

REVIEW

Gender and sex in eating disorders: A narrative review of the current state of knowledge, research gaps, and recommendations

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Abstract

Introduction: Eating disorders (EDs) have long been considered conditions exclusively affecting women, and studies in the ED field regularly exclude men. Research efforts are needed to better understand the role of gender and sex in EDs. This review describes the role of gender and sex in the development of EDs from a biopsychosocial perspective.

Methods: The primary hypothesis of this narrative review is that gender and sex interact to influence ED risk. The literature review was conducted using the PubMed database.

Results: This review first presents the general characteristics and prevalence of EDs according to gender and sex. Next, neurodevelopmental processes, neurobiology, gender roles, body image, and the minority stress model are addressed. Lastly, research perspectives to better include gender and sex in the field of EDs are discussed (e.g., representation of gender and sex diversities, development of appropriate assessment tools, and increasing awareness).

Conclusion: Although substantial knowledge gaps remain, there is a growing recognition of the importance of integrating gender and sex in ED research that holds promise for further development in the field.

KEYWORDS

biological psychiatry, brain development, eating disorders, gender/sex, sexual and gender diversities

1 | INTRODUCTION

Sex and gender are closely related constructs that play an essential yet understudied role in the development of *eating disorders* (EDs). Sex refers to biological characteristics, including genetics (e.g., sex chromosomes), physiology (e.g., sex hormones), and anatomy (e.g., the reproductive system) (Clayton & Tannenbaum, 2016; Tannenbaum

et al., 2016). Generally, sex is assigned at birth and considered a dichotomous variable; however, intersex individuals are a group of people that transcend sex as a binary construct due to their diversity in sexual characteristics. In contrast, gender refers to a psychosocial phenomenon (Clayton & Tannenbaum, 2016; Swaab et al., 2021; Tannenbaum et al., 2016) that is modulated by environmental forces and can fluctuate throughout life (Tannenbaum et al., 2016). Gender

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includes gender identity (i.e., how individuals define themselves), gender roles (i.e., social norms and stereotypes related to masculinity and femininity), and gender relations (i.e., interactions between individuals according to their gender and the expectations placed on them by society) (Clayton & Tannenbaum, 2016; Tannenbaum et al., 2016). For further definitions, a glossary of key terms used in this review can be found in Table 1. Given the close interaction between biology and environment, gender and sex are two interacting constructs that must be appropriately considered in research (i.e., they should not be used interchangeably) (Clayton & Tannenbaum, 2016; DuBois et al., 2021; Howard et al., 2017; Tannenbaum et al., 2016). The term gender/sex has been used in previous literature to represent the interaction between gender and sex as well as the recognition that these biological and sociocultural constructs are often intertwined (Hyde et al., 2019).

To our knowledge, few studies have considered *both* gender and sex in ED research. EDs have long been considered a condition that primarily affects girls and women (Coelho et al., 2021; Murray et al., 2017; Strother et al., 2012). For example, in *anorexia nervosa* (AN), amenorrhea—a symptom that can only be observed in individuals with a female reproductive system—had been one of the diagnostic criteria up to the publication of the DSM-IV (American Psychiatric Association, 2013). Even today, woman-centered conceptualizations of EDs may negatively affect some individuals based on their sex (Hartman-Munick et al., 2021; Murray et al., 2017; Romito et al., 2021; Strother et al., 2012; Uniacke et al., 2021). Consequently, more efforts are needed to address the role of gender/sex in ED research. Relying on birth-assigned sex as a binary variable is not sufficient to capture the high levels of inter- and intra-individual variability within the same sex, or to refine the psychosocial aspects of gender diversity that modulate ED risk.

This narrative review describes the role of gender/sex in the development of EDs from a biopsychosocial perspective. Our overarching hypothesis is that both gender and sex, and their *interaction*—as implied by the term gender/sex—influence risk for EDs (which is linked to high levels of symptoms, without the individual necessarily meeting all diagnostic criteria). To address this, evidence based on clinical and community samples were included. The rationale to include research from community samples in addition to research from clinical samples was based on that subclinical levels of ED symptoms are common in the general population (e.g., body dissatisfaction and binge eating behaviors) (Zeiler et al., 2016). Moreover, increased levels of these symptoms are thought to increase the risk of developing full-threshold ED in some individuals (Stice et al., 2017; Treasure et al., 2015). Thus, subclinical symptoms as studied in community samples were included to highlight potential gender and sex differences in these predisposing aspects of EDs.

Our review takes a transdiagnostic approach. By doing so, we focus on etiological similarities and differences between different types of EDs (Smolak & Levine, 2015). Although this review focuses mainly on results obtained in human samples, some evidence from animal models has been included, as these paradigms may shed light on certain processes that remain difficult to study in humans (e.g., the effect of hormones on the brain). Figure 1 summarizes the main concepts

addressed in the present review. First, the prevalence and characteristics related to gender/sex in EDs will be presented. Next, aspects linked to neurodevelopment, neurobiology, gender roles, body image, and the minority stress model will be addressed. Finally, research perspectives on gender/sex to move EDs research forward will be discussed.

2 | PREVALENCE AND CHARACTERISTICS OF EATING DISORDERS ACCORDING TO SEX AND GENDER

In the general population, the prevalence of EDs ranges between 1% and 5%, and men represent between 17% and 43% of the cases seen in ED clinics (American Psychiatric Association, 2013; Murray et al., 2017). Hence, the prevalence of EDs is often considered higher in women than in men. Beyond sex, those whose gender identity does not align with their sex assigned at birth (e.g., transgender, genderqueer, gender-fluid, and gender nonbinary) report a greater prevalence of ED symptoms compared to cisgender individuals (Grammer et al., 2021). For example, the prevalence of EDs among transgender individuals ranges between 2% and 18% (Hartman-Munick et al., 2021). These differences in prevalence rates suggest that specific risk factors (e.g., minority stress, sociocultural norms, and expectations) may differentially affect risk for disordered eating behaviors according to gender and sex (Bankoff & Pantalone, 2014; Dotan et al., 2021), which further underscores the importance of addressing gender diversity in ED research.

In addition, sexual orientation—a construct closely related to gender and sex, yet orthogonal—is associated with risk for EDs (Bankoff & Pantalone, 2014; Calzo et al., 2018; Dotan et al., 2021; Grammer et al., 2021; Murray et al., 2017; Nagata et al., 2020). Findings from a recent study using data from the Avon Longitudinal Study of Parents and Children (ALSPAC) indicated that gay and bisexual boys had 2.67 times the odds to engage in dieting in order to lose weight at age 14, and 12.53 times the odds of binge eating at age 16 compared to completely heterosexual boys (Calzo et al., 2018). Gay and bisexual boys also reported more body dissatisfaction than their heterosexual peers (Calzo et al., 2018). Moreover, lesbian and bisexual girls had more than three times the odds of binge eating behaviors at ages 14 and 16, and of purging behaviors at age 16 compared to completely heterosexual girls (Calzo et al., 2018). Although there appears to be a consensus that disordered eating is more prevalent in gay and bisexual boys and men than their heterosexual counterparts, findings are more conflicting for lesbian or bisexual girls and women (Bankoff & Pantalone, 2014). These findings reinforce the need for research efforts to better understand EDs in these populations.

Furthermore, the clinical presentation of EDs differs according to gender/sex diversity (Nagata et al., 2020; Roberts et al., 2021). For example, body image concerns in men often relate to muscularity (Coelho et al., 2021; Lavender et al., 2017; Murray et al., 2017; Ridout et al., 2021). Overtraining is also more prevalent in men than in women (Coelho et al., 2021; Lavender et al., 2017; Murray et al., 2017; Ridout et al., 2021). Men are more frequently diagnosed with other specified

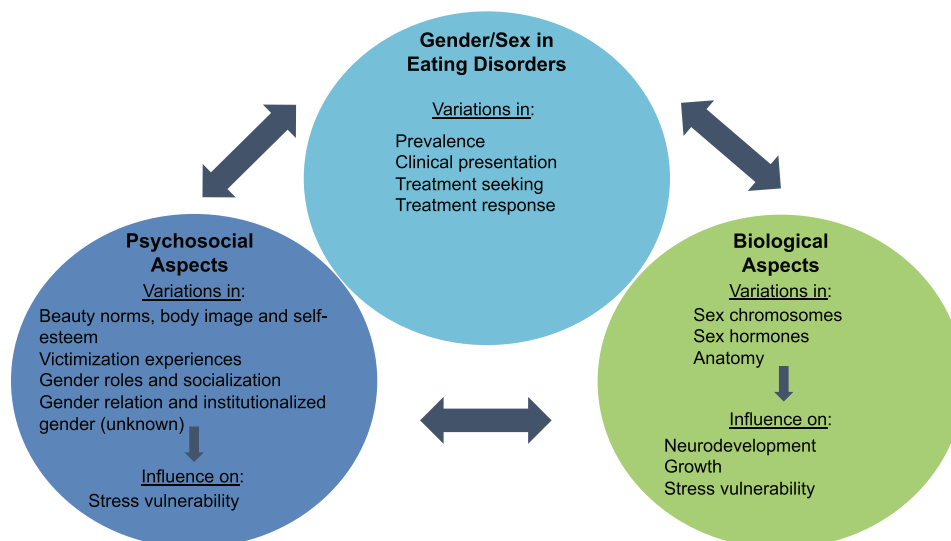


FIGURE 1 A biopsychosocial perspective on the role of gender/sex in eating disorders

or unspecified EDs than women (Coelho et al., 2021; Lavender et al., 2017; Murray et al., 2017; Ridout et al., 2021). Men may also be less likely to seek professional help for an ED, and when they do, symptoms are often more severe and comorbidities more frequent relative to women (Murray et al., 2017; Ridout et al., 2021). Beyond the typical differences observed between men and women, subgroup differences might also exist between individuals with different sexual orientations (e.g., lesbian vs. bisexual women).

Relatedly, current diagnostic tools may be more sensitive in detecting EDs in women (Coelho et al., 2021; Franceschini & Fattore, 2021;

Hartman-Munick et al., 2021; Lavender et al., 2017; Murray et al., 2017; Ridout et al., 2021). Indeed, these tools are often based on a clinical presentation of EDs that is perhaps more typical in women (Coelho et al., 2021; Franceschini & Fattore, 2021; Hartman-Munick et al., 2021; Lavender et al., 2017; Murray et al., 2017; Ridout et al., 2021). This may complicate the detection of EDs in men (Lavender et al., 2017; Strother et al., 2012) and may contribute to the impression that the differences in prevalence between sexes are greater than it really is. There is therefore a need for research efforts to optimize diagnostic tools for EDs, to consider the existing variability related to gender/sex.

TABLE 1 Glossary of key terms related to sex and gender research^{a,b}

| | |
|------------------------------|--|
| Sex | Biological attributes of humans and animals that include physical features, chromosomes, gene expression, hormones, and anatomy |
| Sex assigned at birth | Categorization as male or female on one's birth certificate that is based primarily on medical examination of genitals |
| Gender | Socioculturally constructed roles, behaviors, expressions, and identities of girls, women, boys, men, and gender-diverse people |
| Gender/sex | Term used to recognize that biological sex and sociocultural gender are typically inseparable |
| Gender identity | A person's innate sense of being male, female, both, neither, or even dimensionally |
| Gender roles | Sociocultural stereotypes an individual assimilates, enacts, and adopts throughout life |
| Gender relations | Interactions between people and institutions according to sex and gender identity, based on the expectations placed on them by society |
| Cisgender | Individuals whose gender aligns with their sex assigned at birth. |
| Transgender | Umbrella term that refers to individuals whose gender identity does not align with sex assigned at birth. Some examples include transmasculine, transfeminine, gender nonbinary, genderqueer, gender-fluid, First Nations two-spirit individuals, and bigender |
| Intersex | Individuals with variations or combinations of what are considered XY male-typical and XX female-typical chromosomal, gonadal, and genital characteristics that do not fit neatly into one binary sex category |

^aChase, B., & Ressler, P. (2009). An LGBT/queer glossary. *The English Journal*, 98(4):23–24.

^bHyde et al. (2019).

3 | NEURODEVELOPMENT, GENDER, AND SEX

Neurodevelopment and growth are both associated with risk for ED symptoms (e.g., Herle et al., 2020; Marion et al., 2020; Watson et al., 2019). Importantly, these two processes do not occur at the same rate for boys and girls (Culbert et al., 2021; Fisher et al., 2018; Franceschini & Fattore, 2021; McCarthy et al., 2017). Differential rates in neurodevelopment may influence the timing of greater vulnerability to adversity according to sex (Culbert et al., 2021; Franceschini & Fattore, 2021; McCarthy et al., 2017; VanRyzin et al., 2020). In this regard, the endocrine system is an important area of research for understanding sex differences in the risk of EDs, as sex hormones play a major role in critical periods for neurodevelopment—including periods when signs and symptoms of EDs often develop (e.g., puberty) (Culbert et al., 2021; McCarthy et al., 2017; Mikhail et al., 2021; VanRyzin et al., 2020). The role of sex hormones during the prenatal and perinatal periods is also of interest, as sex hormones are involved in the organization of the brain during development, which may promote behavioral, cognitive, and emotional differences between boys and men as well as girls and women (Culbert et al., 2021; McCarthy et al., 2017; Mikhail et al., 2021; VanRyzin et al., 2020). For example, vulnerability to adversity is likely influenced by developmental peaks in sex hormones (e.g., estrogen and testosterone), which may contribute to differentiate boys and girls as it relates to ED (Culbert et al., 2021; Fisher et al., 2018; Franceschini & Fattore, 2021; Hildebrandt et al., 2010; McCarthy et al., 2017; VanRyzin et al., 2020). Studies in animal models suggest that elevated prenatal and perinatal testosterone levels in males compared to females may be protective from binge eating behaviors later in life (Mikhail et al., 2021). Furthermore, studies in animals and in humans suggest that estrogen has an inhibitory effect on food intake (Franceschini & Fattore, 2021; Hildebrandt et al., 2010), and low levels of estrogens have been associated with symptoms of AN and BN (Hildebrandt et al., 2010; Ramoz et al., 2013). The role of estrogen pathways in EDs is also supported by findings from genetic studies, including evidence of polymorphisms in genes relevant to the estrogen pathways (e.g., *ESRRA*, *HDAC4*, and *ESR2*) (Cui et al., 2013; Franceschini & Fattore, 2021; Paolacci et al., 2020; Scott-Van Zeeland et al., 2014).

The interaction between estrogens and neurotransmission systems (e.g., serotonin system) might play a role in gender/sex differences in EDs (Hildebrandt et al., 2010). Indeed, sex hormones can modulate specific brain pathways implicated in EDs, including those involved in appetite regulation and reward response (Culbert et al., 2021; Franceschini & Fattore, 2021; Lenroot & Giedd, 2010; Swaab & Bao, 2020). This modulation can be sex-dependent and affect behavior (Culbert et al., 2021; Franceschini & Fattore, 2021; Lenroot & Giedd, 2010; Swaab & Bao, 2020). For example, women typically show a greater preference for high-calorie and fatty food than men (Culbert et al., 2021). This differential preference is also observed in animal models and is associated with hormonal activity (Culbert et al., 2021; Franceschini & Fattore, 2021; Lenroot & Giedd, 2010). Eating behaviors and nutritional status (e.g., malnutrition) can, in turn, affect the endocrine system, which further complexifies research on the role of sex

hormones in EDs (Franceschini & Fattore, 2021; Schorr & Miller, 2017). Moreover, the menstrual cycles (which are associated with variations in hormonal levels) have also been associated with levels of binge eating symptoms (Franceschini & Fattore, 2021; Mikhail et al., 2021). Longitudinal studies are needed to clarify the link between neurodevelopment, hormones, and ED symptoms, especially in boys and girls. Given that interactions between biological processes and environment are closely linked to neuroendocrine functioning, future studies should investigate the link between gender/sex, hormones, and EDs in gender-diverse populations.

Additionally, an important developmental period of vulnerability to EDs is puberty (Klump, 2013), when the first signs of EDs often tend to appear (Swanson et al., 2011; Treasure et al., 2020). Physical and behavioral differences between boys and girls become more pronounced during puberty (Allen et al., 2008; Favaro et al., 2009; Smink et al., 2013; Stice et al., 2013). The influence of puberty on the risk for EDs is likely due to biological aspects (e.g., hormone levels and rapid body changes), psychosocial aspects (e.g., the stress of entering high school), and a combination of both. At the biological level, genetic risk for EDs increases at puberty in boys and girls (Culbert et al., 2021, 2009; Franceschini & Fattore, 2021; Klump, 2013; Timko et al., 2019). This increase is thought to be associated, at least partly, with genetic factors that can be modulated (e.g., activated/deactivated) by sex hormones (Klump, 2013). For example, lower levels of estrogens during puberty have been associated with changes in genetic influences that may contribute to the risk of ED symptoms (Franceschini & Fattore, 2021; Klump et al., 2018). Additionally, the rapid bodily changes occurring during puberty are central in EDs, where higher body mass index (BMI) represents a biopsychosocial risk factor (Marion et al., 2020; Puhl et al., 2020; van Eeden et al., 2021).

In addition to puberty and reproductive development, body image and self-esteem may modulate the psychological response to relatively rapid physical changes. For example, children who reach puberty more quickly than their peers (e.g., early menarche in girls) may have more difficulty adjusting emotionally to their physical changes (Zimmer-Gembeck et al., 2021), which, in turn, may influence their risk for EDs. Beyond biological maturity, considering gendered factors that may be at play during puberty is of interest. For example, it would be insightful to understand how body image and self-esteem relate to gender/sex, and how their relation may influence the onset of ED symptoms in young adolescents. Some evidence exist on this matter. For example, among youth whose gender identity does not match their assigned sex at birth, puberty may be associated with physical changes that accentuate the discrepancy between their body and gender identity, thereby possibly increasing levels of distress and risk for EDs (Romito et al., 2021).

4 | NEUROBIOLOGY, GENDER, AND SEX

Sex chromosomes and transcriptional regulatory mechanisms are key to sex expression, as they allow the development of typically masculine

(XY) or feminine (XX) traits (Gegenhuber & Tollkuhn, 2019; McCarthy et al., 2017; Swaab et al., 2021). Yet, sex chromosomes can present variations that influence gender/sex in concert with a range of sex hormones and genetic variations. For example, intersex individuals with variations in sexual characteristics often have anatomical characteristics that are not typical of XX or XY. This example illustrates how biological sex cannot invariably be dichotomized. Given their influence on health and well-being, these sexual variations beyond the typical XX or XY phenotypes must be considered (Rosenwohl-Mack et al., 2020).

Despite the well-established variations in gender/sex characteristics, neuroscience research has long conceptualized the masculine and feminine brains as separate entities. This dichotomized categorization might be due to the existence of differences between typically feminine and masculine brains. From as early as fetal development, the brain differentially expresses thousands of genes in men and women (Swaab et al., 2021). Evidence also supports differences in brain size between the sexes, with male brains being 9%–25% larger than female brains (Kaczurkin et al., 2019). These genetic and neuroanatomical sex differences are thought to be associated with later-life risk for mental health problems (McCarthy et al., 2017). Yet, the dichotomized categorization of the human brain based on sex has been criticized, as there is considerable intragroup variability among typically “masculine” and “feminine” brains that sometimes outweigh intergroup variability (Fisher et al., 2018; Joel et al., 2015; Kaczurkin et al., 2019).

It has been proposed that a “brain mosaic” may better represent the link between gender/sex and the human brain. This concept is related to the notion that many traits (e.g., specific behaviors, temperament, and personality traits) are more typically observed in one sex than the other. This notion, however, does not rule out the possibility that individuals can exhibit characteristics more typical of the opposite sex. For instance, physical aggression is typically perceived as a more typically masculine trait, although women can be physically aggressive as well (Hyde, 2014). The concept of brain mosaics applies this notion to neurobiology. It suggests that some brain traits, such as variations in cortical thickness and anatomical or functional connectivity, may be more prevalent in one sex compared to the other (Joel, 2021; Joel et al., 2015). Still, the concept does not preclude the existence of potentially significant neurobiological overlap across sexes.

According to the concept of brain mosaics, only a minority of individuals should exclusively present traits more typical of their own sex (Joel, 2021; Joel et al., 2015). Most individuals would exhibit their own unique combination of typically feminine and masculine brain characteristics (Joel, 2021; Joel et al., 2015; Zhang et al., 2021). This notion allows for a wide variability that may, at least partly, reflect the complexity of neurodevelopmental processes in humans that are highly influenced by the gendered social environment (Joel, 2021; Joel et al., 2015; Zhang et al., 2021). Although sex chromosomes and hormones play a role in neurodevelopment and sex/gender differences, several other factors possibly further increase interindividual variability in brain tissues, structures, and functions (Joel, 2021; Joel et al., 2015; Zhang et al., 2021). These factors include gender/sex-related genetic, epigenetic, growth, and environmental factors, as well as their interaction with timing of exposure, which may contribute to the large

variability of phenotypes observed in humans (Joel et al., 2015; Joel, 2021).

Overall, the human brain is clearly far too complex to be dichotomized based on sex; rather, it likely falls along a continuum of masculinity/femininity (Joel et al., 2015; Joel, 2021). The concept of brain mosaics may allow a more inclusive approach to gender-related variability in EDs research given that brain differences have been reported in gender-diverse populations (Fisher et al., 2018). How these brain differences fit into a brain mosaic is an interesting area for future study, especially as it relates to refining assessment and treatment approaches in EDs that differ among girls/women, boys/men, and gender nonbinary and gender-diverse people (Calzo et al., 2018; Hartman-Munick et al., 2021; Nagata et al., 2020; Strother et al., 2012). Notably, sociocultural gender-related factors and features have not been directly incorporated in the brain mosaics framework.

5 | GENDER ROLES AND STEREOTYPES

From an evolutionary perspective, certain features related to traditional gender roles may have been favored in one sex or the other to promote the survival of the human species (Lenroot & Giedd, 2010; Weisberg et al., 2011; Archer, 2019). Gender roles are the sociocultural stereotypes that an individual enacts and adopts throughout life. Some of these features may influence risk for EDs (Weisberg et al., 2011). For example, sensitivity to social cues and empathy were perhaps more favored among women due to their traditional role in the community (e.g., caring for children) (Weisberg et al., 2011; Archer, 2019). Exhibiting more traits related to socialization (i.e., typically feminine traits) may predispose some individuals to EDs via, for instance, an increased vulnerability to other people's socio-evaluative perceptions. This hypothesis is supported by studies in other psychiatric conditions, such as depressive disorders (Archer, 2019; Rubinow & Schmidt, 2019).

During adolescence, when the first symptoms of EDs often manifest, the social pressures to conform to gender roles increase (Weisberg et al., 2011; Priess et al., 2009). These social pressures may differ by gender/sex and influence risk for EDs throughout development. Likewise, previous studies have reported that individuals who strongly endorse stereotypes related to masculine norms may be at increased risk for mental health problems (Wong et al., 2016), although the opposite has also been reported (Arcand et al., 2020). At the same time, individuals who exhibit both typically feminine and masculine traits, and who are able to adapt and use these traits according to circumstances (i.e., “androgynous” individuals), are thought to be less at risk for mental health difficulties due to their greater adaptability (Juster et al., 2016). In EDs, the endorsement of gender norms and stereotypes also influences treatment-seeking behaviors (Wong et al., 2016). For example, the endorsement of stereotypes related to masculinity is a barrier to EDs treatment, as seeking help for a condition considered to be “typically feminine” could be seen as compromising masculinity (Murray et al., 2017). Another barrier to EDs treatment is the fear of not being taken seriously by health professionals due to gender stereotypes—a fear that has been reported especially among

transgender and other gender-diverse communities (Hartman-Munick et al., 2021).

6 | BODY IMAGE, SEX, AND GENDER

Sex and gender also influence risk for EDs through their relation with body image ideals set by society (Murray et al., 2017; American Psychiatric Association, 2013). Indeed, historical and sociocultural ideals of beauty—muscularity in men and thinness in women—have been associated with risk for ED symptoms (Murray et al., 2017; Lavender et al., 2017; Franceschini & Fattore, 2021; Aparicio-Martinez et al., 2019; Jiotsa et al., 2021). Body image also affects the risk of EDs in people whose gender identity differs from their sex assigned at birth, sometimes through the search for congruence between body and gender identity (Hartman-Munick et al., 2021; Romito et al., 2021; Uniacke et al., 2021). For example, a transgender man may restrict his energy intake to limit the development of his breast and maintain a more typically masculine body shape (Murray et al., 2017; Romito et al., 2021; Roberts et al., 2021; Nowaskie et al., 2021).

Other gender-related motivations may promote the development of ED symptoms. For example, concerns regarding an “ideal” weight for gender affirming surgery might be a preoccupation for some transgender people (Hartman-Munick et al., 2021). Indeed, obesity is a known risk factor for surgical complications and may prevent some people from accessing gender affirming surgery (Shin et al., 2022; Ives et al., 2019; Brownstone et al., 2021). In addition, BMI can in some cases serve as a reminder to transgender people of the anthropometrics of their sex assigned at birth, which can also be distressing.

Further, individuals whose gender identity does not match their sex assigned at birth and who undergo gender affirming therapy report fewer symptoms of ED than those who do not undergo such therapy (Uniacke et al., 2021). One possible explanation for this finding is that gender affirming therapy may influence body image by better aligning one’s physical attributes with their gender identity (Romito et al., 2021). Further, members of the lesbian, gay, bisexual, transgender, and queer (LGBTQ+) community may be confronted with both cisgender beauty standards and that are specific to their community’s subcultures (Murray et al., 2017). In sum, the findings presented above point to a need for ED research that addresses the influence of gender and sexual orientation to develop a more comprehensive picture of the risk factors for EDs.

7 | MINORITY STRESS MODEL AND EATING DISORDERS

The minority stress model refers to health disparities related to the lived experiences of people from stigmatized groups, including (but not limited to) sexual and gender minority (SGM) (DuBois et al., 2021; Uniacke et al., 2021; Meyer, 2003; Juster et al., 2019). Although the underlying biopsychosocial mechanisms remain poorly understood, research has shown that SGM people are more likely to experience high

levels of stress (e.g., violence, discrimination, trans/homonegativity, and stigma internalizations) than cisgender and heterosexual people (DuBois et al., 2021; Meyer, 2003; Juster et al., 2019). The compounded forms of stigma that SGM people face may put them at increased risk for mental disorders (DuBois et al., 2021; Uniacke et al., 2021; Meyer, 2003). Other factors may reinforce this stigma, as minority stress is often associated with other risk factors for negative health outcomes (e.g., poverty and social isolation) (Howard et al., 2017). Importantly, victimization experiences are a known risk factor for EDs (Zimmer-Gembeck et al., 2021; Mitchison et al., 2019; Lie et al., 2019), raising the hypothesis that specific stressors associated with minority stress may also be linked to EDs. Supporting this, SGM individuals who report discriminatory experiences show significantly higher prevalence rates of AN than people who do not report such experiences (3.78% vs. 0.82%) (Kamody et al., 2020). Additionally, some SGM people may use suboptimal coping mechanisms, including avoidance, to cope with the adversity and negative emotions they experience due to stigmatization (Hughto et al., 2017; Brustenghi et al., 2019; Perthes et al., 2021). This use of suboptimal coping strategies may further increase their risk for EDs. In contrast, SGM people who come out to their relatives display better mental health outcomes (Juster et al., 2019), suggesting a positive effect of using adaptive coping mechanisms (e.g., acceptance).

Adverse experiences and stress have the potential to create a biological imprint (DuBois et al., 2021; Juster et al., 2011), possibly through the interaction between biological processes and the social environment. Minority stress may represent a specific form of adversity that can influence important biological mechanisms and increase risk for negative health outcomes in SGM populations (Juster et al., 2015; Juster et al., 2013; Flentje et al., 2020). For example, high levels of stress have been associated with changes in inflammatory markers, and changes in immune/inflammatory processes have been associated with psychiatric disorders, including EDs (McCarthy et al., 2017; VanRyzin et al., 2020; Breton et al., 2022). Further, sex differences in inflammatory profiles and in response to adversity have been identified in previous literature (McCarthy et al., 2017; VanRyzin et al., 2020). By contrast, research shows that “coming out” to family and friends is related to lower diurnal concentrations of the stress hormone cortisol as well as less anxiety, depression, and burnout (Juster et al., 2013). In sum, biological imprinting associated with stressful life experiences can offer an important avenue to explore the biological impact of minority stress and associated risk for psychiatric disorders, including EDs.

8 | DISCUSSION

Overall, there are many ways by which gender and sex can influence risk for EDs. The effect of gender and sex on ED risk fluctuates over the lifetime (Franceschini & Fattore, 2021; Culbert et al., 2021; McCarthy et al., 2017; Rubinow & Schmidt, 2019), which suggests that dynamic and complex interactions between biology and environment are at play. One important current limitation of ED research is that many studies only include presumably cisgender women (Murray et al., 2017;

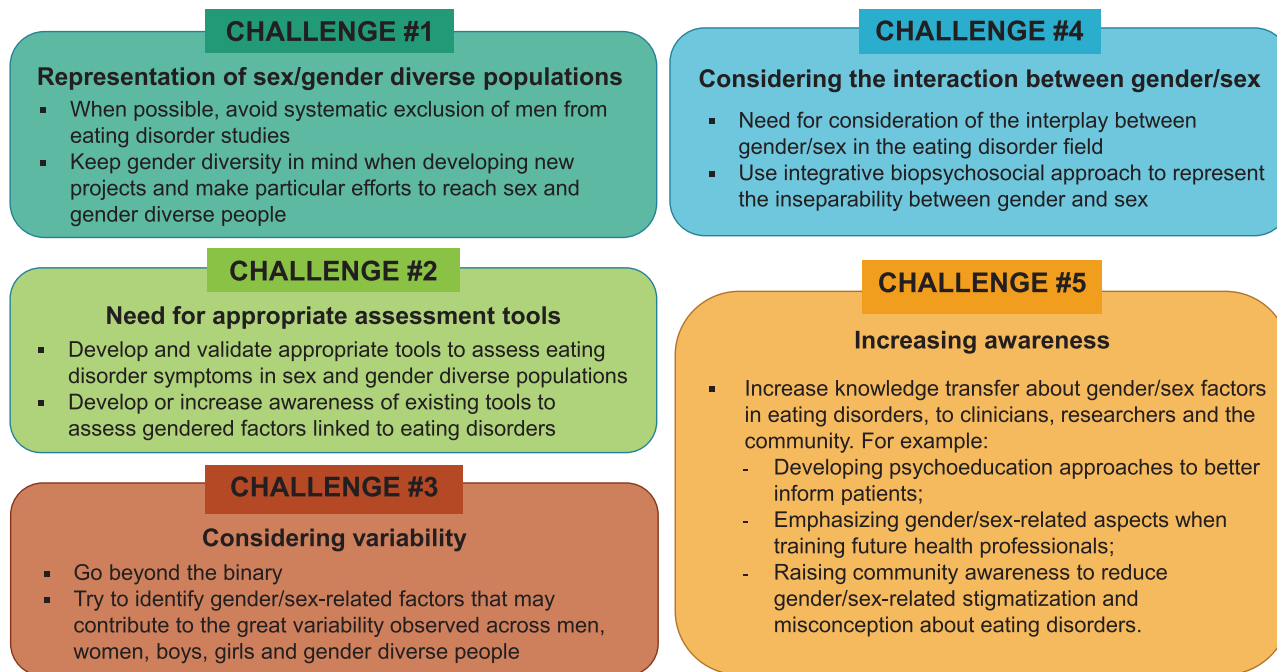


FIGURE 2 Moving forward with gender/sex research in eating disorders

Strother et al., 2012; Coelho et al., 2021). Recruiting cisgender men and gender diverse people in ED research represents a challenge but would be a significant step forward (Coelho et al., 2021). Active multisite collaborative efforts may be needed to optimize recruitment. Still, efforts to integrate gender and sex in ED research should go beyond merely recruiting men and gender-diverse people (Juster et al., 2016). We propose the following perspectives to help move ED research forward as it relates to gender and sex considerations (Figure 2).

1. *Representation and participation.* Work is needed to allow the representation of gender/sex-diverse individuals in ED research and in neuropsychiatry more broadly (Edmiston & Juster, 2022). Large collaborative research efforts might help achieve proper representation. Notably, men are often excluded from research on EDs or, at times, selectively exclude themselves due to gendered expectations. Fortunately, work published in the last 2 years seems to reflect a greater inclusion of gender-diverse populations in ED research (e.g., males and SGM individuals).
2. *Measurement and inclusion.* Developing and validating tools to properly characterize gender and sex will help address gender/sex issues in future ED studies. Such work should be done in gender-diverse populations as well as in community samples, including boys/men, girls/women, and LGBTQ+ people. Given the various biological, developmental, and psychosocial factors associated with gender/sex in EDs, it is imperative that information on sex, gender, sexual orientation, and their correlates be integrated as much as possible into new research. Gender minority individuals should be included in ED research even if subsample sizes are small, as even descriptive statistics are informative and, most importantly, promote inclusion.

3. *Gender/sex continuums and brain mosaics.* Another approach to move ED research forward would be to conduct studies based on the concept of brain mosaics. In the study of ED symptoms, identifying gender/sex-related factors (e.g., BMI, temperament, and hormones) that may contribute to the overlap and differences between men, women, and gender diverse people would be enriching. Additionally, going beyond the settled boundaries of “masculinity” and “femininity” based on sex as a binary in neurobiological research might lead to new insights on the neurodevelopmental processes underlying ED symptoms.
4. *Transdisciplinarity and methodological triangulation.* Integrative approaches incorporating biopsychosocial aspects and considering both gender and sex will promote the advancement of knowledge in biomedical research (Clayton & Tannenbaum, 2016; DuBois et al., 2021; Hankivsky et al., 2018). Developmental studies on EDs including objective measures of puberty, such as hormonal levels (e.g., similar to Lenroot & Giedd (2010) and Juster et al. (2016)), could be useful considering the major role of puberty on ED risk. By addressing sex, gender, and related biopsychosocial aspects in research, it may become possible to clarify their roles in ED risk and treatment response.
5. *Knowledge transfer and community engagement.* Although the literature is relatively limited, the evidence summarized in the current review suggests that gender/sex affects risk, clinical presentation, and treatment-seeking behaviors in EDs. Health professionals need to be well informed about the realities of different gender/sex populations.

Knowledge transfer is also key to reduce stigmatization toward communities, such that SGM individuals feel seen and accepted and,

most importantly, are not hesitant to seek help for EDs. To ensure that knowledge transfer and health promotion messages have the intended beneficial impact on communities (Tannenbaum et al., 2016), research is needed to design messages that will consider the wide range of gender/sex diversity. Finally, community efforts toward knowledge transfer must be thoughtful and conscientious, and the reinforcement of gender/sex stereotypes in EDs (e.g., EDs are typically feminine conditions) should be avoided (McCarthy et al., 2017).

9 | CONCLUSION

Sex and gender are increasingly being considered in ED research, and the stereotype that EDs are typically feminine conditions is beginning to dissipate. Nevertheless, current knowledge on EDs in males and LGBTQ+ populations remains quite limited. Further efforts are needed to integrate gender/sex diversity into ED research using a biopsychosocial perspective. We hope that the recommendations proposed in the current review will offer insights and ideas for advancing ED research pertaining to gender/sex considerations and will help in guiding clinical practices and policy-making for SGM protection.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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PEER REVIEW

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