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# Decision regret among women considering planned oocyte cryopreservation: a prospective cohort study

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## Abstract

**Purpose** To (1) prospectively characterize the incidence of decision regret among women considering planned oocyte cryopreservation (planned OC), comparing those who pursued treatment vs those who did not freeze eggs, and (2) to identify baseline predictors for future decision regret.

**Methods** A total of 173 women seen in consultation for planned OC were followed prospectively. Surveys were administered at (1) baseline (< 1 week after initial consultation) and (2) follow-up, 6 months after planned OC among participants who froze eggs or 6 months following consultation in the absence of further communication to pursue treatment. The primary outcome was the incidence of moderate-to-severe decision regret, indicated by a Decision Regret Scale score > 25. We also examined predictors of regret.

**Results** The incidence of moderate-to-severe regret over the decision to freeze eggs was 9% compared to 51% over the decision not to pursue treatment. Among women who froze eggs, adequacy of information at baseline to decide about treatment (aOR 0.16, 95% CI 0.03, 0.87) and emphasis on future parenthood (aOR 0.80, 95% CI 0.66, 0.99) were associated with reduced odds of regret. Forty-six percent of women who froze eggs regretted not doing so earlier. Among women who did not freeze eggs, the primary reasons were financial and time constraints, correlating with increased odds of decision regret in an exploratory analysis.

**Conclusions** Among women undergoing planned OC, the incidence of decision regret is low compared to the regret confronting women seen in consultation for planned OC but who do not pursue treatment. Provider counseling is key to offset the regret risk.

**Keywords** Planned oocyte cryopreservation · Oocyte freezing · Fertility preservation · Decision regret

## Introduction

There is a widening chasm between societal trends and biological realities with regard to fertility as women progressively delay the age of childbearing [1, 2]. To bridge this gap, planned oocyte cryopreservation (planned OC) is one tool increasingly used to mitigate the risk of future age-related decline in fertility [3–6]; nearly 17,000 oocyte banking cycles occurred in 2020 [7]. Indeed, planned OC is now recognized by the American Society for Reproductive Medicine (ASRM) as “an ethically permissible medical treatment that may enhance women’s reproductive autonomy and promote social equality” [3].

As the use of oocyte cryopreservation for the indication of age-related infertility prophylaxis [8] increases, ASRM encourages ongoing research to “shed light on how best

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to offer and use planned OC” [3]. In predominantly cross-sectional survey and qualitative interview studies, authors have examined the sociodemographic characteristics, motivations, and emotional responses of individuals pursuing planned OC [9–14], the information sources upon which they rely [14–18], and the disposition outcomes of frozen eggs [15, 18–22]. In the longest follow-up studies to date, less than half of women who underwent planned OC ultimately returned to use their frozen eggs [22–24].

A better understanding of patient characteristics and perspectives may inform provider counseling and facilitate an evidence-based approach to decision-making for individuals considering planned OC [22]. One unique feature of planned OC is that most patients are expected to never use their frozen oocytes [22]. In the absence of medical outcomes such as live birth rates per frozen oocyte, patients’ appraisal of their experience undergoing planned OC and other patient-centered outcomes may be the primary means with which to assess the impact of this medical intervention.

Decision regret is one patient-centered outcome reflecting distress or remorse following a decision [25]. Increasing emphasis is now being placed on decision regret as a health-care quality indicator and an important outcome in its own right [26]. The decision to pursue planned OC is complex [27, 28], imposing the potential risk of decision regret.

There is an emerging literature on decision regret following a planned OC. In a prior retrospective cohort study of women undertaking planned OC ( $N=201$ ), we revealed a non-negligible prevalence of decision regret following the procedure [29]. We found that one in six planned OC patients experienced moderate-to-severe decision regret when queried after a mean follow-up time of 2 years; a 16% prevalence was later echoed in a Turkish cohort [30].

The research to date that includes decision regret as an outcome has comprised exclusively of cross-sectional survey studies [15, 20, 21, 29, 30], limiting the ability to identify informative predictors of future regret. A prospective study design could facilitate a better understanding of which baseline characteristics and perspectives, identified prior to undergoing OC, might forecast a high risk for decision regret. Additionally, a prospective study could allow a comparison of regret among women who decide to pursue planned OC vs those who do not, to better contextualize the incidence of decision regret among the larger cohort of individuals considering planned OC.

Accordingly, we undertook the current study to rigorously characterize the risk of decision regret for those considering planned OC using a prospective design. Our objectives were [1] to prospectively identify baseline characteristics that forebode risk for decision regret among individuals considering planned OC and [2] to compare the risk for decision regret in women who decided to undergo planned OC relative to those who did not.

## Materials and methods

### Design

We conducted a prospective cohort study of women seen in consultation for planned oocyte cryopreservation (planned OC) at the Center for Reproductive Health at the University of California, San Francisco. Institutional Review Board approval was obtained (#16–20,540), and participants provided written, informed consent. Eligible individuals were recruited between May 2018 and March 2020.

Within a week following the initial consultation with a physician to discuss planned OC, a baseline questionnaire was administered online via REDCap (Nashville, TN). Participants were then tracked prospectively and divided into two groups based on whether they underwent treatment for planned OC (“Freeze”) or did not pursue treatment (“No Freeze”). If a participant pursued planned OC and underwent egg retrieval, a follow-up questionnaire was distributed electronically 6 months after the egg retrieval procedure. For those individuals who enrolled in the study and completed the baseline questionnaire but did not ultimately move forward with treatment after 6 months had elapsed following the initial consultation, a follow-up (“No Freeze”) questionnaire with tailored content was administered.

### Participants

Eligibility assessment was performed via chart review. Individuals were eligible to participate in the study if the purpose of the physician consultation was to discuss planned OC during the study period. We defined planned OC as a procedure to freeze eggs for one’s own future use as a means of mitigating the risk of future age-related fertility decline. Only individuals who had not previously frozen eggs at our center or elsewhere were eligible for inclusion in the cohort. Individuals who pursued oocyte cryopreservation for the purposes of donation to another person, in the setting of transgender care, or prior to anticipated gonadotoxic treatment for a medical disease such as cancer were excluded. Participants initially seen in consultation for planned OC who then ultimately pursued treatment to conceive immediately (e.g., donor insemination) or to preserve fertility via embryo cryopreservation were also excluded from the research cohort.

### Questionnaires

#### Baseline questionnaire

The questionnaires (Supplemental material) included a composite of validated instruments and questions tailored

to the study objectives. A multidisciplinary panel of topic experts, including reproductive endocrinologists, a research-trained clinical psychologist, and clinical research personnel, developed the surveys. Beta testing of the questionnaires was further undertaken by clinical research staff and a sample of volunteer patients prior to distribution. Questions honed in on factors associated with decision regret in the initial retrospective study [29], as well as items uniquely designed to extend the preliminary findings via this prospective cohort strategy.

The baseline questionnaire, administered within a week after the initial physician consultation, examined the following domains: [1] sociodemographic factors, [2] mental health, [3] fertility concerns, [4] parenting attitudes, and [5] decision-making items.

Sociodemographic factors included relationship status, educational attainment, income, race/ethnicity, and sexual orientation. The mental health history section asked whether patients had ever talked to a doctor about depression or anxiety and whether they had previously or were currently taking medication for either condition. These questions were included based on our previous findings linking these items with the risk of psychological distress [31].

The parenting attitudes section included the following four items adapted from the validated Fertility Problem Inventory “Need for Parenthood” and “Rejection of Childfree Lifestyle” domains [32]: “I could see a number of advantages if I didn’t have a child,” “For me, being a parent is a more important goal than having a satisfying career,” “As long as I can remember, I’ve wanted to be a parent,” and “I could visualize a happy life without a child.” These items correlated with decision regret in the prior study [29]. A “Parenting attitudes score” was similarly calculated from the average of coded Likert scale responses, reversing the scoring for items oppositely worded; a higher score indicated a greater emphasis on the importance of being a parent. The fertility concerns section included the following four items: “I am afraid I won’t be able to have any children,” “I am worried about my ability to get pregnant,” “I am concerned that I may not be able to have children,” and “I am concerned that I may not be able to have the number of children I would like.” A “Fertility concern score” was generated as the numeric average of the coded Likert scale responses to these questions; a higher score indicated a greater degree of concern about fertility.

The decision-making items asked participants about their preparation to make a decision regarding whether or not to freeze eggs. They were also asked to anticipate potential future regret or disappointment in various future scenarios regarding their decision and the ultimate disposition of their eggs (for example, “consider a scenario where you freeze your eggs but never use them; please consider how you would feel”) (Supplemental material).

## Follow-up questionnaire

The follow-up questionnaire (Supplemental material) was administered after prospective tracking determined whether a participant fell into the freeze vs no freeze group. The questionnaire was distributed 6 months after egg retrieval for the freeze group or 6 months after the initial consultation for the no freeze group if there was no additional communication from the patient indicating an intention to pursue treatment. To determine how participants appraised their decision (to freeze or not to freeze their eggs), the follow-up questionnaire used the Decision Regret Scale (DRS) [25]. The DRS is a validated, 5-item Likert response scale developed by a group of decision scientists and healthcare providers. Validation of this scale has occurred in a variety of patient populations [26], and convergent validity with multiple measures (decisional conflict, satisfaction, and health outcomes) has been demonstrated [25]. The DRS scores range from 0 to 100 with the following cut-offs: 0, no regret; 1–25, mild regret; > 25, moderate to severe regret. We considered decision regret, the primary outcome, dichotomously using a cut-off of > 25 to indicate the presence of clinically meaningful decision regret, consistent with our prior study [29].

The follow-up questionnaire administered to the freeze group also included items to assess their experience with treatment as well as sentiments of satisfaction after having undergone the process. Participants were asked to anticipate possible regret or disappointment in two possible future scenarios: [1] never using the eggs and [2] returning to use the eggs but being unsuccessful in having a baby.

The follow-up questionnaire administered to the no freeze group, on the other hand, included items to assess reasons behind not pursuing treatment at this time (“Why didn’t you pursue egg freezing at this time? Check all that apply” and “What was the primary reason you did not pursue egg freezing at this time?”).

Both freeze and no freeze follow-up questionnaires queried changes in participants’ self-assessment of their fertility status prior to their initial consultation.

## Statistical analysis

Descriptive statistics were generated, and variables were tested for the normality of distributions. Categorical variables were compared between groups (freeze vs no freeze) using Fisher’s exact or chi-squared as appropriate. Continuous variables were compared using two-sided *t*-tests or Kruskal–Wallis non-parametric testing. Likert-type scale responses were coded from 1 to 5, to reflect “strongly disagree” to “strongly agree,” respectively. Descriptive data regarding the percentage of participants who agreed with a given statement encompassed those participants replying

“agree” or “strongly agree;” participants replying “strongly disagree,” “disagree,” or “neutral” were not included in the reported percentages of participants in the agreement.

The primary outcome, decision regret, encompassed moderate-to-severe regret consistent with our prior study [29]. The DRS scores were considered dichotomously, with scores > 25 indicating the presence of moderate-to-severe regret. Univariable logistic regression models ascertained factors associated with regret. Variables were selected a priori based on topic expertise and literature review. Due to the extremely strong magnitude of the effect of the group (freeze vs no freeze), stratified analyses were undertaken to investigate predictors of regret in each group considered separately.

To delineate the independent predictive value of covariates, multivariable logistic regression models were generated for each group (freeze vs no freeze), incorporating all factors meeting significance at the  $p < 0.20$  level in the univariable analyses. Assumptions of modeling were met before data interpretation. A correction for multiple comparisons was not performed. STATA v16.1 (College Station, TX) was the statistical analysis software used in this study. A  $p < 0.05$  was considered statistically significant.

## Results

Two hundred and six eligible women, ages 28–42 years, consented to participate in this prospective study. A total of 173 women completed the study (84%), of whom 133 (77%) froze their eggs and 40 (23%) did not. Thirty-three women were lost to follow-up (16%), 13 of whom froze eggs and 20 of whom did not (Supplemental Fig. 1).

The baseline sociodemographic factors of participants are included in Table 1. The average age of the complete study cohort (freeze plus no freeze groups) was 34.7 years old; the age range was 28–42. Most participants were single, and all participants had attained college degrees. Overall, 44% of participants had some degree of cost-sharing for egg-freezing expenses through an employer benefit. Eighty-four percent of participants made greater than \$100,000 annually (Table 1).

Baseline mental health parameters are listed in Table 1. At baseline, 37% of the complete cohort (freeze and no freeze) reported having talked to a doctor about depression; 49% of participants reported previously talking to a doctor about anxiety. One in four women (25%) reported previous use of medication for anxiety, while one in nine (11%) reported current use of anti-anxiety medications at baseline (Table 1).

We assessed baseline readiness to make a decision regarding egg freezing following the initial consultation. Eighty-seven percent of the cohort reported adequate information to

make a decision about whether to pursue planned OC (91% freeze vs 75% no freeze).

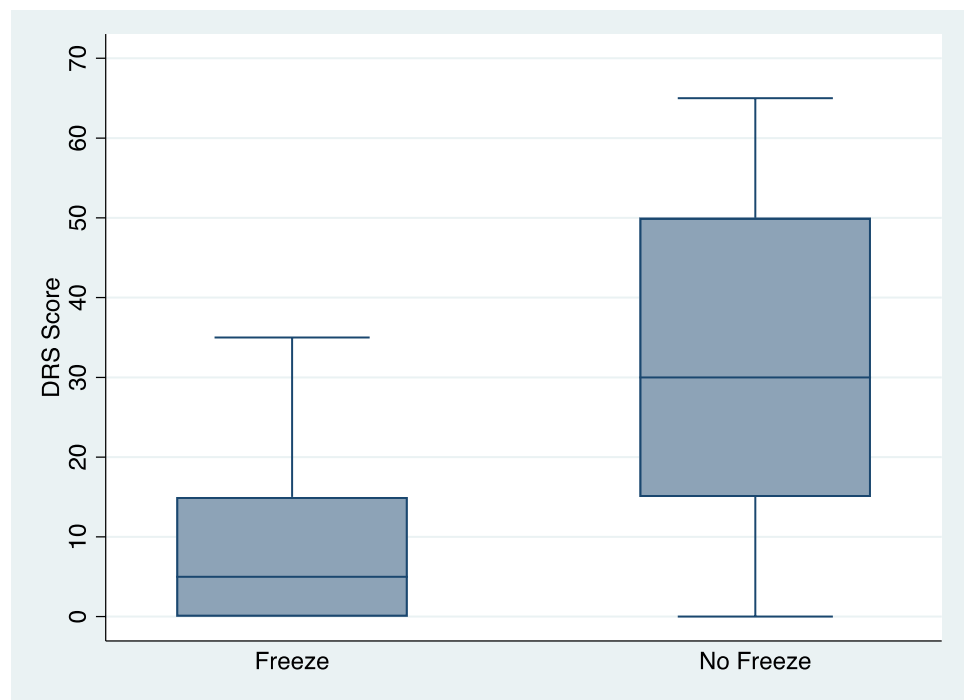
We examined three possible future scenarios to better understand how participants anticipated regret or disappointment depending on their decision and ultimate disposition of eggs. The majority of women at baseline (87%) anticipated that they would regret not freezing their eggs if they did not pursue this option (88% and 85%, freeze vs no freeze). In contrast, a minority of women (8%) anticipated regretting never using the eggs after having frozen them (7% and 13%, freeze vs no freeze). Lastly, the majority of women (90%) anticipated disappointment, but not regret, if they were to return in the future to use frozen eggs but be unsuccessful in having a baby.

The primary outcome, moderate-to-severe decision regret, was determined in the follow-up questionnaire, distributed 6 months after an egg retrieval (freeze) or 6 months after the initial consult in the absence of any communication indicating intent to proceed (no freeze). Decision regret over the decision to pursue planned OC (freeze) vs the decision not to pursue planned OC (no freeze) varied significantly between groups (Fig. 1). The incidence of moderate-to-severe regret was 51% among women who did not freeze eggs vs 9% among women who did freeze eggs ( $p < 0.01$ ). Meanwhile, no regret was experienced by 8% of women who did not freeze eggs vs 38% of those who did freeze eggs. The remainder experienced mild regret (41% and 53% for no freeze vs freeze, respectively). The median DRS score was 30 (indicative of moderate-to-severe regret) among the no freeze group vs 5 (indicative of mild regret) among the freeze group ( $p < 0.01$ ) (Fig. 1).

We examined which factors present at baseline were associated with moderate-to-severe decision regret at follow-up in a stratified analysis among women who did and did not freeze eggs. Among participants who froze their eggs (freeze group), those who reported adequate information to make a decision after their initial consultation (i.e., at baseline) had 78% reduced odds of decision regret (OR 0.22, 95% CI 0.05, 0.96,  $p = 0.04$ ) (Table 2). Another protective factor reducing the risk for decision regret was a higher baseline parenting concern score (i.e., the emphasis placed on the importance of being a parent) (OR 0.79, 95% CI 0.65, 0.96,  $p = 0.02$ ). Participants who reported disappointment with the outcome of their cycle at the study close had a trend toward increased odds of regret (OR 3.33, 95% CI 0.97, 11.43,  $p = 0.06$ ) (Table 2).

Among participants who did not freeze eggs (no freeze group), a trend was observed linking the baseline report of having previously talked to a physician about anxiety with the risk for decision regret (OR 3.33, 95% CI 0.86, 12.98,  $p = 0.08$ ) (Table 2); however, no predictive factors were identified at a statistically significant threshold.

**Fig. 1** Decision Regret Scale (DRS) scores among women considering planned OC by whether or not they pursued treatment



Freeze: Women who pursued planned OC (N=133)

No Freeze: Women who did not pursue planned OC (N=40)

$P < 0.01$  (Kruskal-Wallis)

Scale 0-100, 0: no regret, 1-25: mild regret, >25: moderate-to-severe regret.

Box plots display median and interquartile range (IQR)

Next, multivariable models were created to discern the independent impact of the various predictors of decision regret (Table 3) incorporating covariates associated with moderate-to-severe decision regret at the  $p < 0.20$  level. Among women who froze their eggs, acknowledging adequate information to make a choice about egg freezing at baseline (aOR 0.16, 95% CI 0.03, 0.87,  $p = 0.03$ ) and baseline parenting concern score (aOR 0.80, 95% CI 0.66, 0.99,  $p = 0.04$ ) retained independent predictive associations with decision regret (Table 3). In contrast, among women who did not freeze their eggs, no predictors remained associated at the  $p < 0.05$  level in the multivariable model.

Among the women who did not freeze their eggs, we asked for the primary reason they made this decision. The most common reasons for not pursuing planned OC were expense (28%), not having time (15%), and feeling unlikely to require eggs in the future (13%). Less common primary reasons for not freezing eggs included concerns about future success rates with the eggs, medical risks, and newly meeting a partner. In an exploratory analysis conducted to evaluate how the primary reason for not freezing eggs influenced decision regret risk, we found that those participants who decided not to freeze eggs primarily as a result of lacking money or time had fivefold increased odds of decision regret (OR 4.95, 95% CI 1.02, 24.10,  $p = 0.05$ ).

In addition to decision regret, we examined other attitudes at the follow-up to assess the broader landscape of patient-reported outcomes. Of note, among women who froze their eggs, 95% felt good about “having taken control of my future hope to have children,” 91% perceived “more options for planning a family,” 20% were disappointed with the outcome of their cycle, 19% of women who underwent planned OC felt “more anxious” about their future fertility, and 46% of women who undertook planned OC reported regret over not freezing eggs earlier in their lives.

## Discussion

In this prospective cohort study of women considering planned OC, the incidence of decision regret was much lower among those who ultimately pursued treatment vs those who did not. Moderate-to-severe decision regret impacted 9% of women who pursued treatment vs 51% of women who decided not to freeze their eggs.

The 9% prevalence of moderate-to-severe anxiety following planned OC is slightly lower than our prior (16%) [29], which may relate to differences in the study design

**Table 1** Participant sociodemographic and mental health characteristics at baseline

	Freeze ( <i>n</i> = 133) <i>N</i> (%)	No freeze ( <i>n</i> = 40) <i>N</i> (%)	All participants ( <i>n</i> = 173) <i>N</i> (%)
<b>Sociodemographics</b>			
Age, years	34.7 (2.5)	35.0 (2.7)	34.7 (2.6)
<b>Relationship status</b>			
Single	79 (59)	24 (60)	103 (60)
Significantly involved, not living together	27 (20)	7 (18)	34 (20)
Living with partner	22 (17)	8 (20)	30 (17)
Married	2 (2)	1 (3)	3 (2)
Separated	1 (1)	0 (0)	1 (1)
Divorced	2 (2)	0 (0)	2 (1)
<b>Education</b>			
College graduate	39 (29)	18 (45)	57 (33)
Graduate degree	94 (71)	22 (55)	116 (67)
<b>Income</b>			
< \$50,000	3 (2)	0 (0)	3 (2)
\$50,000–100,000	20 (15)	4 (10)	24 (14)
\$100,000–250,000	75 (57)	23 (58)	98 (57)
\$250,000–500,000	30 (23)	11 (28)	41 (24)
> \$500,000	3 (2)	1 (2)	4 (2)
Prefer not to state	2 (2)	1 (2)	3 (2)
<b>Race</b>			
White	60 (45)	26 (65)	86 (50)
African American or Black	2 (2)	1 (3)	3 (2)
Asian or Pacific Islander	50 (38)	7 (18)	57 (33)
Latin American or Hispanic	8 (6)	3 (8)	8 (6)
Middle Eastern	7 (5)	0 (0)	7 (4)
Multi-ethnic	5 (4)	2 (5)	7 (4)
Other	1 (1)	1 (3)	2 (1)
<b>Sexual orientation</b>			
Heterosexual	125 (95)	40 (100)	165 (96)
Lesbian	1 (1)	0	1 (1)
Bisexual	5 (4)	0	5 (3)
Prior pregnancy	9 (7)	6 (15)	15 (9)
Prior parity	1 (1)	0 (0)	1 (1)
Employment benefit	57 (45)	16 (43)	73 (45)
Time elapsed between baseline and follow-up questionnaire (months)	10.4 (3.9)	10.2 (5.1)	10.3 (3.9)
<b>Mental health parameters</b>			
Ever talked to a doctor about depression, Y/N	51 (38)	12 (32)	63 (37)
Ever taken a medication for depression, Y/N	25 (19)	7 (19)	32 (19)
Currently taking a medication for depression, Y/N	7 (5)	3 (8)	10 (6)
Ever talked to a doctor about anxiety, Y/N	61 (46)	22 (58)	83 (49)
Ever taken a medication for anxiety, Y/N	27 (20)	16 (42)	43 (25)
Currently taking a medication for anxiety	11 (8)	7 (18)	18 (11)

Some column percentages sum to > 100% due to rounding to the nearest integer

Please see Supplemental Table 1 for additional baseline participant characteristics

*N*, number (%) or mean (SD) as indicated; Y/N, yes/no

and follow-up interval. It is also possible that the counseling improved or the “intervention” of participating in

the study itself helped offset the risk for future regret by offering a mechanism for self-reflection as well as

**Table 2** Baseline predictors of decision regret—univariable logistic regression analyses

	Freeze		No freeze	
	OR (95% CI)	<i>p</i> -value	OR (95% CI)	<i>p</i> -value
Age at baseline	0.95 (0.75, 1.21)	0.69	1.12 (0.87, 1.44)	0.39
Work benefit		0.25		0.38
No	Ref			
Yes	0.50 (0.16, 1.61)		0.63 (0.23, 1.74)	
Agree on adequate info at baseline		0.04*		0.64
No	Ref			
Yes	0.22 (0.05, 0.96)		1.43 (0.32, 6.39)	
Agree on adequate emotional support at baseline		0.89		0.77
No	Ref			
Yes	1.13 (0.22, 5.55)		0.80 (0.18, 3.57)	
Predicted likelihood of using eggs, at baseline		0.84		0.33
< = 50%	Ref		Ref	
> 50%	1.61 (0.31, 8.50)		4.00 (0.64, 25.0)	
I have no idea	1.57 (0.27, 9.16)		2.00 (0.38, 10.6)	
Predicted likelihood of successfully having a baby with frozen eggs, at baseline		0.91		0.36
< = 50%	Ref		Ref	
> 50%	0.74 (0.19, 2.93)		2.57 (0.53, 12.4)	
I have no idea	0.82 (0.14, 4.84)		1.00 (0.17, 5.98)	
Fertility concern score at baseline	1.02 (0.86, 1.21)	0.80	1.17 (0.98, 1.40)	0.09*
Parenting concern score at baseline	0.79 (0.65, 0.96)	0.02*	1.13 (0.94, 1.34)	0.19*
Ever talked to an MD about anxiety		0.13*		0.08*
No	Ref		Ref	
Yes	2.62 (0.75, 9.16)		3.33 (0.86, 13.0)	
Ever took medications for anxiety		0.26		0.21
No	Ref		Ref	
Yes	2.11 (0.58, 7.61)		2.40 (0.61, 9.38)	
Taking medications for anxiety at baseline		1.00		0.32
No	Ref		Ref	
Yes	1.00 (0.12, 8.56)		2.50 (0.42, 15.0)	
Ever talked to an MD about depression		0.40		0.45
No	Ref		Ref	
Yes	1.67 (0.51, 5.48)		1.75 (0.42, 7.45)	
Ever took medications for depression		0.19*		0.36
No	Ref		Ref	
Yes	2.36 (0.65, 8.56)		2.33 (0.39, 14.0)	
Taking medications for depression at baseline		0.57		#
No	Ref			
Yes	1.90 (0.21, 17.4)		****	

Decision regret outcome variable was dichotomized with DRS questionnaire scores > 25 indicating the presence of regret

\*Variables with  $p < 0.20$  selected for the multivariable analyses

#Unable to calculate due to no concurrent depression medication use among those without regret

Please see Supplemental Table 1 for additional baseline participant characteristics

consideration of various future scenarios, allowing participants to make a more informed decision [33].

Other research to date examining decision regret as an outcome following planned OC has been exclusively



**Table 3** Predictors of decision regret at study close—multivariable logistic regression analyses

	Freeze		No freeze	
	aOR (95% CI)	<i>p</i> -value	aOR (95% CI)	<i>p</i> -value
Agree on adequate info at baseline		0.03	-	-
Disagree	Ref			
Agree	0.16 (0.03, 0.87)			
Ever took medications for depression		0.37	-	-
No	Ref			
Yes	2.17 (0.40, 11.8)			
Ever talked to an MD about anxiety		0.50		0.17
No	Ref			
Yes	1.66 (0.39, 7.14)		2.75 (0.66, 11.5)	
Parenting concern score at baseline	0.80 (0.66, 0.99)	0.04	1.02 (0.83, 1.26)	0.85
Fertility concern score at baseline	-	-	1.13 (0.92, 1.37)	0.24

Decision regret outcome variable was dichotomized with DRS questionnaire scores > 25 indicating the presence of regret

Models adjusted for variables meeting  $p < 0.20$  in univariable analysis

cross-sectional retrospective survey studies, reporting varying regret prevalences of 0% [34], 9% [20], 13% [15], and 16% [30]. Only the latter [30] and our prior work [29] used the validated 5-item Decision Regret Scale [25] rather than a single investigator–designed question and reported identical decision regret prevalences of 16%. This prospective cohort study extends this prior body of work and overall corroborates the impression that the minority of individuals who undergo planned OC ultimately regret this decision [22].

The addition of a “control” group of women who decided not to freeze eggs enables the contextualization of regret among women who underwent planned OC. While a 9% risk of moderate-to-severe regret after planned OC still underscores opportunities to improve the patient experience for those pursuing this treatment, we found a significantly higher rate of regret (51%) in individuals who decided not to freeze eggs following their initial consultation.

Our exploratory analysis suggested that the main drivers of regret among women who did not freeze eggs included a lack of time or money. These data highlight ongoing issues with access to fertility preservation services which limit reproductive options for most individuals. Indeed, in a standard IVF clinic, the out-of-pocket expense of egg freezing approaches \$15,000 per cycle, plus additional annual storage fees. Although our cohort included primarily women of high socioeconomic backgrounds, even some of these individuals reported financial access challenges. While this analysis is hypothesis-generating, there are data linking financial burden as the main driver of decision regret among a cohort of women who underwent planned OC in the UK [20]. As the expense of planned OC constrains options and may impact decision regret for individuals considering treatment (whether or not treatment is

ultimately pursued), continued advocacy efforts are critical for diversity, equity and inclusion, and expansion of access to these reproductive services.

Among individuals who pursued planned OC, a baseline acknowledgment of adequate information to make a decision about treatment following the initial physician consultation offset the risk of future decision regret. This provides an actionable opportunity for improving quality care. An assessment of the adequacy of counseling might be incorporated into the consenting procedure as a checkpoint to potentially mitigate future decision regret. Baseline attitudes emphasizing the value an individual places on future parenting (“parenting concern score” adapted from the validated Fertility Problem Inventory) also correlated with lower odds of future decision regret. As prospective planned OC patients deliberate whether or not to pursue treatment, some assessment of values about a future role as a parent may be helpful in their process.

Among individuals who did not pursue planned OC, a self-report of previously speaking with a physician about anxiety was suggested to possibly increase the risk for decision regret. Psychological literature suggests that anxiety can both (a) impair our decision-making processes and (b) predispose to repetitive reassessments of the decisions we do make. The relationship between anxiety and decision regret among individuals considering fertility preservation services should be examined more closely in future studies.

Because planned OC is undertaken as a preventative measure (colloquially “elective”) in the absence of current disease and it is anticipated that less than 50% of women are ultimately likely to return to use their eggs [23], patient-reported outcomes will ultimately be the most relevant and meaningful outcomes for many

who consider planned OC. Decision regret is one such patient-centered outcome. Another important consideration is satisfaction; in our study, 95% of women who pursued planned OC felt “good about having taken control of my future hope to have children,” and 91% perceived “more control over my reproductive future.” Such intangible psychological benefits should be considered in an appraisal of the impact of planned OC.

Notably, however, these sentiments were not universal. One in five women who froze eggs was disappointed by their cycle outcome; the same percent felt “more anxious about my future fertility.” Almost half (46%) of women regretted not freezing eggs earlier in life, a sentiment consistent with a prior qualitative study revealing a desire among individuals for earlier awareness of the planned OC option [27]. When asked at the conclusion of the study about self-perception of their “fertility” compared with before their initial consult, one in four felt “less fertile” at the end of the study (regardless of whether or not a planned OC was undertaken). Awareness of the potential impact of a fertility preservation consultation on anxiety and fertility self-appraisal, and the ramifications of these sentiments, may help providers improve patient-centered care. Involving colleagues with expertise in mental health may provide a more holistic patient experience. Finally, as the decision to pursue planned OC is complex and individualized [27, 28], rigorously validated decision aids [28] may supplement provider counseling in the future support of women considering this option.

Limitations of this study include its relatively limited follow-up time, with outcomes assessed 6 months after egg retrieval (or not pursuing treatment). Longer-term studies are needed to determine if and how these perspectives may evolve over time. Notably, our prior study reported a similar prevalence of decision regret as seen in this study among women, an average of 2 years from treatment [29] among women who froze their eggs. Given the live birth rate of 34–39% in the longest follow-up studies of planned OC to date [35, 36], regret may become more prevalent as more women return to use their eggs and are potentially unsuccessful. We were unable to account for differences in consultation styles between the different physicians seen by participants in the study. An additional limitation of our study was the slightly disproportionate loss of follow-up among women who did not freeze their eggs. At our center, approximately 67% of women seen in consultation for planned oocyte pursue treatment, whereas 77% of the participants in this study froze eggs. While 51% is an estimate of the prevalence of moderate-to-severe regret in the population of women who choose not to undergo planned OC, the true prevalence might be lower if women with significant regret selectively provided feedback by participating in the study or higher if women with significant regret selectively declined to participate. It is also possible that unmeasured confounders bias the outcome. Finally, the data reflected here represent our experience at a single metropolitan academic center.

## Conclusion

In conclusion, we report the results of the first prospective study of regret among women considering planned OC. Deciding not to pursue treatment was associated with a markedly increased incidence of decision regret as compared to pursuing a planned OC. Adequate counseling of individuals considering planned OC is a critical factor in offsetting the risk of future decision regret. While there were certain risks associated with planned OC, most notably increased anxiety about fertility potential for some individuals, most women reported positive sentiments of satisfaction, signaling intangible benefits of planned OC. Ultimately, access to the ability to achieve one’s desired family size is an issue of reproductive autonomy. Ongoing work is needed to both inform and promote equitable and quality fertility preservation care.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10815-023-02789-w>.

## Declarations

**Conflict of interest** The study funder, EMD Serono, provided remuneration for participant time and effort. The funder provided financial support only and was not involved in the study design, data collection, analysis, or interpretation of study results. EGJ received an investigator-sponsored research grant from the study funder, EMD Serono. LP, AM, RW, JC, MIC, and HGH have nothing to disclose.

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