicate whether they, after an unfavourable test result, expected their own, their partner's, or their children's problems to increase, to become depressed, to be able to plan future life better, and whether they expected adverse consequences for finding or keeping work. Contrasting expectations after a favourable test result were also explored. Response categories were "agree", "do not know", or "disagree". Women were also asked which test outcome they expected. Their answers were divided into five categories, ranging from "I have a strong feeling of not having inherited the gene mutation" to "I have a strong feeling of having inherited the gene mutation". Answers such as "I feel it is a fifty-fifty chance" or "My expectations about it are changing every day" were scored as "not having a particular presentiment".

At risk carriers were also asked about their plans on future risk management if identified as a mutation carrier. If women considered prophylactic surgery, it was registered how sure they felt about this option and what time scale they had in mind to have it performed.

Personality traits

Two scales of the Self-Assessment Questionnaire-Nijmegen (SAQ-N),[20] a questionnaire measuring different personality traits, were administered. They assess Optimism[21] (eight items, for example, "In uncertain times I usually expect the best") and Emotional Expression[22 23] (18 items, assessing the repression, physical acting out, and control over feelings of anxiety, anger, and depression, for example, "When I feel unhappy or miserable, I let others see how I feel" and "When I feel angry, I still have control over my behaviour"). The frequency of such feelings/behaviour could be indicated, by use of a four point scale, ranging from "almost never" to "nearly always".

Experience with the disease in the family

The personal experience with breast and ovarian cancer in the family was explored during the interviews. We asked how long they had been aware of the genetic nature of breast/ovarian cancer in their family. Information was gathered on the number and age of relatives with breast/ovarian cancer, on the outcome of the disease, and on the personal involvement with these relatives. An affected relative was categorised as "close", if the woman was involved with her during the disease and its treatment. Thus, one could have a "close" contact with a cousin, and a "not close" contact with a sister, for example, if there had been no contact with this sister for years. Experience with serious sequelae of breast/ovarian cancer in relatives was categorised as follows: (1) women who are/were in close contact with relatives with metastatic breast/ovarian cancer, (2) women who know/knew such relatives but were not involved with them during the disease, and (3) women who knew no relative with metastatic breast/ovarian cancer.

Statistical methods

To control for a possible violation of randomness owing to belonging to the same family, we used a random regression model for continuous data performed by the program Proc Mixed of the statistical package Statistical Analysis Systems (SAS/PC, version 6.12). By means of this method, family specific effects on the outcome variables could be estimated.[24] For further data analysis, we used the Statisti-

Table 1 Characteristics of the study sample (female risk carriers applying for presymptomatic testing and their partners) and non-respondents

	Risk carriers (n=85)	*Non-respondents (n=33)*	*p<0.05†*	*Partners* (n=66)*
Mean age (y)	38.4	39.0	—	38.9
Range				
19–40	63%	67%		64%
41–68	37%	33%		36%
Education				
Low	29%	25%		32%
Intermediate	61%	63%	—	44%
High	10%	12%		24%
Marital status				
Married/living together	87%	85%	—	
Unmarried/divorced/widowed	13%	15%		
Have children	72%	76%	—	
Mean number (range)	2.2 (1–5)	2.1 (1–4)	—	
Children <15 years	44%	49%	—	
Girls (>18 years)	55% (36%)	55% (39%)	—	
Boys	58%	61%	—	
Want (more) children	36%			
Prior risk				
50%	78%	85%	—	
25%	19%	15%		
12.5%	3%			
Close relative(s) with metastatic				
BC/OC	48%	42%	—	

*All but two male.
†Characteristics from respondents compared to non-respondents (*t* tests for independent samples).

cal Package for Social Sciences (SPSS/PC, version 8.0). Differences between subgroups, for example between subjects at risk and partners, were tested by *t* tests for independent samples (levels of $p \leq 0.05$, two tailed, were regarded as statistically significant). The relation between the independent factors and the level of general and cancer related distress was estimated by a single linear regression model. Factors significantly related to the level of distress ($p \leq 0.05$) were included in a multiple linear regression model (backward elimination procedure). The variance explained by this regression model was described.

Results

DESCRIPTIVES

Sample characteristics of participants and non-respondents

For 85 women and 66 partners, pre-test interview and questionnaire data are available. The characteristics of women participating in the study were compared to those of the 33 women who did not want to participate in the psychological study or who dropped out during the pre-test assessment (28%), by means of a *t* test for independent samples (table 1). No differences were found between respondents and non-respondents regarding sociodemographic characteristics, prior risk, or familiarity with metastatic breast/ovarian cancer in close relatives ($p \leq 0.05$, two tailed).

Table 2 Anticipation of the impact of the test outcome

	Risk carriers (n=85) Agree (%)	*Partners (n=66) Agree (%)*	*p<0.05*
After an unfavourable test result, I expect...			
My problems to increase	**35**	21	*
My partner's problems to increase	30†	**62**	*
My children's problems to increase	46‡	34‡	
To become depressed	4	2	*
To be able to plan future life better	36	8	*
Adverse effects regarding finding/keeping work	12§	—	
After a favourable test result, I expect...			
My problems to decrease	**42**	33	
My partner's problems to decrease	34†	**77**	*
My children's problems to decrease	50‡	56‡	
My mood to improve	42	33	

†For risk carriers having a relationship.
‡For risk carriers/partners with children.
§For risk carriers with current or future job.

The decision to be tested

Once a presymptomatic DNA test became possible in the family, it took subjects (n=85) several weeks to one year to decide to have this test performed. The majority (72%) decided within two months. A major reason for testing for almost all women was to obtain certainty about their mutation carrier status. This was closely followed (86%) by the wish to know the necessity for intensive surveillance or prophylactic surgery. Knowing the risks for their children was of major relevance for 50% of the women with children. Knowing about risks for future children was a reason for one third of the women considering future offspring (n=9).

Expected consequences after an unfavourable test result

An increase in problems after an unfavourable test outcome was anticipated by one third of the risk carriers and one fifth of the partners (table 2). Another third of the risk carriers doubted whether an unfavourable test result would increase their problems.

Unchanged problems, both after an unfavourable and a favourable test outcome, were expected by 29% of the risk carriers. Of the partners, only 9% thought that the test result would not affect the problems for their wives. This difference in percentages is statistically significant ($p \leq 0.05$, two tailed).

Almost half of the women (43%) intended to undergo prophylactic mastectomy after being identified as mutation carriers. The others were still undecided (23%) or would opt for regular surveillance (34%). Oophorectomy was considered by 50% of the women and one third were still undecided or wanted to delay this intervention. A minority (17%) would not opt for prophylactic oophorectomy.

Experience with the disease in the family

Half of the participants were familiar with metastatic breast or ovarian cancer in one or more close relatives. One quarter had no experience with cancer in relatives at this stage of the disease. The period of time since becoming aware of the hereditary nature of the disease in the family varied from a few weeks to 25 years. This awareness had existed for less than one year in 40% of the risk carriers.

DISTRESS LEVELS

Distress levels of at risk carriers

General distress. Women had a mean anxiety score on the Hospital Anxiety and Depression Scale of 5.5 (0-17, SD 3.8), which is below the "borderline value" of 8. Scores equal to or higher than 8 were found in 26%. The mean depression score was low (mean 2.5, 0-14, SD 2.9), and only 7% of the women had "borderline" or higher depression levels. Mean Anxiety and Depression scores on the Symptom

Table 3 Betas for associations between predictive factors and distress: results from single and multiple regression models for risk carriers

	Anxiety	*Depression*	*Cancer related distress*
Expected consequences of an unfavourable test result			
Expecting increase of problems after unfavourable test result	0.37**	0.27*	0.39**
Prophylactic mastectomy if mutation carrier	0.40**	0.28**	0.42**
Personality traits			
Optimism	−0.30**	−0.36**	−0.13
Emotional expression	−0.28**	−0.28*	−0.25**
Sociodemographic characteristics			
Being younger than 40	0.28**	0.01	0.07
Have children under 15	0.22*	0.08	0.19
Experience with cancer in relatives			
Number of relatives with breast/ovarian cancer	0.23*	0.08	0.35**
Familiarity with relative with metastatic breast/ovarian cancer	0.11	0.28*	0.05
Age of onset of disease in particular family <40	0.22*	0.03	0.28*

*p<0.05, resulting from a single regression model.
**p<0.05, resulting from both a single and a multiple regression model.

Checklist were similar to those of a normal female population.

Cancer related distress. A large range in scores was found for both the Intrusion (0-31) and Avoidance (0-29) scales. Because of a lack of comparability with other international studies (the Impact of Event Scale is often used with different response categories and "Distressing Events"), only general conclusions are possible. Total absence of intrusive thoughts and feelings about breast/ovarian cancer in the preceding week was reported by 14%, and avoidance of these thoughts or feelings by 22% of the women. About one quarter of them reported intrusion and avoidance to occur quite frequently (their mean scores on these scales are equal to or higher than 7 and 8, respectively, which represent an average response of "at least sometimes").

Distress levels of partners

General distress. Partners' levels on the Anxiety (mean 4.3, SD 5.6) and Depression scales (mean 3, SD 3.1) of the HAD did not differ significantly from those of the subjects at risk. "Borderline" to "high" levels of anxiety and depression were found in 17% and 12% of the partners, respectively. On the Symptom Checklist, their mean anxiety and depression scores were similar to those of a "normal male" population.

Cancer related distress. Partners reported significantly lower levels of intrusive thoughts and feelings about breast/ovarian cancer and avoidance of these thoughts and feelings than the subjects at risk. One quarter (28%) of the partners had experienced no intrusive thoughts or feelings about breast/ovarian cancer in the preceding week, and 42% had not experienced a tendency to avoid these thoughts or feelings. Regular experiences of intrusion or avoidance were reported by only 9% (their mean scores on these scales are equal to or higher than 7 and 8, respectively, which represent an average response of "at least sometimes").

SINGLE PREDICTIVE FACTORS FOR DISTRESS

We used a random regression model for continuous data (SAS/PC, version 6.12) in order to estimate family specific effects on the outcome variables.[24] Seventy three participants originated from 23 families (varying from two to 10 participants per family) and the remaining 12 originated from different families. Because no family specific effects were found, controlling for this variable was not necessary. For further data analysis we used a Statistical Package for Social Sciences (SPSS/PC, version 8.0).

For the subjects at risk, we entered all the predictive variables included in the study in a linear regression analysis, with Anxiety and Depression levels (HAD) and cancer related distress (IES) as outcome variables. Because the levels of Intrusion and Avoidance were found to be highly correlated (0.58, $p<0.01$), we decided not to distinguish between these two different aspects of cancer related distress in this regression analysis and to use the total IES score. The variables significantly related to the level of general or cancer related distress are presented in table 3.

General distress

More anxiety and depression was found in at risk carriers who anticipated an increase in problems after an unfavourable test result and in those who had decided to undergo a prophylactic mastectomy in the case of being a mutation carrier. Women who both anticipated problems and opted for mastectomy after an unfavourable test result (29%) had the highest levels of distress and those not expecting problems nor considering mastectomy after an unfavourable test outcome (29%) the lowest. Having a relatively pessimistic personality and not being inclined to express one's emotions was related to higher levels of anxiety and depression.

Anxiety (though not depression) was significantly increased in women who were younger than 40 years and who had young children. Also, having an increased number of affected relatives with breast/ovarian cancer and an age of onset of cancer in these relatives below 40 years was related to higher levels of anxiety.

Depression (though not anxiety) was significantly related to familiarity with the serious consequences of breast/ovarian cancer in relatives. The highest level of depression was found in women who knew/had known close relatives with metastatic breast or ovarian cancer, and the lowest level in women who had not known any such relatives.

Cancer related distress

Five predictive variables related to anxiety or depression were in the same way related to cancer related distress. More cancer related distress was reported by women who (1) expected their problems to increase after an unfavourable test result, (2) intended to undergo prophylactic mastectomy after becoming identified as a mutation carrier, (3) were inclined not to express their emotions, (4) had greater numbers of relatives with breast or ovarian cancer, and (5) came from families in which the age of onset of cancer was lower than 40 years.

JOINT PREDICTORS OF DISTRESS

The single variables that proved to be significant predictors of general or cancer related distress were included in a multiple linear regression model for the three outcome variables seperately. As shown in table 3, the most important variables for predicting general and/or cancer related distress were: (1) anticipating problems after an unfavourable test outcome, (2) opting for prophylactic mastectomy if identified as a mutation carrier, (3) being unoptimistic, (4) being inclined not to express one's emotions, (4) being younger than 40 years, and (5) having a large number of relatives with breast or ovarian cancer. These variables explain 37% of the variance for anxiety, 26% for depression, and 32% for cancer related distress.

Discussion

LOW DISTRESS LEVELS IN SUBJECTS AT RISK

For this paper we analysed psychological functioning, expectations about post-test life, and experiences with HBOC in healthy women at risk of being a *BRCA1* or *BRCA2* mutation carrier and their partners. Assessments took place between genetic counselling/blood sampling and disclosure of the test result six to eight weeks later.

Mean levels of anxiety and depression in at risk carriers were similar to those of a normal population. Little distress was also found in previous studies, in which all participants had been aware of the genetic nature of cancer in the family for a relatively long period of time.[6 7 9 10] Participants in these latter studies may have had low distress levels as a result of emotional habituation.[7 9 10] This is the first study on psychological implications of presymptomatic DNA testing for *BRCA1*/*BRCA2*, including women who were only recently informed about the genetic nature of this disease in their family or who had little or no experience with breast or ovarian cancer in the family. It was hypothesised that these women might experience more distress than those with longer experience of this problem. However, the length of time participants were aware of the genetic nature of cancer was not significantly related to the degree of distress. Also, having much experience with cancer in the family was significantly associated with a high, instead of a low level of pre-test distress. This is in line with the results from a previous study at our centre.[6]

The quite low distress levels are contrary to what one might expect from subjects who, within a few weeks, will hear about their risk of developing cancer. Is the period of waiting for the test result really unthreatening for many women, or is there also a tendency to minimise the emotional impact of it? Our impression is that both hypotheses may be valid. On one hand, having provided the blood sample for the DNA test may temporarily induce some respite. Tested subjects then seem to have the feeling of having done everything they could and to postpone distressing thoughts until the week in which disclosure of the result takes place. This can be illustrated by two pre-test interviews. "Only sometimes it comes into my mind that I have done the test. I was much more distressed by it all when I heard about this gene in the family, some weeks ago, and I thought I would feel anxious after having the blood sample taken, but up until now I have had no feelings of anxiety at all." And . . . "I actually feel rather calm now. This might be because there is so much time in between, these five, six weeks".

On the other hand, because everything is still uncertain in the pre-test period, many at risk carriers may have used more or less conscious mechanisms to minimise the implications of an unfavourable test outcome.[6 25] This is reflected in the result that only one third of the women reported to expect adverse emotional consequences after being identified as a mutation carrier. Interestingly, partners acknowledged adverse consequences for their wives significantly more often. These results are strikingly similar to those described in previous studies.[6 19] It may have been more threatening for women to acknowledge adverse emotional consequences of an unfavourable test outcome for themselves, than for partners to acknowledge these consequences for their wives. At risk carriers may have dismissed these threatening thoughts.

DISTRESS IN PARTNERS

Partners had general distress levels similar to their wives, but lower cancer related distress. Only one fifth of the partners anticipated emotional consequences for themselves if their wives received an unfavourable test result. Impressions from the interviews showed a tendency of many partners to not want to worry in advance, "since there is still a considerable chance of a good result". As one partner stated: "At this moment nothing can be said about whether cancer is in the game or not, so I see no reason to worry. I mean, if there is a soccer game, and someone scores a goal, I cannot yet feel happy or sad, since nothing can be said then about the final score. I only start to react emotionally, when the game is over ..."

PREDICTIVE FACTORS FOR HIGH DISTRESS LEVELS

Increased to high general and cancer related distress levels were found in one quarter of the at risk carriers. Similar proportions were also reported in a study on women with first degree relatives with breast cancer.[26] A number of factors were independently associated with general or cancer related distress. Women who anticipated emotional consequences after an unfavourable result may have been more conscious of the threat induced by the test and, therefore, more distressed. This may be seen as "working through" the possible impact of an unfavourable test result in advance.[6] The increased anxiety in women considering undergoing prophylactic mastectomy if becoming identified as a mutation carrier may be explained by the profound physical and emotional consequences of this intervention. However, it is also possible that women who are more distressed about their risk for cancer

in the first place are more likely to opt for a more radical preventive intervention.

Strong relationships were found between personality traits and distress. Many other studies on psychological functioning in burdensome conditions report similar conclusions.[27 28] Relatively pessimistic participants may be more distressed in uncertain times in general and, therefore, also during the testing procedure. One woman described herself in the interview as being always optimistic and she explained: "It would amaze me if I was found to carry the mutation, but if so, I would focus on the idea that I may very well belong to the percentage of gene carriers who never develop breast or ovarian cancer." Women who were not inclined to express their emotions, thus the more introverted types, may have been more distressed because they did not sufficiently share their feelings with others.

The age of women was also associated with the level of distress. From the interviews, the impression was obtained that many women in their thirties are very conscious of the possibility of developing cancer and, because of their young age, of the profound consequences of it. As one young woman said: "My mother was in her early thirties when she developed cancer, and not yet forty when she died from it, so that makes me anxious, the idea that life can be so short." For older women the idea of developing cancer is perceived as something more hypothetical. The fact that they have already lived a long time without having developed cancer seems to induce a feeling of trust: why would cancer be detected tomorrow? One woman in her sixties mentioned: "I have undergone quite a lot of mammograms already, and they have never shown anything suspect. This gives me the feeling that the results of future check ups will also be all right." This feeling of trust in the results from surveillance seemed also to be present in women younger than 30 years. One woman in her late twenties explained: "If I am found to be a mutation carrier, this will have implications for the future, but I do not have the feeling that I could develop cancer right now." Distress levels in this group of young women were somewhat lower than in women in their thirties, but this difference was not significant.

Women with young children may experience more anxiety than women without or with grown up children, because of the threat of leaving young children behind if they developed cancer and died. For many women this was a very important reason for wanting to undergo the test, as one woman said: "I feel responsible for my family, and especially for my children. I awfully regret not having a mother any more myself, and I am over thirty, so imagine that my little children would lose their mother. I find it really terrible thinking about this."

As mentioned above, women who have been more familiar with the profound consequences of breast or ovarian cancer in their families were more distressed than those with little or no experience with affected relatives. The confrontation with burdensome consequences of HBOC may have made these women more aware of what the test is about. As one woman expressed it: "I know what I am talking about, since I've seen cancer in close relatives too often. The sickness of these relatives, and the cancer hospital, come regularly to my mind, and I do not want to end there too. That is what it is all about, you want to prevent this terrible disease." Moreover, the testing procedure may reactivate sorrow and grief about cancer in relatives. This is clearly illustrated by a young woman who lost her mother from breast cancer some years ago: "This is a period when I am thinking more often about my mother than usual. I'm sometimes wondering for example what she would think and do in this situation."

Strikingly, the objective and perceived prior risk of having inherited the mutation are not related to pre-test distress. Women with a prior risk of 25% or lower, and those who expect to be non-carriers, are not less distressed than the others.

While about one quarter of the women were quite distressed, only six (7%) received additional psychological counselling in the pre-test period. The majority were able to cope without additional support. It should be noted that the pre-test interview, and the idea that more interviews would follow in the post-test period, may have been experienced as supportive. The percentage of subjects requesting additional psychological counselling might have been higher if the study participants had not been interviewed for the current study. Other researchers have already warned that the special attention provided to subjects at risk involved in psychological studies might lead to an underestimation of the impact of testing.[29]

GENERALISABILITY OF THE RESULTS

The study sample consisted of a relatively heterogeneous group of healthy women who wanted to know if they had inherited the *BRCA1*/*BRCA2* gene mutation. There was great variety with respect to age and experience with cancer in the family. This makes the results of this study generalisable to other groups of healthy subjects undergoing *BRCA1*/*BRCA2* testing. However, subjects at risk needing more than one year to decide to undergo the test are not represented in this study. All women applied for testing within one year after the test became available to them, and the majority even made an appointment within two months. This urgency for testing applied to both women who had been aware of the hereditary nature of cancer in the family for a long period of time and those having been informed about it only recently. In the interviews, women often mentioned that they felt they had no choice, now that they knew about their risk of being a mutation carrier and about the possibility of having it tested. As one woman said: "I do not see it as a choice. I feel that I have to undergo the test and, after an unfavourable test result, preventive surgery … I've got a family and children and I want to stay with them as long as possible." In the future an increasing number of women might apply for testing, having been undecided for years and

having doubts about the benefits of testing. Such women might be more distressed than those in the present study. In this study, however, no associations were found between distress and the amount of time taken before test application

It is unknown whether similar low distress levels would have been found in the women who did not want to participate in the study. We speculate that their scores on the questionnaires might not have been so high either, since the majority of them did not see any use in participation because they did not anticipate any adverse psychological implications of testing. However, a minority of the non-respondents found it too threatening to discuss their feelings about the issue.

IMPLICATIONS FOR CLINICAL PRACTICE

The main aim of this study was to explore the psychological impact of awaiting a *BRCA1/BRCA2* test result for healthy women and their partners. It was found that most women at risk and partners seemed to cope well during this pre-test period, but some were quite distressed. Distress is more likely to occur in at risk carriers who: (1) expect their problems to increase after an unfavourable test result, (2) consider prophylactic mastectomy if identified as a mutation carrier, (3) are unoptimistic, (4) have a tendency not to express their emotions, (5) are younger than 40 years, and (6) are familiar with the serious consequences of cancer in the family.

Future analyses of post-test data may establish if at risk carriers with low pre-test distress and expecting no increase in problems after an unfavourable test outcome may be at risk for severe psychological maladaptation after the result. Because at this stage it is unknown which attitudes are related to maladjustment in post-test life, it is important to respect different ways of dealing with the uncertainty induced by the test and not to force risk carriers to abandon possibly minimising strategies.

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