

Understanding Infertility Among Female Physicians

This paper focuses on the struggles of fertility faced by female resident physicians and will cover topics including this history of the marginalization of women in medicine and its impact on fertility, social barriers to childbearing for female physicians and common biological causes of infertility, screening tests and treatments.

Part I : Socio Economic Struggles of Childbearing and Maternity for Female Residents

Recent surveys have shown that female physicians struggle with infertility and difficulty with childbearing to a greater degree than the general population. One such survey published in the Journal of Women's Health reflected on the experience of female physicians who graduated medical school between 1995-2000. They found the average age of first pregnancy was 30.4 years. Nearly one quarter of respondents who had attempted conception were diagnosed with infertility, with an average age at diagnosis of 33.7 years.¹ With the long and rigorous journey of medical education that begins after undergraduate education which includes 4 years of medical school and 3+ years of residency training, it is easy to see that the age of childbearing for female physicians is usually considerably higher compared to the general population, consequently older age at childbearing is one of the most recognizable causes of female infertility in female residents. Looking at Drexel University College of Medicine's (DUCOM) medical student demographics for the class of 2025, the mean age of matriculation was 24 which is comparable to the national matriculation data from AAMC from 2018. From the last year of published data for female matriculants from AAMC, ages ranged from 20 (1st percentile) to 37 (99th percentile).^{2 3} According to the survey published in the Journal of Women's health, the mean age at which

female physicians who completed the survey graduated medical school was 27.5 years.¹ With the typical duration of medical school lasting 4 years, the mean age of graduation from medical school will likely be closer to 28 years both nationally and for DUCOM.

Unfortunately, female physicians have a long history of being marginalized compared to their male counterparts, leading to a stark contrast in the number of practicing female physicians to their male counterparts. The distinct gender inequities between men and women in our society is reflected in the history of gender normative roles where women were expected to stay home and take care of the family and men were expected to work and undertake roles in leadership. Society today has moved away from the paternalistic view from society, and women have made great strides in the workplace and in leadership. The percentage of female medical students reflects this shift in society with 55.5% of matriculants identifying as female nationally and 57% at DUCOM.² As we continue to close the gender gap in medicine, it is important to note that the number of independently practicing female physicians continues to be lower than independently practicing male physicians. The Association of American Medical College in its latest report on Physician Sex and Specialty in 2019 found that out of all 936,254 active practicing physicians, 63.7% of them were men and 36.3% were women.⁴ With this, much anticipated shift in gender roles and practicing female physicians, there is a greater need to focus on the reproductive health and infertility of female physicians. Regardless of the improvements in access to medical education and jobs for female physicians, gender inequality and biases unfortunately continue to shape how female physicians are treated in the medical field. Implicit bias held by common society and by other healthcare professionals have shown to negatively impact women in their medical careers and contributes to decreased leadership advancements, lower salaries, and impairs their general wellness as it contributes to imposter syndrome and burnout.⁵ Two large

surveys conducted in 1995 and 2014 examining the effects of implicit gender based bias in the academic medical settings demonstrated that bias had a substantial effect on women's career and affected women to a greater degree than men. The results of the two studies, conducted about 20 years apart, did not demonstrate much change in the prevalence of gender bias. The latter of the two studies, conducted in 2014, demonstrated that 66% of women and about 10% of men perceived personal gender bias.⁵

The survey published by the Journal of Women's Health demonstrated that the average age at which female physicians had their first child was about the age of 30.4 years, and if we take into account the average age at which medical students graduated medical school as 27.5 and the fact the the shortest residencies last for 3 years, we can infer these female physicians are often training as residents when they have their first child.¹ In regards to reproductive health or childbearing, the gender based inequalities we discussed earlier are often present at a structural level and make it harder for female residents to get the resources or maternity leave they need in the post partum setting. The lack of national guidelines in regards to maternity leave and resources for mothers or soon to be mothers, precipitate inequalities faced by female residents. One study surveyed residents in various specialties in multiple residency programs, demonstrating that most residents taking maternity leave take about 6 weeks of leave, which included vacation time or sick leave. They also found that the most frequent determinant of leave was the resident's desire to not extend their residency training, other factors included the amount of paid leave. Longer maternity leaves were associated with longer breastfeeding duration and perceptions of logical support from program administration.⁶

Benefits from preserved and regulated maternity leave helps residents who are considering motherhood have been shown to be better for both maternal and infant health

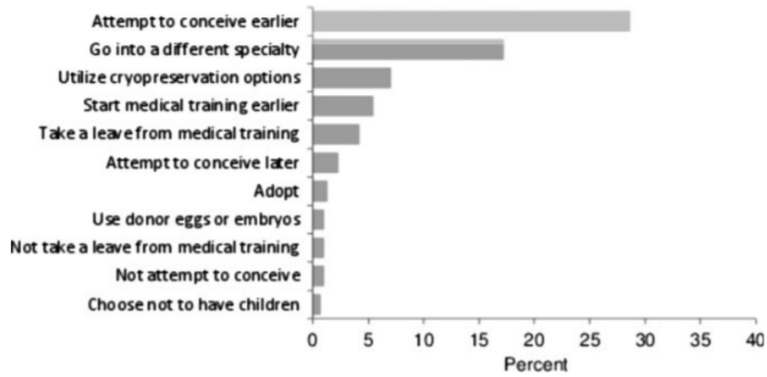
outcomes.⁷ For residents who are new mothers, benefits of longer maternity leave (greater than 12 weeks) include a lower rates of postpartum depressive symptoms and self-reported poor health. For infants, longer maternity leave was associated with longer duration of breastfeeding, and better access to healthcare resulting in more childhood check ups and up to date immunizations.⁷

With the strenuous journey of residency and its time constraints, family planning is an important consideration for many residents. A recent survey examining first pregnancies among female physicians found that a majority of pregnancies were intentional. About 15% of physicians also responded that they had terminated at least one pregnancy. When asked about their reason for pregnancy termination, the most commonly cited factor (65%) was found to be career followed by relationship and financial situation.¹ Although it is hard to understand the circumstances under which each female physician made their decisions regarding family planning, it is interesting to note that that career and financial situation are easily influenced by the residency program they might be in. Changes in policies allowing female physicians to advance in their careers and not fall behind because of taking maternity leave or taking care of their family, and having enough paid maternity leave to help their financial situation may influence the decisions future female physicians make regarding their family planning.

With delaying the age at which female residents conceive, comes the reality of decreasing ovarian reserve. The same survey that was published by the Journal of Women's Health to better understand the perspectives of female physicians on fertility and childbearing attempted to analyze the satisfaction with their decisions regarding their reproductive health and academic success.¹ They found that most female physicians would have done nothing differently, however out of those who had regrets regarding their fertility and childbearing decisions, the most common

regret was not attempting to conceive earlier, other reasons included choosing a different speciality, using cryopreservation to preserve their ovarian reserve, starting medical training earlier etc.¹

FIG. 2. Retrospective reflections and regrets. Respondents were asked to reflect upon their reproductive and academic decision-making. Reassuringly, when asked what they would do differently if they knew in their 20s what they know now, most respondents (56.8%) stated they would do nothing differently regarding fertility/conception/childbearing. Nevertheless, substantial minorities would attempt to conceive earlier, go into a different speciality, or use cryopreservation to extend fertility.



Along with the strains of various residency programs, the speciality a female resident chooses also influences the decisions they make in regards to their fertility and childbearing. This is not limited to time off for maternity leave as stated above, but also the perceived support from the residency program and gender distribution of the physicians in a particular speciality. Several studies have tried to better understand the gender gap present in certain medical specialities. One such speciality where the gender gap continues to persist is anesthesiology. A recent large survey conducted through the American Society of Anesthesiologists in 2020, 11.6% of female anesthesiologists stated that they would counsel a female medical student against a career in anesthesiology due to its obstacles pertaining to motherhood.⁸ Two factors were found to have a statistically significant correlation to their opinion, namely, those whose desired age of childbearing and the number of children desired were affected by work demands.⁸ Better understanding the difficulties faced by female physicians in fields of medicine where gender inequality exists can help us target these inequalities and assure the success of female physicians in the future. This study, like the previous surveys examined, demonstrated struggles of

childbearing and female fertility as pertinent concerns endorsed by female physicians in anesthesiology. Interestingly, the study did not find a correlation with female anesthesiologists counseling medical students against anesthesiology due to obstacles pertaining to motherhood and weeks of maternity leave offered, percentage of women faculty, female residents or pregnant co-residents.⁸ Nonetheless, opinions on family planning can be heavily influenced by the environment a female resident is in during residence.

One major influence for any residency experience is the opinions held by program directors. By examining the opinions of various program directors in residency programs where a gender gap exists, we can better understand the biases present and address these biases to help female physicians with their academic success and fertility goals. A recent survey that went to program directors at various anesthesiology residency programs in the US published in 2021 found, as expected, that parental leave delayed board certification and affected fellowship opportunities.⁹ What was concerning however was that being a female resident and parent was perceived to negatively affect their timeliness, technical skills, scholarly activities, procedural volumes, standardized test scores and affected training experience of their co-residents, while being a male resident and parent was not.⁹ Although it is not clear if these responses suggest a true implicit bias program directors have against female physicians parents or if these responses are a reflection of worse performance by this population. If these results reflect the implicit bias held by program directors, understanding the basis of these biases and helping program directors understand how this bias might affect their leadership and the experiences of female residents who are parents is essential for the well being of these residents, their academic success and their family planning goals. If these results reflect a true worsened performance by female physicians, it would be important for program directors to better understand why these residents might be

performing worse and reflect on the adequacy of maternal leave, lactation policies and resources available to them. Studies directed towards program directors in urology, another male dominated field, found similar concerning perspectives with a small portion of program directors who found that pregnancy during residency was a burden on other residents. A majority of these program directors also concurred that having formal policies in place for maternity/ paternity leave would be beneficial for residents.¹⁰

Other studies that attempted to understand the perspective of surgery residents, where male residents represent 62% of residents, found that around 73% of female surgical residents had witnessed faculty members or residents making negative comments about pregnant trainees or childbearing during residency while they were pregnant and were perceived poorly during their own pregnancies. Furthermore 63.6% of female residents were concerned that their work schedule or duties adversely influenced their health or the health of their unborn child. Similarly, they found that 75.4% of female residents who would found additional child care support helpful during residency and 58.1% of residents who had children stopped breastfeeding earlier than they would have liked due to challenges of balancing work with lactation duties.¹¹ It is easy to see how the negative opinions of faculty, program directors and peer residents can influence the decisions pregnant residents make. With specialties where there is a male predominance, it may be even harder for female residents to get their voices heard and the survey aimed at female surgical residents found, can adversely affect the health of the residents and children before and after their birth appropriate accommodations are not made.

Understanding the perspective of program directors on female resident well being as it pertains to maternity can also be helpful as it would help understand any implicit biases present or perceived barriers to providing patients with appropriate support for maternity. A qualitative

Table 3. Representative Quotes for Each Theme

Theme	Illustrative quotations
Desire to not extend training	Well I've offered it [5 in 6 leave policy] to several of the residents who are pregnant, but no one has wanted to take it because there is a really...there is an imperative to finish your training and move on to fellowship. I think the 2 things that drive people's desire not to extend their training are: one, not to be away when their peers have to work, and I think the second is they don't want to extend their training and overlap with residents coming up.
Brief maternity leave negatively impacts the quality of work of some residents, but it varies by resident	I have had female residents say, "I feel like I should be home," and they are distracted at work, and the faculty have come to me to say, "your resident X is really conflicted. Is there something we can do for her?" I've seen women come back and having [a] child has actually focused them and I think made them better residents; they have stepped up their game in terms of time management, efficiency, you know all those things. And I've also seen women struggle when they come back.
Lack of a formal lactation policy makes it difficult to support pumping during surgical procedures	We had one incident with a faculty member where a resident broke scrub to go pump, she told the faculty member where she was going and he said ok great...go pump and then 5 min into being gone, he called her. "Ok I need you back now," and it wasn't an emergency. It was just, "you know I need you back now," and I think he just, I don't know, maybe he didn't realize how much time had elapsed or not, or maybe he didn't know how long it takes to pump. I don't think the residents feel comfortable asking many faculty members for that accommodation. I am confident that my faculty would accommodate it; I think that there probably is a reticence though on their [residents] part to ask.
Mismatch between leave policy options and financial logistics	So the biggest challenge that we've had, that has now been sort of ameliorated by our local GME office, was how we have to work [out] payment, like salary [during maternity leave]. There is an issue of salary. Even though the board allows 5 y to be done in 6, there is not going to be salary continuation through the year they are off.
Resentment by coresidents varies on a case-by-case basis	You might get some resentment. Do they like that resident? Is that resident someone they feel like has really worked hard the whole residency? Are they a real team player?...Then they are more likely to cover for them and not worry. But if it is a resident perceived as weak or someone who is a little more likely to take advantage, then they get a little more resentful. I think a lot of it depends on the individual who is having maternity leave. If that person is viewed as strong and collaborative and goes out of their way, then there are almost never any issues. If that person is already viewed as someone who is not one of the stronger residents or who sometimes dumps on other residents, then it can be a problem....

survey directed towards understanding the barriers present for female residents at their surgical residency programs found five major themes: listed in table 3 below.¹² These themes reflect the same challenges reported by residents including longer training times, lack of lactation policies, negative attitudes towards pregnant residents, financial constraints, and impacts on quality of work. These themes along with the narratives of the challenges faced by female residents demonstrate a need for cultural change and need for

additional resources. At the same time, it is also important for us to understand the perspective of residents, and their desire to not extend their training while normalizing the importance of

maternal and postpartum needs and taking time away from work as it pertains to maternal and neonatal health.

As we come to better understand the struggles faced by female residents in regards to childbearing and maternity, changes can be made to ameliorate these struggles. Issues regarding maternity leave have been prominent in almost all medical specialties. The American Board of Medical Specialties released a new policy that was effective starting July 1, 2021 which guaranteed parental leave, caring for immediate family members or sick leave for programs that last for a minimum of 2 years. They allowed for a minimum of 6 weeks of time away from training at least once during training without exhausting other allowed time away from training or extending training.¹³ This is a great step towards providing residents with the accommodations they might need with childbearing and maternity. The greatest benefit from the policy is that residents taking time off for these reasons will not need to exhaust all their time away and can still take much needed breaks later on for other emergencies or for vacation. Another essential part of this policy is that training will not be extended if residents chose to take these 6 weeks off. As seen from previous surveys, one of the major reasons that program directors perceived female residents may not take additional time off for maternity leave, even though they might have benefited from it, was extended time of residency training.¹² Allowing female residents to take 6 weeks off without needing to extend their training will help them get the accommodations and care they need in the final weeks of their pregnancy as well as the resources and time they may need to adjust to their newborns, lactation and doctors appointments. There are, of course, some limitations to this policy, one of which being that this policy only applies to programs that are 2 years in duration or longer. Many specialties require residents to match into a separate

program for their first year (intern year or transitional year) of training before completing their residency training at another location. Although most programs that do not require an intern year or transitional year last for a minimum of 3 years, and residents who continue their residency training after an initial year at another institution continue training for at least 3 more years, residents at the beginning of their medical training in these programs would not be covered under this policy. Because of the new implementation of this policy that became effective for the 2021-2022 academic year, we can see its impact on resident well being in the next few years and adjust the policy as needed to meet the needs of residents during this time. This leave will likely continue to be unpaid, and may still continue to be a financial burden on residents as they tackle new expenses and childcare. Apart from this policy, the Family Medical Leave Act can be used for maternity leave for 12 weeks of unpaid leave.

As we continue to better understand these socio economic barriers to maternity for female residents. Larger issues of female infertility can also be addressed as we provide residents with the resources and accommodations they need to be comfortable with pregnancy at a younger biological age that may reduce some of the barriers of female infertility.

Part II Biological Causes of Infertility

Biological age is one of the main causes of female infertility in female residents, the largest population of females dealing with infertility are those who delayed childbearing without their willing until their 30s or 40s.¹⁴ Although females possess several hundred thousand primordial follicles at puberty, only about 300-400 of these follicles reach maturity, the rest are lost through apoptosis that is most accelerated during the last 10-15 years before menopause.¹⁴

As women lose their ovarian reserve, the chances the likelihood of conception decreases while the risk of early pregnancy termination increases, even more so in those aged 35-45.¹⁴ The quality of oocytes also declines with age with a much higher proportion of poor quality oocytes compared to healthy oocytes after the age of 30 which also contributes to early pregnancy termination and reduced chance of contraception as we age. Along with the decreasing ovarian reserve that comes with age, age also increases GnRH dysregulation. As we age, desynchronized GnRH secretion leads to impaired timing of LH surges, and elevation of FSH which accelerates loss of follicles. The aging ovary also places a role in this dysregulation as there it leads to decrease in inhibin B, antimullerian hormone and oestradiol with loss of ovarian reserve leading eventually to menopause with anovulatory cycles and loss of menstrual cycles.¹⁴

Although ovarian reserve is largely dependent on age and genetics some, environmental and individual risk factors may play a role to accelerate ovarian decline. For female residents, understanding their ovarian reserve can help them plan for family planning or better understand their risk for infertility due to decreased viable oocytes. Some individual risk factors for accelerated decline in ovarian reserve include patients who undergo chemotherapy or pelvic radiation, severe endometriosis, ovarian surgery, strong smoking history, family history of early menopause, genetic conditions such as turner syndrome or turner mosaic syndrome and fragile X syndrome.¹⁵ There are several screening and diagnostic tests available to to understand an individual's ovarian reserve, these are called the Ovarian Reserve Tests (ORTs). Tests that measure hormone levels such as Anti-mullerian hormone (AMH), a hormone that declines with follicular preserve can be conducted during any part of the menstrual cycle, this particular test does have limitations, namely, women taken oral contraceptives(OCPs) are advised to wait 3-4 months after discontinuing their OCPs for more accurate results as AMH levels can be falsely

decreased with OCPs.¹⁵ Other hormonal tests such as basal follicle stimulating hormone (collected during day 3 of the menstrual cycle) and basal estradiol when used in combination, can also be helpful in predicting ovarian function.^{14 15} Other tests such as Gonadotropin releasing hormone agonist stimulation tests which look at an individual's response to GnRH stimulation on serum estradiol levels measured during days 2-3 of the cycle can also be used to predict ovarian function. Ultrasound imaging such as Antral Follicle Count (AFCs) can also be conducted in the early follicular phase to determine ovarian reserve as it sums ovarian follicles between 2 and 10 mm. Although easy to perform, AFCs can have significant variability based on how it is read. With such a wide variety of ORTs available, helping female residents obtain these tests as screening tests to better understand their ovarian reserve can help with their family planning goals. It is also important to note that these tests cannot predict when patients will undergo a significant decline in fertility, and are more predictive of ovarian response at time of testing.¹⁵ Although the tests described are relatively simple, they can pose a great financial burden on residents hoping to have children in the future. Providing these residents with funding for ORTs or coverage for ORTs with residency program provided health insurances can help lessen the burden of female patients and provide them with the resources they need to make changes in their family planning goals or decisions to preserve their oocytes.

Although there are no treatments to prevent age-related ovarian decline from occurring, using donor oocytes, embryo cryopreservation and oocyte cryopreservation are some of the treatment options available to preserve fertility before patients lose their ovarian reserve. Oocyte cryoprecipitation (OC) is most commonly used when patients desire a direct genetic descendant. With OC, pregnancy rates have been reported to be similar to those following fresh oocyte insemination by multiple randomized controlled trials, particularly in younger individuals who

have not experienced significant decline in their oocyte reserve.^{15 17} Women who chose to undergo elective oocyte cryoprecipitation have relatively good oocyte survival rate. This rate along with the number of oocytes a woman might need for one live birth increase with age.¹⁵ For healthy female residents, oocyte cryoprecipitation would be an elective procedure which would be an additional cost. Residents typically go into residency with several hundred thousand dollars in debt and are paid wages that are insufficient for paying for elective procedures such as ovarian stimulation for oocyte collection, oocyte cryoprecipitation and fees for keeping oocytes cryopreserved. Elective cryoprecipitation has become more common recently with several tech companies such as Facebook who wave fees for their employees and setting a good precedent for companies in other industries and for residency programs to one day cover fees for procedures such as cryoprecipitate given its benefits.

Oocyte retrieval is usually done in combination with controlled ovarian hyperstimulation cycles or cycles in which the ovaries are stimulated to procedure several mature oocytes instead of the typical 1-2 oocytes per month. This enables patients to be able to have several mature oocytes be collected in one session. Typically, patients undergo about 2-3 cycles for 20 mature oocytes.¹⁵ There are several risk factors associated with each session of ovarian hyperstimulation and oocyte retrieval, although they are rare, they include infection, damage to organs, blood loss, ovarian torsion and anesthesia risks. Ovarian hyperstimulation syndrome is another more common risk of ovarian hyperstimulation caused by ovarian swelling causing pain and discomfort. Its symptoms can range from milder symptoms such as ovarian tenderness, nausea and vomiting to more severe symptoms requiring hospitalization.

Apart from the well known age related causes of ovulation dysfunction, non-age related cases also exist, these include oligoovulation, anovulation that may be connected to reproductive

hormonal imbalances. The reproductive hormones are controlled on a three point axis called the hypothalamic pituitary ovarian axis (HPO), dysregulation of reproductive hormones at any of the levels of this axis can lead to anovulation and infertility. These hormonal disturbances can be induced by individual or environmental factors such as intense exercise, eating disorders, or stress; excess hormone release such as hyperprolactinemia, tumors such as pituitary adenomas/ tumors, hypothalamic tumors or ovarian tumors. Destruction of the glands can lead to decreased hormone production and function, this can occur though Sheehan's syndrome, empty sella syndrome or autoimmune causes such as lymphocytic hypophysitis. Hormonal disturbances involving different organ systems can also affect ovulation. Adrenal gland tumors or dysfunction can lead to cushing's syndrome, hormone producing syndromes, liver disease, hypothyroidism or hyperthyroidism. Reproductive hormones can also be altered due to medications including OCPs, antidepressants or antipsychotic medications, steroids or chemotherapeutic agents.¹⁶

According to the CDC, Polycystic Ovarian Syndrome (PCOS) is one of the most common causes of female infertility in the United States affecting up to 12% of women in the US.¹⁸ PCOS is a condition in which women are unable to ovulate most often due to lack of sufficient hormones, which leads the ovaries to develop multiple small cysts which make androgens such as luteinizing hormone (LH) and testosterone in greater quantities than physiologically necessary by women. There are several reproductive abnormalities present with PCOS, they include menstrual dysfunction with oligo (fewer than expected) or amenorrhea (no menstrual bleeding) caused by reduced or lack of ovulation.¹⁹ Another key feature in patients with PCOS is hyperandrogenism or excess male hormone production (androgens) which is characterized by growth of coarse dark hair in areas where women typically have fine hair or no

hair, acne, and male pattern balding.¹⁹ Patients with PCOS can also develop insulin resistance to a greater degree than the general population and have some link to obesity.

Although there are no screening tests available for PCOS, discussing symptoms of amenorrhea/ oligomenorrhea or hyperandrogenism associated with PCOS with a primary care provider or Ob/Gyn physician can help residents obtain testing for diagnosis. Healthcare providers can also obtain additional blood tests to check for reproductive hormone and androgen levels along with ultrasound tests to look at ovaries for diagnosis. If a patient is diagnosed with PCOS, physicians can order additional labs to test for insulin insensitivity. Treatment for PCOS includes therapies to reduce the effects of androgen excess by using medication such as spironolactone, and birth control pills. These birth control pills are also prescribed to regulate the menstrual cycle. Other medications such as metformin may also be prescribed to improve insulin resistance which is often seen with PCOS. If patients are hoping to get pregnant, physicians can also start them on medications such as clomiphene to help with their fertility as it stimulates ovulation.

Apart from hormonal causes of female infertility, conditions such as endometriosis can lead to endometriomas, which along with other types of ovarian cysts can lead to infertility. Anatomical abnormalities such as fallopian tube abnormalities and uterine / cervical structural abnormalities are other possible causes of female infertility. Follow up with primary care providers, Ob/Gyns or physicians specializing in fertility treatment can help residents deal with these conditions.

Infertility among female residents is unfortunately a more common occurrence than one would hope for. With a combination of socioeconomic factors and biological factors influencing a resident's family planning goals, it is important for female residents to consider all the factors

in play. It is also important for us as a society to understand the biases and lack of resources for female residents as they become pregnant and mothers. It is also our responsibility to educate residents on the decline of ovarian reserve with age as it may occur at much younger ages than residents might expect. Educating residents on fertility preservation techniques and providing them with financial support for preservation techniques such as oocyte cryoprecipitation can also help residents meet their family planning goals. Working with their primary care physicians or Ob/Gyns can also help residents better understand other biological causes of female infertility such as PCOS that residents may be at risk for. This can help female residents with individual fertility assessments and counseling, enable early diagnosis of infertility, help residents maintain their health, and help them meet their family planning goals.

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