

# Factors influencing postmortem disposition of cryopreserved sperm in men undergoing fertility preservation

Ruben Blachman-Braun, M.D., M.Sc., Jordan C. Best, B.S., W. Austin Wyant, M.Sc., Libert Ramos, D.N.P., Emad Ibrahim, M.D., and Ranjith Ramasamy, M.D.

Department of Urology, Miller School of Medicine, University of Miami, Miami, Florida

**Objective:** To study the factors that influence men's disposition toward postmortem disposition of their cryopreserved gametes.

**Design:** Retrospective chart review.

**Setting:** Large academic health center.

**Patient(s):** All patients  $\geq 18$  years of age who underwent sperm cryopreservation from June 2016 to January 2020 were included. Samples intended for donation or records with an unspecified reason for preservation were excluded.

**Interventions(s):** Not applicable.

**Main Outcome Measure(s):** Patients' reasons for undergoing sperm cryopreservation, method of retrieval, and whether they chose to have the sample preserved or discarded postmortem.

**Result(s):** A total of 217 participants were included, with a mean age of  $35.8 \pm 10.8$  years. Of these, 176 (81.1%) decided to preserve their sperm for a spouse and 41 (18.9%) elected to have the sample discarded when choosing the fate of their cryopreserved sample after their death. There was no significant difference in disposition toward sample fate based on age or method of collection. However, there was a significant difference based on the "reason for cryopreservation." We found that compared with patients who underwent sperm cryopreservation because of cancer-related treatments, the patients who underwent sperm banking before vasectomy were more inclined to discard the sample. Men whose sperm was collected as in vitro fertilization backup were less willing to discard the sample.

**Conclusion(s):** It appears that men's dispositions toward postmortem disposition of their cryopreserved sperm are influenced by reason for cryopreservation, rather than age or method used for collection. As cryopreservation has become more common and affordable, understanding the factors that affect men's disposition toward the postmortem disposition of the cryopreserved gametes is imperative, because this knowledge has the potential to influence institutional policies and legislation, and may help in resolving future legal conflicts and ethical dilemmas. (Fertil Steril Rep® 2020;1:21–4. ©2020 by American Society for Reproductive Medicine.)

**Key Words:** Sperm, cryopreservation, advanced directives

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The first reported successful sperm cryopreservation occurred in 1953 when a child was conceived with sperm that had been frozen with the use of dry ice. As the process has become more common, the technique has evolved from using dry ice to liquid nitrogen and eventually liquid nitrogen vapor (1). The reasons men choose to undergo sperm cryopreservation include concerns about infertility, preparing for

a vasectomy, gender reassignment (1), cancer treatment (2), and in vitro fertilization (IVF), among others. Until relatively recently, there was little regulation over how cryopreserved sperm should be handled once the man it came from died. However, that changed in the 1990s when the California Supreme Court took a case that would decide the fate of cryopreserved sperm after the man who originally had it

frozen died. The court ruled in favor of the man's girlfriend, who requested all of the cryopreserved samples. The decision was based on the opinion that "the fate of the sperm must be decided by the person from whom the sample was obtained." Because the man originally cryopreserved the sperm for the future fertility of his girlfriend, the court ruled in her favor (3).

Given this ruling, a critical question is asked to everyone before performing sperm cryopreservation: What will be the fate of the sample after the donor dies? Patients have the option to discard it or preserve it for a spouse. We hypothesized that men's age, reason for sperm cryopreservation, and method of collection would influence whether men

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Reprint requests: Ranjith Ramasamy, M.D., Department of Urology, Miller School of Medicine, University of Miami, 1120 NW 14th Street, 15th Floor, Miami, FL 33136 (E-mail: [ramasamy@miami.edu](mailto:ramasamy@miami.edu)).

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preferred that the sample be preserved or discarded postmortem. Our objective was to study the factors that influence men's disposition toward postmortem disposition of their cryopreserved gametes.

## MATERIALS AND METHODS

### Patient Selection and Clinical Evaluation

After obtaining institutional review board approval (20170849), we performed a single-center retrospective review including the records of all patients who underwent sperm cryopreservation from June 2016 to January 2020, with all patients  $\geq 18$  years of age at the time of sample collection included. Samples intended for donation or records with an unspecified reason for preservation were excluded. All sperm samples were collected by the same members of the team either through surgical retrieval or in-office simple collection after masturbations. Before cryopreservation, participants were required to self-report the reason for cryopreservation and select the disposition of the sample after they die, which was either to discard it or to conserve the sample and transfer it as property of the surviving spouse.

### Statistical Analysis

Statistical analysis was performed with the use of SPSS version 24 software. For patients with more than one sperm banking, we considered only the information related to the first collection for the statistical analysis. Means and standard deviations were reported in accordance with the data distribution; comparison of age between groups was performed with the use of the Student *t* test. Categorical variables were reported as absolute values and frequencies and were analyzed with the use of a chi-square or Fisher exact test as required. Risk analysis for the discard disposition of the cryopreserved sperm was obtained through linear logistic regression analysis, first with a univariable analysis and then as a multivariable-adjusted model. A *P* value of  $< .05$  was considered to be statistically significant.

## RESULTS

A total of 217 men were included, with a mean age of  $35.8 \pm 10.8$  years. Of these, 176 (81.1%) opted to preserve for a spouse and 41 (18.9%) chose to discard the cryopreserved gametes after their death. Regarding the method of collection, patients had similar disposition toward the sample's fate whether it was collected via ejaculation or surgical retrieval. Stratifying the data by age groups (i.e., 18–35, 36–50, and  $>50$  years), there were no significant differences between patients in the different age groups regarding their decision to either discard or preserve the sample. Demographics including age groups, insurance status, and race/ethnicity are included in Table 1.

After performing univariable and multivariable-adjusted analysis, there was a statistically significant difference in men's disposition toward the fate of cryopreserved sperm sample among the self-reported reasons for undergoing cryopreservation ( $P = .001$ ; Table 2). Of the 82 patients who banked sperm before cancer treatments, 63 (76.8%) elected

**TABLE 1**

Demographics: patient age groups, insurance status and race/ethnicity.	
Age, y	
18–35	106 (48.8%)
36–50	86 (39.6%)
>50	25 (11.5%)
Insurance status	
Insured	198 (91.2%)
Uninsured	19 (8.76%)
Race/ethnicity	
White/non-Hispanic	92 (42.4%)
White/Hispanic	85 (39.2%)
Black or African American/non-Hispanic	24 (11.1%)
Asian/non-Hispanic	9 (4.14%)
Black or African American/Hispanic	3 (1.38%)
American Indian and Alaska Native	2 (0.92%)
Pacific Islander/non-Hispanic	1 (0.46%)
More than one race/non-Hispanic	1 (0.46%)

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to preserve their gametes for their spouse. Compared with the patients who underwent sperm cryopreservation because of cancer-related treatments, the patients who underwent sperm banking before vasectomy were more inclined to discard the sample (odds ratio [OR] 3.45, 95% confidence interval [CI] 1.16–10.27;  $P = .026$ ), and those whose sperm was collected as IVF backup were less willing to discard the sample (OR 0.42, 95% CI 0.18–0.97;  $P = .043$ ). There were no significant differences between age or method of sperm collection and men's disposition of the cryopreserved sperm (Table 3).

## DISCUSSION

This study shows that men are more likely to leave cryopreserved sperm to their partners (81.1%) than to have the samples discarded after their deaths (18.9%). We found no difference in the fate of sperm regarding the collection method (ejaculation vs. surgical retrieval) and no differences between age groups. However, there was a statistically significant difference in disposition toward the fate of the sample among the self-reported reasons patients had for cryopreserving.

The majority of men choosing to leave their cryopreserved sample to their partner may be partially attributed to the inherent desire to have progeny, which is rooted in the neurobiology of the human species (4, 5). In choosing to cryopreserve their sperm, patients recognize that they may have a future need for those gametes. However, there is limited scientific evidence analyzing the underlying decision-making process that leads to sperm banking. For men, choosing whether or not to cryopreserve their sperm can be a difficult decision. An even more difficult decision may be deciding what the fate of their sperm should be when they die. Tomlinson et al. evaluated the reasons that cryopreserved sperm was discarded and found that 13.6% ( $n = 95/698$ ) of the samples removed from banking were removed because of death of the patient (6). Developing an understanding of the factors that affect men's disposition toward the eventual fate of cryopreserved sperm can assist with counseling patients and helping them make a more well educated decision.

TABLE 2

Clinical characteristics, self-reported reasons that led to cryopreservation, and methods used to obtain the sperm of the analyzed patients, with comparison between those who gave advance directives to preserve and those who wished to discard their banked sperm postmortem.

Variable	Overall (n = 217; 100%)	Preserve (n = 176; 81.1%)	Discard (n = 41; 18.9%)	P value
Age, y, mean ± SD (range)	35.8 ± 10.8 (18.1–72.1)	34.1 ± 11.2 (18.1–68.3)	36.5 ± 13.4 (18.9–72.1)	.218
Age group, y				.481
18–35	106 (48.8%)	84 (47.7%)	22 (53.7%)	
36–50	86 (39.6%)	73 (41.5%)	13 (31.7%)	
>50	25 (11.5%)	19 (10.8%)	6 (14.6%)	
Reason				.001
Cancer treatment	82 (37.8%)	63 (35.8%)	19 (46.3%)	
IVF backup	113 (52.1%)	101 (57.4%)	12 (29.3%)	
Prevasectomy	17 (7.8%)	8 (4.5%)	9 (22%)	
Postvasectomy	2 (0.9%)	2 (1.1%)	0	
TRT	3 (1.4%)	2 (1.1%)	1 (2.4%)	
Method of collection				.057
Ejaculation	172 (79.3%)	135 (76.7%)	37 (90.2%)	
Surgical retrieval	45 (20.7%)	41 (23.3%)	4 (9.8%)	

IVF, in vitro fertilization; TRT, testosterone replacement therapy.

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TABLE 3

Univariable and multivariable-adjusted risk analysis considering the advance directive to discard the cryopreserved sperm as the main outcome.

Variable	Univariable			Multivariable		
	OR	95% CI	P value	OR	95% CI	P value
Age (y)	1.02	0.99–1.05	.262	1.03	0.99–1.06	.123
Reason						
Cancer treatment	1			1		
IVF backup	0.39	0.18–0.87	.021	0.42	0.18–0.97	.043
Prevasectomy	3.73	1.27–11	.017	3.45	1.16–10.27	.026
TRT	1.66	0.14–19.30	.686	1.60	0.14–18.67	.707
Method of collection						
Ejaculation	1			1		
Surgical retrieval	0.36	0.12–1.06	.063	0.60	0.18–2.05	.417

CI, confidence interval; IVF, in vitro fertilization; OR, odds ratio; TRT, testosterone replacement therapy.

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In contrast to our finding that age is not a significant factor influencing the postmortem disposition of banked sperm, other studies have listed age as a factor affecting the decision. Styer et al., in a smaller sample size (n = 112), found that male patients were more likely to decide to preserve their sperm for a spouse as they became older (for every 1-year increase, OR 1.07, 95% CI 1.01–1.14;  $P = .0291$ ) (7). Although this could be attributed to population differences, it may also be the result of the particular socioeconomic situation at the time in which the study was performed. However, our study was not necessarily powered to detect difference in age. In our study, 82 (37.8%) of the men opted for sperm banking within the context of cancer treatment. This commonality may be due to the awareness of the risks that life-saving cancer therapies (i.e., chemotherapy, radiation, and surgery), in addition to cancer itself (8), present to male reproductive competency. For these reasons, it is crucial that health practitioners working with people diagnosed with cancer are aware of the potential impacts of cancer and cancer therapy on reproductive competency (9). Furthermore, all men undergoing cancer treatment

should receive proper counseling, including a referral for sperm banking, because patients may have an interest in reproduction after cancer treatment (10).

Because the decision of whether to discard or preserve cryopreserved gametes may have an impact on patients' psychological well-being, there is clinical utility in better understanding patients' decision-making process. A study in the United Kingdom found that patients who chose to discard their sperm (n = 19/193; 9.8%) were significantly more likely to experience negative treatment side-effects (OR 4.37, 95% CI 1.61–11.85;  $P = .004$ ), to be confident about their fertility (OR 1.78, 95% CI 1.05–3.03;  $P = .034$ ), view fertility monitoring as less important (OR 0.61, 95% CI 0.39–0.94;  $P = .026$ ), hold positive views toward disposal (OR 5.71, 95% CI 2.89–11.27;  $P < .001$ ), and have less of a desire for children in the future (OR 0.41, 95% CI 0.26–0.64;  $P < .001$ ) (11). A study in the United States found that patients' (n = 56) reasons for choosing to discard their cryopreserved sperm included death (n = 21), fertile but no plans for children (n = 23), having the ability to produce

good quality sperm ( $n = 8$ ), and infertile with no plans for children ( $n = 4$ ) (12).

In the present study, 17 men (7.8%) underwent sperm banking before vasectomy. These men were more likely to request that their samples be disposed of (OR 3.45, 95% CI 1.16–10.27;  $P=.026$ ). This is possibly because this subgroup of patients may have elected for vasectomy after fulfilling their desire for children. In contrast, patients that underwent sperm banking as an IVF backup were less willing to choose to discard the cryopreserved sperm (OR 0.42, 95% CI 0.18–0.97;  $P=.043$ ). These results might be attributable to the fact that these patients are actively trying to have children. Overall, our findings indicate that the main factor influencing postmortem disposition of cryopreserved sperm is the reason the patient decided to undergo sperm cryopreservation. It is imperative that clinicians are aware of this as they counsel patients considering sperm banking.

The present study was conducted to study the factors that influence men's disposition toward postmortem disposition of their cryopreserved gametes. It is imperative that clinicians counseling patients have an understanding of the factors that affect men's choice of postmortem disposition. Although our results are encouraging, the present study does not completely capture the complex decision-making process that these men undergo. Limitations of the study include that participants were asked to self-report only one reason for undergoing cryopreservation, and that relationship status, country of origin, and religion were unable to be analyzed because they were not part of the collection form. Furthermore, only patients that were able to afford cryopreservation themselves were included. The study strengths include sperm collection and documentation being conducted by the same team members, as well as the studied cohort including patients that underwent both surgical retrieval and in-office collection of sperm. Further studies with larger sample sizes are needed to analyze factors that affect men's disposition toward the fate of cryopreserved sperm in people of different faiths, socioeconomic status, geographic regions, and partner perceptions. In addition, further research should analyze factors that affect men's disposition toward posthumous collection and use of reproductive tissue (13) and posthumous reproduction (14).

## CONCLUSION

It appears that men's disposition toward postmortem disposition of their cryopreserved sperm are mainly influenced by the reasons that led to the preservation, rather than by their ages or the methods used for collection. As cryopreservation has become more common and affordable, understanding men's disposition toward the postmortem disposition of their cryopreserved gametes is imperative, because this knowledge has the potential to influence institutional policies and legislation, and may help in resolving future legal conflicts and ethical dilemmas.

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