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Talking About Fertility in Sex-Education Class: STIs, Substance Use, and Reproductive Technology as Grounds for Discussion

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ABSTRACT

Secondary school sex education has been identified as a productive site for teaching about fertility. U.S. sex-education curricula of all types does not explicitly include fertility, but research suggests fertility is nonetheless discussed in the sex-education classroom. To identify the contexts of those in-class discussions, we analyze semi-structured interviews with 32 secondary-school sex educators representing states with different curricular mandates (i.e. abstinence-based; comprehensive). Findings reveal that discussions about fertility unfold in the contexts of: (a) STIs, (b) substance use, and (c) reproductive technologies. Within those contexts, participants reported that they tended to highlight fear appeals related to fertility information; that they focused on male fertility over female in discussions about substance use; and that they lacked the time and resources to communicate nuances of fertility information. In these respects, this study has important implications for the communication and implementation of sex-education campaigns designed to alleviate low fertility knowledge rates.

KEYWORDS

Fear appeals; fertility information; health communication; sex-education curricula; teachers' experiences

Introduction

Issues of fertility have been the subject of much mainstream news coverage as of late. Reports of an impending “fertility crisis” brought on by falling fertility rates nationally and globally (Goodkind, 2024; Ip & Adamy, 2024; Latham, 2023), have circulated alongside articles and opinion pieces concerning the harms of adolescent and unintended pregnancy (Green Carmichael, 2023; Varney, 2022); high maternal and infant mortality rates, particularly among Black, Indigenous, and Hispanic or Latinx populations (Kindelan, 2023; Rabin, 2023); shifting legislation related to contraception

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and abortion access (Filipovic, 2024; Fischer & Matat, 2024); and high rates of reproductive-health issues such as infertility (Jeong, 2023; Swan & Colino, 2021). This news coverage demonstrates that fertility—which refers to one’s ability to become pregnant or contribute to a pregnancy (Zegers-Hochschild et al., 2017)—is a highly discussed and fraught topic in the twenty-first century. In part, this is because the factors associated with fertility for any one individual, family, or society are multifold, and the causes of fertility problems can be difficult to pinpoint.

One factor that consistently plays a role in fertility management and health—which is defined in terms of individual needs, goals, and desires—is one’s level of fertility knowledge. Fertility knowledge refers to medically accurate and scientifically validated information about the “factors that affect fertility and chance of pregnancy” (Harper et al., 2021, para. 2). This includes topics related to not only the anatomy and physiology of human reproduction but also the average reproductive lifespan for females and for males; how long it tends to take for a pregnancy to occur during a given timeframe of sexual activity and/or age-range; variables such as substance use, diet, sexually transmitted infections (STIs), and pollution exposure that can affect the health of reproductive body parts and products including ovum (i.e. eggs) and spermatozoa (i.e. sperm); and the availability and realities of contraceptives, abortifacients, and reproductive technologies (Bunting et al., 2013; Kudesia et al., 2017). Fertility knowledge, in and of itself, does not ensure reproductive health or that fertility goals are achieved in any given case, especially because socio-cultural, economic, and relational factors are central to these outcomes as well (Ekechi, 2021; Ray et al., 2020). However, higher levels of fertility knowledge may better position individuals to achieve their fertility related goals, whether that be avoiding pregnancy, becoming pregnant, or planning to become pregnant at some later point (Emmanuel Iyanda et al., 2020).

Research demonstrates that fertility knowledge is comparatively low across a variety of population groups. Internationally, Bunting et al. (2013) reported on a survey of individuals representing 79 different countries who were actively in the process of trying to conceive. They found low overall fertility knowledge rates, with men, younger individuals, and those without a university education demonstrating the lowest fertility knowledge. In the United States, Lundsberg and colleagues (2013) reported similar results, though with a focus on women of reproductive-age in particular, and Siegel et al. (2021) reported that, in a sample of female-identified 18–45 year olds, fertility knowledge was significantly lower among Black, Indigenous, and Hispanic or Latinx women than it was among those who identified as non-Hispanic white; the authors concluded their study by calling for “improving fertility education in diverse communities” to reduce

“clinically significant infertility disparities” (p. 347). In Haiti, Simon and colleagues (2023) found that less than a quarter of women reported correct knowledge of the ovulatory cycle, which is central to fertility knowledge writ large. In Australia, Ford et al. (2024) reported low fertility knowledge levels among 15–18 year olds, with adolescents knowing far more about sexual health content in general than they did about fertility; and Hammarberg et al. (2017) found that individuals and couples tended to have “several gaps in knowledge” about “factors that influence fertility and pregnancy health negatively;” they too—like Siegel, Sheeder, and Polotsky—called for “school curricula” to address these knowledge gaps (Hammarberg et al., 2017, p. 88).

This call—to alleviate low fertility-knowledge levels and poor fertility outcomes by integrating fertility information into secondary-school sex-education curricula—is one gaining traction among scholars, educators, and health advocates alike. For instance, Nargund (2015) argued that, given current rates of fertility related problems and complications, fertility education should be included as a mandatory element of what, in the U.K., is called sex and relationship education. Littleton (2014) offered a corresponding argument, drawing from interviews with adolescent girls about their knowledge and understanding of fertility to delineate insights related to effective fertility education curricular design, and M. Lee (2019), analyzing interviews with 54 U.S. women experiencing infertility, concluded that the lack of fertility information in secondary school sex-education curricula seemed to contribute to delayed diagnosis and treatment, particularly among minority women. Moreover, Avellaneda and Dávalos (2017) found that curricular mandates for sexuality education inclusive of fertility related information were associated with desired (low) fertility rates among adolescents in 17 Latin American countries. In light of this line of reasoning and research, the International Fertility Education Initiative (IFEI) was configured in 2020 with the goal of advocating for fertility education that is embedded in sex-education curricula around the globe (Harper et al., 2021).

In the United States specifically, even though fertility information is not an explicitly mandated part of sex-education curricula of any type in any state, research suggests that the topic may already be included to a greater or lesser extent in many secondary school sex-education classes (Jensen & Krall, 2024). What is less known, however, is how fertility information is introduced in the context of specific states’ curricular mandates, particularly because sex-education curricula is such a controversial aspect of U.S. educational policy and debate and therefore likely to play a major role in how fertility information is characterized (Gonzalez et al., 2017; Kramer, 2019).

To shed light on this question and ultimately assess the state of fertility education in U.S. sex education, this study draws from 32 semi-structured interviews about fertility messaging with public secondary school sex educators from states representing two distinct curricular mandates (i.e. abstinence-based; comprehensive). Our analysis of these interviews reveals that all 32 participants reported discussing fertility in their classes and highlights the three key topics that U.S. sex educators report as the most prevalent contexts for discussing fertility information in their current lessons (i.e. STIs, substance use, and reproductive technologies), as well as the relationship between specific curricular mandates and these topics and how fertility itself is represented or characterized overall. We find that fear appeals or negatively framed discussions of fertility are common across these topical discussions, though they are especially common in the context of topics directly tied to mandated curricula (i.e. STIs and substance use); that educators teaching abstinence-based curricula are more limited in terms of how they feel they can teach about fertility; and that teachers across-the-board seem to lack the time and resources to clearly explicate the complex factors involved in fertility management and health. In what follows, we provide an overview of our methodology, delineate our findings by drawing from representative examples from the interviews, and, ultimately, consider the implications of this analysis for the implementation of educational efforts designed to alleviate low rates of fertility knowledge.

Method

Upon gaining university institutional review board approval, semi-structured interviews were conducted with 32 secondary school sex educators working in public schools in one of two U.S. states, one with an abstinence-based curricular mandate ($n = 18$) and one with a comprehensive curricular mandate ($n = 14$).

Participants

Of the 32 total interviewees, 21 self-identified as female and 11 self-identified as male. In terms of race and ethnicity, 27 participants self-identified as white and/or Caucasian, 3 self-identified as Hispanic or Latinx, 1 self-identified as Mexican and Jewish American, and 1 self-identified as African American. The average age of participants was 43 years. Most participants reported being responsible for teaching grades 9–12 or grades 10–12, and only 5 participants reported being responsible for teaching younger students such as those in grades 6–8. A summary of individual participant information is provided in [Table 1](#).

Table 1. Summary of participants, curricular type, and grades served.

Name	Gender, age	Self-identified race/ethnicity	Curricula type	Grades served
Lacy	Female, 43	Caucasian	Abstinence-based	6–8
Dale	Male, 53	White	Abstinence-based	9–12
Asa	Female, 58	African American	Abstinence-based	7–8
Kim	Female, 29	Latina	Comprehensive	6–12
Dana	Female, 40	Mexican/Jewish American	Comprehensive	9–12
Tess	Female, 35	Hispanic	Comprehensive	9–12
Tony	Male, 57	Hispanic/Latino	Comprehensive	6–8
Kit	Female, 61	White/Caucasian	Comprehensive	9–12
Dale	Male, 35	White	Comprehensive	9–12
Jess	Female, 54	White/Caucasian	Comprehensive	9–12
Alex	Male, 36	White	Comprehensive	9–12
Ellis	Female, 29	White/Caucasian	Comprehensive	7–12
Sean	Male, 36	White/Caucasian	Comprehensive	9–12
Bryn	Female, 33	White/Caucasian	Abstinence-based	9–12
Jules	Male, 50	White	Comprehensive	9–12
Demi	Female, 46	White	Abstinence-based	10–12
Ann	Female, 24	White	Abstinence-based	10–12
Deb	Female, 25	White/Caucasian	Comprehensive	9–12
Jan	Female, 50	White	Abstinence-based	10–12
Pat	Female, 32	White	Abstinence-based	10–12
Joe	Male, 60	Caucasian	Abstinence-based	10–12
Lee	Female, 29	White	Abstinence-based	10–12
Viv	Female, 35	White/Caucasian	Abstinence-based	10–12
Sid	Female, 27	White/Caucasian	Abstinence-based	9–12
Joy	Female, 46	Caucasian	Abstinence-based	10–12
Ray	Male, 33	Caucasian	Comprehensive	9–12
Jay	Male, 52	White	Comprehensive	9–12
Eve	Female, 54	White	Abstinence-based	10–12
Blaine	Male, 35	White	Abstinence-based	7–9
Max	Male, 54	Caucasian	Abstinence-based	10–12
May	Female, 64	Caucasian	Abstinence-based	7–9
Lin	Female, 55	Caucasian	Abstinence-based	10–12

Procedure

Participants were recruited for this study using stratified, purposive sampling methods. The study’s basic criteria for inclusion was that participants had taught, or were currently teaching, one or more courses in sex education at a public secondary school in one of two U.S. states, Utah or Colorado. In order to teach sex-education content in a public secondary school in Utah, one must meet the basic requirements for teaching secondary school and complete a “teaching Sex Education Topics” training every 3 years (Utah State Board of Education, 2024). To qualify to teach sex-education content in a public secondary school in Colorado, one must only meet the basic requirements and endorsements for the broader subject matter of the basic teaching assignment (e.g. health; physical education; family and consumer science) (Colorado Department of Education, 2024). These states were selected because they represent two different sex-education curricular mandates with Utah mandating an abstinence-based curricula and Colorado mandating a comprehensive sex-education curricula. More specifically, the Utah State Legislature currently requires that all public secondary schools offer opt-in abstinence-based sex-education instruction at least

twice between grades 8 and 12. The curricula must stress the benefits of sexual abstinence and include information about puberty and adolescence; reproductive anatomy and physiology; pregnancy and fetal development; STI prevention including condoms; the effectiveness of specific contraceptive methods in preventing pregnancy; and healthy relationships (Sexuality Information & Education Council of the United States, 2024a; see also, Utah State Board of Education, 2019). By contrast, while the Colorado State Legislature does not require that public secondary schools necessarily teach sex education at all, it requires that, if sex education is offered, an opt-out comprehensive sex-education curriculum be provided that does *not* emphasize abstinence as the best or only beneficial sexual-health practice. Topics that must be covered include anatomy of the reproductive system and fertilization; puberty; STI prevention and transmission; pregnancy and all pregnancy outcomes including abortion; contraceptive methods in terms of choice, availability, and effectivity; sexual decision-making; healthy relationships; and sexual consent (Sexuality Information & Education Council of the United States, 2024b; see also, Colorado Department of Education, 2019).

To locate eligible participants, the authors searched both states' Department of Education websites for information about individuals teaching health and/or sex-education classes at the middle, junior-high, and/or high-school levels. They used that information to send recruitment emails to individual teachers summarizing the study, describing what participation would involve, and inviting participation for qualified teachers. With the goal of obtaining a maximum variation sample (Lindlof & Taylor, 2019), representing a range of diverse teacher demographics, school locations, and experience levels, the authors engaged in four phases of sampling. Phases one and two focused, first, on contacting teachers in UT and then in CO, and moved alphabetically through districts and schools within each district. Phases three and four focused on identifying racially and ethnically diverse participants and serving-schools in first UT and then CO, moving through school districts recognized as the most racially and ethnically diverse to those recognized as less so. Recruitment concluded (and the survey was stopped) after 32 interviews, when maximum variation among participants, and a high degree of theoretical saturation, was achieved. Overall, the authors sent 1,329 recruitment emails (1,084 to CO teachers; 245 to UT teachers).

Interested participants set up either a telephone ($n=14$) or Zoom ($n=18$) interview, depending on their preference, and signed a consent form digitally. Remote interviews allowed for a wider range of participation across states, locales, and demographics, and provided the flexibility needed for very busy professional educators to consider taking part. A semi-

structured format for the interview protocol was enlisted to ensure a degree of consistency concerning subject matter and focus across interviews while also maintaining a degree of malleability to accommodate the distinctive experiences and insights of individual participants (Lindlof & Taylor, 2019). The protocol itself included eight central queries related to participants' experiences teaching secondary-school sex education, why (or why not) they included fertility information in their lessons, how they taught about fertility and what they taught, how students responded to their lessons related to fertility, and their thoughts about the integration of fertility knowledge and information into formal sex-education curricula. The interviews also included several demographic questions and offered a definition of human fertility derived from existing research (Jensen et al., 2018; Kudesia et al., 2017), in terms of "an individual's ability to become pregnant and have children," with the caveat that "often this issue is communicated in terms of a female fertility timeline from when fertility begins to when it ends. It can also be communicated in terms of male reproductive capacities." For their participation, interviewees received a \$30 gift card. The interviews averaged 35.4 minutes in length and ranged from 21 minutes to 63 minutes. Audio of each interview was recorded digitally, and each digital recording was transcribed verbatim prior to analysis.

Data analysis

Interviews were analyzed via techniques of the constant-comparative method (Corbin & Strauss, 2015). This process included several interconnected analytic phases. The first phase followed each interview wherein the interviewing author recorded open field notes and memos having to do with the details of the interview experience and any thoughts the author had in terms of central, emergent themes or content (for instance, reproductive technology emerged right away as a theme that interviewees were mentioning in individual interviews). These records were shared with the research team as a whole. After each interview was transcribed (first by the interviewing author and then by a professional transcription service), the transcriptions and audio-recordings were compared and verified for accuracy by the interviewing author.

The second phase of analysis involved a holistic open-coding process wherein the first and second authors reviewed all available materials including field notes, memos, and interview transcriptions and engaged in an iterative, comparative reading both individually and as a pair to identify overarching themes. One of the emergent themes at this stage, and one that the authors ultimately decided to explore more closely, was related to participants' specific teaching mandates and associated curricula and how

that might play a role in fertility content and messaging. During the third phase of analysis, all five authors came together to code ten representative interviews from the sample as a whole in light of the curriculum-specific theme. They worked first individually and then as a group to compare and contrast content within and across interviews. This open-coding process resulted in the development of emergent themes and sub-categories, which led to a focus on what specific content in existing sex-education lessons tended to introduce or otherwise incorporate fertility information. The authors identified and explicated seven sub-themes related to this query, and then worked through the interviews coding them according to these sub-themes. This involved pulling out specific examples from the interviews for each sub-theme (for instance, references to in vitro fertilization, surrogacy, or egg donation were catalogued as examples of the theme of reproductive technology) and quantifying how many interviewees mentioned instances that fell into each category. Then, all members of the research team convened to talk through and compare and contrast everyone's coding, identifying especially elucidatory examples and ensuring that readings of the sub-themes and data were consistent across authors.

The final analytical phase involved consolidating categories down from seven to five, and then focusing in on the three categories with the most responses because categories four and five included the answers of only five and four total interviewees, respectively. The findings explicated in the next section are the result of this qualitative, multi-phase investigation. Pseudonyms are used for all participants to protect their anonymity, as well as to protect the anonymity of their schools, students, and colleagues.

Results

Sex-education content that includes fertility information

Across the interviews, all participants reported teaching about fertility to a lesser or greater extent at some point in their classes. Even though they had no curricular guide for discussing fertility in this context, the natural overlap in content between mandated sex-education issues and fertility knowledge information was such that discussions about fertility unfolded repeatedly for educators across several common themes. The three most common themes or topics that sex educators mentioned as likely to include fertility-related information were: (a) sexually transmitted infections (STIs), (b) substance use, and (c) reproductive technologies. The first of these categories falls within mandated curricula for both represented states, the second falls within the bounds of associated health curricula, and the third is not included explicitly in either state's curricula. The same findings emerged across abstinence-based and comprehensive curricular groups,

however participants teaching an abstinence-based curriculum were more likely than those teaching a comprehensive curriculum to report beginning conversations about fertility through the lens of STIs (a topic that was explicitly part of the sex-education curriculum). Participants of both curricula were equally likely to report discussing fertility through the lens of substance abuse (a topic that was part of adjacent health curriculum). Participants teaching a comprehensive curriculum were more likely than those teaching an abstinence-based curriculum to report beginning conversations about fertility in the context of reproductive technologies (a topic that was not an explicit part of the sex-education curriculum). In what follows, we draw from the interview data to provide an overview of how, specifically, fertility was said to be discussed in these contexts.

Sexually transmitted infections and fertility

Over 35% of participants in the study ($n = 12$) mentioned that, when they discussed sexually transmitted infections (STIs) in their sex-education classes, as they are all mandated to do by state curricula, they also discussed or fielded questions about issues of fertility, especially concerning infertility and miscarriage. In almost all of these instances, participants reasoned that, because STIs were already part of the curricula, an associated discussion of STIs' potential negative impact on fertility was to be expected. For instance, Blaine gave an overview of this part of his lesson plans, recalling:

Then we talk about sexually transmitted diseases and infections, and then it could come up in that because we do talk about, that's one of the side effects. Like in my slides for sexually transmitted diseases we talk about infertility as a side effect for different sexually transmitted diseases.

Similarly, Lee explained, "I have specific diseases and disorders that I have to talk about, so when we talk about STDs [sexually transmitted diseases] I talk about how they can cause infertility." And Joe noted that state law "says that we have to" discuss contraception, and "that falls in line with the STDs and the STDs being a significant threat to fertility. That's another topic that comes up." In each of these instances, sex educators described discussing issues of fertility not for their own sake but because they were seen as related to information that was explicitly authorized by the curriculum; it should also be noted that some participants employed outdated language—STD rather than STI—that may have diminished their messaging's persuasiveness by perpetuating stigma (A. S. D. Lee & Cody, 2020).

Continuing to draw from relational logic, several participants teaching abstinence-based curricula in particular identified discussion of this specific

subject matter—STIs—as the major or only opportunity available to them to talk about fertility in their classes in any way. For instance, after describing the connections he makes in class between STIs and infertility as a “side effect,” Blaine realized that “that would be about it,” in that he did not explicitly discuss fertility in any other way. Similarly, Asa explained, “The only time we talk about fertility is when we talked about contracting sexually transmitted diseases that may cause infertility,” noting also that students tend to “sit up in their seats” and “get a little bit more engaged at that point because a lot of them don’t realize that sexually transmitted diseases—how bad they can truly be.” In this respect, Asa saw STI curricula as a chance not only for legitimately introducing fertility issues as a topic in the abstinence-based sex-education classroom but also as a mechanism for punctuating that content in ways that students tended to pay attention to, even if that meant highlighting only negative or fear-inducing aspects of fertility messaging.

Although some accounts along these lines situated problems of fertility as a direct outcome of an STI, and did not include many details about how fertility problems might result from an STI, some others offered more specific information about the means through which an STI could affect fertility. Teri, for example, explained:

We talk about fertility, especially when it starts coming, talking about STDs and how some of those create the pelvic inflammatory situation. Where we end up with, you know, they may not even know that they’ve got it. They think they’re safe because they haven’t, they don’t have anything coming out that’s, or they don’t have anything burning, so they’re okay. Actually, our fertility rate in our country is dropping and it’s not all just because our society is changing and not wanting as many children, we also have huge infertility rates and some of it really is this prevalence or this increasing prevalence of STDs.

Teri was somewhat unique in this sample in that she linked the physiology of “STDs” (again, using that outdated language) and fertility issues to a broader commentary about population-level fertility rates. She taught her students that an infection can create specific physiological changes (such as pelvic inflammation) that reduce fertility and that, especially because those changes are not always apparent (i.e. no discharge or burning), occur often and widely across many people without medical treatment.

Where Teri was not unique was that her commentary about the connection between STIs and fertility problems was largely future-oriented, referencing the harm to fertility of not necessarily STIs in and of themselves but the harm of STIs left untreated over time. Those participants, like Teri, who provided more detailed depictions of STIs in relationship to fertility issues were also more likely than those who offered briefer, causative accounts of that relationship to imply in their teaching that getting medical

treatment quickly for an STI—or getting a preventative vaccine—could diminish its harms to fertility. For example, Jules employed intentional language—trading out deterministic terms (e.g. “gonna be”) for more contingent ones (e.g. “could be”)—to note,

We would go through all the STDs, the viral versus the bacterial, and the fact that if certain ones were untreated, that a loss of fertility was gonna be—could be—could become part of that as an outcome, as a consequence.

Likewise, Kit recalled, “I talked about STDs. I taught about that, the potential impact on future fertility of an STD, scar tissue in the fallopian tubes, those sorts of things.” By highlighting some of the mediating or complicating factors involved (e.g. scar tissue, type of “STDs”), and taking a bit more time and care to play out the fact that contracting an STI does not necessarily and immediately cause infertility, these educators provided their students with a more accurate, nuanced portrayal of the relationship between STIs and fertility problems, and suggested that obtaining STI treatment now could protect them from fertility-related challenges in the future. This last point was not something that participants necessarily said explicitly to students, although Kit, for one, suggested that she answered student questions about, “Well, how do you know” if you have an STI, with information about testing and treatment. But even without the provision of explicit testing-and-treatment-guidance, Jules’ and Kit’s deliberate language choices and decision to include additional information in their lessons created space for students to make that important connection themselves.

Substance use and fertility

About 28% ($n = 9$) of participants reported that they discussed issues of fertility in the context of substance use or abuse. Although the use of drugs and alcohol among minors is not a mandated part of either state’s sex-education curricula specifically, it is a mandated topic in associated, secondary school health curricula and, therefore, was not seen by participants as outside the bounds of their teaching purview. To highlight that curricular connection, Alex organized his health classes across the semester so that content related to substance use could be introduced directly before the sex-education unit. He recalled:

We did our drug and alcohol unit before—right before, so it would come up as one of the side effects—negative side effects of using drugs or alcohol, is that it would lead to infertility or reduced sperm production and things like that. We would talk about what that meant.

Dana organized her classes similarly, reasoning that, “if we’re teaching about marijuana and alcohol from a prevention standpoint, I really feel that sexual health should be taught as well,” because the subjects are

interrelated in terms of issues such as fertility, contraception, and pregnancy. Kim used that same logic to explain that teachers in her school taught fertility education across units so that “we’re using sex ed, we’re using drugs and alcohol education.” In this respect, information about fertility tended to be covered in these classes at the intersections of recognized health units, and teachers were designing their courses in some cases to make the most of those points of overlap.

Across the interviews, teachers noted that in-class conversations linking substance use and fertility problems often focused on spermatozoa (i.e. sperm) in particular as negatively affected. Kit recalled that “I’ve talked about the impact of drugs and alcohol on sperm,” and described “really wanting kids to understand the impact of different types of drugs on sperm, because I want kids to also think about their future fertility.” Sean also worked in his classes to emphasize the relationship between substance use and sperm impairment, though his focus on the impact of substance use was more immediate than was Kit’s. He remarked:

I bring it back to the classroom in terms of alcohol or different types of prescription medication or marijuana, or how long it takes the sperm to develop, for the 70 days, or whatever the window is, depending on the person.

And Lin noted, “we talk about how it actually can, there’s certain drug usage that can cause impotence and that also or even just lack of sexual interest but that also it can like affect your sperm in such a way.” Lacy explained that her own focus in the classroom on the impact of substance use on sperm (and boys and men) particularly was invoked in an attempt to disprove widespread myths associating infertility with girls and women alone. She noted, when talking to male students,

I’m like, ‘Realize things that you do or don’t do, don’t eat healthy or stress or drugs, realize that could affect your fertility, too.’ Most of the time, they’re just like, ‘Oh my gosh, I never thought about it. I just thought it was a girl—a female thing.’ I’m like, ‘No, it can go both ways.’

Lin seemed to have employed similar reasoning because she contrasted her discussion about drug use and sperm with the idea that “it’s not just the woman that gets affected that has a drug baby but it is also the sperm that has created that baby.”

To that final point, several participants did incorporate a discussion of harms to ova (i.e. eggs) or complications in pregnancy resulting from substance use. Sometimes this included also the idea that legal substances too, such as prescribed drugs or even caffeine, could negatively affect fertility in both males and females. Viv, for instance, mentioned in her classes that even legal, prescribed drug use for the treatment of a broad range of health conditions could cause problems related to fertility. She said, “We talk

along the lines of, if someone were to have cancer and go through chemo[therapy], then maybe the chemo can influence sperm and egg production.” Most often, depictions of even legal substances as potentially harmful were discussed in relationship to female fertility and, specifically, pregnancy. Viv explained that she sometimes had questions from students about how drug use affects pregnancy, or why some people have miscarriages or have more trouble getting pregnant in light of substance use. Tony recalled talking students through how, during pregnancy specifically, “They can’t do drugs, they can’t smoke, they should stay off caffeine.” Likewise, Dale mentioned that pregnancy could be negatively affected not just by drugs and smoking but also by nutrition and dietary choices. These recommendations go well beyond the recommendations targeting males who are seeking to protect their sperm by—for instance—avoiding illegal drugs. However, corresponding discussions about caffeine consumption in particular were also brought up in Tess’s class when a student asked if “drinking Mountain Dew will reduce my sperm count, and I won’t be able to get somebody pregnant,” and even “Can I drink enough Mountain Dew to not knock up my girlfriend?” These comments imply that teachers were regularly expressing to students that many consumable substances play a role in hindering or potentially supporting fertility and individuals’ specific fertility related goals.

That substance use of all types is not clear-cut in terms of its effect on fertility, however, was implied by many participants and emphasized still further when several teachers mentioned during class, as Alex put it, “that there’s drugs and stuff that doctors can give you to increase fertility.” Moreover, Ellis categorized birth-control pills as drugs that, although they are generally taken to purposely halt one’s ability to become pregnant, can also have long-term health effects related to cardiovascular disease and cancer that could negatively affect fertility later on. These remarks indicate that students who were taught about fertility in the context of substance use may have been receiving messages that came across as confusing or even contradictory, especially because they tended to lack adequate description or opportunities for discussion and clarification.

Reproductive technologies and fertility

About 28% ($n = 9$) of the interviewees described discussing fertility in the classroom in the context of reproductive technologies, which are medical interventions used to treat infertility and other reproductive-health problems. These instances were distinct from discussions having to do with either STIs or substance use because reproductive technologies were not explicitly tied to any existing curricular mandates. For this reason, the sex

educators who talked about fertility in the context of reproductive technology were more likely to discuss fertility for its own sake because fertility as a subject matter was not introduced in light of another, mandated topic. But while fertility discussed in terms of reproductive technologies was more likely to receive focused attention and discussion than it was in discussions highlighting STIs or substance use, teaching about fertility through this lens also put educators at potential risk because, to do so, they were technically going outside the bounds of their state's educational decree. Thus, educators teaching comprehensive sex education, which is more inclusive, made up the bulk of this group of respondents, while educators teaching more restrictive, abstinence-based curricula were not as likely to report discussing fertility in this way. As Kim explained of this issue, "There is always a lot of hesitation on fertility information. I think it's because a lot of people think if we're teaching that, students are going to want to get pregnant." She noted, though, that in her state, Colorado, "If we're offering sex ed, it has to be comprehensive under the law, so we are gonna include [fertility information]."

In a number of cases, that fertility information was discussed in terms of in vitro fertilization (IVF), wherein an ovum is fertilized outside the body and then inserted by healthcare practitioners into the uterus. IVF was, by far, the most frequently mentioned reproductive technology discussed by participants in their classes. Interviewees suggested that this was often because students asked questions and became especially engaged when IVF technologies were mentioned. Alex recalled that "we talked about, a little bit about in vitro fertilization," because "the kids thought that was—they'd never heard—a lot of them had never heard about it, so it was quite interesting for them. They definitely had a reaction to that." Ellis was also driven by student interest to discuss IVF and associated issues of fertility, noting, "we ended up talking about IVF," and "I know they have asked questions about IVF." She explained of students:

They see it on TV a lot where it's just like, 'Oh, well, we went through IVF' or all these characters on TV that it's just this no big deal thing to go to the doctor and start getting these treatments or something. The shows don't really show the cost and what it does to you mentally and all of that.

Ellis felt that students were in need of additional information about the realities of IVF treatment and took it upon herself to offer what she saw as a more realistic picture of such treatment in terms of expense, mental toll, and more.

Demi also found herself discussing IVF in her sex-education classes when, "Someone said, 'Well, what is in vitro?'" With this prompting, Demi decided to go into quite a bit of detail about the mechanics of IVF, drawing from previous lessons about reproductive anatomy and processes to

explain what happens physiologically when someone undergoes this treatment. She recalled,

I just talk about, well, here's the anatomy. Here's the uterine lining, the endometrium. What happens if it can't implant? What if you have a fertilized egg? What if this? What do you do? What do all these people and neighbors, whatever, you heard it there. What are they going through? We just talk about the process. There's a great YouTube video on it. ... I always find something less than five minutes where I can just go through and be like, 'Hey, here's just an overall what in vitro is, so where they will fertilize the eggs, and they'll implant it and try to get anything to implant, or they'll fertilize it outside. That's really important because it's not working inside because of the hostile environment, all this stuff. ... I think it's important that they understand that there's other ways for fertility. There's other ways to produce a baby if there's a problem.

Like Ellis, Demi used student questions about IVF to offer a broader message concerning fertility and infertility treatments writ large. For Ellis, this message concerned the high prices paid for such treatment and that not everyone has access to them, regardless of how such technologies are portrayed in popular media. For Demi, the message concerned the idea that issues of infertility could be treated medically, should be understood using the same physiological vocabulary the class had enlisted for other sex-education lessons, and were, therefore, not necessarily unresolvable.

These same overarching points about access and availability of reproductive technology were also mentioned by Tess, though not in the context of IVF specifically but infertility treatments more generally. She explained,

I also talk to them about, like, there are alternatives to getting pregnant if in the future that's something you wanna do, but they all cost a lot of money, so it's a privilege. It's not something everybody can do. It's a privilege thing.

Tess was especially careful to address not just the existence of reproductive technologies but also the extreme barriers to this type of reproductive healthcare because, as she put it, "I teach in a low-income school, so I talk about it that way. This is a privilege that not everybody has." Similarly, expense—though not necessarily issues of equity or access—was a key point that Lacy brought up in talking with her classes about infertility treatments. She mentioned, "Then we go, how much does adoption cost? It's like, do we do infertility treatments, or do we go adoption route?" Lacy's juxtaposition of infertility treatments with adoption is one that several other participants enlisted as well, guided by the idea that economic considerations (whether for medical treatments or social services) were among the most important when navigating fertility problems.

Beyond IVF, several other specific reproductive technologies were also mentioned among interviewees as subjects they addressed in their classes. Like Lacy, Deb also grouped adoption in with reproductive technologies,

recalling, “we touch on infertility and what different options there are for adoption, and IVF and donated embryos and all of that.” Kit recalled how students themselves mentioned the idea of surrogacy and related technologies in their presentations to the class, and Jess mentioned that she tended to discuss oocyte cryopreservation, or egg freezing, in class. She explained, “I know people who, because of a medical thing or because of an age thing, you know, froze eggs or, you know, did that thinking forward so that they had that opportunity.” Jess’s discussion of this specific technology did not include much by way of physiological detail, likely because her goal in mentioning egg freezing (like Deb’s probable goal in referencing donated embryos) seemed to be student awareness that these technologies exist over in-depth understanding or engagement. These remarks stood in contrast to other participants’ more descriptive overviews of IVF technology and the socio-cultural issues surrounding infertility treatments more broadly.

Discussion

This study sheds light on how issues of fertility are introduced and discussed in U.S. sex-education classrooms, particularly across differently mandated sex-education curricula. The overarching goal of this analysis is to assess ongoing and existing fertility education efforts furthered by individual, U.S. teachers to inform the future design and implementation of educational programs aimed at alleviating low fertility knowledge rates and improving sexual and reproductive health education writ large.

Sexually transmitted infections as a warrant for fear-based discussion of fertility

Our results demonstrate that the most common topic that teachers employed to introduce or discuss issues of fertility to public secondary school students was that of STIs (although many participants actually used the outdated terminology of STDs). This makes sense in that both states represented in this study mandate that sex-education courses must cover STIs in terms of prevention and awareness. Teachers in our sample felt that this mandate warranted their discussions of fertility issues in the sex-education classroom, even though fertility is not part of the curriculum, because STIs have been shown to be related to fertility problems. This reasoning was especially prevalent for teachers who were mandated to teach abstinence-based curricula because they worried, more than did those teaching comprehensive curricula, that going too far afield of the explicit subject matters outlined in their approved curricula would put them at risk for professional censure. For them, STI-related lessons served as one of

their only opportunities for discussing issues of fertility and so they made the most of that content by highlighting that connection, sometimes in terms of relatively straightforward references to STIs directly causing fertility problems and sometimes with a bit more nuance wherein mediating factors related to, for instance, time-to-STI-diagnosis-and-treatment were identified as related to whether fertility problems would develop or not. This latter point about treatment—one that was only suggested by a few educators—was an especially important element of the discussion because it emphasized that if students were to become infected with an STI directly, their access to—and willingness to get—medical care would reduce their risk of fertility problems now and in the future. On the whole, reported STI-oriented discussions about fertility consisted of fear appeals or otherwise negatively valenced portrayals highlighting how generalized or specific sexual-health behaviors could result in undesirable fertility outcomes.

Substance-use conversations focused largely on male fertility

Beyond STIs, teachers were also likely to cite lessons about substance use as a context for their in-class discussions about fertility. Substance use and abuse is a mandated topic of associated health curricula for both states, and teachers found themselves designing the flow of their health classes so that the substance use portion of the class overlapped with sex-education content. This organization functioned as a warrant for them to discuss fertility problems as such problems have been shown to be related to a variety of substance-use issues. The majority of teachers who talked about discussing fertility in the context of substance use focused their messages on the negative health implications to sperm (and boys and men) specifically. In some cases, this focus was elicited in an effort to disillusion students of the idea that fertility problems are primarily caused by female partners, rather than male. The downside of this focus, however, is that the potential harms to female fertility of substance use are downplayed or overlooked, particularly when they are not framed in terms of pregnancy and pregnancy outcomes. Across the board, interviewees who discussed fertility in the context of substance use suggested that the complicated relationship between even legal substance use and fertility, or drugs as a treatment for fertility problems, was difficult to fully explicate without an overarching curriculum to guide them. Their messages were therefore neither comprehensive nor entirely clear, and they likely left students with a muddled portrayal of the relationship between various substances and fertility. As in conversations about STIs, conversations about substance use were also largely negatively valenced and/or fear-based, even though some substances such as nutritive foods play a positive role in fertility health.

Reproductive technologies associated with more balanced discussions about fertility

Finally, interviewees also reported introducing or discussing issues of fertility in their classrooms in the context of reproductive technologies. These conversations, unlike those associated with STIs or substance use, played out without the backdrop of a curricular mandate because reproductive technologies are not included in either state's health- or sex-education curricula. For this reason, these discussions were the most likely to focus on fertility issues for their own sake and thus offer a more balanced portrayal of fertility as a subject matter that was not entirely negative or fear-inducing. Of the three thematic discussions highlighted in this analysis, this one was the most likely to situate fertility within a framework of potential choice and positive decision-making, while also highlighting the idea that fertility care access and effectivity is less than assured and often inequitable. Because there was no clear curricular tie and associated justification for these kinds of discussions, abstinence-based teachers were less likely to facilitate them than were comprehensive teachers. Those teachers who did report incorporating fertility information via this context into their lessons often reported doing so in response to student comments about, and interest in, IVF specifically. They discussed employing IVF as a jumping-off point for either the realistic representation of reproductive technologies more broadly, or as a chance to normalize such technologies by building from and applying vocabulary enlisted during previous sexual- and reproductive-health lessons. In many ways, IVF seemed to function therein as a synecdoche for any type of reproductive technology. Given that teachers did not seem to have the time or resources to present reproductive technologies more comprehensively, the IVF shorthand functioned as a realistic and useful approach for bringing a sense of coherence and consistency to an incredibly complex subject matter.

Application and curriculum design

At the level of application and curriculum design, these interviews offer important insight for those looking to improve existing fertility messaging and build curricula to alleviate low fertility knowledge levels. First, they demonstrate that curricular ties to existing sex-education and health-oriented content can function as a double-edged sword. On one hand, these ties provide clear warrants for educators who are worried about justifying their discussions of fertility in the classroom and, in some cases, serve as the only opportunity that they feel they have to discuss fertility at all. On the other hand, fertility messaging that is tied to other curricular foci tends to emphasize other topics, rather than fertility itself, and tends to be almost

entirely negatively valenced or fear-based, which gives the impression that fertility is a worrisome and threatening concern rather than a multifaceted aspect of reproductive and sexual health worth understanding and deciphering. Messages about, for instance, the positive impact of being quickly diagnosed with and treated for an STI on fertility health are often lost or underplayed in this context, even though students are positioned to act on this kind of insight in the here and now and do not necessarily have only to wait long into the future to ultimately accept their fate, as some discussions about STIs in an abstinence-based framing might imply.

Second, although the fact that fertility information is included at all in existing U.S. sex education is encouraging in some respects, the quality of those messages is decidedly one-sided and simplified because teachers are either preoccupied with tying that messaging to existing, approved content or lacking in the time and resources necessary for elucidating the nuances and complexity of fertility education as laid out by groups such as the IFEI (Harper et al., 2021). Those resources include pedagogical guidance and support that can only be derived from an educational environment wherein the value in explicitly teaching fertility to secondary school students is recognized. Efforts to advocate for the integration of fertility education directly into mandated curricula can be bolstered by references to the harms to teachers and students alike of not doing so. These harms include the circulation of incomplete, hurried, and not entirely clear fertility information that, in many cases, is grounded in appeals to fear and offers confounding information that may actually work against fertility knowledge gain and efficacy due to its lack of clarity, as well as the use of outdated terms such as STDs rather than STIs that may perpetuate stigma and discourage rapid detection and treatment that would be fertility protective. The interviews analyzed for this study suggest that these harms are most likely to play out in the most restrictive curricular environments (e.g. abstinence-only and abstinence-based), with comprehensive sex-education pedagogy offering more opportunities for teachers' information gathering, student responsiveness, and agency in lesson planning. Given that abstinence-based curricula have repeatedly been shown to be less effective than comprehensive curricula in supporting positive student health outcomes (Atkins & Bradford, 2021; Bordogna et al., 2023), this study's results provide yet another reason—related to fertility knowledge and outcomes specifically—for advocating for comprehensive sex education in secondary schools nationwide and globally.

Limitations, future research, and strengths

This study is limited by its dependence on a small sample of qualitative interviews representing teachers' experiences in just two U.S. states.

Participants, on average, were over 40 years of age, so the voices of younger educators may not be adequately represented in this data. The results are therefore not generalizable, but they do serve as an excellent starting point for future research designed to assess how people learn about fertility in the United States and what kinds of information they learn in different curricular environments. Additional studies are needed to expand this analysis to see if younger sex educators and sex educators in other states, or those working with different iterations of required curricula, report similar experiences. Future research is also needed to explore students' sense of what they learn about fertility in the sex-education classroom. This would help to triangulate and contextualize the findings at hand, as well as to explore if students themselves find sex-education curricula to align well with fertility related lessons. Ongoing research along these lines will support the informed design and implementation of robust fertility knowledge education and healthcare.

The research presented here provides additional evidence for claims about how fertility information is being circulated in secondary school sex-education classes. It also goes a step further in that research trajectory by providing insight about the specific topics that are used to introduce fertility related material, how teachers are both supported and limited by existing sex- and health-education curricula in regard to their fertility related lessons, and the ways those lessons may be in-need of improvement, particularly in light of negative portrayals of fertility writ large, a lack of emphasis on the importance of early STI diagnosis and treatment, inadequate attention to female fertility in the context of substance use, and limited attention to the nuances and complexities of different variable factors impacting fertility health.

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