14 Influence of Hormonal Fluctuations, Pregnancy, and the Postpartum Period on the Career of the Female Physician

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Introduction

Female physicians experience significant physiologic events unique to women that if not addressed can adversely impact their careers. The reproductive years pose challenges that relate to changes in the hormonal milieu and physical demands of menstrual symptoms, pregnancy and the peripartum timeframe, breastfeeding, perimenopause, and ultimately menopause; experiences only faced by female bodied physicians. Hormonal fluctuations have both short- and long-term effects on the body due to the influence of sex chromosomes and sex steroids. Activational sex steroid hormonal effects include those that are non-permanent and reversible, which come at puberty and disappear at menopause, while organizational hormonal effects are perma-

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nent and remain despite loss of hormone, such as the effects on breast tissue. Sex hormones act via steroid receptors throughout the body including in the central nervous system (CNS) resulting in changes of the brain that regulate mood, behavior, and cognition. In this chapter, the physiologic changes and biopsychosocial ramifications resulting from hormonal changes across a women's reproductive lifespan that may play a role in the careers of female physicians will be discussed. Solutions that may mitigate the symptoms and potentially prevent various ramifications will also be reviewed.

Hormonal Fluctuations Throughout a Woman's Life Span

Women go through remarkable changes during their life span that are characterized by significant fluctuations in circulating pituitary-ovarian hormones. Menarche, menstruation, pregnancy, and menopause represent times with wide variation in levels of the estrogens (estradiol, estrone, estriol), progesterone, androgens (testosterone, DHEA), as well as the pituitary hormones (follicle-stimulating hormone (FSH), luteinizing hormone (LH)). The neuromodulatory effects of these hormones can result in changes of mood, behavior, and cognition [1]. Sex hormones bind steroid receptors, both extra and intracellularly, ultimately resulting in regulation of gene expression [2], with both activational and organizational effects. Activational effects occur in the CNS by acting on GABAergic, serotonergic, and dopaminergic synapses, as well as in peripheral tissues through hormone-specific receptors [3, 4]. Central organizational effects include neural changes such as myelination and dendritic spine remodeling. Through cellular pathways, estrogen acts to activate anti-apoptotic and cell survival pathways, which help cells meet their energy demand and protect against neurodegeneration [1]. Peripherally, sex hormones act to develop secondary sex characteristics, as well as interact on peripheral tissues such as the vasculature and organs [5]. Differences in estrogen and testosterone levels across the life span mean that sex steroids influence the regulatory and structural aspects of the body differently in women and men [5].

Mood Disorders

Compared to men, postpubertal women worldwide are on average twice as likely to develop symptoms that meet criteria for major depression or anxiety during their lifetime [6, 7]. The underlying mechanisms explaining these differences are likely multifactorial and include biopsychosocial influences. Fluctuations in sex hormones throughout a women's life may be one contributor, as demonstrated by the fact that the risk of mood disorders can be higher around a woman's menstrual cycle, postpartum, and during the peri- and postmenopausal transition [1]. It has also been shown that sex hormone fluctuations affect various cognitive domains. For example, low levels of estrogen and progesterone during the menstrual cycle are associated with improved visual-spatial abilities and decreased verbal abilities; with opposite effect seen when estrogen and progesterone are high [8].

Vignette: A 27-year-old general surgery intern is on day 2 of her 7-day period. She knows this is the day she has the heaviest flow but feels uncomfortable alerting her senior resident and attending that she may need to scrub out of a case to change her tampon. Six hours into the case she realizes she has leaked through her tampon and must scrub out to change her scrubs and tampon. Her senior resident tells her not to scrub back in because they are almost done. When the attending returns at the end of the case, he sees she is no longer working on the case and wonders why, but does not bring it up. The following day she develops significant cramping and lightheadedness making it difficult for her to remain in another case. Due to the discomfort, she scrubs out again and her attending again wonders why she was absent. The senior resident relates these events to others in the program, and later the intern is advised by other senior residents that she has been viewed as unreliable and even unprofessional because she left the operating room.

Menstruation, Premenstrual Syndrome (PMS), and Premenstrual Dysphoric Disorder (PMDD)

Menarche heralds a major transition in a woman's reproductive life span. Menses become a monthly event for most women, and for some women it is associated with debilitating recurrent emotional and physical symptoms such as mood symptoms, dysmenorrhea, and menorrhagia [9].

PMS is defined as recurrent adverse symptoms present only in the luteal phase of the menstrual cycle [10]. Up to 90% of menstruating women suffer from at least one premenstrual symptom, and 5–8% suffers from severe symptoms with significant impairment [9, 11, 12]. Women may develop physical (breast tenderness, bloating), behavioral, or emotional symptoms (irritability, depressed mood, tearfulness) in response to hormonal fluctuations [9, 13]. While the etiology has not been fully elucidated, individual response to fluctuations in estrogens and progestogens and serotonin insufficiency offer possible explanations [14].

The diagnosis of PMDD, as defined by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM 5), includes at least five symptoms with at least one symptom pertaining to affectively, lability, irritability, depressed mood, or anxiety, and at least five of the following symptoms must be present including appetite change, decrease interest in activities, concentration difficulty, feeling out of control, sleep disturbance, low energy, or physiologic symptoms including breast tenderness, increased weight, bloating, arthralgias, or myalgias [15]. The diagnosis of PMDD is more stringent than PMS. While it is difficult to accurately assess the epidemiology of PMDD, based on few community-based surveys, the prevalence of PMDD ranged from 1.2% to 6.4% and is ubiquitous worldwide [14].

Effects of PMS reach further than just physical symptoms and may lead to missed work or school, higher medical costs, and decreased quality of life [16]. As noted in the vignette above, menstrual symptoms including but not limited to menorrhagia, dysmenorrhea, and mood changes may interrupt work days and negatively impact work performance of the female physician or trainee.

Treatment for PMS and PMDD

Prior to initiating treatment, it is important to rule out other disorders that are common mimickers including depression or anxiety, hypothyroidism, or substance use disorders. Treatment for PMS and PMDD oftentimes includes a multifactorial approach including lifestyle measures, medications, supplements, and nonpharmacologic therapies [14, 16, 17]. Selective serotonin reuptake inhibitors (SSRIs), including sertraline, paroxetine, and fluoxetine, may be used as first-line pharmacologic therapy for both PMS and PMDD [14, 16, 17]. Although the evidence is not robust, studies have shown that combined hormonal contraceptives (CHC) may help with depressive symptoms associated with hormonal fluctuations [1, 13, 14, 16, 18, 19]. Additionally, calcium (1000–1200 mg per day) may improve depressive symptoms, fatigue, and appetite for those with PMS [14, 16]. Complementary alternative pharmacologic therapies that have been evaluated include vitamin B6, chasteberry, St. John's wort, *Ginkgo biloba*, and evening primrose oil [14]. Nonpharmacological therapies include acupuncture, exercise, a complex carbohydrate diet during the luteal phase, and cognitive behavior therapy with mixed results [14, 16]. For those with resistant symptoms, other therapies include GnRH agonists, surgery with bilateral oophorectomy, and hysterectomy [14]. Given the increased risk of long-term health consequences of premature surgical menopause, especially without hormone replacement therapy until the average age of menopause, use of this option is and should be rare [20].

Combined Hormonal Contraceptives (CHCs) and Long-Acting Reversible Contraceptives (LARCs)

CHCs regulate endogenous sex steroids by suppressing hypothalamic gonadotropin-releasing hormone (GnRH) and gonadotropin secretion from the pituitary, thus reducing ovarian hormone secretion [21]. Contraception is largely a result of inhibition of the midcycle surge of LH, but progestins also act at the endometrium

and create cervical mucus that helps with contraception. Due to hormonal regulation, CHCs reduce menstrual variability and oftentimes lead to less severe premenstrual symptoms. Depending on the dosages of estrogen and progestins, potential side effects include emotional lability, bleeding irregularities, nausea, weight gain, breast tenderness, headaches, and sexual dysfunction [22]. Many of the side effects depend on the type and dose of the hormone used (Table 14.1). For example, lower ethinyl estradiol levels may be considered safe regarding VTE risk, but provide less endometrial stabilization [23, 24].

In addition to contraception, CHCs are often initiated for management of dysmenorrhea, menorrhagia, menstrual-related migraine, or polycystic ovarian syndrome. The benefit of CHC on reproductive regulation and quality of life for many menstrual-related conditions is large, and the risk appears low. For female physicians, the ability to partly control reproduction timing with CHCs helps to balance their career and reproductive life planning. Furthermore, CHCs have been shown to reduce the risk of both ovarian and endometrial cancer [25–29]. Although decreased with lower formulations of estrogen, risks of CHCs include cardiovascular vascular events, including venous thromboembolism, pulmonary embolism myocardial infarction, and cerebrovascular events. Breast cancer incidence is increased only slightly while taking CHCs and within 10 years of discontinuation [30].

LARCs are highly efficacious as a contraceptive and can help to mitigate some symptoms associated with the menstrual cycle including dysmenorrhea and menorrhagia. LARCs approved by the Federal Drug Administration (FDA) include five intrauterine devices (IUDs) and one subdermal progestin implant. The copper IUD contains no hormones and is safe for those who have contraindications to estrogen use. Some develop heavier menses with increased dysmenorrhea, an undesired side effect. Levonorgestrel-containing IUDs and subdermal progestin implants are also safe for those with contraindications to estrogen use. Both have the additional benefit of decreasing menstrual bleeding and sometimes causing amenorrhea, and both may result in irregular bleeding [31]. The Center for Disease

Table 14.1 Side effects related to the hormonal composition of combined hormonal contraception as well as various formulations available [15]

Hormone	**Dosage**	**Side effect**
Estrogen	Low (20 mcg EE)	Break through bleeding, amenorrhea
Estrogen	High (35 mcg EE)	Nausea/bloating, headache, breast tenderness
Progestins	Low[a]	Break through bleeding, dysmenorrhea, menorrhagia
Progestins	High[a]	Weight gain, depression
Androgenic progestins	Low	Low libido
Androgenic progestins	High	Acne, weight gain, hirsutism
Formulations		**Hormone combination**
High estrogen: high progestin: high androgenic		Ethinyl estradiol/norgestrel
High estrogen: high progestin: anti-androgenic		Estradiol valerate/dienogest
Medium estrogen: high progestin: anti-androgenic		Ethinyl estradiol/drospirenone
Medium estrogen: low progestin: low androgenic		Ethinyl estradiol/norgestimate
Medium estrogen: medium progestin: low androgenic		Ethinyl estradiol/norethindrone
Medium estrogen: medium progestin: medium androgenic		Ethinyl estradiol/levonorgestrel
Medium estrogen: high progestin: low androgenic		Ethinyl estradiol/desogestrel
Low estrogen: low progestin: low androgenic		Ethinyl estradiol/norethindrone
Low estrogen: medium/high progestin: medium/high androgenic		Ethinyl estradiol/norethindrone
Low estrogen: high progestin: low androgenic		Ethinyl estradiol/ethynodiol diacetate

EE ethinyl estradiol
[a]Dose levels dependent on type of progestin

Control and Prevention (CDC) publishes a summary of US Medical Eligibility Criteria for Contraceptive Use that can help tailor choice of contraceptive based on underlying medical conditions [32].

Noncontraceptive Benefits of CHC

Female physicians and physician trainees may benefit from both the contraceptive and noncontraceptive benefits of CHC and LARCs. While not FDA approved specifically for these indications, CHC helps treat dysmenorrhea, menorrhagia, hyperandrogenism, ovarian cysts, polycystic ovary syndrome (PCOS), endometriosis, and PMS [33]. In women over 40, data suggest CHC may help prevent cardiovascular disease and depression [34].

Given the additional burdens based on hours worked and disproportionate home burdens female physicians face, it is logical to conclude that addressing these disorders in female physicians can lead to improved quality of life. In addition, utilizing CHCs or LARCs to provide predictability in menstruation can be empowering to female physicians who at times have no control over other parts of their schedule. For example, in the above vignette the surgical resident could consider continuous CHCs to control menorrhagia and dysmenorrhea. Lastly, many aspects of medical training have to be planned, so having access to reliable contraception to facilitate reproductive life planning is crucial for many female physicians.

Vignette: A 35-year-old female family medicine resident became pregnant with her second child during her second year of residency. It had taken her a long time to conceive her first child, so the timing of the second pregnancy was a bit unexpected, but it was a wanted pregnancy. Her first trimester went well and she felt supported by her program director, who rearranged her second-year residency schedule to accommodate delivery and maternity leave. She was on an away rotation, which delayed her scheduled anatomy scan. At the anatomy scan, she learned her fetus had a severe congenital anomaly and the pregnancy could not be continued. She had to leave an inpatient rotation to receive

the emergent required care. Her program continued to accommodate her during this time with days off for the procedure, but she was required to return to her inpatient rotation only a few days after the procedure. She later pursued genetic testing prior to attempting an additional pregnancy and sought counseling given the emotionally and physically taxing unexpected experience she had endured.

Pregnancy, the Postpartum Period, and Reproductive Life Planning

Motherhood can be a factor associated with significant stress and burden for female physicians for many reasons. Pregnancy takes a physical and emotional toll on the female body. During pregnancy, there are increases in chorionic gonadotropin, progesterone, and estradiol levels, which can result in multiple physical complaints that may impact activities of daily living. These include, but are not limited to, gastrointestinal symptoms such as nausea, vomiting and constipation, fatigue, breast tenderness, frequent urination, changes in appetite, back pain, pelvic pain, chronic nasal congestion, and sleep disturbances [35]. While causation has not been established, hormonal changes in progesterone, estrogen, prolactin, cortisol, oxytocin, thyroid hormone, and vasopressin after child birth may play a role in postpartum depression [36]. It is estimated that 7–15% of pregnant women suffer from depressive symptoms in developed countries and 19–25% of women in low-resource countries [37]. After pregnancy, up to 13–19% of women suffer from postpartum depression [38]. Fortunately, treatments for postpartum depression are effective and typically include use of standard antidepressants and psychotherapy. In addition, brexanolone, an intravenously administered synthetic allopregnanolone and a positive allosteric modulator of α-aminobutyric acid (GABA), was recently approved by the FDA specifically for postpartum depression [39].

The demands that accompany a physician's career may take a toll on pregnancy outcomes [35–39]. A study done by Takeuchi et al. found that female physicians in Japan who worked longer hours during the first trimester had a higher risk of threatened abortion and preterm birth [40]. In fact, women who worked ≥71 hours per week had a threefold higher risk of a threatened abortion compared to women who worked 40 hours or less per week. It may become a necessity for female physicians to disclose early on in pregnancy to their employer or training program given concerns such as radiation exposure (e.g., interventional radiology or cardiology) or scheduling conflicts (residency schedule). Women may already be concerned about risk for pregnancy complications or loss, and early reporting may further contribute to their emotional uneasiness or distress [41]. However, there would be presumably less emotional distress associated with reporting early in pregnancy if it were considered routine and accepted within the medical culture as demonstrated by an infrastructure that was able to accommodate the schooled disruption associated with pregnancy and delivery.

The stress of family planning and its effect on a female physician's career has been studied in multiple countries denoting the universality of this challenge [40, 42–44]. Female physicians oftentimes delay childbearing due to training requirements and commitments. A study conducted in Taiwan found that female physicians tend to give birth at an older age compared to nonphysician counterparts (approximately 34 vs. 31 years old) [42]. Maternity leave can contribute to a delay in training completion because there are minimum required days trainees must work during residency and fellowship [45]. In fact, being younger at the time of first childbirth has been associated with a delay in attaining specialty board qualifications [46]. Female physicians were more likely to attain their medical degree and/or specialty board with just a 1 year increase in age of first childbirth, and the likelihood was lower if they resigned work for childbirth instead of taking a maternity leave.

On average, female physicians take a shorter maternity leave than other working mothers. The Family and Medical Leave Act (FMLA) allows 12 weeks of unpaid leave for those with newborns

or newly adopted children living in the United States, and the average maternity leave taken is 10 weeks [47]. For comparison, a group of female physician trainees at Mayo Clinic averaged only 5–8 weeks of maternity leave, and in the early 2000s the mean time taken for maternity leave among pediatric residents was a mere 3 weeks [48, 49]. Although a study found that 9 weeks or greater of maternity leave is associated with greater satisfaction with maternity leave and child birth timing, most female physicians did not take 9 weeks [50]. Female physicians may desire longer maternity leaves but feel pressure from their training, work, and colleagues to take a shorter leave [45, 48]. Factors that may allow more female physician trainees to have an adequate maternity leave include larger size training programs, more nonresident-run teams, and the increased hire of advanced practitioners [48]. The latter may also benefit maternity leave availability for practicing physicians.

Reproductive Life Planning

A reproductive life plan is a set of personal goals set by both men and women regarding the conscious decision whether or not to have children, and it includes the tools to achieve those goas; it is recommended by the CDC to promote preconception health [51, 52]. It allows one to accomplish reproductive life goals in the setting of personal values and access to resources (Box 14.1) [53]. For female physicians, their education trajectory may complicate this plan. For example, female residents have been found to delay pregnancy due to perceived threats to careers. Specifically, in surgical fields, women may have a longer delay in pregnancy compared to those in nonprocedural fields. Subsequently, there has been a higher rate of assisted reproduction and infertility. Nearly 25% of surveyed female physicians experienced infertility [54–56]. Another study looking at deferment of personal life decisions found that 64% of female physicians deferred personal life decisions such as marriage (28%) or buying a home (5%) and over 80% of them deferred childbearing. These deferrals may threaten career satisfaction. Of the women surveyed, fewer would elect to

do medicine again of those who deferred personal life decisions compared to the group who did not defer life choices (71% vs 85%, $p < 0.0001$) [44]. Along with the potential emotional dissatisfaction that may come with delaying childbirth, there are numerous health consequences due to advancing maternal age including higher risk for stillbirths, miscarriage, ectopic pregnancies, and birth defects [57].

Box 14.1: Reproductive Life Planning [50]
A set of personal goals set by both men and women regarding the conscious decision whether or not to have children and includes the tools to achieve those goals. It allows one to accomplish reproductive life goals in the setting of personal values and access to resources.

Example of questions to create a RLP:

- "Do you want to have (more) children?"
- "How many (more) children would you like to have and when?"
- "How will you prevent childbirth until you are ready?"

The ideal biologic time for a woman to have a baby tends to coincide with periods of high demand in medical training and new career steps for women, such as starting fellowship or transitioning to a faculty position after training. This is even more salient for women who decide to subspecialize or continue training [48] and may influence the reason why a substantial proportion of female physicians reported regrets about family planning and career decisions [55]. Furthermore, despite taking primary responsibility for child care and domestic activities, female physicians are often left feeling inadequate in both their family and professional roles [58]. Responses from over 300 female residents surveyed at Mayo Clinic highlights some of the stressors associated with pregnancy and child birth during residency. The decision to have a child during residency influenced research output, alterations in rotations, program completion dates, and changes in pre-

vious career plans for women more when compared to male colleagues [48]. A study conducted in Hungary by Gyorffy et al. found that female physician burnout is a risk factor for high-risk pregnancies and miscarriages, and poor pregnancy outcomes are risk factors for female physician burnout [43]. Accommodating pregnancy and childbirth in a supportive way would clearly benefit the health and wellbeing of female physicians and trainees.

There is promising data that female residents perceive program directors and division chiefs as more supportive of pregnancy during residency than previously perceived. Over a 7 year span, these improvements were noted by residents spanning different subspecialities, and they noted that involvement of female program leadership was likely a positive factor contributing to a more supportive environment [59]. Medicine in general is shifting to recognize the importance of work–life integration, including support of childbearing at all stages of the medical career. This is demonstrated in the increasing pregnancy rates seen during residency, which have increased almost threefold since the 1980s [48, 59].

Improving female physicians' childbearing experience and their pregnancy outcomes could be achieved by creating an environment that is supportive of family planning and provides adequate maternity leave. Medical societies are now endorsing accommodations for physician wellbeing and have provided recommendations to employers and training programs. The American Association of Pediatrics (AAP) advocates that all training programs have a written policy for parental leave and recommends a minimum of 6–8 weeks of paid leave after the birth or adoption of a child [49]. Similarly, the American College of Obstetricians and Gynecologists (ACOG) recommends all medical schools, residency, and fellowship program should provide at least 6 weeks of paid parental leave as part of standard benefits. Additionally, ACOG recommends that programs and medical specialty boards allow resident physicians to be board eligible even if they take more than 6 weeks of leave [60]. Empowering women with options for pursuing desired training while following an opportune reproductive path is paramount in mitigating the burnout associated with family planning [61].

Vignette: A 35-year-old first-time mother and new attending returns to work as an obstetrician after 12 weeks of maternity leave. She successfully breastfed during maternity leave and has set a goal of exclusively breastfeeding her baby for 1 year. When she returns from matternity leave, she is placed on call for labor and delivery. She has four very busy call days and does not find time to pump appropriately. She breastfeeds her baby 1–2 times during the day, but given her inability to find time to pump during her busy call days, her milk supply drops and she stops breastfeeding when her infant is 6 months old – far short of her stated goal of breastfeeding to 1 year. This causes her to feel intense guilt and frustration.

Breastfeeding

In the postpartum period, the female body undergoes significant hormonal changes [62, 63], in part related to lactation. Prolactin levels increase during the end of pregnancy to help develop mammary tissue in preparation for milk production [62]. Once newborns latch, the prolactin level increases. While prolactin is increasing, there is a fall of estrogen and progesterone to aid in milk production. An increase in gonadotropin-releasing hormone (GnRH) results in elevated LH and FSH which suppresses ovulation and menstruation. Oxytocin levels increase as an infant suckles resulting in breast milk let down as a result of contraction of the myoepithelial cells around the alveoli [62]. These intricate and substantial hormonal fluctuations contribute to physiologic consequences and may influence mood and other symptoms. For example, increased prolactin levels in nursing mothers have been linked to lower anxiety [63].

Oxytocin's physiological effects include promoting uterine contraction and reducing postpartum uterine bleeding. It also boosts a state of calm and reduces stress in the mother, while enhancing feelings of affection between the newborn and mother

that promotes bonding. In order to stay in tune with an infant's needs, milk production is reduced by a feedback inhibitor of lactation. This protects breasts from deleterious effects of engorgement such as clogged milk ducts and mastitis; however, it also results in decreased production if unable to remove milk in a timely manner whether through nursing or breast pumping [62].

Breast milk provides the nutrition an infant needs in the first 6 months of life, and breastfeeding plays an integral role in the neuroendocrinology of the mother–child interaction [62]. Because of this, the American Academy of Pediatrics (AAP) recommends exclusive breastfeeding for up to 6 months and continued breastfeeding in conjunction with solid foods until 1 year or longer [64]. The World Health Organization also supports exclusive breastfeeding for the first 6 months with continuation up to 2 years or beyond while introducing complementary foods [65]. Breast milk contains fats, carbohydrates, vitamins, minerals, water, as well as anti-infective properties [62, 66]. The anti-infective properties arise from immunoglobulins, white blood cells, and whey proteins, which kill bacteria, viruses, and fungi, and oligosaccharides, which prevent bacteria from attaching to mucosal surfaces. The nutritional properties and connection breastfeeding provides between mother and infant makes it an integral part of child rearing for many women [62]. Further, research finds that breastfeeding provides maternal protection against breast cancer, ovarian cancer, and endometrial cancer [67–69].

Reaching breastfeeding goals can be challenging for female physicians. A shorter maternity leave means that women must start pumping breast milk early to create a backup supply available once they are back at work. Infants of female physicians may be introduced to a bottle early on depending on how much maternity leave is taken. This may be challenging if the infant refuses the bottle, or then prefers the bottle over the breast. The infant's response to bottle-feeding may influence a mother's decision or ability to continue breastfeeding, making it difficult to reach breastfeeding recommendations outlined by the WHO and AAP [70].

In order to continue breastfeeding and provide infants with breast milk, women must commit to pumping throughout the work day. Busy clinical schedules and lack of suitable locations to

pump create challenges for physician mothers. Disruption of a pumping routine can negatively impact a woman's milk production. In many specialities, it can be nearly impossible to structure clinical work around a breast pumping schedule. Beyond the challenges of scheduling times to pump, female physicians may perceive judgment by colleagues when they are excused to pump and may feel they are missing valuable patient or educational experiences. These challenges in sum may lead to early breastfeeding cessation. Additional cited barriers for female physicians include 80 hour work weeks during training, stress associated with the burdens of clinical, research and educational production, night shifts, anxiety related to increased need to control, analyze, and measure infant feeding, and suboptimal medical education related to breastfeeding [71]. In organizations where compensation is dependent on number of patients seen, pumping can effect a woman's compensation. Not surprisingly, motherhood, especially for those who choose to breastfeed, is noted to be one of the principal causes of the gender pay gap [72]. In dual physician households, women shoulder more household responsibilities including child rearing than men; on average, women with children work less hours outside the home per week than male counterparts with children [73, 74].

Physician mothers are classified as a high-risk group for not meeting organizational and personal breastfeeding goals [71]. One study found that while 56% of female physicians intended to breastfeed for 1 year, only 34% met this goal [75]. Another study showed that over one third of physician mothers did not meet their goal to breastfeed to 12 months [76]. Meeting breastfeeding goals illustrates the complicated trade-offs female physicians navigate between home and work responsibilities. Falling short on breastfeeding goals can lead to feelings of guilt and dissatisfaction; while at the same time missing integral educational, patient, and work experiences results in disruption of career development [77]. When physician mothers reach their personal breastfeeding goals, they are more likely to support and counsel other physician moms and colleagues, as well as their patients about breastfeeding [71].

Aiding women with their breastfeeding goals would undoubtedly help mitigate the stressors faced by female physicians. Fortunately, federal laws have made it so that hospitals and clinics must have dedicated space available for lactation spaces and time for breast milk expression [78]. Additionally, many provide hospital grade pumps with phones and computers nearby. However, while lactation spaces are required, hospital grade pumps and an adequate workspace (i.e. including a computer or telephone) are not. Hospital grade pumps allow for an average of 15.5 min per pumping session versus 24 min with a portable pump [79]. Hospitals and clinics can help mitigate female physician burnout resulting from breastfeeding by providing hospital-grade pumps and adequate lactation room facilities to allow for increased efficiency and productivity during work hours. Other suggestions for improving the breastfeeding experience for female physicians include:

- Not having to make up missed work due to pregnancy or maternity leave
- Providing longer maternity leave
- Allowing sufficient time for pumping
- Increasing the level of support for breastfeeding efforts at work [76]

Lastly, social support and authentic connection is a critical aspect to achieving better outcomes for female physician mothers [80]. Social media groups may provide support for breastfeeding physician moms. Participating in support groups and improving breastfeeding education to both females and males would help to normalize and bring to the forefront the benefit of supporting breastfeeding for all involved. It is also important to provide support to women who make the decision, or who, for various reasons have to, discontinue breastfeeding before meeting WHO and AAP recommending durations. Self-compassion is also critical. Breastfeeding can be challenging for all women. Emphasis on choosing the plan that makes most sense for the infant and physician mother as a whole should be the focus.

Vignette: A 48-year-old female anesthesiologist started to notice significant issues with her sleep, waking up multiple times at night secondary to night sweats, resulting in fatigue that interfered with work. She was prescribed zolpidem, but her symptoms continued to worsen. It became clear that the symptoms began the same time she started to notice changes to her menstrual cycle with less frequent menses and intensified with the cessation of menses 12 months prior. Shortly after being prescribed transdermal estradiol and oral progesterone, her vasomotor symptoms were nearly completely gone and she noted improved energy and sleep.

Menopause

Menopause is defined retrospectively on a clinical basis 12 months after the last menstrual cycle. In the United States, the average age of menopause is 51. Women often begin to develop symptoms of menopause during perimenopause, a few years before menopause, when the ovarian hormones begin to fluctuate greatly [81]. The first sign of perimenopause typically is a change in the menstrual cycle. Menopausal symptoms include hot flashes, night sweats, joint pain, sleep disturbance, changes to cognition and mood, vaginal dryness, or other sexual health problems [82]. These symptoms are sometimes debilitating and can negatively impact a woman's quality of life. Additionally, untreated women may have higher healthcare resource utilization and more indirect work productivity loss, compared to controls [83]. As many as 75% of women will experience bothersome vasomotor symptoms (VMS) during menopause, and the average duration of menopausal symptoms can be as long as 7.4 years and longer for some [84]. Up to 42% of women aged 60–65 may still report VMS. Therefore, it is important to consider treatment for menopause.

Prior to the Women's Health Initiative (WHI) in the 1990s, women were being prescribed menopausal hormone therapy (HT) for symptoms, and also to prevent certain chronic diseases such as cardiovascular disease. In fact, observational and basic science studies showed that HT reduced coronary heart disease and all-cause mortality by nearly half [85, 86]. The WHI set out to evaluate the cardiovascular outcomes of HT. In 2002, the estrogen (conjugated equine estrogen) + progestin (medroxyprogesterone acetate) arm was closed early due to increased risk of cardiovascular disease and breast cancer [87]. This information drastically changed practice and has had ripple effects in menopause medicine.

Subanalysis of the WHI as well as subsequent random control data demonstrates that the risks identified in the WHI are for women who initiate HT more than 10 years from their last menstrual cycle or after age 60 [88–91]. Subsequently, guidelines have issued support of the use of HT early in menopause for symptomatic women [81, 89]. Many nonhormonal therapies, most off label, have been identified as effective for treating the vasomotor symptoms of menopause in women who choose not to use HT or have contraindications, such as selective serotonin reuptake inhibitors (SSRI), serotonin and norepinephrine reuptake inhibitors (SNRI), gabapentinoids, clinical hypothesis, and cognitive behavioral therapy [92]. Additionally, it has become clear that women who go through menopause early (surgically or otherwise) should be on HT at least until the average age of menopause to prevent long-term health consequences, such as osteoporosis, cardiovascular disease, and dementia, regardless of the presence of vasomotor symptoms [27]. Despite this updated and robust information, many women are not being treated, likely for many reasons including lack of comprehensive menopause training [93, 94].

No specific studies have evaluated the impact of perimenopause or menopause specifically on female physicians. However, menopause generally coincides with the most productive time in a female physician's career. By her 50s, most women are finished with childbearing and children are often old enough to allow more time to dedicate to herself and career if she chooses. The potential

for menopausal symptoms to impact career productivity, along with well-established quality of life improvements, is a reason to consider therapy for menopausal symptoms. For women without absolute contraindications (e.g., hormone responsive breast cancer, underlying clotting disorder) and significant vasomotor symptoms, HT is a reasonable option to consider.

Conclusion

Female physicians face challenges unique to women during their careers. Hormonal fluctuations throughout a woman's life span, from menarche through menopause, can contribute to temporary and long-term physiologic consequences. Women in medicine must integrate the challenges of their profession while planning and executing their reproductive life plan. Addressing symptoms related to hormonal fluctuations, including pharmacologic and nonpharmacologic therapies, can be considered. Additionally, institutional support of female physicians by providing adequate maternity leave, breastfeeding, and pumping resources, as well as support and wellbeing programs, can help mitigate distress and burnout often faced by female physicians.

Take home points

- The impact of fluctuating sex steroids, especially during puberty, menses, pregnancy, and menopause, can lead to many physiologic changes in a woman's life. This has the potential to impact the female physician career and should be addressed.
- There are many menstrual-related symptoms and disorders. These can be addressed by treatment with SSRIs (for PMS/PMDD) or combined hormonal contraceptives in appropriately selected women.
- Reproductive life planning for female physicians is impacted by their education trajectory and unique work demands. Many times this leads to attempting pregnancy later in life, which can

lead to infertility and more health consequences to the woman and her fetus. In turn, interrupting reproductive life planning affects female physician's satisfaction with their career paths.
– Improving services for female physicians during training and throughout their careers, including improved maternity leave and supporting breastfeeding, is recommended. Assisting women in achieving their breastfeeding goals benefit both mother and baby in innumerable ways.
– Most women experience menopause symptoms which can last up to 7.4 years. Considering treatment with HT is an option, especially for those less than age 60 or within 10 years of menopause. Treatment can significantly improve symptoms of menopause as well as quality of life.

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