Fertility knowledge and views on egg freezing and family planning among surgical specialty trainees

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BACKGROUND: There are limited studies focusing on resident and fellow attitudes on family planning and egg freezing. Surgical training programs are often longer and more time consuming than other fields. It is important to understand how this training affects family planning decisions.

OBJECTIVE: This study aimed to describe fertility knowledge and viewpoints on family planning among US residents or fellows.

STUDY DESIGN: The Advocate Aurora Health Institutional Review Board approved this study on October 8, 2019 (IRB# AHC-7213-S5500413). A 32-question survey was emailed to trainees across US programs in a variety of specialties (obstetrics/gynecology; ophthalmology; otolaryngology; urology; and neurology, plastic, general, thoracic and orthopedic surgery) to assess fertility knowledge. Pearson chi square tests were conducted to investigate differences in fertility knowledge by groups of interest (trainee specialty, gender, trainee program type). Demographics and viewpoints on family planning and egg freezing are described. All analyses were performed using SAS, version 9.4.

RESULTS: A total of 447 surveys were collected from October 2019 to January 2020. Participants included 309 residents, 94 fellows, and 44 with unknown status across the 9 specialties. Participants were mostly female (73%), aged 26 to 30 years (48%), White (69%), married (59%), and heterosexual (95%), with no children (72%). When asked at what age a woman’s fertility slightly decreases, obstetrics/gynecology trainees had 39% less likelihood of answering correctly compared with non—obstetrics/gynecology respondents (P=.0207). Female respondents had 18% less likelihood of answering correctly relative to male respondents, and trainees in academic programs were 20% to 60% more likely to answer correctly relative to those in community programs, but these findings were not statistically significant. Interestingly, female respondents had 2.89 times increased odds of having 0 children (P<.0001), 0.42 times increased odds (ie, 58% decreased odds) of being married (P=.0003), and 1.33 times increased odds of postponing childbearing (P=.2438).

CONCLUSION: This study found that despite their sex or focused training in reproductive endocrinology and infertility, female respondents and obstetrics/gynecology trainees were not more well-versed in basic female fertility knowledge than their counterparts. Furthermore, female respondents were less likely to have children or be married, and more likely to report postponing childbearing, highlighting differences in family planning by sex. Fertility-focused educational interventions for obstetrics/gynecology trainees are necessary. More research into barriers to family planning, particularly by sex, are also merited.

Key words: Family planning, fertility preservation, medical training, oocyte cryopreservation, infertility

Introduction
Several studies have investigated the views of young professionals and healthcare workers on family planning and oocyte cryopreservation. There is a trend among female professionals to delay childbearing because of desire to complete their education, an active professional life, or inability to afford raising a child. This tendency is also seen among female obstetrics and gynecology (OB/GYN) residents, with >70% reporting postponing pregnancy because of their medical training.

Residency and fellowship training for surgical specialties is demanding and lengthy. Previous studies that focused on residents have only included OB/GYN residents.
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Why was this study conducted?
This study aimed to describe fertility knowledge and viewpoints on family planning among US residents or fellows.

Key findings
This study found that despite their sex and focused training in infertility, female respondents and obstetrics and gynecology (OB/GYN) trainees were not more well-versed in basic female fertility knowledge. Furthermore, female respondents were less likely to have children or be married, and more likely to report postponing childbearing.

What does this add to what is known?
This study illustrates the need for fertility-focused educational interventions for OB/GYN trainees. Given that female trainees seem to be disproportionately affected by surgical training, more research into barriers to family planning by sex should be conducted.

GYN trainees. However, limited data exist on family planning among different surgical specialties and how viewpoints change throughout residency and fellowship. Two studies did include trainees from different residency programs and found that female residents postponed pregnancy because of potential career effects and busy schedules. However, these studies only included respondents from a limited number of academic institutions. It is also unclear how increased knowledge of fertility, oocyte preservation, and assisted reproductive technology (ART) affects trainees’ personal decisions about family planning.

Oocyte cryopreservation has only become more widely available in the past few years. The American Society for Reproductive Medicine reclassified the procedure from experimental to elective in October of 2012. Consequently, current residents and fellows have been exposed to and learned about this procedure either in their postgraduate training or in medical school. However, previous studies have shown that OB/GYN residents held misconceptions about ART and fertility, with many residents overestimating the age at which fertility declines.

Although a previous study conducted a similar assessment among OB/GYN trainees only, fertility knowledge and family planning knowledge and decisions are important to understand across all physician trainee specialties because they can inform education and training opportunities and trainee culture. We aimed to study a broad group of surgical residents and fellows across 9 different common specialties, and examine their fertility knowledge, views on oocyte cryopreservation, and how their career choices may affect their family planning.

Materials and Methods
A 32-question survey was created using Qualtrics (Qualtrics, Provo, UT), with all questions adopted with permission from a previous study by Esfandiari et al. The survey collected demographic, training, and education information. Questions assessed viewpoints on childbirth, egg freezing, and the effect of residency/fellowship on family planning. Three questions based on a previous study by Yu et al were used to determine fertility knowledge: (1) “At what age is there a slight decrease in a woman’s ability to become pregnant?” (correct answer=ages 25–29 or 30–34); (2) “At what age is there a marked decrease in a woman’s ability to become pregnant?” (correct answer=ages 35–39); and (3) “What is the overall chance, on average, that a couple who undergoes treatment with in vitro fertilization will have a child after one treatment?” (correct answer=20%–29%).

This was a closed-survey study. The questions appeared in the same order to all respondents, and certain questions were only displayed on the basis of participants’ responses (ie, if the participant selected they were a resident, they received a question asking what residency they were in).

Participants
The Advocate Aurora Health Institutional Review Board approved this study through expedited review. Participants included residents and fellows in training programs accredited by the Accreditation Council for Graduate Medical Education (ACGME). Programs surveyed included: general surgery, neurosurgery, OB/GYN, ophthalmology, orthopedic surgery, otolaryngology, plastic surgery, thoracic surgery, and urology.

Using the ACGME website, a list of all program coordinators for surgical residencies and fellowships was compiled. An email with an anonymous survey link was sent to all the programs’ directors and/or coordinators who forwarded it to residents and fellows. The survey included a written informed consent that indicated that the survey was voluntary and anonymous. The consent described the purpose of this study, how the data would be stored, and the names of the investigators of the study. Participants had to consent to the study to continue to the survey questions.

Statistical analysis
Data were collected with no identifying markers and automatically captured in a database. Descriptive statistical analysis of all study subject characteristics was performed. Data were assessed for normality, and appropriate univariate analyses were performed. Counts and associated percentages were provided to describe the study sample. Pearson chi square tests were conducted to investigate whether fertility knowledge differed by groups (female, male, non-binary, third gender) and trainees’ training year (ie, first, second, third, and fourth and above). All analyses were performed using SAS, version 9.4 (SAS Institute, Cary, NC).
Results

A total of 447 surveys were collected from October 2019 to January 2020. All surveys were included regardless of the percentage completed, and 382 surveys were 100% completed. Participants included 309 residents, 94 fellows, and 44 with unknown status. Participants mostly identified as female (73%), and were mostly aged 26 to 30 years (48%), White (69%), married (59%), and heterosexual (95%), with no children (72%) (Table 1). A variety of residencies and fellowships were represented in the study. OB/GYN residents and fellows of OB/GYN specialties had the largest representation (49.5% and 58.7%, respectively) (Table 2).

Views regarding family planning

Descriptively, more female than male respondents were single (19% vs 13%) and less were married (55% vs 74%). Of the female respondents, 78% had 0 children and 22% had 1 child, whereas 56% of male respondents had 0 children and 44% had 1 child. Relative to male respondents, female respondents had 2.89 times increased odds of having 0 children ($P<0.0001$). The number of children did not seem to be affected by academic vs community programs and type of training program. However, although this was not statistically significant, OB/GYN trainees had 1.37 times greater odds of having 0 children compared with non-OB/GYN participants ($P=0.1646$; 76% and 69%, respectively).

Female trainees also had 1.33 times increased odds of reporting postponed plans for children when compared with male trainees ($P=0.2438$; 66% vs 60%, respectively). Community program trainees had 0.825 times greater odds, or 17.50% lesser likelihood, of postponing children compared with academic trainees ($P=0.4873$; 61% and 65%, respectively). OB/GYN trainees had 1.23 times greater odds of postponing children compared with non-OB/GYN trainees ($P=0.3410$; 67% vs 62%, respectively). Respondents cited a variety of reasons for postponing children, including career plans, concerns about lack of time to care for a child and availability of childcare, and concerns for their cor-esidents/fellows (Figure 1). Participants were able to enter free text responses to this question, and many cited lack of a partner, financial burden/insecurity, long-distance relationships, and having a partner that is also in residency/fellowship. There were also female participants who indicated inability to breastfeed in their program and to operate while pregnant as reasons for postponing children. One trainee stated, “the program would likely kick me out.”

Views on egg freezing

Among female respondents, 59% would consider freezing oocytes, but only 5% had frozen oocytes. Most of those who would consider oocyte cryopreservation would do so between the ages of 26 and 30 (37%) or 31 and 34 (50%). All participants were asked if all female residents/fellows should consider egg freezing and 46% said yes, 28% said no, and 26% were unsure.

| TABLE 1
| Demographics of respondents |
|-----------------------------|
| Characteristic            | Counts (%) |
| Age                        |             |
| <26                        | 4 (0.9)     |
| 26–30                      | 206 (47.9)  |
| 31–34                      | 150 (34.9)  |
| ≥35                        | 70 (16.3)   |
| Sex                        |             |
| Male                       | 112 (26.2)  |
| Female                     | 312 (73.1)  |
| Nonbinary                  | 2 (0.5)     |
| Race                       |             |
| African American           | 19 (4.4)    |
| Asian/Pacific Islander     | 52 (12.1)   |
| White                      | 296 (69.0)  |
| Hispanic/Latino            | 30 (7.0)    |
| Multiracial                | 20 (4.7)    |
| Prefer not to say          | 12 (2.8)    |
| Sexuality                  |             |
| Bisexual                   | 12 (2.8)    |
| Heterosexual               | 407 (94.9)  |
| Homosexual                 | 8 (1.9)     |
| Other                      | 2 (0.5)     |
| Relationship               |             |
| Divorced/widowed           | 4 (0.9)     |
| In relationship            | 48 (11.2)   |
| Living with partner        | 48 (11.2)   |
| Married                    | 254 (59.2)  |
| Single                     | 75 (17.5)   |

* Race was classified by the investigator and assessed for demographic description. There were 18 surveys with missing data for the question determining race.

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Several questions addressed insurance coverage and financial aspects of egg freezing. Almost 80% of respondents considered an affordable cost for the procedure as <$5000. With regard to current employers offering coverage for oocyte cryopreservation, only 12% reported having coverage, whereas 42% stated they had no coverage and 46% were unsure if coverage was available. This contrasts with the 66% of respondents who reported preferring an employer that offered oocyte freezing as part of the benefit package.

Participants were asked in which circumstances they would consider egg freezing. The most common response, at 84%, was if insurance coverage were available. Other factors that were commonly selected were not having a partner (56%), no effect on the health of children born from vitrified oocytes (59%), and local availability of egg freezing (60%) (Figure 2).

Fertility knowledge
Three questions were used to evaluate fertility knowledge: (1) age at initial decrease in women’s fertility, (2) age at significant decrease in women’s fertility, and (3) average success rate of 1 in vitro fertilization (IVF) cycle (Table 3). Most notably, regarding knowledge of age at initial decrease in women’s fertility, OB/GYN trainees had 0.61 greater odds, or 39% lesser likelihood, of answering correctly relative to non-OB/GYN trainees ($P=0.0207$) and female respondents had 0.82 greater odds, or 18% lesser likelihood, of answering correctly relative to male respondents ($P=0.4926$) (Table 4).

In general, trainees in academic programs had a higher percentage of correct responses than those in community programs, but the differences were not statistically significant (Q1, 65% vs 53%; Q2, 68% vs 58%; Q3, 49% vs 44%).

In addition, there were no significant differences by postgraduate year regardless of specialty. A chi-square test was performed and failed to identify a statistically significant association between trainee type (OB/GYN vs other) and training year level (postgraduate year 1 to fellow) in terms of answering any of the 3 knowledge questions correctly, indicating no differences between trainee types by training year. Furthermore, percentages of OB/GYN trainees and other trainees who answered items correctly did not correlate with training year, revealing that years of education did not consistently improve knowledge among OB/GYN trainees or other trainees in our sample.

Comment
This study surveyed a group of residents and fellows from a variety of surgical subspecialties on their attitudes toward family planning and their knowledge of fertility. It is important to assess the viewpoints of these physicians because the long training programs and demanding schedules of a surgical residency/fellowship affect family planning. Esfandiari et al$^2$ found that 72.8% of female OB/GYN residents intended to delay pregnancy in residency. Our study confirms this trend in a variety of surgical specialties, with 56% of all female participants and 59% of OB/GYN female participants reporting plans to delay child-rearing.
The respondents in this study cited many reasons for postponing pregnancy and raising a child. The 2 most common reasons were concern about having time to raise a child (87% of participants) and career plans (80.3%). Respondents who reported delaying childbearing also had concerns about the availability of childcare, concern for their co-residents/fellows, lack of benefits, and lack of program support.

In addition, the exposures at work play a role in family planning decisions. Of the respondents who reported delaying childbearing, 24% cited concern over prenatal health. Previous studies have shown that female surgeons have a...
### TABLE 3
Resident or fellow awareness of fertility issues

| Fertility issue | All trainees (N=377) | First-year residents (N=49) | Second-year residents (N=46) | Third-year residents (N=82) | Fourth to Seventh-year residents (N=112) | Fellows (N=88) | P value |
|-----------------|-----------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------------------|---------------|---------|
| At what age is there a slight decrease in a woman’s ability to become pregnant? | Count (%) | Count (%) | Count (%) | Count (%) | Count (%) | Count (%) | .2020 |
| 15−24 | 1.59 | 0.00 | 0.00 | 2.44 | 1.79 | 2.27 |
| 25−29<sup>a</sup> | 16.71 | 12.24 | 21.74 | 17.07 | 18.75 | 13.64 |
| 30−34<sup>a</sup> | 46.15 | 61.22 | 32.61 | 39.02 | 48.21 | 48.86 |
| 35−39 | 35.54 | 26.53 | 45.65 | 41.46 | 31.25 | 35.23 |
| At what age is there a marked decrease in a woman’s ability to become pregnant? | Count (%) | Count (%) | Count (%) | Count (%) | Count (%) | Count (%) | .3936 |
| 25−34 | 1.86 | 2.00 | 0.00 | 1.23 | 2.68 | 2.27 |
| 35−39<sup>a</sup> | 65.52 | 70.00 | 63.04 | 60.49 | 62.50 | 72.73 |
| 40−44 | 28.91 | 22.00 | 32.61 | 32.10 | 31.25 | 25.00 |
| 45−49 | 3.71 | 6.00 | 4.35 | 6.17 | 3.57 | 0.00 |
| What is the overall chance, on average, that a couple who undergoes treatment with in vitro fertilization will have a child after one treatment? | Count (%) | Count (%) | Count (%) | Count (%) | Count (%) | Count (%) | .8251 |
| 0%−19% | 14.81 | 14.00 | 21.74 | 15.85 | 12.50 | 13.64 |
| 20%−29%<sup>a</sup> | 47.62 | 56.00 | 34.78 | 46.34 | 49.11 | 48.86 |
| 30%−39% | 25.93 | 20.00 | 32.61 | 23.17 | 27.68 | 26.14 |
| 40%−100% | 11.64 | 10.00 | 10.87 | 14.63 | 10.71 | 11.36 |

<sup>a</sup> Indicates the correct answer based on published literature. For the slight decrease in fertility there are 2 correct answers based on literature that suggests the decline can begin in the late 20s or early 30s.

Matevosian. Fertility knowledge and family planning views of surgical trainees. Am J Obstet Gynecol Glob Rep 2022.
higher rate of infertility and pregnancy complications. A study by Anderson et al.\cite{8} suggested that in addition to later age of pregnancy and demanding work schedules, surgeons are exposed to reproductive hazards such as radiation, surgical smoke, working conditions, sharps injury, anesthetic gases, and intraoperative use of toxic agents that can affect their fertility. The work by Phillips et al.\cite{9} also had similar findings, concluding that 32% of female surgeons had difficulties with fertility vs approximately 11% of the general population. The authors also found that surgeons had fewer children and higher age at first pregnancy, and relied on ART more than the general population.

Previous research showed that the decision to postpone having children or pursue oocyte cryopreservation is affected by knowledge of the subject’s ovarian reserve. Among female professionals and students, almost 40% reported they would consider egg freezing. After Anti-Müllerian hormone testing, the percentage rose to 60% on the basis of declining fertility.\cite{2} Our study population had a higher interest in oocyte cryopreservation, perhaps owing to increased knowledge of the procedure, with 59% of female respondents reporting considering egg freezing. Only 5% of participants have previously undergone oocyte cryopreservation.

According to the responses, the stark contrast between those who would consider the procedure and those who underwent it seems to be owing to cost and insurance coverage. Almost 80% of the trainees considered an affordable cost to be <$5000. However, 1 cycle can cost over $10,000.\cite{3} Only 12% reported having employer insurance coverage for egg freezing, whereas 66% preferred an employer who provides coverage. Our findings are similar to those of a previous study by Cardozo et al.\cite{10} which reported that 59% of graduate students were concerned by the cost of egg freezing and 81% would be more likely to consider the process if it were covered by insurance or paid for by their employer. In that study, <1% of participants reported coverage for egg freezing. Programs and physician employers should consider providing egg freezing coverage as a benefit because it is clearly important for most female trainees and would change the way they approach family planning decisions.

Finally, the survey included a component to assess the fertility knowledge of the respondents. Three questions were used and focused on fertility decline and the success of ART. Previously, studies that focused on nonmedical populations demonstrated misconceptions about fecundability and success of ART. For example, a survey of female professionals and students, among other populations, reported that knowledge of declining fertility was lacking. A study by Matevosian et al.\cite{11} demonstrated a significant knowledge gap in women; however, this study focused on nonmedical populations and may not reflect the unique challenges faced by female trainees. Our study aimed to address this gap by assessing the knowledge of surgical trainees.

### Table 4: Accuracy of Fertility Knowledge Questions

| Question                                                                 | Trainees | Gender | Program Type | OB/GYN | Other | Odds Ratio (95% CI) | P value |
|--------------------------------------------------------------------------|---------|--------|--------------|--------|-------|--------------------|---------|
| At what age does a woman’s fertility start to decrease?                  |         |        |              |        |       | 0.61 (0.40–0.93)   | .0207*  |
| Female                                                                   | 69.30%  | Female | Community    |        |       | 0.52 (0.20–1.32)   | .2612   |
| Male                                                                     | 57.58%  | Male   | Academic     |        |       | 0.67 (0.32–1.41)   | .3806   |
| At what age is there a significant decrease in a woman’s fertility?      |         |        |              |        |       | 0.93 (0.61–1.42)   | .7355   |
| Female                                                                   | 66.07%  | Female | Community    |        |       | 1.24 (0.77–2.01)   | .3882   |
| Male                                                                     | 64.65%  | Male   | Academic     |        |       | 1.26 (0.80–2.01)   | .3022   |
| What is the average success rate of 1 IVF cycle?                         |         |        |              |        |       | 0.91 (0.61–1.36)   | .6347   |
| Female                                                                   | 48.75%  | Female | Community    |        |       | 1.22 (0.78–1.93)   | .3704   |
| Male                                                                     | 46.73%  | Male   | Academic     |        |       | 1.27 (0.79–2.05)   | .3416   |

CI, confidence interval; IVF, in vitro fertilization; OB/GYN, obstetrics/gynecology.

*Indicates significant P value.

Matevosian. Fertility knowledge and family planning views of surgical trainees. Am J Obstet Gynecol Glob Rep 2022.
and male Master of Business Administration students demonstrated a consistent overestimation of fecundability with age and of the success of ART and its ability to overcome the natural aging process. A study of young graduate women had similar findings demonstrating an average knowledge of fertility with 64% of correct items. Again, respondents underestimated the impact of age on fertility and approximately one-third believed that a woman had a similar chance of achieving pregnancy in her thirties and forties.

Studies focused on medical students and residents/fellows do show a higher level of knowledge when it comes to fertility and ART. This can easily be explained by the exposure to the topic during medical school and postgraduate training. However, even among physicians and medical students there are still large gaps in understanding. A study that aimed to create and validate a fertility knowledge assessment found that the mean score among the general female population was 55.9% vs 64.9% among medical students and OB/GYN trainees. A study of specifically OB/GYN residents had similar results. Almost half of the residents overestimated when fertility significantly declines, and over three-quarters overestimated the success of ART.

Our study had similar results and again illustrated misconceptions about fertility and ART. Overall, 65% of respondents correctly estimated when fertility markedly decreases, and 48% correctly estimated the chance of achieving pregnancy with 1 IVF cycle. There were no statistically significant differences between male and female participants in correctly responding to the 3 questions. Trainees from community programs had decreased odds of correctly answering all 3 questions compared with their academic counterparts, but this finding was also not statistically significant. Interestingly, OB/GYN trainees were less likely than non-OB/GYN respondents to answer the first question correctly, and this was statistically significant. OB/GYN participants were also slightly less likely to answer the first and third question correctly, although this was not statistically significant. This is contradictory to the expectation that increased exposure to reproductive endocrinology and infertility (REI) would increase the knowledge of residents and fellows.

We hypothesize that the lack of knowledge among OB/GYN trainees may be because of a paucity of exposure to REI. Our study, along with previous work, indicates that OB/GYN residents and fellows are not receiving appropriate REI training. One contributor may be the lack of consistent structure of the REI rotation in different programs. Many residency programs do not have an REI fellowship and thus have a varied experience in REI depending on the practices in their community. Residences also vary in the length of time that they dedicate to the REI rotation. Increased exposure to the field and more effective didactics are necessary to improve understanding of fertility and ART. Patients often rely on OB/GYN physicians as their first source of information about reproductive health, infertility, and ART. Proper training and knowledge will allow physicians to counsel and educate their patients.

This study has several strengths and limitations. Although we had a robust response of 447 surveys, this represents a very small portion of all surgical specialty residents/fellows (1.8%). This may be because of our inability to directly distribute the survey to all surgical residents and fellows nationally. Our study method relied on program directors and program coordinators to forward the survey link to their trainees. Therefore, some residents/fellows may not have received the survey and were unable to participate. Because of this sampling method, we were not able to determine how many trainees received our survey link or calculate the exact response rate. However, those who responded represented a diverse variety of races, ages, and relationship statuses. Our respondents also reflected the general lesbian, gay, bisexual, and transgender (LGBT) makeup of the United States. Of our respondents, 5.2% identified as LGBT vs 4.5% of the general population. There may have also been a selection bias given that those who were more interested in egg freezing and family planning may have been more likely to participate in the study. In addition, 65 of the surveys were incomplete, but all available responses were used in our analysis because this was a descriptive study.

Future studies should be performed on similar populations to confirm our findings with a larger number of respondents. This type of research is necessary to further understand the barriers to family planning, specifically for female residents and fellows. In addition, fertility-focused educational interventions for OB/GYN residents should be implemented and studied.

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