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ARTICLES

TEACHING ABOUT THE BIOLOGICAL CLOCK: Age-Related Fertility Decline and Sex Education

Kerry Lynn Macintosh*

There is only one good, knowledge, and one
evil, ignorance.
—Socrates¹

Some twenty percent of American women bear their first child after age thirty-five.² Despite these success stories, postponing motherhood is risky because fertility declines with age.³ The Centers for Disease Control and Prevention note, “[a]bout one-third of couples in which the woman is older than [thirty-five] years have fertility problems. Aging not only decreases a woman’s chances of having a baby but also increases her chances of miscarriage.”⁴

Most women have a general understanding that fertility declines with age.⁵ However, many do not realize just how early it declines until they attempt to conceive in their thirties or forties and fail.⁶ Some of these older women will conceive through in vitro

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¹ JOHN BARTLETT, FAMILIAR QUOTATIONS 70 (Justin Kaplan ed., 16th ed. 1992).

² *Infertility FAQs*, CTRS. FOR DISEASE CONTROL & PREVENTION (Jun. 20, 2013), <http://www.cdc.gov/reproductivehealth/Infertility/Index.htm>.

³ See *infra* Part I.

⁴ *Infertility FAQs*, *supra* note 2.

⁵ Lisbet S. Lundsberg et al., *Knowledge, Attitudes, and Practices Regarding Conception and Fertility: A Population-based Survey Among Reproductive-age United States Women*, 101 FERTILITY & STERILITY 767, 770 fig. 1 (2014) (study revealing that over eighty percent of women aged eighteen to forty understood aging decreased chances of conception).

⁶ See *infra* Part II.A.

fertilization ("IVF"), but others will fail because IVF cannot make their eggs young and fertile again.⁷

Twenty-first century women deserve a full range of reproductive options, including the option to conceive children with their own eggs. This Article argues that the key to reproductive choice is better information about reproductive options and limitations.

Analysis proceeds in three parts. Part I shares the biological facts about age-related fertility decline in women. IVF cannot reverse this decline, and embryo screening, egg freezing, and egg donation are imperfect solutions.⁸ Part II uses personal stories and social science studies to show that women do not know enough about age-related fertility decline. Furthermore, Part II explores possible reasons for this lack of knowledge. Finally, Part III offers two ways to improve awareness of age-related fertility decline. First, obstetrician/gynecologists ("Ob/Gyns") should take a more proactive role in sharing the facts with patients. Second, states should amend their laws to require that sex education courses cover not only birth control and sexually transmitted diseases ("STDs"),⁹ but also age-related fertility decline.

I. FACTS ABOUT AGE-RELATED FERTILITY DECLINE

The biological facts that drive age-related fertility decline are simple. By the time a girl reaches puberty, she has 300,000 to 400,000 eggs.¹⁰ Thenceforth, she will lose approximately 1,000 eggs per month for each ovulation.¹¹ Her supply of eggs, or ovarian reserve,¹² steadily diminishes as the years pass, until she reaches age thirty-seven and has, on average, only 25,000 eggs left.¹³ At that critical juncture, she begins to lose eggs at an accelerated rate.¹⁴ By the time she reaches fifty-one, the median age of menopause, she has only around 1,000 eggs left.¹⁵

The passage of time affects not only the quantity, but also the quality of eggs. A brief biology refresher will help to explain

⁷ For a discussion of the biology of age-related fertility decline and its link to IVF success rates, see *infra* Parts I.A, I.B.

⁸ See *infra* Part I.B.

⁹ E.g., CAL. EDUC. CODE § 51933(b) (West, Westlaw through 2014 Reg. Sess.).

¹⁰ SHERMAN J. SILBER, HOW TO GET PREGNANT 54 (rev. ed. Sept. 2005, paperback ed. 2007).

¹¹ *Id.*

¹² *Id.* at 42.

¹³ *Id.* at 54.

¹⁴ *Id.* at 58 fig. 3.6.

¹⁵ M.J. Faddy et al., *Accelerated Disappearance of Ovarian Follicles in Mid-life: Implications for Forecasting Menopause*, 7 HUM. REPROD. 1342, 1344 (1992).

why. When a human egg (or sperm) prepares itself for fertilization, it must undergo the process of meiosis, thereby reducing its complement of forty-six chromosomes to twenty-three.¹⁶ Ideally, at the moment of fertilization, a human egg has one copy of each of twenty-two autosomal chromosomes, plus one sex chromosome, the X chromosome.¹⁷ Likewise, a human sperm has one copy of each of the autosomal chromosomes, plus either an X or Y chromosome.¹⁸ When egg and sperm combine, they yield a human embryo that has twenty-two pairs of autosomal chromosomes, plus two sex chromosomes:¹⁹ two X chromosomes for females, or one X and one Y chromosome for males.²⁰

However, sometimes meiosis goes wrong, resulting in an egg that carries more or less than the standard single copy of a particular chromosome.²¹ Aging eggs are particularly susceptible.²² If a flawed egg is fertilized, the resulting embryo will have the wrong number of chromosomes and will not develop properly.²³

When an embryo or fetus has three copies of a given chromosome in each of its cells, rather than the standard two, it has a condition known as trisomy.²⁴ Only two percent of clinical pregnancies in women under twenty-five involve trisomy, but thirty-five percent of such pregnancies in women older than forty do.²⁵

For example, consider the well-known association between maternal age and Down syndrome.²⁶ A flawed egg leads to the conception of an embryo that has three copies of chromosome 21, or trisomy 21. Most likely, the embryo will miscarry; however, if it survives to term, the child will have Down syndrome.²⁷ A woman's

¹⁶ For a more complete account of meiosis, see SILBER, *supra* note 10, at 294-97.

¹⁷ *Id.* at 278-79, 291-92.

¹⁸ *Id.*

¹⁹ *Id.*

²⁰ *Id.* at 305.

²¹ *Id.* at 296-97.

²² *Id.* at 297.

²³ *Id.* at 293.

²⁴ NEW OXFORD AMERICAN DICTIONARY 1853 (Angus Stevenson & Christine A. Lindberg eds., 3d ed. 2010).

²⁵ Kerry Lynn Macintosh, *Brave New Eugenics: Regulating Assisted Reproductive Technologies in the Name of Better Babies*, 2010 U. ILL. J.L. TECH. & POL'Y 257, 261 (2014) (citing Renee H. Martin, *Meiotic Errors in Human Oogenesis and Spermatogenesis*, 16 REPROD. BIOMED. ONLINE 523, 524 (2007)). A "clinical pregnancy" exists when there is evidence of a gestational sac and heartbeat. Shirley J. Paine et al., *Ethical Dilemmas in Reproductive Medicine*, 18 WHITTIER L. REV. 51, 55 (1996).

²⁶ SILBER, *supra* note 10, at 277.

²⁷ *Id.* at 293.

odds of delivering a child with Down syndrome increase significantly after age thirty-five and spike upward at age forty and older.²⁸

In sum, as a woman ages, the quantity and quality of her eggs decrease, and the odds increase that she will be unable to conceive, suffer a miscarriage, or give birth to a child with chromosomal abnormalities.²⁹ Further, when a pregnant woman is thirty-five or older, and especially if she is over forty, the risks of additional negative outcomes increase both for her (chronic hypertension, preeclampsia and gestational diabetes)³⁰ and her child (preterm birth, low birth weight, and fetal death).³¹

A. *How early does fertility decline?*

In 2014, the American College of Obstetricians and Gynecologists (“ACOG”), together with the American Society for Reproductive Medicine (“ASRM”), issued a Committee Opinion on Female Age-Related Fertility Decline (“Committee Opinion”).³² According to these medical experts, a woman’s fertility begins to decline significantly when she is thirty-two years old and takes a sharp downward turn at age thirty-seven.³³ The Committee Opinion attributed this decline primarily to a decrease in egg quality.³⁴ As it noted, “[a]ge alone has an effect on fertility.”³⁵

The Committee Opinion presented various types of evidence in support of its conclusion. Because this evidence matters to the forthcoming analysis, it will be summarized briefly here.

²⁸ *Id.* at 277 fig. 12.3.

²⁹ *Id.* at 277-78. One group of researchers has found that when a woman is thirty-five or older, she also has an increased risk of bearing a baby with a *non-chromosomal* birth defect, such as a heart defect or club foot. Lisa M. Hollier et al., *Maternal Age and Malformations in Singleton Births*, 96 *OBSTETRICS & GYNECOLOGY* 701, 703-04 (2000).

³⁰ M.C. Hoffman et al., *Pregnancy At or Beyond Age 40 years Is Associated with an Increased Risk of Fetal Death and Other Adverse Outcomes*, 196 *AM. J. OBSTETRICS & GYNECOLOGY* e11, e12 tbl. 1 (2007).

³¹ *Id.* at e12 tbl. 2, e13 tbl. 3. For purposes of this study, “fetal death” occurred when a fetus age twenty weeks or more died. *Id.* at e11.

³² American College of Obstetricians and Gynecologists Committee on Gynecologic Practice & The Practice Committee of the American Society for Reproductive Medicine, *Committee Opinion: Female Age-Related Fertility Decline*, 123 *OBSTETRICS & GYNECOLOGY* 719 (2014) [hereinafter *Committee Opinion*].

³³ *Id.*

³⁴ *Id.*

³⁵ *Id.*

1. Surgical evidence

The Committee Opinion cited³⁶ a 1992 article in which researchers retrieved ovaries from surgical patients or cadavers and counted small ovarian follicles³⁷ (*i.e.*, compartments containing undeveloped eggs).³⁸ The researchers discovered that the follicles steadily declined in number over the years. In fact, after the number 25,000 was reached, at 37.5 years of age, the rate of attrition doubled.³⁹

2. Population studies

The Committee Opinion cited⁴⁰ a 1982 research article examining data sets from ten populations that did not use birth control.⁴¹ The data sets came from different countries and ranged in date from approximately 1600 to 1950; yet, researchers found that marital birth rates consistently declined in tandem with the age of the wife, plunging around age thirty-seven.⁴² To determine whether fertility decline was due to aging, rather than diminished sexual activity or damage from previous pregnancies, the researchers also examined data sets from seven other populations in which birth control was rare, but late marriages common.⁴³ Again, fertility declined steadily with age and took a sharp downward turn around age thirty-seven.⁴⁴

Lest this 1982 study be considered outdated, in 2014, researchers published a study of six populations (including 58,501 women) that did not use birth control.⁴⁵ Based on data establishing age at last birth, they concluded that barrenness rose gradually until sometime between thirty-five and forty, when it spiked upwards.⁴⁶ Twelve percent of the women bore no more children after age thirty-five.⁴⁷

³⁶ *Id.*

³⁷ Faddy et al., *supra* note 15, at 1342-43.

³⁸ SILBER, *supra* note 10, at 11.

³⁹ Compare Faddy et al., *supra* note 15, at 1344, with Karl R. Hansen, *A New Model of Reproductive Aging: The Decline in Ovarian Non-growing Follicle Number from Birth to Menopause*, 23 HUM. REPROD. 699 (2008) (researchers used modern stereology techniques to analyze ovaries collected from 122 women; decline in ovarian follicles increased steadily with age, without sudden change).

⁴⁰ *Committee Opinion*, *supra* note 32.

⁴¹ J. Menken et al., *Age and Fertility*, 233 SCIENCE 1389 (1986).

⁴² *Id.* at 1390 fig. 1.

⁴³ *Id.* at 1390.

⁴⁴ *Id.* at 1390 fig. 2.

⁴⁵ Marinus J.C. Eijkemans et al., *Too Old to Have Children? Lessons from Natural Fertility Populations*, 29 HUM. REPROD. 1304 (2014).

⁴⁶ *Id.* at 1309 fig. 2C.

⁴⁷ *Id.* at 1304.

In other words, by age thirty-five, one out of every eight women apparently was already unable to conceive a pregnancy leading to a live birth. Twenty percent, or one out of every five, bore no more children after age thirty-eight; and fifty percent, or one out of every two, bore no more children after age forty-one.⁴⁸

3. Donor insemination study

The Committee Opinion cited⁴⁹ a 1982 study in which 2,193 women married to sterile men underwent up to twelve cycles of donor insemination.⁵⁰ For women twenty-five years old or younger, the cumulative pregnancy rate was seventy-three percent; similarly, those twenty-six to thirty years old had a cumulative pregnancy rate of seventy-four percent. However, women aged thirty-one to thirty-five had a lesser cumulative pregnancy rate of sixty-one percent, while women older than thirty-five had a rate of fifty-four percent.⁵¹ This study showed the effects of aging on fertility while eliminating the decline in sexual activity that often accompanies aging as a confounding factor.⁵²

4. IVF statistics

The Committee Opinion cited statistics for IVF cycles conducted in the United States in 2010. The statistics showed that ability to conceive decreased with age, while risk of miscarriage increased.⁵³ This Article presents statistics for IVF cycles conducted in 2012 immediately below, in Part II.B.

In sum, a woman's ability to conceive declines significantly in her thirties, long before she has her last period and reaches menopause.⁵⁴ The Committee Opinion's recommended strategies for dealing with age-related fertility decline will be presented below in Part III.

B. Assisted reproductive technologies

IVF and related technologies cannot change the foregoing biological facts; if anything, they reveal the importance of young eggs.⁵⁵ The Society for Assisted Reproductive Technologies

⁴⁸ *Id.*

⁴⁹ *Committee Opinion, supra* note 32.

⁵⁰ D. Schwartz & M.J. Mayaux, *Female Fecundity as a Function of Age: Results of Artificial Insemination in 2193 Nulliparous Women with Azoospermic Husbands*, 306 N. ENGL. J. MED. 404 (1982).

⁵¹ *Id.* at 406.

⁵² *Id.* at 405.

⁵³ *Committee Opinion, supra* note 32.

⁵⁴ *Id.* at 720.

⁵⁵ See Siladitya Bhattacharya et al., *Factors Associated with Failed Treatment: an Analysis of 121,744 Women Embarking on Their First IVF Cycles*, 8

(“SART”) collects and reports data for all its member clinics nationwide.⁵⁶ Table 1 below is an edited version of a chart on the SART website; it reflects results for IVF⁵⁷ cycles with fresh embryos conceived from non-donor eggs during the year 2012.⁵⁸ The age of the woman is indicated along the top. The first horizontal row of cells shows the percentage of cycles that yielded pregnancies; the second horizontal row shows the percentage of cycles that resulted in live births.⁵⁹

TABLE 1

	Under 35	35-37	38-40	41-42	Over 42
Percentage of cycles that yielded pregnancies	46.7	37.8	29.7	19.8	8.6
Percentage of cycles that resulted in live births	40.7	31.3	22.2	11.8	3.9

Note how powerfully the age of the woman predicts success or failure in the IVF process. For women under thirty-five, the results were good: 46.7% of the IVF cycles, or nearly half, resulted in a pregnancy; 40.7% yielded a live birth. Only thirteen percent of the pregnancies were lost to miscarriage or stillbirth.

Women in their mid-to-late thirties did not fare as well. For those aged thirty-five to thirty-seven, 37.8% of IVF cycles produced a pregnancy, while 31.3% yielded a baby, for a pregnancy loss rate of around seventeen percent. In women aged thirty-eight to forty, the effects of aging were more pronounced: although 29.7% of IVF cycles led to pregnancy, only 22.2% resulted in live births. In other words, roughly a quarter of their hard-won pregnancies were lost.

PLOS ONE e82249 (2013) (“Female age is a key predictor of failure to have a livebirth [sic] following IVF as well as the risk of poor performance at each stage of treatment.”).

⁵⁶ SART is an organization of professionals who offer IVF or other assisted reproductive technologies. More than ninety percent of clinics that offer assisted reproductive technologies in the United States are members of SART. *What Is SART?*, SOC’Y FOR ASSISTED REPROD. TECH., http://www.sart.org/What_is_SART/ (last visited May 8, 2014).

⁵⁷ More than ninety-nine percent of the reported cycles involved IVF. Less than one percent of the reported cycles involved gamete intrafallopian transfer (“GIFT”) and less than one percent involved zygote intrafallopian transfer (“ZIFT”). *Clinic Summary Report, All SART Member Clinics*, SART CORP., https://www.sartcorsonline.com/rptCSR_PublicMultYear.aspx?ClinicPKID=0 (last visited May 8, 2014).

⁵⁸ *Id.*

⁵⁹ *Id.*

Women in their forties struggled to get pregnant and deliver a child. For women aged forty-one to forty-two, only 19.8% of IVF cycles yielded pregnancies, and only 11.8% resulted in live births. That is, roughly forty percent of the women who joyously heard that they were pregnant did not take a baby home. Finally, of all IVF cycles in which a woman older than forty-two used her own eggs, only 8.6% resulted in a pregnancy. The percentage of cycles leading to a live birth was only 3.9%, meaning that slightly more than half of the pregnancies ended in miscarriage or stillbirth. Such results explain why most fertility clinics are reluctant to offer IVF treatment to a woman if she is forty-three or older: failed cycles reduce their success rates.⁶⁰

The IVF industry has developed various responses to the problem of age-related fertility decline. Three are examined here: comprehensive chromosomal screening of embryos, egg freezing, and egg donation.

1. Comprehensive chromosomal screening

A recent study found that comprehensive chromosomal screening (“CCS”) of embryos improved IVF outcomes in female patients over thirty-five.⁶¹ Fresh blastocysts⁶² screened by morphology (shape) were transferred to the patients in Group A, the control group. Vitrified and thawed blastocysts were transferred to the patients in Group B, but only after cells removed from the outer layer had been screened and found to have normal chromosomes.⁶³ Around forty-one percent of the patients in Group A became pregnant; however, twenty percent of the pregnancies miscarried in the first trimester. Nearly sixty-one percent of the patients in Group B became pregnant, and there were no miscarriages in the first trimester.⁶⁴

These results show that CCS has benefits but also limitations. If an older woman still has the ability to produce some chromosomally normal eggs, and thus some chromosomally normal embryos, CCS can help her find the normal embryos to transfer. However, if her egg quality has already declined to the point where she can

⁶⁰ Claudia Kalb, *Should You Have Your Baby Now?*, NEWSWEEK, Aug. 13, 2001, at 40, 45.

⁶¹ W.B. Schoolcraft et al., *Comprehensive Chromosome Screening (CCS) with Vitrification Results in Improved Clinical Outcome in Women > 35 Years: A Randomized Control Trial*, 98 FERTILITY & STERILITY S1 (2012).

⁶² A blastocyst is a five to seven-day-old embryo which is nearly ready to implant in the uterus. SILBER, *supra* note 10, at 25.

⁶³ Schoolcraft et al., *supra* note 61.

⁶⁴ *Id.*

only produce chromosomally abnormal embryos, CCS cannot correct the problem.

2. Egg freezing

Within the last ten years or so, laboratories have perfected a form of egg freezing known as vitrification.⁶⁵ Using high concentrations of cryoprotectant and an extremely fast cooling process, labs can transform eggs into a glass-like state without creating ice crystals that can damage eggs.⁶⁶ When IVF is performed with eggs donated by young women, pregnancy rates are comparable whether vitrified or fresh eggs are used.⁶⁷ Thus far, children born from vitrified eggs have not exhibited a higher rate of birth defects than those born via standard IVF.⁶⁸

Some have suggested that egg freezing is the solution to age-related fertility decline.⁶⁹ In theory, women could bank their eggs while relatively young, pursue careers and mates, and use the eggs to procreate later when they are ready.⁷⁰ However, this technological solution to a biological problem is limited in two respects.

First, egg freezing is expensive because it requires the help of a fertility clinic that has reproductive endocrinologists and a good laboratory. The woman must use drugs to stimulate her ovaries, undergo transvaginal retrieval, and subject her eggs to freezing and

⁶⁵ The Practice Committees of the American Society for Reproductive Medicine and the Society for Assisted Reproductive Technology, *Mature Oocyte Cryopreservation: A Guideline*, 99 FERTILITY & STERILITY 37 (2013) [hereinafter *A Guideline*].

⁶⁶ *Id.* Another method, known as slow freezing, has been applied to eggs since the 1980s. *Id.* The available evidence suggests that vitrified eggs are more likely than slow-frozen eggs to survive thaw, undergo fertilization, and generate clinical pregnancies. *Id.* at 38, 40.

⁶⁷ Ana Cobo et al., *Use of Cryo-banked Oocytes in an Ovum Donation Programme: A Prospective, Randomized, Controlled, Clinical Trial*, 25 HUM. REPROD. 2239, 2243 tbl. IV (2010); see also Laura Rienzi et al., *Embryo Development of Fresh 'Versus' Vitrified Metaphase II Oocytes After ICSI: A Prospective Randomized Sibling-Oocyte Study*, 25 HUM. REPROD. 66, 70 tbl. III (2010) (reporting comparable fertilization and embryo development data for fresh and vitrified sibling oocytes).

⁶⁸ Cobo et al., *supra* note 67, at 2244. See also *A Guideline*, *supra* note 65, at 40 (acknowledging short-term studies in which birth defects are not elevated in children born from vitrified or slow-frozen eggs, but arguing that more long-term developmental data is needed).

⁶⁹ E.g., Nichole Wyndham et al., *A Persistent Misperception: Assisted Reproductive Technology Can Reverse the "Aged Biological Clock,"* 97 FERTILITY & STERILITY 1044, 1046 (2012).

⁷⁰ *Id.*

storage.⁷¹ This process costs 7,000 to 12,000 dollars, not counting the drugs (another 3,000 dollars) and storage (1,000 dollars per year).⁷² If, years later, she decides to get pregnant, she will once again need help from a fertility clinic to thaw the eggs, fertilize them, and transfer the resulting embryos to her uterus,⁷³ all at additional expense.

Second, and more fundamentally, women can only freeze the eggs they have. If they wait to freeze eggs until their mid-thirties or forties, the quantity and quality of their eggs will already have declined. According to one recent meta-analysis of IVF performed with frozen eggs, live births decreased with the age of the woman no matter what freezing technique was employed.⁷⁴ For this reason among others, the ASRM and SART recently declined to recommend egg freezing as a solution to age-related fertility decline.⁷⁵

3. Egg donation

Finally, women who are unable to conceive with their own eggs can turn to young egg donors for help. Egg donation can be a fast track to motherhood: in IVF cycles conducted with donor eggs in 2012, the percentage of embryo transfers resulting in live births was 56.6% for women at all ages.⁷⁶

Egg donation is an expensive process. The prospective mother must pay for the donor's medical expenses (including ovarian

⁷¹ Emma Rosenblum, *Later, Baby: Egg Freezing Technology Is Helping Women Kiss the Mommy Track Goodbye*, BLOOMBERG BUSINESSWEEK, Apr. 21-27, 2014, at 44, 47.

⁷² *Id.* at 48. An alternative protocol, known as "minimal stimulation," uses fewer drugs at lower cost: 5,000 to 9,000 dollars in New York City, plus 500-1,000 dollars for the drugs. Sarah Elizabeth Richards, *Do You Have to Be Rich to Freeze Your Eggs?*, SLATE (Aug. 22, 2013), http://www.slate.com/articles/double_x/doublex/2013/08/the_cost_of_egg_freezing_after_years_of_prohibitive_pricing_clinics_are.html. But this method produces only three to seven eggs, whereas the standard method produces as many as ten to twenty eggs. Rosenblum, *supra* note 71, at 48.

⁷³ Rosenblum, *supra* note 71, at 47-48.

⁷⁴ Aylin Pelin Cil et al., *Age-specific Probability of Live Birth with Oocyte Cryopreservation: An Individual Patient Data Meta-analysis*, 100 FERTILITY & STERILITY 492 (2013); *see also A Guideline*, *supra* note 65, at 40 (citing studies in support of the proposition that success with frozen eggs declines with maternal age). To be sure, individual women may sometimes succeed despite their age: in the meta-analysis, two women gave birth at ages forty-two (using slow-frozen eggs) and forty-four (using vitrified eggs). Cil et al., *supra* note 74.

⁷⁵ *A Guideline*, *supra* note 65, at 41 (In declining to recommend egg-freezing to delay childbearing, the two organizations also cited lack of data on the safety, efficacy, and cost-effectiveness of egg freezing for that purpose.).

⁷⁶ *Clinic Summary Report, All SART Member Clinics*, *supra* note 57.

stimulation and egg retrieval) as well as her own.⁷⁷ Unless she is lucky enough to find another IVF patient with extra eggs to share, or a family member or friend willing to donate for free, the prospective mother must also pay a stipend to the donor to compensate for her time and trouble, and pay yet another fee to the agency that recruited and screened the donor.⁷⁸ All told, the cost of a cycle of IVF with donor eggs can range from 25,000 to 30,000 dollars.⁷⁹

More importantly, even if egg donation were free, it would be an imperfect solution. Women who turn to donors because their own eggs are no longer viable lose the chance to conceive a child who is genetically related to them.⁸⁰

C. *Critique of Age-related Fertility Decline*

The foregoing discussion indicates that age-related fertility decline is a serious problem for women; however, not everyone agrees. In 2013, Jean Twenge published an article in which she claimed that the media had overblown the issue.⁸¹ According to her, the vast majority of women remained fertile throughout their thirties (though she advised women to complete their families by age forty).⁸² She discounted studies of long-ago populations, noting that modern women had access to electricity, antibiotics, and fertility treatments.⁸³ She argued that IVF cycle data did not predict natural fertility; IVF patients had to take drugs, and used the technology for reasons unrelated to age, such as scarred fallopian tubes or male factor infertility.⁸⁴ Finally, she theorized that fertile women became pregnant easily and completed their families early; thus, those struggling to get pregnant in middle-age likely included a disproportionate number of the infertile, leading doctors to the false conclusion that older women could not conceive.⁸⁵

⁷⁷ SILBER, *supra* note 10, at 422-23. For an egg donation protocol, see *id.* at 422 tbl. 171, 424-25.

⁷⁸ *Id.* at 421-23. The ASRM advises that a recipient must have a good reason for paying a donor more than a maximum of 5,000 dollars, and further warns that payments over 10,000 dollars are considered inappropriate. The Ethics Committee of the American Society for Reproductive Medicine, *Financial Compensation of Oocyte Donors*, 88 FERTILITY & STERILITY 305 (2007).

⁷⁹ Rachel Gurevich, *How Much Does IVF Cost?*, ABOUT.COM (May 16, 2014), http://infertility.about.com/od/ivf/f/ivf_cost.htm.

⁸⁰ Wyndham et al., *supra* note 69, at 1045.

⁸¹ Jean Twenge, *How Long Can You Wait to Have a Baby*, THE ATLANTIC, July/Aug. 2013, at 54.

⁸² *Id.* at 60.

⁸³ *Id.* at 57-58.

⁸⁴ *Id.*

⁸⁵ *Id.* at 58.

Twenge's critique contains several kernels of truth, but she overstates her case, as explained below.

1. Population studies

Twenge is correct that past populations are not the equivalent of present populations. However, she errs in dismissing studies of populations living in the nineteenth century or earlier. Data from those older populations are consistent with data from more modern populations that shunned birth control,⁸⁶ as well as with studies of twentieth-century couples who underwent donor insemination.⁸⁷

Moreover, Twenge's critique rests on the assumption that present populations are necessarily more fertile than past populations. However, that assumption is unproven and may be incorrect. Women living today have certain medical advantages over their ancestors, but they also face disadvantages. For example, women have access to antibiotics that cure STDs and post-partum infections, but also endure environmental pollution⁸⁸ and use cigarettes, both of which can hasten menopause.⁸⁹ IVF and other fertility treatments create more opportunities to conceive; however, some believe that these treatments, by allowing infertile men and women to transmit their genes to the next generation, have caused the general population to become less fertile overall.⁹⁰

2. IVF data

Just as past populations are not the same as present populations, IVF patients are not a perfect substitute for the population as a whole. However, although Twenge has identified distinctions between IVF and natural conception, she overstates their importance to this debate.

For example, Twenge stresses that IVF requires fertility drugs, whereas natural conception does not. However, the drugs used to stimulate ovaries during an IVF cycle are purified forms of

⁸⁶ For example, consider a 1957 study that focused on the Hutterites, an American Protestant sect in which birth control was not practiced. Christopher Tietze, *Reproductive Span and Rate of Reproduction Among Hutterite Women*, 8 FERTILITY & STERILITY 89 (1957). Tietze studied records of 209 married women. *Id.* at 90. He found that one woman out of ten had stopped reproducing by age thirty-five. *Id.* By age forty, one in three was no longer getting pregnant; by age forty-five, that number had jumped to seven out of eight. *Id.* Tietze also discovered that the time between pregnancies increased along with the age of the mother. *Id.*

⁸⁷ Eijkemans et al., *supra* note 45, at 1310.

⁸⁸ *Id.*

⁸⁹ Lu Sun et al., *Meta-analysis Suggests That Smoking Is Associated With an Increased Risk of Early Natural Menopause*, 19 MENOPAUSE 126 (2012).

⁹⁰ Eijkemans et al., *supra* note 45, at 1310.

follicle-stimulating hormone (FSH) and luteinizing hormone (LH); these are the very same gonadotropins that the pituitary releases in order to stimulate egg growth during a natural cycle.⁹¹ As a woman ages, and her ovarian reserve declines, so does her ability to respond to gonadotropins.⁹² Thus, a poor response to gonadotropins packaged as fertility drugs has significance beyond the realm of IVF. It is a telling symptom of age-related fertility decline.

Twenge also claims that many women use IVF for reasons unrelated to age, such as reproductive system disorders or sperm quality.⁹³ SART data for IVF cycles conducted in 2012 provide some objective support for her claim: the diagnosis frequency for tubal factor was six percent, endometriosis three percent, and uterine factor one percent; the diagnosis frequency for male factor alone was seventeen percent.⁹⁴ By comparison, the diagnosis frequency for diminished ovarian reserve was seventeen percent, ovulatory dysfunction seven percent, and multiple female factor (which might include problems with ovaries or eggs) twelve percent.⁹⁵

Nevertheless, her claim is misleading in two respects. First, reproductive system disorders such as diseased fallopian tubes, endometriosis, or uterine fibroid tumors are in fact *related* to age, because a woman's risk of acquiring them increases as the years pass.⁹⁶ In other words, such disorders provide yet another reason to be concerned about postponing motherhood into one's thirties or forties.

Second, and more fundamentally, IVF data should not be discounted on the ground that some patients have reproductive system disorders or partners with poor quality sperm, because modern medicine can often surmount those problems. IVF bypasses blocked fallopian tubes by creating embryos in the lab and transferring them directly to the uterus.⁹⁷ Fibroid tumors can be surgical-

⁹¹ SILBER, *supra* note 10, at 174, 201.

⁹² American Society for Reproductive Medicine, *Age and Fertility, A Guide for Patients*, AM. SOC'Y FOR REPROD. MED. 6 (rev. ed. 2012), https://www.asrm.org/uploadedFiles/ASRM_Content/Resources/Patient_Resources/Fact_Sheets_and_Info_Booklets/agefertility.pdf.

⁹³ Twenge, *supra* note 81, at 57-58.

⁹⁴ *Clinic Summary Report, All SART Member Clinics*, *supra* note 57.

⁹⁵ *Id.*

⁹⁶ *Committee Opinion*, *supra* note 32.

⁹⁷ See SILBER, *supra* note 10, at 219-35 (describing IVF process). Robert Edwards, one of the doctors who pioneered IVF, was inspired to do so by the sadness of patients who had been rendered infertile by blocked fallopian tubes. ROBERT EDWARDS & PATRICK STEPTOE, *A MATTER OF LIFE: THE STORY OF A MEDICAL BREAKTHROUGH* 11-15 (1980). Indeed, Lesley Brown, the first woman to bear an IVF baby, had her tubes removed. *Id.* at 152. Unfortunately, women do

ly removed.⁹⁸ Endometriosis can be treated with drugs or surgery (though doctors must take care not to harm a patient's ovaries in the process).⁹⁹ Likewise, male factor infertility can be overcome so long as a man has a few healthy sperm.¹⁰⁰ Using a technique known as intracytoplasmic sperm injection or ICSI, IVF clinics can select a single spermatozoon and inject it directly into an egg.¹⁰¹ As one fertility doctor stated, "[a]bout the only thing that seems to stand in the way of most couples with male infertility having children is, in truth, the biological clock of the wife."¹⁰²

IVF data should be viewed with caution for a *different* reason, one that Twenge does not mention: infertile women are more likely than other women to produce eggs and embryos with chromosomal abnormalities.¹⁰³ The presence of women with chromosomally abnormal eggs in the IVF patient pool probably shifts success rates downward for *all* age brackets.

Nevertheless, even if IVF patients are inherently less fertile than women in the general population, the age-based trends in IVF data reinforce the conclusions of other studies. In other words, the IVF data have value as one more piece of evidence demonstrating that fertility declines with age.

3. Skewed perspective

Twenge argues that the data linking age to infertility is an illusion, created when fertile women reproduce early and leave only the less fertile behind, who struggle to conceive into their thirties and forties.¹⁰⁴ David Dunson's recent study of 782 couples attempting to conceive a clinical pregnancy at natural family planning centers in Europe refutes this claim.¹⁰⁵ The study linked fertility de-

sometimes fail at IVF if their diseased fallopian tubes leak toxic substances into the uterus, or trap and fail to release a migrating embryo. SILBER, *supra* note 10, at 214.

⁹⁸ The Practice Committee of the American Society for Reproductive Medicine in collaboration with The Society of Reproductive Surgeons, *Myomas and Reproductive Function*, 90 FERTILITY & STERILITY S125, S127-28 (2008); cf. SILBER, *supra* note 10, at 421 (claiming older women treated with donor eggs can get pregnant even when fibroid tumors are left in place).

⁹⁹ See SILBER, *supra* note 10, at 92-95 (describing treatments, while questioning whether they harm fertility more than they help).

¹⁰⁰ *Id.* at 255 ("No matter what the cause of the male infertility, ICSI bypasses the problem successfully.").

¹⁰¹ *Id.* at 249-50 (describing ICSI process).

¹⁰² *Id.* at 254.

¹⁰³ Macintosh, *supra* note 25, at 261 (citing Martin, *supra* note 25, at 524).

¹⁰⁴ Twenge, *supra* note 81, at 58.

¹⁰⁵ David B. Dunson et al., *Increased Infertility with Age in Men and Women*, 103 OBSTETRICS & GYNECOLOGY 51 (2004).

cline to the age of the woman, and showed that the decline was not due to an increase in the proportion of sterile couples over time.¹⁰⁶

4. Playing the odds

Finally, what of Twenge's claim that many women remain fertile well into their thirties and forties?¹⁰⁷ In her article, she cites studies that favorably portray fertility in middle-aged women.¹⁰⁸ Two of those studies are examined here.

a. Rothman study

Kenneth Rothman and a team of researchers studied the results when 2,820 Danish women attempted to conceive naturally within twelve menstrual cycles.¹⁰⁹ The study showed that the woman's age had relatively little effect except when the woman was thirty-five to forty years old, at which point the odds of conceiving dropped significantly.¹¹⁰ The team also studied the results when couples took these simple steps to facilitate conception: having sexual intercourse two times a week or more; using a non-hormonal form of birth control prior to attempts to conceive;¹¹¹ and timing intercourse to coincide with ovulation.¹¹² Such steps did improve the odds of conception; however, the steps were less effective for women thirty and older and did not completely counteract the effects of age-related fertility decline.¹¹³ Specifically, seventy-five percent of women aged thirty-five to forty who took all three steps conceived;

¹⁰⁶ *Id.* at 54. The study relied on a statistical model to assess sterility rates. For a discussion, *see id.* at 52.

¹⁰⁷ Abha Maheshwari et al., *Women's Awareness and Perceptions of Delay in Childbearing*, 90 FERTILITY & STERILITY 1036, 1041 (2008). Indeed, a recent article reported that a forty-six year-old woman who underwent IVF with her own fresh eggs conceived and bore a healthy son. Mark P. Trolice, *Live Birth from a 46-year-old Using Fresh Autologous Oocytes Through In Vitro Fertilization*, 102 FERTILITY & STERILITY 96 (2014). However, as the article noted, the prognosis for most women forty-five and older remained poor. *Id.* at 98.

¹⁰⁸ Twenge, *supra* note 81, at 57.

¹⁰⁹ Kenneth Rothman et al., *Volitional Determinants and Age-related Decline in Fecundability: A General Population Prospective Cohort Study in Denmark*, 99 FERTILITY & STERILITY 1958 (2013).

¹¹⁰ *Id.* at 1961. Researchers found that the average per cycle odds of conceiving for women aged thirty-five to forty were 0.77, relative to a reference value of 1.00 set for women aged twenty to twenty-four. *Id.* at 1959-60, 1961 tbl. 3.

¹¹¹ The researchers deemed this factor relevant because prior use of hormonal birth control could slow a woman's return to normal, fertile cycles. *Id.* at 1959.

¹¹² *Id.*

¹¹³ *Id.* at 1961.

while ninety-one percent of women aged twenty to twenty-four did so.¹¹⁴

To be sure, seventy-five percent sounds like a robust success rate; however, the flip side is that twenty-five percent of women aged thirty-five to forty failed to conceive, even after doing all they could to improve their chances. Moreover, this study did not indicate how many of the older women miscarried. Finally, Rothman and his team stated that few of the participants in the study belonged to the oldest category, suggesting that "our findings may not be applicable for the oldest couples seeking to conceive."¹¹⁵

The Rothman study also compared women who had borne children previously (parous) with women who had never had a child before (nulliparous). Age had a more pronounced effect on the ability of nulliparous women to conceive,¹¹⁶ suggesting that their ovarian reserve could be lower.¹¹⁷

b. Dunson study

David Dunson and a different set of researchers studied 782 European couples that attempted to conceive naturally over the course of twelve cycles, with intercourse twice a week. Few women failed to conceive in their twenties or early thirties.¹¹⁸ However, for women aged thirty-five to thirty-nine, eighteen percent failed to conceive.¹¹⁹

Flip the numbers around, and the prognosis seems rosier: eighty-two percent of women aged thirty-five to thirty-nine

¹¹⁴ *Id.* at 1961 tbl. 2.

¹¹⁵ *Id.* at 1963.

¹¹⁶ *Id.* at 1962.

¹¹⁷ Twenge speculates that the nulliparous women had blocked fallopian tubes or partners with sperm issues rather than egg quality problems. Twenge, *supra* note 81, at 58. However, the data do not point to that conclusion. At one point, the researchers divided the nulliparous women into two groups: those who had never been pregnant, and those who had been pregnant but never borne a child. When viewed independently, the odds of conceiving *improved* for women who had never been pregnant before. Rothman et al., *supra* note 109, at 1962 fig. 1C. Yet, this is precisely the group to which women with blocked fallopian tubes or infertile partners would likely belong. Meanwhile, the odds for women who had been pregnant but never borne a child showed an earlier and more severe drop with age. *Id.* This outcome is not surprising, given the strong association between miscarriage and chromosomal abnormalities, and between chromosomal abnormalities and the age of the mother. SILBER, *supra* note 10, at 365; Macintosh, *supra* note 25, at 260-61.

¹¹⁸ Only eight percent of nineteen to twenty-six year-old women failed to conceive; only thirteen percent to fourteen percent of women aged twenty-seven to twenty-nine and aged thirty to thirty-four failed to conceive. Dunson et al., *supra* note 105, at 53.

¹¹⁹ *Id.*

achieved a clinical pregnancy within twelve cycles.¹²⁰ Based on data trends, Dunson estimated that roughly half of these women who failed to achieve a clinical pregnancy in the first year would conceive if they kept trying for one additional year;¹²¹ if true, only nine percent would be left without any pregnancy at all.

Even if the Dunson study is correct, and most women in their mid-to-late thirties will conceive after a year or two, a failure rate that ranges from nine percent (estimated) to eighteen percent (documented) is significant.¹²² Moreover, the Dunson study did not indicate how many of the clinical pregnancies ended in miscarriage.

In sum, the Rothman and Dunson studies reinforce a key point: when it comes to fertility, all women are not created equal. Age will matter for some more than others because ovarian reserve varies.¹²³ For those women who fail to conceive or suffer a miscarriage due to declining egg quantity or quality, motherhood deferred will be motherhood denied. Birth announcements received from more fertile peers will be cold comfort indeed.

Unfortunately, an individual woman cannot easily predict whether she can safely delay motherhood into her mid-thirties and beyond. As the authors of the 2014 population study noted:

Regrettably, there are no reliable biological markers that accurately portend the onset of reproductive failure. Irregular menstrual cycles and hot flushes signifying imminent menopause represent symptoms that arise too late to be offered as a [sic] predictive measures because sterility is likely to have started already years earlier, when the menstrual pattern was still regular and hormone levels deviated little from the standard norm.¹²⁴

¹²⁰ Twenge, *supra* note 81, at 57.

¹²¹ Dunson et al., *supra* note 105, at 54 tbl. 1.

¹²² Interestingly, the eighteen percent failure rate that Dunson found for women aged thirty-five to thirty-nine is close to the twenty percent failure rate for thirty-eight year-old women found in the 2014 population study. Eijkemans et al., *supra* note 45, at 1304. *See also* Twenge, *supra* note 81, at 57 (citing a study by Anne Steiner who found that eighty percent of white women aged thirty-eight and thirty-nine with prior pregnancies were able to conceive within six months).

¹²³ *See* Macintosh, *supra* note 25, at 261.

¹²⁴ Eijkemans et al., *supra* note 45, at 1310.

Medical tests of ovarian reserve do exist;¹²⁵ however, doctors who are not fertility specialists may not know of them.¹²⁶ Moreover, if a woman is not aware of the risk of age-related fertility decline, she will not ask for such a test. Thus, this Article next seeks to determine what women already know about age-related fertility decline.

II. THE GAP IN FERTILITY KNOWLEDGE

Part II begins with the personal stories of two women who lost their ability to conceive because they didn't know enough about age-related fertility decline. Part II validates their experiences with data from social science experiments.

A. *Personal stories*

1. Jane Everywoman

In 2013, a woman living in the United Kingdom published an article entitled: *Cassandra's Prophecy: Why We Need to Tell the Women of the Future About Age-Related Fertility Decline and 'Delayed' Childbearing*.¹²⁷ Writing under the pseudonym Jane Everywoman, the author described herself as a schoolteacher and academic researcher. She postponed efforts to conceive until age thirty-two, by which time she had obtained higher degrees and professional certificates and felt secure in her marriage and profession.¹²⁸ Conditioned by sex education to believe that unprotected sex invariably led to live births, and lulled by media stories about celebrities falling pregnant in middle-age, poor Jane was shocked to discover that she could not conceive at all.¹²⁹

¹²⁵ The standard test measures levels of FSH in a blood sample drawn on day three of the menstrual cycle. In theory, a high level of FSH signals that the woman is less fertile because the pituitary is struggling to stimulate the ovary to produce eggs. However, in recent years, some doctors have abandoned the FSH test as unreliable. See SILBER, *supra* note 10, at 49-51. An alternative is to count antral follicles in the ovary at any point during the menstrual cycle. The more follicles that are present, the more fertile the woman is considered to be. *Id.* at 62-66. For a discussion of tests of ovarian reserve, see The Practice Committee of the American Society for Reproductive Medicine, *Testing and Interpreting Measures of Ovarian Reserve: A Committee Opinion*, 98 FERTILITY & STERILITY 1407 (2012).

¹²⁶ See SILBER, *supra* note 10, at 53 (asserting that most doctors and technicians do not understand the significance of antral follicle counts).

¹²⁷ Jane Everywoman, *Cassandra's Prophecy: Why We Need to Tell the Women of the Future About Age-Related Fertility Decline and 'Delayed' Childbearing*, 27 REPROD. BIOMED. ONLINE 4 (2013).

¹²⁸ *Id.* at 4.

¹²⁹ *Id.* at 4-5.

Jane Everywoman knew that fertility declined with age, but did not understand that the decline had little to do with one's general health and everything to do with an inexorable decline in egg quality due to aging.¹³⁰ Around age thirty-four, she began to consult medical doctors, who told her to "wait two years" or "go home and relax."¹³¹ Even though she had begun to experience discomfort during her menstrual cycle at age thirty-two, and irregularities by age thirty-seven, no doctor advised her that she might be entering perimenopause¹³² (a period of hormonal fluctuations and declining fertility that precedes menopause).¹³³ She waited patiently for conception to occur in the false hope that, if it did not, IVF could solve the problem. When she was thirty-nine, she visited an IVF clinic only to learn that she had few eggs left.¹³⁴ Her IVF cycles with donor eggs failed.¹³⁵ Jane Everywoman remained childless at age forty-two, when the article was published.¹³⁶

Based on her experiences, Jane Everywoman identified several misunderstandings that needed correction: (1) the cultural perception of forty as young, which clashed with the realities of reproductive biology; (2) family planning programs and contraceptives that sent an implicit message that conception is easy, even inevitable; (3) the false belief that IVF was a miracle technology that could help most women in their forties get pregnant with their own eggs; and (4) failure to grasp that fertility varied among women and declined years before menopause (which could also come early).¹³⁷ She argued that better education was necessary to enable women to make informed reproductive decisions.¹³⁸ In her view, basic facts regarding age-related fertility decline should be communicated through sex education programs in the schools and public health messages aimed at young women.¹³⁹ Accurate information about

¹³⁰ *Id.* at 6.

¹³¹ *Id.* at 5.

¹³² *Id.* at 4, 5. An herbalist did suggest that Jane might be entering perimenopause, but Jane questioned that advice because it didn't come from a medical doctor. *Id.* at 5.

¹³³ Mayo Clinic Staff, *Diseases and Conditions, Perimenopause, Definition*, MAYO CLINIC, <http://www.mayoclinic.org/diseases-conditions/perimenopause/basics/definition/con-20029473> (last visited Sept. 19, 2014).

¹³⁴ Everywoman, *supra* note 127, at 5.

¹³⁵ *Id.*

¹³⁶ *Id.*

¹³⁷ *Id.* at 6-7.

¹³⁸ *Id.* at 8.

¹³⁹ *Id.*

the true odds of conceiving through fertility treatments should also be disseminated.¹⁴⁰

2. Tanya Selvaratnam

In 2014, Tanya Selvaratnam brought the issue of age-related fertility decline to the fore in her trade press book, *The Big Lie: Motherhood, Feminism, and the Reality of the Biological Clock*.¹⁴¹ Ms. Selvaratnam married her husband at age thirty-seven and became pregnant after only two months.¹⁴² However, she suffered a miscarriage.¹⁴³ Her Ob/Gyn told her “You have time,” thereby lulling her into a false sense of security.¹⁴⁴ When she was almost thirty-nine, she suffered a second miscarriage; tests showed the fetus had a chromosomal abnormality. Ms. Selvaratnam did her own research and realized that many of her remaining eggs probably carried abnormal numbers of chromosomes due to her advancing age.¹⁴⁵

At age forty, Ms. Selvaratnam visited a new Ob/Gyn who placed her on Clomid, a fertility drug. Once again, she got pregnant, and once again, she miscarried.¹⁴⁶ Finally, she resolved to undergo IVF at a fertility center but postponed her cycle when an ultrasound revealed a mass in her abdomen.¹⁴⁷ A biopsy revealed she had cancer.¹⁴⁸ Surgery cured her,¹⁴⁹ but before she could begin the postponed IVF cycle, her marriage collapsed under the stress of all that had gone before.¹⁵⁰

Left without partner or child at age forty-one,¹⁵¹ Ms. Selvaratnam birthed a book instead, with this blunt message:

The Big Lie is that women can do what they want on their own timetables. . . . The Big Lie is that women can delay motherhood until they are ready emotionally and

¹⁴⁰ *Id.*

¹⁴¹ TANYA SELVARATNAM, *THE BIG LIE: MOTHERHOOD, FEMINISM, AND THE REALITY OF THE BIOLOGICAL CLOCK* (2014).

¹⁴² *Id.* at 13.

¹⁴³ *Id.* at 14.

¹⁴⁴ *Id.* at 19.

¹⁴⁵ *Id.* at 20.

¹⁴⁶ *Id.* at 23-26.

¹⁴⁷ *Id.* at 90.

¹⁴⁸ *Id.* at 143-44. Specifically, she was diagnosed with gastrointestinal stromal tumor or GIST, which is caused by a genetic mutation. *Id.* at 146. A subsequent CT scan of her torso revealed that she also had a thymoma in her chest, near the heart. *Id.* at 149-51.

¹⁴⁹ *Id.* at 151-54, 209-14.

¹⁵⁰ *Id.* at 215-21.

¹⁵¹ Ms. Selvaratnam turned forty-one on March 20, 2012. *Id.* at 93. She separated from her husband on December 2, 2012. *Id.* at 221.

financially, until they have their careers figured out and have found the perfect partner, and that if they have trouble, then science will find a way to give them a child.¹⁵²

Like Jane Everywoman, Ms. Selvaratnam blamed her plight in part on inadequate sex education.¹⁵³ As a child and teenager, she took sex education and learned how to avoid STDs; but her teachers never explained that she would enjoy a brief reproductive prime in her twenties and face a steep decline in egg quality in her thirties.¹⁵⁴ Had she known the specific facts, she might have tried to get pregnant in her mid-thirties, when she first met her husband; she might have gone to a fertility specialist immediately after her first miscarriage.¹⁵⁵ As she concluded, “[w]omen should be taught about the life span of their eggs, about assisted reproductive technologies, and about the meaning of infertility. Sex education should be more than just preventing pregnancy and STDs.”¹⁵⁶

Ms. Selvaratnam also deplored media stories about celebrities in their forties and fifties who give birth. Too often, the stories misled readers and viewers who were never told that the celebrities might have used eggs from younger donors to become pregnant.¹⁵⁷ She praised celebrities who were brave enough to tell the truth, and called for more realistic portrayals of fertility decline in popular culture.¹⁵⁸

B. *Studies from the United States*

Social science studies support the personal stories of these two women. In this section, this Article discusses four studies conducted in the United States.

1. United States

The four United States studies are presented here in reverse chronological order.

a. *Yale School of Medicine 2014*

In 2014, researchers from the Yale School of Medicine published the results of an online survey of 1,000 women aged eighteen to forty and living in the United States.¹⁵⁹ The survey aimed

¹⁵² *Id.* at 35.

¹⁵³ *Id.* at 49-50.

¹⁵⁴ *Id.* at 35, 37.

¹⁵⁵ *Id.* at 50.

¹⁵⁶ *Id.* at 49-50.

¹⁵⁷ *Id.* at 118-19.

¹⁵⁸ *Id.* at 122-27.

¹⁵⁹ Lundsberg et al., *supra* note 5. The women surveyed came from regions

“to assess overall knowledge, attitudes, and practices related to conception and fertility among reproductive-age women in the United States.”¹⁶⁰ The survey covered many topics, but of greatest interest here are the responses to questions regarding the effects of aging. More than eighty percent of the women understood that aging reduced the chances of conceiving a child.¹⁶¹ But when it came to *specific* effects of aging, fewer women were informed. Aging increases the time to conception, risk of miscarriage, and odds of giving birth to a child with genetic or chromosomal abnormalities; however, only around seventy to eighty percent of the women knew those facts,¹⁶² prompting the researchers to express concern that more than one-fifth of the women *didn't* know about these risks.¹⁶³ Amazingly, around forty percent of the women falsely believed their ovaries could keep on producing new eggs throughout their reproductive lifespans.¹⁶⁴

Interactions with health care providers were also discouraging. Only twenty-three percent of women aged thirty-five to forty had discussed the effect of age on fertility with a health care provider.¹⁶⁵ Ten percent or less of women in younger age brackets had done the same.¹⁶⁶ The researchers called for better education and improved interaction between patients and health care providers.¹⁶⁷

b. UCSF 2012

A University of California at San Francisco (“UCSF”) study published in 2012 focused specifically on beliefs regarding fertility and aging.¹⁶⁸ The researchers surveyed sixty-one women who had conceived through IVF and given birth at age forty or older.¹⁶⁹

throughout the United States and were diverse in terms of their race, education, income level, sexual orientation, employment, and marital status. *Id.* at 768. Fifty-eight percent of the women already had children and forty-six percent thought they might have more in the future. *Id.* Only fifteen percent of the women said they didn't want any children. *Id.*

¹⁶⁰ *Id.* at 767.

¹⁶¹ *Id.*

¹⁶² *Id.* Women aged twenty-five to thirty-four were most likely to understand that age increased time to conception and risk of miscarriage, while women aged thirty-five to forty scored highest on the link between age and genetic or chromosomal abnormalities. *Id.*

¹⁶³ *Id.* at 772.

¹⁶⁴ *Id.* at 770.

¹⁶⁵ *Id.* at 771.

¹⁶⁶ *Id.* at 771 fig. 2.

¹⁶⁷ *Id.* at 773.

¹⁶⁸ See K. Mac Dougall et al., *Age Shock: Misperceptions of the Impact of Age on Fertility Before and After IVF in Women Who Conceived After Age 40*, 28 HUM. REPROD. 350 (2012).

¹⁶⁹ *Id.* at 351.

Before treatment the women had had a general sense that age mattered; for example, forty-eight percent had realized that fertility declined after age forty.¹⁷⁰ However, many simply had not known how much or how soon fertility declined. Thirty percent of the women had believed their fertility would taper gradually and end only when they reached menopause.¹⁷¹ Moreover, thirty-one percent of the women had believed they could get pregnant at age forty without any difficulty.¹⁷² When the women failed to conceive and consulted fertility professionals, the truth hurt. Forty-four percent of the women were shocked to learn the true facts about age-related fertility decline.¹⁷³ Another fifty-two percent had to be told that even IVF could not ensure that they would be able to get pregnant using their own eggs.¹⁷⁴

This gap in fertility knowledge was not due to social or financial disadvantage; to the contrary, the women tended to have good educations and were financially comfortable enough to afford IVF.¹⁷⁵ The women ascribed their misperceptions to many of the same factors that Jane Everywoman and Tanya Selvaratnam had enumerated: messaging about pregnancy prevention that implied it was easy to get pregnant; belief that a healthy lifestyle equated to fertility; failure of health care providers to provide them with the facts of age-related fertility decline; and media accounts of pregnant forty-something celebrities.¹⁷⁶

The authors of the study found it striking that well-educated women were so ignorant of fertility facts, and surmised that career focus might have drowned out fertility messaging.¹⁷⁷ Other possible factors contributing to ignorance included the long delay in developing scientific information regarding age-related fertility decline,¹⁷⁸ as well as the “unwelcome social implications of this information.”¹⁷⁹ For example, the ASRM tried to share the biological facts with the public in 2001, but provoked opposition from critics who claimed women would feel pressured to choose motherhood over education or work.¹⁸⁰

¹⁷⁰ *Id.* at 352.

¹⁷¹ *Id.*

¹⁷² *Id.*

¹⁷³ *Id.* at 353.

¹⁷⁴ *Id.*

¹⁷⁵ *Id.* at 353-54.

¹⁷⁶ *Id.* at 352-53.

¹⁷⁷ *Id.* at 354.

¹⁷⁸ *Id.* at 353-54. For example, the ASRM did not recommend expedited evaluation of women at age thirty-five until 2008. *Id.* at 354.

¹⁷⁹ *Id.*

¹⁸⁰ *Id.* The ASRM placed eye-catching public advertisements in New York

Going forward, twenty-eight percent of the women in the UCSF 2012 study suggested better fertility education for young women and men.¹⁸¹ Nearly a quarter, or twenty-three percent, asserted that they would have attempted to conceive earlier, had they only known the facts.¹⁸² However, forty-six percent of the women said their personal circumstances would not have accommodated earlier childbearing.¹⁸³

The UCSF 2012 study did not include older women who *failed* at IVF. Had such women been included, the study responses might have been even more critical of gaps in fertility education.¹⁸⁴

c. *EMD Serono 2011*

EMD Serono, a biopharmaceutical company that sells fertility drugs among other products,¹⁸⁵ published its own study in 2011.¹⁸⁶ The study canvassed 1,010 women aged twenty-five to thirty-five to assess their fertility knowledge.¹⁸⁷ None of the women had children yet, but seven out of ten planned to do so in the future.¹⁸⁸ On the surface, the women seemed to understand age-related fertility decline. Eighty-two percent acknowledged that a woman's age is a risk factor for infertility.¹⁸⁹ Seventy-eight percent realized that fertility decreases more than a decade before menopause,¹⁹⁰ an event which itself occurs on average at ages fifty to fifty-four.¹⁹¹

However, other survey responses indicated that women's knowledge was incomplete at best. On average, the women in the

and other American cities warning women about age-related fertility decline. The American Infertility Association (a patient-advocacy organization) distributed pamphlets with information on age-related fertility decline to doctor's offices in New York City. These efforts provoked a backlash from feminists and some women who felt pressured by the information. Kalb, *supra* note 60, at 42. Some questioned the motivations of fertility doctors, suspecting them of trumpeting age-related risks so they could drive women into their clinics and line their own pockets. *Id.* at 48.

¹⁸¹ Mac Dougall et al., *supra* note 168, at 353.

¹⁸² *Id.*

¹⁸³ *Id.*

¹⁸⁴ *Id.* at 354.

¹⁸⁵ See *Fertility*, EMD SERONO, <http://www.emdserono.com/en/therapies/fertility/fertility.html> (last visited May 5, 2014).

¹⁸⁶ See *In the Know: Fertility IQ 2011 Survey, Fertility Knowledge Among US Women Aged 25-35: Insights from a New Generation*, EMD SERONO 18 (2011), <http://www.resolve.org/about/in-the-know-fertility-iq-white-paper-2011.pdf> [hereinafter *Fertility IQ 2011 Survey*].

¹⁸⁷ *Id.* at 10.

¹⁸⁸ *Id.* at 10, 12.

¹⁸⁹ *Id.* at 14.

¹⁹⁰ *Id.*

¹⁹¹ *Id.* at 18.

survey wanted to have two children between the ages of 31.8 and 35.6.¹⁹² In other words, they planned to defer their first birth until nearly thirty-two, an age when fertility has already begun to decline.¹⁹³ Yet, three out of four women were not worried about being able to conceive,¹⁹⁴ suggesting that they did not know the risk they were taking in waiting so long.

Furthermore, the women had an unrealistically optimistic view of what IVF could do for them. One fifth of the women thought pregnancy rates were twice as high (fifty percent to fifty-nine percent) as they actually are (twenty percent to twenty-nine percent).¹⁹⁵ Fifty-four percent didn't realize that success turned on the age of the woman supplying the eggs.¹⁹⁶ Less than twenty percent understood that a woman over thirty-five was more likely to succeed using the eggs of a twenty year-old donor.¹⁹⁷

Like many other studies, this one concluded that women did not have an adequate understanding of age-related fertility changes.¹⁹⁸ It urged that doctors do more to educate women. "Public health initiatives to help achieve this objective might include arming Ob/Gyns with fertility education resources, such as pamphlets, links to websites, discussion guides, or self-assessments, that they can pass along to patients even if their time together is limited."¹⁹⁹

d. UCSF 2006

In 2006, UCSF researchers published the results of an interview study of seventy-nine couples that had had children with the aid of donor eggs.²⁰⁰ The researchers found that the women had constructed two different narratives regarding their age-related fertility decline. "Eleventh hour moms" were those who first tried to conceive with their own eggs, typically in their late thirties or early forties, only to find that their fertility was already compromised and that donor eggs were the only solution.²⁰¹ These women were keenly aware of the precious time they had lost.²⁰² Some blamed

¹⁹² *Id.* at 12.

¹⁹³ *See supra* text accompanying note 33.

¹⁹⁴ *Fertility IQ 2011 Survey, supra* note 186, at 12.

¹⁹⁵ *Id.* at 22.

¹⁹⁶ *Id.*

¹⁹⁷ *Id.*

¹⁹⁸ *Id.* at 26.

¹⁹⁹ *Id.*

²⁰⁰ *See* Carrie Friese et al., *Rethinking the Biological Clock: Eleventh-hour Moms, Miracle Moms and Meanings of Age-related Infertility*, 63 Soc. Sci. & MED. 1550 (2006).

²⁰¹ *Id.* at 1553-54, 1559.

²⁰² *Id.* at 1554.

Ob/Gyns for not warning them about age-related fertility decline, and claimed they would have pursued fertility treatments sooner had they been properly informed.²⁰³ Others forcefully argued that women should be better educated about the relationship between aging and fertility.²⁰⁴

“Miracle moms” experienced donor eggs as a gift that had allowed them to turn back the clock and conceive beyond their normal reproductive lifespan.²⁰⁵ They were not as likely to blame others for their infertility as the eleventh-hour moms were.²⁰⁶ However, women in the miracle mom group also tended to be older than the eleventh-hour moms and thus had a different clinical experience. With many giving birth at age forty-five or older, these women either knew from the beginning that they could not get pregnant with their own eggs or were told so promptly upon arriving at the fertility clinic.²⁰⁷

The researchers observed that the consequences of age-related fertility decline appeared not to be adequately understood by either doctors or popular culture. Further, they noted that only a handful of IVF doctors who served a small subset of infertile women were currently engaged in the medical evaluation of age-related fertility problems.²⁰⁸

C. *Studies from Canada and the United Kingdom*

This Article advocates for changes to the education system in the United States. Thus, studies conducted in the United States are most pertinent. However, this Article deems studies from Canada and the United Kingdom to also be relevant for the following reasons. First, like the United States, Canada and the United Kingdom are places where many women delay childbearing.²⁰⁹ Second, scientists in the United Kingdom invented IVF,²¹⁰ so women there

²⁰³ *Id.* at 1554-55.

²⁰⁴ *Id.* at 1555.

²⁰⁵ *Id.* at 1555-56.

²⁰⁶ *Id.* at 1558.

²⁰⁷ *Id.* at 1556.

²⁰⁸ *Id.* at 1557.

²⁰⁹ See Karla L. Bretherick et al., *Fertility and Aging: Do Reproductive-aged Canadian Women Know What They Need to Know?*, 93 *FERTILITY & STERILITY* 2162 (2010); see also Louisa Peacock & Laura Donnelly, *Women Delaying Motherhood Is 'Worrying Issue', Says Chief Medical Officer*, *THE TELEGRAPH* (Jan. 16, 2014), <http://www.telegraph.co.uk/women/womens-health/10578227/Women-delaying-motherhood-is-worrying-issue-says-Britains-chief-doctor.html> (reporting that the average age of mothers in the United Kingdom is thirty, tied with Germany for highest in the world).

²¹⁰ See generally EDWARDS & STEPTOE, *supra* note 97 (describing the pioneering work of Robert Edwards and Patrick Steptoe in the United Kingdom).

have long had access to that option. Third, both Canada and the United Kingdom share our English language, making it plausible that women who live there have been exposed to some of the same information as women here, such as feature stories about pregnant celebrities in their forties, or news reports on the latest assisted reproductive technologies.

1. Canada

Consider two studies from our neighbor Canada. A 2012 publication told the story of how researchers had surveyed around 3,300 childless women to determine their grasp of fertility basics and assisted reproduction.²¹¹ The results were mixed. For example, ninety percent of the women surveyed understood that fertility declined after the age of thirty-five, and eighty percent knew that miscarriage rates were higher for women in their forties.²¹² Yet, seventy-three percent of the women incorrectly thought that fitness and health predicted fertility better than age did.²¹³ Only forty-nine percent understood that a woman's eggs reflected her age.²¹⁴ Strikingly, ninety-one percent mistakenly believed that assisted reproduction could help women reproduce with their own eggs until menopause.²¹⁵ Meanwhile, less than half of the women understood how expensive IVF treatment was.²¹⁶ The researchers concluded there were "significant gaps in the knowledge upon which many women may be basing their childbearing decisions" and advised the implementation of public education programs to improve understanding of fertility and assisted reproduction.²¹⁷

In the second study, published in 2010, researchers surveyed 360 female undergraduate students to determine their knowledge of age-related fertility decline.²¹⁸ Seventy percent of these students understood that fertility declines before menopause; however, only forty-five percent recognized that when it comes to infertility, the age of a woman is the greatest risk factor.²¹⁹ Similarly, only twenty-four percent selected the age of a woman as the greatest risk

²¹¹ See Judith C. Daniluk et al., *Childless Women's Knowledge of Fertility and Assisted Human Reproduction: Identifying the Gaps*, 97 *FERTILITY & STERILITY* 420 (2012).

²¹² *Id.* at 424.

²¹³ *Id.*

²¹⁴ *Id.*

²¹⁵ *Id.*

²¹⁶ *Id.*

²¹⁷ *Id.*

²¹⁸ Bretherick et al., *supra* note 209.

²¹⁹ *Id.* at 2165.

factor for miscarriage.²²⁰ Finally, the students underestimated the percentage of couples that experience infertility when the woman is over forty: their response mean was fifty-three percent, while the actual population mean is seventy to ninety percent.²²¹

The researchers posited three reasons that the students might lack knowledge: health care programs that emphasized pregnancy prevention rather than fertility awareness; failure to seek out facts that were not relevant to immediate goals; and media stories that depicted forty-something celebrities with babies, without explaining that the women may have resorted to IVF, donor eggs, or surrogates.²²² The researchers argued that their findings “support the case that there is a need for education on fertility and aging,” particularly among university-educated women who might be particularly tempted to postpone motherhood in favor of career goals.²²³

2. United Kingdom

Next, consider a study conducted by United Kingdom researchers. The researchers polled 362 women who were patients at a fertility clinic and another 362 women who were pregnant.²²⁴ Thirty-seven percent of the fertility clinic patients had first attempted a planned pregnancy after they had turned thirty; only twenty-four percent of the pregnant women had waited that long.²²⁵ Moreover, seventy-three percent of the fertility clinic patients indicated that they had put off their first planned pregnancy, whereas only fifty-three percent of the pregnant woman had done so.²²⁶ Thirty-five percent of the fertility clinic patients regretted their decision to postpone pregnancy.²²⁷

Perhaps unsurprisingly, eighty-five percent of the patients already enmeshed in fertility treatment understood that their chances of pregnancy declined between ages thirty and forty, while only seventy-six percent of the pregnant women possessed that knowledge.²²⁸ However, only fifty-three percent of the fertility clinic patients realized that the odds of having a baby via IVF declined during that same decade.²²⁹ An astounding eighty-four percent of

²²⁰ *Id.*

²²¹ *Id.* tbl. 2.

²²² *Id.* at 2166.

²²³ *Id.* at 2167.

²²⁴ Maheshwari et al., *supra* note 107, at 1036.

²²⁵ *Id.* at 1037.

²²⁶ *Id.*

²²⁷ *Id.* at 1037-38.

²²⁸ *Id.* at 1038.

²²⁹ *Id.* (Similarly, only forty-five percent of the pregnant women knew that the odds of having a baby via IVF declined from ages thirty to forty.).

the clinic patients thought fertility treatments could overcome the effect of age, while seventy-six percent of the pregnant women held the same mistaken view.²³⁰ Both groups of women exhibited a fairly high degree of knowledge regarding the association of age with risk of miscarriage and giving birth to a Down's syndrome child.²³¹

The researchers attributed these misconceptions to poor messaging; society had emphasized the avoidance of teenage pregnancies, but had ignored the problems that could arise when women delayed motherhood for personal or professional reasons.²³² The researchers concluded women should be given more information about the consequences of waiting to conceive.²³³ Meanwhile, the women who participated in the study agreed that more information should be provided: twenty to twenty-four percent believed the information should be provided at school age, while around half targeted the early twenties as the best time.²³⁴

D. *A global perspective*

Lastly, for those who seek a broader perspective, consider the International Fertility Decision-Making Study.²³⁵ Researchers from the United Kingdom and Switzerland surveyed over 10,000 men and women from seventy-nine countries in order to assess fertility knowledge.²³⁶ Those surveyed were volunteers who were trying to conceive a child.²³⁷ The questionnaire was comprised of thirteen true/false questions, three of which touched upon the topic of age-related fertility decline.²³⁸ The average correct score on the questionnaire was only fifty-seven percent.²³⁹ As low as this average

²³⁰ *Id.*

²³¹ Specifically, seventy-two percent of the fertility clinic patients and sixty-five percent of the pregnant women knew of the association between age and risk of miscarriage; eighty-six percent of the fertility clinic patients and eighty-five percent of the pregnant women understood that age increased the risk of giving birth to a Down's syndrome child. *Id.* at 1038-39.

²³² *Id.* at 1041.

²³³ *Id.* at 1041-42.

²³⁴ *Id.*

²³⁵ See Laura Bunting et al., *Fertility Knowledge and Beliefs about Fertility Treatment: Findings from the International Fertility Decision-making Study*, 28 *HUM. REPROD.* 385 (2013).

²³⁶ *Id.*

²³⁷ *Id.* at 387.

²³⁸ The entire test was reproduced in an Appendix to the study. Two of the true/false questions addressed age-related fertility decline specifically: "A woman is less fertile after the age of [thirty-six] years"; and "These days a woman in her [forties] has a similar chance of getting pregnant as a woman in her [thirties]." *Id.* at 397. A third true/false question could be relevant to menopause: "A woman who never menstruates is still fertile." *Id.*

²³⁹ *Id.* at 390.

was, it probably overestimated fertility knowledge, because most of those surveyed were infertile and had sought medical advice for their problem.²⁴⁰ The researchers recommended education to improve levels of fertility knowledge.²⁴¹

E. *Summary*

Personal accounts and recent studies indicate that many women do not grasp the consequences of deferring that first planned pregnancy into their thirties and forties. Some of the factors that feed this lack of awareness include: sex education classes and public messaging that place undue emphasis on pregnancy prevention; doctors who fail to share the facts about age-related fertility decline with their patients; media accounts of celebrity mothers in their forties; false belief that good health predicts fertility; and misplaced confidence in the power of assisted reproductive technologies to overcome the effects of aging. Too often, women are left with regrets and the belated realization that biology does indeed matter.

III. TEACHING ABOUT THE BIOLOGICAL CLOCK

This Part considers two means of combatting the misconceptions women hold regarding age and fertility. First, it urges Ob/Gyns to take a more proactive role in sharing the facts of age-related fertility decline with their patients. Second, this Part recommends that sex education in public schools be expanded to include the basic facts of age-related fertility decline. To accomplish that goal, state laws that govern sex education must be amended.

A. *Doctors as teachers*

As mentioned previously, in 2014, the ACOG and the ASRM released a Committee Opinion addressing the topic of age-related fertility decline in women.²⁴² The Committee Opinion reported the ages at which fertility declines (significantly at thirty-two and sharply at thirty-seven).²⁴³ In light of such facts, it made the following recommendations:

- Education and enhanced awareness of the effect of age on fertility is essential in counseling the patient who desires pregnancy.
- Women older than thirty-five years should receive expedited evaluation and treatment after six months of failed attempts to conceive or earlier, if clinically indicated.

²⁴⁰ *Id.* at 393.

²⁴¹ *Id.* at 394.

²⁴² *Committee Opinion, supra* note 32.

²⁴³ *Id.*

- In women older than forty years, immediate evaluation and treatment are warranted.²⁴⁴

These recommendations, which apparently are aimed at physicians and other health care providers, are a step in the right direction.²⁴⁵ Considering the inadequate medical advice that Jane Everywoman and Tanya Selvaratnam received, it is heartening to see not only fertility specialists, but also Ob/Gyns exhorted to educate patients regarding age-related fertility decline and move them quickly into treatment if they are thirty-five or older. Ob/Gyns are a primary source of information regarding fertility for many women,²⁴⁶ so it makes sense to enlist their support in this cause.

Yet, the first recommendation is problematic, for it deems education essential only in counseling patients who desire pregnancy. That framing works for patients who present themselves for treatment at fertility clinics; their desire for pregnancy is obvious, and the specialists who treat them certainly should share facts that drive outcomes, including facts about age-related fertility decline. However, the desires of the thousands of women who obtain routine care and birth control from Ob/Gyns every year will not be so obvious. Waiting until a woman articulates a desire for pregnancy is too late. Office visits are short and she might not bring the topic up, even if she desires children; or she might not desire children yet, because she thinks she still has plenty of time to conceive when in fact she does not.

Fortunately, there is an alternative. Ob/Gyns can and should share the facts regarding age-related fertility decline with every new patient who comes to their offices. There is no harm in communicating facts to women before they are ready to use them. A twenty-five year old woman who is not ready for motherhood can still benefit from information that empowers her to balance her career and eventual childbearing.

Ob/Gyns may resist the foregoing suggestion for several reasons. First, even though Ob/Gyns routinely quiz patients regarding sexual activity and birth control practices, some may hesitate to broach the topic of age-related fertility decline because it is so sensitive.²⁴⁷ Second, some Ob/Gyns believe the amount of time avail-

²⁴⁴ *Id.* at 720.

²⁴⁵ See Wyndham et al., *supra* note 69, at 1046 (advocating that doctors and other health care professionals inform young women about age-related fertility decline).

²⁴⁶ See *Fertility IQ 2011 Survey*, *supra* note 186, at 23 (reporting that roughly half of the women surveyed relied upon Ob/Gyns to provide them with information about fertility).

²⁴⁷ Kalb, *supra* note 60, at 47.

able to discuss issues with patients during office visits is already too short.²⁴⁸ Third, Ob/Gyns may argue that the message will not get through to patients unless they initiate the conversation and are motivated to learn.²⁴⁹

However, such arguments do not justify a passive approach to the issue of age-related fertility decline. Ob/Gyns can provide the key facts to women in a manner that is not unduly intrusive, time-consuming, or unclear. For example, when an Ob/Gyn provides a new patient with a packet containing a medical history form and required disclosures, she could include an informational brochure or list of websites that address common fertility threats, such as age-related decline and STDs.²⁵⁰ Alternatively, as Ms. Selvaratnam has suggested, physicians could hang charts that illustrate the impact of age on fertility in their waiting or examination rooms.²⁵¹

If the simple act of sharing information seems too controversial, American doctors should consider the courageous example set by medical experts in the United Kingdom. In 2009, the Royal College of Obstetricians & Gynaecologists ("RCOG") issued a statement outlining the known risks of postponing childbearing, including infertility, miscarriage, and poor pregnancy outcomes.²⁵² The RCOG acknowledged women had career and other reasons for postponing motherhood; nevertheless, its statement *encouraged* women to consider bearing their children during "optimal fertility," that is, between the ages of twenty to thirty-five years.²⁵³

²⁴⁸ See *In the Know: Fertility IQ 2012 Healthcare Provider Survey, Healthcare Provider Perception of Fertility Knowledge Among US Women Aged 25-35*, EMD SERONO 13 (2012), <http://www.resolve.org/about/in-the-know-fertility-iq-white-paper-2012.pdf> [hereinafter *Fertility IQ 2012 Healthcare Provider Survey*].

²⁴⁹ There does seem to be a mismatch between medical practice and patient perception regarding provision of information about age-related fertility decline. When EMD Serono surveyed Ob/Gyns, forty-six percent or nearly half claimed to have discussed that topic with patients. *Id.* Yet, when EMD Serono surveyed patients, seventy-eight percent claimed that they never discussed age-related fertility decline with their Ob/Gyns. *Fertility IQ 2011 Survey, supra* note 186, at 24.

²⁵⁰ Cf. *Fertility IQ 2012 Healthcare Provider Survey, supra* note 248, at 26 (asserting that Ob/Gyns should provide patients with fertility education materials, such as pamphlets, websites, guides, or self-assessments).

²⁵¹ SELVARATNAM, *supra* note 141, at 60.

²⁵² See *RCOG Statement on Later Maternal Age*, ROYAL COLL. OF OBSTETRICIANS & GYNAECOLOGISTS (June 15, 2009), <https://www.rcog.org.uk/en/news/rcog-statement-on-later-maternal-age>.

²⁵³ *Id.*

B. Sex Education

As Jane Everywoman and others have suggested, there is another way to communicate the facts of age-related fertility decline to women, and that is through sex education in schools.²⁵⁴ This suggestion has merit, and should be implemented throughout the United States. For purposes of illustration, this Article will use California law to demonstrate how state legislators can amend the law to expand sex education.

In California, provision of comprehensive sexual health education in public schools is optional, rather than mandatory.²⁵⁵ However, if a school district chooses to offer such education, certain criteria must be met, such as age-appropriate instruction and presentation of information that is medically accurate and objective.²⁵⁶

For purposes of this Article, the most relevant criteria have to do with the content of the instruction. Beginning in seventh grade (when students enter their teens), the program must: (1) teach that abstinence is the only sure way to avoid pregnancy and STDs; (2) provide information about STDs, including transmission, prevention, and resources for testing and medical care; (3) provide information about the efficacy and safety of FDA-approved contraception; (4) teach students how to make responsible decisions about sexuality; and (5) teach students the law on surrender of an unwanted newborn to authorities.²⁵⁷

These sex education requirements focus on prevention of STDs and pregnancy. Doubtless, STDs and teen pregnancy are evils to be avoided. Yet, as discussed in Part II, persistent messaging about the need to prevent conception can mislead young women into believing that fertility is perpetual, when such is not the case.²⁵⁸ It is particularly unfortunate that a state like California, which insists upon the provision of medically accurate information about STDs and pregnancy, does not require fertility education also.

The Education Code defines “comprehensive sexual health education” as “education regarding human development and sexuality, including education on pregnancy, family planning, and

²⁵⁴ Everywoman, *supra* note 127, at 8; J. Boivin et al., *Cassandra’s Prophecy: A Psychological Perspective. Why We Need to Do More Than Just Tell Women*, 27 REPROD. BIOMED. ONLINE 11, 12 (2013).

²⁵⁵ CAL. EDUC. CODE § 51933(a) (West 2004) (“School districts *may* provide comprehensive sexual health education . . .”) (emphasis added). However, all students must receive HIV/AIDS prevention education once in middle school and again in high school. *Id.* § 51934(a).

²⁵⁶ *Id.* §§ 51933(b)(1), (2).

²⁵⁷ *Id.* §§ 51933(b)(8), (9), (10), (11), (12).

²⁵⁸ Maheshwari et al., *supra* note 107, at 1041.

sexually transmitted diseases.”²⁵⁹ This definition is broad enough to encompass information and materials regarding fertility. Therefore, the California State Legislature should amend the Education Code to require educators to teach students how age affects the ability of a woman to conceive and carry a healthy fetus to term. It would be easy to add a subpart to the relevant Code section²⁶⁰ phrased along the following lines:

Commencing in grade seven, instruction and materials shall provide information about age-related fertility decline in women.

If the California State Legislature wishes to enact a more comprehensive approach, it could phrase the mandate more broadly:

Commencing in grade seven, instruction and materials shall provide information about threats to fertility, including age-related fertility decline in women.

Such language would encourage educators to discuss the impact of not only age, but also STDs on fertility. STDs can cause pelvic inflammatory disease that scars fallopian tubes and leaves women infertile.²⁶¹ The Education Code already requires instruction and materials that provide information regarding STDs, including: “[H]ow sexually transmitted diseases are and are not transmitted, the effectiveness and safety of all federal Food and Drug Administration (FDA) approved methods of reducing the risk of contracting sexually transmitted diseases, and information on local resources for testing and medical care for sexually transmitted diseases.”²⁶² It is not too much to insist that educators go the extra mile, and spell out the fertility-related consequences of STDs, which can be particularly devastating for women.

Of course, the Education Code requires the factual information presented in courses to be medically accurate and objective.²⁶³ The term “medically accurate” is defined to mean:

[V]erified or supported by research conducted in compliance with scientific methods and published in peer-reviewed journals, where appropriate, and recognized as accurate and objective by professional organizations and agencies with expertise in the relevant field, such as

²⁵⁹ CAL. EDUC. CODE § 51931(b) (West 2004).

²⁶⁰ EDUC. § 51933(b).

²⁶¹ See *Pelvic Inflammatory Disease (PID)—CDC Fact Sheet*, CTNS. FOR DISEASE CONTROL & PREVENTION, <http://www.cdc.gov/std/pid/stdfact-pid.htm> (last visited May 25, 2014).

²⁶² EDUC. § 51933(b)(9).

²⁶³ *Id.* § 51933(b)(2).

the federal Centers for Disease Control and Prevention, the American Public Health Association, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists.²⁶⁴

As previously discussed, the ACOG and the ASRM have recently issued the Committee Opinion reporting the facts of age-related fertility decline. This document explains how aging reduces a woman's ability to conceive and increases her risk of a miscarriage. Even if educators did nothing more than share this document with students, it would be a big step forward in increasing fertility education. Presumably, the ACOG and the ASRM could provide educators with additional medically accurate information about risks to the fertility of women, and men also, if the Legislature so requested.

Other states that regulate the content of sex education in public schools can adapt this approach to their own circumstances. The precise language of the necessary amendments will depend upon the structure and language of the statutes and codes involved. However, to ensure that legislative intent is honored, it is recommended that specific terms and phrases, such as "age-related fertility decline in women," be included.

C. *Challenges and responses*

This Article has proposed changes to medical practice and state legislation. Change is seldom comfortable, and these proposals may draw opposition. In this section, this Article responds to several potential challenges to its core thesis, that is, that doctors and sex educators should share information about age-related fertility decline with women.

First, those who believe most women can reproduce into their late thirties²⁶⁵ may argue that it is unnecessary to share the Committee Opinion with patients and students. However, as this Article has demonstrated, some women who wait that long to start their families will end up childless.²⁶⁶ Moreover, an individual woman cannot easily predict the duration of her fertility. She can seek a medical evaluation of her ovarian reserve;²⁶⁷ but she will not be motivated to do that unless she first grasps the facts about age-related fertility decline, unclouded by popular misconceptions about pregnant celebrities and assisted reproductive technologies. Thus, the best way to combat involuntary childlessness is to inform *all* wom-

²⁶⁴ EDUC. § 51931(f).

²⁶⁵ Twenge, *supra* note 81, at 60.

²⁶⁶ See *supra* Part I.

²⁶⁷ Text accompanying notes 125-26, *supra*.

en of the facts, so that each individual is empowered to manage her own fertility and risk.²⁶⁸

Second, others might concede that age-related fertility decline is real, but question whether sharing the Committee Opinion with patients and students will make a difference. After all, many women wait to conceive, not because they want to, but because they don't have the right partner or are working to achieve employment and financial security.²⁶⁹ In one of the Canadian studies discussed in Part II.C above, eighty percent of the subjects identified financial security, desire for children, and availability of a suitable partner as factors that would affect their decisions on when to reproduce, whereas fewer than forty-five percent identified the biological clock as such a factor.²⁷⁰

However, knowledge of age-related fertility decline is still a potential game-changer for two reasons. First, it could give women the information they need to make the effective use of egg freezing. If a woman has been provided with the Committee Opinion and knows when egg quantity and quality begin to decline, she is more likely to freeze her eggs before she reaches that point. Second, women who wait to reproduce, knowing the risks, may feel less devastated and angry than those who allow the biological clock to run out because no one told them the truth.²⁷¹

Third, some might worry that women who learn about age-related fertility decline in the doctor's office or at school will ultimately choose to prioritize motherhood over education and career.²⁷² In the opinion of this writer, such concerns do not justify withholding information about age-related fertility decline from women. To do so would be tantamount to a judgment that women do not deserve the right to make the decisions that are best for them as individuals. Moreover, egg freezing holds the potential to reduce tradeoffs between career and motherhood, but only if women are informed about the need to extract eggs while they are still young.

Fourth, in response to the recommendation that sex education courses include facts about age-related fertility decline, some

²⁶⁸ Cf. Maheshwari et al., *supra* note 107, at 1041-42 (arguing that the facts of age-related fertility decline should be provided to all women, but expressing no opinion on how this might best be done).

²⁶⁹ Kalb, *supra* note 60, at 42.

²⁷⁰ Bretherick, *supra* note 209, at 2167.

²⁷¹ *Id.*

²⁷² See Twenge, *supra* note 81, at 60 (citing an unnamed study for the proposition that "every year a woman postpones having children leads to a 10 percent increase in career earnings").

critics may fear a rise in teen births.²⁷³ However, it seems unlikely that the facts of age-related fertility decline will put pressure on middle and high school children, whose biological clocks have not begun to tick in any meaningful way. The average sixteen year-old girl must double her age to thirty-two before she experiences a significant decline in her fertility.²⁷⁴ Indeed, providing information to students who have the luxury of many years to ponder and act on it may be the best means of educating women without placing undue pressure on them.

Finally, critics may assert that expanding sex education courses is pointless; teenagers will consider information about what may happen in their thirties or forties to be irrelevant to their lives and disregard it.²⁷⁵ However, no educator worthy of the name gives up simply because his or her words may occasionally fall on stony ground. For every young girl who ignores the facts, another will quietly file them away in the back of her mind, to be remembered when she begins to think more seriously about motherhood.

IV. CONCLUSION

Fertility in women declines with age. IVF cannot change that scientific fact; it can only offer infertile women the chance to reproduce with a younger donor's eggs. Egg freezing is the technological talk of the day, but it is not a perfect solution either. Women cannot benefit from egg freezing unless they understand the threat that aging presents and act while they and their eggs are still young.

If we aspire to be a society in which women are fully empowered to exercise reproductive choice, we must teach about the biological clock. Misconceptions about conception should be addressed and corrected now, lest they persist into the twenty-first century and blight the lives of countless women.

²⁷³ See, e.g., Theresa Marteau, *Cassandra's Prophecy: A Public Health Perspective*, 27 REPROD. BIOMED. ONLINE 19 (2013). Similarly, in 2014, United Kingdom media reported that abortions among women in their forties had increased. Some speculated that exaggerated information about age-related fertility decline had caused older women to conclude that they were incapable of conceiving and abandon their birth control prematurely. See, e.g., Rebecca Smith, *Abortion Among Over-40s on Rise as Older Women Mistakenly Shun Contraception*, THE TELEGRAPH (May 13, 2014), <http://www.telegraph.co.uk/health/healthnews/10824709/Abortion-among-over-40s-on-rise-as-older-women-mistakenly-shun-contraception.html>.

²⁷⁴ *Committee Opinion*, *supra* note 32.

²⁷⁵ Cf. Marteau, *supra* note 273, at 19 (arguing that public health education does not change behavior in populations).

