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## Introduction

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In 1849, Elizabeth Blackwell became the first woman in the United States to graduate from medical school. In 2008, 159 years later, nearly one-half of all graduating medical students were women. Female medical school graduates are often attracted to psychiatry as a specialty, making up more than 50% of psychiatry residents. Some have theorized that women tend to enter specialties in which they can be involved with women's health issues, such as psychiatry and obstetrics/gynecology. Although mental health issues are evenly divided between men and women, patterns of illness and patterns of utilization of healthcare resources vary dramatically between these two populations. Female patients tend to be highly represented in primary care and outpatient mental health settings, often making up a significant proportion of resident caseloads. Women with mental health issues frequently present differently than men and typically struggle with different psychosocial issues. Similarly, female psychiatry residents are often confronted with different challenges than their male colleagues. In this issue, we discuss the psychological issues that many women face, both residents and patients. Dr. Claudia L. Reardon reviews the influence of sports on women's psychological well-being. Dr. Rachel Molander discusses the struggles of many women in their efforts to achieve balance between their lives and their careers. Another article highlights the hormonal changes that occur in the brain during pregnancy, affecting women's mood and cognitive functioning. Understanding the issues women face will help us to be more supportive of our colleagues and more sensitive and compassionate toward our patients.

# Women, Exercise, and Sports: A Review of Psychiatric Factors

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Exercise and sports can have profound physical and psychological effects on female psychiatric patients, yet as mental health professionals, we often fail to ask our female patients about their physical activities. The relationship between exercise and mental health is generally understudied. However, we do know enough about the benefits of regular exercise as well as the potential psychiatric problems, such as eating disorders, associated with excessive exercise that inquiring about physical activity should be a routine part of our psychiatric assessment of this population.

## Psychiatric Benefits of Exercise for Women

Many practitioners intuitively realize that exercise has mental health benefits. These benefits have been most quantified in studies of depression. A 2006 meta-analysis of 11 randomized controlled trials demonstrated a large clinical effect size for exercise as treatment for clinical depression (1). Even more recently, a Cochrane review (2) examined 23 trials comparing women who exercised regularly with comparison subjects and found an overall large clinical effect size. However, the investigators acknowledged that many of the included studies did not use intent-to-treat analysis or blinded outcome assessment, and when only the small number of more methodologically robust trials were considered, effect sizes were much smaller.

Exercise as a potential therapy for depression in women is especially relevant, given the high prevalence rates of depression in women of normal childbearing age (15 to 45 years old). Many of these women wish to avoid treatment with medications during pregnancy and the postpartum period. One prospective, nonrandomized study of pregnant women without depression demonstrated that women who exercised

regularly reported significantly fewer depressive symptoms in the first and second trimesters compared with women who did not exercise regularly, but this difference was not upheld in the third trimester (3). The American College of Obstetricians and Gynecologists (4) has recommended 30 minutes of moderate exercise on most days for pregnant women. Thus, we can generally be confident in recommending this regimen for our pregnant patients. Moreover, exercise has been studied as therapy for postpartum depression. In a controlled trial (5), 80 women with depression at 4 weeks postpartum were assigned to 1) standard care (comparison group) or 2) 1 hour of supervised exercise and two sessions of at-home exercise every week for 3 months. The women in the exercise group exhibited significantly lower depression scores on the Edinburgh Postnatal Depression Scale at 5-months postpartum relative to women in the standard-care group.

Exercise to treat menopausal symptoms has been studied as well. Many women experience distressing physical and emotional symptoms during menopause and are appropriately reluctant to take hormone replacement therapy to address these symptoms. Several randomized, controlled trials have found that aerobic exercise can improve depressive symptoms and insomnia associated with menopause (6). Further, there is some evidence that lower intensity exercise, such as yoga, can improve psychological well-being in menopausal women (7, 8).

## Barriers to Exercise for Women

Despite the established psychological benefits of routine exercise, women often describe numerous barriers that prevent them from initiating and sustaining exercise regimens (9). Women are often responsible for childcare, which

makes it difficult for them to find opportunities to exercise (10, 11). Gyms that offer childcare services can help in this regard. However, some women may feel uncomfortable working out in the coed environment of a gym (11). Finally, women, particularly those who are family caretakers, often describe feeling guilty about taking time for themselves to exercise (11). These barriers necessitate strategizing with female patients to make regular physical activity practical and sustainable.

## Psychiatric Problems Associated With Exercise and Sports Among Women

While exercise has numerous psychiatric benefits for women, excessive exercise can be associated with certain psychiatric problems, such as eating disorders and substance abuse. Although we need to be particularly vigilant in assessing for these psychiatric problems in female athletes, we must also be mindful that they can occur in association with exercise at any level.

A review on eating disorders in sports found that the incidence rate of eating disorders among female athletes has been reported to be as high as 60% and is most associated with wrestling, long-distance running, gymnastics, and figure skating (i.e., “leanness sports”) (12). Female athletes with eating disorders are at risk for the “female athlete triad”: disordered eating, amenorrhea, and osteoporosis. The development of this triad usually begins with a female athlete’s belief that lower body weight will translate into greater athletic success. This leads her to diet, and if the dieting is excessive, menstrual dysfunction and subsequent diminished bone mineral density can ensue (13).

It is also known that involvement in ath-

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letics, particularly at the college level, can be associated with heavy alcohol use. Student athletes, including women, report higher levels of alcohol use (14) and binge drinking (15, 16) than their non-athlete peers.

Contrary to popular belief, female athletes, and even recreational exercisers, are at risk for anabolic steroid abuse. In 2003, the Centers for Disease Control and Prevention (17) reported “lifetime illegal steroid use” in 7.3% of ninth-grade girls in the United States, although some have called this report into question (18). Nevertheless, healthcare providers must be aware that steroid use is a problem that does not exclude women. The use of anabolic steroids can have significant medical and psychiatric sequelae, including depression, mania, psychosis, violence, and cognitive impairment (19, 20) and, in our female patients, can cause masculinization and infertility.

## Conclusions

Taken together, the benefits of exercise outweigh the risks, and thus the American College of Sports Medicine (21) has encouraged all women and girls to participate in physical activities and sports. In the field of psychiatry, it is generally useful to recommend to most female patients, including those who are pregnant, postpartum, or menopausal, exercise as an adjunctive treatment for depression and, most likely, for other psychiatric disorders. However, we must be vigilant for psychiatric problems in some female athletes and women who exercise regularly, especially in those participating in leanness sports, who are at greater risk for eating disorders. Moreover, we must be sensitive to the barriers unique to women

as they try to implement exercise or sports into their daily routines.

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# Balancing Residency and Motherhood: Can We “Have It All”?

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When I started medical school, I had a seemingly bottomless well of energy and ambition. I saw the stepwise progression of my professional future through a rosy lens that was polished by years of schooling in the art of academic advancement. Marriage, children, and the “other stuff of life” were filed in a remote cerebral corner. When these thoughts would sneak into my frontal lobes, encouraged by slides of age-fertility graphs or the gnawing cry of a newborn on an obstetrics rotation, I neatly tucked them back, telling myself that it would all fit in eventually. I was on track, involved, and inspired in this intense process of becoming a doctor. The prospect of family seemed, at best, distracting.

Then it changed—quite suddenly, really. It was not a cognitive event. It emerged from the depths of my Darwinian biology and took me quite by surprise. I needed a



baby, like now. There was no way that this fit into my professional plans. I could not make sense of this feeling, and it wouldn't go away. I tried lists of pros and cons, timelines, and logic. I sought the advice of mentors, friends, and family. Now? Later? Ever? If I just gathered enough information, I figured that I could map out this baby business and fit it in where it belonged. This process was clearly futile. Eventually my husband, who is a person much more capable than I of a Zen-like acceptance of life's uncertainties, basically said, “What the heck, let's go for it.” And so we did. A year later, I was still not pregnant, and we gave it up with a mixture of relief and disappointment. I deliberately turned my attention back to my career, and hit “submit” on my residency application.

I was traveling around for interviews 2 months later when a suspicious wave of

nausea and Mack-truck fatigue took me to task. I was pregnant. I felt thrilled and totally unnerved by the sensation that things were about to get way off track. Starting my internship at 8 months pregnant began to look increasingly unmanageable, and I eventually took a deep breath and dropped out of the match. “I'll be back,” I told myself and others, keeping quiet about the anxiety of stepping off this comfortable ladder. When I told one of my mentors the news, confidently assuring him of my plans to be a mother-clinician-educator-researcher, he said, “I don't know, you have to be realistic, now; you *can't* have it all.” I scoffed, totally naïve to the path ahead, and said under my breath, “You just watch me.”

There is nothing like pregnancy, labor, and early motherhood to teach one the true definition of the word “humility.” I

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have never been so tired, so needed, nor so totally vulnerably in love as I was in those first few months with my little baby. It was total bliss and totally terrifying. In true form, I charged forward with baby books, play groups, baby-mom yoga, and organic pretty much everything. I took on mothering like step 1 of the boards. One day I found myself in a circle of mothers and babies at the library singing *The Itsy Bitsy Spider*. The babies seemed entirely uninterested in our antics, and they were all probably just wondering when the next milking session would start. I realized that I had drifted way outside of my element. One night, I dreamt that my brain was leaking out into my breast pump (at times, this did not feel entirely unrealistic). I loved being a mother; in fact, it was the most extraordinary thing that had ever happened to me. But the other parts of me were falling farther and farther away, and I knew I needed to start making my way back.

My baby was 10 months old when I started residency. Leaving the house each morning was an exercise of will,

and I cried most days in a bathroom stall. But between these moments, I was back on my game—learning, teaching, doctoring—and I began to appreciate this feeling in a whole new way. I dropped to part-time during my second year, and for the first time, I felt my personal and professional life settle into a fine balance.

When my second daughter was born 3 years later, I moved more slowly through those early months, opting for solo walks in the forest over play groups and sing-a-longs. I had the same feeling of bliss, but with more presence and without the fear of doing it wrong. By that time, I suspected that my job as a mother was about as simple as love, limits, and letting this little person just be who she is going to be. My 3-month maternity leave felt short, but it had been granted through the gritted teeth of the house staff office. I understood their resistance, since this kind of biological bomb shell does not fit well into the system of residency training. I thought it odd that in the protocol-rich field of medicine that there wasn't one for how to manage a resident's parental leave. In any event, I was able to work it out with the help of my co-residents and

program director, and I was thankful for the time.

When I returned from maternity leave, that past sense of balance eluded me for quite awhile. I could not see clearly how to keep up the necessary energy for both my family and plans for my career. Around that time, an experienced professor and mother told me to have patience. "You *can* have it all, just not all at once," she said. I liked the sound of that but knew I'd have to operate a little differently if this was to work. So I started with getting clear on the difference between what I wanted and what others wanted for me. Thus, I learned to say "no" without worrying about disappointing people; I began to set better limits with patients (to their benefit and mine); I thought less about building my resume and more about what mattered to me. In short, I changed out those old rosy lenses and tried to grow up some.

I finally finished just this year, and the path has been anything but straight. I have not been on track for a long time, and I am no longer sure what it even means to "have it all." I do know that my life is full of learning, love, and blessings—that I have enough.

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# The Pregnant Brain

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*Changes in mood and cognitive functioning are common in pregnant women. It is important to understand the specific changes women may encounter while pregnant in order to avoid pathologizing normal alterations in mental functioning. The purpose of the present study was to identify the biological factors responsible for creating these emotional and cognitive changes during pregnancy.*

Pregnancy can be a difficult time for women, even among those without a history of mental illness. As mental health practitioners, it is important for us to understand the issues with which women struggle during pregnancy. As residents, it is important for us to recognize that residency typically coincides with a time of high female fertility just before the decrease in fertility, which generally occurs starting at about age 30. Thus, it is not surprising that many residents become pregnant during their training. At the same time, many of the patients for whom residents provide treatment are also pregnant, and they often ask questions about normal mental changes during pregnancy and what may or may not represent psychopathology.

## Mood Fluctuations in Pregnancy

“Sarah” was a 22-year-old woman who was pregnant for the first time. She had no history of psychiatric disorders and complained of mood lability since becoming pregnant. She was concerned that her symptoms may have been indicative of a mental health problem. She stated, “I feel like I’m on an emotional roller coaster. One minute I’m great, and the next minute I’m freaking out. I don’t know if I’m crazy or if it is just my hormones!”

In our culture, pregnancy and childbirth are typically associated with positive emotions. However, this is not the case for all women. Stories like that of Sarah’s are very common, since pregnancy can be a time of significant stress, and even women

who are happy to be pregnant often find themselves experiencing mood fluctuations during the course of their pregnancy (1–3). Many of these fluctuations are the result of the vast hormonal changes that occur during pregnancy. Nearly all hormonal systems are affected in pregnancy. Some of the most significant hormones influencing mood in pregnant women are estrogen, progesterone, cortisol, prolactin, and oxytocin.

Estrogen and progesterone are key factors in establishing and maintaining pregnancy. Progesterone is initially produced in the corpus luteum, but its production site switches to the placenta at approximately 40 days after ovulation. Progesterone levels steadily rise as pregnancy progresses, and this hormone is primarily responsible for the continuation of the pregnancy. Progesterone inhibits contraction of the smooth muscle of the uterus, and it is anti-inflammatory and immunosuppressive, protecting the fetus from immunological rejection by the mother (4). Estrogen is produced primarily by the placenta, and estrogen levels increase linearly throughout pregnancy. Additionally, estrogen increases uterine blood flow and assists with the development of fetal organs.

Both estrogen and progesterone are fat soluble and can cross the blood-brain barrier. The emotional effects of progesterone and estrogen can be thought of as opposites, with estrogen generally improving mood (5–9) and progesterone mainly causing negative mood (10–12). Since both estrogen and progesterone increase during pregnancy, it is not surprising that pregnant women often experience mood lability as a result of the contrary actions of these hormones.

Many effects of progesterone on mood are mediated through allopregnanolone and pregnenolone metabolites. Some of the sedation and fatigue pregnant women experience may be as a result of the effects of pregnenolone. The sedating effects of

pregnenolone on mood are not entirely clear. However, feelings of fatigue are clearly linked to depression. Pregnancy is often a time of physiological and psychological stress, and thus it is possible that the sedation associated with pregnenolone may be beneficial in decreasing anxiety during pregnancy.

Stress hormones, including the corticotropin-releasing hormone (CRH), ACTH, and cortisol, are known to increase throughout pregnancy. CRH is produced by the placenta and increases exponentially during pregnancy (13). In turn, CRH stimulates release of maternal ACTH from the anterior pituitary (14). ACTH then drives the release of cortisol from the adrenal gland, and maternal levels of cortisol increase throughout gestation. Cortisol-binding globulin increases 2- to 3-fold during pregnancy, resulting in the total circulating cortisol to increase to more than the total free cortisol. However, pregnancy is a state of hypercortisolism, and the high levels of cortisol in pregnancy have been postulated to affect anxiety levels (15, 16).

Prolactin, a peptide hormone produced by the anterior pituitary gland, also increases during gestation, reaching its peak prior to delivery. Prolactin production is triggered by gradually rising levels of estradiol. For women who do not breast feed, estradiol and prolactin levels typically return to baseline 6 weeks after delivery. In nursing women, prolactin levels decrease more slowly as a result of the intermittent hyperprolactinemia related to infant suckling. There is limited evidence of the psychological effects of increased prolactin, although some sources suggest that high levels of prolactin are anxiolytic, while low levels may be associated with depression (17, 18). Although pregnant women have high levels of cortisol, the HPA axis is actually less responsive to stress during pregnancy and lactation than at baseline, and both pro-

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lactin and oxytocin have been shown to play a role in regulating HPA axis activity (15, 17).

Oxytocin is a neuropeptide that is synthesized in the paraventricular nucleus and the supraoptic nucleus of the hypothalamus. It is then transported to the posterior pituitary, where it is released in a pulsatile fashion into the circulatory system (19). The increase in oxytocin during pregnancy and in postpartum nursing may result in the most significant effects on mood and behavior than that found in any hormone produced during pregnancy. Commonly referred to as the “social hormone,” oxytocin affects multiple interactive behaviors in humans and animals. Oxytocin reduces anxiety via modulation of the HPA axis, and it increases bonding between individuals (19–21). More than any other hormone, oxytocin is believed to be responsible for the maternal feelings of love and protection that most women develop for their newborns, although other hormones, such as prolactin, may also play a role (18, 21). Interestingly, oxytocin can impair memory, especially memory of adverse events. Many women report having little memory of the pain of labor, an effect that may be mediated, at least in part, by oxytocin (22).

## Cognitive Changes During Pregnancy

“Amy” was a 31-year-old woman who worked as a computer software engineer for a local technology company. She was in her third trimester and struggling to concentrate at work. She presented with the chief complaint of memory loss. She stated, “I can’t remember anything, and I’m scared I’m going to lose my job.”

Problems with forgetfulness and other cognitive deficits are common issues in pregnancy. Many studies have reported correlations between pregnancy and subjective memory difficulties (e.g., forgetfulness, reading difficulties, disorientation, poor concentration), with 80% of women stating that they have experienced problems with memory and forgetfulness during pregnancy (23–26).

Most studies, including a meta-analysis of cognitive changes in pregnancy, have shown that both subjective and objective measures of memory are adversely affected during pregnancy (27). The most common deficits reported are in verbal memory, the executive component of working memory, and free recall (23–25).

Similar to problems with mood lability, the causes of these cognitive changes may be related to the hormonal shifts that occur in pregnancy and the postpartum period. Most women who experience problems with memory notice them during the second trimester, when high levels of progesterone and allopregnanolone are present in the brain. Similarly, women who experience difficulties with concentration and working memory as a part of premenstrual dysphoric disorder typically experience these problems during the luteal phase, when levels of progesterone and allopregnanolone are very high (28).

Conversely, estrogen, which is also increased in pregnancy, may improve verbal memory and motor skills (29–31). Evidence that estrogen exerts a neuroprotective effect on brain tissue is overwhelming (31, 32). What is not clear is how this plays out across the life cycle of human females. Large studies have failed to demonstrate a positive effect of estrogen on cognitive functions in postmenopausal women, although there is presently debate regarding the possibility of a “critical window” for starting estrogen during postmenopause in order for women to benefit from its cognitive effects (32–35). In premenopausal women, estrogen does seem to play a role in cognition, with studies showing improvements in working memory and executive functioning with higher estrogen levels (31, 34, 36). Given the evidence for cognitive difficulties during pregnancy, it seems likely that the negative cognitive effects of progesterone and its metabolites outweigh the possible positive effects of estrogen on the brain during pregnancy.

In addition to hormonal effects on the brain during pregnancy, the size and structure of a woman’s brain changes. In pregnant women, brain size decreases—and ventricular size increases—starting

shortly after placental implantation. This “brain shrinkage” is greatest when the child is full term and slowly reverses after birth, although it may take as long as 6 months for a woman’s brain to return to prepregnancy size (37). It is likely that this shift in brain volume also affects memory and cognition in pregnant women.

Although pregnancy itself may be a period of cognitive difficulty, postpartum women seem to exhibit enhanced memory and spatial abilities. Having children may literally reshape the brain, allowing new mothers to focus their attention and activities on their children. After delivery, some women report a subjective increase in attention and focus, especially on possible “threats” to themselves and the child.

## Conclusions

Pregnancy is a time of great physical and psychological changes. It is normal for pregnant women to experience fluctuations in mood as a result of the dramatic fluctuation in their hormonal status. Women can also experience significant cognitive changes, including alterations in verbal and working memory. However, women may have improved cognitive functioning in some domains during the postpartum period. It is important for us as psychiatrists to understand the normal changes of the brain during pregnancy in order to appropriately counsel our patients.

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