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Cancer-related distress in unselected women with newly diagnosed breast or ovarian cancer undergoing BRCA1/2 testing without pretest genetic counseling

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ABSTRACT
Background: Genetic testing is increasing in patients newly diagnosed with cancer. This study investigated the levels, course and predictors of cancer-related distress, defined as intrusion and avoidance, in women undergoing BRCA1/2 testing without pretest genetic counseling shortly after a diagnosis of breast or ovarian cancer.

Material and methods: Unselected for family history or age, 259 women with breast cancer and 50 women with ovarian cancer, underwent BRCA1/2 testing shortly after diagnosis. Cancer-related distress was measured with the Impact of Event Scale before and after genetic testing. In order to identify predictors of distress, the subscale scores were regressed on baseline predictor variables including sociodemographic and medical variables, perceived social support, and decisional conflict regarding genetic testing.

Results: The mean levels of intrusion and avoidance were in the moderate range both before and after genetic testing with a statistically significant decline during follow-up. Younger age, shorter time since diagnosis, lower levels of social support, and a diagnosis of ovarian cancer predicted higher levels of both intrusion and avoidance. In addition, higher levels of decisional conflict and living with a partner predicted higher levels of intrusion.

Conclusions: Women having genetic testing shortly after a diagnosis of breast or ovarian cancer had a moderate mean level of cancer-related distress, which decreased with time. Health personnel offering genetic testing to newly diagnosed women with breast or ovarian cancer should be aware of the potential predictors for increased cancer-related distress identified in this study: younger age, less perceived social support, higher levels of decisional conflict regarding genetic testing, and living with a partner.

Background
Genetic testing has become increasingly important in patients diagnosed with breast or ovarian cancer in recent years, as the presence of germline variants not only predicts a high risk of breast and ovarian cancer, but also gives an opportunity for personalized cancer treatment. After the introduction of poly-(ADP-ribose) polymerase (PARP) inhibitors for treatment of ovarian cancer in BRCA1/2 mutation carriers, diagnostic genetic testing of patients with ovarian cancer has been implemented in routine clinical practice in several countries [1–3]. Although less established, similar procedures are gradually introduced in breast cancer clinics, since decisions regarding surgery and neoadjuvant chemotherapy might be directed by BRCA1/2 carrier status [4–6]. This new approach often implies that the genetic test is performed a short time after diagnosis, without traditional pretest genetic counseling or risk assessment. While previously cancer-related distress has been thoroughly investigated in persons receiving traditional genetic counseling for hereditary cancer [7–10], less is known about the cancer-related distress in women newly affected with breast or ovarian cancer who are offered genetic testing regardless of age and family history, and who undergo genetic testing without pretest genetic counseling. In contrast to women seeking genetic counseling because of a suspicious family history of hereditary breast and ovarian cancer, the women who are tested as part of the routine diagnostic work-up in a cancer clinic may be less aware of the possibility that their cancer can have a hereditary cause, and thus be less prepared for a decision making process regarding genetic testing. Obviously, receiving a potential...
life-threatening cancer diagnosis is associated with significant distress [11–14]. Concern has been raised that introducing genetic testing shortly after diagnosis would impose an additional psychological burden for women in this stressful situation [15], but so far, the evidence does not support this concern [16].

High levels of distress interfere with the patients’ ability to perceive important information given by health personnel [17] and may constitute an obstacle for understanding the consequences of genetic testing [18]. More attention should therefore be drawn to the patients with higher levels of distress.

We define distress as intrusive thoughts and avoidance responses in this study. Intrusion and avoidance are often associated with post-traumatic stress disorder (PTSD), but are also studied as reactions to actual or possible threatening events without implicating the status of a PTSD-diagnosis [8,9], as in this article. Intrusion symptoms include unbidden thoughts and images both awake and during sleep, waves of overwhelming feelings of fear and repetitive behavior. Avoidance responses include denial of the meaning and consequences of the threatening event, blunted sensation, emotional numbness, and attempts to block out unpleasant feelings and memories [19].

The relatively low correlation between stressful life events on one hand, and adverse outcome on the other, has stimulated the search for moderating variables [20,21], and social support has a central position in this research. To seek social support seems to be one of the most successful coping strategies and is often associated with favorable health outcome [22,23]. One theory, ‘the buffer theory’, states that social support protects against the potential pathogenic effects of stressful life events, and that this protective property is activated when needed, e.g., when a person is diagnosed with cancer and/or is undergoing genetic testing [20,24].

While some people find it easy to make a choice about genetic testing, others have stronger ambivalence toward this. Women who are newly diagnosed with breast or ovarian cancer are often overwhelmed with information and choices they have to make [18]. Underlying decisional conflict regarding genetic testing may have an impact on the experienced distress for these women.

There are some well-described predictors of psychological distress among cancer patients, e.g., young age and short time since cancer diagnosis, while other predictors have shown more ambiguous effects in different studies, e.g., educational level, employment status, marital status, and cancer type [13,14,25–27].

The aim of this study was to document the level, course and predictors of cancer-related distress, in patients undergoing genetic testing a short time after the diagnosis of breast- or ovarian cancer.

Material and methods

Study design and participants

The patients participated in a prospective multi-site study in which genetic testing for pathogenic BRCA1/2 variants and familial cancer risk assessment were offered to all women newly diagnosed with breast or ovarian cancer, the DNA-BONus study. The study protocol and the results of the genetic testing have been published in details elsewhere [28]. All patients with newly diagnosed breast or ovarian cancer, unselected for age and family history, were consecutively invited to participate, from September 2012 to April 2015. The participants could choose to participate only in the genetic testing study, in an associated psychosocial study, or both. This article presents data exclusively from patients participating in the psychosocial study. The participants did not receive genetic counseling prior to testing, but were given written information about hereditary breast and ovarian cancer in addition to brief information from their treating physician or nurse. The genetic test result was given to the patient in a letter from a genetic counselor if the test result was normal and there was no indication for further genetic testing. Patients who tested positive for a BRCA1/2 mutation, or had a personal or family history suspicious of elevated familial cancer risk, received a phone call from a genetic counselor with information about the result and were invited to a post-test face-to-face genetic counseling session.

The first questionnaire in the psychosocial sub study was given to the participants along with the invitation to the study (T1). The second and third questionnaires were mailed to the participants 1 week (T2) and 6 months (T3) after disclosure of the BRCA1/2 test result, respectively.

The study protocol was approved by the Regional Committee for Medical and Health research Ethics (REK Vest 2012-62).

Study measurements

Clinical and sociodemographic variables

Self-reported family history was retrieved from all participants in the DNA-BONus study through a structured written questionnaire linked to the blood sampling for genetic testing [28]. Clinical information was collected from the patients’ medical files. Questions about education level, biological children, cohabitation, and employment status were included in the first questionnaire (T1).

Subjective distress

Subjective distress was measured with the Impact of Event Scale (IES-15) [19]. This is a 15-item questionnaire comprising two subscales: intrusion thoughts (IES-I), which includes seven items and is scored from 0 to 35, and avoidance behavior (IES-A), which consists of eight items, and is scored from 0 to 40. The scale was developed to measure current stress reactions after any specific traumatic event [19]. In the present study, ‘cancer diagnosis’ was defined as the specific event. The sub-scale scores are considered low in the range of 0–8, moderate at 9–19 and severe at 20 and above [19].

Social support

The concept of perceived social support was measured by the version of the Interpersonal Support Evaluation List (ISEL) used by King and colleagues, which consists of 30 items that
are answered with a score from 1 to 4 [7,29]. The average sum score for each participant was used.

**Decisional conflict**
To measure the participant’s ambivalence toward making a choice of undergoing BRCA1/2 genetic testing we used the Decisional Conflict Scale (DCS) [30,31]. In the DCS, 16 items are scored from 0 to 4, where three dimensions of decisional conflict are measured: uncertainty about selection of alternatives (three items), specific factors contributing to uncertainty (nine items), and perceived effectiveness of decision making (four items). Higher scores indicate higher levels of decisional conflict. The sum score of all items was converted to a 0–100 scale, where total scores below 25 are associated with low level of decisional conflict and scores above 37.5 are associated with problems in implementing decisions [31].

**Statistical methods**
Missing values were replaced by the respondent’s own average score for each questionnaire if at least 60% of the items were filled in by the respondent. Descriptive statistics were used to describe the sociodemographic, clinical and psychological variables, reporting the mean values, median values, standard deviation (SD), standard error of means (SEM), range and proportions. Paired sample t-tests and paired Wilcoxon–Mann–Whitney tests were used to compare changes in IES scores between the different time points.

To identify the characteristics related to the levels of IES-I and IES-A and to test the changes of IES-I and IES-A over time, the subscale scores were regressed on the baseline predictor variables using mixed linear modeling. The mixed linear model uses all available data, and can account for correlations between repeated measurements on the same subjects and has sufficient flexibility to model time effects [32]. All predictors were entered into the mixed linear models to assess both main effects and possible interactions with time. The regression analyses were run backwards stepwise, both with and without interaction with time. The significance level was set at .05 for all statistical tests, and results were reported as estimates with 95% confidence intervals. All statistical analyses were performed using IBM Statistical Package for the Social Sciences (SPSS, version 24.0) (SPSS Inc., Chicago, IL).

**Results**

**Study sample**
Of 772 eligible women in the DNA-BONus study, 403 (52.2%) underwent genetic testing and 309 (40.0%) gave consent for the psychosocial sub study: 259 women diagnosed with breast cancer and 50 women diagnosed with ovarian cancer. The mean age of the participants was 56.1 years (range: 24–89 years). The mean time from diagnosis to returning the first questionnaire (T1) was 45 (median: 26) days for patients with breast cancer and 156 (median: 76) days for patients with ovarian cancer. On average, participants returned T1 two days before blood sampling for the genetic test. Cancer treatment was initiated for 256 patients before T1, 31 participants had not started cancer treatment before T1, and treatment status was unknown for 22 participants at T1. The sociodemographic and clinical characteristics of the study sample are provided in detail in Table 1.

**Level of intrusion (IES-I) and avoidance (IES-A) before and after genetic testing**
Table 2 show the mean levels of IES-I and IES-A scores at the three measurement points. The mean IES-I score was 14.6 (median 14.0) at T1 and decreased statistically significantly to 12.1 (median 9.0) at T2 (p < .001) and with a further statistically significant decrease to 9.7 (median 7.0) at T3 (p < .001). The overall decrease from T1 to T3 was 5.2, which corresponds to 14.9% of the total IES-I scale (0–35). The mean IES-A score was 12.7 (median 11.0) at T1, decreased statistically significantly to 10.2 (median 8.0) at T2 (p < .001), but with no further statistically significant decrease from T2 to T3 (mean score 9.7, median 8.0). The overall decrease in IES-A score from T1 to T3 was 3.0, 7.5% of the total IES-A scale (0–40). At inclusion nearly one-third and one-fourth of the patients, respectively, had IES-I and IES-A scores indicating a severe stress response, Table 2. At T3 the proportions of patients with scores in the severe range were reduced to 14.0 and 16.0% for IES-I and IES-A, respectively, Table 2.

**Mixed linear models for intrusion and avoidance**
The results of the mixed linear regression analyses for IES-I and IES-A scores are given in Table 3. After backward stepwise selection, the final model showed that younger age was a predictor of higher IES-I, i.e., for each 10 years decrease in age the mean value of IES-I score increased with 1.80, Table 3. Additional predictors of higher levels of IES-I were shorter time since diagnosis, lower level of perceived social support, higher level of decisional conflict regarding the genetic test, diagnosis of ovarian cancer and living with a partner. Higher levels of IES-A was associated with younger age, shorter time since diagnosis, lower level of perceived social support and a diagnosis of ovarian cancer. For both IES-I and IES-A, none of the predictor variables retained in the final model showed significant interaction with time. For full overview over the mixed linear regression analyses for IES-I and IES-A, see online Supplemental Tables S1 and S2.

**Discussion**
We found that women who chose BRCA1/2 genetic testing shortly after a diagnosis of breast- or ovarian cancer had mean levels of intrusion and avoidance in the moderate range both before and after genetic testing, with a statistical significant decrease during a mean time of 7.5 months follow-up. Younger age, shorter time since diagnosis, a diagnosis of ovarian cancer, lower levels of social support, higher levels of decisional conflict, and living with a partner, predicted higher levels of distress.
The majority of the participants had a high level of education, were working and living with a partner. In addition, they reported a high average level of perceived social support. This may indicate that the participants represent a self-selected group of resourceful women. We know from previous studies that patients seeking traditional genetic counseling for hereditary cancer are highly selected and resourceful [7,8]. The same tendency of self-selection might have occurred in our study. The finding of low levels of decisional conflict may, not surprisingly, reflect that those with higher levels of decisional conflict declined genetic testing and/or to answer the questionnaires.

The mean levels of intrusion and avoidance symptoms in the present study were in the moderate range (IES subscale scores 9–19) at all measurements, with mean IES scores ranging from 14.6 (IES-I) and 12.7 (IES-A) at T1 to 9.7 (IES-I and IES-A) at T3. The change in mean IES-I score from T1 to T3 is of a magnitude (14.9% of the total IES-I scale) which may indicate a clinical significant reduction in intrusion during a mean follow-up of 7.5 months. Our results are in line with previous reports on patients newly diagnosed with breast cancer [12,16]. Wevers et al. [16] found in their study of breast cancer patients at high risk of hereditary breast cancer mean levels of IES-I at 18.6–18.7 before surgery, and 11.8–12.4 at 6 months follow-up. The corresponding IES-A scores were 14.0–15.0 before surgery and 10.1–10.5 at 6 months follow-up [16]. In a large study of more than 3000 women with breast cancer unselected for hereditary cancer

<table>
<thead>
<tr>
<th>Diagnostic group</th>
<th>Breast cancer, N = 259</th>
<th>Ovarian cancer, N = 50</th>
<th>All respondents, N = 309</th>
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<tr>
<td>Continuous variables</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Age, years</td>
<td>55.7 (11.5)</td>
<td>58.3 (11.4)</td>
<td>56.1 (11.5)</td>
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<td>Time from diagnosis to T1a, days</td>
<td>45 (72)</td>
<td>156 (259)</td>
<td>63 (129)</td>
</tr>
<tr>
<td>Time from T1 to T2b, days</td>
<td>52 (48)</td>
<td>46 (21)</td>
<td>51 (46)</td>
</tr>
<tr>
<td>Time from T1 to T3c, days</td>
<td>226 (39)</td>
<td>225 (30)</td>
<td>226 (38)</td>
</tr>
<tr>
<td><strong>DCSδ, range: 0–100</strong></td>
<td>19.7 (15.2)</td>
<td>15.3 (13.3)</td>
<td>19.0 (15.2)</td>
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<tr>
<td><strong>ISEL, range: 1–4</strong></td>
<td>3.46 (0.46)</td>
<td>3.46 (0.48)</td>
<td>3.46 (0.47)</td>
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<td><strong>Categorical variables</strong></td>
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<td><strong>Categories</strong></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>42 (16.2)</td>
<td>8 (16.0)</td>
<td>50 (16.2)</td>
</tr>
<tr>
<td>High school</td>
<td>91 (35.1)</td>
<td>24 (18.0)</td>
<td>115 (37.2)</td>
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<td>University</td>
<td>121 (46.7)</td>
<td>17 (34.0)</td>
<td>138 (44.7)</td>
</tr>
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<td>Missing</td>
<td>5 (1.9)</td>
<td>1 (2.0)</td>
<td>6 (1.9)</td>
</tr>
<tr>
<td>Employed</td>
<td>161 (62.2)</td>
<td>28 (56.0)</td>
<td>189 (61.2)</td>
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<tr>
<td>Missing</td>
<td>4 (1.5)</td>
<td>1 (2.0)</td>
<td>5 (1.6)</td>
</tr>
<tr>
<td>Having biological children</td>
<td>228 (88.0)</td>
<td>44 (88.0)</td>
<td>272 (88.0)</td>
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<tr>
<td>Missing</td>
<td>4 (1.5)</td>
<td>0 (0.0)</td>
<td>4 (1.3)</td>
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<td>Living with a partner</td>
<td>180 (69.5)</td>
<td>38 (76.0)</td>
<td>218 (70.6)</td>
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<tr>
<td>Missing</td>
<td>3 (1.2)</td>
<td>0 (0.0)</td>
<td>3 (1.0)</td>
</tr>
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<td><strong>Detection method</strong></td>
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<td>Screen-detected</td>
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<td>0 (0.0)</td>
<td>106 (34.3)</td>
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<tr>
<td>Symptomatic</td>
<td>137 (52.9)</td>
<td>50 (100)</td>
<td>187 (60.5)</td>
</tr>
<tr>
<td>Other</td>
<td>16 (6.2)</td>
<td>0 (0.0)</td>
<td>16 (5.2)</td>
</tr>
<tr>
<td><strong>Stagee</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>123 (47.5)</td>
<td>4 (8.0)</td>
<td>127 (41.1)</td>
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<tr>
<td>II</td>
<td>108 (41.7)</td>
<td>9 (18.9)</td>
<td>117 (37.9)</td>
</tr>
<tr>
<td>III</td>
<td>21 (8.1)</td>
<td>23 (46.0)</td>
<td>44 (14.2)</td>
</tr>
<tr>
<td>IV</td>
<td>7 (2.7)</td>
<td>13 (26.0)</td>
<td>20 (6.5)</td>
</tr>
<tr>
<td>Unknown</td>
<td>0 (0.0)</td>
<td>1 (2.0)</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td><strong>DCS category</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (0–24)</td>
<td>150 (59.1)</td>
<td>35 (70.0)</td>
<td>185 (60.9)</td>
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<tr>
<td>Intermediate (25–37.5)</td>
<td>75 (29.5)</td>
<td>9 (18.0)</td>
<td>84 (27.6)</td>
</tr>
<tr>
<td>High (&gt;37.5)</td>
<td>29 (11.4)</td>
<td>6 (12.0)</td>
<td>35 (11.5)</td>
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<tr>
<td><strong>Post-test genetic counseling</strong></td>
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<td></td>
</tr>
<tr>
<td>Not offered</td>
<td>156 (60.2)</td>
<td>18 (36.0)</td>
<td>174 (56.3)</td>
</tr>
<tr>
<td>Offered, not accepted/received</td>
<td>34 (13.2)</td>
<td>8 (16.0)</td>
<td>42 (13.6)</td>
</tr>
<tr>
<td>Offered and received</td>
<td>69 (26.6)</td>
<td>24 (48.0)</td>
<td>93 (30.1)</td>
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<tr>
<td><strong>BRCA1/2 mutation found</strong></td>
<td>6 (2.3)</td>
<td>9 (18.0)</td>
<td>15 (4.9)</td>
</tr>
<tr>
<td><strong>FDR with breast or ovarian cancer</strong></td>
<td>56 (21.6)</td>
<td>3 (6.0)</td>
<td>59 (19.1)</td>
</tr>
<tr>
<td><strong>FDR with other cancer</strong></td>
<td>86 (33.2)</td>
<td>20 (40.0)</td>
<td>106 (34.3)</td>
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</tbody>
</table>
A high level of distress has a negative impact on the patient's ability to receive and remember information and can lead to lower adherence and compliance to treatment and follow-up [17]. Identification of patients with higher levels of intrusion and avoidance is therefore of interest to ensure better health care for these patients. Our study confirms the significance of young age as a predictor of intrusion and avoidance symptoms after a diagnosis of cancer. Consistent with findings in previous studies in patients with breast or ovarian cancer [12,14,16], we also found that the level of cancer-related distress is inversely correlated to time since diagnosis.

Looking at the two different cancer types in our study group, patients with ovarian cancer had higher levels of both intrusion and avoidance symptoms as compared to patients with breast cancer. This may reflect the severity of the ovarian cancer disease, which was more often diagnosed at an advanced stage. There are few studies in the literature...
In summary, our study documents a moderate level of cancer-related distress in women having genetic BRCA1/2 testing without pretest genetic counseling shortly after a diagnosis of breast- or ovarian cancer, and that the level of distress decreases with time. Although this indicates that a simplified procedure for genetic testing of large patient groups with newly diagnosed cancer is feasible, we identified possible predictor factors for experiencing increased cancer-related distress: younger age, less perceived social support, higher levels of decisional conflict, and being a woman living with a partner. Clinicians should be aware of this when offering diagnostic genetic testing, to make sure that the more vulnerable patients do not miss the opportunity for personalized treatment.

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No potential conflict of interest was reported by the authors.

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