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Reproductive Expectations in Female Young Adult Cancer Survivors

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B.S., Pennsylvania State University, 2017

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An abstract of

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Abstract

Reproductive Expectations in Female Young Adult Cancer Survivors

By Stephanie Ramer

More women are surviving cancer, and this has led to an increased focus on the long-term effects of cancer and its treatments, such as the effects on fertility. The objective of this study was to investigate feelings around reproduction of female survivors of young adult cancers and understand how these feelings differ from women who are not cancer survivors using data from the Furthering Understanding of Cancer, Health, and Survivorship in Adult (FUCHSIA) Women's study. Our cohort included 979 cancer survivors and 992 comparison women who were asked questions about their feelings around reproduction, their reproductive histories, demographic characteristics, and lifestyle. We fit models to estimate whether cancer survivors were more or less likely to agree with the questions about reproductive feelings compared with the cancer-free women. Our results suggest that cancer survivors with children were more likely to report they wanted more children (Odds Ratio 1.33, 95% Confidence Interval 1.05, 1.67) and would be disappointed if they could not get pregnant again (OR 1.15 95% CI 0.90, 1.53). Nulliparous cancer survivors rated having biologic children more important than the comparison group (OR 1.17, 95% CI 0.82, 1.67) and were less comfortable with adoption (OR 0.59 95% CI 0.38, 0.92) and using assisted reproductive technology (OR 0.80, 95% CI 0.55, 1.16). Generally, predictors of reproductive feelings were similar for cancer survivors and comparison women. Younger women and women who had fewer children than desired were more likely to want a/another child and be disappointed if they could not get pregnant. Parous women were more likely to value the importance of having biologic children and less likely to agree that they would be comfortable with adoption. Our results suggest that many cancer survivors still want children after treatment, even if they already have children yet parous women are less likely to receive fertility counseling. Therefore, adequate fertility counseling services for cancer survivors are needed regardless of whether women already have children as they may not have reached their desired family size at the time of diagnosis.

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Chapter I: Background/Literature Review

Cancer treatment has evolved over the past twenty years, increasing survival rates so that more people are able to continue with their lives for years after a cancer diagnosis. However, as the primary objective of cancer treatments is survival, reproductive health can be overlooked. Treatments such as chemotherapy and pelvic radiation can be gonadotoxic and impair fertility. Surgery to treat cancer may directly or indirectly involve reproductive organs. Women treated with gonadotoxic therapies may become amenorrheic or enter menopause early reducing the number of years they are able to have children (1, 2). And even those who do not become amenorrheic may experience subfertility (2). This is especially of concern to young women who may still be hoping to start or expand their family at the time of diagnosis.

Further, although not all cancers require treatment with gonadotoxic drugs, women may delay pregnancy while being treated for cancer and possibly for years after. As women grow older, ovarian reserve decreases and they become less fertile. Women are considered in their prime reproductive years between 20-35 with fertility gradually declining starting at age 30 (3). By age 40, women only have about 5% chance of getting pregnant per menstrual cycle (3). For young women who are diagnosed with cancer in their 20s and 30s the window of fertility becomes even shorter, as they have to postpone childbearing for the length of their treatment.

In addition, diagnosis with cancer may affect whether women are comfortable getting pregnant. Among survivors of hormone sensitive cancers, such as breast and ovarian cancer, there is a fear that becoming pregnant may lead to recurrence of cancer because of the influx of hormones that accompanies being pregnant (4). Although it has not been

proven that pregnancy is associated with recurrence of cancer, the fear may cause women to avoid pregnancy (5). There also may be fear that if they were to have a child and get cancer again, they would not be able to take care of the child (4).

Epidemiology of Cancer in Reproductive Aged Women

Each year in the United States, approximately 94.6 women aged 20 to 39 per 100,000 are diagnosed with cancer (6). In young adult women, the most common cancers are thyroid cancer, breast cancer and melanoma (7). Among women in this age group, cancer is the leading cause of death (8). However, the five-year survival rate among young adult women across all cancers is approximately 86%, though this varies by the type of cancer (7). Although incidence of young adult cancers is highest among non-Hispanic white women, the mortality rate from cancer is highest among non-Hispanic black women, which is largely due to differential breast cancer mortality rates (7).

The effect of cancer on pregnancy

In 2018, the mean age at first birth of women in the United States was 26.9 years, this is an increase of two years from 2000(9, 10). Between 2000 and 2014, the proportion of women having their first births between 30-34 rose 28% and the proportion of women having their first births over 35 rose 23% (10). Women over 30 now account for 30.2% of first births (10). It is well-established that one of the main risk factors for cancer in women is age. Thus, as more and more women are delaying pregnancy until their thirties, more women's plans for a family are interrupted by a cancer diagnosis.

Research suggests that female cancer survivors are in fact less likely to give birth compared to the general population, however the magnitude of the difference in births

differed according to age at cancer onset, cancer site and parity (11-14). Registry studies allow researchers to compare childbearing in the general population to national cohorts of cancer survivors. A Swedish study found that cancer survivors were 27% less likely to give birth compared to the general population (11). A similar hospital registry study in Norway found that the probability of first time parenthood among female cancer survivors was 66% whereas the probability among the general population was 79% (15). In a study using the Finnish Cancer Registry that matched siblings, female young adult cancer survivors were 63% less likely to parent at least one child (13).

Survivors of childhood cancer and survivors of young adult cancers differ with respect to treatments, types of cancers, and life circumstances. Currently, more studies have investigated birth rates in the childhood cancer survivor population as opposed to survivors of young adult cancers. The Childhood Cancer Survivor Study reported that childhood cancer survivors were 19% less likely to have children compared to their siblings If the survivors had been treated with radiation, their likelihood of having children was further diminished (16). Furthermore, the British Childhood Cancer found that female childhood cancer survivors had fewer children than expected compared to their age cohort, and those cancer survivors that were treated with radiation had a higher chance of miscarriage and delivering preterm (12).

Cancer survivors treated with chemotherapy often experience amenorrhea during and after treatment. However, the duration of amenorrhea varies (17). Amenorrhea is associated with subfertility, which raises concerns about the fertility of cancer survivors after treatment (17, 18). Amenorrhea is an imperfect marker of ovarian reserve, but there is additional evidence that chemotherapy causes decreases in Anti-Mullerian Hormone

(AMH), a biomarker of ovarian reserve, during treatment and that can persist after treatment has ceased (19).

Fertility Preservation

Fertility preservation increases the chance that a survivor receiving gonadotoxic therapy will be able to have a biological child after cancer. Fertility preservation options include embryo freezing, unfertilized oocyte freezing, ovarian transposition, conservative gynecological surgery, ovarian suppression and ovarian tissue freezing (20, 21). For women desiring future children, embryo and oocyte freezing are recommended and are procedures that need to be performed prior to her cancer treatment. Ovarian transposition and conservative gynecological surgery are procedures that attempt to protect the reproductive organs from the effects of radiation or surgery (20, 22). Ovarian tissue freezing is recommended in cases where women are not able to complete an ovary stimulation cycle (20, 22). Currently, ovarian tissue freezing is considered an experimental procedure. Finally, ovarian suppression is recommended in cases where other fertility preservation strategies are not feasible, however it is currently unclear how effective ovarian suppression is at preserving ovary function (22).

The American Society of Clinical Oncology and the American Society of Reproductive Medicine recommend that possible infertility and fertility preservation options are discussed soon after diagnosis so that as many fertility preservation options as possible are available (20, 22). It is also recommended that patients be referred to reproductive specialists even if a patient is ambivalent about having children as feelings about reproduction can change over time (20, 22). However, it is unclear how often these recommendations are followed.

Studies looking at whether fertility concerns were addressed by a physician prior to starting cancer treatment found that around 30-41% of women did not discuss fertility with their doctor prior to treatment, although these studies were conducted about ten years ago so these proportions may have changed (23-26). One of these studies found that only 51% of women felt their concerns were being adequately addressed during these discussions (23). Thus, discussing treatment options with regards to fertility and fertility preservation options should be a priority for physicians prior to their patient starting treatment. By understanding women's feelings about fertility preservation, we can tailor information for cancer survivors to best suit their needs.

While fertility preservation options give women a better chance of having a live birth, they do not a guarantee that women will be able to conceive. Furthermore, there are barriers to women being able to access their fertility options even if the doctor initiates a discussion about them. Fertility preservation is largely not covered by health insurance because it is not considered medically necessary (27). Further, fertility preservation technologies are expensive and so women may not be able to take advantage of these options even if they are notified of them.

Fertility Concern and Reproductive Expectations

Many women consider childbearing and becoming a mother a large part of their identity. Research on women who are not cancer survivors has suggested that women who are involuntarily childless have higher rates of depression and lower rates of life satisfaction than women who have not experienced infertility (28). Considering many cancer survivors experience distress and life changes because of their diagnosis, involuntary childlessness may have greater effects on their quality of life as compared to women not

affected with cancer. In studies of cancer survivors, women who were unable to have a child reported lower quality of life and lower physical well-being (28, 29).

Information on met or unmet reproductive expectations is limited for cancer survivors. Around 62-66% of women will have at least one child at the time of cancer diagnosis (23, 25, 30). Considering that some of these women will have had two or more children and that around 12.5% of women only want one child, there are likely many women that have completed their reproductive goals prior to their cancer diagnosis (31). However, some women that have one child want to have more after they have completed their cancer treatment, and some of the nulliparous women want children.

Most studies investigating how cancer survivors feel about their reproductive health have focused on fertility concern. Fertility concern is usually defined as concern about the possibility of becoming infertile after cancer treatment. Fertility concern is most commonly measured as a summed response to Likert scale questions that may be dichotomized into more or less concern about fertility (23, 25). Although fertility concern is not the only factor in how a woman feels about reproduction, the evidence surrounding fertility concern is important to consider. In a study of fertility concern among cancer survivors, 38% of women were found to be more concerned, as opposed to less concerned, about their fertility after their cancer diagnosis and in 26% of these women this concern affected their treatment decisions (25). The literature consistently suggests that fertility concern among cancer survivors, as well as desire to have children, is associated with fewer prior pregnancies, younger age at diagnosis and being treated with chemotherapy (23, 25, 32). Further, higher levels of concern about fertility is associated with reporting poorer mental health and more distress after treatment (28, 29). However,

two points of disagreement in the literature are whether difficulty becoming pregnant and greater education are associated with fertility concern or not (23, 25).

Infertility is not necessarily the only factor that stops women from becoming pregnant. Multiple qualitative studies have investigated cancer survivor's reproductive goals and their feelings about these goals. Qualitative studies have shown that cancer survivors are interested in having children after treatment and are happy when they have children (33, 34). One study even found that women who did not have children at the time of treatment were more likely to prioritize fertility over survival (35). Estimates of how many survivors stated wanting to have more children before treatment ranged from 48-59% (30, 34). However, there is evidence that cancer survivors report being hesitant about having more children because of fear of reoccurrence and concerns about a child growing up without a mother (35).

Critical gaps

While fertility and reproductive health among cancer survivors has received more attention over the past decade, significant gaps in the literature exist. Many studies on fertility focus on women with breast cancer, likely because it is the most common cancer in reproductive-aged women. Also, there are many networks for breast cancer survivors that raise awareness and may motivate survivors to participate in studies. However, by only looking at young women diagnosed with breast cancer, we are missing a portion of our target population. Additionally, many of these studies do not include women without cancer for comparison.

Of the studies investigating feelings around reproduction and desire for children in cancer survivors, the studies are either large studies, such as the registry studies, that do not gather much detail as to why women are not meeting their reproductive goals or qualitative studies that are detailed about individual feelings but do not have samples sizes large enough for sub-group analyses. Finally, there is a significant lack of diversity in sample populations. In all the studies on this topic, the samples were predominantly white (4, 23, 25, 30, 32).

This thesis will address these gaps by examining feelings around reproduction, importance of biologic children, comfort with assisted reproductive technology (ART) and adoption, and desire for children in a large sample of women using a standardized set of questions, allowing for quantitative data analysis. Furthermore, our study includes a larger proportion of black women than previous studies and women diagnosed with many different types of cancer not limited to breast cancer. Thus, our study results may be more generalizable than prior studies.

Chapter II: Reproductive Expectations in Female Young Adult Cancer Survivors

Introduction

Currently, the five-year cancer survival rate among young adult women diagnosed with any cancer is approximately 86% though this varies by the type of cancer (7). As more women are surviving cancer, there has been an increased focus on the long-term effects of cancer and its treatments, such as the effects on fertility. The gonadotoxic drugs used to treat cancer may result in subfertility or infertility in women diagnosed with cancer making it harder for these women to meet their reproductive goals (1, 2). Furthermore, the years that women are fighting cancer may negatively impact the window in which they are able to have children. Studies of cancer survivors have found that women who were unable to have a child reported lower quality of life and lower physical well-being (28, 29). Inability to achieve reproductive goals is especially of concern to young women who are still looking to start or expand their family at the time of their diagnosis (2).

Previous registry-based studies in Scandinavian countries show that female pediatric, adolescent, and young adult cancer survivors are less likely to give birth compared to the general population (11-14). Further, prior research suggests that fertility concerns among cancer survivors are associated with fewer prior pregnancies, younger age at diagnosis, and being treated with chemotherapy (23, 25, 32). Most of the prior research has focused on infertility, but infertility is not the only factor that affects women's reproductive plans. There has been limited, primarily qualitative research on the reproductive goals of cancer survivors.

The primary objective of this study was to investigate feelings around reproduction of female survivors of young adult cancers and understand how these feelings differ from women who are not cancer survivors. The secondary objective of this study is to explore how certain characteristics predict feelings about reproductive goals in a population-based study of female survivors of young adult cancers.

Methods

Study Population

For this study we used data from the Furthering Understanding of Cancer, Health, and Survivorship in Adult (FUCHSIA) Women's study, a population-based study examining the effect of cancer treatment on future fertility in reproductive-aged women. Women were eligible to participate in the FUCHSIA Women's Study if they were between the ages of 22 and 45, had been diagnosed with a reportable malignant cancer (36) or ductal carcinoma in situ between 1990 and 2009 and were at least two years post diagnosis at enrollment. Eligible women were identified and contacted by the Georgia Cancer Registry and interested women were invited to participate in a detailed telephone interview covering their reproductive histories and their desire for children (37).

Women without a history of cancer were recruited for comparison using a commercial list. The comparison women were frequency-matched to the cancer survivors on age and location of residence in the state of Georgia. Women who had a hysterectomy were excluded from the main analyses because they were no longer able to get pregnant and therefore, were asked different questions about their feelings around reproduction. The Institutional Review Boards of Emory University and the Georgia Department of Public Health approved this study.

Our outcomes are defined based on how women answered questions about their feelings about reproduction (Table 1). The questions asked about importance of future biologic children, satisfaction of life if unable to have children, and comfort with adoption and ART. Participants identified whether they strongly agreed, agreed, neither agreed nor disagreed, disagreed, or strongly agreed. For our regression models, we dichotomized our outcomes into important versus not important, which included neither important nor unimportant, somewhat unimportant, and very unimportant or agreement versus non-agreement, which included neither agree nor disagree, disagree, and strongly disagree depending on the question.

As part of the interview, women were asked about factors that were thought to influence the relationship between cancer survivorship and reproductive feelings including age, race, income, marital status, education, health insurance, BMI, parity, age at first pregnancy, number of children women wanted to raise and if they raised any children to whom they were not biologically related. We also determined whether women had met their reproductive goals by comparing the number of children women reported that they currently wanted to the number of children the women had given birth to at the time of the interview.

Statistical Analysis

We examined descriptive statistics for the study population stratified by whether they were a survivor of cancer or in the reference group. For our primary analysis, we fit separate logistic models for each reproductive question to determine whether cancer survivors were more or less likely to agree with the questions about reproduction compared with the cancer-free women. We further stratified these models on parity.

To address our secondary objective, we fit separate logistic regression models for the cancer survivor group and for the reference group. We estimated the unadjusted association between factors associated with reproduction, such as age at first pregnancy, previous pregnancies and having fewer children than desired, and agreement with each of the questions in Table 1. We identified the factors that we thought could be associated with reproductive feelings through a review of the literature. We only present unadjusted models to improve interpretation of the results (38). SAS 9.4 was used for all statistical analyses.

Results

A total of 979 cancer survivor and 992 women without cancer were included in our analysis. Women who had a hysterectomy (n=384) prior to completing the interview were excluded from the main analyses although we provide data on these women in the appendix (see below).

Characteristics of the women included in the main analyses stratified by whether they were a cancer survivor or not are shown in Table 2. The mean age at time of interview was 37 in both groups. Cancer survivors and our reference group were similar in age at first pregnancy, race and education. Cancer survivors were more likely to report not being in a relationship at the time of the interview and having an annual income less than $50,000 but more likely to have some form of health insurance. The mean number of children birthed among cancer survivors was 1.3 which was less than the mean number of children among the comparison group which was 1.8. Among cancer survivors, 32.7% reported having no children at the time of the interview compared with 20.6% in the reference group. Similarly, cancer survivors were less likely to have 3 or 4 children

compared to the reference population, and there was a higher proportion of women in our reference group who desired 3 and 4 children compared to our cancer survivor group both at age 20 years and at the time of the interview. More cancer survivors reported raising non-biologic children compared to our reference group.

Appendix Table 1 provides detailed responses to questions about feelings around reproduction for the cancer survivors and comparison women, and Table 3 presents the results from the logistic regression models for the association between survivorship and feelings about reproduction. Having biologic children was important to most women regardless of survivorship status (Appendix Table 1). Among parous women, survivors were more likely to want another child (OR 1.33, 95% CI 1.05, 1.67). Furthermore, among parous women, survivors were more likely to be comfortable with ART (OR 1.20 95% CI 0.94, 1.53). However, among nulliparous women, survivors were less likely to be comfortable with ART than the reference group (OR 0.80, 95% CI 0.55, 1.16). Among nulliparous women, survivors were less likely to be comfortable with adoption compared to the reference group (OR 0.59 95% CI 0.38, 0.92).

Appendix Table 2 summarizes the feelings of cancer survivors and comparison women who raised non-biologic children. The results were similar to the feelings expressed in the whole sample. Despite already raising non-biologic children, over 80% of these survivors and comparison women indicated that they thought raising a biologic child was important. Further, these cancer survivors were more likely to want to have another biologic child than these comparison women.

Women who had hysterectomies were asked questions that were modified because the women were no longer able to have children. Cancer survivors with hysterectomies were

more likely indicate they would have liked to have had another child and that they were disappointed when they found out they could not have another child than comparison women with hysterectomies (Appendix Table 3). These cancer survivors were also more likely to indicate that they would be comfortable using ART.

Table 4 shows the association of reproductive feelings and desire for children, age, parity, and history of infertility stratified by survivorship. For most characteristics, results were similar for cancer survivors and comparison women.

Individuals who had fewer children than desired were less likely to indicate that having children who were related to them biologically was important, but they were more likely to report that they wanted to have another child and more likely to be disappointed if they could not get pregnant. They were also less likely to say they would be satisfied with their life in unable to have more children, regardless of whether they were in the survivor or comparison group.

Younger women were more likely to want more children at the time of interview and more likely to be disappointed if they could not get pregnant. Although the strength of the association between age and disappointment was generally similar for the cancer survivors and the cancer-free women, 42% of the cancer survivors in the reference age group (40-45) compared with 29% of the comparison women indicated they would be disappointed if they could not get pregnant. Younger women were more likely to state that they were comfortable with ART and adoption.

For both cancer survivors and comparison women, being parous was strongly associated with indicating that having biological children was important and being satisfied with life

if they were unable to have more children. Parous women were less likely to want another child, be disappointed if they could not become pregnant, be comfortable with ART, and be comfortable with adoption. The exception was cancer survivors with only one child, who were more likely than nulliparous cancer survivors to want another child (OR 1.2, 95% CI 0.8-1.8).

Discussion

Our results suggest that cancer survivors with children were more likely to report they wanted more children and would be disappointed if they could not get pregnant again. Nulliparous cancer survivors rated having biologic children more important than the comparison group and were less comfortable with adoption and using ART. When we looked at what characteristics predicted reproductive feelings, we found few differences between cancer survivors and cancer-free women. Women who had fewer children than desired were more likely to want a/another child and be disappointed if they could not get pregnant. However, they were also less likely to agree that having a biologic child was important and more likely to agree that they would be satisfied if they were unable to get pregnant. Further, younger women were more likely to want more children, be disappointed if they could not get pregnant, and be more comfortable with adoption and ART. Parous women were more likely to value the importance of having biologic children and less likely to agree that they would be comfortable with adoption.

Multiple qualitative studies have reported that cancer survivors are interested in having children after treatment and are happy when they have children (33, 34). Our results support this finding as we found that cancer survivors were more likely to report they wanted more children at the time of the interview than the comparison group. Lee et al

found that women who did not have children at the time of treatment were more likely to prioritize fertility over survival (35). We found that women with fewer children than desired were less likely to report they would be satisfied with life if unable to have children. Both findings suggest that women may be concerned with their quality-of-life following treatment if they have not met their desired family size. Our findings that younger women and women with fewer children were more likely to want more children and more likely to be disappointed if they were unable to get pregnant supports existing literature that suggests that fertility concern among cancer survivors, as well as desire to have children, is associated with fewer prior pregnancies, younger age at diagnosis (23, 25, 32).

A strength of our study is that cancer survivors were identified from the Georgia Cancer Registry, which includes all incident cases of cancer in Georgia. Thus, our study is population-based (37). Further, our study is larger than the prior qualitative studies evaluating the reproductive feelings of cancer survivors. Another strength is that we were able to include survivors diagnosed with many different types of cancer. We were also able to compare the cancer survivors to a large group of comparison women without a history of cancer. Using a standardized set of questions allowed us to quantitatively compare cancer survivors to comparison women. We also measured the number of children participants desired, which is distinctive because it allows us to identify women who already have children but desire a larger family and well as women who are involuntarily childless.

This study also has several limitations. One limitation is the possibility of measurement error. As with any interview, there is a possibility that our questions are not adequately

measuring the feelings we are attempting to capture because of how we are asking the questions. It is possible that women might give the same response to a given question for different reasons. Another limitation of this study is the temporality of the data as we are capturing individual women's feelings at arbitrarily different points in time, so we are not comparing women at the same time from their diagnosis or at the same time in their reproductive window. Women who are currently concerned about reproduction may meet their goals later on and women who are not currently concerned may struggle to meet their reproductive goals in the future. Furthermore, we are unable to assess how women's feelings about reproduction are changing over time. There is also a possibility that we did not identify and collect data on factors that might add value to our analyses.

Our results suggest that many cancer survivors still want children after treatment, even if they already have children. We found that parous cancer survivors were more likely than parous comparison women to want another child and be disappointed if they were unable to become pregnant. In a study using the same cohort of women, Chin et al found that women who already had children were less likely to receive fertility counseling prior to the cancer diagnosis (24). While a healthcare provider may not see the patient's fertility as a priority because she already has children, it is clear that these women still may want to expand their family. Thus, our results provide support for the importance of providing fertility counseling services for cancer survivors regardless of age and whether women already have children as they may not have reached their desired family size at the time of diagnosis.

Tables

Table 1: FUCHSIA Questions about Reproductive Feelings

Questions	Response Choices
1. When you were 20, how important was it that you have children that were related to you biologically at some point?	Very important Somewhat important Neither important nor unimportant Somewhat unimportant Very unimportant
2. Currently, how important to you is it that you have at least one child that is related to you biologically? That child can be one you already have or one you want to have in the future.	
3. I want to have a biologic child or another biologic child	Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree
4. I would be disappointed if I found out I could not get pregnant or get pregnant again	
5. I would be comfortable with the idea of using assisted reproductive technology, such as in vitro fertilization or artificial insemination, to help me get pregnant	
6. I would be comfortable with the idea of adopting a child	
7. I will be satisfied with my life if I am unable to have children or more children	

Table 2. Demographics Table

	Cancer Survivors N=979	Comparison Women N=992
Demographics		
Age	37.2 (4.8)	37.6 (5.0)
22-29	76 (7.8)	71 (7.2)
30-34	204 (20.8)	149 (15.0)
35-40	351 (35.9)	393 (39.6)
40-45	348 (35.6)	379 (38.2)
Race		
White	674 (68.9)	653(65.8)
Black	249 (25.4)	288 (29.0)
Asian	13 (1.3)	12 (1.2)
Other	36 (3.6)	33 (3.2)
Missing	7	7
Marital Status		
Married/Living with Partner	684 (69.9)	759 (76.5)
Committed Relationship	61 (6.2)	54 (5.4)
Single	222 (22.7)	177 (17.8)
Other	10 (1.0)	1 (0.1)
Missing	2	1
Education		
High School	63 (6.4)	46 (4.6)
Some College	237 (24.2)	231 (23.3)
College Graduate	364 (37.2)	364 (36.7)
Some Graduate School	314 (32.1)	350 (35.3)
Missing	1	1
Health Insurance		
Employer	456 (46.6)	408 (41.1)
Parents	297 (30.3)	389 (39.2)
Public	86 (8.8)	29 (2.9)
Self-Insured	54 (5.5)	60 (6.1)
None	86 (8.8)	104 (10.5)
Missing	2	2
Income		
Less than $50K	324 (33.4)	269 (27.5)
Greater than $50K	647 (66.6)	709 (72.5)
Missing	8	14
BMI		
Underweight	13 (1.3)	20 (2.0)
Normal	465 (47.7)	411 (41.6)
Overweight	254 (26.1)	283 (28.7)
Obese	242 (24.9)	273 (27.6)
Missing	5	5
Reproductive History		
Parity		
0	320 (32.7)	204 (20.6)
1	225 (23.0)	177 (17.9)
2	284 (29.0)	365 (36.8)

3	109 (11.1)	172 (17.4)
4+	41 (4.2)	73 (7.4)
Missing	0	1
Age at first pregnancy		
<22	229 (31.5)	259 (31.5)
22-29	321 (44.1)	376 (45.7)
30-34	146 (20.1)	155 (18.8)
35-40	27 (3.7)	28 (3.4)
40-45	5 (0.7)	5 (0.6)
Nulliparous at interview	250	168
Missing	1	1
How many children would you ideally like to raise?		
0	65 (6.9)	41 (4.1)
1	97 (10.2)	90 (9.1)
2	427 (45.1)	414 (41.8)
3	214 (22.6)	256 (25.8)
4+	144 (15.2)	190 (19.2)
Missing	32	31
How many children did you want to raise at 20?		
0	177 (19.2)	152 (16.4)
1	54 (5.9)	59 (6.4)
2	336 (36.5)	313 (33.7)
3	187 (20.3)	190 (20.5)
4+	167 (18.1)	215 (23.1)
Missing	58	63
Raised non-biologic children		
Yes	95 (14.4)	87 (11.0)
No	563 (85.6)	701 (89.0)
Did not raise a child	320	204

Table 3. Association of Survivorship with Reproductive Feelings

Question	Nulliparous				Parous			
	Survivor	Comparison Women	OR	95% CI	Survivor	Comparison Women	OR	95% CI
Importance of biologic children								
Important	157	93	1.17	(0.82, 1.67)	579	700	0.89	(0.64, 1.24)
Not important	160	111	1		76	82		
Want a(nother) biologic child								
Agree	158	118	1.02	(0.70, 1.48)	210	256	1.33	(1.05, 1.67)
Not agree	104	79	1		310	501		
Disappointed if could not get pregnant								
Agree	156	117	0.99	(0.68, 1.45)	168	223	1.15	(0.90, 1.46)
Not agree	106	79	1		351	535		
Comfortable with ART								
Agree	118	99	0.80	(0.55, 1.16)	164	211	1.20	(0.94, 1.53)
Not agree	142	95	1		352	544		
Comfortable with adopting								
Agree	184	157	0.59	(0.38, 0.92)	324	476	0.99	(0.79, 1.25)
Not agree	77	39	1		193	193		
Satisfied with my life if unable to have (more) children								
Agree	175	131	1.00	(0.68, 1.48)	454	656	1.09	(0.78, 1.52)
Not agree	88	66	1		65	102		

Table 4. Association of Reproductive Feelings with Reproductive Characteristics Stratified by Survivorship

	Cancer Survivor			Comparison Women		
	Important/ Agree	Not important/ Not Agree	OR (95% CI)	Important/ Agree	Not important/ Not agree	OR (95% CI)
Importance of biologic children						
Fewer children than desired						
Yes	408	91	0.8 (0.6, 1.1)	325	106	0.6 (0.4, 0.8)
No	325	138	1	465	85	1
Age						
22-29	58	18	1.1 (0.6, 2.0)	60	11	1.6 (0.8, 3.3)
30-35	160	44	1.3 (0.8, 1.9)	118	31	1.1 (0.7, 1.8)
35-40	266	81	1.1 (0.8, 1.6)	328	64	1.5 (1.1, 2.2)
40-45	234	81	1	253	76	1
Parity						
0	157	160	1	93	111	1
1	198	27	7.5 (4.7, 11.8)	162	14	13.8 (7.5, 25.4)
2	249	33	7.7 (5.0, 11.8)	319	45	8.5 (5.6, 12.8)
3	97	10	9.9 (5.0, 19.6)	154	16	11.5 (6.4, 20.6)
4+	35	6	6.0 (2.4, 14.5)	64	7	10.9 (4.8, 25.0)
History of Infertility						
Yes	272	62	1.3 (0.9, 1.8)	274	73	1.0 (0.7, 1.4)
No	497	114		442	150	
Want a(nother) biologic child						
Fewer children than desired						
Yes	316	118	12.1 (8.9, 16.6)	287	127	15.9 (11.0, 22.9)
No	49	290	1	84	450	1
Age						
22-29	50	15	7.9 (4.2, 15.0)	59	10	20.1 (9.8, 41.3)
30-35	116	57	4.8 (3.2, 7.3)	94	54	5.9 (3.9, 9.1)
35-40	128	158	1.9 (1.3, 2.8)	144	239	2.1 (1.5, 2.9)
40-45	71	168	1	71	242	1
Parity						
0	158	104	1	118	79	1
1	105	57	1.2 (0.8, 1.8)	93	81	0.8 (0.5, 1.2)
2	73	160	0.3 (0.2, 0.4)	102	249	0.3 (0.2, 0.4)
3	23	67	0.2 (0.1, 0.4)	40	122	0.2 (0.1, 0.4)
4+	9	26	0.2 (0.1, 0.5)	21	48	0.3 (0.2, 0.5)
History of Infertility						
Yes	132	184	1.3 (1.0, 1.8)	137	131	1.2 (0.9, 1.6)
No	220	379		214	273	
Disappointed if could not get pregnant						
Fewer children than desired						
Yes	271	162	9.9 (6.9, 14.2)	244	170	6.7 (5.0, 9.1)
No	49	290	1	94	441	1
Age						
22-29	51	14	11.3 (5.8, 21.9)	54	15	12.0 (6.4, 22.5)
30-35	106	67	4.9 (3.2, 7.5)	87	60	4.8 (3.2, 7.4)
35-40	104	182	1.8 (1.2, 2.6)	118	267	1.5 (1.1, 2.1)
40-45	58	180	1	72	240	1
Parity						
0	156	106	1	117	79	1
1	82	80	0.7 (0.5, 1.0)	77	97	0.5 (0.4, 0.8)

2	56	177	0.2 (0.2, 0.3)	93	257	0.2 (0.2, 0.4)
3	19	70	0.2 (0.1, 0.3)	38	126	0.2 (0.1, 0.3)
4+	11	24	0.3 (0.2, 0.7)	15	54	0.2 (0.1, 0.4)
History of Infertility						
Yes	107	208	1.2 (0.9, 1.7)	118	150	1.0 (0.7, 1.3)
No	211	390		190	296	
Comfortable with ART						
Fewer children than desired						
Yes	193	237	2.5 (1.8, 3.4)	173	238	2.2 (1.6, 2.9)
No	84	253	1	134	399	1
Age						
22-29	30	35	2.6 (1.5, 4.7)	37	32	3.4 (2.0, 5.7)
30-35	76	97	2.4 (1.6, 3.7)	63	82	2.2 (1.5, 3.4)
35-40	110	173	2.0 (1.3, 2.9)	122	260	1.4 (1.0, 1.9)
40-45	58	178	1	80	232	1
Parity						
0	118	142	1	99	95	1
1	66	96	0.8 (0.6, 1.2)	51	122	0.4 (0.3, 0.6)
2	66	165	0.5 (0.3, 0.7)	98	251	0.4 (0.3, 0.5)
3	24	64	0.5 (0.3, 0.8)	44	119	0.4 (0.2, 0.6)
4+	8	27	0.4 (0.2, 0.8)	18	51	0.3 (0.2, 0.6)
History of Infertility						
Yes	104	210	0.8 (0.6, 1.1)	88	176	1.1 (0.8, 1.4)
No	192	406		183	302	
Comfortable with adopting						
Fewer children than desired						
Yes	318	115	2.4 (1.7, 3.2)	324	89	2.7 (2.0, 3.6)
No	181	154	1	306	229	1
Age						
22-29	49	16	2.4 (1.3, 4.5)	50	19	1.5 (0.8, 2.6)
30-35	124	48	2.0 (1.3, 3.1)	110	37	1.6 (1.1, 2.6)
35-40	192	94	1.6 (1.1, 2.3)	250	134	1.0 (0.8, 1.4)
40-45	132	104	1	201	111	1
Parity						
0	184	77	1	157	39	1
1	111	50	0.9 (0.6, 1.4)	108	66	0.4 (0.3, 0.7)
2	142	90	0.7 (0.5, 1.0)	221	129	0.4 (0.3, 0.6)
3	55	34	0.7 (0.4, 1.1)	96	68	0.4 (0.2, 0.6)
4+	16	19	0.4 (0.2, 0.7)	50	18	0.7 (0.4, 1.3)
History of Infertility						
Yes	212	104	0.9 (0.7, 1.2)	171	97	1.05 (0.8, 1.4)
No	396	203		321	162	
Satisfied with my life if unable to have (more) children						
Fewer children than desired						
Yes	311	123	0.3 (0.2, 0.4)	301	112	0.3 (0.2, 0.4)
No	308	30	1	481	55	1
Age						
22-29	37	28	0.2 (0.1, 0.4)	42	27	0.2 (0.1, 0.4)
30-35	130	43	0.5 (0.3, 0.9)	114	33	0.5 (0.3, 0.8)
35-40	242	44	1.0 (0.6, 1.6)	323	62	0.7 (0.5, 1.1)
40-45	203	36	1	274	39	1
Parity						
0	175	88	1	131	66	1
1	134	28	2.4 (1.5, 3.9)	153	21	3.7 (2.1, 6.3)
2	211	22	4.8 (2.9, 8.0)	301	49	3.1 (2.0, 4.7)

3	80	10	4.0 (2.0, 8.2)	141	23	3.1 (1.8, 5.3)
4+	29	5	2.9 (1.1, 7.8)	60	9	3.4 (1.6, 7.2)
History of Infertility						
Yes	268	48	1.2 (0.8, 1.7)	223	46	1.2 (0.8, 1.7)
No	494	106	1	392	94	1

APPENDIX

Appendix Table 1. Reproductive Feelings in Cancer Survivors

	Nulliparous		Parous	
	Cancer Survivors	Comparison Women	Cancer Survivors	Comparison Women
Importance of biological children at 20				
Important	192 (60.19)	127 (62.3)	498 (76.0)	623 (79.4)
Neither important nor unimportant	49 (15.4)	28 (13.7)	74 (11.3)	70 (8.9)
Unimportant	78 (24.5)	49 (24.0)	83 (12.7)	92 (11.7)
Missing	1	0	4	3
Importance of biologic children				
Important	157 (49.5)	93 (45.6)	579 (88.4)	700 (89.5)
Neither important nor unimportant	34 (10.7)	32(15.7)	37 (5.7)	46 (5.9)
Unimportant	126 (39.8)	79 (38.7)	39 (6.0)	36 (4.6)
Missing	3	0	4	6
Want a(nother) biologic child				
Agree	158 (60.3)	118 (59.9)	210 (40.4)	256 (33.8)
Neither Agree nor Disagree	32 (12.2)	31 (15.7)	41 (7.9)	81 (10.7)
Disagree	72 (27.5)	48 (24.4)	269 (51.7)	420 (55.5)
Missing	58	7	139	31
Disappointed if could not get pregnant				
Agree	156 (59.5)	117 (59.7)	168 (32.4)	223 (29.4)
Neither Agree nor Disagree	17 (6.5)	25 (12.8)	64 (12.3)	76 (10.0)
Disagree	89 (34.0)	54 (27.6)	287 (55.3)	459 (60.6)
Missing	58	8	140	30
Comfortable with ART				
Agree	118 (45.4)	99 (51.0)	164 (31.8)	211 (28.0)
Neither Agree nor Disagree	27 (10.4)	31 (16.0)	42 (8.1)	75 (9.9)
Disagree	115 (44.2)	64 (33.0)	310 (60.1)	469 (62.1)
Missing	60	10	143	33
Comfortable with adopting				
Agree	184 (70.5)	157 (80.1)	324 (62.7)	476 (62.9)
Neither Agree nor Disagree	33 (12.6)	18 (9.2)	66 (12.8)	110 (14.5)
Disagree	44 (16.9)	21 (10.7)	127 (24.6)	171 (22.6)
Missing	59	8	142	31
Satisfied with my life if unable to have (more) children				
Agree	175 (66.5)	131 (66.5)	454 (87.5)	656 (86.5)
Neither Agree nor Disagree	23 (8.8)	23 (11.7)	19 (3.7)	26 (3.4)
Disagree	65 (24.7)	43 (21.8)	46 (8.9)	76 (10.0)
Missing	57	7	140	30

Appendix Table 2. Reproductive Feelings of women who have raised non-biologic children

	Cancer Survivor	Comparison Women
Importance of biological children at 20		
Important	63 (66.3)	70 (80.5)
Neither Important nor unimportant	16 (16.8)	8 (9.2)
Unimportant	16 (16.8)	9 (10.3)
Importance of biologic children		
Important	129 (86.6)	80 (80.8)
Neither important nor unimportant	10 (6.7)	9 (9.1)
Unimportant	10 (6.7)	10 (10.1)
Want a(nother) biologic child		
Agree	35 (48.6)	28 (35.0)
Neither Agree nor Disagree	7 (9.7)	8 (10.0)
Disagree	30 (41.7)	44 (55.0)
Disappointed if could not get pregnant		
Agree	28 (38.9)	20 (25.0)
Neither Agree nor Disagree	12 (16.7)	8 (10.0)
Disagree	32 (44.4)	52 (65.0)
Comfortable with ART		
Agree	28 (39.4)	23 (29.1)
Neither Agree nor Disagree	8 (11.3)	7 (8.9)
Disagree	35 (49.3)	49 (62.0)
Comfortable with adopting		
Agree	53 (73.6)	55 (69.6)
Neither Agree nor Disagree	6 (8.3)	7 (8.9)
Disagree	13 (18.1)	17 (21.5)
Satisfied with my life if unable to have (more) children		
Agree	59 (81.9)	69 (86.3)
Neither Agree nor Disagree	3 (4.2)	5 (6.3)
Disagree	10 (13.9)	6 (7.5)

Appendix Table 3. Reproductive Feelings in Women who have had a hysterectomy

	Cancer Survivor	Comparison Women
Importance of biological children at 20		
Important	225 (75.3)	65 (81.3)
Neither Important nor unimportant	27 (9.0)	7 (8.8)
Unimportant	47 (15.7)	8 (10.0)
Importance of biologic children		
Important	220 (73.3)	59 (73.8)
Neither important nor unimportant	23 (7.7)	5 (6.3)
Unimportant	57 (19.0)	16 (20.0)
Had circumstances allowed, I would have liked to have a biologic child or another biological child		
Agree	322 (65.2)	67 (57.8)
Neither Agree nor Disagree	31 (6.3)	6 (5.2)
Disagree	141 (28.5)	43 (37.1)
I was disappointed when I found out I could not get pregnant or get pregnant again		
Agree	251 (51.9)	51 (45.9)
Neither Agree nor Disagree	52 (10.7)	13 (11.7)
Disagree	181 (37.4)	47 (42.3)
I would have been comfortable with the idea of using ART to help me get pregnant		
Agree	220 (44.35)	41 (36.0)
Neither Agree nor Disagree	50 (10.1)	14 (12.3)
Disagree	226 (45.6)	59 (51.8)
I would have been comfortable with the idea of adopting a child		
Agree	440 (88.5)	103 (90.4)
Neither Agree nor Disagree	10 (2.0)	3 (2.6)
Disagree	47 (9.5)	8 (7.0)

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