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Anticipating Ovarian Tissue Cryopreservation in the Health-Care Marketplace: A Willingness to Pay Assessment

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Introduction

Advances in cancer therapy are allowing patients to live longer, healthier lives, changing the landscape of survivorship, and opportunities for life after disease. These cancer therapies, though, are not without consequences: more cancer patients are burdened with the long-term side effects of aggressive cancer therapies. An important example is the impact of radiation and chemotherapy on male and female fertility. The term oncofertility refers to developing scholarship on the issues of fertility management arising from oncology therapy, combining the two diverse fields of oncology and fertility into one unified discipline.¹ Oncofertility researchers are actively working to develop fertility preservation options for the unique population of cancer patients and bringing these options to the patient's bedside as they become available.

A new oncofertility procedure, ovarian tissue cryopreservation (OC), provides an alternative to female cancer patients for whom embryo or egg banking is not a viable option. Although this technique is still considered experimental, researchers are hoping it can fill the current gap in options for female patients. The science behind OC is actively being studied in the laboratory, but little is known about the real-world implications of this medical procedure, including whether patients would pay for it and what level of value they would place on it. The purpose of this study is to directly assess whether young women facing the prospects of cancer treatment would value fertility preservation and, if so, by how much.

To assess the relative economic value of fertility, we administer a “willingness to pay” (WTP) survey in which we ask respondents how much they would be willing to pay for the OC procedure, for treatment for other health problems, and for a variety of consumer goods and services. We then compare their WTP for OC to their WTP for goods and services that are already commonly available, drawing comparisons between the two groups. Through this assessment, we seek to answer the following two questions: “What is fertility preservation worth?” and “What are the characteristics of individuals who most highly value fertility preservation?”

Because OC is likely to be costly, many individuals will not have the financial wherewithal to pay for this medical procedure. Thus, a critical question is whether they would be willing to pay for insurance to cover the cost of the procedure. Our survey concludes by asking respondents about their WTP for OC insurance coverage, allowing our analysis to fully address the prominent questions related to how this technology will operate in the health-care marketplace.

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¹The term oncofertility was coined by Dr. Teresa Woodruff at Northwestern University's Feinberg School of Medicine.

Fertility Preservation Options

Radiation and chemotherapy as part of aggressive cancer treatment regimes can destroy a woman's fertility, causing her to undergo early menopause or even lose her fertility completely. There are a number of existing fertility preservation procedures available to female cancer patients, the most well established being embryo and egg banking. In both procedures, eggs are harvested from a woman and frozen for later use with in vitro fertilization.² These two options, however, entail their own list of complications and are not available to every patient. There are two major classes of patients for whom these are not viable options: prepubescent women and women whose cancer therapy must begin immediately (e.g., women diagnosed with leukemia). Embryo and egg banking require a 2- to 3-week delay in cancer treatment, so they are not an option if therapy must begin immediately. Every year, between 1,600 and 1,700 women and girls under the age of 30 in the United States are diagnosed with cancer and are at risk for losing their fertility. There is also an unknown number of women who may avoid embryo and egg banking due to the side effects of egg harvesting and the IVF procedure.

Ovarian tissue cryopreservation is an experimental procedure designed for women who are not candidates for or do not choose to pursue embryo or egg banking. Patients opting for OC will undergo a surgery to remove one whole ovary prior to cancer treatment. Tissue from the resulting ovary is then frozen and preserved at a cryogenic facility for use at a later date. Subsequent to cancer treatment (or at a later date when the woman wants to pursue a pregnancy), researchers thaw the ovarian tissue and attempt to mature the follicles from the tissue within the laboratory. The mature oocyte is then fertilized, either with a partner's sperm or with a donor's sperm, and the resulting embryo is transferred back into the woman using IVF.

Ovarian tissue cryopreservation offers numerous benefits when compared to the prevailing treatment options. First, OC can be performed on prepubescent female patients who cannot undergo hormone treatment and otherwise have no other fertility treatment options.³ Second, the procedure can be performed immediately, delaying cancer treatment for at most 1–2 days, while the hormone therapies required for embryo and egg banking can entail an average delay of 2–3 weeks. Third, OC provides a viable fertility option for women who wish to avoid any side effects associated with hormone treatments. Finally, since OC does not require immediate fertilization of an egg, it allows women who do not have a partner or access to donor sperm more control over with whom to have biological children than they would have with embryo banking.

Willingness to Pay

OC can be a costly technology. For the 43 OC procedures performed to date, the average facility charge has been approximately \$30,000, although the range of actual costs is quite varied. For example, Northwestern University has negotiated a fixed rate of \$12,000 per procedure, and a number of other medical centers have package prices available for women choosing to undergo OC. Another factor to consider in estimating the actual cost is insurance coverage. To date, the majority of OC procedures have been covered by health insurance companies; indeed, all patients with health insurance who have undergone OC at Northwestern have received insurance coverage for the procedure (Gerrity, 2009, Executive

²In embryo banking, the harvested eggs are fertilized with a partner's or donor's sperm and the resulting embryo is frozen for later use with IVF.

³Though removal of ovarian tissue is an established procedure, the techniques for freezing and thawing the tissue and use of the thawed tissue in "in follicle maturation" (IFM) are still experimental and this procedure has not yet resulted in pregnancy in humans. (http://www.myoncofertility.org/articles/what_oncofertility_consortiums_current_project)

Director of the Oncofertility Consortium, Personal conversation). However, as only 43 procedures have been performed to date, these statistics are still preliminary. Due to the varied institutional prices and insurance status of cancer patients, it is difficult to estimate the actual costs of OC. A useful comparison, however, can be made between OC and IVF to gauge the social value of OC. The average cost of IVF is \$12,400 and insurance companies generally cover 40–50% of this cost. Society has clearly indicated that the benefits of IVF exceed the cost, as evidenced by the widespread use of the procedure and insurance coverage. Whether the benefits of OC exceed its much higher cost, however, remains unclear. The actual cost of the OC procedure as well as its relative social value will become more apparent as the procedure becomes more widespread.

One way to assess the value of OC would be to perform a cost-effectiveness analysis, for example, by measuring QALYs (quality-adjusted life year) gained per dollar spent. There is no consensus about how to value fertility in QALYs, however [1–3]. The fact that the patient would be dealing with cancer therapy and an uncertain prognosis further complicates using the QALY approach to assess the value of the OC procedure.

Rather than rely on cost-effectiveness analysis (CEA), we can instead perform a cost-benefit analysis, in which both costs and benefits are denominated in dollars. As per the previous discussion, we have already completed a preliminary analysis of the cost of OC. The main purpose of this study is to explore the benefits of the OC procedure. One such way to dollar denominate the benefits of a good or service is to examine the price that consumers pay in the current market place. By definition, those consumers who purchase the product have a WTP that exceeds the price. This approach, however, is not practical for services like OC where consumers are still learning about the value and the price is substantially subsidized.

Contingent valuation (CV) surveys – essentially, asking people how much they would pay – are a necessary substitute when market prices are not appropriate measures of WTP. CV has long since been used to determine the value of nonmarket goods and services. CV surveys use a series of questions asking respondents how they would assess the value of a technology or procedure based on the respondents' own personal experiences. In this approach, survey design is critical to obtaining meaningful WTP estimates [4]. The surveyor must thoroughly describe the attributes of the good or service and should also encourage the respondent to think about valuation of a variety of other goods and services. When probabilities are involved (such as procedures like OC that may have less than a 100% success rate), respondents should be made comfortable thinking about probabilities in general (e.g., the probability of changing jobs within the next year). In designing our CV survey for OC we were careful to include all of these considerations in our survey design. Since we interviewed both young women and parents with young daughters, we adjusted the wording of certain questions to reflect the differences between these two groups. This analysis focuses only on the responses of the cohort of young women, as the parent interviews are not yet completed.

Existing research utilizing the CV methodology to assess the value of infertility procedures demonstrates the appropriateness of this approach in the realm of reproductive health. Neumann and Johannesson (1994) have previously implemented a CV survey to estimate the WTP for the IVF procedure itself and for insurance coverage for IVF [1]. They report an average WTP of about \$25,760 (in 2009 dollars; \$17,730 in 1994 dollars) for IVF treatment that has a 10% success rate. They also report a WTP of \$865 for a lifetime insurance benefit to cover the costs of IVF with a similar 10% success rate. In 2002, 0.3% of women required the use of IVF, which would work out to an actuarially equivalent payment of \$77 for each IVF procedure.

These estimates demonstrate the applicability of CV surveys and the WTP approach in understanding and estimating the relative value of fertility procedures and insurance coverage for these same procedures.

Survey Methods

In order to estimate the anticipated value of OC in the health-care marketplace, we conducted a contingent valuation survey. We administered surveys to two different groups: (a) young women (ages 18–25) and (b) parents (ages 20–69) with daughters (ages 5–17). The survey begins with basic demographic questions, including family history and religious preferences. After hearing a detailed description of the OC procedure, respondents are asked to imagine that they (or their daughter) have recently been diagnosed with leukemia and require immediate cancer treatment. OC is presented as their (or their daughter's) only viable option for preserving fertility, as their cancer treatment must begin immediately due to the severity of their (or their daughter's) cancer diagnosis. Survey participants were given varying levels of success for the OTC procedure: one-third of respondents were told that OC had a 25% success rate, another third were given a success rate of 50%, and the rest were told that OC is 100% successful. Within each survey, the given success rate of the procedure was consistent. Respondents were then asked to report their WTP for a variety of goods and services (such as a cell phone and a plasma screen TV), several medical interventions (including ACL surgery), and OC. Because some of these goods and services can be very costly, we told respondents that, if necessary, a payment plan could be created to allow them to borrow the money to pay for the good or service and pay back the cost over time.

We also used CV methods to inquire about the WTP for lifetime insurance coverage for the OC procedure. In theory, this valuation should depend on (a) the WTP for OC, (b) the expected cost of the OC procedure, and (c) the probability that OC will be required. Participants were told that OC would cost approximately \$30,000. After several questions that required the respondent to think about probabilities and attitudes toward risk taking, we posited that 1% of women would be candidates for OC. Respondents were then asked whether they would be willing to pay for insurance to cover the cost of the OC procedure and, if so, how much they would be willing to pay annually for insurance to cover the cost of OC. Based on this information, risk neutral respondents should have a WTP for OC insurance of \$300 if they valued OC at \$30,000 or higher or 1% of their WTP if they valued OC at less than \$30,000. Thus, the upper bound on the willingness to pay for insurance should be \$300 plus a risk premium.⁴

The survey samples consisted of 75 young women from the Chicago area. We recruited all respondents through the posting of flyers at local undergraduate and graduate campuses throughout the city. By and large, the respondents consisted mostly of either students or employees of Northwestern University. The surveys were delivered in a one-on-one interview format with the same interviewer performing all interviews.

For the most part, respondents reported usable answers for nearly all questions. Some respondents, however, reported being willing to pay “whatever it took” for some of the medical procedures in the survey, including OC. In order to estimate means of these willingness to pay values, we set these respondents' WTP equal to the maximum finite WTP given by other respondents.

⁴Individuals whose WTP for OC equals or exceeds \$30,000 should be willing to pay at least \$300 for insurance, which is the actuarially fair value. Those who value OC at less than \$30,000 might prefer not to purchase insurance at \$300 unless they are very risk averse.

Results

Our analysis yielded meaningful results about the willingness to pay for the OC procedure itself and insurance to cover the cost of this medical operation. Table 27.1 reports summary statistics for the CV questions on the willingness to pay for the OC procedure among the sample of young women. The mean WTP for OC is a high monetary amount and, as evidence by our results, even a modest success rate of 25% is highly valued among this cohort. Note also that WTP does not display a “certainty premium,” whereby the WTP for 100% success is disproportionately larger than WTP for smaller success probabilities. Instead, the WTP for OC is relatively consistent across varying success rates for the procedure. The nonlinearity in WTP as a function of the success rate may reflect the valuation of hope, as described by Becker et al. [5]. In other words, individuals highly value the possibility of being able to bear children, independently of the actual probability it will occur.

Our analysis also compared WTP for the OC procedure against WTP for a number of other common goods and services, in an attempt to assess the relative value of OC. Table 27.2 reports summary statistics for WTP for a big screen TV, a Toyota Corolla, and ACL surgery. The mean valuation for OC is significantly higher than the mean valuation for the television and the new car ($p < 0.05$, two-sided t -test). The mean WTP for OC, however, is not statistically distinguishable from the mean for ACL surgery ($p = 0.52$, two-sided t -test). Slightly more than half of the respondents (55%) were willing to pay more for OC than for a new car and the same percentage were willing to pay more for OC than for ACL surgery. Put another way, among our sample OC is more valuable than a new Toyota Corolla and about as valuable as ACL surgery.

As per the previous discussion, if respondents were risk neutral, their WTP for OC insurance would equal \$300 if they valued OC at \$30,000 or higher, or 1% of their WTP if they valued OC at less than \$30,000. Table 27.3 describes the WTP for OC insurance across varying reported success rates of the procedure. Of the 65 respondents willing to pay a positive amount for OC, 22 out of 65 (34%) were not willing to pay any amount for OC insurance. Among these 22, the mean WTP for OC was \$21,468 and 6 had a WTP for OC of \$30,000 or higher, which exceeds the posited cost of treatment. Thus, a nontrivial fraction of respondents reports economically irrational valuations.

Discussion

Our results demonstrate that the young women in our sample value fertility preservation more than they value a new Toyota Corolla and about the same as they value surgery to repair a torn ACL. Although respondents were at an age where they may have more limited responsibility for financial decisions (18–25), this sample was able to place reasonable values on all of the consumer goods listed (cell phone, television, new car, and car safety system). Our results indicate that the calculated values for WTP for OC are reasonable both relative to other goods and services and in absolute terms.

Unfortunately, the survey did not yield reasonable results for WTP for insurance to cover the cost of the OC procedure. The correlation coefficient for OC and OC insurance was about 0.08. However, this appears to have been a problem in the Neumann and Johannesson (1994) study as well, where respondents' WTP for insurance was well above the actuarially fair value implied by respondents' WTP for the procedure itself (implying a very high degree of risk aversion). We conclude that individuals may find it difficult to evaluate the set of probabilities required to determine a reasonable value for insurance.

Conclusions

As fertility preservation technologies continue developing, the health-care marketplace needs to anticipate how these medical procedures will operate on an economic and actual level. Finances are a real concern for a large majority of Americans, and understanding the economic value that young women place on fertility preservation in the hypothetical situation of cancer can help clinical care providers and insurance companies alike to shape their policies, procedures, and recommendations.

The preliminary results of our survey are important for a number of reasons. Our results suggest that young women see OC as more valuable than a new Toyota Corolla and about as valuable as ACL surgery. The perceived value of OC among this sample is thus relatively high. Finally, our inconclusive results on WTP for insurance coverage point to need for continued research around this topic to better understand how the insurance marketplace can integrate OC into its existing structure.

Acknowledgments

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Table 27.1

WTP for ovarian cryopreservation

Good/service	WTP (mean) (\$)	WTP (SD) (\$)	Median (\$)	Interquartile range (\$)
OC – 25% success rate	16,304	20,538	7,000	2,000–23,000
OC – 50% success rate	17,360	17,300	10,000	5,000–25,000
OC – 100% success rate	33,160	50,745	20,000	5,000–40,000

Table 27.2

WTP for OC and other goods and services

	WTP (mean) (\$)	WTP (SD)(\$)	Median (\$)	Interquartile range (\$)
Big screen television	729	837	500	250–1,000
Toyota corolla	15,891	10,716	15,000	10,000–30,000
ACL surgery	27,385	42,041	15,000	5,000–25,000
OC – all success rates	22,274	33,604	10,000	5,000–30,000

Table 27.3

WTP for OC insurance

Good/service	WTP (mean) (\$)	WTP (SD) (\$)	Median (\$)	Interquartile range (\$)
OC insurance – 25% success	644	1,363	100	0–500
OC insurance – 50% success	573	932	320	0–800
OC insurance – 100% success	565	936	150	0–1,000