

# **Psychological distress and cognitive coping in pregnant women diagnosed with cancer and their partners**

## **Running title:**

Cancer during pregnancy: distress and coping

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### **Disclosure**

The authors have declared no conflicts of interest.

## **ABSTRACT**

### **Objective**

A cancer diagnosis during pregnancy may be considered as an emotional challenge for pregnant women and their partners. We aimed to identify women and partners at risk for high levels of distress based on their coping profile.

### **Methods**

Sixty-one pregnant women diagnosed with cancer and their partners filled out the Cognitive Emotion Regulation Questionnaire (CERQ) and the newly constructed Cancer and Pregnancy Questionnaire (CPQ). K-means cluster analysis was performed on the CERQ-scales. Scores on the CPQ were compared between the women and their partners and between the CERQ-clusters.

### **Results**

Comparison of women and partners on the CPQ did not reveal significant differences on distress about the child's health, the cancer disease, and the pregnancy or on information satisfaction ( $p = 0.16$ ,  $p = 0.44$ ,  $p = 0.50$ ,  $p = 0.47$  respectively). However, women were more inclined to maintain the pregnancy than their partners ( $p = 0.011$ ). Three clusters were retrieved based on the CERQ scales, characterized by positive coping, internalizing coping and blaming. Women and partners using internalizing strategies had significantly higher scores on concerns about the child's health ( $p = 0.039$ ), the disease and treatment ( $p < 0.001$ ), and the pregnancy and delivery ( $p = 0.009$ ) compared to positive and blaming strategies. No cluster differences were found for information satisfaction ( $p = 0.71$ ) and tendency to maintain the pregnancy ( $p = 0.35$ ).

### **Conclusion**

Women and partners using internalizing coping strategies deal with the highest levels of distress and may benefit from additional psychosocial support.

### **KEY WORDS**

Cancer, oncology, pregnancy, cognitive emotion regulation, cognitive coping, distress

## Background

One in 1000 to 2000 pregnant women is diagnosed with cancer. In the recent years, evidence is accumulating that cancer treatment during pregnancy is possible and safe for both mother and child [1-6].

Pregnancy and the transition to parenthood are major life events in a woman's life, which may be associated with heightened levels of emotions [7]. When cancer is diagnosed during pregnancy, the experience of joy of being pregnant and becoming a mother may become intertwined with fear for one's own life and that of the baby. In a study based on self-reports of 74 pregnant women diagnosed with cancer, 20.9 to 51.5% reported clinically significant levels of distress [8], compared to 2.3 to 33.3% in healthy pregnant women [9] and 20 to 40% in non-pregnant breast cancer patients [10]. Although different measures of distress were used, the results indicate that a cancer diagnosis may be considered as an additional emotional challenge for pregnant women.

Anxiety and stress during pregnancy have been associated with adverse birth outcomes (e.g., spontaneous abortion, preterm labor, growth restriction) [11] and cognitive, behavioral and emotional problems in the child [12]. Therefore, it is important to have a better understanding of how pregnant women cope with their cancer diagnosis and treatment and the associated emotions and concerns. Cognitive processes are a way to regulate our emotions and to help us not to become overwhelmed by them during or after a threatening or stressful life event. Garnefski et al. identified nine cognitive emotion regulation or coping strategies, which people use to a higher or lower extent when confronted with a stressor [13]. The first strategy, *self-blame*, refers to thoughts of putting the blame for what you have experienced on yourself, while *blaming others* includes thoughts of putting the blame on the environment or another person. *Focus on thought* or *rumination* means thinking about the feelings and thoughts associated with the negative event. *Catastrophizing* refers to thoughts of explicitly emphasizing the terror of

what you have experienced, while *putting into perspective* has to do with thoughts of brushing aside the seriousness of the event or emphasizing the relativity when comparing it to other events. *Acceptance* includes thoughts of accepting what you have experienced and resigning yourself to what has happened. *Positive reappraisal* has to do with attaching a positive meaning to the event in terms of personal growth. Thinking about joyful and pleasant issues instead of thinking about the actual event has been labeled as *positive refocusing*. Last, *refocus on planning* refers to thinking about what steps to take and how to handle the negative event. Several studies have indicated that these cognitive processes may affect the emotional response during and after the experience of a stressful life-event [14-17]. The strategies of acceptance, putting into perspective, positive refocusing, positive reappraisal and refocus on planning have been associated with fewer depressive and anxiety symptoms and are therefore referred to as ‘more adaptive’ in the literature [13, 14]. The strategies of rumination, self-blame, blaming others and catastrophizing have been related to more symptoms of anxiety and depression and are considered as ‘less adaptive’ [13, 14].

To date, there is a lack of knowledge about the concerns pregnant women diagnosed with cancer and their partners experience, how they deal with these concerns and who is at risk for high levels of distress. The aims of the present study are threefold: (1) to compare the distress and concerns of the women and their partners, (2) to investigate whether there are subtypes of women and partners using similar cognitive coping strategies when confronted with cancer during pregnancy and (3) to investigate the relationship between these subtypes of women and partners based on their coping strategies and their level of distress and concerns.

## **Methods**

### **Participants**

Given the rarity of a cancer diagnosis during pregnancy, participants were retrospectively (after delivery) and prospectively (before delivery) recruited from the European cancer in pregnancy registry between 2008 and 2011, organized by the International Network on Cancer, Infertility and Pregnancy (INCIP). Women and their partners from Belgium and The Netherlands were invited to participate in the study.

### **Procedure**

Women identified retrospectively were contacted by their physician in order to explain the study. After agreement, the questionnaires and informed consents were sent to them. In the prospective part, newly diagnosed women and their partners were asked to take part in the study once decisions on treatment were taken.

### **Measures**

#### ***Cancer and Pregnancy Questionnaire (CPQ)***

The CPQ consists of five reliable subscales with a total of 40 items: concerns about the child's health (16 items,  $\alpha = 0.95$ ), concerns about the cancer disease and treatment (8 items,  $\alpha = 0.70$ ), concerns about the pregnancy and delivery (6 items,  $\alpha = 0.75$ ), satisfaction with the information and care of the medical team (6 items,  $\alpha = 0.86$ ), and tendency to maintain the pregnancy (4 items,  $\alpha = 0.62$ ) (the full questionnaire and details on the construction are available in appendix S1-S2). The participants indicated how well the statements corresponded to their thoughts on a 7-point scale, ranging from 1 = *not at all* to 7 = *very well*.

#### ***Cognitive Emotion Regulation Questionnaire (CERQ)***

The CERQ was developed by Garnefski et al. to measure cognitive emotion regulation strategies that characterize the individual's style of responding to stressful events [13]. We asked the participants to indicate how they think/thought about the cancer diagnosis and treatment during pregnancy. The questionnaire consists of nine subscales with a total of 36 items to be rated on a 5-point scale, ranging from 1 = *(almost) never* to 5 = *(almost) always*. A

shorter 27-item version with three items per subscale was used to prevent patients from overload, with acceptable internal consistency in our sample ( $\alpha$ 's ranging from 0.62 to 0.83).

### **Statistical analyses**

To identify subtypes of women and partners who used similar coping strategies to deal with cancer during pregnancy, we performed a K-means cluster analysis on the 122 participants (i.e., 61 women and their partner) using the 9 CERQ-scales (appendix S3). Differences in scores on the CPQ between women and their partners and between coping clusters were examined using multivariate analysis of variance. Retrospective vs. prospective participation and parity were explored as possible covariates, but not included in the analysis because of low correlations (ranging from -0.225 to 0.217) with the subscales of the CPQ. Pearson correlations were used to determine the relationship between stage at diagnosis / prognosis of breast cancer patients and the subscales of the CPQ. Only breast cancer patients were included because this is the largest and most homogeneous group and because of the lack of comparability between the stages and the ways of determining the prognosis of the different cancer types.

## **Results**

### **Participant characteristics**

Sixty-one women and their partners were included, 43 (70.5%) retrospectively and 18 (29.5%) prospectively. Thirty-four women (55.7%) already had one or more children when diagnosed with cancer during pregnancy (multiparous women), while 27 women (44.2%) were pregnant with their first child (nulliparous women). Median age at diagnosis was 32 years (range 22-42) and median gestational age was 16 weeks (range 1-36). Cancer types and treatment modalities are summarized in Table 1. Retrospective participants scored significantly higher than prospective participants on concerns about the child's health ( $p = 0.015$ ), but not on concerns about the disease and treatment ( $p = 0.83$ ), the pregnancy and delivery ( $p = 0.38$ ), satisfaction

with information and care of the medical team ( $p = 0.11$ ) or tendency to maintain the pregnancy ( $p = 0.67$ ). Nulliparous parents were more concerned about the pregnancy and delivery ( $p = 0.037$ ) and less satisfied with the information and care of the medical team ( $p = 0.013$ ) compared to multiparous parents, but no significant differences were found for concerns about the child's health ( $p = 0.79$ ), the disease and treatment ( $p = 0.54$ ) or tendency to maintain the pregnancy ( $p = 0.56$ ). We combined the groups to obtain an adequate sample size in further analyses.

### **Comparison of women's and partner's levels of distress**

Subscale differences between women and their partners on the CPQ are presented in Figure 1. Women were more inclined to maintain the pregnancy than their partners ( $p = 0.011$ ). However, the strength of concerns about the child's health, about the disease and treatment and about the pregnancy and delivery was not significantly different between women and their partners ( $p = 0.16$ ,  $p = 0.44$ ,  $p = 0.50$ , respectively). Women and partners were equally satisfied with the information and care provided by the medical team ( $p = 0.47$ ).

### **Clusters of cognitive emotion regulation strategies**

A three-cluster solution was chosen (appendix S3, Figure 2). The first cluster of women and partners is characterized by positive z-scores on the CERQ-subcales acceptance, putting into perspective, positive refocusing and positive reappraisal, and negative z-scores on self-blame, rumination, catastrophizing and blaming others ( $N = 59$ , 48.3%). We labeled this cluster as positive coping. The second cluster includes women and partners with positive z-scores on rumination, catastrophizing, refocus on planning, self- and other-blame and positive reappraisal, and negative z-scores on acceptance and positive refocusing ( $N = 40$ , 32.8%). We labeled it as the internalizing coping cluster. The third cluster is characterized by positive z-scores on self- and other-blame, and negative z-scores on all other strategies ( $N = 23$ , 18.9%). We labeled this cluster as blaming self/other. Retrospective and prospective cases were equally



distributed in the clusters ( $p = 0.20$ ), as well as patients and partners ( $p = 0.37$ ), and nulliparous and multiparous parents ( $p = 0.15$ ).

### **Cluster differences in distress**

Women and partners mainly using internalizing coping strategies (cluster 2) had significantly higher levels of concerns than those using positive coping strategies (cluster 1) or those who blame themselves and others for what happened (cluster 3) (Figure 3). This was true for concerns about the child's health ( $p = 0.039$ ), the disease and treatment ( $p < 0.001$ ) and the pregnancy and delivery ( $p = 0.009$ ). No cluster differences were found for information satisfaction ( $p = 0.71$ ) or tendency to maintain the pregnancy ( $p = 0.35$ ).

### **Distress and coping in relation to disease characteristics**

A subgroup analysis of women with breast cancer showed that a higher stage of disease at diagnosis was related to more concerns about the disease and treatment ( $p = 0.05$ ), but not about the child's health ( $p = 0.71$ ) or about the pregnancy and delivery ( $p = 0.54$ ). This relationship was not found for the partners ( $p = 0.11$ ;  $p = 0.82$ ;  $p = 0.67$  respectively). However, the higher the stage at diagnosis, the more partners were inclined to maintain the pregnancy ( $p = 0.042$ ). This was not true for the women ( $p = 0.47$ ). No relationship was found between stage at diagnosis and information satisfaction for both women and partners ( $p = 0.43$ ;  $p = 0.16$  respectively). Moreover, the 5-year overall survival prognosis of women with breast cancer was not related to their level of concerns about the child's health ( $p = 0.97$ ), the disease and treatment ( $p = 0.30$ ) and the pregnancy and delivery ( $p = 0.98$ ) or to information satisfaction ( $p = 0.95$ ) or the tendency to maintain the pregnancy ( $p = 0.36$ ).

Women with different stages of breast cancer and their partners were equally distributed in the coping clusters ( $p = 0.79$ ), indicating that the use of coping strategies was not different for those having a lower or higher stage of the disease at diagnosis.

## **Conclusions**

To the best of our knowledge, this is the first study addressing the particular concerns and coping strategies of pregnant women diagnosed with cancer and their partners. An association between the use of cognitive coping strategies and the level of distress was found. Women and partners mainly using internalizing coping strategies had the highest levels of distress, compared to those using positive or blaming coping strategies.

We aimed to compare the level of distress and concerns between the women and their partners. Interestingly, women and their partners reported similar levels of distress about the child's health, about the cancer disease and treatment and about the pregnancy and delivery. Nulliparous parents were more concerned about the pregnancy and delivery than multiparous parents, which is consistent with the literature [18]. Satisfaction with information and care provided by the medical team were quite high in our sample and this was not significantly different for women and partners. However, women were more inclined to maintain the pregnancy than their partners. Our findings underscore the importance of evaluating the level of distress and concerns for both the women and their partners in order to identify who may benefit from additional psychosocial support.

Given our combined retrospective and prospective design, results of the groups were compared. Retrospective participants reported higher levels of concerns about the child's health as compared to prospective participants. A possible explanation may be that evidence on fetal safety of maternal cancer treatment is growing. Women diagnosed nowadays can thus be better informed about the safety and risks for their child, which may lower their level of distress.

Moreover, a higher stage of the disease at diagnosis was related to more concerns about the disease and treatment for women with breast cancer, but not for their partners. Surprisingly, there was no relationship with the 5-year overall survival prognosis. It is likely that physicians informed their patients about the stage of their disease, but not always communicated the

percentage of overall survival. In general, the prognosis of women with breast cancer in our study was high. This is in part a result of the inclusion of retrospective cases with a history of cancer during pregnancy, who were still alive at the moment of completion of the questionnaire, and therefore might have had a good prognosis. Partners of women with a higher stage of breast cancer at diagnosis were more inclined to maintain the pregnancy than those of women with a lower stage at diagnosis, which was not true for the women themselves. It might be that partners who are afraid to lose their wife from cancer adhere to the baby as a way of searching for consolidation, connection to their partner and future prospects.

The second aim of our study was to identify subtypes of women and partners who use similar cognitive coping strategies when confronted with cancer during pregnancy. In our sample, we identified three subtypes: 48.3% of women and partners preferably used positive coping strategies, 32.8% mainly used internalizing coping strategies and 18.9% mainly blamed themselves and others for what happened. The internalizing and blaming clusters are comparable in their use of the strategies self-blame and blaming others, but highly differ in their scores on the strategies of rumination and catastrophizing. The first cluster is different to cluster two and three in the frequent use of positive or adaptive strategies and the absence of negative or maladaptive strategies (which are present in cluster two and three).

Thirdly, we aimed to investigate the relationship between these subtypes of women and partners based on their cognitive coping strategies and the level of distress and concerns. Participants mainly using internalizing emotion regulation strategies had significantly higher levels of distress and concerns than those who used positive coping strategies or searched for someone to blame. This is partly consistent with the literature, as women and partners in the positive coping cluster mainly use strategies that are labeled as 'more adaptive' [13] and thus are expected to have lower levels of distress. Also, the strategies that are considered as 'less adaptive' in the literature [13] were highly present in our group of participants who used

internalizing coping strategies. Surprisingly, participants who mainly searched for someone to blame for their cancer situation had the lowest levels of concerns and distress. One hypothesis is that these women and partners deny or avoid their emotions and thoughts and as a consequence report low levels of concerns and distress. Moreover, it is likely that other ways of emotion regulation, such as physiological (e.g. rapid pulse, rate of breathing, muscle tension), social (e.g. expression of feelings, distraction), behavioral (e.g., withdrawing, crying, angeriness, information seeking) and other conscious and unconscious cognitive processes (e.g. selective attention, projection) are intertwined with the cognitive emotion regulation processes investigated in this study.

Our study has some limitations. First, recall bias may confound the results when including retrospective cases. Retrospective participants may evaluate or remember the event in a different way because of their experiences that have followed the cancer during pregnancy period, e.g. a positive or a negative treatment outcome, a positive or negative outcome of the child. We dealt with this limitation by comparing the retrospective and prospective results. Another limitation is the heterogeneity of the study group in terms of variation in diseases, timing of diagnosis during pregnancy, prognosis, and treatment options. Lastly, the results are based on the validated CERQ and a new constructed Cancer and Pregnancy Questionnaire, which is not yet validated. Therefore, the results should be interpreted with caution. As this is the first questionnaire specifically addressing the psychological burden of cancer during pregnancy, it may provide useful information for both physicians and psychosocial workers in this field. As a future project, we plan to validate the newly constructed CPQ to improve the evaluation of distress and concerns and to implement it as a tool for distress screening and psychosocial care of pregnant women diagnosed with cancer and their partners.

Based on our results, we summarize some clinical recommendations for physicians and psychosocial caregivers confronted with pregnant cancer patients and their families. First, the

women in our study underscore the importance of clear information about the disease, treatment and prognosis of the mother and about the available evidence on the outcome of children after prenatal exposure to cancer treatment. Therefore, it is recommended that personalized information is provided in a format that the woman will understand, in a process of shared decision-making about the cancer treatment and continuation of pregnancy. Second, as women and their partners may be confronted with uncertainty, a lot of questions and diverse emotions, it is important to evaluate their levels of distress and concerns and their coping strategies. Therefore, it is advisable to organize at least one consultation with a psychologist. The results in our study indicate that women and partners who use internalizing coping strategies may benefit from additional psychosocial support. Although women and partners who mainly search for someone to blame had the lowest levels of distress, denial and avoidance of emotions may be underlying mechanisms. In that case, psychosocial support may also be advised to help them to recognize and express emotions and to teach them coping strategies that are more adaptive in the long term.

Lastly, a cancer diagnosis during pregnancy is a very particular stressful life-event. Women confronted with this situation often do not feel completely understood by others. Contact with other families who have experienced cancer during pregnancy may help some of them to cope more easily with their emotions, thoughts and concerns (e.g. organization 'Hope for Two').

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Figure 1. Differences in distress/concerns, information satisfaction and tendency to maintain the pregnancy between women and their partners

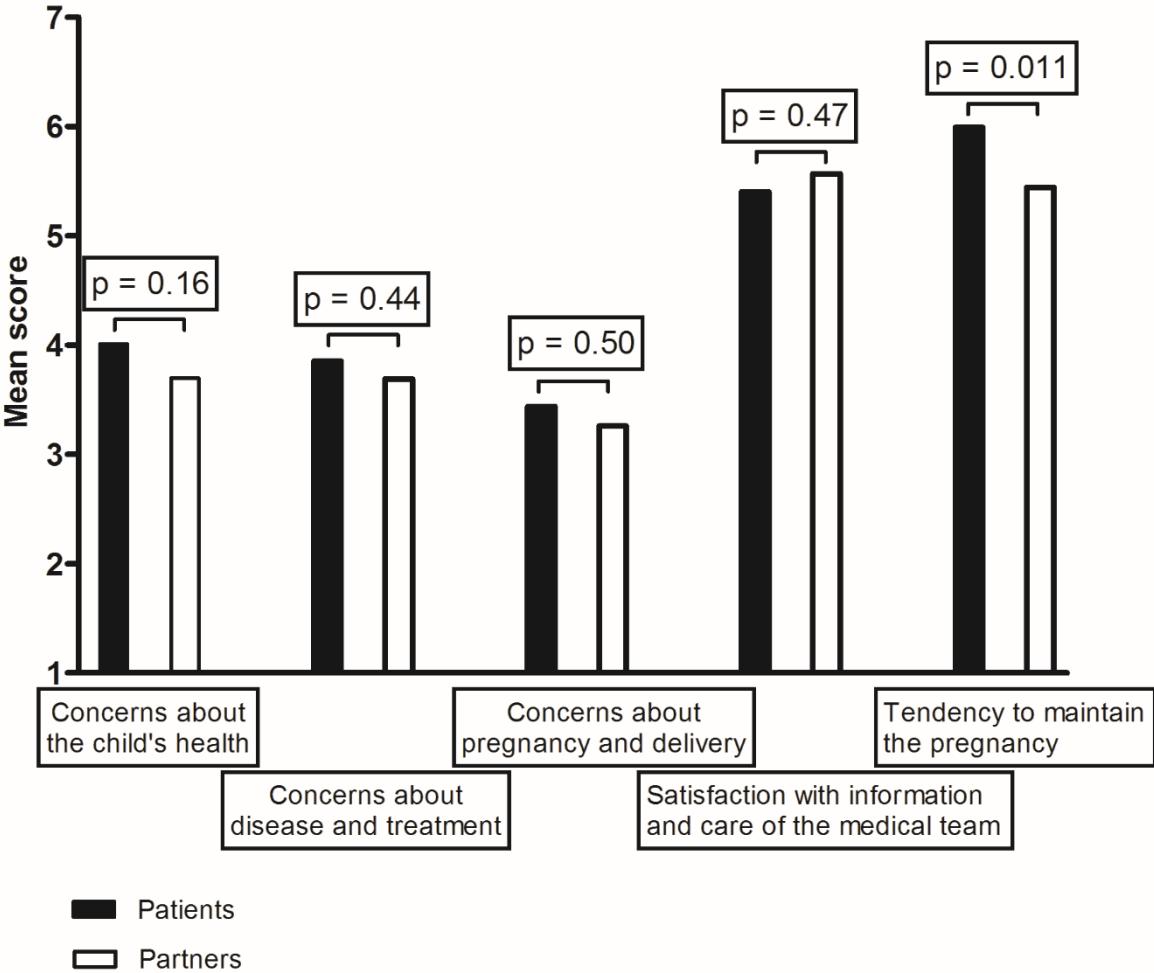
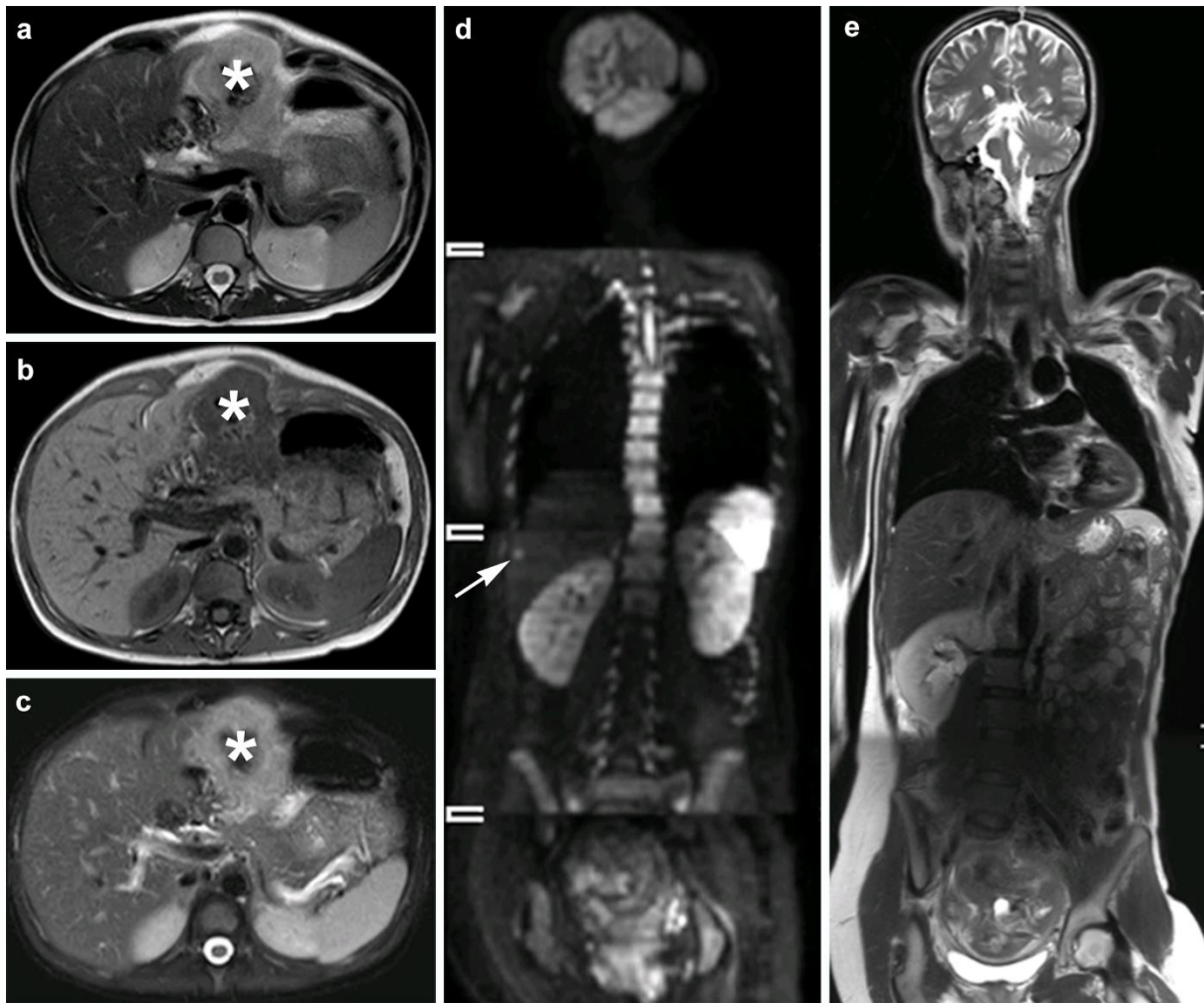


Figure 2. Three-cluster solution based on the CERQ-scales for women (N = 61) and their partners (N = 61)





Note: Positive and negative z-values are shown to present relative differences between the clusters. Positive z-values indicate that participants in this cluster use these strategies more than participants in the other clusters. Negative z-values indicate that participants in this cluster use these strategies less than participants in the other clusters.

Figure 3. Differences in distress/concerns, information satisfaction and tendency to maintain the pregnancy between CERQ-clusters

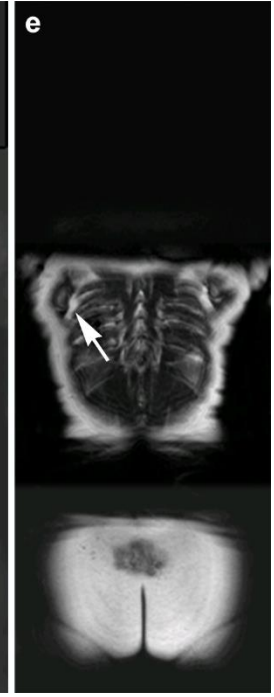
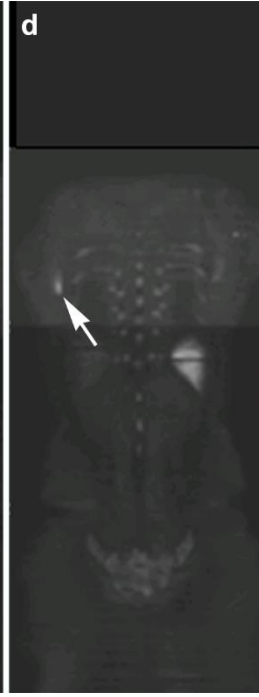
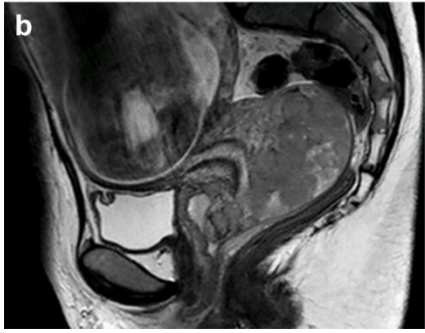
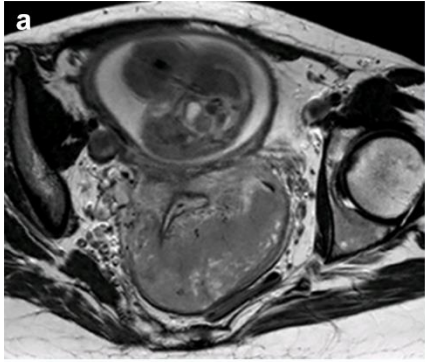


Table 1

*Cancer types and treatment modalities*

	N	%		N	%	
<b>Cancer type</b>			<b>Stage at diagnosis during pregnancy</b>			<b>Median 5 year survival prognosis in % (range) <sup>a</sup></b>
Breast cancer	38	62.30				90.60 (61.40-97.70)
			1	8	21.05	94.45 (90.60-97.10)
			2	17	44.74	90.20 (78.20-97.70)
			3	10	26.32	80.85 (61.40-97.70)
			recurrence	3	7.89	
Hematological malignancies	13	21.31				
Hodgkin lymphoma	5	0.08				
Non-Hodgkin lymphoma	3	4.92				
Acute myeloid leukemia	3	4.92				
Acute lymphoblastic leukemia	2	3.28				
Cervical cancer	4	6.56				89.10
			1	4	100.00	
Ovarian cancer	3	4.92				89.60 (46.70-89.60)
			1	2	66.67	
			3	1	33.33	

Tongue cancer	1	1.64	
Ewing sarcoma	1	1.64	
Gastrointestinal stromal tumor	1	1.64	recurrence
<b>Treatment during pregnancy</b>			
Surgery only	5	8.20	
Chemotherapy only	17	27.87	
Radiotherapy only	2	3.28	
Surgery + chemotherapy	27	44.26	
Surgery + radiotherapy	2	3.28	
Surgery + chemotherapy + radiotherapy	4	6.56	
No treatment during pregnancy	3	4.92	
Herceptin	1	0.02	

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<sup>a</sup> Details on the determination of prognosis are available in appendix S4.

## **SUPPLEMENTARY FILE**

### **Psychological distress and cognitive coping in pregnant women diagnosed with cancer and their partners**

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## S1 Construction of the Cancer and Pregnancy Questionnaire

A retrospective questionnaire, consisting of 87 items, and a prospective questionnaire, consisting of 75 items, were developed in Dutch by Prof. dr. Frédéric Amant and Prof. dr. Bea Van den Bergh. The questionnaires were designed to specifically address concerns and issues related to cancer during pregnancy. Twenty-five of these items are part of the Pregnancy Related Anxiety Questionnaire (PRAQ), developed and validated by Prof. dr. Bea Van den Bergh [1]. The other items were constructed based on our own experience with pregnant cancer patients.

As cancer during pregnancy is a rare phenomenon, the sample size was too small as compared to the number of items of the questionnaires to perform exploratory factor analysis. The items in common between the retrospective and the prospective questionnaire were thematically organized into subscales. This resulted in six subscales. A reliability analysis on the subscales was performed and the items that resulted in the highest reliability for each subscale were selected. One subscale with items on concerns about the partner was left out because the reliability was too low. In the final questionnaire, five subscales with a total of 40 items were retained.

We continue to collect data and plan to validate the questionnaire in the future.

## S2 Table

### *Subscales and items of the Cancer and Pregnancy Questionnaire*

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#### **Cancer and Pregnancy Questionnaire**

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##### **Concerns about the child's health**

I sometimes worry that our child will be weak.

I am afraid that our child will have a physical abnormality.

I am afraid that our child will be born with a physical disability requiring a lot of support in daily life.

I am concerned that our child will not be able to grow up normally with his/her peers due to the cancer treatment.

I am afraid that there will be serious complications during the pregnancy due to the cancer treatment.

I am afraid that the results of the tests carried out on our baby shortly after birth will be abnormal.

I am afraid that our child will be brain damaged or will have a mental disability.

I am afraid that our child will suffer growth retardation due to the cancer treatment.

I am concerned that our child will have learning difficulties at school due to the cancer treatment.

I am concerned that the cancer treatment will affect our child's physical appearance, making him/her less attractive, and I fear the reactions of others.

I am concerned that the examinations performed, to determine the type and the extent of the tumor, will have a detrimental effect on our child's health.

I am scared that our child will die before, during or shortly after birth.

I am afraid that our child will have difficulty doing sporting activities as a result of the cancer treatment.

I am always nervous when an ultrasound is performed that an abnormality will be found.

I am afraid that our child will be admitted to the specialized baby unit shortly after birth.

I am concerned that the cancer treatment may be harmful to our unborn child.

##### **Concerns about the disease and treatment**

I am afraid that the cancer treatment given to me during pregnancy will not be as effective as the treatment given to non-pregnant women.

I am concerned about the extent of the physical exhaustion caused by the treatment.

I am concerned that not all the tests, to determine the type and extent of the tumor, can be carried out due to the pregnancy.

I often wonder whether the cancer would have been detected earlier had I not been pregnant.

I am often concerned about my chances of survival.

I often wonder whether the cancer would have been detected had I not been pregnant.

I often wonder whether I would have had cancer had I not been pregnant.

I am often concerned about the cost of my cancer treatment.

##### **Concerns about the pregnancy and delivery**

I am concerned that I have become irritable, overly sensitive and that I react in a different way than I would like.

I am concerned about my sudden mood swings.

I am afraid that there will be complications during labor and delivery.

I am concerned that I am too preoccupied with myself and will become withdrawn.

I often worry that my pregnancy is so different to that of other pregnant women.

I sometimes worry that becoming a mother will change me a lot and for example, make me feel old.

##### **Satisfaction with the information and care provided by the medical team**

I am satisfied with the information I received from my physician regarding the current health state of mothers who underwent cancer treatment during pregnancy.

I am satisfied with the information I received from my physician about the possible risks of the cancer treatment to our child.

I am satisfied with the information I received from my physician regarding the follow-up plan for our child after birth.

I am satisfied with the information I received from my physician about the possible (side) effects of my cancer treatment.

I am comfortable asking my physician for detailed explanations of difficult medical terms and treatments.

The medical team is caring and supportive regarding my wellbeing.

**Tendency to maintain the pregnancy**

I will do everything I can to save our baby.

I have no right to endanger the life of our unborn child.

I have an overwhelming urge to protect our child.

I seriously considered having my pregnancy terminated.

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### S3 Cluster analysis on the CERQ scales

To identify subtypes of women and partners who used similar coping strategies to deal with cancer during pregnancy, we performed a K-means cluster analysis on the 122 participants (i.e., 61 women and their partner) using the 9 CERQ-scales. We explored values of K (i.e., the number of clusters) going from 1 up to 8 and used a scree plot to determine the optimal number of clusters. Prior to the analysis, data were transformed into z-scores in order to facilitate the interpretation of the clustering.

When looking at a scree plot of the number of clusters against the (mis)fit-value of each solution, the clearest elbow appears at the solution with two clusters and a less pronounced elbow is encountered for the three- and four-cluster solution. The solution with four clusters is not used because it contains a very small cluster ( $N = 3$ ) and therefore cannot be considered as stable. The three-cluster solution (Figure 2) is chosen because it is a refinement of the solution with two clusters (i.e., one cluster is split into two separate clusters) that makes more sense from a substantive point of view.

#### S4 Determination of the 5-year overall survival prognosis

The 5-year overall survival prognosis of breast cancer patients was calculated with the predict tool ([www.predict.nhs.uk](http://www.predict.nhs.uk)) developed by the Cambridge Breast Unit at the University of Cambridge and the Eastern Cancer Information and Registration Center.

The 5-year overall survival prognosis of women with cervical or ovarian cancer was determined according to the FIGO staging [2, 3].

The prognosis of women with hematological malignancies, tongue cancer, ewing sarcoma or a recurrence during pregnancy was not determined, due to a lack of articles giving information on the 5-year overall survival or because some parameters were missing to provide a reliable prognosis.

## References

1. Van den Bergh BRH. The influence of maternal emotions during pregnancy on fetal and neonatal behavior. *Pre- and Peri-Natal Psychology* 1990;**5**:119-30.
2. Quinn MA, Benedet JL, Odicino F, Maisonneuve P, Beller U, Creasman WT, Heintz AP, Ngan HY, Pecorelli S. Carcinoma of the cervix uteri. FIGO 26th Annual Report on the Results of Treatment in Gynecological Cancer. *Int J Gynaecol Obstet* 2006;**95**:S43-103. doi:10.1016/S0020-7292(06)60030-1
3. Heintz AP, Odicino F, Maisonneuve P, Quinn MA, Benedet JL, Creasman WT, Ngan HY, Pecorelli S, Beller U. Carcinoma of the ovary. FIGO 26th Annual Report on the Results of Treatment in Gynecological Cancer. *Int J Gynaecol Obstet* 2006;**95**:S161-92. doi:10.1016/S0020-7292(06)60033-7

