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**Title:**

Knowledge about and attitude towards fertility preservation in young female cancer patients:  
a cross-sectional online survey

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**Abstract**

Recent advances in cancer therapy have resulted in an increased number of long term cancer survivors. However, as a consequence of their treatment, women might be confronted with impaired fertility. The options of fertility preservation techniques are increasing. The goal of this study was to assess knowledge about and attitudes towards fertility preservation in young female cancer patients.

A cross-sectional online survey was conducted including 155 former female cancer patients from English and German speaking countries. The survey consists of questions about attitude towards and knowledge about fertility preservation.

Results have shown that knowledge about fertility preservation was limited among participants. Positive attitudes towards fertility preservation significantly outweighed negative attitudes. Knowledge and attitude did not differ according to language or different healthcare systems. Confidence of knowledge was significantly higher in women who underwent any FP procedure compared to those who did not. Greater emphasis should be placed on counselling opportunities, the provision of adequate information and supporting material. A better understanding of these issues will hopefully enhance patients' decision-making about fertility preservation options and assist the development of strategies to improve quality of care.

**Keywords:** Fertility preservation, cancer, women, attitude, knowledge, counselling

Number of **words** in manuscript: 2372

## **Introduction**

Recent advances in cancer therapy have resulted in increased numbers of long term cancer survivors (Hudson, Stanley, Nahata, Bowman-Curci, & Quinn, 2017; Maltaris et al., 2007). As a consequence of their therapy however, women who are treated for cancer during their reproductive life span might be confronted with impaired fertility (Angarita, Johnson, Fader, & Christianson, 2016; Findeklee et al., 2015). The number of fertility preservation (FP) options is increasing. Consequently, in the short period of time in which newly diagnosed women make decisions about surgical options and adjuvant therapy, they may additionally be faced with decisions concerning how to protect their fertility (Kim, 2006; Maltaris et al., 2007).

The entire situation is challenging for all involved parties and the psychological impact is considerable. Previous research has shown that fertility after treatment is a major concern, especially in young cancer patients (Angarita et al., 2016; Partridge et al., 2004; Peddie et al., 2012; Tschudin et al., 2010; Zebrack, Casillas, Nohr, Adams, & Zeltzer, 2004). It seems essential that relevant information regarding FP options is provided prior to commencing adjuvant treatment (Corney & Swinglehurst, 2014; Deshpande, Braun, & Meyer, 2015; Hill et al., 2012). Nevertheless young women often did not receive all the information they needed (Howard-Anderson, Ganz, Bower, & Stanton, 2012; Lee et al., 2006; Shnorhavorian et al., 2015). The existing literature shows that the percentage of patients that recall having received counselling about fertility issues ranges from 34% to 72% (Duffy, Allen, & Clark, 2005; Partridge et al., 2004; Shnorhavorian et al., 2015; Thewes et al., 2005; Zebrack et al., 2004) and many of them considered themselves as inadequately informed (Crawshaw, Glaser, Hale, & Sloper, 2009; Meneses, McNees, Azuero, & Jukkala, 2010; Wilkes, Coulson, Crosland, Rubin, & Stewart, 2010).

Based on these previous findings the study objectives to assess (a) level of knowledge

concerning FP techniques and level of confidence of knowledge and (b) attitude towards FP. Furthermore we were interested in (c) differences concerning knowledge and attitudes between the targeted different language groups and healthcare systems and (d) in differences between participants who made use of any FP option compared to those who did not.

## **Material and Methods**

This study is part of the CAFDA (Cancer And Fertility Decision Aid) research project that is a mixed study approach designed to optimise patient support. This component of the study is a cross-sectional online survey comprising participants from the UK and USA (further referred to as “English speaking sample”) and from Switzerland, Germany and Austria (further referred to as “German speaking sample”). The recruitment of participants in different countries was meant to offer the opportunity to compare participants with different health care systems.

### ***Participants***

Women were eligible if they were 18 years or more, had a cancer diagnosis within the last 10 years and during reproductive lifespan and had a cancer therapy potentially affecting the reproductive function. A total of 155 women completed the online questionnaire. 80 participants have been recruited in the English speaking countries. Data of this sample have partly been published previously (Tschudin et al., 2010). 75 women were recruited in the German speaking countries.

### ***Measures***

The Cancer and Fertility Survey (CFS) was specifically developed for the CAFDA study and consists of items assessing fertility issues in cancer patients and of validated questionnaires. The English version of the CFS is described extensively elsewhere (Tschudin et al., 2010). The CFS was translated into German by two independent translators and retranslated by a

third one. For the study presented here the following data were used for analysis (see table 1): *Socio-demographic and disease-related items*: data included age, country of residence, ethnicity, education, marital status, number of children and medical characteristics of cancer (year of diagnosis, type of cancer and type of treatment). In addition participants were asked if they had undergone any FP procedure, how satisfied they were with the applied technique. The importance of having a child was assessed by using the 3-item need for parenthood scale, (Collins, Freeman, Boxer, & Tureck, 1992).

*Discussion on fertility*: Items focused on awareness of the effect of cancer (and its treatment) on fertility. Women rated their and the doctor's perceived risk that cancer would lead to infertility.

*Knowledge about FP*: Items assessing participants' knowledge about the main FP techniques available at the time of the study (freezing embryos, freezing egg cells, freezing ovarian tissue, freezing immature egg cells, in vitro maturation of egg cells, organ preserving surgery and hormonal protection of the ovaries during cancer treatment). Participants had to indicate if they had heard or read about the techniques. In addition they had to rate their level of confidence of knowledge about the techniques known.

*Attitude towards FP*: Participants attitude was assessed with 6 positive (e.g., '... options to preserve fertility gave me hope.') and 7 negative (e.g., '... options to preserve fertility were a burden to me.') attitudinal statements towards FP. Four additional statements were about risk-taking when using FP-techniques (e.g., re-introducing cancer cells).

The online version of the survey was produced using the software *SurveyTracker* for the English version and *2ask* for the German version, respectively.

### ***Procedure***

12 English and 6 German websites about cancer or fertility concerns have published the CFS. Duration of accessibility to the survey varied between websites from a few weeks to the

entire time period of the study (1.5 years). Users were addressed with one statement about the survey (“Fertility and cancer – We invite you to take part in a survey on fertility and cancer”) and an option button. Clicking on this button, participants were transferred automatically to the CFS. Informed consent was obtained from all study participants. The ethics committee of the School of Psychology, Cardiff University and of Basel, Switzerland approved the study protocol.

### ***Statistical Analyses***

All statistical analyses were performed by the authors using the statistics program Statistical Package for Social Sciences (SPSS, version 22.0). Statistical significance was set at .05. For the ratings of the attitude scale average scores were computed. Quantitative analyses included descriptive statistics and comparison tests (chi-square-tests, t-tests, analyses of variances) of all dependent variables with the group variable “sample” (English or German speaking sample) and “application of FP” (yes or no). Missing data on demographic, medical and family characteristics was not replaced and denominators for percentages were reported where these differ from the total sample of N=155.

## **Results**

### ***Socio-demographic and disease-related data***

Socio-demographic and disease-related data are presented in table 2. Women from the English and the German speaking sample did not differ in any of these variables.

In total, 29.9% (44) of the participants indicated having undergone any kind of FP. In the German speaking sample there were 26 and in the English speaking sample 18 women who made use of FP. However, this difference is not statistically significant ( $\chi^2 = 1.46$ ,  $p = .228$ ). Out of these 44 participants who underwent FP, 68.2% (30) were satisfied/very satisfied, 22.7% (10) were neither satisfied nor dissatisfied and 9.0% (4) were dissatisfied/very

dissatisfied with the procedure of FP. The samples did not differ in their mean satisfaction scores about the applied FP technique (2.28 (1.4) vs. 2.19 (0.8);  $F(1,43)=.08$ ;  $p=.786$ ).

### ***Need for parenthood scale***

The majority of the participants (82.9% (121)) stated that having a child is important to them. 110 women (75.4%) stated that it is difficult to imagine a life without children and 111 (76.0%) estimated being a parent as one of the most important things to them.

### ***Fertility issues***

77.4% (120) of the participants stated that any kind of health care professional once informed them on how cancer or its treatment would affect fertility. According to the participants, their health care professional rated the risk for fertility difficulties between middle and high ( $M = 6.74$ ,  $SD = 1.96$ ). Participants of the English speaking sample recalled the risk estimated by their health care professionals slightly higher compared to the German speaking sample ( $F(119) = 4.33$ ;  $p = .04$ ). Participants own perception of the estimated risk of fertility impairment was even higher ( $M = 6.91$ ,  $SD = 2.02$ ) with no differences between the two samples. 27.7% (43) of the total sample feared that infertility was the consequence of therapy. Furthermore, willingness to make use of FP techniques was moderate ( $M = 2.24$ ,  $SD = 1.40$ ), especially when risks were involved.

### ***Knowledge about FP***

Overall, participants stated to know about techniques like freezing embryos (73.3% (110)) or freezing egg cells (77.9% (116)). Other FP techniques, such as hormonal protection of the ovaries (43.6% (65)), freezing ovarian tissue (34.7% (52)), organ preserving surgery (29.9% (44)), freezing immature egg cells (23.0% (34)) or in-vitro maturation of egg cells (20.3% (30)) were less known (Fig. 1). Knowledge scores did not differ between the two samples. Overall, participants' confidence of knowledge about a specific technique was moderate ( $M = 2.38$ , ( $SD = 1.00$ )) without significant differences between the English and German speaking



sample. However, confidence of knowledge was significantly higher in women who underwent FP compared to those who did not ( $F(1,128)=11.36$ ;  $p < 0.01$ ).

### ***Attitude towards FP***

Figure 2 shows that in the total sample a positive attitude was significantly higher compared to a negative attitude about FP ( $F(28,119) = 2.56$ ;  $p < .01$ ) as well as in both study populations (German speaking sample:  $F(16,55) = 4.96$ ;  $p < .01$ , English speaking sample:  $F(26,63) = 8.65$ ;  $p < .01$ ). The possibilities of FP were appraised to be beneficial (63.3%) and 93.3% (140) stated that every cancer patient undergoing a treatment that might harm fertility should have the possibility to preserve fertility. However, 64.9% (96) of the participants considered decisions on preserving fertility as difficult. Table 3 shows single attitudinal statements towards FP. There were no differences between the English and German speaking sample or between participants who underwent FP compared to those who did not.

### **Discussion**

Results showed that knowledge on FP techniques was limited among the young female cancer patients sampled. Regarding their attitudes towards FP, however, positive attitudes significantly outweighed negative attitudes. Knowledge and attitude did not differ according to language or different healthcare systems. Confidence of knowledge was significantly higher in women who underwent any FP procedure compared to those who did not. To our knowledge, this is the first study with a German speaking population assessing knowledge about and attitude towards FP in young female cancer patients.

### ***Fertility issues***

The majority of our participants (77.4%) were informed by a health care professional about potential fertility impairment due to cancer treatment. Compared with previous studies, the rate of informed participants was above the upper range (Duffy et al., 2005; Partridge et al.,

2004; Schover, Brey, Lichtin, Lipshultz, & Jeha, 2002; Shnorhavorian et al., 2015; Zebrack et al., 2004). Concerns on fertility, however, were comparable to those found by Partridge et al. (2004).

Most of the participants stated that having a child is very important to them. The parenthood scale although does not differ whether they wish for a biological child or a child in general. This important differentiation needs to be evaluated and taken into account in further studies.

### ***Knowledge***

Knowledge about FP techniques was generally found to be limited and only established techniques at the time of the survey were well known among this sample. Confidence of knowledge was higher in participants who underwent any kind of FP as they might have been engaged in depth with this issue. Deficits of knowledge about FP and information regarding fertility impairment related to cancer treatment were shown in many other studies (Garvelink et al., 2015; Quinn, Vadaparampil, Bell-Ellison, Gwede, & Albrecht, 2008; Yee, 2015).

These and other studies stated that patients need to understand the impact of their cancer and its treatment on their fertility and to know the options available in order to make an informed decision (Peate, Meiser, Friedlander, Zorbas, et al., 2011). Furthermore, Corney and Swinglehurst (2014) concluded that more emphasis should be placed on informing young women about fertility issues shortly after diagnosis. Providing written material may be beneficial (Deshpande et al., 2015). Accordingly, educational tools such as decision-aids, may be used to improve patient comprehension, information sharing and knowledge enhancement (Balthazar et al., 2012; Ehrbar et al., 2016; Stacey et al., 2014).

### ***Attitude***

Positive attitude significantly outweighed negative attitude towards FP. However, willingness to make use of FP techniques was lower if cancer treatment would be delayed. This is a result that also has been reported by Loi et al. (2010) and Senkus et al. (2014) who found that cure

remains their first priority for the majority of young patients with breast cancer. Peddie et al. (2012) concluded in their study that also for the medical staff survival was always viewed as paramount and future fertility as secondary.

To conclude, young female cancer patients state to have a positive attitude towards FP but have limited knowledge. Providing information about FP by an early referral to a fertility specialist as well as with additional written material is very important (Angarita et al., 2016; Deshpande et al., 2015; Lagana, La Rosa, Rapisarda, Platania, & Vitale, 2017). Therefore, the next step is to elaborate and offer adequate and desired methods to provide this information. Various researcher developed and evaluated a decision aid , in addition to a consultation with a fertility specialist (Garvelink et al., 2013; Garvelink, Ter Kuile, Louwe, Hilders, & Stiggelbout, 2017; Peate, Meiser, Friedlander, Saunders, et al., 2011). A better understanding of these issues will hopefully contribute to enhance patients' decision-making about FP options and assist the development of strategies to improve quality of care.

### ***Strengths and Limitations***

The comparison of participants who completed the questionnaire in English with those who answered the German version showed no significant differences between the two groups. This might be due to rather slight differences in the healthcare system of the contributing countries.

The composition of an online sample is arbitrary and prone to a selection bias and thus not representative for young cancer patients in general. Also, medical data of the participants could not be controlled and a recall bias needs to be considered. Participants with a diagnosis up to 10 years ago have been included and availability of FP techniques has changed during

this period of time. The study population showed a very high educational status, which is a common bias in studies but needs to be taken into account.

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**Tables:**

Table 1: Overview Questionnaires

<b>Questionnaire</b>	<b>Scale</b>
Sociodemographic and disease-related items	-
FP technique applied	Yes/No
<i>Satisfaction with applied technique</i>	5-point Likert Scale (1 = very satisfied, 5 = very dissatisfied)
Need for Parenthood scale	5-point Likert Scale (1 = strongly agree, 5 = strongly disagree)
Discussion on fertility	With whom they talked about fertility and cancer
<i>Perceived risk of infertility</i>	9-point-Likert Scale (1 = no risk at all for fertility, 9 = infertility is the consequence of therapy)
<i>Helpfulness of discussion on fertility</i>	5-point-Likert Scale (1 = not at all helpful, 5 = extremely helpful)
Knowledge about FP	Yes / no
<i>Level of confidence</i>	5-Point Likert Scale (1 = not at all, 5 = very much)
Attitude towards FP	5 Point Likert Scale (1 = strongly agree, 5 = strongly disagree)



Table 2: Socio-demographic and disease-related data from the English and the German speaking sample

	English (N = 80)	German (N= 75)	Total (N = 155)
Age <sup>a</sup>	36.76 (8.33)	34.95 (7.40)	35.89 (7.92)
Living in a partnership <sup>b</sup>	84.0 (63)	72.2 (52)	78.2 (115)
Number of births given <sup>b</sup>	31.3 (25)	28.2 (20)	29.0 (45)
Number of children <sup>a</sup>	.79 (1.12)	.61 (1.32)	.70 (1.22)
Number of nulliparous women <sup>b</sup>	58.8 (47)	69.6 (48)	63.8 (95)
	UK: 47.5 (38)		
	USA: 38.8	CH: 52.9 (37)	
Country of residence <sup>b</sup>	(31)	D: 42.9 (30)	
	Other: 13.7	Other: 4.2 (8)	
	(11)		
Higher education <sup>b</sup>	70.0 (56)	78.9 (56)	74.2 (112)
Number of years since diagnosis <sup>a</sup>	3.42 (4.9)	5.40 (7.57)	4.98 (6.57)
Cancer type <sup>b</sup>			
Cervix	45.0 (36)	2.8 (2)	25.3 (38)
Breast	30.4 (24)	59.2 (42)	44.0% (66)
Lymphoma	19.0 (15)	23.9 (17)	21.3% (32)
Uterus, kidney, ovaries, stomach o. intestines	5.1 (4)	14.8 (10)	9.3% (14)
Treatment <sup>b</sup>			
Surgery	72.5 (58)	74.6 (53)	73.5% (111)
Radiotherapy	47.5 (38)	59.2 (42)	53.0% (80)
Chemotherapy	61.3 (49)	84.5 (60)	72.2% (109)

Immuno- or hormonal therapy	18.8 (15)	45.1 (32)	30.3% (47)
Combined therapy	58.8 (47)	81.3 (61)	69.7% (108)

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<sup>a</sup> Mean (SD) <sup>b</sup> Percentage (Number)

UK: United Kingdom, USA: United States of America, CH: Switzerland, D: Germany

Table 3: Attitudinal statements towards FP

	<b>English</b>	<b>German</b>	<b>Total</b>
	<b>(N=73)</b>	<b>(N=69)</b>	<b>(N=142)</b>
<b>Access</b> to fertility preserving procedures for every female cancer patient	93,5% (72)	93,2% (68)	<b>93,3%</b> (140)
<b>Ethical</b> reservations	13,2% (10)	8,5% (6)	<b>10,9%</b> (16)
<b>Religious</b> reservations	5,2% (4)	5,6% (4)	<b>5,4%</b> (8)
<b>Thinking about</b> FP was perceived as difficult while being under cancer treatment	64,9% (50)	64,8% (46)	<b>64,9%</b> (96)

Percentage (number) of patients that strongly and moderately agreed  
Group differences: ns

**List of Figures:**

Figure 1: Knowledge about fertility preservation techniques

Figure 2: Attitude towards fertility preservation

*Find figures attached to the submission as a PDF-File.*