Baby budgeting: oocyte cryopreservation in women delaying reproduction can reduce cost per live birth

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Objective: To determine whether oocyte cryopreservation for deferred reproduction is cost effective per live birth using a model constructed from observed clinical practice.
Design: Decision-tree mathematical model with sensitivity analyses.
Setting: Not applicable.
Patient(s): A simulated cohort of women wishing to delay childbearing until age 40 years.
Intervention(s): Not applicable.
Main Outcome Measure(s): Cost per live birth.
Result(s): Our primary model predicted that oocyte cryopreservation at age 35 years by women planning to defer pregnancy attempts until age 40 years would decrease cost per live birth from $55,060 to $39,946 (and increase the odds of live birth from 42% to 62% by the end of the model), indicating that oocyte cryopreservation is a cost-effective strategy relative to forgoing it. If fresh autologous assisted reproductive technology (ART) was added at age 40 years, before thawing oocytes, 74% obtained a live birth, and cost per live birth increased to $61,887. Separate sensitivity analyses demonstrated that oocyte cryopreservation remained cost effective as long as performed before age 38 years, and more than 49% of those women not obtaining a spontaneously conceived live birth returned to thaw oocytes.
Conclusion(s): In women who plan to delay childbearing until age 40 years, oocyte cryopreservation before 38 years of age reduces the cost to obtain a live birth. (Fertil Steril® 2015;103: 1446–53. ©2015 by American Society for Reproductive Medicine.)
Key Words: Oocyte cryopreservation, vitrification, fertility preservation, cost analysis, ART

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In recent years, there has been an increase in the number of women delaying childbirth for educational, professional, and personal pursuits (1). The Organization for Economic Cooperation and Development recently reported that among member countries, 27.8 years was the average age of first birth. This statistic has risen steadily since the 1970s (2). The US fertility rate is now the lowest ever reported (3).

Well established is that female fertility precipitously declines with advancing age (4–10), as is the limited ability of conventional assisted reproductive technology (ART) to surmount age-related infertility (11, 12). The live birth rate per treatment cycle decreases by nearly 50% for women initiating IVF after the age of 40 years (13). Thus, involuntary childlessness is a relatively frequent consequence of delaying conception attempts.

To maintain the possibility of creating their families at a later date, some women are beginning to embrace the use of oocyte cryopreservation as a technologic bridge from reproductive prime to preferred conception age. Oocyte cryopreservation has the potential to extend fertility beyond a woman's natural reproductive lifespan as well as to preserve a woman's option to parent genetically linked children with a future partner. Nearly 90% of surveyed women cited lack of partner as their primary reason for pursuing oocyte cryopreservation, and most found "the egg freezing process" to be "empowering" (14). Recently, oocyte cryopreservation has become more accepted as accumulating data have demonstrated pregnancy rates (PRs) comparable with those from IVF cycles using fresh female gametes (15–20). The American Society for Reproductive Medicine recently lifted the technology's "experimental" designation, corroborating these data (21).

Recent acceptance of oocyte cryopreservation as a conventional therapy has spurred interest in whether it is cost effective relative to more established ART options. Two recently published studies (22, 23) that endeavored to answer this question had markedly different results. A US-based model by Hirshfeld-Cytron et al. (22) found that oocyte cryopreservation was not cost effective, whereas a Netherlands-based analysis by Van Loendersloot et al. (23) found that oocyte cryopreservation provided an overall cost savings of $24,600 per live birth. A subsequent coauthored letter (24) by these two groups explained that the differences in their results were likely due to variations in model inputs and design, including age, cost estimates of ART, and probabilities of success with cryopreserved oocytes.

Given that oocyte cryopreservation for deferred childbearing is evolving into mainstream therapy, that outcomes from studies evaluating cost effectiveness were conflicting, and that sufficient oocyte cryopreservation cycle data is now available from our center, we sought to conduct a cost-effectiveness analysis (as performed in the United States) using a real-data driven approach. Our main study objective was to determine whether cryopreserving oocytes at age 35 years with the intention to thaw, fertilize, and implant at age 40 years is more cost effective than attempting pregnancy and, if needed, undergoing conventional IVF at age 40 years.

MATERIALS AND METHODS

Model Design

We constructed a decision-tree mathematical model involving theoretical 35-year-old women with personal reasons (e.g., career, lack of partner) for deferring childbearing until 40 years of age. Our model examined three treatment strategies available to such women, as depicted in Figure 1. We based the described strategies on observed patient treatment choices and clinical outcomes, and on professional guidelines (14, 25).

Approval was obtained from the New York University School of Medicine Institutional Review Board to retrospectively analyze the oocyte cryopreservation cycles completed at the New York University Langone Medical Center Fertility Center from June 2007 to April 2014. These data furnished the inputs for our cost model. We found that with eight mature, meiosis II (MII) oocytes available per thaw cycle, outcomes were comparable to fresh IVF (20). The average 35-year-old patient needed to complete 1.2 oocyte cryopreservation treatment cycles to bank 16 MII for two future potential thaw cycles (Table 1).

Fertility treatment strategies modeled were as follows and were based on the strategies most often used in clinical practice (Fig. 1):

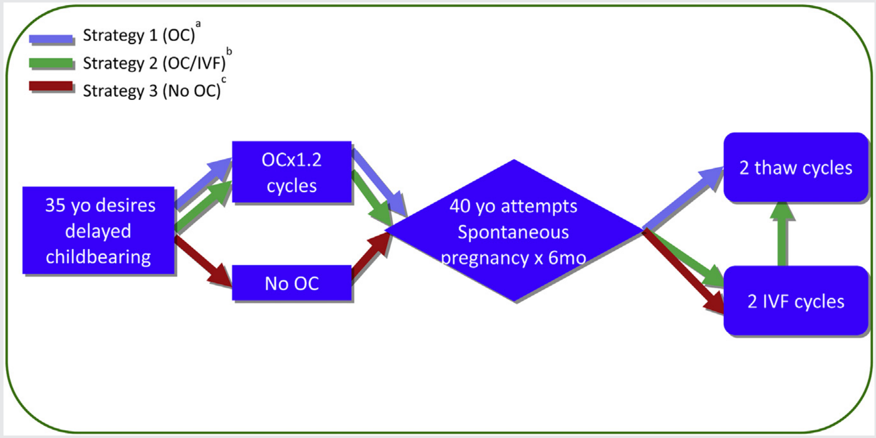
- Strategy 1: Oocyte cryopreservation (notated in blue in all figures). In this strategy, patients elect to undergo oocyte cryopreservation at age 35 years to obtain at least 16 MII oocytes for potential use after age 40 years. In strategy 1 (as in all three strategies), women attempt spontaneous conception by timed intercourse for a period of 6 months when reaching 40 years of age. If no spontaneous live birth is obtained, the women then proceed with two IVF cycles using previously banked oocytes.
- Strategy 2: Oocyte cryopreservation/IVF (notated in green) is similar to strategy 1 in that women also undergo oocyte cryopreservation at age 35 years and attempt spontaneous conception at age 40 years. However, in strategy 2, if no live birth is obtained spontaneously, the women undergo two fresh autologous IVF cycles at age 40 years before thawing banked cryopreserved oocytes. We have observed this strategy used by patients in an attempt to maximize chances at autologous live birth (14).
- Strategy 3: No oocyte cryopreservation (notated in red). In this strategy, women wishing to defer childbearing decline the option to undergo oocyte cryopreservation at age 35 years and instead attempt spontaneous pregnancy for 6 months upon reaching the age of 40 years (25). Then, if no live birth is achieved, they undergo two cycles of fresh IVF.

Model Inputs

Model inputs for natural fecundity at age 40 years were derived from the published literature. In all three strategies, a 16% total live birth rate was used as the result of 6 months of attempting spontaneous pregnancy by a 40-year-old woman. This number was calculated by taking the likelihood of a pregnancy during 6 months of attempts (6) and subtracting the expected proportion of biochemical and clinical miscarriages (26).

For ART success, a dataset containing all fresh, autologous ART cycle starts reported in 2011 was obtained from the SART Research Committee. Society for Assisted Reproductive Technology Clinical Outcomes Reporting System (SART CORS) includes data from 90% of all ART clinics in the United States. Mean live birth per cycle start by age was calculated from the SART CORS database for 2011 (the most

FIGURE 1



Schematic representation of treatment strategies analyzed in cost-effectiveness analysis. [a] Strategy 1: OC × 1.2 cycles (mean number required to obtain 16 meiosis II oocytes at age 35 years), attempt spontaneous conception for 6 months at age 40 years, and 2 oocyte thaw cycles using stored oocytes if no live birth. [b] Strategy 2: OC × 1.2 cycles, attempt spontaneous conception at age 40 years for 6 months, 2 fresh autologous assisted reproductive technology (ART) cycles if no live birth, 2 oocyte thaw cycles using stored oocytes if still no live birth. [c] Strategy 3: no OC at age 35 years, attempt spontaneous conception at age 40 years for 6 months, 2 fresh autologous ART cycles if no live birth. OC = oocyte cryopreservation.

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recent available reporting year). These data provided ART live birth model inputs for all three treatment strategies. The mean live birth per cycle start from fresh, autologous, ART at age 40 years was 16.82%. Live birth rates from oocytes cryopreserved, thawed, and fertilized at experienced centers are now known to be comparable with those of fresh IVF completed at the age of freeze (15–20). Therefore we used 33.04%, the mean live birth per fresh, autologous cycle start at age 35 years. calculated from SART CORS 2011, as the model input for live birth rate per oocyte thaw cycle in strategies 1 and 2 (Supplemental Table 1, available online).

Oocyte cryopreservation and oocyte storage for 5 years, thaw cycle, and fresh IVF charges (each including medication costs) were randomly obtained for 17 regionally diverse fertility clinics by published pricing on internet websites (27–30) or by phone or e-mail inquiries made in July 2014. Median charges obtained were used as primary model inputs (oocyte cryopreservation and storage: $15,048; oocyte cryopreservation thaw cycle: $5,094; fresh autologous ART cycle: $14,987) (Supplemental Table 2, available online). Charges obtained by this sampling method were consistent with those published by the Livestrong Foundation, Attain Fertility, Cost Helper Health, and RESOLVE (31–34).

TABLE 1

Number of MII oocytes obtained by age at cryopreservation at NYU Fertility Center from 2007–2014.

Age (y)	No. of OC cycles (N = 1,545)	No. of MII oocytes (mean ± SD)	Minimum–maximum (no. of MII oocytes)	Mean no. of cycles required to obtain 16 MII oocytes
≤30	12	14.75 ± 6.8	6–26	1.1
31	6	16.2 ± 13.1	5–41	1.0
32	9	13.7 ± 9.5	4–27	1.2
33	37	13.2 ± 7.5	2–32	1.2
34	96	13.1 ± 9.4	0–50	1.2
35	126	13.0 ± 8.0	1–39	1.2
36	150	12.3 ± 8.6	1–47	1.3
37	234	10.3 ± 7.4	0–44	1.6
38	239	10.1 ± 6.8	0–37	1.6
39	232	9.6 ± 6.7	0–37	1.7
40	176	8.5 ± 6.1	0–35	1.9
41	108	8.6 ± 6.3	1–35	1.9
42	72	7.9 ± 6.0	1–33	2.0
43	27	9.3 ± 5.0	0–20	1.7
44	13	6.3 ± 4.0	1–14	2.5
45	8	3.9 ± 2.5	1–9	4.1

Note: OC = oocyte cryopreservation; MII = meiosis II; NYU = New York University.

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Sensitivity Analyses

Cost per live birth was calculated for each strategy using a data-driven mathematical decision-tree probability model based on the inputs described. Sensitivity analyses were performed to compare the cost effectiveness of each strategy and varying different model inputs, including the age at cryopreservation, probability of spontaneously conceived live birth at 40 years of age, cost of oocyte cryopreservation, and the cost of an IVF cycle at 40 years of age. First, to determine up to what age the cost benefit per live birth persisted, we varied age at oocyte cryopreservation for the range of 25–40 years of age. In this analysis, we used the mean number of cycles required to obtain 16 MII oocytes and the mean live birth per cycle start for each specific age group (Table 1). All remaining model inputs were consistent with those used in the primary model.

Second, natural fecundity has proven difficult to study, and estimates in older women may be prone to underestimation due in part to confounding by partner age and coital frequency; therefore, precise estimates are limited (35). To determine how oocyte cryopreservation cost effectiveness was impacted by the magnitude of age-related fertility decline, we varied the proportion of women obtaining a live birth from 6 months of attempts at spontaneous conception from 0–50%. Third, given the wide reported range of oocyte cryopreservation cycle cost ($10,804–$17,000; Supplemental Table 2), we varied oocyte cryopreservation cycle cost to determine whether there were price point(s) that altered the cost effectiveness of the models' treatment strategies. Fourth, given the complex pricing structures used in IVF cycles (which mean that published per cycle pricing may overestimate actual costs), as well as the uncertainty of future IVF costs, we varied IVF cycle cost to determine potential price points that may alter the cost effectiveness of the three strategies. Finally, because the proportion of women undergoing oocyte cryopreservation for social reasons who ultimately return to use their eggs is not known but is highly determinative of the therapy's cost–benefit, we varied this proportion from 0–80%.

RESULTS

In our primary model, which used oocyte cryopreservation at age 35 years, pregnancy attempts at age 40 years, and median US ART charges, strategy 1 (oocyte cryopreservation) was most cost effective, with a mean cost per live birth of $39,946 with 62% of patients predicted to achieve live birth by the end of the model. Strategy 2 (oocyte cryopreservation/IVF), in which patients underwent fresh IVF at age 40 years before thawing oocytes, resulted in the highest likelihood of live birth by the end of the model at 74%; however, cost per live birth was also greatest with this strategy at $61,887. Strategy 3 (no oocyte cryopreservation), in which patients did not cryopreserve oocytes, resulted in only 42% of women obtaining a live birth at a cost per live birth of $55,060. In short, in our primary model, strategy 1 was more cost effective than strategy 3, which was more cost effective than strategy 2.

Given that oocyte cryopreservation for deferred reproduction was cost effective when patients underwent oocyte cryopreservation at age 35 years, we endeavored to determine up to what age the cost–benefit per live birth persisted. As expected in this analysis, in strategy 3, where no oocyte cryopreservation had been performed, likelihood and cost per live birth remained constant across ages at 42% and $55,060, respectively (red line, Fig. 2A). Importantly, strategy 1 was always more cost effective than strategy 2 and was more cost effective than strategy 3 until the age of 38 years. This is depicted graphically at the point of intersection of blue and red lines in Figure 2A, where cost per live birth for strategy 1 surpasses that of strategy 2 after the age of 37 years. Cost effectiveness of strategy 2 was similar to strategy 3 only up to the age of 31 years, after which strategy 3 was more cost effective. In our model, women who underwent oocyte cryopreservation before the age of 35 years using strategy 2 had at least a 74% chance of achieving live birth.

We further evaluated the impact of age-related fertility decline by varying the likelihood that a woman at age 40 years will succeed in having a live born child after attempting natural conception of 6 months. As expected, the cost per live birth with strategy 3 decreased rapidly with improved natural fecundity at age 40 years (Fig. 2B). However, cost effectiveness of strategy 3 did not surpass that of strategy 1 until fecundity during 6 months of attempts reached 35%, more than twice that indicated by published literature.

Given the wide range of reported oocyte cryopreservation cycle costs, we performed sensitivity analysis varying the cost for a cycle (including medications) (Fig. 2C). Age at oocyte cryopreservation was fixed at 35 years. In this analysis, strategy 1 was always the most cost-effective option. Strategy 2 only became more cost effective than strategy 3 when the cost of an oocyte cryopreservation cycle was less than $9,341, which was lower than the lower limit of the reported range of costs. Furthermore, we varied the cost of an IVF cycle (Fig. 2D) and observed that strategy 3 was more cost effective than the other strategies only when the cost of IVF was less than $11,000, which was again lower than the lower limit of the reported range of costs for IVF cycles.

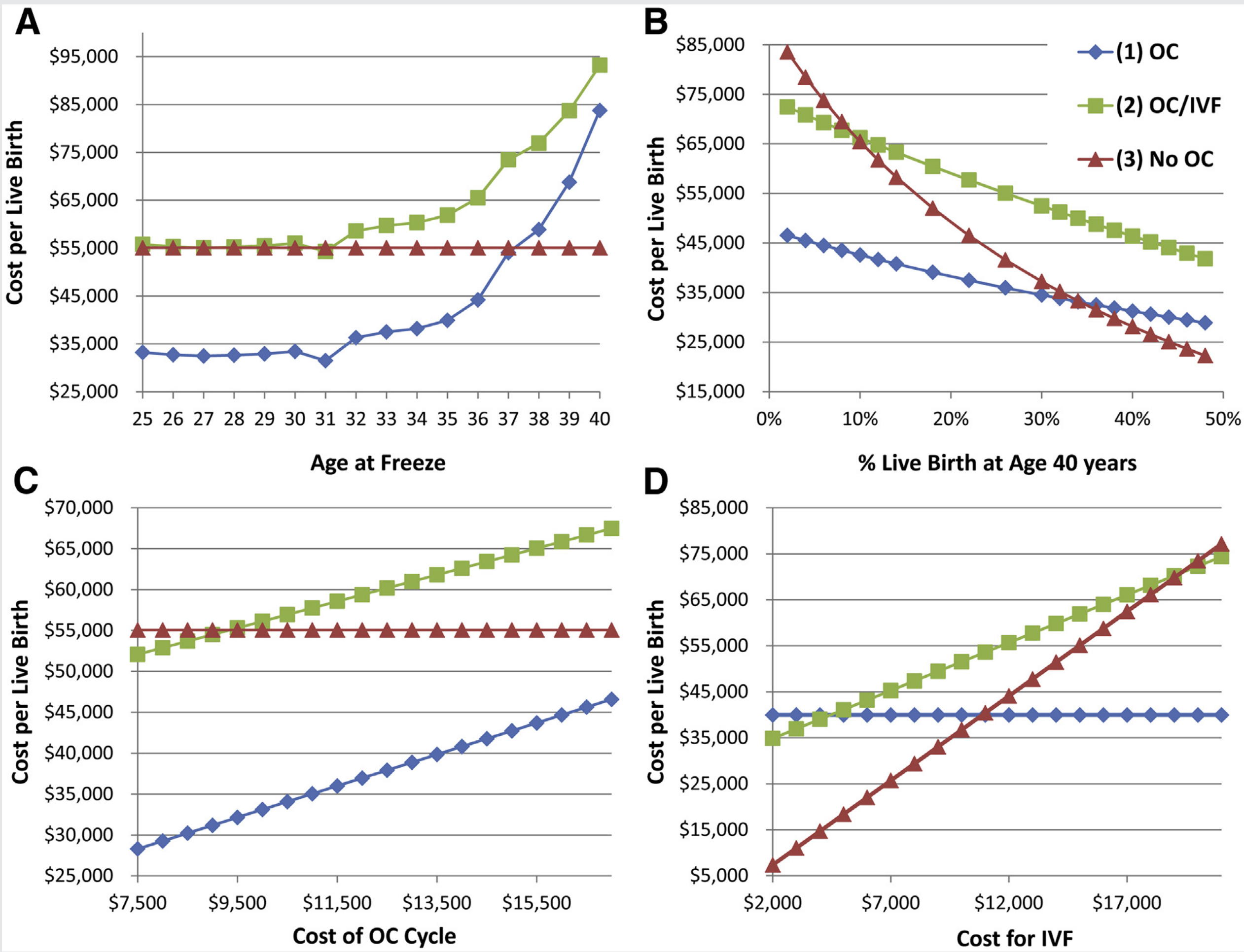
Finally, we attempted to answer the question of what percentage of women would need to use their frozen oocytes to warrant pursing oocyte cryopreservation treatment from a cost perspective. Because the primary model indicated that strategy 2 was not cost effective even if 100% of those still not pregnant after two fresh IVF cycles at age 40 years returned to thaw, this strategy was omitted from this sensitivity analysis. Oocyte cryopreservation was determined to be cost effective when more than 49% of those women, who did not achieve a live birth after 6 months of attempting spontaneous pregnancy at age 40 years, returned to thaw their oocytes for fertilization and ET (not depicted graphically).

DISCUSSION

Our data-driven analyses established several clinically useful cutpoints for patients and clinicians considering whether oocyte cryopreservation for deferred childbearing is warranted from a cost perspective. Specifically, among women planning to defer pregnancy attempts until age 40 years, our model predicted a lower overall cost per live birth among those electing for oocyte cryopreservation before age 38 years. Our model further indicated that among women with cryopreserved oocytes, fresh IVF before oocyte thaw cycle(s) would increase the chances of live birth, although at an increased cost. Women cryopreserving oocytes by age 35 years *and* undergoing fresh IVF at age of desired childbearing (40 years) had at least a 74% chance of live birth according to model outputs.

A major strength of our model derives from its data-driven approach and reliance on observed patient practices. The number of oocyte cryopreservation cycles needed and costs incurred were based on 7 years of oocyte yield data among patients undergoing treatments for personal (nonmedical) indications at our clinic. In addition, our model

FIGURE 2



Sensitivity analyses comparing cost-effectiveness between treatment strategies while varying individual model inputs. Each panel represents a separate sensitivity analysis, in which the model input named on the X-axis was varied, whereas all other model inputs were held constant. Cost per live birth is represented on the Y-axis such that lower points on each graph represent the more cost-effective strategy for the given model input. Model inputs varied in the sensitivity analyses included: (**A**) age at oocyte cryopreservation (OC), (**B**) probability of live birth at age 40 years from 6 months' attempts at spontaneous conception, (**C**) cost of OC, and (**D**) cost of an IVF cycle. In all panels, the *blue line* represents Strategy 1, the *green line* represents Strategy 2, and the *red line* represents Strategy 3. See Figure 1 and methods for a detailed description of each strategy.

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adds to existing literature on this question, in that the treatment strategies assessed by the model are those we have seen used most commonly by women of advancing reproductive age considering oocyte cryopreservation for personal indications (14). In their 2011 model, Van Loendersloot et al. (23) did not allow for any spontaneous pregnancy attempts at age 40 years among women with oocytes cryopreserved, and those without cryopreserved oocytes attempted for 12 months before moving to IVF. The American Society for Reproductive Medicine (ASRM) Practice Committee has stated that "women older than 35 years should receive an expedited evaluation and undergo treatment after 6 months of failed attempts to conceive or earlier" (10). Hirshfeld-Cytron et al. (22) allowed for the possibility of spontaneous pregnancy at age 40 years with 6 months of attempts in all groups. However, their model involved oocyte cryopreservation at the young age of 25 years, which as stated previously, does not accord with patient patterns in our experience. Although the former study reported a significant cost savings per live birth with oocyte cryopreservation, the latter did not find oocyte cryopreservation to be cost effective unless the cost of an IVF cycle was more than $22,000.

Although it builds on existing models, our study has several limitations. Decision-tree models are inherently limited by the accuracy and precision of their data inputs. Because oocyte cryopreservation remains in its relative infancy, sufficient thaw cycle outcome data by age at oocyte cryopreservation for women undergoing oocyte cryopreservation for personal indications are not yet available. Therefore, by necessity, our model assumed that women receiving blastocysts resulting from oocyte cryopreservation would have live birth rates equivalent to infertile couples undergoing fresh, autologous ART at the same age. Although numerous studies have demonstrated the general noninferiority of oocyte thaw cycles (15–20), these equivalent success rates likely rely to some extent on the center's experience level with oocyte cryopreservation as well as practices regarding the number of oocytes thawed and number of embryos transferred. Our model compensates for this to some extent by indicating eight MII oocytes per thaw cycle, which equated with success rates comparable to fresh IVF at our center (20). The live birth rates per thaw cycle by age at oocyte cryopreservation used in our model are somewhat higher than those reported in a recent meta-analysis by Cil et al. (36). However, the highest number of vitrified-thawed oocytes fertilized in their model was six, and their meta-analysis of vitrified oocytes included patients undergoing oocyte cryopreservation for medical fertility preservation and studies published as early as 2003. Since then, success rates have likely improved.

In addition, costs associated with oocyte cryopreservation and oocyte thaw cycles vary widely, and the proportion of women who will ultimately use their cryopreserved oocytes remains unknown. Sensitivity analyses compare values within a range of reasonable uncertainty and represent an accepted method to evaluate and account for inputs with wide ranges (37). They provide useful insight into the question of whether oocyte cryopreservation completed for nonmedical indications is cost effective. Estimating costs has proved to be particularly challenging for this work. By varying age at cryopreservation, cost of treatment, cost of an IVF cycle, and natural fecundity at age 40 years in separate analyses, we were able to obtain more specific information that clinicians and patients considering oocyte cryopreservation can use to determine whether it will be cost effective for a particular woman's situation. In this way we are able to show the cost points at which our conclusions change and improve the applicability of these findings across many clinical scenarios, as well as a range of possible future costs.

Varying age at cryopreservation, we determined the age-to-cost effectiveness threshold for undergoing oocyte cryopreservation to be 38 years. This information is encouraging for patients and providers of oocyte cryopreservation in that it is consistent with the mean age of women seeking oocyte cryopreservation observed in our clinical practice. Among 1,439 oocyte cryopreservation cycles performed at our center for personal, nonmedical indications, we observed a decrease in mean patient age from 40.0 to 37.9 years ($P<.0001$) from 2005 to 2013. It is important to note that although it was cost effective in this sensitivity analysis, oocyte cryopreservation for women in their 20s and early 30s may be impractical for both financial and societal reasons.

Our model indicated that at least 49% of those women who do not obtain a live birth after 6 months of attempts at spontaneous conception beginning at age 40 years must use their cryopreserved oocytes for oocyte cryopreservation to be cost effective per live birth. Approximately 12% of *all* women who have undergone oocyte cryopreservation at our center have returned to attempt pregnancy using cryopreserved oocytes (14). However, this percentage will likely increase given that many of these women cryopreserved their oocytes recently and have not had sufficient time to return to attempt pregnancy.

In addition to reliance on inputs, it is important to recognize the necessary simplicity of mathematical models relative to individual clinical situations. For example, in the present study, costs of ectopic pregnancies (EPs) and spontaneous abortions were not explicitly considered in the decision-tree. However, because miscarriage occurs more frequently among pregnancies resulting from older oocytes (e.g., the spontaneous and fresh ART pregnancies at age 40 years occurring in our model), inclusion of these costs would likely have increased the cost effectiveness of oocyte cryopreservation predicted by the model. Probabilities of canceled cycles and of no transfer (due to lack of oocytes surviving thaw, no oocytes obtained at retrieval in fresh cycles, or failed fertilization of all oocytes) were not explicitly modeled. In our experience, cycles resulting in no transfer are quite unlikely among patients with eight MII oocytes available to thaw (20) and represent a more common occurrence among patients undergoing fresh ART at age 40 years. In addition, frequencies of all these outcomes (miscarriage, EP, cycle cancellation, and no transfer) were largely accounted for by using inputs for *live birth per cycle start* rather than *per ET*. Therefore, cost per live birth in each strategy takes into account the cost of cycles that do not proceed to transfer and that do not progress from implantation to live birth.

Variation in age at pregnancy attempts and oocyte thaw was not explicitly modeled. However, it is unusual for women to return earlier than 5 years after oocyte cryopreservation, and if patients wait longer to attempt pregnancy (e.g., after age 40 years), oocyte cryopreservation only becomes more cost effective, as spontaneous pregnancy and autologous live birth rates decrease with age. We did not model ovulation induction and/or IUI in women who did not conceive spontaneously at the age of 40 years. A recent randomized controlled trial (38) compared IVF versus clomiphene citrate (CC) or gonadotropin ovulation induction with IUI in women aged 38–42 years with unexplained infertility of ≥ 6 months' duration. The investigators found that IVF decreased time to pregnancy by 3–4 months, with 5% live birth per ovulation induction cycle versus 15% per IVF cycle. The study did not include a cost analysis of these therapies. An additional simplification was that, as with prior published models, ours did not consider the possibility of the patient who changes her decision to defer childbearing and obtains a spontaneously conceived live birth before the age of 40 years.

Loss of individual productivity and/or absence from work was not included in our analysis, which focused on clinical rather than societal costs. Our analysis did not directly account for potential changes in the cost of IVF during the 5-year period between oocyte cryopreservation and pregnancy attempts at age 40 years due to potential inflation/deflation or changes in technology or other factors; however, sensitivity analyses varied the cost of oocyte cryopreservation and IVF cycles to evaluate potential effects on our findings. Using similar methods to sample regionally diverse clinics for IVF pricing, we found that the median cost of an ART cycle including medications was relatively stable from 2011 to 2014 and were consistent with those reported by ASRM and RESOLVE (39). Of note, most clinics include the cost of assisted hatching and intracytoplasmic sperm injection (ICSI) in their IVF pricing. As there are likely higher rates of assisted hatching and ICSI in older patients undergoing IVF, our sensitivity analyses also take into account potential differences in cost due to differences in these procedures by age group. Furthermore, if the cost of fresh autologous ART were to increase, so would the cost effectiveness of oocyte cryopreservation, by comparison. From the insurer's perspective, it is important to recognize that our model is based on financial charges—that may overestimate actual costs. From the individual patient and her health care provider's/counselor's perspective, it is important to recognize that costs presented here represent average cost per live birth, which does not necessarily equal the cost to an individual woman.

Finally, and perhaps most important, many women pursuing this technology may seek it out as an *insurance policy* of sorts, which our model cannot address. It is not possible to estimate the *value* of increased likelihood of having a genetic child or the "peace of mind" that cryopreserved oocytes may provide to an individual woman.

In conclusion, for women younger than age 38 years, oocyte cryopreservation proved to be a cost effective means to increase the likelihood of conceiving and delivering a genetically related child. Analysis indicated that fresh ART before oocyte thaw cycle(s) increased the chances of live birth among women with cryopreserved oocytes, although at an increased cost. Women cryopreserving by age 35 years who then undergo fresh ART attempts before oocyte thaw had at least a 74% chance of live birth according to model outputs. These findings support, from a cost perspective, an integral role for oocyte cryopreservation technology in reproductive planning for women who are not ready to complete childbearing before reaching the upper end of reproductive prime.

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SUPPLEMENTAL TABLE 1

Live birth per cycle start by patient age for all fresh autologous ART, SART CORS 2011.

Age (y)	Live birth (%)	No. of cycles (N = 163,484)
25	40.16	1,377
26	41.09	2,470
27	41.58	3,550
28	41.27	5,021
29	40.77	6,922
30	39.76	8,694
31	39.75	10,093
32	38.23	11,416
33	36.37	12,672
34	35.38	13,568
35	33.04	13,776
36	30.66	13,077
37	28.01	12,613
38	24.50	12,648
39	20.45	13,030
40	16.82	12,303
41	13.34	10,254

Note: ART = assisted reproductive technology; SART CORS = Society for Assisted Reproductive Technology Clinical Outcomes Reporting System.

Devine. Oocyte cryopreservation can reduce costs. Fertil Steril 2015.

SUPPLEMENTAL TABLE 2

Reported costs and ranges for OC and ART in 2014 dollars.

Treatment/service	Median cost ($)	Range ($)
OC cycle (with meds)[a]	13,548	10,096–17,000
Storage × 5 y[b]	1,500	0–3,000
Oocyte thaw cycle[b]	5,094	3,427–6,760
Fresh ART cycle[c] (with meds and assuming 50% ICSI)	14,987	12,908–17,065

Note: ART = assisted reproductive technology; ICSI = intracytoplasmic sperm injection; OC = oocyte cryopreservation.
[a] References 26–29; e-mail communication July 2014: Texas Fertility Center, Shady Grove Fertility Center, South Florida Institute for Reproductive Medicine.
[b] References 26–31; e-mail communication July 2014: Texas Fertility Center, Shady Grove Fertility Center, South Florida Institute for Reproductive Medicine.
[c] References 27, 30, 32, 33; e-mail communication July 2014: Texas Fertility Center, Shady Grove Fertility Center, South Florida Institute for Reproductive Medicine.

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