

Perspective

Femtech Fills a Void Left by the Lack of Comprehensive Sexuality Education

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SEXUAL HEALTH EDUCATION - CLASS IS NOT IN SESSION

When I give lectures about my work on oocyte biology [1] or my previous research developing a smartphone application to teach adolescent girls about sexual health [2], I usually provide some overview of menstrual cycle physiology or contraception. After each talk, almost without fail, several very educated individuals with terminal degrees in fields outside reproductive science will come up to me and tell me that they had never been formally taught how reproduction works. It's always a reminder that we who work in reproduction have so much to do besides scholarly work. We must also partake in the travail of advocacy for education - not only for girls, women, and people with periods, but everyone - as every single human being owes their very existence to the workings of the menstrual cycle.

People with periods can benefit immensely from reproductive health literacy conveyed via technology with the goal of sexual wellbeing [3] yet; there is a wide chasm between reproductive scientists and the general public. This gap is only exasperated by the fact that sexual health education has been neglected within general education in the United States. Sexual health education is not standardized by each state [4] nor universally mandated. The US spends 3.6 trillion dollars on healthcare [5] but has recently slashed budgets that provide evidence-based sexual health education [6]. However, the main entities delivering comprehensive sexuality education in the US are non-profit organizations like the Sexuality Information and Education Council of the United States and Planned Parenthood Federation. The consequences of which are seen in the high teenage pregnancy rates compared to similar nations [7] and alarming reproductive disparities, including sexually transmitted infections in racial and ethnic minorities [8].

With the current disruption of in-school education caused by the SARS-CoV-2 pandemic, sexual health education for children and young adults could be further jeopardized. Also, it is not feasible for healthcare providers to provide on-going comprehensive

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sexual information given their time constraints seeing patients. Health information that was once distributed in an office waiting room may no longer be appropriate due to the risk of possible transmission of the coronavirus. While the American College of Obstetricians and Gynecologists recommends an initial health visit with young women at ages 13-15 [9], the reality is many adolescents never see a gynecologist or any other physician for preventative reproductive care and sexual health education. Additionally, very few trainees in obstetrics and gynecology, family medicine and pediatrics perceive they have adequate knowledge of pediatric and adolescent gynecology [5]. All of these unmet educational needs in turn create a disastrous recipe for increased deficits in sexual health literacy and therefore poor reproductive outcomes i.e. early or unintended pregnancies, STIs, infertility and reproductive cancers which disproportionately affect minority girls and women in the United States [8].

UNINTENDED PREGNANCIES IN THE MODERN WORLD

Globally, unintended pregnancy accounted for 44% of all pregnancies between 2010 and 2014 [6], with Ameyaw et al., 2019 reporting unintended pregnancy ranges between 10.8% (Nigeria) and 54.5% (Namibia) in Sub-Saharan Africa [10]. Despite all the available options for reliable contraception, approximately 50% of pregnancies in the United States are unintended with rates as high as 69% among Black women [8]. In Europe too, with many countries offering universal healthcare, the estimate is 34% (in Western Europe) to 54% (in Eastern Europe) of pregnancies are unintended [11]. These numbers are jarring given our modern contraceptive methods.

There are numerous barriers to reliable contraception, including: limited access to good quality services and health insurance coverage; limited method choice; experience or fear of side effects; cultural and/or religious opposition; and users and/or provider's biases and gender-based barriers [12]. Intimate partner violence (IPV) must also be mentioned, which affects 30% of women around the world [13]. IPV impacts

control over reproductive coercion, contraception and sexual intercourse [12]. The United Supreme Court has recently ruled that employers citing religious objections may opt out of birth control coverage for female employees, further jeopardizing access for women [14]. Even when some barriers such as access and costs are removed, it is not uncommon for women to switch and discontinue methods of birth control---largely due to side effects [15]. Therefore, it suggests that the existing contraceptive options are not serving women's needs. Perhaps what are missing are adequate, personalized counselling, contraceptive education and support that could inform contraceptive choice via more structured mHealth interventions.

FEMTECH BUILDS A DIGITAL BRIDGE OVER THE WIDENING DIVIDE

The term "Femtech" was coined by Ida Tin, the founder and Chief Executive Officer of Clue, Period & Ovulation Tracker App. It refers to the software, diagnostics, products, and services that use technology often to focus on improving women's health. The Clue smartphone application is a free resource for people to better understand their cycles and track symptoms related to their menses. Since Ms. Tin coined the term in 2016, the field has vastly expanded. With the advent of the pandemic it is even more apparent that patients will now need access to healthcare professionals for reproductive counseling and sexual health education in innovative ways that accommodate social distancing and quarantining. Femtech appears to be the answer that has been right under our noses all along.

Prior to the pandemic work with US adolescent girls showed that smartphone applications were an acceptable way to convey sexual health education [16]. My collaborators and I recently reviewed further studies that also found that mobile health (mHealth) applications were preferred among this demographic [15]. The mHealth intervention model for sexual health education has been utilized by the World Health Organization's Armadillo Project in Peru and Kenya [17,18]. However, beyond adolescence, very few prospective, randomized studies have been conducted about improved health outcomes in adult women who utilize Femtech, specifically mHealth applications, in reproduction. Furthermore, few mHealth interventions respond to the needs of women and people with periods throughout the reproductive lifespan from menarche to the climacteric. Our mission at Clue is to change this by partnering with clinicians and scientists to conduct high-quality reproductive research (with the informed consent of our 14 million global users) so that we can further the progress of healthcare for people with periods at every stage of their reproductive life. We currently have 15 published papers as a result of such collaborations. In March 2018, analyst firm Frost and Sullivan released a report stating that femtech could become a \$50 billion market by 2025. This in itself shows that femtech has become a serious technology category, with huge potential. These technologies are directly relevant to 50% of the population, and address a range of needs that have been severely neglected for many decades. The world now has an explosion of applications and mHealth inventions, resulting in an unprecedented amount of data for researchers to help women's healthcare progress. Most importantly femtech should be science-based and work toward the goal of reducing disparities, improving clinical outcomes,

sexual wellbeing and providing sexual education within the easy reach of your smartphone.

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