

**Body Dysmorphic Disorder in Adolescents:
Presentation, Correlates, and Sex Differences**

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Thesis Summary

Body dysmorphic disorder (BDD) is a chronic and often severe mental disorder that typically begins during adolescence, yet there is very little research conducted in this age group. This thesis explored the presentation and correlates of BDD in a sample of 3,149 Australian high school students aged 12–18 years.

Chapters 2 and 3 focused on individuals with probable cases of BDD; full-syndrome BDD (pBDD) was reported by 1.7% of participants, and subthreshold BDD (sBDD) by 3.4%. Both pBDD and sBDD were associated with higher symptoms of comorbid disorders, increased mental health service use, and poorer quality of life compared to those without BDD.

Chapters 4 and 5 examined sex differences in BDD symptoms in the whole sample. Chapter 4 identified a new factor structure in a measure of BDD symptoms, and cross-sex measurement invariance testing found that the measure can be used to compare BDD symptoms between male and female adolescents. As BDD symptoms varied by sex in the whole sample, cut-off scores were calculated for males and females. Chapter 5 compared competing models of the classification of BDD with anxiety, depression, obsessive-compulsive disorder, and eating disorders. In males and females, BDD symptoms formed their own factor which was correlated with affective and eating disorder factors, though many of the model parameters differed by sex.

Chapter 6 examined sex differences in the presentation of BDD in pBDD and sBDD participants. Males and females did not differ in the severity of BDD symptoms, endorsement of many body areas of concern, or rates of elevated comorbid symptoms for most disorders. Further, in males, muscle dysmorphia was not associated with greater BDD severity.

This thesis represents the largest known study of BDD in adolescents, and provides unique information about BDD prevalence and presentation, sex differences, and the assessment and classification of BDD symptoms.

Statement of Candidature

I certify that the work of this thesis entitled “Body Dysmorphic Disorder in Adolescents: Presentation, Correlates, and Sex Differences” has not been previously submitted for a degree to any other university or institution.

I certify that the thesis is an original piece of research which has been written by me, with support from Drs. Jennifer Hudson, Jonathan Mond, Cynthia Turner, and Andrew Baillie. The individual contributions of co-authors and contributors have been appropriately acknowledged. In addition, I certify that all information sources and literature used when preparing this thesis have been referenced appropriately.

Macquarie University Ethics Committee approval was obtained for all aspects of the research studies presented in this thesis, reference 5201300531 and 5201100886 (see Appendix ii). The research was also approved by the governing body of each participating school.

Sophie Schneider:

Date: 16th of December, 2016

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Summary of Contributions to Empirical Papers

Contribution	Chapter 2	Chapter 3	Chapter 4	Chapter 5	Chapter 6
Study conception	SS, JH	SS, JH, JM	AB, SS, JH	SS, JH, CT	SS, JH, CT
Data collection	SS, JH	SS, JH	SS, JH	SS, JH	SS, JH
Data analysis	SS, JH	SS, JH	SS, AB, JH	SS, JH	SS, AB, JH
Interpretation of results	SS, JH, CT, JM	SS, JH, JM, CT	SS, JH, AB, JM, CT	SS, JH, JM, CT	SS, JH, AB, JM, CT
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Paper revisions	JH, CT, JM	JH, JM, CT	JH, AB, JM, CT	JH, JM, CT	JH, AB, JM, CT

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Chapter 1.

General Introduction

Introduction

Body dysmorphic disorder (BDD) is a mental disorder that involves preoccupation with perceived defects in appearance that appear minimal or non-existent to others, and repetitive behaviours or mental acts in response to these concerns (American Psychiatric Association [APA], 2013). BDD is primarily a disorder of adolescent onset (Bjornsson et al., 2013; Marques, LeBlanc, et al., 2011), and onset prior to the age of 18 is associated with increased suicidality and comorbidity in adults (Bjornsson et al., 2013). BDD in adolescents may disrupt the attainment of important developmental milestones such as identity formation, initiation of romantic relationships, academic and occupational attainment, and increasing autonomy (Phillips, 2008). As BDD tends to follow a chronic course (Phillips, Menard, Quinn, Didie, & Stout, 2013), these difficulties are likely to persist into adult life. Together, these factors highlight the need for early detection of BDD, in order to reduce distress and impairment associated with the disorder.

Research examining BDD during the adolescent years is scarce (Phillips, 2008), and much information on the presentation of adolescent BDD comes from a few key studies of treatment-seeking individuals. However, these studies have involved small sample sizes with few male participants, and may be unrepresentative of adolescents with BDD in the general community (Albertini & Phillips, 1999). Research is greatly needed in order to better understand the prevalence, presenting features, and correlates of BDD in male and female adolescents in the general community. Research conducted in large community samples can also help to address core questions regarding the assessment of BDD, impact of subthreshold disorder presentations, the classification of BDD, and sex differences across these domains.

This chapter will begin with an overview of the definition and core features of BDD. It will then review current findings about the presentation of BDD in adolescents. Next, it will outline the limitations of this research, particularly regarding the reliance on clinical samples. It will then discuss some of the research questions that can be addressed when large, non-

clinical samples are used to study adolescent BDD. Finally, it will present the aims and structure of this thesis.

Throughout the thesis, the primary focus will be on research conducted in adolescent samples, defined here as those aged 12–18 years. However, due to the limited available research in this group, research will also be presented from child and adult samples in order to provide context to adolescent studies, and to suggest directions for future adolescent research.

Understanding BDD

BDD in the Diagnostic and Statistical Manual of Mental Disorders. According to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (*DSM-5*; APA, 2013), BDD is classified as an obsessive-compulsive and related disorder that involves “Preoccupation with one or more perceived defects or flaws in physical appearance that are not observable or appear slight to others.” (p 242). Individuals with BDD believe that aspects of their appearance are ugly, abnormal, or deformed, despite these flaws being unobservable, or appearing minimal, to others (APA, 2013). These appearance preoccupations are experienced as intrusive and distressing, and typically occur for 3–8 hours per day (Phillips, 2008). In addition to preoccupation, “At some point during the course of the disorder, the individual has performed repetitive behaviours (e.g. mirror checking, excessive grooming, skin picking, reassurance seeking) or mental acts (e.g. comparing his or her appearance with that of others) in response to the appearance concerns.” (APA, 2013, p. 242). These responses typically function to improve, hide, examine, or distract from the body area of concern, however, they usually worsen preoccupation and distress over time (Didie, Kelly, & Phillips, 2010).

Additionally, *DSM-5* specifies that the appearance concerns must cause significant distress or impairment, and that the preoccupation is not better accounted for by weight concerns in someone meeting diagnostic criteria for an eating disorder (APA, 2013). This does not imply that BDD cannot be diagnosed if an eating disorder is present (Hartmann, Greenberg, & Wilhelm, 2013); rather it is intended to avoid misdiagnosing eating disorders as BDD. *DSM-5*

also includes two diagnostic specifiers (APA, 2013). If the individual is preoccupied with their body build not being muscular enough, or their build being too small, they are diagnosed with the muscle dysmorphia subtype of BDD. This subtype primarily affects males, and is associated with increased suicidality, and behaviours intended to increase muscularity, such as weight lifting, controlled diets, and steroid use (C. G. Pope et al., 2005). Additionally, the level of insight can be specified: good or fair insight indicates recognition that the beliefs may not be true, poor insight indicates that the beliefs are thought to be probably true, and absent insight indicates delusional beliefs, where the individual is convinced of the accuracy of their beliefs (APA, 2013).

It is important to note that the majority of studies presented in this thesis were conducted using diagnostic criteria from the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (*DSM-IV*; APA, 1994). In *DSM-IV*, BDD was classified as a somatoform disorder, diagnosis did not require the presence of repetitive behaviours or mental acts, and there were no specifiers for muscle dysmorphia or level of insight. There are also some differences in the wording of the diagnostic criteria between *DSM* editions. Despite these differences, Schieber, Kollei, de Zwaan, and Martin (2015) found that the addition of a repetitive behaviour criterion reduced the estimated population prevalence of BDD only slightly (3.2% vs. 2.9%). Although further research is needed to fully establish the effect of criteria changes on the diagnosis of BDD, the findings of Schieber et al, suggests that *DSM-IV* criteria perform similarly to *DSM-5* in population-based research. As data collection for this thesis began prior to the release of *DSM-5*, the measures used to assess BDD were based on *DSM-IV* criteria.

A cognitive-behavioural model of BDD. Several cognitive-behavioural models have been proposed to explain BDD aetiology or maintenance (Neziroglu, Roberts, & Yaryura-Tobias, 2004; Veale, 2004; Veale et al., 1996; Wilhelm, 2006). Fang and Wilhelm (2015) recently developed an integrated model informed by previous models and current research. According to this model, individuals with BDD have an unusual response to negative

thoughts about appearance. Specifically, they focus excessively on details of the disliked appearance features instead of processing their appearance holistically, and they have a high degree of selective attention to perceived flaws. This selective attention interacts with maladaptive interpretations about appearance; these may include high self-standards for beauty, overestimation of the importance of appearance, interpretation biases for anger and contempt in facial expressions, and biases towards detecting threat in social situations. Maladaptive thinking about appearance flaws then leads to distressing feelings such as disgust, sadness, and anxiety. The individual tries to regulate these negative emotional states using maladaptive coping strategies such as ritualistic behaviours and avoidance, which are negatively reinforcing and can strengthen maladaptive interpretations.

The development and maintenance of maladaptive cognitions and emotions in BDD is likely to be influenced by a range of factors (for reviews, see Fang & Wilhelm, 2015; Li, Arienzo, & Feusner, 2013; Neziroglu, Khemlani-Patel, & Veale, 2008). Potential aetiological factors may include life experiences, such as cultural beliefs, experiences bullying, or abuse. Personality traits and cognitive styles have also been implicated, including rejection sensitivity, intolerance of uncertainty, perfectionism, or fear of negative evaluation. A range of biological factors may be relevant, including genetic vulnerability, serotonin system dysfunction, and deficits in visuospatial processing. Finally, triggers for appearance concerns could include changes to appearance such as puberty, negative comments by others, stress, or negative mood. Further research is needed in order to evaluate the impact of these potential aetiological factors in BDD, and to evaluate these models in adolescent populations.

The scope of BDD research. BDD is a relatively understudied disorder (Bjornsson, Didie, & Phillips, 2010; Phillips, 2015), especially in children and adolescents (Phillips, 2008). In order to quantify the available BDD research, we conducted a search of the Scopus citation database for all documents that included ‘body dysmorphic disorder’ in the title, keywords or abstract. We then narrowed this search to documents that included the terms ‘child’, ‘adolescent’, or ‘youth’. We then repeated the search for ‘obsessive compulsive

disorder' (OCD), as BDD and OCD are closely related (Phillips, 2015). Figure 1.1 presents the number of documents indexed by Scopus for each of the disorders from 1990–2015, and the subset of documents that relate to child, adolescent, or youth research.

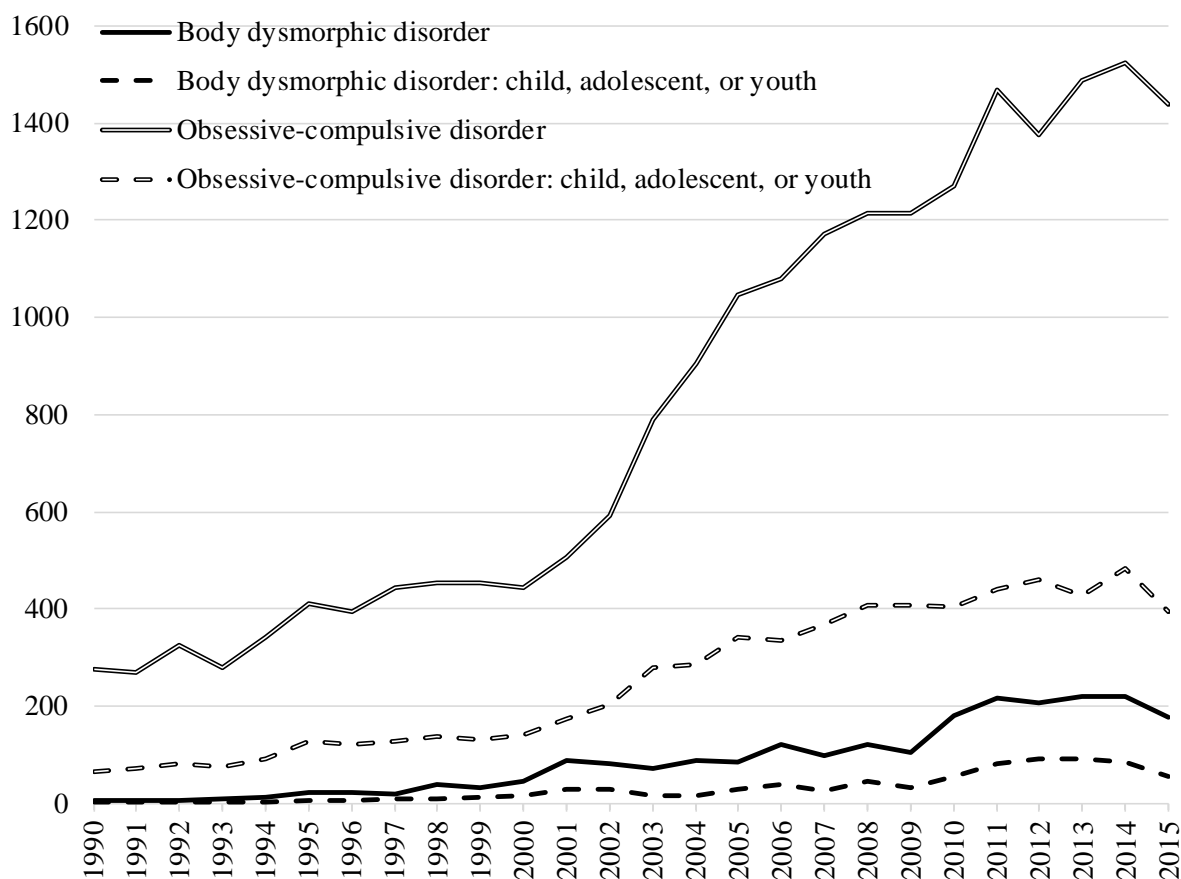


Figure 1.1. Scopus Records of Body Dysmorphic Disorder and Obsessive-Compulsive Disorder Research, 1990–2015

Despite OCD being less prevalent than BDD (APA, 2013), OCD research outweighed BDD by 9:1 over the years 1990–2015. In 2010–2015, OCD research still outweighed BDD by 7:1. Although BDD research increased in the lead up to *DSM-5* (APA, 2013), it appears to have plateaued in recent years. This supports the claim that BDD is understudied, particularly in young people, and highlights the need for sustained research efforts.

The Presentation of BDD in Adolescents

Prevalence. Only two studies have explored the community prevalence of adolescent BDD. Mayville, Katz, Gipson, and Cabral (1999) found BDD prevalence of 2.2% in 566 high school students aged 14–19 years from the United States. Rief, Buhlmann, Wilhelm,

Borkenhagen, and Brahler (2006) reported BDD prevalence of 2.3% in 174 German participants aged 14–20 years. Though both studies involved relatively small samples, these estimates are consistent with the adult BDD prevalence rates of 1.7–3.2% reported across the United States, Germany, and Sweden (Brohede, Wingren, Wijma, & Wijma, 2015; Buhlmann et al., 2010; Koran, Aboujaoude, Large, & Serpe, 2008; Rief et al., 2006; Schieber et al., 2015).

Onset and course. In retrospective reports from adults with BDD, the mean age of BDD onset was approximately 16 years, and subclinical symptoms were typically present from 13 years of age (Bjornsson et al., 2013; Conroy et al., 2008; Marques, LeBlanc, et al., 2011). Onset of BDD prior to the age of 18 was reported by 66.8% of adults, and was associated with greater comorbidity, and higher rates of suicide attempts than adult-onset BDD (Bjornsson et al., 2013). Adults with BDD appear to have low rates of remission and high chances of relapse, with earlier age of onset and longer duration of illness associated with decreased probability of remission (Phillips et al., 2013). However, remission rates are better in those with milder BDD (Bjornsson et al., 2011) and those who receive specialised BDD treatment (Phillips, Grant, Siniscalchi, Stout, & Price, 2005). There is limited information on the course of BDD in adolescents, though they are significantly more likely to report a continuous disorder course than adults (97.2 vs. 77.9%; Phillips, Didie, et al., 2006).

Clinical features. BDD involves obsessive preoccupation with appearance concerns that appear normal to others (APA, 2013). Thinking about appearance for at least one hour per day is recommended as an indication of preoccupation (Phillips, 2005), but many individuals with BDD spend much of their waking lives focused on their appearance. In two clinical samples, 54.3–67.9% of children and adolescents reported thinking about their appearance for more than 3 hours a day (Albertini & Phillips, 1999; Phillips, Didie, et al., 2006). Any part of the body can be a focus concern for a young person with BDD; frequently endorsed body areas of concern in adolescents include the skin, hair, weight, face, teeth, legs, nose, and stomach, and adolescents typically dislike 5–6 different body areas at a time

(Albertini & Phillips, 1999; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006).

Those with BDD respond to their appearance preoccupation with repetitive behaviours or mental acts that typically aim to reduce the distress of these concerns (APA, 2013). In adolescents, these commonly include comparing appearance with others, camouflaging, mirror checking, grooming, touching the body area, skin picking, reassurance seeking, dieting, and changing clothes (Albertini & Phillips, 1999; Phillips, Didie, et al., 2006). These behaviours are unhelpful in reducing preoccupation in the long run, and can even be damaging; for example, skin picking can cause infection and permanent damage (Phillips & Rogers, 2011). They are often time consuming as well; 25.0% of adolescents in one study spent more than 8 hours a day on BDD-related behaviours (Albertini & Phillips, 1999).

Overall, many core features of BDD are similar in adolescents and adults (Albertini & Phillips, 1999; Phillips, Didie, et al., 2006). However, some important developmental differences have been reported. Compared to adults, adolescents with BDD reported higher rates of suicide attempts, poorer insight into their disorder, and lower rates of BDD remission than adults (Phillips, Didie, et al., 2006). Adolescents were also more likely to report primary appearance concerns related to their weight and shape, possibly due to the rapid physical changes associated with puberty (Albertini & Phillips, 1999; Dyl et al., 2006). Appreciation of adolescent-specific presenting features in BDD may be important in improving detection of the disorder.

The impact of BDD. In clinical samples, adolescents with BDD often report severe levels of distress and substantial functional impairment, such as difficulties with daily functioning and reduced attainment of important life goals. Negative outcomes reported across three studies of children and adolescents included social interference (93.9-100.0%), academic or employment interference (84.8–100.0%), experiencing severe to extreme levels of distress (54.3–74.1%), dropping out of school (18.2–36.7%), being housebound for at least a week (13.9–15.2%), and poor overall quality of life (Albertini & Phillips, 1999; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006).

These findings are consistent with outcomes of adults with BDD, who report high levels of interference with occupational and academic achievement, many are single or unemployed, and some have been housebound or hospitalised due to BDD (Phillips, Menard, Fay, & Weisberg, 2005). In community samples, adults with BDD had lower incomes, higher unemployment, were more likely to have had plastic surgery, were less likely to be married, and more likely to be divorced than the general population (Rief et al., 2006). They also reported substantial interference with dating, socialising, work or school (Koran et al., 2008).

Perhaps the most concerning correlate of BDD is the high rate of suicidality. In clinical samples of adolescents with BDD, 66.7–80.6% experienced suicidal ideation, and 16.7–44.4% had attempted suicide (Albertini & Phillips, 1999; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). Adolescents with BDD were more than 5 times more likely to attempt suicide than the general adolescent population (Phillips, Didie, et al., 2006). This association does not appear to be a general function of psychopathology, as a study of adolescent psychiatric inpatients found that those with BDD had significantly higher scores on a suicide probability scale than those without (Dyl, Kittler, Phillips, & Hunt, 2006). The association between BDD and elevated suicidality is also found in adults in clinical samples (Phillips & Menard, 2006), and to a lesser extent, in community samples (Buhlmann et al., 2010; Rief et al., 2006).

Comorbidity with other disorders. Adolescent studies with broad inclusion criteria report relatively high rates of lifetime comorbidity; major depressive disorder (72.7–80.6%), social anxiety disorder (30.3–38.9%), OCD (27.8–39.4%), specific phobia (15.2–16.7%), and panic disorder (2.8–15.2%), with lower rates of anorexia nervosa (6.1–11.1%), bulimia nervosa (3.0–5.6%) bipolar disorders (2.8–18.2%) and dysthymia (3.0–5.6%; Albertini & Phillips, 1999; Phillips, Didie, et al., 2006). Two studies with stricter exclusion criteria for suicidality and substance use found lower comorbidity; major depressive disorder (23.3–69.2%), social anxiety disorder (30.8–33.3%), specific phobias (26.7–38.5%), generalised anxiety disorder (7.7–13.3%), OCD (0.0–3.3%), and eating disorders (0.0–3.3%; Greenberg,

Mothi, & Wilhelm, 2016; Mataix-Cols et al., 2015).

In the largest known clinical sample of adults with BDD (Gunstad & Phillips, 2003), lifetime comorbidity was high with major depressive disorder (81.6%), social anxiety disorder (36.5%), OCD (32.1%), and substance use disorders (28.0%). Other frequently reported comorbid disorders were panic disorder (13.0%), specific phobias (10.2%), eating disorders (7.8%), and dysthymia (6.5%). An increased number of comorbid disorders was associated with greater distress and problems in overall functioning, specifically, with higher rates of attempted suicide, and increased chance of being single, housebound, or unemployed (Gunstad & Phillips, 2003).

Sex differences in the presentation of BDD. Limited research from community samples have found that BDD prevalence did not differ significantly between males (1.7%) and females (2.9%), but in the sample as a whole, females reported higher mean BDD symptoms than males (Mayville et al., 1999). In another study, females were more likely to be classified as having high-risk BDD symptoms than males, though this grouping was based on scores derived from adult research (Mastro, Zimmer-Gembeck, Webb, Farrell, & Waters, 2016). These findings are consistent with adult research, where symptoms of BDD are elevated in females (Buhlmann et al., 2010; Rief et al., 2006), but sex differences in BDD prevalence typically fail to reach significance (Buhlmann et al., 2010; Koran et al., 2008; Rief et al., 2006). The only exception is Schieber et al. (2015), who reported an unusually high female prevalence (4.4%) compared to males (1.7%). Together, these studies indicate that symptoms of BDD may be elevated in females, but BDD prevalence appears to be similar across sex.

Although sex differences in specific clinical features of BDD have not been explored in adolescent samples, adult studies suggest modest differences between males and females in some features (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips, Menard, & Fay, 2006). The overall severity of BDD was similar in males and females (Phillips & Diaz, 1997; Phillips, Menard, & Fay, 2006), but males were more likely to be single or living alone than females

(Phillips, Menard, & Fay, 2006). Some presenting features of BDD also differed; men were more likely to lift weights than females, and females were more likely to camouflage their appearance concerns, pick their skin, and check the mirror excessively than men (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips, Menard, & Fay, 2006). Some comorbidity differences also emerged, with females reporting higher lifetime bulimia and generalised anxiety disorder, and males reporting higher rates of lifetime substance use disorder (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips, Menard, & Fay, 2006). Males were more likely to be concerned about their genitals, body build, and thinning hair, whereas females were more likely to be concerned about weight, breasts/chest, hips, buttocks, thighs, legs, and other hair concerns (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips, Menard, & Fay, 2006).

Muscle dysmorphia is a subtype of BDD where individuals are concerned about being insufficiently muscular, and it affects males almost exclusively (APA, 2013). In a sample of 63 adult males with BDD, the 14 (22.2%) individuals with muscle dysmorphia reported poorer quality of life, greater suicidality, and higher frequency of substance use disorder than those without muscle dysmorphia (C. G. Pope et al., 2005). This suggests that muscle dysmorphia may represent a more severe presentation of BDD, potentially one that is closely linked to eating disorders (Phillips, Wilhelm, et al., 2010), or represents a culturally-bound disorder presentation reflecting Western masculine body image ideals (Kanayama & Pope, 2011). However, there is debate regarding the classification of muscle dysmorphia in *DSM-5*. Although some researchers argue that it is better understood as an eating disorder (Murray & Touyz, 2013), a recent systematic review concluded that there was insufficient evidence to support the classification of muscle dysmorphia as a distinct entity in *DSM-5* (dos Santos Filho, Tirico, Stefano, Touyz, & Claudino, 2015). Further research is needed to understand the presentation and classification of muscle dysmorphia in males.

Limitations of Current Adolescent BDD Research

The research reviewed indicates that BDD typically begins prior to the age of 18, and affects approximately 2.2% of adolescents. However, detailed information on the presentation

and impact of BDD primarily comes from four studies of adolescents diagnosed with BDD in clinical settings, with these studies including a total of just 126 adolescents with BDD (Albertini & Phillips, 1999; Dyl et al., 2006; Greenberg et al., 2016; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). Not only are these findings based on small samples, but they have not addressed potential sex differences in the presentation of BDD. Albertini and Phillips (1999) suggested that treatment-seeking adolescents may not be representative of those with BDD in the general community, for example, they may have a more severe BDD presentation, greater comorbidity, or increased suicidality. It is important to establish whether findings from clinical samples are representative of adolescents in the general community, as there are substantial barriers to the detection and treatment of adolescent BDD.

Not seeking appropriate treatment. Many individuals with BDD do not access mental health services (Buhlmann, 2011; Marques, Weingarden, LeBlanc, & Wilhelm, 2011), and there are a range of potential barriers. In adult research, embarrassment and shame are frequently reported as reasons for not seeking treatment (Buhlmann, 2011; Marques, Weingarden, LeBlanc, & Wilhelm, 2011). As individuals with BDD are often willing to disclose other mental health concerns like depression and anxiety (Veale, Akyüz, & Hodsoll, 2015), this suggests that feelings of shame may be specific to, or magnified for, their BDD concerns. Insight is often poor in BDD, and young people with BDD in clinical samples often lack any insight into their appearance concerns (Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). In adults, poor insight is related to greater BDD symptom severity (Hartmann, Thomas, Greenberg, Matheny, & Wilhelm, 2014) and lower rates of mental health treatment-seeking (Phillips, Menard, Pagano, et al., 2006). Further, many people with BDD do not believe that mental health treatment will improve their appearance concerns (Marques, Weingarden, et al., 2011). This can be understood in light of poor insight; when convinced that there is a genuine physical defect, it is logical to seek cosmetic, dental or dermatological treatment to change the appearance of the feature. These types of treatments were received by 33.3–36.4% of adolescents with BDD, but it did not lead to symptom improvement in any of

these participants (Albertini & Phillips, 1999; Phillips, Grant, Siniscalchi, & Albertini, 2001).

Poor detection of BDD in clinical samples. When assessed using routine clinical interviews, adolescents and adults typically do not disclose their BDD (Conroy et al., 2008; Dyl et al., 2006; Grant, Kim, & Crow, 2001; Veale et al., 2015; Zimmerman & Mattia, 1998). Even in adolescents diagnosed with BDD, just 40.8% of their mental health providers were aware of their body image concerns (Phillips, Didie, et al., 2006). In adults, lack of disclosure is related to feelings of embarrassment, thinking appearance concerns were realistic, not knowing where to seek help, being afraid of being negatively judged, and feeling the provider would not understand (Conroy et al., 2008; Veale et al., 2015). However, adding a BDD-specific screening item or diagnostic module does result in the identification of cases of BDD that were not disclosed in unstructured clinical interviews (Dyl et al., 2006; Veale et al., 2015; Zimmerman & Mattia, 1998).

Even when excessive and distressing appearance concerns are disclosed to clinicians, symptoms of BDD can be confused for related disorders such as OCD, depression, social anxiety, and eating disorders (Phillips & Feusner, 2010). Not only do these disorders share some presenting features, but they are often comorbid with BDD (Gunstad & Phillips, 2003; Phillips, Didie, et al., 2006). Educational resources have been developed to educate clinicians about the presentation of BDD and how to conduct a differential diagnosis (for example, Phillips, 2010), but there is little information specific to adolescents. Further, it can be difficult to differentiate reasonable and unreasonable levels of concern in some individuals (Crerand & Sarwer, 2010). In these cases, it is important to consider the extent of the distress and impairment associated with the appearance concern, in addition to the physical appearance of the feature.

Underrepresentation of males in clinical samples. Studies where adolescents were recruited specifically for BDD-focused research have involved predominantly female samples (76.9–90.9% female; Albertini & Phillips, 1999; Greenberg et al., 2016; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). Given that the population prevalence of BDD is thought to

be similar in males and females, this suggests that males with BDD may be less likely to access mental health services (Phillips, Didie, et al., 2006). Accordingly, adolescent males do report lower utilisation of mental health services than females in studies of other disorders (Johnson et al., 2016). However, a study that screened for BDD in a general adolescent psychiatric population found probable BDD prevalence of 5.4% in females, and 9.0% in males (Dyl et al., 2006). This suggests that detection of BDD may in fact be poorer in adolescent males than in females. Regardless, it is unclear how representative findings from female-biased clinical samples are of adolescents in the general community, and further research is needed to examine treatment-seeking and disorder detection across males and females.

Future Directions for Adolescent BDD Research

Research in large community samples. There is very little research on the prevalence of adolescent BDD, therefore establishing a reliable prevalence estimate is crucial for determining the extent of adolescent BDD. Studies of BDD in clinical samples give vital information about the presentation of adolescent BDD, however, it is unclear how representative these samples are of adolescent BDD in the general population. Research is clearly needed in the general community, in order to understand the presentation of BDD in adolescents who do not seek treatment. Unfortunately, few such studies have been conducted. The largest study of adolescent BDD was the previously discussed prevalence study of 566 American high school students (Mayville et al., 1999). BDD prevalence did not differ significantly between males and females, but across the whole sample, BDD symptoms were lower in males than females, and lower in those from an African American ethnic background than from other ethnic groups. A recent study by Mastro et al. (2016) evaluated appearance anxiety indicative of BDD in 387 community participants aged 10–13 years. Those at high risk of BDD experienced elevated symptoms of depression and social anxiety, more extreme weight management behaviours, greater rejection sensitivity, and poorer social functioning and social competence than those at low risk for BDD. This preliminary evidence suggests that BDD symptoms are associated with a range of negative outcomes in adolescents in the

community. However, further research in large samples is required to better understand how many young people are affected by BDD, how these features present, and what impact it has on their lives.

Evaluation of BDD screening tools. The gold standard for assessing the presence of BDD in adolescents and adults is a face-to-face clinical interview with a trained mental health professional (Phillips & Feusner, 2010). However, this approach is not feasible in large-scale research, or in many routine clinical settings, so brief screening tools have been developed to detect the presence of BDD. Some measures directly assess the diagnostic criteria of BDD, for example, the Body Dysmorphic Disorder Questionnaire, which has good sensitivity and specificity (Grant et al., 2001; Phillips, Atala, & Pope, 1995). Similar measures have been widely used in prevalence studies (Koran et al., 2008; Rief et al., 2006; Schieber et al., 2015). They may also be useful in clinical settings to probe for the presence of BDD. Other measures developed in adult samples assess the overall severity of a range of BDD symptoms, and derive a cut-off score to differentiate between those with and without BDD (for example; Littleton, Axson, & Pury, 2005; Oosthuizen, Lambert, & Castle, 1998; Phillips, Atala, et al., 1995; Veale et al., 2012). These types of questionnaires typically take longer to complete and require validation to determine clinical cut-off scores, but can provide more detailed information about BDD symptoms and associated outcomes. To our knowledge, no prior study has evaluated the psychometric properties of BDD screening measures in adolescents. This is problematic due the potential for developmental differences in the presentation of BDD, as previously outlined. Thus, it is important to evaluate the psychometric properties of an instrument developed for adults when using it with adolescents.

In addition to evaluating measures in adolescent samples, it is important to ensure it performs equally well in males and females. If a measure functions differently across sex, observed group differences in scores may reflect measurement problems and may not be interpretable. For example, one study found that a BDD symptom measure functioned differently in Japanese adult males and females (Tanaka, Tayama, & Arimura, 2015). Other

studies of sex biases in adolescent body image measures have reported mixed results, and highlighted the need to evaluate such measurement issues (Elosua & Hermosilla, 2013; Maïano, Morin, Monthuy-Blanc, & Garbarino, 2009). Further, even when the measurement properties of a measure are acceptable in males and females, differences in population norms may necessitate different cut-off scores for males and females. No prior study has included a large enough sample to provide cut-off scores for BDD measures in adolescents. As research in large samples typically requires the use of brief screening tools, it is important that studies evaluate the psychometric properties of such measures in adolescent samples, ensure that such measures function equivalently in males and females, and provide information on score distributions.

Importance of subthreshold BDD presentations. Previous research has focused on individuals who meet all diagnostic criteria for BDD (referred to as full-syndrome BDD). However, there is increasing recognition of the potential negative impact of subthreshold disorders; symptom presentations associated with significant distress or impairment that do not meet full diagnostic criteria (Pincus, Davis, & McQueen, 1999). In adolescents, subthreshold mental disorders are approximately twice as common as full-syndrome disorders (Roberts, Fisher, Blake Turner, & Tang, 2015), and are associated with increased comorbidity, functional impairment, and higher risk of later full-syndrome disorders (Balázs et al., 2013; Haller, Cramer, Lauche, Gass, & Dobos, 2014; Shankman et al., 2009; Wesselhoeft, Sørensen, Heiervang, & Bilenberg, 2013; Wolitzky-Taylor et al., 2014). The prevalence of subthreshold BDD is unknown, but individuals with BDD typically report experiencing subthreshold symptoms for several years prior to full-syndrome disorder onset (Phillips, Menard, et al., 2005). The only study to examine a subthreshold-like group of adolescents with BDD found that those at moderate risk for BDD reported depression symptoms, self-worth, and appearance-related rejection sensitivity at levels intermediate between high-risk and low-risk groups (Mastro et al., 2016). There were similar numbers of adolescents in the high and moderate risk groups (9.0% vs 7.8% of the sample), and

participants in both groups were disproportionately female. Although the findings should be considered with some caution due to the use of cut-off scores derived from adult research, these findings suggest that subthreshold BDD may be associated with negative outcomes in adolescents. Further research is required to assess the prevalence, impact, and course of subthreshold BDD. If subthreshold BDD is associated with substantial distress or impairment, or high risk for later full-syndrome BDD, it may be an appropriate target for early intervention or prevention programs, as has been proposed for subthreshold anxiety and depression (Wolitzky-Taylor et al., 2014).

The classification of BDD. As BDD is poorly understood and frequently misdiagnosed (Phillips & Feusner, 2010), its classification may have practical implications regarding screening for BDD in the presence of related disorders, improved clinical decision making, development of interventions, and understanding of shared aetiological factors (Abramowitz & Jacoby, 2015; Chosak et al., 2008; First et al., 2004; Phillips & Stein, 2015; Phillips, Stein, et al., 2010). In the third and fourth editions of the *DSM* (APA, 1987, 1994), BDD was classified as a somatoform disorder. However, this approach was criticised due to the low association between BDD and other somatoform disorders (for a review, see Cororve & Gleaves, 2001). The release of *DSM-5* saw the reclassification of BDD within the new ‘obsessive-compulsive and related disorder’ (OCRD) chapter, together with OCD, hoarding disorder, trichotillomania (hair-pulling disorder), excoriation (skin picking) disorder, and several other specified and unspecified OCRD disorders (APA, 2013). BDD, OCD, and hoarding disorder are considered to be ‘higher-order’ disorders due to their cognitive focus, whereas trichotillomania and excoriation disorder are considered to be ‘lower-order’ disorders due to their motoric focus (Phillips & Stein, 2015). Despite these changes, debate continues regarding the classification of BDD.

BDD as an obsessive-compulsive spectrum disorder. BDD has long been conceptualised as related to OCD (Phillips, McElroy, Hudson, & Pope, 1995), and there is good evidence of the association between BDD and OCD across core disorder features,

elevated comorbidity, family history, and shared treatment response (Abramowitz & Jacoby, 2015; Bienvenu et al., 2012; Kelly & Phillips, 2011; Phillips, Stein, et al., 2010). However, the association between BDD and other *DSM-5* OCDs is poorly understood. A recent twin study found a moderate shared genetic influence of OCD symptoms on BDD symptoms, and low shared environmental risk factors (Monzani, Rijdsdijk, Harris, & Mataix-Cols, 2014). However, OCDs other than OCD are rarely reported in those with BDD (Phillips, Menard, et al., 2005), though it should be noted some OCDs are new to *DSM-5*, and others may not be assessed as part of routine BDD assessment. Studies examining BDD comorbidity in OCDs provide mixed findings. Although 29.1% of 55 participants with pathological skin picking had comorbid BDD (Grant, Redden, Leppink, & Odlaug, 2015), a community sample of 66 individuals with trichotillomania reported no cases of comorbid BDD (Lochner et al., 2012). Recent studies of comorbidity in hoarding disorder did not include assessment of BDD (Frost, Steketee, & Tolin, 2011; Hall, Tolin, Frost, & Steketee, 2013). Therefore, with the exception of OCD, there is limited evidence to support specific associations between BDD and *DSM-5* OCDs.

BDD as an affective spectrum disorder. Recent reviews have emphasised the strong association of both BDD and OCD with anxiety and depressive disorders (Abramowitz & Jacoby, 2015; Frías, Palma, Farriols, & González, 2015). BDD is associated with anxiety and unipolar depression across important domains including comorbidity, family history, disorder course, and cognitive biases (Abramowitz & Jacoby, 2015; Fang & Hofmann, 2010; Frías et al., 2015; Phillips & Stout, 2006). OCD formed part of the anxiety disorders chapter in *DSM-IV* (APA, 1994), reflecting its close associations with anxiety disorders across comorbidity, cognitive and emotional processing, and genetic factors (Stein et al., 2010). Together, these associations suggest that BDD and OCD may belong to a broader ‘affective spectrum’ that also includes anxiety and unipolar depression (Phillips, McElroy, et al., 1995). Indeed, a combined ‘anxiety and obsessive-compulsive spectrum’ chapter was considered by the *DSM-*

5 Anxiety, Obsessive-Compulsive Spectrum, Post-Traumatic, and Dissociative Disorders Work Group (Phillips & Stein, 2015).

BDD as a body image disorder. Although most research on the classification of BDD has focused on its association with OCD and affective disorders, BDD may also be conceptualised as a body image disorder, due to the central concerns about appearance (Rosen & Ramirez, 1998; Veale et al., 1996). Research into the association between BDD and eating disorders is relatively limited, and there has been confusion regarding the diagnosis of BDD in the presence of an eating disorder in *DSM-IV* (Hartmann et al., 2013; Phillips, Wilhelm, et al., 2010). Regardless, studies have found similarities between BDD and eating disorders, primarily anorexia nervosa, across their clinical features, onset and course, cognitive features, and personality traits (Cororve & Gleaves, 2001; Hartmann et al., 2013; Jolanta & Tomasz, 2000; Rosen & Ramirez, 1998). Accordingly, BDD has been theorised to form part of a body image spectrum of disorders (Cororve & Gleaves, 2001).

BDD as an internalising disorder. In addition to the associations of BDD to OCD, anxiety, depression, and eating disorders, there is also evidence of an association between eating disorders and OCD in clinical samples (Cororve & Gleaves, 2001; Grant, Kim, & Eckert, 2002; Phillips & Kaye, 2007). Further, adolescent studies have found that OCD, anxiety, depression, and eating disorders are all part of a broad internalising spectrum of disorders (Beesdo-Baum et al., 2009; Blanco et al., 2015; Kessler et al., 2012; Lahey et al., 2008; Wittchen et al., 2009). Thus, BDD may form part of an internalising spectrum that includes OCD, anxiety, depression, and eating disorders.

Limitations to current classification research. Classification decisions for *DSM-5* were informed by 11 different validators that indicated the relatedness of disorders; symptom similarity, comorbidity among disorders, course of illness, familiarity, genetic risk factors, environmental risk factors, neural substrates, biomarkers, temperamental antecedents, cognitive and emotional processing abnormalities, and treatment response (APA, 2013). There is limited information regarding the association of BDD to other disorders across many

of these validators, and research has typically examined bivariate associations between disorders. These studies often lack appropriate comparison groups to test the hypothesised associations; it is not sufficient just to demonstrate that BDD is associated with OCD, it should also be shown that this association is stronger than the association of OCD to other disorders (Allison, 1993). Further, these studies have typically involved small numbers of BDD participants recruited from clinical samples, and thus may not be representative of the general population (Frías et al., 2015). Further research is clearly needed to examine the associations between BDD and other disorders in large, non-clinical samples. Additionally, as the structure of psychopathology may vary meaningfully at different developmental stages (Wittchen et al., 2009), it may be particularly informative to explore the classification of BDD at the time of peak disorder onset, and to consider novel classification models.

Overview of the Thesis

In summary, BDD is a mental disorder of primarily adolescent onset, affecting approximately 2% of the adolescent population. In clinical samples, adolescent BDD is associated with substantial distress and impairment. There may be differences in disorder presentation between adolescents and adults, and between males and females. Research conducted in large non-clinical samples is needed in order to explore core research questions in representative samples. The aim of the current thesis is to address some of these gaps by establishing the prevalence, presenting features, and correlates of BDD in a community sample of adolescents, to explore questions regarding subthreshold disorder presentations, the measurement and classification of BDD symptoms in adolescents, and sex differences across these domains.

Assessment of BDD in the thesis. In this thesis, BDD is assessed using two different measures; one that categorises participants based on endorsement of *DSM-IV* BDD criteria, and another that assesses severity of BDD symptoms regardless of BDD status. As previously discussed, there is little information regarding the psychometric properties of BDD screening tools in adolescents, so measure selection was based on the limited research available.

The first measure used is the Body Dysmorphic Disorder Questionnaire-Adolescent Version (BDDQ-A; Phillips, 2005), which assesses *DSM-IV* BDD criteria in a series of yes or no questions, supplemented by open questions to assess the types of body areas of concern, and the nature of any life interference. BDDQ-A responses are used to identify those individuals with probable full-syndrome BDD (pBDD), or probable subthreshold BDD (sBDD). Chapters 2 and 3 present detailed information regarding the content and application of the BDDQ-A. The BDDQ-A was selected as it directly assesses *DSM-IV* BDD criteria, and has good sensitivity and specificity in adult samples (Grant et al., 2001; Phillips, Atala, & Pope, 1995). As the diagnostic criteria of BDD are the same regardless of age or sex (Phillips, Wilhelm, et al., 2010), this measure was expected to also perform well in adolescents. However, it is important to note that adolescent-specific sensitivity and specificity data has not been published, and calculation of this information in the thesis sample is not possible as diagnostic interviews were not conducted.

As the BDDQ-A does not provide information about the severity of their BDD symptoms, the Body Image Questionnaire-Child and Adolescent version (BIQ-C; Veale, 2009) is used to measure 12 BDD symptoms on a continuous scale. Chapter 4 presents a detailed discussion of the rationale for selecting this measure, and an exploration of its psychometric properties. As there is evidence of sex differences in the endorsement of BDD symptoms, the thesis will examine the psychometric properties of the BIQ-C across males and females before using it to compare BDD symptoms across sex.

Overview of thesis chapters. The following thesis chapters include five empirical papers and a general discussion. The empirical papers utilise self-report questionnaire data from 3,149 Australian high school students, the largest known sample in which BDD has been assessed. Participants were recruited from two larger studies examining emotional health in separate samples of female and male adolescents. These studies have slight differences in procedures, most importantly, that some questionnaires were administered to males but not to females. We wish to note that information regarding participant sex is based on school

enrolment. As we did not enquire as to the gender identity of each participant, we refer to participant sex throughout the thesis.

Each empirical paper has been formatted for journal publication. As the target journals vary in their audience, focus, and formatting requirements, slight changes have been made to the empirical papers to create consistency throughout the thesis. Namely, we have simplified the title pages, used Australian spelling throughout, adjusted large table layouts to improve readability, and applied APA formatting and referencing (American Psychological Association, 2010). For ease of reference, we have replaced in-text citations to empirical studies contained within the thesis with the relevant chapter number. All tables and figures in Chapters 2–6 are located at the end of each chapter, after the references. As each paper has been submitted as a discrete work, some repetition is unavoidable. However, each paper introduces new ideas and addresses different research questions.

Chapter 2 presents the first empirical paper “Prevalence and Correlates of Body Dysmorphic Disorder in a Community Sample of Adolescents”. This chapter focuses on those adolescents with probable full-syndrome BDD (pBDD). It establishes the prevalence of pBDD in the whole sample, and compares prevalence between males and females, and between younger and older adolescents. It then explores the impact of pBDD by comparing a number of important correlates between adolescents with pBDD and those without BDD (non-BDD). These include symptoms of depression, anxiety, and eating disorders, past mental health service use, and in males only, quality of life, muscularity concerns, and symptoms of conduct disorder, hyperactivity, peer problems, and emotional symptoms.

Chapter 3 then explores issues related to subthreshold BDD (sBDD), in the paper “Subthreshold Body Dysmorphic Disorder in Adolescents: Prevalence and Impact”. The study establishes the overall prevalence of sBDD, and compares prevalence by age and sex. The relative severity of sBDD is then explored by comparing a range of outcomes between sBDD and pBDD participants, and between sBDD and non-BDD participants. Together, Chapters 2 and 3 establish the prevalence of pBDD and sBDD, and explore the impact of

these BDD presentations on a range of clinically-relevant outcomes. However, before sex differences in BDD symptoms can be explored, it is important to establish the psychometric properties of the BIQ-C in males and females.

Chapter 4 explores key measurement issues of the BIQ-C across the whole sample, in the paper “Measurement Invariance of a Body Dysmorphic Disorder Symptom Questionnaire across Sex: The Body Image Questionnaire-Child and Adolescent Version”. This study is the first to perform cross-sex measurement invariance of a BDD symptom measure in adolescents. That is, it examines the equivalence of key psychometric properties of the measure between males and females to determine the suitability of the measure for comparing BDD symptom scores across sex. It also provides information regarding the distribution of BDD symptoms in males and females across the whole sample.

Chapter 5 continues the focus on BDD symptoms in the whole sample, in “The Classification of Body Dysmorphic Disorder Symptoms in Male and Female Adolescents”. This paper uses confirmatory factor analysis to test the fit of competing models of the classification of symptoms of BDD with OCD, anxiety, depression, and eating disorders. These models represent the classification of BDD within the obsessive-compulsive spectrum, the affective spectrum, the body image spectrum, or the internalising spectrum, and a novel model where BDD forms its own factor. The study fits the models separately for males and females and uses measurement invariance testing to examine the equivalence of the best model between males and females.

Chapter 6 includes the final empirical paper, “Sex Differences in the Presentation of Body Dysmorphic Disorder in a Community Sample of Adolescents”. This paper selects only those participants with pBDD or sBDD, and provides a detailed exploration of the sex differences in clinically-relevant features; BDD symptoms, body areas of concern, elevated comorbid symptoms, and past mental health service use. It also examines whether muscle dysmorphia is associated with a more severe disorder presentation in males.

Chapter 7 contains the general discussion. It outlines the unique contributions of each study, theoretical and clinical implications of the research, study limitations, and thesis conclusions. Finally, Appendix i presents an invited book chapter “Body Dysmorphic Disorder in Children and Adolescents: Advances in Theoretical and Clinical Research”. The chapter is an overview of a symposium that I chaired at the World Congress of Behavioural and Cognitive Therapies in June, 2016, and where I reported findings from Chapter 5. Appendix ii includes information relating to ethics approval for the research.

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The following chapter presents the first empirical paper “Prevalence and Correlates of Body Dysmorphic Disorder in a Community Sample of Adolescents”. This paper focuses on identifying adolescents with probable full-syndrome BDD (referred to as probable-BDD, or pBDD). It establishes the prevalence of pBDD in the total sample, and compares prevalence between males and females, and younger and older adolescents. It then explores the impact of pBDD by comparing a number of important correlates between those with and without BDD.

Chapter 2.

Prevalence and Correlates of Body Dysmorphic Disorder in a Community Sample of Adolescents

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Abstract

Aims. Body dysmorphic disorder (BDD) typically begins in adolescence, yet little is known about the prevalence and correlates of BDD in this age group. The current study aimed to explore the presenting features of adolescents meeting probable criteria for BDD (pBDD) in a large community sample, and compare levels of comorbid psychopathology, quality of life, and mental health service use between adolescents with pBDD and those without.

Method. Questionnaires were completed at school by 3,149 adolescents; 63% male, aged 12–18 years ($M = 14.58$). These assessed *DSM-IV* BDD criteria, past mental health service use, and symptoms of BDD, anxiety, depression, obsessive-compulsive disorder, and eating disorders. In male participants, additional measures assessed quality of life, muscularity concerns, emotional symptoms, peer problems, conduct problems, and hyperactivity.

Results. The prevalence of pBDD was 1.7%; there was no sex difference in prevalence, but older adolescents reported higher prevalence than younger adolescents. Participants with pBDD reported substantially elevated levels of psychopathology, quality of life impairment and mental health service use compared to non-BDD participants.

Conclusions. The prevalence of pBDD in adolescents is similar to adult samples, and pBDD is associated with comorbidity, distress, and functional impairment in a community sample. Further research is required to better understand the presentation of BDD in adolescents, and to improve diagnosis and treatment.

Keywords. Body dysmorphic disorder, adolescents, prevalence, clinical features, comorbidity.

Introduction

Body dysmorphic disorder (BDD) involves the preoccupation with perceived flaws or defects in appearance that are not observable or appear minimal to others (American Psychiatric Association [APA], 2013). Few studies have examined BDD in adolescents, despite the fact that mean BDD onset is 16 years (Bjornsson et al., 2013). The clinical presentation of BDD is relatively similar between adults and young people regarding BDD severity, levels of comorbidity, and extent of impairment (Albertini & Phillips, 1999; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). However, adolescents may experience poorer insight and greater suicidality than adults (Phillips, Didie, et al., 2006), and adults with BDD onset prior to the age of 18 report higher rates of suicidality and comorbidity than those with adult-onset BDD (Bjornsson et al., 2013). BDD appears to disrupt normal adolescent development by impairing social functioning, initiation of romantic relationships, educational and vocational attainment (Phillips, 2005). As BDD tends to follow a chronic course (Phillips, Menard, Quinn, Didie, & Stout, 2013), these difficulties are likely to persist into adult life.

Despite the potential severity of BDD in adolescence, only two studies have explored its prevalence. Mayville, Katz, Gipson, and Cabral (1999) found 2.2% BDD prevalence in 566 USA high school students aged 14–19 years. Rief, Buhlmann, Wilhelm, Borkenhagen, and Brahler (2006) reported BDD prevalence of 2.3% in 174 Germans aged 14–20 years. Though replication in larger samples is required to increase confidence in these estimates, they are consistent with the adult BDD prevalence of 1.7–3.2% reported across the USA, Germany, and Sweden (Brohede, Wingren, Wijma, & Wijma, 2015; Buhlmann et al., 2010; Koran, Aboujaoude, Large, & Serpe, 2008; Rief et al., 2006; Schieber, Kollei, de Zwaan, & Martin, 2015). Several studies have found a trend towards higher BDD prevalence in females compared to males, but these differences are typically not statistically significant (Buhlmann et al., 2010; Koran et al., 2008; Mayville et al., 1999; Rief et al., 2006), with the exception of Schieber et al. (2015).

Little is known about the correlates of adolescent BDD in community samples. This is potentially problematic, as individuals with BDD often do not access appropriate mental health services (Marques, Weingarden, LeBlanc, & Wilhelm, 2011), and BDD is typically not detected in routine clinical settings (Grant, Kim, & Crow, 2001; Veale, Akyüz, & Hodsoll, 2015). Caution may therefore be needed when generalising findings from treatment-seeking samples to cases of BDD in the community. One recent study (Mastro, Zimmer-Gembeck, Webb, Farrell, & Waters, 2016) evaluated appearance anxiety, indicative of BDD, in 387 community participants aged 10–13 years. Those at high risk of BDD experienced elevated symptoms of depression and social anxiety, more extreme weight management behaviours, greater rejection sensitivity, and poorer social functioning and social competence than those at low risk for BDD. However, it is unclear to what extent the measure used by Mastro et al. (2016) differentiates between BDD and eating disorder symptomology. This preliminary evidence suggests that BDD symptoms are associated with a range of negative outcomes in adolescents in the community, but further research is clearly needed.

In sum, the available evidence indicates that BDD may have similar prevalence in adolescents and adults, and is associated with considerable distress and impairment in young people. However, knowledge about the presentation and correlates of adolescent BDD is largely restricted to clinical samples. The current study aimed to identify probable cases of BDD (hereafter referred to as pBDD) in a large sample of Australian high school students. We aimed to explore the presenting features of pBDD, including demographic correlates, BDD symptoms endorsed, and the body areas of concern. Given that BDD typically begins at 16 years, we hypothesised that the prevalence of pBDD would be higher among participants aged 15–18 years compared to those aged 12–14 years. We also hypothesised that there would be no significant sex difference in pBDD prevalence. Based on patterns of comorbidity found in clinical samples of adolescents with BDD, it was hypothesised that symptoms of anxiety, depression, obsessive-compulsive disorder, and eating disorders would be elevated among adolescents with pBDD compared to those without pBDD (referred to as non-BDD).

Finally, it was hypothesised that levels of quality of life impairment, muscularity concerns, emotional symptoms, peer problems, conduct problems, and hyperactivity – measures that were completed only by male participants – would be higher among males with pBDD when compared with non-BDD males. While past use of mental health services was also assessed, the available evidence did not permit any a priori hypotheses concerning between-group differences in this outcome.

Method

Participants

Participants were recruited from seven high schools in New South Wales, Australia as part of two separate longitudinal studies of the development of emotional health. The first study examined utilisation of an online treatment program for anxiety and depression in four Catholic boys' high schools. The second study examined the development and prevention of anxiety and depression in two independent and one government-run girls' school. Of 5,005 students enrolled at the time of testing, 3,149 consented and participated (62.9% response rate). Participants were 63.5% male ($n = 2000$) and had a mean age of 14.58 years ($SD = 1.37$, range 12–18).

Procedure

Assessment sessions took place during school time, supervised by members of the research team. Questionnaires were completed confidentially using de-identified codes and participants were informed that confidentiality would be broken only if their questionnaire responses indicated serious risk of harm. The research was approved by the Human Research Ethics Committee of Macquarie University, reference 5201300531 and 5201100886, and by each school and their governing body.

All participants consented to involvement in the relevant larger study of emotional health, which included the measures used in the current study. Data presented here are from the initial stages of these larger studies. Parents were provided with written information about the study methods and were asked to discuss participation with their child. Information about

the programs was also provided directly to students, typically in school assemblies or class groups. At boys' schools, parents were asked to fill in a form to opt out if they did not wish to participate. If parents did not opt out, students provided active consent via an online consent form. At girls' schools, parents were required to provide written consent to opt in to the research and all students had the opportunity to opt out of testing verbally.

Measures

All participants. The socio-educational advantage of each school was assessed using the Index of Community Socio-Educational Advantage (Australian Curriculum and Assessment Reporting Authority, 2013). The ICSEA has a mean of 1,000 ($SD = 100$), with higher scores indicating greater socio-educational advantage of the school.

Participants provided demographic information, and if relevant, answered brief questions addressing past assessment or treatment for mental health concerns including the reasons for seeking help, the type of professional consulted, and when services were accessed. They also completed the following measures.

The Body Dysmorphic Disorder Questionnaire-Adolescent Version (BDDQ-A; Phillips, 2005) is a brief screening measure designed to assess *DSM-IV* criteria for BDD (APA, 1994). Figure 2.1 displays the content and application of the BDDQ-A. Additional open text items assess the nature of any impairment, and the body areas of concern. The adult BDDQ has good sensitivity (100%) and specificity (89–93%) in psychiatric settings (Grant et al., 2001; Phillips, Atala, & Pope, 1995), though sensitivity and specificity information has not yet been established for the BDDQ-A.

The Body Image Questionnaire, Child and Adolescent Version (BIQ-C; Veale, 2009) examines BDD symptoms such as appearance checking, avoidance, and interference. The questionnaire begins with a screening item. If the participant is happy with their appearance and does not want to improve any particular features, they do not answer further items and receive a total score of 0. All other participants rank up to five body areas of concern, then answer twelve items about BDD symptoms with response options ranging from 0 to 8.

Psychometric data have not yet been published for the BIQ-C. Cronbach's alpha for the 12 symptom items was $\alpha = .88$ in the current study.

The child version of the 26-item Eating Attitudes Test (ChEAT-26; Maloney, McGuire, & Daniels, 1988) measures disordered eating attitudes and behaviours. The least problematic responses (*never, rarely, sometimes*) are scored 0, with remaining responses scored 1 (*often*), 2 (*very often*), or 3 (*always*). Good internal consistency has been found in previous adolescent populations (Smolak & Levine, 1994). In the current study, internal consistency was $\alpha = .87$. A ChEAT-26 total score of 20 or above indicates a high risk of clinically significant eating disorder pathology in young people (Maloney et al., 1988).

The Spence Children's Anxiety Scale (SCAS; Spence, 1998) contains 38 items assessing social anxiety, separation anxiety, generalised anxiety, panic/agoraphobia, obsessive-compulsive disorder, and physical injury fears, rated from 0 (*never*) to 3 (*always*). The scale has strong psychometric properties (Spence, Barrett, & Turner, 2003). In this study, total scale internal consistency $\alpha = .93$. Age and sex-specific cut-off scores have been developed from Australian community norms that identify the top 16% of anxiety scores (Spence, *n.d.*).

The Short Mood and Feelings Questionnaire (SMFQ; Angold, Costello, Messer, & Pickles, 1995) measures 13 depressive symptoms from 0 (*not true*) to 2 (*true*). The SMFQ correlates well with diagnostic measures of depression and discriminates between depressed and non-depressed individuals, with a total score > 7 suggesting elevated depressive symptoms (Angold et al., 1995). The measure has been found to have strong internal consistency (Rhew et al., 2010), current study $\alpha = .92$.

Male participants only. The drive for muscularity scale (DMS; McCreary and Sasse, 2000) measures muscularity-driven behaviours and body image concerns. The anabolic steroid use item was omitted (McCreary, Sasse, Saucier, & Dorsch, 2004), so the total score is the mean of the remaining 14 items scored from 1 (*never*) to 6 (*always*). As muscularity concerns are primarily linked to body image dissatisfaction among males (McCreary, 2007),

the DMS was administered to male participants only. The measure has good internal consistency (McCreary et al., 2004), current study $\alpha = .93$.

Two additional measures were administered only at boys' schools due to differences in the design of the two larger studies. The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) assesses emotional symptoms, conduct problems, hyperactivity and peer problems using 20 items scored from 0 (*not true*) to 2 (*certainly true*). These are summed to create a total difficulties scale, in this study, $\alpha = .83$. Age and sex-specific cut-off scores have been developed from Australian community norms that identify the top 10% of responses (Mellor, 2005).

The Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q; Endicott, Nee, Yang, & Wohlberg, 2006) contains 14 items assessing life satisfaction across a range of physical, emotional and social domains. Items are scored from 1 (*very poor*) to 5 (*very good*), the total score is converted to the percentage of the maximum possible score (range 0–100%). The measure shows strong internal consistency and test-retest reliability (Endicott et al., 2006). Current study internal consistency $\alpha = .92$.

Data Analysis

Analyses were conducted using SPSS version 23. Categorical variables were compared between groups using Pearson's chi-square tests or Fisher's exact tests, with odds ratios or Cramer's *V*. Continuous variables were compared between groups using Independent-Samples *t*-tests, with Cohen's *d* as the measure of effect size.

Results

Demographic Characteristics

The demographic characteristics of participants are given in Table 2.1. Compared to the non-BDD group, pBDD participants were older, and more likely to live in 'other' household types, such as blended families or families with non-parent primary caregivers. Further, pBDD participants were less likely to report their mothers had an Oceanian cultural background (e.g. Australian, New Zealander, Melanesian, or Polynesian), and more likely to

report ‘other’ cultural backgrounds (Africa, the Middle East, and the Americas). There was no association between the school attended and BDD prevalence; $\chi^2(1, N = 3,149) = 3.95, p = .684$, Cramer’s $V = .04$.

Prevalence and Presentation of Probable-BDD

Probable-BDD was identified in 55/3,149 participants (1.7%, 95% CI = [1.4, 2.3]). As predicted, there was no difference in pBDD prevalence between males (35/2,000 = 1.8%, 95% CI = [1.3, 2.4]) and females (20/1,149 = 1.7%, 95% CI = [1.1, 2.7]), $\chi^2(1, N = 3,149) = 0.00, p = .985$, odds ratio = 1.00 (95% CI = [0.57, 1.73]). The prevalence of pBDD was higher among adolescents aged 15–18 years (39/1,637 = 2.4%, 95% CI = [1.8, 3.2]) compared to those aged 12–14 years (16/1,512 = 1.1%, 95% CI = [0.7, 1.7]), $\chi^2(1, N = 3,149) = 8.03, p = .005$, odds ratio = 2.28 (95% CI = [1.27, 4.10]).

The 55 pBDD participants most frequently endorsed BDDQ-A items relating to distress (85.5%), followed by avoidance (65.6%), interference with socialising or dating (50.9%), and interference with school or work (21.8%). Most (72.7%) reported thinking about their appearance for one to three hours per day, whereas relatively few (27.3%) spent more than three hours a day. pBDD participants typically reported multiple body areas of concern ($M = 5.3, SD = 2.7$, range = 1–13). The most commonly disliked areas were the skin (63.6%), nose (40.0%), hair (34.5%), muscularity (32.7%), stomach (23.6%), weight (21.8%), height (21.8%) and legs (20.0%).

Comparison between Probable-BDD and Non-BDD Participants

Table 2.2 presents the comparison of BDD symptoms, comorbid symptom, and quality of life between the pBDD and non-BDD groups. Mean symptom scores were significantly higher for pBDD participants than non-BDD participants for all outcome measures. As anticipated, pBDD participants reported significantly higher BIQ-C symptoms of BDD than non-BDD participants. This represented a very large effect size, and is consistent with their categorisation using the BDDQ-A. Large effect sizes were also found for group differences in symptoms of depression, social anxiety, and generalised anxiety, and in measures

administered to males only, for total difficulties, emotional symptoms, peer problems, hyperactivity, drive for muscularity, and reduced quality of life. Post hoc analysis of covariance was conducted examining the association between BDD group and symptom scores, controlling for age, sex, mother's cultural background, and household type. The effect of BDD group remained significant in most analyses, with minor reductions in partial eta squared (details available from the first author upon request). However, BDD group was not a significant predictor of scores on the measure of eating disorder symptoms in the analysis of covariance. In a final set of analysis of covariance models, participant school was added as a covariate, but this resulted in no meaningful difference in the association between BDD group and the independent variables.

Table 2.2 also presents the percentage of participants in each group with elevated scores (where measures had published cut-off scores). The pBDD group experienced significantly higher odds of reporting elevated symptoms across all measures with established cut-off scores, again with the exception of the measure of eating disorders. The highest odds ratios were obtained for symptoms of depression and social anxiety, and, for male participants, emotional symptoms and peer problems.

Past mental health service use was more common for pBDD (40.9%) than non-BDD participants (15.8%), $\chi^2(1, N = 2638) = 20.06, p < .001$, odds ratio 3.69 (95% CI = [2.00, 6.79]). No participants reported BDD or similar concerns among their reasons for accessing services.

Discussion

The current study was the first to examine the prevalence and correlates of probable-BDD (pBDD) in a large, community-based sample of adolescents. The observed pBDD point prevalence (1.7%) is at the lower end of estimates from previous studies in adolescents and adults (Koran et al., 2008; Mayville et al., 1999; Rief et al., 2006). Older adolescents had higher pBDD prevalence than younger adolescents, consistent with reports of mean BDD onset at 16 years (Bjornsson et al., 2013). No sex difference in pBDD prevalence was

observed, consistent with most studies using *DSM-IV* criteria (Buhlmann et al., 2010; Koran et al., 2008; Rief et al., 2006). Therefore, although symptoms of BDD may be more common among females than males (Buhlmann et al., 2010; Mastro et al., 2016), the prevalence of full-syndrome BDD appears to be equal between adolescent males and females.

Most demographic characteristics were similar between BDD groups, though pBDD participants were slightly older, and there were some differences in household type and mothers' cultural background. The number and types of body areas of concern reported by participants in the current study were similar to those observed in clinical adolescent samples (Phillips, Didie, et al., 2006), with skin, facial features, and hair the most common focus of concern. As predicted, pBDD was associated with markedly elevated symptoms of anxiety, depression, obsessive-compulsive disorder and eating disorders and differences between pBDD and non-BDD groups on these measures were not accounted for by age, sex, mothers' cultural background, or household type. Additionally, pBDD participants were more likely to report abnormal or elevated levels of most comorbid symptoms. This is consistent with the high rates of these disorders found in clinical samples of youth with BDD (Albertini & Phillips, 1999; Phillips, Didie, et al., 2006), and the elevated symptoms of depression and social anxiety in adolescents at high risk of BDD in the community (Mastro et al., 2016). However, the likelihood of reporting high risk eating disorder scores was not elevated among pBDD participants in the current study and the association between pBDD and elevated levels of eating disorder symptoms was no longer significant when age, sex, mother's cultural background, and household type, were statistically controlled. These findings may be due, in part, to the use of the BDDQ-A, which excludes individuals with primary weight concerns from the pBDD group.

For the measures administered only to males, pBDD was associated with significantly poorer quality of life, and higher levels of muscularity concerns, emotional symptoms, peer problems, hyperactivity and conduct problems. Quality of life impairment in males with pBDD was notable, with scores similar to young people receiving treatment for major

depressive disorder (Endicott et al., 2006). Though quality of life does not appear to differ between adult males and females with BDD (Phillips, Menard, & Fay, 2006), it is unclear whether this is the case among adolescents.

Rates of prior contact with mental health services were significantly higher for pBDD than for non-BDD participants, although no participant reported BDD as a reason for accessing these services. This mirrors the adult literature, where individuals with BDD typically receive treatment for comorbid mental health problems rather than BDD per se, even when BDD is the most interfering problem (Grant et al., 2001; Veale et al., 2015). As insight among adolescents with BDD may be particularly poor (Phillips, Didie, et al., 2006), mental health professionals should screen for BDD among adolescents with a range of presenting problems, and consider incorporating parent reports when assessing the impact of BDD symptoms.

Limitations

Whereas face-to-face interviews with a structured BDD diagnostic module remains the gold standard for assessment of BDD, epidemiological studies typically demand the use of self-report measures. Hence the current study identified probable cases of BDD. Though the sensitivity and specificity of the BDDQ are strong in adults (Grant et al., 2001; Phillips et al., 1995), this has yet to be established in adolescents. The study began prior to the release of *DSM-5* (APA, 2013), and the BDDQ-A was developed using *DSM-IV* criteria. Automatically excluding participants from a potential BDD diagnosis based on a broad weight concern question is likely to lead to the underestimation of BDD prevalence (Brohede et al., 2015; Koran et al., 2008). As BDD with primary weight concern may be particularly common in female adolescents (Dyl, Kittler, Phillips, & Hunt, 2006), use of this criterion may have resulted in underestimation of pBDD prevalence among female participants in the current study. Data on the SDQ and PQ-LES-Q were not available for females, thus limiting conclusions about associations between BDD status and scores on these measures to males.

Finally, all participating schools were socio-educationally advantaged to some extent, so the generalisability of the findings to less advantaged students is unclear.

Conclusion

This study is the first to have examined pBDD prevalence and correlates in a large community sample of adolescents. The prevalence of pBDD in adolescents is similar to adult samples, and pBDD is associated with substantial distress, impairment in quality of life, and comorbidity with other mental health problems. Further, population-based research is needed to elucidate the prevalence and correlates of BDD in young people and thereby inform prevention and early intervention efforts.

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Table 2.1. Comparison of Demographic Characteristics between Probable-BDD (*n* = 55) and Non-BDD (*n* = 3,094) Participants

Variable	<i>n</i>	pBDD	nBDD	<i>t</i> or χ^2	<i>p</i>	<i>d</i> or <i>V</i>
Age	3,149	15.04 ± 1.17	14.58 ± 1.37	2.88	.006	0.34
ICSEA	3,149	1,089.15 ± 74.28	1,092.55 ± 71.76	-0.35	.723	0.05
Sex (Male)	3,149	35 (63.6)	1,965 (63.5)	0.00	.985	.00
Speak English at home	2,335	36 (90.0)	2,095 (91.3)	^{\$}	.775	.01
Mother Cultural background	2,669			19.77	< .001	.09
Oceanian		7 (15.2)	1,078 (41.1)			
European		21 (45.7)	1,026 (39.1)			
Asian		9 (19.6)	339 (12.9)			
Other		9 (19.6)	180 (6.9)			
Father Cultural Background	2,592			2.15	.541	.03
Oceanian		14 (31.1)	996 (39.1)			
European		24 (53.3)	1,087 (42.7)			
Asian		4 (8.9)	292 (11.5)			
Other		3 (6.7)	172 (6.8)			
Mother Occupation	2,178			2.72	.606	.04
Not in the workforce		9 (23.7)	471 (22.0)			
Manager/skilled professional		21 (55.3)	1,007 (47.1)			
Trade/manual		0 (0.0)	82 (3.8)			
Sales/clerical		5 (13.2)	407 (19.0)			
Community/health		3 (13.2)	173 (8.1)			
Father Occupation	2,144			6.11	.191	.05
Not in the workforce		3 (8.1)	100 (4.7)			
Manager/skilled professional		20 (54.1)	1,153 (54.7)			
Trade/manual		7 (18.9)	569 (27.0)			
Sales/clerical		6 (16.2)	157 (7.5)			
Community/health		1 (2.7)	128 (6.1)			
Household Type	2,333			8.81	.012	.06
Two parent household		27 (67.5)	1,829 (79.8)			
Single parent household		5 (12.5)	293 (12.8)			
Step/blended/other		8 (14.5)	171 (7.5)			

Note. Data are presented as mean ± standard deviation or *n* (valid %). ^{\$} Fisher's exact test reported. *d* = Cohen's *d*. *V* = Cramer's *V*, BDD = Body dysmorphic disorder. pBDD = Probable BDD group. BDD = Non-BDD group. ICSEA = Index of Community Socio-educational advantage

Table 2.2. Symptom Severity and Quality of Life Comparisons between Probable-BDD ($n = 55$) and Non-BDD ($n = 3,094$) Participants

Symptom Measure	n	Mean Scores ($M \pm SD$)				Elevated Scores (%)				
		pBDD	nBDD	t	p	d [95% CI]	pBDD	nBDD	χ^2	OR [95% CI]
All Participants	3,149									
BDD	3,057	46.53 \pm 15.92	14.69 \pm 18.67	13.85	<.001	1.71 [1.42, 1.99]	-	-	-	-
Depression	3,146	12.69 \pm 6.52	5.44 \pm 5.58	9.52	<.001	1.30 [1.03, 1.56]	78.2	27.2	69.36	<.001
Total Anxiety	3,146	37.69 \pm 15.07	23.08 \pm 15.86	6.78	<.001	0.92 [0.65, 1.19]	52.7	17.7	44.20	<.001
Panic/Agoraphobia	3,146	6.15 \pm 5.03	2.73 \pm 3.81	5.01	<.001	0.89 [0.62, 1.16]	47.3	16.9	34.56	<.001
Separation Anxiety	3,146	3.36 \pm 2.24	2.36 \pm 2.46	3.01	.003	0.41 [0.14, 0.68]	38.2	15.3	21.47	<.001
Social Anxiety	3,146	9.38 \pm 3.24	5.95 \pm 3.71	6.82	<.001	0.93 [0.66, 1.19]	65.5	22.9	54.18	<.001
Physical Injury Fears	3,146	3.67 \pm 2.40	2.73 \pm 2.40	2.88	.004	0.39 [0.12, 0.66]	41.8	22.3	11.82	.001
Obsessive-Compulsive	3,146	6.44 \pm 3.69	3.79 \pm 3.45	5.65	<.001	0.77 [0.50, 1.04]	41.8	16.5	24.72	<.001
Generalised Anxiety	3,146	8.67 \pm 3.64	5.52 \pm 3.54	6.54	<.001	0.89 [0.62, 1.16]	50.9	17.5	40.84	<.001
Eating Disorder	2,940	11.94 \pm 8.13	8.39 \pm 9.58	2.58	.010	0.37 [0.09, 0.65]	14.3	9.1	\$.209
Males Participants Only	2,000									
SDQ Total Difficulties	1,994	17.49 \pm 5.04	9.06 \pm 5.69	8.70	<.001	1.34 [1.03, 1.65]	42.9	8.5	\$	<.001
Emotional Symptoms	1,994	4.80 \pm 2.00	1.81 \pm 2.00	8.75	<.001	1.31 [1.00, 1.62]	51.4	12.0	\$	<.001
Peer Problems	1,994	3.63 \pm 2.05	1.78 \pm 1.67	6.47	<.001	0.96 [0.65, 1.27]	48.6	12.7	\$	<.001
Conduct Problems	1,994	3.37 \pm 2.05	1.97 \pm 1.74	4.70	<.001	0.72 [0.41, 1.03]	28.6	9.7	\$.002
Hyperactivity	1,994	5.69 \pm 2.26	3.50 \pm 2.25	5.69	<.001	0.89 [0.58, 1.20]	28.6	12.9	\$.019
Drive for Muscularity	1,929	3.46 \pm 1.21	2.43 \pm 1.12	5.36	<.001	0.93 [0.59, 1.27]	-	-	-	-
Quality of Life [%]	1,787	54.40 \pm 18.91	75.78 \pm 16.47	6.79	<.001	1.27 [0.90, 1.64]	-	-	-	-

Note. [%] Higher scores indicate higher quality of life. ^{\$} Fisher's exact test used. BDD = Body dysmorphic disorder. pBDD = Probable BDD group. nBDD = Non-BDD group.

SDQ = Strengths and difficulties questionnaire. OR = Odds ratio. CI = Confidence interval.

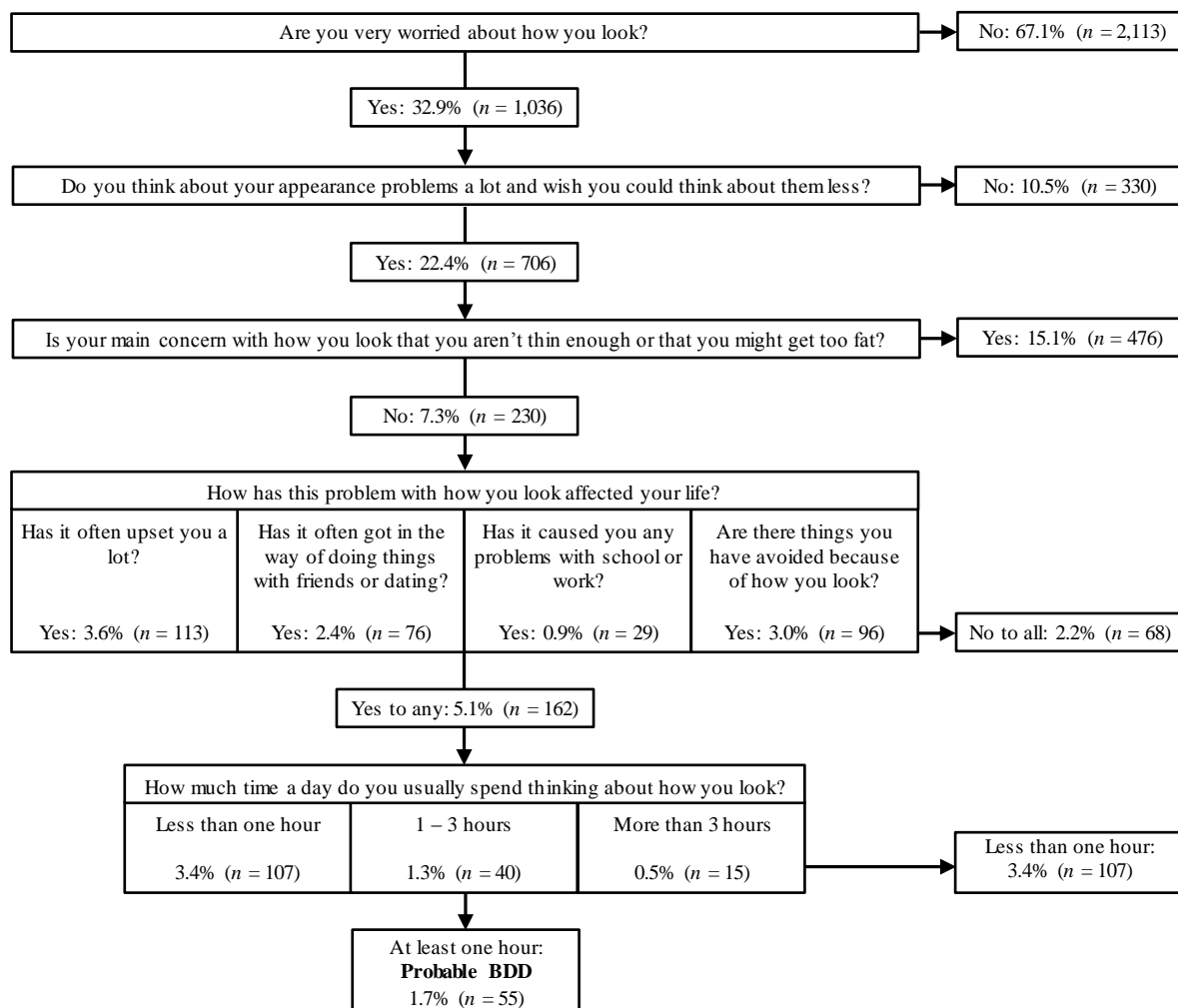


Figure 2.1. Categorisation of Participants Using the Body Dysmorphic Disorder Questionnaire-Adolescent Version (n = 3,149)

The next chapter presents the paper “Subthreshold Body Dysmorphic Disorder in Adolescents: Prevalence and Impact”. Chapter 2 established the prevalence and impact of probable-BDD, however, subthreshold disorders may also be associated with substantial distress and impairment in adolescents. Therefore, the chapter establishes the prevalence of subthreshold BDD in the whole sample, and across sex and age groups. Further, the study explores the relative severity of subthreshold BDD by comparing disorder correlates to those without BDD, and to individuals with probable-BDD. The clinical features of probable-BDD and subthreshold BDD will be explored in depth in Chapter 6.

Chapter 3.

Subthreshold Body Dysmorphic Disorder in Adolescents: Prevalence and Impact

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Abstract

Aims. The current study sought to establish the prevalence of subthreshold body dysmorphic disorder (sBDD) in adolescents, and to compare outcomes of individuals with subthreshold-BDD to those with probable full-syndrome BDD (pBDD) and those without BDD (non-BDD).

Method. Self-report questionnaires assessing *DSM-IV* BDD criteria, past mental health service use, and symptoms of body dysmorphic disorder, anxiety, depression, obsessive-compulsive disorder and eating disorders, were completed by 3,149 Australian high school students ($M_{\text{age}} = 14.6$ years, 63.5% male). Male participants also completed measures assessing quality of life, muscularity concerns, emotional symptoms, conduct problems, hyperactivity, and peer problems.

Results. The prevalence of sBDD was 3.4%. Compared to the non-BDD group, sBDD was associated with elevated symptoms of comorbid psychopathology, greater past mental health service use, and poorer quality of life. Participants with sBDD reported significantly lower mental health service use, and fewer symptoms of depression, eating disorders, and hyperactivity than pBDD participants, however, other comorbid symptoms did not differ significantly between these groups.

Conclusions. Subthreshold BDD is associated with substantial adverse impacts for adolescents in the general community. BDD screening should include subthreshold presentations, and these may be an important target for early intervention programs.

Keywords. Body dysmorphic disorder, subthreshold psychopathology, adolescent, prevalence, comorbidity.

Introduction

Body dysmorphic disorder (BDD) is an obsessive-compulsive spectrum disorder involving preoccupation with perceived defects in appearance (American Psychiatric Association [APA], 2013). BDD typically begins in the adolescent years (Phillips, Menard, Fay, & Weisberg, 2005); it affects 1.7–2.3% of adolescents, prevalence does not appear to differ between adolescent males and females, but is higher in older adolescents than younger adolescents (Chapter 2; Mayville, Katz, Gipson, & Cabral, 1999; Rief, Buhlmann, Wilhelm, Borkenhagen, & Brahler, 2006). In clinical samples, adolescent BDD is associated with high rates of suicidality, functional impairment, and comorbid psychopathology (Albertini & Phillips, 1999; Phillips et al., 2006). Recent community studies have also linked probable cases of adolescent BDD to elevated comorbidity, impaired quality of life, and deficits in social and emotional functioning (Chapter 2; Mastro, Zimmer-Gembeck, Webb, Farrell, & Waters, 2016). Although BDD appears to be a potentially severe disorder in adolescence, little is known about the prevalence and impact of subthreshold-BDD (sBDD).

Subthreshold disorders are symptom presentations associated with significant distress or impairment that do not meet full diagnostic criteria (Pincus, Davis, & McQueen, 1999). In adolescents, subthreshold mental disorders are approximately twice as common as full-syndrome disorders, and constitute a substantial disease burden (Roberts, Fisher, Blake Turner, & Tang, 2015). For example, adolescent subthreshold depression, anxiety, and obsessive-compulsive disorder are linked to increased comorbidity, greater functional impairment, and higher risk of later full-syndrome disorders (Balázs et al., 2013; Haller, Cramer, Lauche, Gass, & Dobos, 2014; Shankman et al., 2009; Wesselhoeft, Sørensen, Heiervang, & Bilenberg, 2013; Wolitzky-Taylor et al., 2014). The only study to examine a subthreshold-like group of adolescents with BDD found those at moderate risk for BDD reported depression symptoms, self-worth, and appearance-related rejection sensitivity at levels intermediate between high-risk and low-risk groups (Mastro et al., 2016). There were similar numbers of adolescents in the high and moderate risk groups (9% vs 8% of the

sample), however, the study did not directly identify those with full-syndrome and subthreshold presentations, so the prevalence of sBDD in adolescents remains uncertain.

The current study aimed to establish the prevalence of sBDD in a large community sample of adolescents. It also sought to examine the impact of sBDD by comparing outcomes both to those with probable full-syndrome BDD (referred to as pBDD), and those without BDD (non-BDD). It was hypothesised that sBDD would be elevated in older adolescents compared to younger adolescents, and that no significant sex difference in prevalence would be observed. Further, it was hypothesised that the sBDD group would report increased symptoms of anxiety, depression, obsessive-compulsive disorder, and eating disorders, and greater past mental health service use, when compared with the non-BDD group. It was also hypothesised that the sBDD group would report lower levels of anxiety, depression, obsessive-compulsive disorder, and eating disorder symptoms, and lower past mental health service use, than those with pBDD. Due to the nature of the recruitment methods, outlined below, a number of measures were administered to male participants only, and therefore the final hypotheses are specific to male participants. It was hypothesised that adolescent males with sBDD would have poorer outcomes on measures of quality of life, muscularity concerns, emotional symptoms, peer problems, conduct problems, and hyperactivity, than non-BDD males, and better outcomes on these measures than pBDD males.

Method

Participants and procedure

Participants were recruited from seven high schools in New South Wales, Australia, involved in two larger studies examining anxiety and depression in adolescents. Of 5,005 eligible students, 3,149 (62.9%) consented and took part in the current study; 2,000 (63.5%) male, mean age 14.58 years ($SD = 1.4$, range = 12–18). Full information about study participants and procedures are available elsewhere (Chapter 2). Briefly, assessment sessions took place in class or year groups during school time, supervised by members of the research team, and teachers where available. Responses were collected confidentially using de-

identified alphanumeric codes and participants were informed that the breaking of confidentiality would be considered only if their questionnaire responses indicated serious risk of harm, such as current suicidal ideation or evidence of abuse. The research was approved by the Human Research Ethics Committee of Macquarie University. Approval was also granted by each school and their relevant governing body. Information about the study was provided directly to parents and students, and informed consent and assent were obtained.

Measures

All participants. The Body Dysmorphic Disorder Questionnaire-Adolescent Version (BDDQ-A; Phillips, 2005) assesses *DSM-IV* criteria for BDD; appearance preoccupation, distress, and impairment (APA, 1994). Participants indicate the body areas of concern and the nature of any associated impairment. Time spent thinking about appearance per day is also assessed, with duration of at least one hour required to indicate BDD. The adult BDDQ has good sensitivity and specificity (Grant, Kim, & Crow, 2001; Phillips, Atala, & Pope, 1995), but psychometric data are not available for the BDDQ-A.

BDDQ-A responses were used to determine BDD group membership. Individuals who were very preoccupied with appearance, experienced related distress or impairment, and were not primarily concerned about weight were classified as *pBDD* if they thought about their appearance for at least one hour per day, or *sBDD* if they spent less than one hour per day thinking about appearance. All remaining participants were classified as *non-BDD*.

The Body Image Questionnaire, Child and Adolescent Version (BIQ-C; Veale, 2009) examines BDD symptoms including appearance checking, distress, avoidance, and impairment. The questionnaire begins with a screening item asking about the presence of any appearance concerns. If the participant does not report any concerns, they are given a total score of 0 and do not answer further items. Those with appearance concerns rank up to five body areas from most to least concerning. Twelve items then assess the nature and impact of appearance concerns, with varying response options scored 0 to 8. Current study internal consistency (Cronbach's alpha) of the 12 symptom items was $\alpha = .88$.

The child version of the 26-item Eating Attitudes Test (ChEAT-26; Maloney, McGuire, & Daniels, 1988) measures disordered eating attitudes and behaviours. The least problematic responses (*never, rarely, sometimes*) are scored 0, the remaining responses scored as 1 (*often*), 2 (*very often*), or 3 (*always*). In the current study, internal consistency was $\alpha = .87$.

The Spence Children's Anxiety Scale (SCAS; Spence, 1998) contains 38 items assessing social anxiety, separation anxiety, generalised anxiety, panic-agoraphobia, obsessive-compulsive disorder, and physical injury fears, scored 0 (*never*) to 3 (*always*). In the current study, total scale internal consistency was $\alpha = .93$.

The Short Mood and Feelings Questionnaire (SMFQ; Angold, Costello, Messer, & Pickles, 1995) assesses depression symptoms over the past two weeks. This 13 item measure is scored from 0 (*not true*) to 2 (*true*). Current study total internal consistency was $\alpha = .92$.

A screening item was included to assess whether participants had ever received assessment or treatment for any mental health concerns. If so, they were asked to indicate the type of mental health professionals consulted (psychologist/psychiatrist/school counsellor/other), and to briefly describe their reasons for seeking treatment.

Male participants. The drive for muscularity scale (DMS; McCreary & Sasse, 2000) is a 15 item measure of muscularity-driven behaviours and body image concerns from 1 (*never*) to 6 (*always*), the total score is the mean of all items. The item assessing anabolic steroid use was omitted. As muscularity concerns are linked primarily to body image dissatisfaction in males (McCreary, 2007), the DMS was administered to male participants only. Current study internal consistency was $\alpha = .93$ (males only).

Two additional measures were completed by male participants only due to differences in study design between male and female schools. The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) measures emotional symptoms, conduct problems, hyperactivity and peer problems over 20 items, rated 0 (*not true*) to 2 (*certainly true*). A total

difficulties score is the sum of these items, and in this study, internal consistency $\alpha = .83$ (males only).

The Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q; Endicott, Nee, Yang, & Wohlberg, 2006), uses 14 items to assess quality of life across physical, emotional and social domains. Items are scored from 1 (*very poor*) to 5 (*very good*), and the total score (range 14–70) is converted to the percentage of the maximum possible score (range 0–100%). Internal consistency for the current study was $\alpha = .92$ (males only).

Statistical analyses

Analyses were performed using SPSS version 23. Pearson's chi-square was used for categorical variables, with Cramer's V or odds ratio as measures of effect size. Analysis of variance (ANOVA) was used to compare continuous variables between groups, with eta square effect size. Games-Howell pairwise comparisons were selected due to group size differences and unknown population variances (Field, 2013).

Results

Of the 3,149 participants, 107 (3.4%) were classified as sBDD, 55 (1.7%) as pBDD, and the remaining 2,987 (94.9%) as non-BDD. Table 3.1 presents the demographic characteristics of each group. Pairwise comparisons indicated that the pBDD group was significantly older than the non-BDD group, whereas the sBDD group did not differ from either of the other groups with respect to age. Chi-square tests indicated that mother's cultural background also differed between groups; non-BDD participants more likely to report an Oceanian background whereas pBDD participants reported higher rates of 'other' cultural background and lower rates of Oceanian backgrounds. Finally, both the sBDD and pBDD groups were more likely than non-BDD participants to live in an 'other' household type, which included step and blended families, and families with non-parent primary caregivers. There were no other differences between groups on demographic variables and no association between the school attended and BDD group membership; $\chi^2 (1, N = 3,149) = 18.54, p = .100$, Cramer's $V = .05$.

Comparisons of sBDD prevalence across age and gender were conducted after excluding the 55 participants with probable-BDD (see Table 3.2). As hypothesised, sBDD prevalence was higher in older adolescents than in younger adolescents. Contrary to expectations, prevalence was also elevated in female participants compared to males.

Table 3.3 presents the ANOVAs comparing quality of life and comorbid psychopathology between the sBDD, pBDD and non-BDD groups. Participants with sBDD reported higher levels of all comorbid symptoms than non-BDD participants, except for eating disorder symptoms as measured by the ChEAT-26. Comparisons between sBDD and pBDD participants were mixed. For the total sample, symptoms of BDD, depression and eating disorders were lower in the sBDD group, whereas symptoms of anxiety did not differ between subthreshold and pBDD groups. In males, SDQ total difficulties and hyperactivity were lower in the sBDD group than the pBDD group, whereas scores of measures of quality of life, muscularity concerns, and other SDQ subscales did not differ between these groups.

Comparisons between groups on each outcome measure were repeated controlling for age, mothers' cultural background, family setting, and sex (where applicable). BDD group remained a significant predictor in these models with little change in partial eta squared, except for eating disorder symptoms, which were no longer predicted by BDD group (details available from the first author upon request). In a final set of analysis of covariance models, participant school was added as a covariate, but this resulted in no meaningful difference in the association between BDD group and the independent variables.

Mental health service use was more common in sBDD (24.7%) than non-BDD participants (14.7%), $\chi^2 (1, N = 2555) = 10.56, p = .001$, odds ratio = 1.90 (95% CI: [1.28, 2.81]), but lower in sBDD participants (24.7%) than in pBDD (45.8%), $\chi^2 (1, N = 229) = 10.80, p = .001$, odds ratio = 2.58 (95% CI: [1.46, 4.58]).

Discussion

The current study aimed to establish the prevalence and impact of subthreshold-BDD in a community sample of adolescents. The prevalence of sBDD (3.4%) was twice as high as

the prevalence of pBDD observed in a previous study of this sample (1.7%; Chapter 2). As hypothesised, sBDD prevalence was significantly higher in older adolescents (15–18 years) compared to younger adolescents (12–14 years). This is consistent with adult reports that the mean age of BDD onset is 16 years, and BDD symptoms are usually present from the age of 13 (Phillips et al., 2005). Contrary to hypotheses, sBDD was significantly more prevalent in females than in males. Though studies of the prevalence of full-syndrome BDD often fail to find significant sex differences (Buhlmann et al., 2010; Chapter 2; Koran, Aboujaoude, Large, & Serpe, 2008; Mayville et al., 1999; Rief et al., 2006), higher female prevalence has been reported in adult samples (Boroughs, Krawczyk, & Thompson, 2010; Schieber, Kollei, de Zwaan, & Martin, 2015), and females were overrepresented in a study of adolescents at high risk for BDD (Mastro et al., 2016).

The sBDD group reported increased past mental health service use, and higher symptoms of anxiety, depression, and obsessive-compulsive symptoms compared to the non-BDD group. The male-only measures followed the same pattern; greater quality of life impairment, emotional symptoms, conduct problems, hyperactivity, peer problems, and muscularity concerns were higher in the sBDD group than the non-BDD group. The only exception was eating disorder symptoms, which did not differ between sBDD and non-BDD participants. This finding may reflect, in part, the use of the BDDQ-A, as this measure excludes individuals with primary weight concerns from the subthreshold-BDD and probable-BDD groups (Phillips, 2005).

Contrary to hypotheses, the severity of some comorbid symptoms did not differ significantly between sBDD and pBDD groups. There was no difference in any anxiety symptoms, and in males, no difference in emotional symptoms, conduct problems, peer problems, muscularity concerns, or quality of life. However, compared to pBDD, sBDD was associated with relatively lower use of mental health services, lower symptoms of BDD, depression, and eating disorders, and, in males, lower SDQ total difficulties and hyperactivity.

Subthreshold and full-syndrome BDD presentations were similar in several important outcomes, but pBDD was associated with increased difficulties in some domains.

The current findings indicate that distressing or impairing BDD concerns that do not meet full criteria for BDD are relatively common in adolescents, and these are more common in females and in older adolescents. The association between sBDD in adolescents and increased impairment and comorbidity, albeit less severe than that associated with pBDD on some outcomes, is consistent with findings from studies of other subthreshold disorders (for example, depression and anxiety; Balázs et al., 2013), and from a study of those at moderate risk of BDD (Mastro et al., 2016). Taken together, this suggests that sBDD does not represent a normal level of appearance concern, and that early intervention for BDD should include the identification of subthreshold presentations.

The detection of sBDD in adolescence may open new pathways for BDD treatment, as adult research indicates that subthreshold symptoms may respond to non-BDD focused treatments such as attentional retraining or cognitive behavioural therapy for social anxiety (Fang, Sawyer, Aderka, & Hofmann, 2013). Additionally, internet-delivered CBT with minimal therapist support is an effective treatment for those with milder BDD presentations (Enander et al., 2016). Low-intensity treatments for subthreshold or mild BDD in adolescence may be beneficial both in increasing the availability of low cost treatment at the early stages of the disorder and in preventing the escalation of sBDD into a full-syndrome presentation.

Some limitations to the current study should be acknowledged. Though the adult version of the BDDQ-A has good sensitivity and specificity (Grant et al., 2001), this has not been established in adolescents. There is a strong correspondence between BDD prevalence estimates using *DSM-IV* and *DSM-5* criteria (Schieber et al., 2015), but future studies should directly evaluate the effect of *DSM-5* criteria on adolescent BDD prevalence. Female participants did not complete certain measures due to differences in larger study methods for males and females in the current study. The impact on quality of life and emotional, conduct and peer-interaction problems in females require examination in future research. It would be

valuable to study the initial emergence of subthreshold BDD in longitudinal research to accurately determine the typical age of onset, the stability of these symptoms, and the risk of escalation into probable-BDD. Generalisability of study findings to less advantaged populations is uncertain, and should be explored further.

In conclusion, sBDD in adolescence is associated with increased mental health service use, greater comorbid psychopathology, and reduced quality of life, though the impact of sBDD is less severe than pBDD on some measures. Further research is required to explore sBDD in more diverse adolescent populations, to establish the longitudinal trajectories of these symptoms, and to evaluate the potential of early intervention for sBDD to alter the course or reduce the severity of BDD presentations.

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Table 3.1. Comparison of Demographic Characteristics between Subthreshold-BDD (*n* = 107), Probable-BDD (*n* = 55) and

Non-BDD (*n* = 2,987) Participants

Variable	<i>N</i>	Subthreshold-BDD	Probable-BDD ⁺	Non-BDD	<i>F</i> or χ^2	<i>p</i>	η^2 or Cramer's <i>V</i>
Age	3,149	14.77 ± 1.40	15.04 ± 1.17	14.57 ± 1.37	4.15	.016	0.00
ICSEA	3,149	1,098.96 ± 71.14	1,089.15 ± 74.28	1,092.33 ± 70.75	0.52	.597	0.00
Sex (Male)	3,149	58 (54.2)	35 (63.6)	1,907 (63.8)	4.14	.126	.04
Speak English at home	2,335	74 (90.2)	36 (90.0)	2,021 (91.3)	0.20	.906	.01
Mother Cultural Background	2,669				26.06	<.001	.07
Oceanian		31 (31.6)	7 (15.2)	1,047 (41.5)			
European		47 (48.0)	21 (45.7)	979 (38.8)			
Asian		16 (16.3)	9 (19.6)	323 (12.8)			
Other		4 (4.1)	9 (19.6)	176 (7.0)			
Father Cultural Background	2,592				6.52	.367	.04
Oceanian		30 (31.6)	14 (31.1)	966 (39.4)			
European		47 (49.5)	24 (53.3)	1,040 (42.4)			
Asian		14 (14.7)	4 (8.9)	278 (11.3)			
Other		4 (4.2)	3 (6.7)	168 (6.9)			
Occupation of Mother	2,178				14.34	.073	.06
Not in the workforce		11 (14.3)	9 (23.7)	460 (22.3)			
Manager/skilled professional		45 (58.4)	21 (55.3)	962 (46.6)			

Trade/manual	2 (2.6)	0 (0.0)	80 (3.9)			
Sales/clerical	8 (10.4)	5 (13.2)	399 (19.3)			
Community/health	11 (14.3)	3 (13.2)	162 (7.9)			
Occupation of Father	2,144			\$	\$	\$
Not in the workforce	4 (5.4)	3 (8.1)	96 (4.7)			
Manager/skilled professional	45 (60.8)	20 (54.1)	1,108 (54.5)			
Trade/manual	11 (14.9)	7 (18.9)	558 (27.4)			
Sales/clerical	8 (10.8)	6 (16.2)	149 (7.3)			
Community/health	6 (8.1)	1 (2.7)	122 (6.0)			
Household Type	2,333			13.44	.009	.05
Two parent household	63 (78.6)	27 (67.5)	1,766 (79.9)			
Single parent household	8 (9.8)	5 (12.5)	285 (12.9)			
Step/blended/other household	11 (13.4)	8 (14.5)	160 (7.2)			

Note. Data are presented as mean \pm standard deviation or n (valid %). ^{\$} Could not be calculated due to low expected cell counts.

Abbreviations. BDD = Body dysmorphic disorder. ICSEA = Index of Community Socio-educational advantage.

⁺ Data has been reported elsewhere.

Table 3.2. Prevalence of Subthreshold Body Dysmorphic Disorder by Age and Sex

Group	N	Subthreshold-BDD		Non-BDD		χ^2	p	OR [95% CI]
		n (%)	95% CI	n (%)	95% CI			
Total	3,094	107 (3.4)	2.8, 4.1	2,987 (94.9)	64.0, 95.6			
Age						4.47	.035	1.53 [1.03, 2.27]
12–14 years	1,496	41 (2.7)	2.0, 3.7	1,455 (96.2)	95.2, 97.1			
15–18 years	1,598	66 (4.0)	3.2, 5.1	1,532 (93.6)	92.3, 94.7			
Sex						4.14	.042	1.49 [1.01, 2.20]
Male	1,965	58 (2.9)	2.2, 3.7	1,907 (95.4)	94.3, 96.2			
Female	1,129	49 (4.3)	3.2, 5.6	1,080 (94.0)	92.5, 95.2			

Note. Probable-BDD participants were excluded from these analyses BDD = Body dysmorphic disorder. OR = Odds Ratio.

CI = Confidence interval.

Table 3.3. Comparison of Symptom Severity and Quality of Life between Subthreshold-BDD ($n = 107$), Probable-BDD ($n = 55$) and Non-BDD ($n = 2,987$) Participants

Symptom Measure	<i>N</i>	Subthreshold-BDD	Probable- BDD ⁺	Non-BDD	ANOVA
All Participants	3,149				
BDD	3,057	35.74 ± 14.79	46.53 ± 15.92	13.97 ± 18.37	$F(2, 91.31)^{\S} = 141.83, p < .001, \eta^2 = .09$
Depression	3,146	9.97 ± 5.76	12.69 ± 6.52	5.28 ± 5.50	$F(2, 3,143) = 83.55, p < .001, \eta^2 = .05$
Total Anxiety	3,146	34.06 ± 15.54	37.69 ± 15.07	22.68 ± 15.72	$F(2, 3,143) = 50.44, p < .001, \eta^2 = .03$
Panic/Agoraphobia	3,146	4.66 ± 4.45	6.15 ± 5.03	2.66 ± 3.77	$F(2, 98.33)^{\S} = 23.13, p < .001, \eta^2 = .02$
Separation Anxiety	3,146	3.36 ± 2.59	3.36 ± 2.24	2.32 ± 2.45	$F(2, 3,143) = 13.73, p < .001, \eta^2 = .01$
Social Anxiety	3,146	8.68 ± 3.53	9.38 ± 3.24	5.85 ± 3.67	$F(2, 3,143) = 54.46, p < .001, \eta^2 = .03$
Physical Injury Fears	3,146	3.51 ± 2.63	3.67 ± 2.40	2.70 ± 2.39	$F(2, 3,143) = 10.05, p < .001, \eta^2 = .01$
Obsessive-Compulsive	3,146	5.37 ± 3.43	6.44 ± 3.69	3.73 ± 3.43	$F(2, 3,143) = 27.90, p < .001, \eta^2 = .02$
Generalised Anxiety	3,146	8.48 ± 3.91	8.67 ± 3.64	5.41 ± 3.48	$F(2, 3,143) = 61.54, p < .001, \eta^2 = .04$
Eating Disorder	2,940	8.33 ± 6.39	11.94 ± 8.13	8.39 ± 9.67	$F(2, 90.92)^{\S} = 3.33, p = .036, \eta^2 = .00$
Male Participants Only	2,000				
SDQ Total Difficulties	1,994	14.28 ± 6.15	17.49 ± 5.04	8.90 ± 5.60	$F(2, 1,991) = 64.59, p < .001, \eta^2 = .06$
Emotional Symptoms	1,994	3.84 ± 2.35	4.80 ± 2.00	1.75 ± 1.96	$F(2, 58.92)^{\S} = 60.81, p < .001, \eta^2 = .07$
Conduct Problems	1,994	3.03 ± 2.26	3.37 ± 2.05	1.94 ± 1.71	$F(2, 58.44)^{\S} = 14.75, p < .001, \eta^2 = .02$
Hyperactivity	1,994	4.50 ± 2.35	5.69 ± 2.26	3.47 ± 2.24	$F(2, 1,991) = 22.17, p < .001, \eta^2 = .02$
Peer Problems	1,994	2.90 ± 2.02	3.63 ± 2.05	1.74 ± 1.65	$F(2, 58.48)^{\S} = 23.32, p < .001, \eta^2 = .03$
Drive for Muscularity	1,929	3.17 ± 1.01	3.46 ± 1.21	2.41 ± 1.11	$F(2, 1,926) = 26.40, p < .001, \eta^2 = .03$
Quality of Life [%]	1,709	64.11 ± 18.57	54.40 ± 18.91	76.07 ± 16.32	$F(2, 1,706) = 33.96, p < .001, \eta^2 = .04$

Note. Bold text indicates a significant pairwise comparison to the subthreshold-BDD group. Data presented as mean ± standard deviation. [%] Higher scores indicate higher quality of life § Welch's Adjusted F reported. + Data have been reported elsewhere. BDD = Body dysmorphic disorder. SDQ = Strengths and Difficulties Questionnaire

The next paper examines issues in the measurement of BDD symptoms across the whole sample, in “Measurement Invariance of a Body Dysmorphic Disorder Symptom Questionnaire across Sex: The Body Image Questionnaire-Child and Adolescent Version”. Chapters 2 and 3 found that 5.1% of the sample reported probable-BDD or subthreshold BDD, and that this was associated with a range of negative outcomes. A core question within the thesis is the potential for sex differences in BDD symptoms, however, before this can be tested it must be established that the measurement instrument does not perform differently between males and females. To address this issue, the following paper examines the cross-sex measurement invariance of a BDD symptom measure in the whole sample. The chapter also presents information about the distribution of BDD symptom scores in males and females, and implications for the use of cut-off scores in continuously scored measures.

Chapter 4.

Measurement Invariance of a Body Dysmorphic Disorder Symptom Questionnaire across Sex: The Body Image Questionnaire-Child and Adolescent Version

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Abstract

Aims. Measures of body dysmorphic disorder (BDD) symptoms have received little psychometric evaluation in adolescent samples. This study aimed to examine cross-sex measurement invariance in the Body Image Questionnaire-Child and Adolescent Version (BIQ-C) to establish whether observed sex differences in total scores may be meaningful or due to differences in measurement properties.

Method. A sample of 3,057 Australian high school students completed the initial screening item of the measure (63.2% male, $M_{\text{age}} = 14.58$, $SD = 1.37$). Of these participants, 1512 (49.5%) reported appearance concerns and completed the full measure.

Results. Partial scalar measurement invariance was established among a revised two-factor, 9-item version of the BIQ-C (BIQ-C-9). Females reported significantly greater latent factor variance, higher BIQ-C-9 total and factor scores, and higher scores on most individual BIQ-C-9 items.

Conclusions. The measure can be used with caution to compare BDD symptoms between male and female adolescents, though sex-specific cut-off scores should be used.

Keywords. Body dysmorphic disorder, measurement invariance, sex differences, adolescent, screening.

Introduction

Body dysmorphic disorder (BDD) is a mental disorder, often severe, involving excessive preoccupation with perceived flaws in appearance (American Psychiatric Association, 2013). Although BDD typically begins during the adolescent years (Bjornsson et al., 2013), few studies have investigated BDD during this developmental period. Limited evidence suggests that adolescent females report higher levels of BDD symptoms than males (Mayville, Katz, Gipson, & Cabral, 1999), and are more likely to report high-risk BDD symptom scores (Mastro, Zimmer-Gembeck, Webb, Farrell, & Waters, 2016). However, caution is needed when interpreting these findings, as the studies did not use measures with demonstrated psychometric equivalence between males and females. If the measure functions differently in males and females, observed group differences may reflect measurement problems, not true sex differences. Establishing the cross-sex measurement invariance of an instrument is necessary before observed sex differences can be properly interpreted.

Evaluation of Cross-Sex Measurement Invariance

Measurement invariance is an attribute of a test where the psychometric properties are known to be equivalent between the groups of interest, for example, males and females. When measurement invariance is demonstrated in a test, observed total scores can be compared meaningfully across groups (Byrne, Shavelson, & Muthén, 1989). Measurement invariance testing involves placing increasingly restrictive equality constraints on families of parameters using multi-group confirmatory factor analysis, and determining whether the addition of each constraint results in a model with significantly poorer fit than the previous less constrained model (Brown, 2015). A poorer model fit indicates that the parameter of interest does vary meaningfully between the groups of interest, in this case, between males and females.

Measurement invariance testing follows a set order. Firstly, *configural invariance* establishes that the same factor structure fits both groups. Secondly, *metric invariance* examines equality of factor loadings, to establish whether latent factors have the same meaning across the groups. Finally, *scalar invariance* tests equality of indicator intercepts, to

establish whether levels of the latent factors have the same meaning across groups (Brown, 2015). Scalar invariance indicates that group differences in latent scores are not driven by measurement differences, thus groups can be meaningfully compared using composite total or factor scores from the measure. Conversely, a failure to demonstrate scalar invariance indicates that composite scores from measure are biased, and should not be used to compare groups. Byrne (2013) recommends additional testing of *the equality of item covariances* in models that allow covariance of specific items. Additionally, if invariance testing results in a poorer fitting model, it is possible to identify partial invariance models where a small number of individual parameters are allowed to vary (Byrne, 2013).

If a measure is found to have full or partial scalar invariance, additional tests can be conducted that assess *population heterogeneity*, exploring characteristics of the sample population itself. *Equality of factor variances* examines whether the within-group variability of the latent factor is different between groups. *Equality of factor covariances* is tested in models with more than one factor to determine whether there are between-group differences in the strength of the relationship between latent variables, and in turn, whether the *equality of latent means* can be established.

No prior study has examined cross-sex measurement invariance of BDD measures in adolescents. However, a recent study found scalar noninvariance in the Japanese version of the Body Image Concern Inventory in adults, indicating a systematic sex bias in the measure (Tanaka, Tayama, & Arimura, 2015). Studies of measurement invariance of body image measures in adolescents have found mixed results. The Body Image Avoidance Questionnaire demonstrated scalar measurement invariance in French adolescents, thus it can be used to compare scores between males and females (Maïano, Morin, Monthuy-Blanc, & Garbarino, 2009). A study examining two factors of the Eating Disorder Inventory in Spanish adolescents found scalar invariance among the drive to thinness factor, and partial scalar invariance of the body dissatisfaction factor (Elosua & Hermosilla, 2013). These studies highlight the potential for systematic sex biases in measures assessing diverse aspects of body image, and thus, the

need for cross-sex measurement to be established in measures prior to comparing scores between males and females.

Selection of a Body Dysmorphic Disorder Symptom Measure

The Body Image Questionnaire-Child and Adolescent version (BIQ-C; Veale, 2009b) was selected for evaluation in the current study as it is free, available online, assesses a range of BDD symptoms, is relatively brief, and uses language appropriate for adolescents. Other BDD measures contained terms that may cause confusion in this population, such as ‘brooding’ (the Appearance Anxiety Inventory; Veale et al., 2014), and ‘misshapen’ (the Dysmorphic Concern Questionnaire; Oosthuizen, Lambert, & Castle, 1998). Further, the BIQ-C reduces participant burden by using an initial screening item, such that participants who do not have appearance concerns do not complete the remaining items. If any concerns are present, the participant describes up to five body areas of concern and then completes 12 items assessing a range of core BDD symptoms such as preoccupation, distress, avoidance, and interference.

The only psychometric information about the BIQ-C comes from previous studies by our research team, conducted in the same population-based sample of adolescents employed in the current study (Chapter 2; Chapter 3). The internal consistency of the 12 BIQ-C symptom items was good (Cronbach’s $\alpha = .88$), and total scores were highest in adolescents who screened positive for BDD using the Body Dysmorphic Disorder Questionnaire-Adolescent Version (Phillips, 2005), intermediate in a group with subthreshold BDD, and lowest in a non-BDD group (Chapter 3). Despite limited information about the BIQ-C, the adult version of the BIQ-C (the BIQ; Veale, 2009a) has been evaluated as a screening measure in adults seeking cosmetic procedures (Veale et al., 2012a). Veale and colleagues identified 9 out of 16 BIQ items that differed significantly between adults with BDD and those from a general community sample, and that did not show a significant group by sex interaction. These 9 items formed the cosmetic procedures screening questionnaire (COPS), and were found to have good internal consistency ($\alpha = .86-.91$), good test-retest reliability,

moderate to good corrected item-total correlations ($r = .41-.86$), and evidence of single-factor structure (Veale et al., 2012a). In addition, there was good convergent validity with measures of BDD symptom severity, body image quality of life, depression, and anxiety (Veale et al., 2012a; Veale et al., 2014). A cut-off value ≥ 40 differentiated between those diagnosed with BDD and community controls with a sensitivity of 88.9% and a specificity of 80.6%.

The COPS is a promising measure for the assessment of BDD symptoms in adults, however, it is unclear to what extent these findings can be extended to the BIQ-C. As the BIQ-C has not been evaluated in a community sample, it is also unclear whether all 12 items should be retained, or reduced to a 9-item version analogous to the COPS.

The Current Study

The primary aim of the current study was to establish the cross-sex measurement invariance of the BIQ-C, in order to determine its suitability for the assessment of BDD symptoms in adolescent males and females, and if scalar invariance was established, to explore sex differences in BIQ-C scores. The secondary aim was to examine the psychometric properties of the 12-item and 9-item version of the BIQ-C to determine if either version has superior psychometric properties.

Method

Participants

Participants were recruited from a convenience sample of seven high schools in New South Wales, Australia, as part of two larger studies of anxiety and depression in adolescents. Data presented here are from the initial stages of these larger studies. Data from these participants has been reported in previous studies of the prevalence and correlates of BDD (Chapter 2; & Chapter 3). Of the 5,005 students enrolled in eligible school grades at the time of testing, 3,057 (response rate of 61.1%) both consented and provided a valid response to the BIQ-C.

Of these 3,057 eligible participants, 1,931 (63.2%) were male, with a mean age of 14.58 years ($SD = 1.37$). The socio-educational advantage of participants' schools was

assessed using the index of community socio-educational advantage (ICSEA; Australian Curriculum and Assessment Reporting Authority, 2013). This indicated that participants attended schools with above average socio-educational advantage (current study ICSEA; $M = 1092.46$, $SD = 70.81$, range = 1002.00–1201.00, ICSEA of all Australian schools; $M = 1,000.00$, $SD = 100.00$).

Additional demographic questions were answered by a subset of participants ($n = 2593$, 84.8%). Of these participants, English was the main language spoken at home (91.3%), most lived in a two-parent home (79.6%), and the cultural background of their parents was predominantly Oceanian (e.g. Australian, New Zealander, Melanesian, or Polynesian; mothers = 40.7%, fathers = 39.0%) or European (mothers = 39.0%, fathers = 42.7%).

Measure

The Body Image Questionnaire-Child and Adolescent Version (BIQ-C; Veale, 2009b) begins with a screening item assessing whether the individual is happy with their appearance and if they want to change any part of their appearance. Those who report no appearance concerns do not answer any further questions. Individuals with appearance concerns are next asked to describe up to five body areas that they dislike the most, and to draw a pie chart to indicate how worried they are about each feature. The pie chart was excluded from the current study, as this question type was not available on the online survey platform used. The next item asks about how long the participant spends thinking about their appearance each day. The following 12 items (items 3–14) assess a range of BDD symptoms, including distress, preoccupation, and interference. These items are scored from 0–8 with value labels specific to the item. For example, an item assessing distress is scored from 0 (*not at all distressing*) to 8 (*extremely distressing*). Reverse scoring is used for three items (items 3, 4, and 6). The BIQ-C total score is calculated by summing items 3–14, and scores range from 0–96. In the current study, BIQ-C total score Cronbach's $\alpha = .86$ in males, and $\alpha = .89$ in females.

Procedure

Questionnaires were completed during class time, under the supervision of members of the research team. Responses were collected using de-identified alphanumeric codes and participants were informed that their responses were confidential unless there was evidence of serious risk of harm, for example, current suicidal ideation. The research was approved by the Human Research Ethics Committee of Macquarie University and by the governing body of each school. Participants provided consent to involvement in the larger study of emotional health. Written information and consent forms were provided to parents and information about the program was provided directly to students in class groups or assemblies. At boys' schools, parents filled in a form to opt out if they did not wish to participate. If parents did not opt out, an online consent form was provided to all students to give active consent. At girls' schools, parents provided written consent to opt in to the research. Students at these schools then had the opportunity to opt out of testing verbally.

Data Analysis

Confirmatory factor analysis (CFA) was used to identify a baseline model with the best fit for males and females. As BIQ-C items have nine response options and the data were not normally distributed, robust maximum likelihood (MLR) estimation with Satorra-Bentler scaled chi-square ($SB\chi^2$) was deemed appropriate (Rhemtulla, Brosseau-Liard, & Savalei, 2012). Evaluation of model goodness-of-fit used the criteria of Hu and Bentler (1999) supplemented by Brown (2015); root mean-square error of estimation (RMSEA) $\leq .06$ indicated good fit ($\leq .08$ adequate), comparative fit index (CFI) and Tucker-Lewis index (TLI) $\geq .95$ indicated good fit ($\geq .90$ adequate), and standardised root mean-square residual (SRMR) $\leq .08$ indicated good fit.

Measurement invariance was established using multi-group CFA of the best-fitting baseline BIQ-C model in males and females. Following Byrne (2013), we examined configural invariance, metric invariance, and scalar invariance. If the baseline model included item covariances, the equality of item covariances was then examined. If a model with full or

partial scalar invariance was identified, the following tests of population heterogeneity were evaluated; the equality of factor variance, equality of factor covariances, and equality of latent means.

To evaluate the results of measurement invariance testing, we followed the recommendations of Sass, Schmitt, and Marsh (2014). Firstly, chi-square difference testing ($\Delta\chi^2$) was used to assess the change in overall model fit in nested models, with a non-significant $\Delta\chi^2$ test indicated an acceptable fit of the more constrained model. This was supplemented by the change in approximate fit indices (ΔAFI), which assesses incremental changes in fit in nested models. Measurement invariance indicated by $\Delta\text{CFI} > -.01$, $\Delta\text{RMSEA} < .015$, and $\Delta\text{SRMR} < .03$ for tests of factor loading invariance, and $\Delta\text{SRMR} < 0.01$ for tests of intercept invariance (Chen, 2007). As MLR estimation was used, calculation of $\Delta\text{SB}\chi^2$ was conducted following the procedures of Muthén and Muthén (n.d.).

When comparing BIQ-C scores or groupings between males and females, independent samples t-tests with Cohen's d effect size were used for continuous variables and Pearson's chi-square tests with odds ratios for categorical variables. The distribution of total scores was examined using t-scores, standardised scores with $M = 50$ and $SD = 10$, calculated separately for males and females.

Analyses were conducted using SPSS Version 19 and Mplus Version 6.12 (Muthén & Muthén, 1998-2010).

Results

The readability score function of Microsoft Word 2013 indicated that the 12 BIQ-C items had a Flesch reading ease of 76.0, indicating that the material is appropriate for those with approximately seven years of formal schooling (Flesch, n.d.). Information on the time taken for the measure was available for 1480 participants. The median time spent on the BIQ-C was 20 s for those without appearance concerns and 4 min 15 s for those with appearance concerns who completed the whole measure. The BIQ-C proved to be quick to administer, and have an appropriate reading age for high school students.

Measurement invariance evaluation of the BIQ-C is only possible for the 1512 (49.5%) participants who reported experiencing appearance concerns on the initial screening item, as the 1545 (50.5%) of participants with no concerns only completed the screening item. Females were significantly more likely to report appearance concerns than males; females (794/1,126 = 70.5%, 95% CI = [67.8, 73.1]), males (718/1,931 = 37.2%, 95% CI = [35.1, 39.4]) $\chi^2(1, N = 3,057) = 316.13, p < .001$, odds ratio = 4.04 (95% CI = [3.45, 4.73]).

Creation of the BIQ-C-9

The development of the adult COPS identified 9 items that discriminated between participants with BDD and those from a community sample (Veale et al., 2012a). As each of these items has an equivalent in the BIQ-C (items 3–8, and 10–12), they were summed to create the BIQ-C-9. A summary of all BIQ-C items and the items included in the BIQ-C-9 is presented in Table 4.1. In the current study, the Cronbach's α for the BIQ-C-9 was $\alpha = .84$ for males, and $\alpha = .89$ for females.

Confirmatory Factor Analysis to Identify a Baseline Model

Confirmatory factor analyses were conducted to identify a well-fitting baseline model for the 1512 participants who completed the whole measure (Table 4.2). Each model was fitted separately for the original 12-item BIQ-C, and the BIQ-C-9. Although the adult COPS was found to have a single factor (Veale et al., 2012b), single factor models of the BIQ-C and BIQ-C-9 (Table 4.2, Models 1 and 2) demonstrated inadequate fit. Patterns of modification indices suggested a multi-factorial structure in the current data. An alternate two-factor structure was therefore tested (Table 4.2, Models 3 and 4). In the BIQ-C, factor 1 comprising interference and behavioural symptoms (items 3, 6, 8, 9, 10, and 11), and factor 2 comprising cognitive and emotional symptoms (items 4, 5, 7, 12, 13, and 14). BIQ-C-9 factors were identical, except for the omission of items, 9, 13, and 14. Though this improved model fit, especially for the BIQ-C-9, it still did not meet standards for acceptable model fit. Modification indices strongly suggested allowing item 3 to load on factor 2 instead of factor 1. The revised two-factor structure appeared to represent an 'interference and avoidance'

factor (items 6, 8, 9, 10, and 11) and a second factor comprising ‘other BDD symptoms’ (items 3, 4, 5, 7, 12, 13, and 14). This resulted in acceptable model fit for females but not for males (Table 4.2, Models 5 and 6).

Modification indices suggested that allowing correlated error between the three reversed-scored items would improve model fit. As there is the potential for shared method variance in reverse-scored items (Brown, 2015), the models were refit allowing for correlated error between these items. This improved fit, particularly for males, but the 12-item BIQ still did not have good model fit for males (Table 4.2, Model 7). The best fitting model (Table 4.2, Model 8) was the BIQ-C-9 with two revised factors and correlated errors between the three reverse-scored items. This model had good CFI and SRMR and adequate RMSEA and TLI in males and females, and thus was utilised as the baseline model for measurement invariance testing. The standardised factor loadings of this model are presented in Supplementary Table S4.1.

The internal consistency (Cronbach’s alpha) of the two factors of the BIQ-C-9 was acceptable for the ‘interference and avoidance factor (males $\alpha = .70$, females $\alpha = .76$) and the ‘other symptoms’ factor (males $\alpha = .74$, females $\alpha = .82$).

Using confirmatory factor analysis, no model using all 12 BIQ-C items had acceptable model fit for males and females. This suggests that the BIQ-C-9 has stronger psychometric properties, and thus is a more appropriate measure for assessing BDD in this population.

Measurement Invariance Testing of the BIQ-C-9

Table 4.3 presents the results of measurement invariance testing. The initial configural model (Table 4.3, Model 1) showed adequate fit, demonstrating the equivalence of the number of factors and patterns of indicator-factor loadings of the BIQ-C-9 across sex.

The next model examined metric invariance (Table 4.3 Model 2); ΔAFI values were acceptable, but the significant $\Delta SB\chi^2$ indicated that constraining factor loadings to equivalence across sex produced poorer model fit compared to the configural model. A partial metric invariance model was identified (Table 4.3, Model 2a) based on model modification

indices; when the factor loading of item 12 was free to vary between groups $\Delta SB\chi^2$ was improved, but the partial metric model still had significantly poorer model fit compared to the configural model. A second partial metric invariance model freeing the factor loading of items 7 and 12 (Table 4.3, Model 2b) resulted in a model that was not significantly different to the configural model. Both of these items showed a higher unstandardised loading on the ‘other symptom’ factor for males (item 7 = 1.58, item 12 = 1.42) than for females (item 7 = 1.35, item 12 = 1.08).

Scalar invariance was then evaluated (Table 4.3, Model 3), with the factor loading and item intercepts of item 7 and 12 allowed to vary by sex. Again, ΔAFI were acceptable but a significant $\Delta SB\chi^2$ indicated that constraining the item intercepts to equality resulted in poorer total model fit. A partial scalar model was identified (Table 4.3, Model 3a) where the item intercept for item 8 was free to vary between groups. This model had acceptable ΔAFI values and $\Delta SB\chi^2$ was not significantly poorer than the partial metric model. The unstandardised intercept of item 8 was 2.31 for males and 2.73 for females.

The next model (Table 4.3, Model 4) evaluated the equality of item covariances by fixing the covariances of the three reverse-scored items (covariances of items 3-4, 4-6, and 3-6) to equality between groups. This resulted in a model with significantly poorer $\Delta SB\chi^2$ and unacceptable ΔCFI and $\Delta RMSEA$ compared to the partial scalar model, indicating that covariances varied between groups. The unstandardised covariances between these items were stronger for males than for females (items 3-4; male = 0.68, female = -0.05, items 3-6; male = 0.91, female = 0.05, items 4-6; male = 1.14, female = 0.13).

As partial scalar measurement invariance was supported, it is appropriate to use the BIQ-C-9 to compare scores between groups, and tests of population heterogeneity can be conducted. First, the equality of factor variances was examined (Table 4.3, Model 5), with all previous non-invariant parameters allowed to vary between groups. $\Delta SB\chi^2$ and ΔCFI indicated that constraining the factor variances to equality resulted in significantly poorer model fit compared to the partial scalar invariance model. In the partial scalar model where

factor variances were constrained to 1 for males, factor variance for females was 1.11 for ‘interference and avoidance’, and 1.70 for ‘other symptoms’. The latent constructs measured by the two-factor BIQ-C-9 thus have greater variability in females than in males. In light of this finding, the equality of factor covariance and latent means could not be directly tested.

Sex Differences in BIQ-C-9 Scores

As partial scalar invariance was established, it is appropriate to examine sex differences using the BIQ-C-9 total scores.

Differences in individual BIQ-C-9 items in those with appearance concerns.

Across the 1512 participants with appearance concerns who completed the whole measure, females reported significantly higher BIQ-C-9 total scores, factor scores, and higher scores for 7 of 9 items (see Table 4.1). The only items that did not differ significantly between males and females related to BDD-related avoidance of places or activities (item 6), and school interference related to BDD (item 10).

Differences in scores in the whole sample. The above analyses only included participants with appearance concerns. This excludes the 62.8% of males and 29.5% of females who reported no appearance concerns on the initial screening item. The distribution of scores in the whole sample was calculated by assigning a score of 0 for the BIQ-C-9 total and factor scores to those who reported no appearance concerns.

Across all 3,057 participants, BIQ-C-9 total scores were significantly higher for females ($M = 17.54$, $SD = 15.71$) than males ($M = 7.20$, $SD = 11.82$), $t(3055) = 20.60$, $p < .001$, $d = 0.74$. Scores for the ‘other symptoms’ factor were also higher in females ($M = 12.23$, $SD = 10.39$) than males ($M = 4.79$, $SD = 7.60$), $t(3055) = 22.71$, $p < .001$, $d = 0.82$. Likewise, the ‘interference and avoidance’ factor scores were higher in females ($M = 5.31$, $SD = 6.06$) than males ($M = 2.41$, $SD = 4.67$), $t(3055) = 14.80$, $p < .001$, $d = 0.54$.

Although a clinical cut-off score has not been established for the BIQ-C-9, Veale et al. (2012a) report that a total COPS score of 40 or above can be used to indicate possible BDD in adults. Females were significantly more likely to have a BIQ-C-9 total score ≥ 40 (111/1,126

= 9.9%, 95% CI = [8.3, 11.7]) than males (45/1,931 = 2.3%, 95% CI = [1.8, 3.1]), $\chi^2(1, N = 3,057) = 83.22, p < .001$, odds ratio = 4.58 (95% CI = [3.22, 6.54]).

Finally, T-scores ($M = 50$, $SD = 10$) were calculated for males and females to provide more information about sex-specific score distributions (see Supplementary Tables S4.2 and S4.3). A T-score of 65 or above indicates a response in the top 6% of scores, and is often used to indicate high risk of a disorder in community samples (Wilmschurst, 2014). In this study, a T-score of 65 corresponded to a total BIQ-C-9 score of 25 for males, and 41 for females.

Discussion

The primary aim of the current study was to evaluate the cross-sex measurement invariance of the BIQ-C in a community sample of adolescents, and if measurement invariance was supported, to compare BIQ-C scores between males and females. The secondary aim was to determine whether to utilise all 12 original items of the BIQ-C or a reduced 9-item version. This is the first study to establish the measurement invariance of a measure of BDD symptoms in adolescents, and to provide information about the distributions of BDD symptoms in a large community sample of adolescents.

Cross-Sex Measurement Invariance in the BIQ-C

The identification of a well-fitting baseline model for measurement invariance testing was unexpectedly challenging. A single factor structure was identified in the adult COPS (Veale et al., 2012b), but this model had poor fit in the current sample. Instead, the items clustered into two factors comprised of items relating to interference and avoidance, and items assessing other BDD symptoms such as checking, preoccupation, and distress. In order to identify a model with good fit for males and females, it was also necessary to allow covariation between the three reverse-scored items (Byrne, 2013). This reflects the shared method effect resulting from reverse-scoring a subset of items (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). In a model with a revised factor structure and correlated errors allowed, the BIQ-C-9 had superior model fit to the 12-item BIQ-C. The BIQ-C-9 was thus utilised for all subsequent analyses.

Measurement invariance testing identified partial scalar invariance across sex, indicating that the BIQ-C-9 generally behaved in similar ways for males and females, and therefore, can be used to compare BDD symptom scores between adolescent males and females. However, some sex differences were observed. Metric noninvariance was found for items relating to preoccupation (item 7) and appearance-related self-evaluation (item 12), indicating that they had a stronger loading on the ‘other symptoms’ factor for males compared to females. Additionally, the scalar non-invariance of the item relating to interference with dating (item 8) indicated that the item had higher values for all levels of the ‘Interference and Avoidance’ factor in females than in males. These non-invariant parameters thus displayed differential item functioning in males and females, and the observed values of items 7, 8, and 12 varied by sex at different levels of the latent variable. Additionally, the covariances between the three reverse-scored items were stronger for males than for females, suggesting a greater method effect for males. It is possible that this may represent a greater acquiescence or response-set bias in males than in females (Barnette, 2000), and thus should be investigated in future studies using this measure. One test of population heterogeneity was conducted, and the variances of the ‘interference and avoidance’ and ‘other symptom’ factors were non-invariant. For both factors, females showed greater factor variance than males, thus the female group drew from a greater range of the underlying constructs than males (Brown, 2015). Overall, these results demonstrate that the BIQ-C-9 can be used with caution to compare BDD symptom scores between males and females.

Sex Differences in BIQ-C-9 Scores

In the 1512 participants with appearance concerns who completed the detailed symptom items, females reported higher BIQ-C-9 total and factor scores, and mean scores were significantly higher for most BIQ-C items. The effect sizes of these comparisons were generally small, though medium strength effects were present for differences in the ‘other symptom’ factor score, and the item relating to the level of distress associated with BDD concerns. There was no significant sex differences in two items relating to overall avoidance,

and interference with school, and the sex difference in the ‘interference and avoidance’ factor comparison was very weak.

When scores were compared across all 3,057 participants, females again reported significantly higher total and factor scores than males. They were also over four times more likely than males to score above the cut-off score that suggests BDD in the adult COPS. This is consistent with past studies in community samples of adolescents that found elevated levels of BDD symptoms and higher risk of BDD in females (Mastro et al., 2016; Mayville et al., 1999). In our female participants, the COPS cut-off score of 40 corresponded to a T-score of 64, which would identify participants in the highest 8% of responses. However, in male participants, a score of 40 corresponded to a T-score of 78, which would only identify participants in the top 0.26% of responses. Given that a T-score of 65 is often used to indicate those at elevated risk for a disorder (Wilmshurst, 2014), our data suggests that adolescent cut-off scores should be set at 41 for females, and 25 for males.

Limitations and Future Directions

This study represents an important first step in identifying a BDD symptom measure that is appropriate for use in adolescents, and can be used to compare scores in males and females. However, a number of research questions require further investigation. The division of the BIQ-C-9 items into ‘interference and avoidance’ and ‘other symptoms’ factors, though similar to the factor structure of another measure of dysmorphic symptoms (Littleton, Axsom, & Pury, 2005), is different to the adult COPS (Veale et al., 2012b). Future studies should specifically examine the factor structure and other psychometric properties when using measures developed with adult samples in adolescent research. The stronger covariance of reverse-scored items in males requires further examination, especially if it represents a response-style bias. As individuals with eating disorders may also report high scores on BDD symptom measures (Mitchison, Crino, & Hay, 2013), the specificity of the BIQ-C-9 to BDD symptoms should be explored. Finally, a simulation study by Steinmetz (2013) found that biased indicators may affect composite scores, particularly in the case of partial scalar non-

invariance. However, the conditions in which invariance may be problematic are unclear, and should be further examined in studies with different numbers of indicators, sample sizes, and invariance results. Further, the presentation of BDD symptoms should be examined in more diverse samples, including in participants with lower socio-educational advantage.

Despite these limitations, the BIQ-C-9 appears to be a practical and promising measure for assessing BDD symptoms in adolescents. It would be particularly valuable to establish further psychometric properties of the measure in large samples, and to examine the sensitivity and specificity of the proposed sex-specific cut-off scores against clinical diagnoses. The ability of the BIQ-C to differentiate between BDD and eating disorder symptoms should also be evaluated, given the potential for overlap in the symptom presentations of these disorders (Veale et al., 2012b). In addition, participating schools had relatively high levels of socio-cultural advantage, so future studies are needed in order to extend the current findings to less advantaged populations.

Conclusions

To our knowledge, this is the first study to establish cross-sex measurement invariance in a measure of BDD symptoms in adolescents, and to provide information about the distribution of BDD symptom scores in a large sample. A reduced 9-item version of the BIQ-C (the BIQ-C-9) had superior psychometric properties to the original 12-item BIQ-C. The BIQ-C-9 was thus used for measurement invariance testing, with a revised factor structure and correlated error allowed among reverse-scored items. As the BIQ-C-9 demonstrated partial scalar invariance across sex, it is appropriate to use the measure to compare BDD symptom scores between males and females. However, some caution is required as the findings also indicated sex differences in the functioning of three items and greater covariances between reverse-scored items in males. The sex differences in observed BIQ-C-9 total, factor, and item scores highlights the need for sex-specific cut-off scores when the measure is used to screen for BDD. Overall, the BIQ-C-9 is a promising measure for the assessment of BDD symptoms in adolescents, but further research is needed to establish its

psychometric properties in a range of samples, and the sensitivity and specificity of the proposed cut-off scores.

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Table 4.1. BIQ-C Items with Independent Samples T-Tests of Item and Total Scores between Males ($n = 718$) and Females ($n = 794$)

Item	Males	Females	t	p	d [95% CI]
3. How often do you check your feature(s)? ^a	2.50 ± 2.04	3.12 ± 2.05	5.88	<.001	0.30 [0.20, 0.40]
4. How much do you feel your feature(s) is ugly, unattractive or 'not right'? ^a	2.92 ± 1.97	3.87 ± 2.08	9.15	<.001	0.47 [0.37, 0.57]
5. How much does your feature(s) cause you a lot of distress?	2.12 ± 1.95	3.22 ± 2.02	10.74	<.001	0.55 [0.45, 0.65]
6. How often does your feature(s) lead you to avoid places or activities? ^a	1.80 ± 2.21	1.84 ± 1.95	0.37	.712	0.02 [-0.08, 0.12]
7. How much is your feature(s) on your mind?	2.82 ± 2.05	3.86 ± 2.05	9.60	<.001	0.50 [0.40, 0.60]
8. If you have a girlfriend or boyfriend, how much does your feature(s) have an effect on your relationship with him or her? Or If you do not have a girlfriend or boyfriend but would like one, how much does it have an effect on you getting one?	2.32 ± 2.18	2.93 ± 2.28	5.36	<.001	0.28 [0.17, 0.38]
9. How much does your feature(s) have an effect on your relationship with your family? ^b	-	-	-	-	-
10. How much does your feature(s) get in the way with your school or college work?	0.68 ± 1.29	0.77 ± 1.34	1.32	.187	0.07 [-0.03, 0.17]
11. How much does your feature(s) get in the way with your social life?	1.70 ± 1.96	1.99 ± 1.99	2.87	.004	0.15 [0.05, 0.25]
12. How much do you feel your appearance is the most important thing about you?	2.52 ± 2.04	3.27 ± 2.01	7.27	<.001	0.37 [0.27, 0.47]
13. How noticeable do you feel your feature is to other people? ^b	-	-	-	-	-
14. How does your feature compare to others of the same age, sex, and ethnic group? ^b	-	-	-	-	-
9-item total	19.37 ± 11.81	24.88 ± 12.94	8.66	<.001	0.44 [0.34, 0.55]
BIQ-C-9 Interference and Avoidance	6.49 ± 5.68	7.54 ± 5.94	3.49	<.001	0.18 [0.08, 0.28]
BIQ-C-9 Other Symptoms	12.88 ± 7.16	17.34 ± 8.02	11.43	<.001	0.59 [0.48, 0.69]

Note. ^a item is reverse-scored. ^b item not included in 9-item BIQ-C. ($M \pm SD$) = Mean ± standard deviation. d = Cohen's d . CI = Confidence interval. BIQ-C =

Body Image Questionnaire-Child and Adolescent Version. BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items.

Table 4.2. Goodness-of-Fit Evaluation of BIQ-C Baseline Model for Males (n = 718) and Females (n = 794)

Baseline Model	Sex	SB χ^2 (df)	RMSEA [90% CI]	CFI	TLI	SRMR
1. BIQ-C, one factor	Male	426.34 (54)	.098 [.089, .107]	.819	.778	.065
	Female	381.77 (54)	.087 [.079, .096]	.898	.875	.047
2. BIQ-C-9, one factor	Male	202.21 (27)	.095 [.083, .107]	.875	.833	.056
	Female	233.98 (27)	.098 [.087, .110]	.917	.890	.040
3. BIQ-C, two factors ^a	Male	366.45 (53)	.091 [.082, .100]	.847	.810	.061
	Female	308.46 (53)	.078 [.070, .086]	.921	.901	.045
4. BIQ-C-9, two factors ^a	Male	184.03 (26)	.092 [.080, .105]	.887	.844	.056
	Female	179.86 (26)	.086 [.075, .098]	.938	.915	.038
5. BIQ-C, two factors (revised ^b)	Male	361.29 (53)	.090 [.081, .099]	.850	.813	.061
	Female	255.47 (53)	.069 [.061, .078]	.937	.922	.041
6. BIQ-C-9, two factors (revised ^b)	Male	174.76 (26)	.089 [.077, .102]	.894	.853	.054
	Female	118.14 (26)	.067 [.055, .079]	.963	.949	.031
7. BIQ-C, two factors (revised ^b), 3 correlated items	Male	256.25 (50)	.076 [.067, .085]	.899	.867	.047
	Female	253.47 (50)	.072 [.063, .080]	.937	.917	.041
8. BIQ-C-9, two factors (revised ^b), 3 correlated items	Male	81.51 (23)	.059 [.046, .074]	.958	.935	.029
	Female	116.21 (23)	.071 [.059, .085]	.963	.942	.031

Note. Bold text indicated acceptable model fit according to the relevant criteria. SB χ^2 = Satorra-Bentler adjusted chi-square. df = Degrees of freedom. RMSEA = Root mean-square error of approximation. CFI = Comparative fit index. SRMR = Standardised root mean-square residual. BIQ-C = Body Image Questionnaire-Child and Adolescent Version. BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items.^a Factor 1; items 3, 6, 8, 9, 10, and 11, Factor 2; items 4, 5, 7, 12, 13, and 14. ^b Revised Factor 1; items 6, 8, 9, 10, and 11, Revised Factor 2; items 3, 4, 5, 7, 12, 13, and 14.

Table 4.3. Summary of Model Fit Statistics for BIQ-C-9 Measurement Invariance across Males (*n* = 718) and Females (*n* = 794)

Invariance Model (free parameters)	Satorra-Bentler Adjusted χ^2 Difference Test					Approximate Fit Indices						
	SB χ^2	Δ SB χ^2	SCF	df	Δ df	p	CFI	Δ CFI	RMSEA [90% CI]	Δ RMSEA	SRMR	Δ SRMR
1. Configural	196.16	-	1.21	46	-	-	.961	-	.066 [.056, .075]	-	.030	-
2. Metric	223.56	27.40	1.22	53	7	<.001	.955	-.006	.065 [.057, .074]	-.001	.047	.017
2a. Partial Metric (12)	210.50	14.34	1.23	52	6	.015	.958	-.003	.063 [.055, .073]	-.003	.042	-.005
2b. Partial Metric (7, 12)	203.82	7.66	1.23	51	5	.077	.960	-.001	.063 [.054, .072]	-.003	.038	.008
3. Scalar (7, 12)	229.69	25.87	1.21	56	5	<.001	.954	-.006	.064 [.056, .073]	.001	.042	.004
3a. Partial Scalar (7, 12, 8)	213.77	9.95	1.21	55	4	.077	.958	-.002	.053 [.053, .071]	-.010	.040	.002
4. Item Covariances (7, 12, 8)	262.70	48.93	1.23	58	3	<.001	.946	-.012	.068 [.060, .077]	.015	.040	.000
5. Factor Variance (7, 12, 8)	234.58	20.81	1.22	57	2	<.001	.953	-.005	.064 [.056, .073]	.011	.067	.027

Note. Bold text indicates an acceptable change in model fit. BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items. SB χ^2 = Satorra-Bentler adjusted chi-square. Δ = Change in value. SCF = Scaling correction factor. *df* = Degrees of freedom. RMSEA = Root mean-square error of approximation. CFI = Comparative fit index. SRMR = Standardised root mean-square residual.

Table S4.1. Standardised Factor Loadings for BIQ-C-9 Items on Revised Factors for Males (n = 718) and Females (n = 794)

Item	Males		Females	
	Factor 1. Interference and Avoidance	Factor 2. Other Symptoms	Factor 1. Interference and Avoidance	Factor 2. Other Symptoms
3		.41		.63
4		.47		.68
5		.70		.82
6	.43		.68	
7		.77		.85
8	.66		.65	
10	.66		.64	
11	.84		.85	
12		.70		.65

Note: BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items.

Table S4.2. Distribution BIQ-C-9 Total and Subscale Scores in Males (*n* = 1,931)

Elevated Range of Scores				Normal Range of Scores			
T-Score	Total Score	Interference and Avoidance	Other Symptoms	T-Score	Total Score	Interference and Avoidance	Other Symptoms
100	66+	26+		64	24		
99	65			63	23		15
98	64	25		62	21-22	8	14
97	63			61	20		13
96	62	24	40 ^a	60	19	7	
95	60-61		39	59	18		12
94	59	23	38	58	17	6	11
93	58			57	15-16		10
92	57		37	56	14	5	
91	56	22	36	55	13		9
90	54-55		35	54	12	4	8
89	53	21		53	11		7
88	52		34	52	10	3	
87	51	20	33	51	8-9		6
86	50		32	50	7	2	5
85	49	19		49	6		4
84	47-48		31	48	5		
83	46	18	30	47	4	1	3
82	45		29	46	2-3	0	2
81	44	17		45	1		1
80	43		28	44	0		0
79	41-42	16	27				
78	40		26				
77	39						
76	38	15	25				
75	37		24				
74	36	14	23				
73	34-35						
72	33	13	22				
71	32		21				
70	31	12	20				
69	30		19				
68	28-29	11					
67	27		18				
66	26	10	17				
65	25	9	16				

Note: ^a Maximum possible score. BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items

Table S4.3. Distribution BIQ-C-9 Total and Subscale Scores in Females (*n* = 1,126)

Elevated Range of Scores				Normal Range of Scores			
T-Score	Total Score	Interference and Avoidance	Other Symptoms	T-Score	Total Score	Interference and Avoidance	Other Symptoms
94		32 ^a		64	40	14	27
93				63	38-39		26
92		31		62	36-37	13	25
91				61	35	12	24
90		30		60	33-34		23
89		29		59	32	11	22
88				58	30-31		21
87		28		57	29	10	20
86				56	27-28	9	18
85		27		55	25-36		17
84	71-72 ^a	26		54	24	8	16
83	69-70			53	22-23		15
82	68	25		52	21	7	14
81	66-67	24		51	19-20	6	13
80	65			50	18		12
79	63-64	23		49	16-17	5	11
78	62			48	14-15	4	10
77	60-61	22	40 ^a	47	13		9
76	58-59	21	39	46	11-12	3	8
75	57		38	45	10		7
74	55-56	20	37	44	8-9	2	6
73	54		36	43	7	1	5
72	52-53	19	35	42	5-6	0	4
71	51	18	34	41	3-4		3
70	49-50		33	40	2		2
69	47-48	17	32	39	0-1		1
68	46		31	38			0
67	44-45	16	30				
66	43	15	29				
65	41-42		28				

Note: ^a Maximum possible score. BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items.

The next paper continues the focus on symptom-level issues in “The Classification of Body Dysmorphic Disorder Symptoms in Male and Female Adolescents”. Using data from the whole sample, confirmatory factor analysis is used to test the fit of competing theoretical models of the classification of symptoms of BDD with obsessive-compulsive disorder, anxiety, depression, and eating disorders. As Chapter 4 highlighted the importance of considering sex differences in BDD symptoms, in this chapter the models are fit separately for males and females, and the equivalence of these models is examined using measurement invariance testing.

Chapter 5

The Classification of Body Dysmorphic Disorder Symptoms in Male and Female Adolescents

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Abstract

Aims. Body dysmorphic disorder (BDD) was categorised in *DSM-5* within the newly created ‘obsessive-compulsive and related disorders’ chapter, however the classification of BDD remains subject to debate. Confirmatory factor analysis was used to test competing models of the co-occurrence of symptoms of BDD, obsessive-compulsive disorder, unipolar depression, anxiety, and eating disorders in a community sample, and to explore potential sex differences in these models.

Method. Self-report questionnaires assessing disorder symptoms were completed by 3,149 Australian adolescents. The fit of correlated factor models was calculated separately in males and females, and measurement invariance testing compared parameters of the best-fitting model between males and females.

Results. All theoretical models of the classification of BDD had poor fit to the data. Good fit was found for a novel model where BDD symptoms formed a distinct latent factor, correlated with affective disorder and eating disorder latent factors. Metric non-invariance was found between males and females, and the majority of factor loadings differed between males and females. The correlations between the BDD and affective disorders latent factors were moderate and slightly stronger for females than males, whereas the correlation between BDD and eating disorder factors was strong for females and weak for males.

Conclusions. This study is the first to statistically evaluate competing models of the classification of BDD. The findings highlight the unique features of BDD and its associations with affective and eating disorders. Future studies examining the classification of BDD should consider developmental and sex differences in their models.

Keywords. Body dysmorphic disorder, adolescent, comorbidity, classification, confirmatory factor analysis.

Introduction

The classification of body dysmorphic disorder (BDD) has been the subject of increasing research interest in the past two decades. As BDD is poorly understood and frequently misdiagnosed (Phillips & Feusner, 2010), its classification may have important academic and practical implications, for example, with regard to screening in the presence of related disorders, improved clinical decision making, development of interventions, or understanding of aetiological factors (Abramowitz & Jacoby, 2015; First et al., 2004; Phillips & Stein, 2015; Phillips et al., 2010). As BDD typically begins during adolescence (Bjornsson et al., 2013), and since the structure of psychopathology may vary meaningfully at different developmental stages (Wittchen et al., 2009), it is particularly important to explore the classification of BDD during this time of peak disorder onset.

Although classified as a somatoform disorder in *DSM-III-R* and *DSM-IV* (American Psychiatric Association [APA], 1987, 1994), BDD has long been conceptualised as related to obsessive-compulsive disorder (OCD) as part of an ‘*obsessive-compulsive spectrum*’ of disorders (Phillips, McElroy, Hudson, & Pope, 1995). Studies have found that BDD and OCD share core disorder features, have elevated comorbidity in clinical samples, increased family history, and similarities in treatment response (Abramowitz & Jacoby, 2015; Bienvenu et al., 2012; Kelly & Phillips, 2011; Phillips et al., 2010). Accordingly, in *DSM-5* (APA, 2013), BDD was included in a new ‘obsessive-compulsive and related disorder’ (OCRD) category, alongside OCD, hoarding, trichotillomania, excoriation, and several other specified and unspecified OCRD diagnoses.

However, the classification of BDD in *DSM-5* has faced criticism. A recent review by Frías, Palma, Farriols, and González (2015) highlighted a number of methodological limitations of studies linking BDD and OCD, including the lack of control groups in comorbidity studies, reliance on samples recruited from specialised clinics, and limited information on specific aetiological pathways. Further, the authors concluded that the evidence reviewed may in fact support a closer association between BDD and social anxiety

disorder than between BDD and OCD. Abramowitz and Jacoby (2015) argue that BDD and OCD are more meaningfully related to anxiety disorders than to other OCRDs in the function of core symptoms, comorbidity, familial disorder patterns, and treatment response. Indeed, BDD is strongly associated with anxiety and unipolar depression across important domains including comorbidity, family history, disorder course, and cognitive biases (Abramowitz & Jacoby, 2015; Fang & Hofmann, 2010; Frías et al., 2015; Kelly, Dalrymple, Zimmerman, & Phillips, 2013; Phillips & Stout, 2006). These studies support an alternate conceptualisation of BDD as part of a broader ‘*affective spectrum*’ that also includes anxiety, OCD, and unipolar depression (Phillips et al., 1995).

Other researchers have focused on the relationship between BDD and eating disorders, as these disorders are associated in their clinical features, onset and course, and cognitive biases (Cororve & Gleaves, 2001; Hartmann, Greenberg, & Wilhelm, 2013; Rosen & Ramirez, 1998). It has thus been proposed that BDD and eating disorders may form a separate ‘*body image spectrum*’ of disorders (Cororve & Gleaves, 2001). However, as OCD and eating disorders are also associated (Phillips & Kaye, 2007), this may instead indicate that BDD, OCD, eating disorders, anxiety, and depression all belong to a single overall ‘*internalising spectrum*’.

While each of these theories regarding the classification of BDD has some empirical support, no prior study has directly compared competing models of BDD classification. Of the different validators used to guide classification decisions in the *DSM-5* (APA, 2013), comorbidity between BDD and associated disorders has been the most widely examined. Confirmatory factor analysis (CFA) of disorder co-occurrence can be used to directly compare the fit of theorised classification models to observed data. This approach has previously been applied to modelling comorbidity in adolescents, and has supported the inclusion of OCD, anxiety, depression, and eating disorders in an internalising spectrum of disorders (Beesdo-Baum et al., 2009; Blanco et al., 2015; Kessler et al., 2012; Lahey et al.,

2008; Wittchen et al., 2009). However, there are some important issues to consider when applying CFA to models of BDD classification.

First, when seeking to model comorbidity between disorders, clinical samples will not be representative of the general population (Angold, Costello, & Erkanli, 1999). This may be particularly true for BDD, where access to appropriate mental health services is low (Buhlmann, 2011; Chapter 2, Marques, Weingarden, LeBlanc, & Wilhelm, 2011) and misdiagnosis is common (Grant, Kim, & Crow, 2001; Veale, Akyüz, & Hodsoll, 2015). Therefore, the classification of BDD will be examined in a community sample.

Second, most adolescent studies have involved categorical analyses of the diagnostic status of a disorder. This approach relies on the application of validated thresholds to determine disorder status (Carragher et al., 2015). However, measures assessing BDD have rarely been evaluated in adolescents and thus do not have well-validated cut-points. Further, categorical approaches ignore the potential importance of subthreshold disorder presentations (Chapter 3; Roberts, Fisher, Blake Turner, & Tang, 2015). The current study will thus examine BDD symptoms, not diagnostic status.

Third, sex differences have been observed in child and adolescent studies in the strength of the association between particular disorders and their latent factor (Lahey et al., 2008), and in overall internalising factor scores (Carragher et al., 2015; Caspi et al., 2014). Hence, while sex differences are not part of the theoretical models of BDD, fitting the models separately for males and females may provide sex-specific information about disorder associations.

Fourth, findings from previous CFA studies suggest that models of affective disorders such as anxiety and depression may show the best fit when separate first order fear and distress factors are identified (Beesdo-Baum et al., 2009; Blanco et al., 2015; Kessler et al., 2012; Wittchen et al., 2009). However, as this structure is not always observed (Lahey et al., 2008), the utility of identifying these factors will be assessed prior to fitting the BDD classification models.

Finally, due to the potential for developmental differences in the structure of psychopathology (Wittchen et al., 2009), classification models developed from adult research may not provide good fit in an adolescent sample. For this reason, the current study will include a novel model, where BDD symptoms form their own factor, correlated with separate affective and eating disorders factors.

The current study

The aim of the current study was to use CFA to test competing models of the classification of BDD in relation to OCD, anxiety, depression, and eating disorders among adolescents. Figure 5.1 presents the models that were selected for CFA testing. In *Model 1*, BDD is part of a single unidimensional internalising factor that also includes OCD, anxiety, depression, and eating disorders. In *Model 2*, BDD is part of an affective spectrum of disorders that includes anxiety, depression, and OCD (Phillips et al., 2010), with a separate correlated eating disorders factor. In *Model 3*, BDD and eating disorders form a body image spectrum of disorders (Cororve & Gleaves, 2001) that is correlated with an affective disorders factor that includes anxiety, depression, and OCD. In *Model 4*, BDD and OCD form a separate obsessive-compulsive spectrum factor that is correlated with separate affective and eating disorders factors (Phillips et al., 1995). Finally, *Model 5* tests the novel hypothesis that BDD forms a separate factor that is correlated with affective disorders and eating disorders factors. Initial analyses will evaluate the utility of anxiety and depression symptoms being modelled as a single factor, or as separate fear and distress factors. The study will then test the fit of each model of the classification of BDD. As prior adolescent studies have found sex differences in models of psychopathology, models will be fit separately for males and females, and the measurement invariance of model fit parameters will be examined.

Method

Participants

Participants were adolescents recruited from seven high schools in the Greater Sydney area of New South Wales, Australia. Four boys' schools were involved in a study examining

utilisation of an online treatment program for anxiety and depression, whereas three girls' schools were involved in a different study examining the longitudinal development and prevention of anxiety and depression. Questionnaires were administered in batteries developed for each study. A total of 5,005 students were enrolled in eligible school grades at the time of testing, and 3,149 (response rate of 62.9%) consented and provided a valid response to the BDD questionnaire. Data from these participants have been reported in previous studies on the prevalence and correlates of BDD (Chapter 2; Chapter 3; & Chapter 4).

Of the participating students, 2,000 were male (63.5%, $M_{\text{age}} = 14.71$, $SD = 1.34$) and 1149 were female (36.5%, $M_{\text{age}} = 14.36$, $SD = 1.39$). School-level scores on the index of community socio-educational advantage (ICSEA; Australian Curriculum and Assessment Reporting Authority, 2013) indicated that participants came from schools with above-average socio-educational advantage (ICSEA of all Australian schools; $M = 1,000.00$, $SD = 100.00$, current study male ICSEA; $M = 1,048.13$, $SD = 38.01$, range = 1,002.00–1,105.00, female ICSEA; $M = 1,169.72$, $SD = 42.86$, range = 1,092.00–1,201.00).

Additional demographic questions were completed by a subset of participants ($n = 2,335$, 74.2%). For both males and females, English was the main language spoken at home (91.5/90.5%), most lived in a two-parent home (79.1/80.8%), and the cultural background of their parents was predominantly Oceanian (mothers = 36.9/42.5%, fathers = 37.2/41.8%) or European (mothers = 42.4/34.0%, fathers = 37.2/41.8%). Parents typically worked as managers or skilled professionals (mothers = 46.9/47.8%, fathers = 47.4/72.0%).

Procedure

Assessment sessions took place in class or year groups during school time, supervised by members of the research team, and teachers where available. Responses were collected confidentially using de-identified alphanumeric codes and participants were informed that confidentiality would be maintained unless their responses indicated serious risk of harm, such as current suicidal ideation or evidence of abuse. The research was approved by the

Human Research Ethics Committee of Macquarie University and the governing body of each school. Consent to the current study was provided as part of the larger study of emotional health conducted at each school. Parents received written information and consent forms, and students were informed about the program using presentations to class groups or assemblies. At boys' schools, parents filled in a form to opt out if they did not wish their child to participate. If parents did not opt out, an online consent form was provided to all male students to give active consent. At girls' schools, parents provided written consent to opt in to the research. Students then had the opportunity to opt out of testing verbally.

Measures

Body dysmorphic disorder symptoms were assessed using an adaptation of the Body Image Questionnaire-Child and Adolescent Version (BIQ-C; Veale, 2009). A previous study by our research team supported the use of a revised 9-item version of the measure assessing two factors: 'interference and avoidance' and 'other symptoms' (Chapter 4). This is referred to as the BIQ-C-9 to distinguish it from the original measure. An initial screening item establishes the presence of any appearance concerns. If no concerns were present, the participant did not answer further questions and received a total score of 0. All other participants described up to five body areas of concern and then answered 9 items about BDD symptoms. Each item has a tailored response format scored from 0–8, with higher scores indicating greater symptom severity (after reverse-scoring of three items). For example, the item "How much is your feature(s) on your mind? That is, you think about it a lot and it is hard to stop thinking about it?" is scored from 0 (*never on my mind*) to 8 (*always on my mind*). In the current study, internal consistency for males/females for total BIQ-C-9 scores were Cronbach's $\alpha = .84/.89$, interference and avoidance factor $\alpha = .71/.78$, and the other symptoms factor $\alpha = .76/.84$.

Anxiety symptoms were assessed using the Spence Children's Anxiety Scale (SCAS; Spence, 1998). It contains 38 items assessing symptoms of OCD, generalised anxiety disorder, panic and agoraphobia, social anxiety, separation anxiety, and specific phobias

(limited to physical injury-related fears). Participants rate the frequency of items such as "I worry about things" from 0 (*never*) to 3 (*always*). The scale has strong psychometric properties, with support found for the six factor model, good internal consistency (total scale $\alpha = .92$, subscale $\alpha = .60-.80$), convergent and divergent validity, and modest test-retest reliability (Spence, Barrett, & Turner, 2003). In this study, internal consistency for males/females for obsessive-compulsive symptoms was $\alpha = .78/.80$, generalised anxiety $\alpha = .79/.82$, panic-agoraphobia $\alpha = .83/.85$, social anxiety $\alpha = .77/.77$, separation anxiety $\alpha = .71/.67$, and specific phobia of physical injury $\alpha = .60/.49$.

Symptoms of depression were measured using the Short Mood and Feelings Questionnaire (SMFQ; Angold, Costello, Messer, & Pickles, 1995). This 13 item measure assesses depressive symptoms (e.g., "I cried a lot") over the past two weeks on a 3-point scale, from 0 (*not true*) to 2 (*true*). The SMFQ correlates well with diagnostic measures of depression and discriminates between depressed and non-depressed individuals (Angold et al., 1995). It has strong internal consistency ($\alpha = .84-.90$; Angold, Erkanli, Silberg, Eaves, & Costello, 2002; Rhew et al., 2010). In this study, internal consistency was $\alpha = .90$ for males and $\alpha = .91$ for females.

The child version of the 26-item Eating Attitudes Test (ChEAT-26; Maloney, McGuire, & Daniels, 1988) was used to measure disordered eating attitudes and behaviours found in the eating disorders anorexia nervosa and bulimia nervosa. Key attitudes assessed include fear of being fat and food preoccupation e.g., "I am scared about being overweight", whereas key behaviours assessed include dietary restriction and purging. Consistent with the recommendations of Anton et al. (2006), items were scored using a 6-point response scale from 0 (*never*) to 5 (*always*) in order to increase scoring variance and reduce skew. The item 'I enjoy trying new rich foods' was reverse scored (Garner, Olmsted, Bohr, & Garfinkel, 1982). The internal consistency of the total scale has been found to be good in previous population-based studies of adolescents ($\alpha = .86-.87$; Rojo-Moreno et al., 2011; Smolak & Levine, 1994). Though alternate factor structures of the ChEAT-26 have been explored in

adolescents (Anton et al., 2006; Rojo-Moreno et al., 2011), the original three-factor structure from the adult version of the questionnaire (Garner et al., 1982) was found to perform adequately in preliminary analysis and was therefore employed in the current study. Internal consistency for males/females in the current study were $\alpha = .79/.80$ for bulimia, $\alpha = .90/.93$ for dieting, and $\alpha = .76/.73$ for oral control.

Data Analysis

CFA was conducted using Mplus version 6.12. Each indicator variable was freely estimated, the mean of each latent factor was set at 0, and the factor variance set at 1. As symptom subscale scores were continuous and not normally distributed, robust maximum likelihood (MLR) estimation with Satorra-Bentler scaled chi-square test of model fit ($SB\chi^2$) was used (Rhemtulla, Brosseau-Liard, & Savalei, 2012). Evaluation of model fit was based on the criteria of Hu and Bentler (1999) supplemented by Brown (2015): root mean-square error of estimation (RMSEA) $\leq .08$ indicated adequate fit ($\leq .06$ good), comparative fit index (CFI) and Tucker-Lewis index (TLI) $\geq .90$ indicated adequate fit ($\geq .95$ good), and standardised root mean-square residual (SRMR) $\leq .08$ indicated good fit. The Akaike information criterion and (AIC) and Bayesian information criterion (BIC) were also considered for each model. When comparing models, smaller AIC and BIC values are preferred, a change in BIC > 10 indicates a very strong support for the model with the smaller BIC (Raftery, 1995).

The initial stage of model testing examined the correlations between the proposed affective disorders factors of distress (depression and generalised anxiety scores) and fear (social anxiety, separation anxiety, specific phobias, and panic/agoraphobia scores). Following Brown (2015), a correlation between these factors $\geq .85$ supported the use of a single underlying factor, providing that the overall model fit was not substantially poorer for the single factor model.

Competing models of the classification of BDD were then tested. If the same model provided the best fit for males and females, multi-group confirmatory factor analysis was used to assess measurement invariance. This involved placing increasingly restrictive equality

constraints on families of parameters and determining whether the addition of each constraint resulted in a model with significantly poorer fit than the previous less constrained model (Brown, 2015). Following the recommendations of Sass, Schmitt, and Marsh (2014) and Chen (2007), measurement invariance was indicated by a non-significant chi-square difference test ($\Delta\chi^2$), change in CFI (ΔCFI) > -.01, change in RMSEA ($\Delta RMSEA$) < .015, change in SRMR ($\Delta SRMR$) < .03 for tests of factor loading invariance, and $\Delta SRMR$ < 0.01 for tests of intercept invariance.

Results

Bivariate correlations (Spearman's Rho) between study measures, by sex, are given in Table 5.1.

Utility of Separate Fear and Distress Factors

We first examined whether symptoms of anxiety and depression should be divided into fear (social anxiety, separation anxiety, specific phobias, and panic/agoraphobia scores) and distress (depression and generalised anxiety) factors. The correlation between the fear and distress factors was very high (males = .97, females = .98), and model fit was not poorer when employing a single-factor model (see Table S5.1). These findings supported the use of a single underlying latent affective disorders factor (Brown, 2015), so separate fear and distress factors were not identified in subsequent models.

Evaluation of Models of the Classification of BDD

Goodness-of-fit parameters for classification models 1–5 (as presented in Figure 5.1) are presented in Table 5.2, and factor loadings are presented in Table 5.3. Theoretically guided models 1–4 did not provide good fit to the data. Model modification indices were examined to identify points of strain, but even adapted versions of Models 1–4 did not provide sufficient fit. Model 5, where BDD formed its own factor, had good model fit and all factor loadings were positive and salient. Model 5 thus represented the best fit to the observed data. Standardised factor loadings and inter-factor correlations of Model 5 are presented in Table 5.4.

Cross-Sex Measurement Invariance of Model 5

Measurement invariance testing was conducted to explore the equivalence of Model 5 parameters for males and females. The configural invariance model showed adequate fit ($SB\chi^2 = 813.546$, $df = 102$, $p < .0001$, CFI = .951, RMSEA = .067 [90% CI = .062, .071], SRMR = .044.), indicating that males and females had equivalent numbers of factors and patterns of indicator-factor loadings. Metric invariance was then examined; $SB\chi^2 = 1017.16$, $df = 111$, $p < .0001$, CFI = .938, RMSEA = .072 [90% CI = .068, .076], SRMR = .062. The chi-square difference test was significant ($\Delta SB\chi^2 = 183.369$, $df = 9$, $p < .0001$) and $\Delta CFI = -.013$, thus constraining the factor loadings to equivalence produced a model with significantly poorer fit. Partial metric models (Byrne, Shavelson, & Muthén, 1989) were explored by freeing individual factor loadings with the highest modification indices, but no partial metric model provided adequate fit. Evaluation of the confidence intervals of the model parameters (Table 5.4) indicated that 8/12 factor loadings and 2/3 factor correlations differed significantly by sex. Females reported higher factor loadings for generalised anxiety, panic and agoraphobia, and eating disorders-dieting, and higher factor correlations between BDD and affective disorders, and between BDD and eating disorders. Males reported higher loadings for BDD-interference and avoidance, separation anxiety, social anxiety, specific phobia, and eating disorders-oral control.

Discussion

This is the first study to use confirmatory factor analysis to compare different models of the classification of BDD symptoms, and one of few to consider developmental and sex differences in the structure of psychopathology. Prior to fitting models of BDD classification, we examined whether lower-order fear and distress factors should be identified within affective disorders. Consistent with Lahey et al. (2008), these factors were so highly correlated that they indicated a single affective factor across symptoms of anxiety and depression. Each of the theoretical models of the classification of BDD had poor fit to the data. Thus, the data did not support BDD classification as part of a single internalising

spectrum (Model 1), a broad affective spectrum (Model 2, Phillips & Stout, 2006), or a narrower obsessive-compulsive spectrum (Model 4; Phillips et al., 1995) or body image spectrum (Model 3, Cororve & Gleaves, 2001). The novel Model 5 did, however, provide acceptable fit to the data. In this model, BDD symptoms formed a separate factor that was correlated with affective spectrum symptoms and eating disorder symptoms.

Although sex differences were not part of the theoretical models of BDD classification, we compared model parameters between males and females as sex differences have been observed in several previous adolescent CFA studies (Lahey et al., 2008; Mitchell, Wolf, Reardon, & Miller, 2014; Prenoveau et al., 2010). Measurement invariance testing of the parameters of Model 5 found metric noninvariance between males and females. That is, whereas the overall model fit was similar in males and females, the loadings of observed scores onto the latent factors differed significantly by sex for a majority of the symptom measures. The relationship between the latent factors also varied by sex; the correlation of the BDD latent factor to both the affective and eating disorder latent factors were stronger in females than in males. Most notably, BDD symptoms were more strongly related to eating disorder symptoms than to affective disorder symptoms in female adolescents, and the opposite pattern was observed in male adolescents. A sex-specific association between BDD and eating disorders has also been observed in a clinical sample of adults with BDD, where lifetime prevalence of eating disorders was significantly higher among females than males (42.3 vs. 11.1%; Phillips, Menard, & Fay, 2006).

These findings highlight the need to consider sex differences as well as developmental differences in the structure of psychopathology (Wittchen et al., 2009). Alternatively, the current findings may reflect, in part, the fact that study participants had not yet passed through the typical age of onset for depression, eating disorders, OCD, or panic disorder (Hudson, Hiripi, Pope, & Kessler, 2007; Kessler et al., 2005). However, associations with earlier-onset disorders such as social anxiety, separation anxiety, and specific phobias were not notably stronger than those for later-onset disorders. Replication of the current findings in samples of

both adolescents and adults is needed to determine whether BDD continues to form a unique factor later in life. However, findings from adult twin studies of BDD symptoms may support the value of considering both shared and unique disorder features. Although BDD symptoms shared common genetic liabilities with symptoms of obsessive-compulsive spectrum disorders (Monzani, Rijdsdijk, Harris, & Mataix-Cols, 2014) and combined anxiety and obsessive-compulsive spectrum disorders (López-Solà et al., 2015), BDD was found to have the strongest disorder-specific genetic influences of the disorders assessed.

Limitations and Future Directions

This study is novel as it constitutes the first attempt to model the associations between symptoms of BDD and comorbid disorders using CFA. However, limitations of the current research need to be considered when interpreting the findings. Participants attended schools with average to high levels of socio-educational advantage, so the generalizability of findings to less advantaged samples is unclear. The study did not assess other *DSM-5* obsessive-compulsive and related disorders, such as trichotillomania and excoriation, and future studies are needed to explore the classification of these disorders. The eating disorder measure was developed to assess symptoms of anorexia nervosa and bulimia nervosa (Maloney et al., 1988), but given that BDD may have specific associations to different eating disorders (Hartmann et al., 2013), a broader range of *DSM-5* eating disorder symptoms should be assessed in the future. This includes assessment of muscularity-oriented disordered eating, particularly given current debates regarding the classification of muscle dysmorphia (dos Santos Filho, Tirico, Stefano, Touyz, & Claudino, 2015; Murray & Touyz, 2013).

As highlighted by Angold et al. (1999), longitudinal research studies are needed in order to understand the sequence of comorbid disorder onset, and to determine common versus specific risk factors for disorders. Further, as comorbidity is only one of the validators used to indicate the relationship between disorders in *DSM-5* (APA, 2013), future studies of the classification of BDD should span the full range of available validators. While the recruitment of participants from a population-based sample may be considered a strength of

the current research (Lahey et al, 2009), particularly given the reliance on highly specialised samples in much previous BDD research, the structure of psychopathology may differ between clinical and non-clinical samples (Kotov, Perlman, Gámez, & Watson, 2015). Key questions regarding the classification of BDD should thus be addressed in clinical and non-clinical samples, and involve longitudinal and large-scale epidemiological studies.

Conclusions

In adolescents, symptoms of BDD appear to form a separate factor that is correlated with symptoms of affective disorders and eating disorders. In both male and female adolescents, BDD is moderately associated with affective disorders, including OCD, anxiety and depression. The association between BDD and eating disorders is strong for females, and weak for males. These findings highlight the need for future studies examining the classification of BDD to consider developmental and sex differences in their classification models. Further research is needed in order to establish both the unique and shared features of BDD, in order to inform classification schemes, clinical practice and aetiological models.

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Table 5.1. Bivariate Correlations (Spearman's Rho) between Symptom Measures for Males (Above the Diagonal) and Females (Below the Diagonal)

	BDD-IA	BDD-OS	Depression	GAD	Social	Separation	Specific	Panic/Ag	OCD	ED-BU	ED-DI	ED-OC
BDD-IA	-	0.92	0.37	0.33	0.37	0.24	0.20	0.28	0.27	0.22	0.26	0.22
BDD-OS	0.87	-	0.37	0.34	0.36	0.23	0.20	0.26	0.26	0.23	0.25	0.21
Depression	0.50	0.50	-	0.57	0.55	0.43	0.32	0.52	0.51	0.32	0.28	0.31
GAD	0.42	0.43	0.62	-	0.65	0.55	0.41	0.58	0.58	0.28	0.24	0.30
Social	0.44	0.44	0.57	0.64	-	0.50	0.42	0.50	0.51	0.25	0.23	0.31
Separation	0.27	0.25	0.39	0.58	0.50	-	0.37	0.49	0.51	0.25	0.27	0.25
Specific	0.17	0.17	0.26	0.39	0.35	0.44	-	0.43	0.36	0.19	0.17	0.20
Panic/Ag	0.35	0.34	0.57	0.69	0.53	0.52	0.44	-	0.52	0.27	0.23	0.28
OCD	0.31	0.32	0.55	0.64	0.52	0.52	0.33	0.60	-	0.32	0.30	0.31
ED-BU	0.44	0.48	0.43	0.33	0.31	0.18	0.13	0.32	0.32	-	0.47	0.47
ED-DI	0.54	0.59	0.41	0.33	0.37	0.20	0.14	0.30	0.31	0.64	-	0.45
ED-OC	0.29	0.30	0.33	0.31	0.28	0.21	0.21	0.32	0.34	0.39	0.45	-

Note. All correlations were significant, $p < .001$. BDD = Body dysmorphic disorder. IA = Interference and avoidance. OS = Other BDD symptoms. GAD = Generalised anxiety disorder. Social = Social anxiety disorder. Separation = Separation anxiety disorder. Specific = Specific phobia relating to physical injury. Panic/Ag = Panic disorder and agoraphobia. OCD = Obsessive-compulsive disorder. ED = Eating disorder. BU = Bulimia. DI = Dieting. OC = Oral control.

Table 5.2. Goodness-of-Fit Evaluation for BDD Classification Models 1–5

Model	Sex	$SB\chi^2$	<i>df</i>	RMSEA [90% CI]	CFI	TLI	SRMR	AIC	BIC
1. Internalising Spectrum	Male	2907.729	54	.163 [.158, .168]	.656	.580	.110	122301.20	122502.83
	Female	1852.598	54	.170 [.164, .177]	.703	.637	.105	76603.97	76785.65
2. Affective Spectrum	Male	1887.239	53	.132 [.126, .137]	.779	.725	.079	120998.90	121206.14
	Female	1336.941	53	.145 [.139, .152]	.788	.736	.095	75999.84	76186.57
3. Body Image Spectrum	Male	1546.790	53	.119 [.114, .124]	.820	.776	.114	120508.49	120715.72
	Female	749.977	53	.107 [.100, .144]	.885	.857	.067	75265.29	75452.02
4. Obsessive-Compulsive Spectrum	Male	2022.670	51	.139 [.134, .144]	.762	.693	.074	120929.37	121147.80
	Female	901.613	51	.120 [.114, .127]	.860	.818	.109	75458.07	75654.89
5. BDD as a Separate Factor	Male	428.643	51	.061 [.056, .066]	.954	.941	.036	118936.70	119155.14
	Female	381.932	51	.075 [.068, .082]	.945	.929	.056	74832.14	75028.96

Note. Bold text indicated acceptable model fit according to the relevant criteria. $SB\chi^2$ = Satorra-Bentler adjusted chi-square. *df* = Degrees of freedom. RMSEA = Root mean-square error of approximation. CI = Confidence interval. CFI = Comparative fit index. TLI = Tucker-Lewis index. SRMR = Standardised root mean-square residual. AIC = Akaike information criterion. BIC = Bayesian information criterion.

Table 5.3. Standardised Factor Loadings and Factor Correlations for Models 1–5

Model	1		2		3		4		5	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Standardised Factor Loading										
Depression	.732	.753	.731	.741	.722	.717	.730	.716	.722	.717
Generalised anxiety disorder	.815	.838	.826	.861	.834	.880	.832	.884	.831	.880
Panic disorder and agoraphobia	.782	.792	.785	.809	.790	.828	.787	.821	.791	.828
Specific phobia (physical injury)	.560	.473	.562	.486	.569	.502	.565	.503	.570	.502
Separation anxiety disorder	.727	.630	.728	.651	.737	.672	.729	.662	.739	.672
Social anxiety disorder	.752	.724	.759	.731	.758	.724	.764	.731	.756	.723
Obsessive-compulsive disorder+	.747	.736	.748	.746	.752	.757	.751	.440	.754	.757
BDD-interference/avoidance	.488	.618	.479	.583	.918	.861	.550	.881	.921	.877
BDD-other symptoms	.493	.625	.484	.588	.911	.889	.553	.907	.918	.926
Eating disorder-bulimia	.398	.532	.792	.805	.315	.642	.790	.780	.789	.780
Eating disorder-dieting	.394	.543	.740	.854	.369	.723	.746	.889	.746	.890
Eating disorder-oral control	.403	.447	.742	.588	.309	.452	.739	.549	.740	.549
Factor Correlations										
Factor 1 - Factor 2	-	-	.465	.568	.488	.589	.922	.611	.476	.558
Factor 1 - Factor 3	-	-	-	-	-	-	.436	.496	.446	.498
Factor 2 - Factor 3	-	-	-	-	-	-	.551	.734	.373	.724

Note. Default formatting = loading for factor 1. Bold formatting = loading for factor 2. Italic formatting = loading for factor 3. BDD = body dysmorphic disorder.

Table 5.4. Model 5 Standardised Factor Loadings and Factor Correlations

Factor	Measure	Male		Female	
		Loading	95% CI	Loading	95% CI
Affective disorders	Depression	.722	.700, .744	.717	.699, .735
	Generalised anxiety disorder	.831	.821, .841	.880	.870, .890
	Panic disorder and agoraphobia	.791	.774, .808	.828	.816, .840
	Specific phobia (physical injury)	.570	.543, .597	.502	.475, .529
	Separation anxiety disorder	.739	.719, .759	.672	.650, .694
BDD	Social anxiety disorder	.756	.743, .769	.723	.707, .739
	Obsessive-compulsive disorder	.754	.740, .768	.757	.742, .772
	BDD-interference/avoidance	.921	.907, .935	.877	.863, .891
Eating disorders	BDD-other symptoms	.918	.904, .932	.926	.914, .938
	Eating disorder-bulimia	.789	.767, .811	.780	.761, .799
	Eating disorder-dieting	.746	.725, .767	.890	.875, .905
	Eating disorder-oral control	.740	.717, .763	.549	.520, .578
Factor Correlations		Factor	95% CI	Factor.	95% CI
Affective Disorders - BDD		.476	.448, .504	.558	.531, .585
Affective Disorders - Eating Disorder		.446	.404, .488	.498	.465, .531
BDD - Eating Disorder		.373	.341, .405	.724	.701, .747

Note. CI = Confidence interval. BDD = Body dysmorphic disorder. Factor = Factor correlation. M = Male. F = Female

Table S5.1. Model Fit Parameters for Fear and Distress Factor Models of Affective Disorders

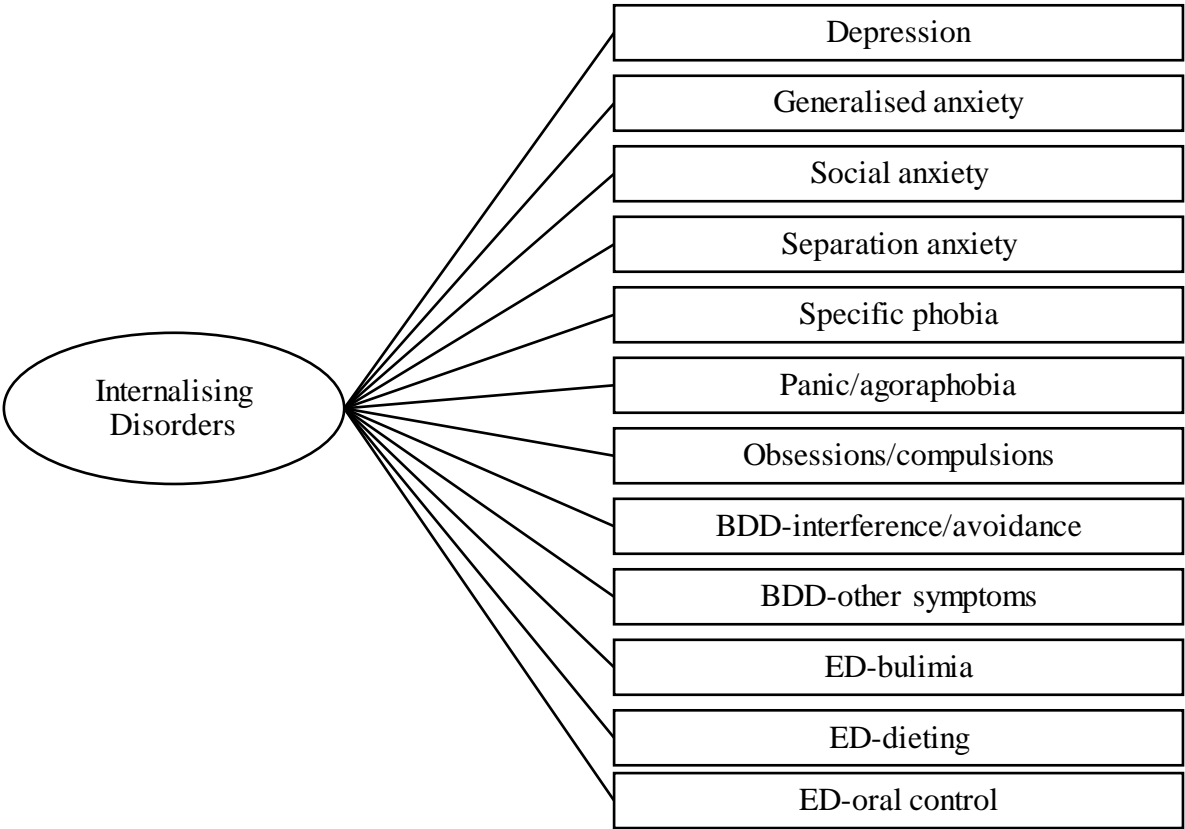
Model	Sex	$SB\chi^2$	df	RMSEA [90% CI]	CFI	TLI	SRMR	AIC	BIC
2 Factors: fear and distress	Male	207.143	8	.112 [.099, .125]	.948	.902	.032	54282.76	54389.16
	Female	100.660	8	.100 [.083, .118]	.964	.932	.034	34485.58	34581.46
1 Factor: affective disorders	Male	197.650	9	.102 [.090, .115]	.951	.918	.033	54288.57	54389.37
	Female	103.575	9	.963 [.080, .113]	.963	.939	.035	34486.41	34577.25

Note. $SB\chi^2$ = Satorra-Bentler adjusted chi-square. df = Degrees of freedom. RMSEA = Root mean-square error of approximation.

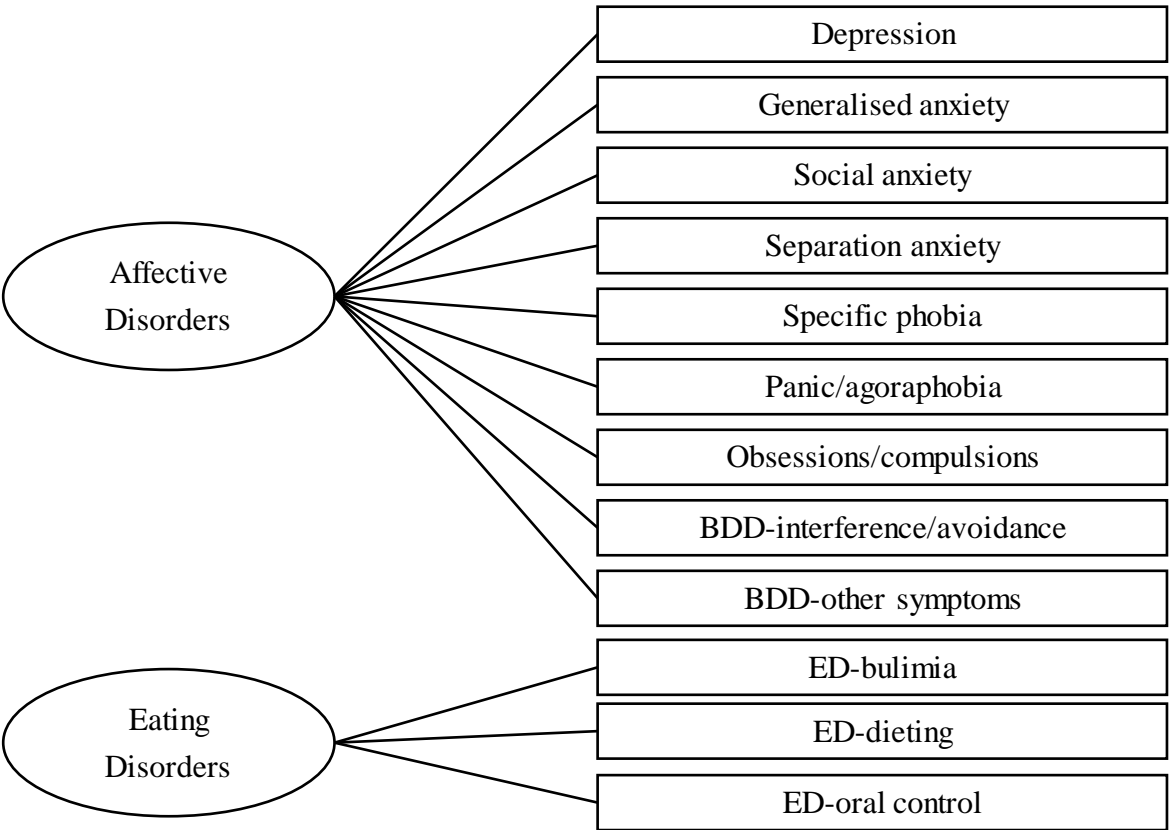
CI = Confidence interval. CFI = Comparative fit index. TLI = Tucker-Lewis index. SRMR = Standardised root mean-square residual.

AIC = Akaike information criterion. BIC = Bayesian information criterion.

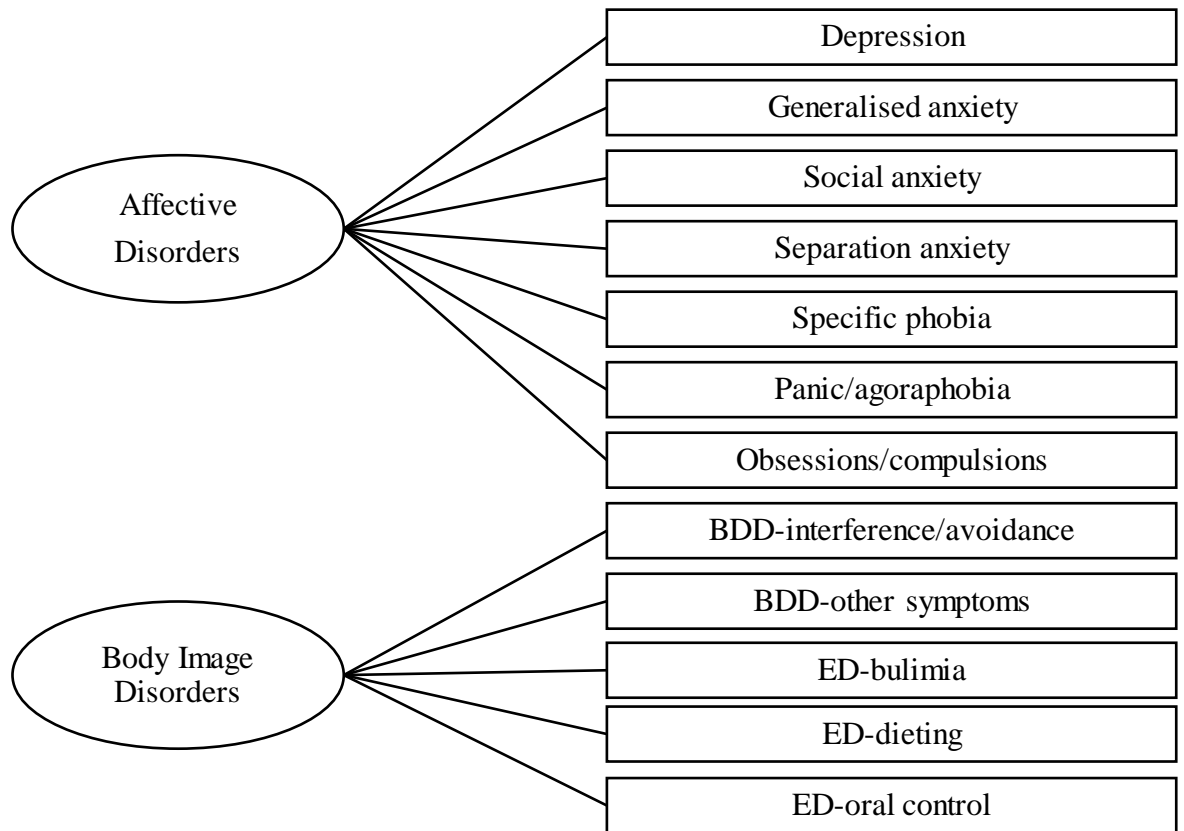
Figure 5.1. Models of the Classification of BDD Symptoms



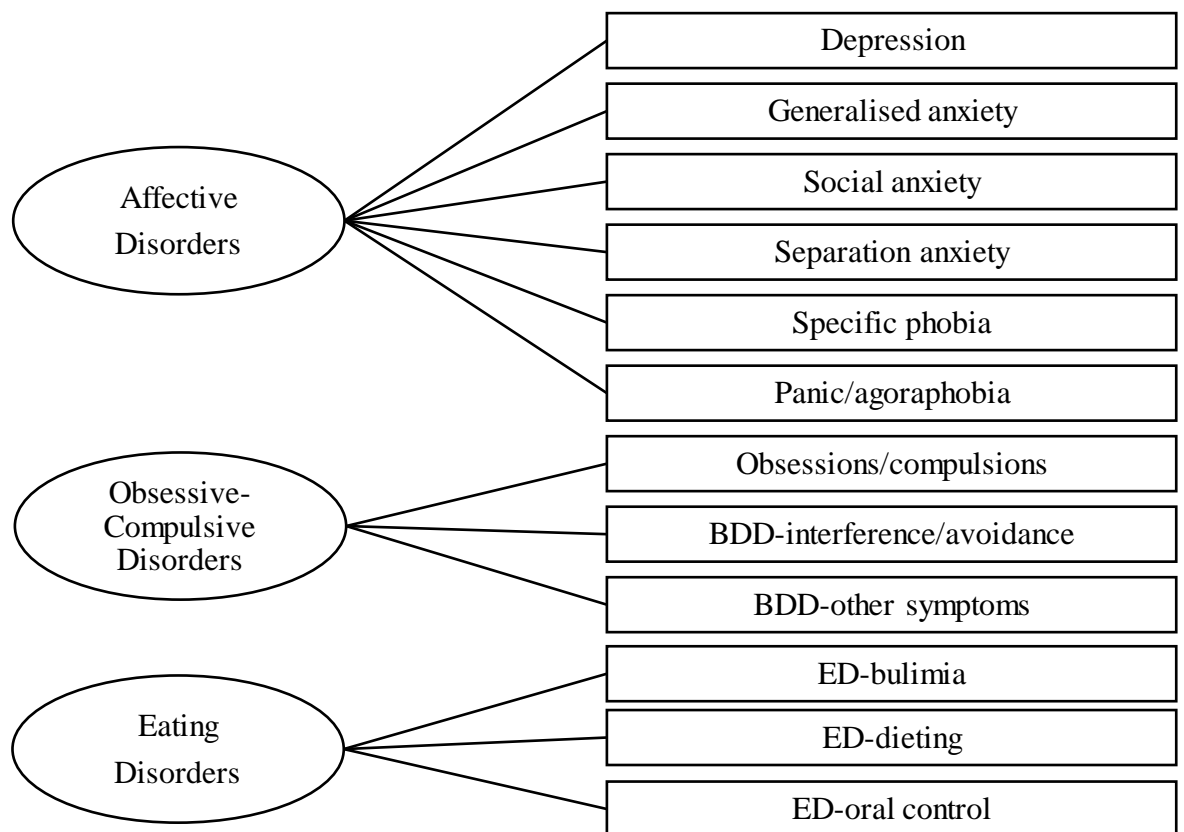
Model 1. BDD in the Internalising spectrum



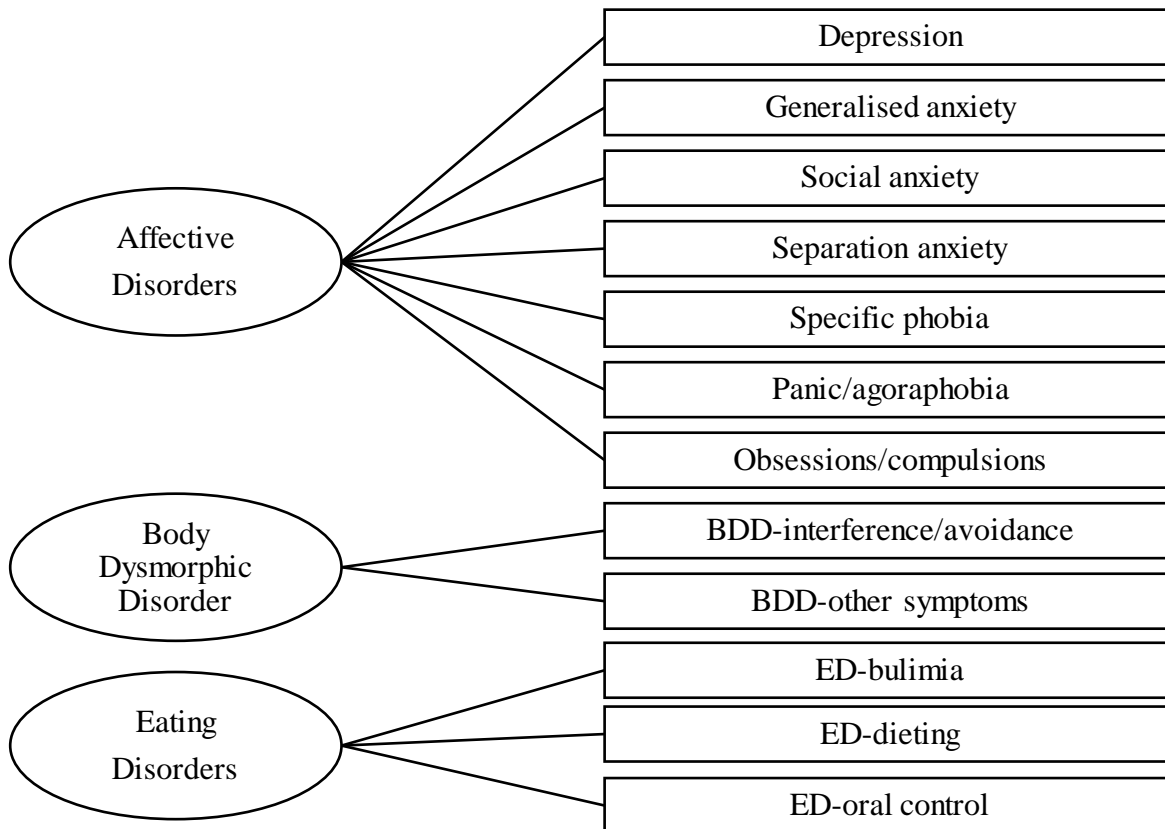
Model 2. BDD in the Affective Spectrum



Model 3. BDD in the Body Image Spectrum



Model 4. BDD in the Obsessive-Compulsive Spectrum



Model 5. BDD as a Unique Factor

Next is the final empirical paper, “Sex Differences in the Presentation of Body Dysmorphic Disorder in a Community Sample of Adolescents”. Chapter 2 and 3 did not explore sex differences in pBDD or sBDD, other than reporting prevalence by sex. Chapter 4 found that the BIQ-C can be used to compare BDD symptoms between males and females, and Chapter 5 highlighted the importance of considering sex differences in the association between BDD and other comorbid symptoms. Chapter 6 builds on findings from previous chapters by exploring sex differences in the presentation of BDD in a combined sample of pBDD and sBDD participants. Specifically, it examines sex differences in the types of BDD symptoms reported, the body areas of concern, the association with elevated comorbid symptoms, and past mental health service use. In males, it will also examine whether muscle dysmorphia is associated with a more severe BDD presentation.

Chapter 6

Sex Differences in the Presentation of Body Dysmorphic Disorder in a Community

Sample of Adolescents

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Abstract

Aims. The current study sought to explore sex differences in the presentation of probable full-syndrome and subthreshold body dysmorphic disorder (BDD) in adolescents from a community sample. Specifically, it examined sex differences in the types of BDD symptoms endorsed, body areas of concern, and the association with elevated symptoms of comorbid disorders. In male participants, it also compared the presenting features of those with and without muscle dysmorphia.

Method. Of 3,149 adolescents assessed using self-report questionnaires, 162 (5.1%) reported probable BDD; 57.4% male, $M_{\text{age}} = 14.89$ years, $SD = 1.33$, primarily from Oceanian or European cultural backgrounds. All participants completed measures of BDD symptoms, past mental health service use, and symptoms of anxiety, depression, obsessive-compulsive disorder and eating disorders. Male participants completed additional measures of quality of life, drive for muscularity, hyperactivity, conduct disorder, peer problems, and emotional symptoms.

Results. Controlling for demographic variables, males and females reported similar BDD symptom severity, rates of elevated comorbid symptoms, and mental health service use. Concerns regarding muscularity, chest, breasts/nipples and thighs differed by sex. Females were more likely than males to report elevated generalised anxiety symptoms. In males, muscle dysmorphia was not associated with greater severity across most measures.

Conclusions. The presenting features of BDD were broadly similar in males and females, and in males with and without muscle dysmorphia. Future research should seek to increase mental health service use in adolescents with BDD, and to improve rates of disorder detection in clinical settings.

Keywords. Body dysmorphic disorder, adolescent, clinical features, sex differences, muscle dysmorphia.

Introduction

Body dysmorphic disorder (BDD) involves preoccupation with perceived defects in appearance that appear minimal, or non-existent, to others (American Psychiatric Association [APA], 2013). BDD typically begins in adolescence; the mean age of disorder onset is 16 years, with mean subclinical symptom onset at 13 years (Bjornsson et al., 2013; Marques, LeBlanc, et al., 2011). BDD onset prior to the age of 18 is reported by 66.8% of adults, and is associated with increased suicidality and comorbidity compared to those with adult onset (Bjornsson et al., 2013). As BDD is a potentially severe disorder that typically follows a chronic course without appropriate mental health treatment (Phillips, Menard, Quinn, Didie, & Stout, 2013), these difficulties are likely to persist into adulthood. Together, these factors highlight the need for early detection and treatment of adolescent BDD (Fang & Wilhelm, 2015).

A serious barrier to the early detection of BDD is under diagnosis in routine clinical settings (Phillips & Feusner, 2010). Across three studies of adolescents and adults in psychiatric settings, standard clinical interviews detected just 1/55 (1.8%) cases of BDD subsequently identified using BDD-focused measures (Dyl, Kittler, Phillips, & Hunt, 2006; Grant, Kim, & Crow, 2001; Veale, Akyüz, & Hodsoll, 2015). Individuals with BDD are unlikely to spontaneously disclose their BDD symptoms, which may be related to feelings of embarrassment or shame, or poor insight into their concerns (Buhlmann, 2011; Didie, Kelly, & Phillips, 2010; Marques, Weingarden, LeBlanc, & Wilhelm, 2011). This places a responsibility on the assessing clinician to probe for the presence of BDD, and to be familiar with the symptomatology of BDD (Phillips & Feusner, 2010; Zimmerman & Mattia, 1998).

As there may be developmental differences in the features or impact of BDD (Phillips, Didie, et al., 2006), it is important that clinicians are aware of the presentation of BDD in adolescents. Accordingly, several studies have provided information about the presenting features of adolescent BDD in clinical samples (Albertini & Phillips, 1999; Dyl et al., 2006; Greenberg, Mothi, & Wilhelm, 2016; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006).

However, it is unclear how representative these findings are of adolescents with BDD in the general community, as treatment-seeking for BDD may be associated with greater symptom severity, increased comorbidity, or suicidality (Albertini & Phillips, 1999). Further, these clinical studies have involved just 126 adolescents with BDD, of whom only 24 (19.0%) were male. As the community prevalence of adolescent BDD is equal across sex (Chapter 2), it is unclear whether the underrepresentation of males in clinical samples may be due to lower treatment-seeking, or additional difficulties in obtaining a diagnosis of BDD. Either way, existing research on the presentation of adolescent BDD is highly limited, and it is unclear how well female-dominated clinical samples represent adolescents in the general community, and male BDD presentations in particular.

Sex differences in adolescent BDD should be explored, as some features of BDD differ between males and females in adult clinical samples. Although overall BDD severity was similar between males and females (Phillips & Diaz, 1997; Phillips, Menard, & Fay, 2006), males were more likely to be single and living alone than females, suggesting greater interference in romantic relationships (Phillips, Menard, et al., 2006). Some BDD symptoms appeared to differ; males were more likely to lift weights than females, whereas females were more likely to try to camouflage their appearance, pick their skin, and check the mirror excessively (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips, Menard, et al., 2006). Males reported higher rates of lifetime substance use disorders than females, whereas females reported higher rates of bulimia and generalised anxiety disorder than males (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips, Menard, et al., 2006). Some of the body areas of concern also differed by sex; males were more likely to be concerned about their genitals, body build, and thinning hair, whereas females were more likely to be concerned about weight, breasts/chest, hips, buttocks, thighs, legs, and other hair concerns (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips, Menard, et al., 2006).

In addition to a lack of research on sex differences in adolescent BDD, there has been little research concerning muscle dysmorphia; a subtype of BDD that affects males almost exclusively, where the individual is concerned about being insufficiently muscular or having a small body build (APA, 2013). In adult males with BDD, those with muscle dysmorphia report poorer quality of life, greater suicidality, and higher prevalence of substance use disorder than those without muscle dysmorphia (Pope et al., 2005). Currently, it is unknown whether muscle dysmorphia is associated with a more severe BDD presentation in adolescent males. There is also substantial debate regarding the classification of muscle dysmorphia. Some researchers have suggested that it is a form of BDD reflecting Western masculine body image ideals (Kanayama & Pope, 2011); whereas others argue that it is better understood as an eating disorder (Mitchison & Mond, 2015; Murray, Griffiths, & Mond, 2016). A recent review reported that there is insufficient evidence to support any proposed classification (dos Santos Filho, Tirico, Stefano, Touyz, & Claudino, 2015). Therefore, not only is it important to determine whether muscle dysmorphia is associated with greater BDD severity for clinical reasons, but research comparing the BDD presentation of males with and without muscle dysmorphia may help to inform the current classification debate.

The Current Study

BDD is underdiagnosed in clinical settings, and there is limited information available to clinicians regarding the presentation of adolescent BDD. Further, it is unclear whether and to what extent findings from female-dominated clinical samples represent male and female adolescents with BDD in the general community. The aims of this study therefore were 1) to explore potential sex differences in the presenting features of BDD in adolescents from a community sample, and 2) to compare the presentation of BDD in males with and without muscle dysmorphia. Consistent with Dyl et al. (2006), we chose to include participants who screened positive both for probable full-syndrome BDD (pBDD) and subthreshold BDD (sBDD). Using the same sample, we have previously identified that pBDD and sBDD are associated with higher symptoms of depression, anxiety, and eating disorders, and higher

rates of mental health service use than those without BDD (Chapter 2; Chapter 3). The pBDD and sBDD groups were therefore combined in the current study in order to identify participants with a broad range of BDD symptom severity, and to increase statistical power for key analyses.

Based on the limited available evidence, it was hypothesised that males would report higher levels of interference with romantic relationships than females, and that females would report higher appearance checking than males. It was further hypothesised that females would be more likely than males to report elevated symptoms of eating disorders and generalised anxiety disorder. Certain body areas of concern were expected to vary by sex, with males predicted to report elevated concerns about muscularity, genitals, body build, and thinning hair, and females to report elevated concerns about weight, breasts, hips, buttocks, thighs, legs, and other hair concerns. Females were expected to report higher levels of past mental health service use than males. Finally, males with symptoms of muscle dysmorphia were hypothesised to have poorer quality of life, a greater number of body areas of concern, greater muscularity-related body image disturbance, and more muscularity-driven behaviours than males without muscle dysmorphia.

Method

Participants

Details of the study design and recruitment methods have been reported previously (Chapter 2; Chapter 3; Chapter 4, & Chapter 5). Briefly, participants were recruited from seven high schools in the Greater Sydney area of New South Wales, Australia. Females were recruited from two independent and one government girls' school participating in a study of the development and prevention of anxiety and depression. Males were recruited from four Catholic boys' schools participating in a study of the utilisation of an online treatment program for anxiety. Of 5,005 students enrolled in eligible school grades at the time of testing, 3,149 (62.9%) consented to involvement in the larger study and provided sufficient information for BDD group categorisation. Of these participants, 93/2,000 males (4.7%) and

69/1,149 females (6.0%) reported pBDD or sBDD using the Body Dysmorphic Disorder Questionnaire-Adolescent Version (Phillips, 2005). This resulted in a final sample of 162 adolescents with pBDD or sBDD (57.4% male, $M_{age} = 14.86$, $SD = 1.33$, range 12–18 years), hereafter referred to as having BDD.

Procedure

All assessments were conducted during school hours, and were supervised by members of the research team. Students completed questionnaires using de-identified codes and participants were informed that their responses were confidential unless their responses indicated serious risk of harm. The research was approved by the Human Research Ethics Committee of Macquarie University, reference 5201300531 and 5201100886, and by the governing bodies of each school.

All participants consented to involvement in the relevant larger study of emotional health, of which the current study was a part. Parents were provided with written information about the overall study and were asked to discuss participation with their child. Students were also informed directly about the study, typically in school assemblies or class groups. At boys' schools, opt-out parent consent was used, and if parents did not opt out, students provided active consent. At girls' schools, opt-in parent consent was used, and all students had the opportunity to opt out of testing verbally. No incentives to participation were provided by the researchers, however, some schools provided incentives to students for the return of consent forms, regardless of the consent status.

Measures

All participants. The Body Dysmorphic Disorder Questionnaire-Adolescent Version (BDDQ-A; Phillips, 2005) assesses *DSM-IV* BDD criteria, appearance preoccupation, and associated distress and impairment (APA, 1994). The response options are yes or no, though participants are asked to describe the body areas of concern, and the nature of any interference and avoidance. Those with a primary concern about weight are excluded from BDD screening. Time spent thinking about appearance per day is also assessed, where thinking

about appearance for at least one hour per day indicates probable full-syndrome BDD, and less than one hour was used to indicate subthreshold BDD.

The Body Image Questionnaire-Child and Adolescent Version (BIQ-C; Veale, 2009) assesses BDD symptom severity. The questionnaire begins with a screening item to determine if the participant has any appearance concerns. If the participant does not report any concerns, they are given a total score of 0 and do not answer further items. Those with appearance concerns rank up to five body areas from most to least concerning, then answer 12 questions assessing appearance checking, distress, avoidance, and impairment. These items have tailored responses on a 0–8 scale, and after reverse-scoring three items, higher scores indicate greater symptom severity.

Although the original BIQ-C has 12 symptoms items, a recent study conducted in our larger adolescent sample supported using an alternate 9-item, 2 factor version of the measure (the BIQ-C-9, Chapter 4). This version had good internal consistency for males/females; total scale Cronbach's $\alpha = .84/.89$, 'interference and avoidance' factor $\alpha = .71/.78$, and 'other symptoms' factor $\alpha = .76/.84$. Among BDD participants in the current study, total scale internal consistency for males/females was $\alpha = .79/.76$. However, internal consistency in the two factors were relatively low ('interference and avoidance' $\alpha = .69/.65$, 'other symptoms' $\alpha = .65/.57$). For this reason, only the BIQ-C-9 total score was utilised in the current study.

The body areas of concern reported in the BDDQ-A and BIQ-C-9 were coded into categories based on body areas reported by Phillips (2005). If the participant reported being concerned about small body build, overall muscularity or the muscularity of a specific body area (e.g. arm muscles), the response was coded as 'muscle dysmorphia'. If they had other or unspecified body build concerns this was coded as 'body build'. If the concern was about overall excess weight or weight-related concerns about a specific area (e.g. fat legs), the response was coded as 'weight'. If the participant did not specify what was disliked about the body area or it was not clearly related to weight or muscularity, it was coded as the specific body area (e.g. nose).

The child version of the 26-item Eating Attitudes Test (ChEAT-26; Maloney, McGuire, & Daniels, 1988) was used to measure disordered eating attitudes and behaviours. The least problematic responses (*never, rarely, sometimes*) are scored 0, the remaining responses scored as 1 (*often*), 2 (*very often*) or 3 (*always*). Good internal consistency has been found in adolescent populations ($\alpha = .86-.87$; Rojo-Moreno et al., 2011; Smolak & Levine, 1994), and a total score of 20 or above indicates a high probability of clinically significant eating disorder pathology (Maloney et al., 1988). In the current study, total scale Cronbach's α values for males/females were $\alpha = .78/.85$.

The Spence Children's Anxiety Scale (SCAS; Spence, 1998) contains 38 items assessing social anxiety, separation anxiety, generalised anxiety, panic-agoraphobia, obsessive-compulsive disorder, and specific phobias (limited to physical injury-related fears). Items are scored 0 (*never*) to 3 (*always*). The scale has good psychometric properties, with support found for the six-factor model, acceptable internal consistency (total scale $\alpha = .92$, subscale $\alpha = .60-.80$), convergent and divergent validity, and test-retest reliability (Spence, Barrett, & Turner, 2003). Age and sex-specific cut-off scores have been developed from Australian community norms; a T-score of 60 indicates those in the top 15.9% of scores, and is used to indicate elevated anxiety (Spence, n.d.). In the current study, Cronbach's α values for the total scale for males/females were $\alpha = .92/.89$, social anxiety $\alpha = .76/.60$, separation anxiety $\alpha = .77/.46$, generalised anxiety $\alpha = .78/.79$, panic-agoraphobia $\alpha = .83/.85$, obsessive-compulsive disorder $\alpha = .78/.74$, and specific phobias $\alpha = .57/.51$.

The Short Mood and Feelings Questionnaire (SMFQ; Angold, Costello, Messer, & Pickles, 1995) assesses depression symptoms over the past two weeks. The 13 items are scored from 0 (*not true*) to 2 (*true*). The SMFQ correlates well with diagnostic measures of depression and discriminates between depressed and non-depressed individuals, with a total score > 7 suggesting elevated depressive symptoms (Angold et al., 1995). It has strong internal consistency ($\alpha = .84-.90$; Angold, Erkanli, Silberg, Eaves, & Costello, 2002; Rhew et al., 2010). In this study, internal consistency for males/females was $\alpha = .90/.86$.

Participants were asked to complete a small number of demographic questions, and whether they had ever received assessment or treatment for any mental health concerns. If so, they were asked to specify what types of professionals were seen and to briefly describe the reasons for seeking treatment. A school-level variable, the index of socio-educational advantage (ICSEA; Australian Curriculum and Assessment Reporting Authority, 2013), was used to estimate the socio-educational advantage of each school.

Male participants only. The drive for muscularity scale (DMS; McCreary & Sasse, 2000) is a 15 item measure of muscularity-oriented behaviours and body image concerns. Items are scored from 1 (*never*) to 6 (*always*), and subscales are calculated as the mean of the items. As suggested by the authors of the measure, the item assessing anabolic steroid use was omitted as it was unlikely to be relevant to this sample (McCreary, 2007). Good internal consistency has been reported in previous population-based studies of adolescent and young adult males ($\alpha = .85-.87$; Brunet, Sabiston, Dorsch, & McCreary, 2010; McCreary, Sasse, Saucier, & Dorsch, 2004). For males in the current study, Cronbach's α for the total scale was .90, muscularity-driven body image $\alpha = .91$, and muscularity-driven behaviours $\alpha = .91$.

Quality of life was assessed using the Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q; Endicott, Nee, Yang, & Wohlberg, 2006). Life satisfaction is assessed using 14 items covering a range of physical, emotional and social domains. A final item assessing total life satisfaction is not included in the total score. Items are scored from 1 (*very poor*) to 5 (*very good*), and the total score (range 14–70) is converted to the percentage of the maximum possible score (range 0–100%). The measure has good internal consistency ($\alpha = .87-.89$) and test-retest reliability, and provides unique information over and above measures of illness severity (Endicott et al., 2006; Merry et al., 2012). For males in this study, Cronbach's $\alpha = .91$.

The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) assesses emotional symptoms, conduct problems, hyperactivity and peer problems using 20 items scored from 0 (*not true*) to 2 (*certainly true*), summed to form a total difficulties score. Age

and sex-specific cut-off scores have been developed from Australian community norms that identify the top 10% of responses (Mellor, 2005). In the current study, male internal consistency for the total score $\alpha = .80$, emotional symptoms $\alpha = .64$, conduct problems $\alpha = .68$, hyperactivity $\alpha = .72$, and peer problems $\alpha = .67$.

Data Analysis

Sex differences in the dependent variables were analysed using chi-square tests with odds ratios or Cramer's V effect sizes for categorical variables, or independent samples t-tests with Cohen's d effect sizes for continuous variables. If a significant bivariate sex difference was found in a dependent variable, supplementary analyses were conducted to control for the effect of any demographic variables that varied by sex. These analyses were either logistic regressions with odds ratio effect size for categorical variables, or analysis of covariance (ANCOVA) with partial eta squared effect size for continuous variables. For all analyses, the level of significance was set at $\alpha = .05$.

Results

Demographic Characteristics

Table 6.1 presents comparisons of demographic variables by sex. There were no significant sex differences in the percent of participants who had pBDD, parent occupation, family setting, or the percentage of participants that spoke English as the main language at home. However, males were significantly older than females, and the socio-educational advantage of their schools was lower. Cultural background coding was condensed due to low numbers in some categories. Asian, African, American, and Middle Eastern backgrounds were coded as 'other', and compared to Oceanian backgrounds (e.g. Australian, New Zealander, Melanesian, or Polynesian) or European backgrounds. There was a significant association between sex and parental cultural background, namely, males were more likely to report that their mothers and fathers had a European background, whereas females were more likely to report 'other' backgrounds, most commonly, Asian backgrounds.

Body Dysmorphic Symptom Comparisons

Endorsement of BDDQ-A distress and interference criteria is shown in Table 6.2. Males were more than twice as likely as females to report interference with socialising or dating, and interference with school or work. However, these sex differences were no longer significant when age, socio-educational advantage, and parental cultural background were controlled for using logistic regressions (see Table S6.1). Descriptive statistics for the BIQ-C-9 item and total scores are presented in Table 6.3. The only significant bivariate sex difference was the item relating to social interference, however, this was no longer significant when controlling for covariates in the supplementary ANCOVAs (Table S6.2).

Body Areas of Concern

Females reported a larger number of different body areas of concern ($M = 5.68$, $SD = 2.89$) than males ($M = 4.24$, $SD = 1.87$), $t(109.24) = 3.62$, $p < .001$, $d = 0.59$ (95% CI = [0.29, 0.93]), however, this difference was no longer significant in the supplementary analysis (Table S6.2). Prior studies have found that males and females differ in the nature of their concerns about hair, for example, thinning hair, excess hair, or hair style. In the current study, however, there was insufficient data to confidently code all responses according to the type of hair concern. Hence, a single hair concern variable was used. Table 6.4 shows sex differences in the body areas of concern that were endorsed by at least 10% of males or females. Significant bivariate sex differences were observed for 9/20 body areas analysed. Sex differences in concerns about muscularity, breasts/nipples, thighs and chest remained significant in the supplementary logistic regressions (Table S6.1), whereas differences in concern about stomach, eyes, and teeth were no longer significant. Logistic regressions for concern about hips and eyebrows could not be conducted due to complete separation of the outcome variable (no males reported concern about hips, and no participants with mothers from an Oceanian background reported concern about eyebrows).

Comorbid Symptom Severity

The percentage of participants with elevated levels of anxiety, depression and eating disorders, by sex, is shown in Table 6.5. Females were more likely to report elevated generalised anxiety symptoms than males, whereas males were more likely to report elevated rates of specific phobia (physical injury) than females. In supplementary analyses, the effect of sex on generalised anxiety disorder scores remained significant, whereas the effect on specific phobia scores did not (Table S6.1).

Past Mental Health Service Use

Information about past mental health service use was provided by 131 participants (80.9%). Past mental health service use was more common in males (33/93 = 35.5%, 95% CI = [26.5, 45.6]) than in females (5/38 = 13.2%, 95% CI = [5.8, 27.3]), $\chi^2 = 6.53$, $p = .011$, odds ratio = 3.63 (95% CI = [1.29, 10.19]). However, this effect was no longer significant in the supplementary logistic regression analysis (Table S6.1)

Of the 33 males and 5 females who had accessed mental health services, the most common professionals consulted were school counsellors (male $n = 20$, female $n = 3$), psychologists (male $n = 15$, female $n = 1$), and psychiatrists (male $n = 4$, female $n = 1$). Information about the reasons for service use was disclosed by 26 males and 5 females, the most common of these being depression/sadness (male $n = 10$, $n = 1$), anxiety (male $n = 6$, female $n = 2$), and family problems (male $n = 5$, female $n = 1$). No participant reported BDD or appearance concerns as a reason for seeking mental health services.

Comparison of Males With and Without Muscle Dysmorphia

Of the 93 male participants, 41 (44.1%) reported at least one body area of concern related to muscularity or small body build. Supporting the conceptualisation of muscle dysmorphia as a primarily male presentation, such concerns were reported by just 4.3% of females. Table 6.6 compares males with and without muscularity concerns on a range of study variables. As predicted, males with muscularity concerns reported significantly higher muscularity-related body image scores on the DMS, and a greater number of different body

areas of concern, than those who did not report these concerns. However, there was no difference in quality of life or muscularity-related behaviours. Males without muscle dysmorphia actually reported greater interference with socialising or dating than those with muscle dysmorphia. There were no significant differences between groups with respect to BDD symptom severity, endorsement of other BDD criteria, or rates of elevated comorbid symptoms, nor with respect to past mental health service use; with muscle dysmorphia (13/41 = 31.7%, 95% CI = [19.6, 47.0]) without muscle dysmorphia (20/52 = 38.5%, 95% CI = [26.5, 52.0]), $\chi^2(1, N = 93) = 0.46, p = .499$, odds ratio = 1.35 (95% CI = [0.57, 3.19]). There were also no differences between groups on any of the demographic variables assessed.

Discussion

Information about the presentation of adolescent BDD is vital for the early detection of the disorder. Overall, in adolescents with probable full-syndrome or subthreshold BDD (BDD) recruited from the general community, there were few sex differences in the presenting features of BDD. Males and females were similar in the types of BDD symptoms endorsed, the association with elevated depression, anxiety, and eating disorder symptoms, many body areas of concern, and rates of past mental health service use. However, there were sex differences in some body areas of concern, and females reported higher rates of elevated generalised anxiety disorder. In males, muscle dysmorphia was not associated with a more severe disorder presentation in terms of BDD symptom severity, quality of life, or severity of most comorbid symptoms.

Summary of Main Findings

Overall, there were few sex differences in the presentation of BDD, or in associated features. Contrary to hypotheses, females did not report higher levels of BDD-related appearance checking. Although males did report greater levels of social interference related to BDD, this was not significant after controlling for demographic variables that differed by sex; age, socio-educational advantage, and parental cultural background. There were no sex differences in endorsement of specific BDD symptoms, or in the overall severity of BDD

symptoms. This is broadly consistent with adult studies, which have found few sex differences in the core symptoms of BDD (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips, Menard, et al., 2006).

As in clinical samples of adolescents (Albertini & Phillips, 1999; Phillips, Didie, et al., 2006) and adults (Phillips, Menard, Fay, & Weisberg, 2005), the most common body areas of concern in the current study sample were skin, hair, and facial features. There was mixed support for the hypothesised sex differences in the body areas of concern. As predicted, males were significantly more likely to report muscularity concerns than females, and females were more likely to report concerns about breasts/nipples and thighs than males. Additionally, males were more likely to report concern about their chest. However, other hypothesised sex differences were not significant, or could not be properly assessed due to the coding system or low numbers for some comparisons.

Females were significantly more likely than males to report elevated symptoms of generalised anxiety disorder, though other symptoms comparisons did not differ by sex. Elevated comorbid symptoms were common in males and females, particularly depression, social anxiety, and generalised anxiety. They occurred at a higher rate than is expected in the general adolescent population (Schmeelk-Cone, Pisani, Petrova, & Wyman, 2012; Spence, n.d.), which is consistent with the high comorbidity of these disorders with BDD in clinical samples (Albertini & Phillips, 1999; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). Elevated levels of eating disorder pathology were less common in the current study, and comorbidity with eating disorders is relatively low in adolescents with BDD in clinical samples (0–16.7%; Albertini & Phillips, 1999; Greenberg, Mothi, et al., 2016; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). However, these studies are likely to have underestimated eating disorder comorbidity as they typically only assessed anorexia nervosa and bulimia nervosa, which may be less common in those with BDD compared to binge eating disorder and ‘not otherwise specified’ eating disorders (Phillips, Menard, et al., 2006).

Unexpectedly, past mental health service use was more common in males (35.1%) than in females (13.2%), though this difference was not significant when demographic variables were controlled for. Service use appears to be lower than in other disorders; data from a national survey of a 6,310 Australian children and adolescents showed 57.1% of those with mild depression, and 40.2% with mild anxiety, accessed mental health services in the past 12 months alone (Lawrence et al., 2015). Further, none of the current study participants who had used mental health services reported that their appearance concerns were a reason for seeking mental health services. Although this latter finding should not be taken as a proxy for poor BDD disclosure as we do not know whether their BDD symptoms were present at the time of service use, it is consistent with reports that individuals with BDD typically present for other concerns, such as mood or anxiety disorders (Veale et al., 2015). Of note, the majority of young people who had accessed help had done so via school counsellors, underscoring the importance of educating school personnel about BDD.

Finally, a substantial number (44.1%) of males reported concerns relating to muscularity or small body build, indicative of the muscle dysmorphia subtype of BDD (APA, 2013). As predicted, males with muscle dysmorphia reported higher muscularity-related body image concern, and were concerned about a higher number of different body areas, than those who did not. However, contrary to findings in adults (Pope et al., 2005), we found no difference in the quality of life of males with and without muscle dysmorphia, nor in BDD and comorbid symptom severity. However, it is important to note that suicidality, substance use, and exercise behaviours were not assessed in the current study, which may be important correlates of muscle dysmorphia (Pope et al., 2005). The similarity in most presenting features of males with and without muscle dysmorphia provides support for the current conceptualisation of muscle dysmorphia as a subtype of BDD.

Limitations and Future Directions

The study began prior to the release of *DSM-5*, which expanded BDD criteria to include repetitive behaviours or mental acts, and clarified exclusion criteria regarding eating

disorders (American Psychiatric Association, 2013). Although adult prevalence estimates are similar when using *DSM-IV* and *DSM-5* criteria (Schieber, Kollei, de Zwaan, & Martin, 2015), this is yet to be established in adolescent samples. The use of self-report screening questionnaires may result in false positives (Brohede, Wingren, Wijma, & Wijma, 2013), for example, if the appearance concerns are realistic or due to another disorder. The BDDQ-A item excluding individuals with primary weight concern is intended to preclude eating disorders being incorrectly labelled as BDD (Phillips, 2005). However, 42.3% of adult females and 11.1% of adult males with BDD report a lifetime history of an eating disorder (Phillips, Menard, et al., 2006), and weight concerns are common in adolescents with BDD (Albertini & Phillips, 1999; Phillips, Didie, et al., 2006). This exclusion criterion may therefore result in the underestimation of BDD prevalence where weight concerns are the primary feature of concern, and underestimation of the comorbidity between eating disorders and BDD. Future studies should explore ways to combine self-report questionnaire assessment of BDD and eating disorders to overcome these limitations. These studies should also assess a wider range of clinically-relevant outcomes, such as suicidality and substance use, as well as administering all measures to male and females. BDD should be explored in more diverse samples to include the generalizability of findings. As insight may be particularly poor in adolescents with BDD (Phillips, Didie, et al., 2006), multi-informant methods should be considered when assessing BDD in adolescents.

The BIQ-C-9 subscales of ‘interference and avoidance’ and ‘other symptoms’, devised in our whole sample in a previous study (Chapter 4) had poorer than anticipated internal consistency. Hence, the psychometric properties of the BIQ-C-9 subscales and those of alternative measures (e.g., Veale et al, 2014) should be evaluated in future research. Although males with and without muscle dysmorphia were similar across many measures, further research is needed to examine the criteria and conceptualisation of muscle dysmorphia (Phillipou, Blomeley, & Castle, 2015). Finally, all participating schools reported average to high levels of socio-educational advantage, and only one school was government-run. Hence,

the generalisability of the findings to populations with lower socio-educational advantage is unclear.

Implications for Research, Policy, and Practice

The presenting features of BDD are highly similar in males and females recruited from a community sample. This is an encouraging finding, as it indicates that clinicians can look for the same core BDD symptoms regardless of sex. Distress and avoidance were the most highly endorsed criteria on the BDDQ-A, and for BIQ-C-9 symptoms, mean scores were highest for items relating to preoccupation about appearance, negative evaluation of features, and the importance of appearance for self-evaluation. Concern about skin and hair are the most common in males and females, though there are some differences in other body areas of concern. BDD was strongly associated with depression and anxiety in this community sample, and females were more likely than males to report elevated generalised anxiety. This highlights the need for clinicians to differentially diagnose BDD from these disorders in clinical assessments.

The relatively low mental health service use in the current study is consistent with findings from adult samples (Buhlmann, 2011; Marques, Weingarden, et al., 2011; Veale et al., 2015). Further research is needed in order to determine service use barriers in adolescent BDD, and to determine why males are underrepresented in specialist BDD settings (Albertini & Phillips, 1999; Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). In this study, some bivariate sex differences were found to be influenced by demographic variables; age, socio-educational advantage, and parental cultural background. This study was underpowered to examine these variables directly, but previous studies have found that the presentation of BDD in adults may be affected by factors such as culture and sexual identity (Boroughs, Krawczyk, & Thompson, 2010; Mayville et al., 1999). Future studies should thus explore the potential impact of a range of demographic variables. The presentation of BDD in our sample was generally consistent with findings from clinical samples of adolescents with BDD. This

suggests that findings from our study can be used to provide information to clinicians about the presentation of adolescent BDD in those with subthreshold or milder BDD presentations.

In conclusion, the presentation of BDD is similar between male and female adolescents in a community sample. This includes the types of BDD symptoms endorsed, many of the body areas of concern, and the close association with anxiety and depression. In males, muscle dysmorphia was not associated with greater BDD severity or poorer quality of life. It is vital that clinicians understand the presentation of BDD and screen for it appropriately, in order to improve early detection of this serious disorder.

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Table 6.1. Demographic Comparisons between Males (*n* = 93) and Females (*n* = 69)

Continuous Variables	Males	Females	<i>t</i>	<i>p</i>	<i>d</i>
	(<i>M</i> ± <i>SD</i>)	(<i>M</i> ± <i>SD</i>)			
Age	15.12 ± 1.31	14.51 ± 1.28	2.97	.003	0.4
ICSEA	1046.33 ± 40.0	1162.07 ± 48.5	16.15	<.001	2.64
Categorical Variables	<i>n</i> (valid %)	<i>n</i> (valid %)	χ^2	<i>p</i>	<i>V</i>
% Full-Syndrome BDD	35 (37.6)	20 (29.0)	1.32	.205	.09
Speak English at home	77 (92.8)	33 (84.6)	1.99	.158	.13
Mother Cultural background			11.39	.003	.28
Oceanian	23 (28.0)	15 (24.2)			
European	46 (56.1)	22 (35.5)	+		
Other ¹	13 (15.9)	25 (40.3)	+		
Father Cultural Background			13.57	.001	.31
Oceanian	22 (29.3)	22 (33.8)			
European	47 (62.7)	24 (36.9)	+		
Other ²	6 (8.0)	19 (29.2)	+		
Mother Occupation			5.59	.235	.22
Not in the workforce	12 (15.8)	8 (20.5)			
Manager/skilled professional	47 (61.8)	19 (48.7)			
Trade/manual	0 (0.0)	2 (5.1)			
Sales/clerical	9 (11.8)	4 (10.3)			
Community/health	8 (10.5)	6 (15.4)			
Father Occupation			4.38	.357	.20
Not in the workforce	4 (5.5)	3 (7.9)			
Manager/skilled professional	42 (57.5)	23 (60.5)			
Trade/manual	15 (20.5)	3 (7.9)			
Sales/clerical	7 (9.6)	7 (18.4)			
Community/health	5 (6.8)	2 (5.3)			
Household Type			2.83	.243	.15
Two parent household	58 (69.9)	32 (82.1)			
Single parent household	9 (10.8)	4 (10.3)			
Step/blended/other household	16 (19.3)	3 (7.7)			

Note. Bold text indicates a significant bivariate sex difference.¹ Other mother cultural background for males/females: North African and Middle Eastern (3.7/0.0%), Asian (7.3/30.6%), People of the Americas (2.4/8.1%), Sub-Saharan African (2.4/1.6%).² Other father cultural background for males/females: North African and Middle Eastern (2.7/3.1%), Asian (4.0/23.1%), People of the Americas (1.3/1.5%), Sub-Saharan African (0.0/1.5%). + Adjusted residual > |1.96|. BDD = Body dysmorphic disorder. ICSEA = Index of Community Socio-educational advantage. CI = Confidence interval. *d* = Cohen's *d*. *V* = Cramer's *V*

Table 6.2. BDDQ-A Distress and Impairment Criteria Comparisons between Males (*n* = 93) and Females (*n* = 69)

BDDQ-A Item	Males		Females		χ^2	<i>p</i>	OR [95% CI]
	<i>n</i>	%	<i>n</i>	%			
3a. Distress	65	69.9	48	69.6	0.00	.964	1.02 [0.52, 2.00]
3b. Interference with socialising or dating	53	57.0	23	33.3	8.90	.003	2.65 [1.39, 5.06]
3c. Interference with school or work	22	23.7	7	10.1	4.92	.044	2.74 [1.10, 6.86]
3d. Avoidance due to BDD	57	61.3	39	56.5	0.37	.541	1.22 [0.65, 2.29]

Note. Bold text indicates a significant bivariate sex difference. BDDQ-A = Body Dysmorphic Disorder Questionnaire-Adolescent Version. OR = Odds ratio, presented relative to the category with the lowest frequency. CI = Confidence interval.

Table 6.3. BIQ-C-9 Item and Total Score Comparisons between Males ($n = 93$) and Females ($n = 69$)

Item (original scale numbering)	Males		Females		t	p	d [95% CI]
	M	SD	M	SD			
3. Frequency of checking appearance	3.78	2.05	3.76	2.19	0.06	.950	0.01 [-0.32, 0.34]
4. Feeling that feature is ugly/not right	4.32	1.83	4.23	1.93	0.29	.772	0.05 [-0.28, 0.38]
5. Amount of distress	3.70	1.72	3.95	1.87	-0.86	.393	-0.14 [-0.47, 0.19]
6. Related avoidance of places or activities	2.70	2.03	2.52	2.13	0.53	.601	0.09 [-0.24, 0.42]
7. How much feature is on the mind	4.82	1.66	4.47	1.65	1.26	.208	0.21 [-0.12, 0.54]
8. Effect on romantic relationships	3.89	2.33	3.74	2.59	0.35	.729	0.06 [-0.27, 0.39]
10. Interference with school work	1.28	1.60	0.94	1.32	1.38	.170	0.23 [-0.10, 0.56]
11. Interference with social life	3.33	2.09	2.63	2.07	1.99	.049	0.34 [0.00, 0.67]
12. Appearance as most important characteristic	4.21	1.93	3.86	1.81	1.652	.101	0.19 [-0.15, 0.52]
9 item total score	30.55	12.44	28.09	12.34	1.20	.232	0.20 [-0.13, 0.52]

Note. Bold text indicates a significant bivariate sex difference. BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items.
 d = Cohen's d . CI = Confidence interval.

Table 6.4. Body Areas of Concern Comparisons between Males (*n* = 93) and Females (*n* = 69)

Area	Males		Females		χ^2	<i>p</i>	OR [95% CI]
	<i>n</i>	%	<i>n</i>	%			
Skin	57	61.3	48	69.6	1.19	.275	1.44 [0.75, 2.80]
Hair	33	35.5	25	36.2	0.01	.922	1.03 [0.54, 1.98]
Nose	24	25.8	26	37.7	2.62	.106	1.74 [0.89, 3.41]
Muscularity	41	44.1	3	4.3	31.62	< .001	17.35 [5.08, 59.19]
Stomach	10	10.8	28	40.6	19.63	< .001	5.67 [2.51, 12.78]
Breasts/Nipples	1	1.1	31	44.9	48.06	< .001	75.05 [9.89, 569.67]
Legs	18	19.4	13	18.8	0.01	.934	1.03 [0.47, 2.28]
Face - Other	14	15.1	13	18.8	0.41	.522	1.31 [0.57, 3.00]
Height	14	15.1	13	18.8	0.41	.522	1.31 [0.57, 3.00]
Weight	12	12.9	15	21.7	2.23	.136	1.88 [0.82, 4.32]
Thighs	1	1.1	22	31.9	30.86	< .001	43.06 [5.63, 329.40]
Lips/Mouth	8	8.6	13	18.8	3.68	.055	2.47 [0.96, 6.33]
Chest	19	20.4	1	1.4	13.19	< .001	17.46 [2.28, 133.96]
Arms	13	14.0	6	8.7	1.07	.301	1.71 [0.61, 4.74]
Eyes	4	4.3	12	17.4	7.63	.006	4.68 [1.44, 15.24]
Body Build	11	11.8	4	5.8	1.72	.190	2.17 [0.66, 7.16]
Teeth	4	4.3	10	14.5	5.21	.022	3.77 [1.13, 12.59]
Hips	0	0.0	11	15.9	15.91	< .001	+
Hands	3	3.2	7	10.1	3.27	.070	3.39 [0.84, 13.61]
Eyebrows	2	2.2	8	11.6	6.10	.014	5.967 [1.23, 29.06]

Note. Bold text indicates a significant bivariate sex difference. ⁺ Could not be calculated due to low frequency. OR = Odds ratio, presented relative to the category with the lowest frequency. CI = Confidence interval.

Table 6.5. Comparison of Percentage of Participants with Elevated or High-Risk Comorbid

Symptoms between Males (*n* = 93) and Females (*n* = 69)

Symptom Measure	Males		Females		χ^2	<i>p</i>	OR [95% CI]
	<i>n</i>	%	<i>n</i>	%			
Depression	57	61.3	49	71.0	1.66	.198	1.55 [0.79, 3.01]
Total Anxiety	38	40.9	31	44.9	0.27	.605	1.18 [0.63, 2.22]
Panic/Agoraphobia	36	38.7	28	40.6	0.06	.810	1.08 [0.57, 2.04]
Separation Anxiety	29	31.2	17	24.6	0.84	.361	1.38 [0.69, 2.80]
Social Anxiety	56	60.2	39	56.5	0.22	.637	1.16 [0.62, 2.19]
Specific Phobia (Physical Injury)	40	43.0	19	27.5	4.10	.043	1.98 [1.02, 3.88]
Obsessive-Compulsive Disorder	35	37.6	21	30.4	0.91	.341	1.37 [0.71, 2.68]
Generalised Anxiety	34	36.6	42	60.9	9.40	.003	2.70 [1.42, 5.13]
Eating Disorder	4	5.1	6	9.4	0.97	.325	1.91 [0.52, 7.1]

Note. Bold text indicates a significant bivariate sex difference. OR = Odds ratio, presented relative to the category with the lowest frequency. CI = Confidence interval.

Table 6.6. Comparisons of Outcomes between Males with ($n = 41$) and Without ($n = 52$) Muscle Dysmorphia

Continuous Variables	With Muscle Dysmorphia		Without Muscle Dysmorphia		t	p	d [95% CI]
	M	SD	M	SD			
BIQ-C-9 item total	31.88	9.05	29.29	14.97	0.94	.349	0.21 [-0.23, 0.64]
Drive for Muscularity Total Score	3.60	1.01	3.00	1.11	2.62	.011	0.56 [0.13, 1.00]
Drive for Muscularity Body Image	4.72	1.16	3.87	1.38	3.07	.003	0.66 [0.22, 1.10]
Drive for Muscularity Behaviours	2.48	1.35	2.12	1.27	1.24	.218	0.27 [-0.16, 0.70]
Quality of Life	59.13	18.19	61.31	20.43	-0.47	.640	0.11 [-0.58, 0.36]
Number of body areas of concern	5.07	1.51	3.57	1.86	4.28	<.001	0.88 [0.44, 1.30]
Categorical Variables	n	%	n	%	χ^2	p	OR [95% CI]
BDDQ-A 3a. Distress	31	75.6	34	65.4	1.14	.286	1.64 [0.66, 4.09]
BDDQ-A 3b. Interference with socialising or dating	18	43.9	35	67.3	5.12	.024	2.63 [1.13, 6.13]
BDDQ-A 3c. Interference with school or work	11	26.8	11	21.2	0.41	.523	1.37 [0.52, 3.57]
BDDQ-A 3d. Avoidance due to BDD	25	61.0	32	61.5	0.00	.956	1.02 [0.44, 2.37]
Elevated Depression	27	65.9	30	57.7	0.64	.422	1.41 [0.61, 3.30]
Elevated Total Anxiety	18	43.9	20	38.5	0.28	.596	1.25 [0.55, 2.88]
Elevated Panic/Agoraphobia	14	34.1	22	42.3	0.64	.422	1.41 [0.61, 3.30]
Elevated Separation Anxiety	12	29.3	17	32.7	0.13	.723	1.17 [0.48, 2.85]
Elevated Social Anxiety	26	63.4	30	57.7	0.31	.576	1.27 [0.55, 2.95]
Elevated Physical Injury Fears	17	41.5	23	44.2	0.07	.789	1.12 [0.49, 2.56]

Elevated Obsessive-Compulsive Disorder	15	36.6	20	38.5	0.03	.853	1.08 [0.46, 2.52]
Elevated Generalised Anxiety	17	41.5	17	32.7	0.76	.383	1.45 [0.62, 3.41]
Elevated Eating Disorder	1	2.6	3	7.7	1.05	.305	3.17 [0.32, 31.86]
Elevated Total Difficulties	16	39.0	16	30.8	0.69	.405	1.44 [0.61, 3.41]
Elevated Emotional Symptoms	19	43.6	21	40.4	0.33	.565	1.28 [0.56, 2.91]
Elevated Peer Problems	16	39.0	18	34.6	0.19	.661	1.21 [0.52, 2.82]
Elevated Conduct Problems	12	29.3	12	23.1	0.46	.498	1.38 [0.54, 3.50]
Elevated Hyperactivity	12	29.3	9	17.3	1.88	.171	1.98 [0.74, 5.29]

Note. Bold text indicates a significant bivariate muscle dysmorphia group difference. BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items. DMS = Drive for Muscularity Scale. SDQ = Strengths and Difficulties Questionnaire. *d* = Cohen's *d*. OR = Odds ratio, presented relative to the category with the lowest frequency. CI = Confidence interval.

Table S6.1. Effect of Sex on Categorical Dependent Variables after Controlling for Age, ICSEA, and Parent Cultural Background

Source	Variable	Males			Females			Chi-Square			Logistic Regression Effect After		
		Valid		%	Valid		%	Bivariate Effect		p	Controlling for Variables		p
		n	n		n	n		OR	OR [95% CI]		OR	OR [95% CI]	
Table 6.2	BDDQ-A 3b	53	23	33.3	23	33.3	.003	2.65	[1.39, 5.06]	.210	2.14	[0.65, 7.03]	
	BDDQ-A 3c	22	7	23.7	7	10.1	.044	2.74	[1.10, 6.86]	.118	3.76	[0.72, 19.72]	
Table 6.4	Muscularity	41	3	44.1	3	4.3	< .001	17.35	[5.08, 59.19]	< .001	24.28	[4.26, 138.31]	
	Stomach	10	28	10.8	28	40.6	< .001	5.67	[2.51, 12.78]	.077	3.71	[0.87, 15.83]	
	Breasts/Nipples	1	31	1.1	31	44.9	< .001	75.05	[9.89, 569.67]	< .001	121.44	[9.65, 1528.59]	
	Thighs	1	22	1.1	22	31.9	< .001	43.06	[5.63, 329.40]	.005	31.68	[2.84, 353.54]	
	Chest	19	1	20.4	1	1.4	< .001	17.46	[2.28, 133.96]	.018	28.48	[1.80, 451.77]	
	Eyes	4	12	4.3	12	17.4	.006	4.68	[1.44, 15.24]	.567	1.99	[0.19, 20.72]	
	Teeth	4	10	4.3	10	14.5	.022	3.77	[1.13, 12.59]	.719	1.44	[0.20, 10.34]	
	Hips	0	11	0	11	15.9	< .001	*	*	*	*	*	
	Eyebrows	2	8	2.2	8	11.6	.014	5.967	[1.23, 29.06]	*	*	*	
Table 6.5	Specific Phobia	40	19	43	19	27.5	.043	1.98	[1.02, 3.88]	.214	2.15	[0.64, 7.17]	
	Generalised Anxiety	34	42	36.6	42	60.9	.003	2.70	[1.42, 5.13]	.032	3.75	[1.12, 12.58]	
Results	Mental Health Service Use	33	5	35.5	5	13.2	.011	3.63	[1.29, 10.19]	.595	1.51	[0.33, 6.87]	

Note. Bold text indicates a significant effect of sex after controlling for other variables. * Value could not be estimated as the value of the outcome variable was 0 for all cases in a group for one or more predictor variables. ICSEA = Index of Community Socio-educational advantage. BDDQ-A = Body Dysmorphic Disorder Questionnaire- Adolescent Version. OR = Odds ratio, presented relative to the category with the lowest frequency.

Table S6.2. Effect of Sex on Continuous Dependent Variables after Controlling for Age, ICSEA, and Parent Cultural Background

Source	Variable	Males				Females		Independent Samples t-test		ANCOVA Effect After	
								Bivariate Effect		Controlling for Variables	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>p</i>	<i>d</i> [95% CI]	<i>p</i>	η^2_p		
Table 6.3	BIQ-C-9 item 11	3.33	2.09	2.63	2.07	.049	0.34 [0.00, 0.67]	.164	.017		
Results	Number of Body Areas of	4.24	1.87	5.68	2.98	< .001	0.59 [0.29, 0.93]	.094	.022		
	Concern										

Note. ICSEA = Index of Community Socio-educational advantage. BIQ-C-9 = Body Image Questionnaire-Child and Adolescent Version, 9 Items. *d* = Cohen's *d*.
CI = Confidence interval. η_p^2 = Partial eta-squared.

Chapter 7.

General Discussion

Overview of Thesis Findings

Body dysmorphic disorder (BDD) is a disorder characterised by preoccupation with imagined or minimal defects in appearance that causes substantial distress and impairment. Despite BDD typically beginning in the adolescent years (Bjornsson et al., 2013), research on BDD during this developmental period has been very limited. This thesis aimed to address a number of key research questions in the largest known study of adolescent BDD. The empirical papers focused on establishing the prevalence, presentation, and correlates of probable cases of full-syndrome (pBDD) and subthreshold BDD (sBDD). Further, they explored issues relating to the measurement and classification of BDD symptoms across the whole sample. This discussion chapter will briefly summarise the key contributions of the five empirical papers presented in Chapters 2–6, the clinical and research implications of the findings, limitations of the research, and overall conclusions.

The Identification of Probable Cases of BDD in Adolescents

Chapters 2 and 3 focused on the identification of individuals who met self-report screening criteria for BDD, with the aim of establishing the prevalence of probable cases of BDD, and examining their comorbid symptoms and past mental health service use. In this thesis, participants with (pBDD) were those who met all screening criteria for *DSM-IV* BDD according to the Body Dysmorphic Disorder Questionnaire-Adolescent Version (BDDQ-A; Phillips, 2005). That is, they were preoccupied with their appearance, had associated distress or impairment, were not primarily concerned about their weight, and thought about their appearance for at least one hour per day. We consider the categorisation to be *probable* as their questionnaire responses indicated they were likely to have BDD, but was not confirmed definitively with a face-to-face diagnostic interview. Participants with sBDD were those who met the same criteria for *DSM-IV* BDD, except they thought about their appearance for less than one hour per day. This duration criterion is widely accepted as an indication of clinical levels of preoccupation and is analogous to the duration criterion for obsessive-compulsive

disorder (Phillips et al., 2010), though it should be noted that this it is not a diagnostic criterion in *DSM-IV* or *DSM-5* (American Psychiatric Association [APA], 1994, 2013).

Prevalence of BDD. As presented in Chapter 2, the prevalence of pBDD in our sample was 1.7%, which was slightly lower than adolescent BDD prevalence estimates from the USA and Germany (2.2–2.3%; Mayville, Katz, Gipson, & Cabral, 1999; Rief, Buhlmann, Wilhelm, Borkenhagen, & Brahler, 2006). However, pBDD prevalence differed significantly between participants aged 12–14 years (1.1%) and those aged 15–18 (2.4%), which is consistent with reports that the mean age of BDD onset is 16 years (Bjornsson et al., 2013). Given that the two previous adolescent prevalence estimates were from samples with a minimum participant age of 14 years, it may be more relevant to compare these estimates to the older adolescent group only. If so, the prevalence estimates from these three studies are highly congruent, especially in light of the differences in study methodology and countries of origin.

To provide some context for this finding, the current prevalence of pBDD in our study was higher than the past 30 day prevalence in Australian adolescents aged 12–17 of OCD (0.5%), generalised anxiety disorder (1.5%), social anxiety disorder (1.7%), separation anxiety disorder (1.5%), or depression (1.4%; Australian Government Department of Health, n.d.). Caution is clearly required when making these comparisons due to differences in study methodologies, but it does indicate that the prevalence of adolescent BDD may in fact exceed that of several other, more widely recognised, adolescent disorders.

As examined in Chapter 3, the prevalence of sBDD (3.4%) was double that of pBDD. There are no equivalent studies with which to compare sBDD prevalence in adolescents, but on average, other subthreshold disorders are twice as common as full-syndrome presentations in adolescents (Roberts, Fisher, Blake Turner, & Tang, 2015). Like pBDD, sBDD was more prevalent in older adolescents (4.0%) than in younger adolescents (2.7%). sBDD was more prevalent in females (4.3%) than in males (2.9%), however, the prevalence of pBDD did not differ by sex. Although individual BDD prevalence studies do not tend to find significant sex

differences (Buhlmann et al., 2010; Koran, Aboujaoude, Large, & Serpe, 2008; Mayville et al., 1999; Rief et al., 2006), a recent review found that sex differences in BDD prevalence vary according to the type of sample assessed (Veale, Gledhill, Christodoulou, & Hodsoll, 2016). Therefore, further research is needed in order to examine prevalence patterns in other samples.

Correlates of BDD. Chapters 2 and 3 indicated that, compared to those without BDD (non-BDD), both pBDD and sBDD were associated with higher symptoms of depression, anxiety, and OCD. Unexpectedly, pBDD and sBDD were only weakly associated with eating disorder symptoms, and these associations were not significant when demographic variables were controlled for. This may be related in part to the use of the BDDQ-A, as this questionnaire excludes any participant with a primary concern about weight or becoming fat (Phillips, 2005). This exclusion may have led to range restriction on the eating disorder symptom measures, reducing the likelihood of identifying a significant association.

Past mental health service use was more common in pBDD and sBDD participants compared to non-BDD participants. It was striking that no individual with pBDD or sBDD reported appearance concerns as a reason for seeking treatment. Though we cannot know whether participants had BDD symptoms when they accessed these services, this finding is consistent with reports that individuals with BDD often seek treatment for comorbid disorders, and do not disclose their BDD (Grant, Kim, & Crow, 2001; Veale, Akyüz, & Hodsoll, 2015).

Regarding symptoms only assessed in males, pBDD and sBDD were associated with higher muscularity concerns, emotional problems, peer problems, conduct problems, and hyperactivity. The association with externalising symptoms was unexpected, as there is fairly low comorbidity of these disorders in adolescents with BDD in clinical settings; attention-deficit/hyperactivity disorder (3.3–6.3%), oppositional defiant disorder (0.0–6.3%), and no cases of conduct disorder were reported (Greenberg, Mothi, & Wilhelm, 2016; Mataix-Cols et al., 2015). However, as 48.0% of adults with BDD report substance use disorders (Phillips,

Menard, Fay, & Weisberg, 2005), it may be valuable to assess a broader range of externalising disorders, both in adolescent and adult samples. Quality of life was significantly poorer in those with pBDD and sBDD compared to non-BDD participants, and pBDD quality of life was similar to that of adolescents diagnosed with depression (Endicott, Nee, Yang, & Wohlberg, 2006). Though this finding needs to be replicated in females, it indicates that adolescents with BDD in the general community are substantially impaired in a range of domains.

When comorbid symptom severity was compared between pBDD and sBDD participants, sBDD was associated with lower mean symptoms of BDD, depression, eating disorders, and in males, lower hyperactivity. However, quality of life and other comorbid symptoms did not differ significantly between these groups. Thus although sBDD is a less severe presentation than pBDD, it is associated with the same types of outcomes as pBDD, and thus may be worthy of clinical attention.

Chapters 2 and 3 established sex differences in prevalence rates, but did not explore sex differences in BDD-related features. Before sex differences in the presenting features of BDD could be explored, it was important to evaluate whether the continuous BDD symptom measure functioned equivalently in males and females. Chapters 4 and 5 thus explored questions relating to the measurement of BDD symptoms across the whole sample of 3,149 adolescents.

Measurement of BDD Symptoms

Chapter 4 focused on the suitability of the Body Image Questionnaire-Child and Adolescent Version (BIQ-C; Veale, 2009) for assessing BDD symptoms in adolescent males and females. Chapters 2 and 3 had presented basic information regarding the internal consistency of the measure, and indicated that scores on this measure were highest in those with pBDD, intermediate in those with sBDD, and lowest in those without BDD. Chapter 4 extended these preliminary findings by exploring the factor structure and cross-sex measurement invariance of the BIQ-C. Based on research on the adult version of the

questionnaire (the BIQ; Veale et al., 2012), the BIQ-C was expected to have a single factor structure. However, the factor structure in adolescents consisted of nine items forming two factors labelled ‘interference and avoidance’ and ‘other BDD symptoms’, and the three reverse-scored items were allowed to covary. It should be noted that Chapter 6 found that these factors had only moderate internal consistency among those with pBDD or sBDD, indicating the need for further research to compare factor structures between clinical and community samples.

Measurement invariance testing in the whole sample found partial scalar invariance between males and females: although the same factor structure fit equally well for males and females, three of the nine items performed differently across sex. Additionally, the measurement effect of the reverse-scored items was stronger in males, suggesting a stronger response-set bias or tendency to acquiesce in males (Barnette, 2000). Together, these findings indicate that the 9-item BIQ-C (the BIQ-C-9) can be used to compare scores between males and females, but that some parameters do differ by sex. In the whole sample of adolescents, females reported higher scores than males for total scores and most individual items. This is consistent with previous studies, where female adolescents reported higher total BDD symptoms than males (Mastro, Zimmer-Gembeck, Webb, Farrell, & Waters, 2016; Mayville et al., 1999). Chapter 4 then considered the appropriateness of adapting the cut-off score suggested for the adult version of the measure (Veale et al., 2012). Using this score identified the top 9.9% of female responses, but only the top 2.3% of male responses. Studies using continuously scored BDD symptom measures should thus adopt sex-specific cut-off scores, otherwise they may underestimate the prevalence of BDD in males. Overall, these findings highlighted the need to directly evaluate the psychometric properties of BDD measures in adolescents, to establish its performance across sex, and to develop appropriate cut-off scores for males and females, and to compare properties of measures between clinical and community samples.

The Classification of BDD

Chapter 5 presented the first known study to use statistical modelling to compare theories about the classification of BDD with depression, anxiety, OCD, and eating disorders. The findings did not support prior theoretical models where BDD formed part of an obsessive-compulsive spectrum, a body-image spectrum, an affective spectrum, or an internalising spectrum. Instead, the only model with adequate fit to the data was one where BDD symptoms formed their own factor, which was correlated with an affective disorders factor, and an eating disorders factor. Further studies are needed to determine whether this model is also supported in adults, or whether it represents a developmentally-specific association between comorbid symptoms. Although the overall fit of this model was similar for males and females, the majority of factor loadings differed by sex. What was most striking was that in females, BDD had a stronger association with eating disorders than affective disorders, whereas the opposite pattern was true for males. The sex-specific association of BDD with eating disorders is congruent with findings in adults with BDD, where lifetime eating disorders are significantly more common in females than in males (Phillips, Menard, & Fay, 2006). Findings from Chapter 4 clearly support the need to further evaluate potential models of the classification of BDD, and to explore all parameters of such models in both males and females.

Together, Chapters 4 and 5 reinforce the need to examine sex differences in the presentation of BDD symptoms in the general community, and the associations between symptoms of BDD and other disorders. However, it was unclear whether sex differences in BDD symptoms were also observed in those with probable cases of BDD.

Sex Differences in the Clinical features of BDD

Chapter 6 explored sex differences in BDD symptoms, body areas of concern, comorbid symptoms, and mental health service use in a combined group of pBDD and sBDD participants. After controlling for demographic variables that differed by sex, there were few sex differences across the measures assessed. Females were more likely to report elevated

symptoms of generalised anxiety and concerns about breasts/nipples and thighs than men, and men were more likely to report concerns about muscularity and chest than females. No other differences between sexes emerged in the body areas of concern.

There were no differences between males and females in endorsement of BDD criteria or symptoms, rates of past mental health service use, or with rates of elevated symptoms of most disorders. The broad similarity of male and female presentations of BDD in our sample was encouraging, as it suggests that findings from predominantly female samples can also be applied to males with BDD. Together, the empirical papers indicate that although there are significant sex differences in symptoms of BDD across the whole sample, when those adolescents who meet criteria for subthreshold or clinical presentations of the disorder are examined, BDD prevalence and presentation is largely similar in males and females.

Chapter 6 also found that, in males with pBDD or sBDD, those with muscle dysmorphia reported higher scores for muscularity-related body image, and a greater number of body areas of concern than males without muscle dysmorphia. However, there was no difference between groups regarding BDD severity, quality of life, or most comorbid symptoms. Thus in our sample, muscle dysmorphia was not associated with a more severe BDD presentation, supporting the current conceptualisation of muscle dysmorphia as a subtype of BDD (APA, 2013). However, it is important to note that we did not assess suicidality, substance use, or exercise behaviour, which may be important correlates of muscle dysmorphia (Pope et al., 2005).

As is expected of a non-clinical sample, our participants had a less severe disorder presentation than adolescents from clinical samples. However, there were a number of similarities regarding the types of symptoms endorsed, body areas of concern, and relationship to comorbid anxiety, OCD, and depression. Further, the overall similarity between male and female BDD presentation indicates that clinicians can look for the same types of BDD symptoms in adolescents regardless of sex. In adolescents with pBDD or sBDD, the most common BDD symptoms related to distress, preoccupation, and appearance

evaluation, with items relating to interference less frequently endorsed. The most common body areas of concern were the skin, hair, and facial features, similar to clinical samples of adolescents (Albertini & Phillips, 1999; Phillips, Didie, et al., 2006) and adults (Phillips, 2008). A majority of pBDD and sBDD participants reported elevated or high risk symptoms of depression and social anxiety, and a substantial minority reported elevated generalised anxiety, panic and agoraphobia, and OCD. This is also consistent with clinical samples, where comorbidity is high with depressive and anxiety disorders (Albertini & Phillips, 1999; Phillips, Didie, et al., 2006). Although past mental health service use was elevated compared to participants without BDD, it was lower than service use by adolescents with other mental disorders (Lawrence et al., 2015).

Implications of Thesis Findings

Clinical Implications

It is vital that clinicians recognise that BDD is not a rare disorder. In fact, it may be more prevalent in adolescents than OCD and some anxiety disorders. In our community sample, both pBDD and sBDD were associated with substantial levels of distress and impairment, significantly decreased quality of life, and higher rates of comorbid symptoms than those without BDD. These factors highlight the need for early detection of BDD, especially in light of the chronic course of the disorder (Phillips, Menard, Quinn, Didie, & Stout, 2013). BDD should be assessed as part of standard clinical intake procedures, especially given that BDD is unlikely to be diagnosed unless it is enquired about directly (Grant et al., 2001; Veale et al., 2015). This may simply involve incorporating brief screening items, and then administering more detailed assessments where required (Phillips, 2005; Veale et al., 2015). BDD assessment must take into account that insight into BDD concerns may be particularly poor in adolescents (Phillips, Didie, et al., 2006). Further, it is important to differentially diagnose BDD from other comorbid disorders, such as anxiety, depression, OCD, and eating disorders. The prevalence of pBDD was equal in males and females, so clinicians should be careful to assess appearance concerns in all adolescents. Fortunately,

most BDD symptoms reported by adolescents were similar across sex, so clinicians can assess for the same core symptoms in all adolescents.

The detection of BDD in clinical settings is vital in order to provide appropriate treatment. Though there is limited treatment outcome research in adolescents (Phillipou, Rossell, Wilding, & Castle, 2016), there is increasing evidence to support the use of cognitive-behavioural therapy (Greenberg et al., 2016; Krebs, Turner, Heyman, & Mataix-Cols, 2012; Mataix-Cols et al., 2015). Delivering these programs requires substantial skill and training and may require adaptations for adolescents (Greenberg, Blashill, Ragan, & Fang, 2016), and thus may not be practical for all clinicians. Fortunately, research in adults indicates that cognitive-behavioural therapy for BDD can be delivered online with support from minimally trained clinicians (Enander et al., 2016). Such programs could greatly increase access to BDD treatment by reducing clinician burden and engaging individuals who are unwilling or unable to attend face-to-face appointments. Adult research also suggests that subthreshold BDD symptoms may respond to non-BDD focused treatments (Fang, Sawyer, Aderka, & Hofmann, 2013), thus may be a good target for early intervention programs. Lower intensity treatments for subthreshold or mild BDD in adolescence should be evaluated, as they may increase the availability of acceptable low cost treatment at the early stages of the disorder. Despite these promising future directions for BDD treatment, it is important to note that mental health services were only accessed by a minority of participants. Therefore, education is required to inform the general community of the presentation of BDD, the availability of successful treatments, and how to access help.

Research and Theoretical Implications

This thesis has consistently highlighted the lack of prior research across many important domains. This section will suggest a few areas of particular need, though this is by no means exhaustive. There is a clear need for BDD to be included in larger epidemiological studies in order to establish the relative prevalence and severity of the disorder. In order to facilitate this type of research, reliable and valid screening instruments are required. As this

thesis has demonstrated, is important to directly evaluate the psychometric properties of a measure in adolescent samples. Further, due to differences in the distribution of BDD symptoms between males and females, different cut-off scores are likely to be needed for continuously scored measures. Also, as established BDD screening measures were developed using *DSM-IV* criteria (for example, Phillips, 2005), measures must be adapted to directly address all *DSM-5* criteria. It is also important to find methods that combine BDD and eating disorder assessment in order to detect both presentations, rather than excluding all individuals with primary weight concerns. Otherwise, both BDD and eating disorders may be systematically under detected.

Further, there is substantial debate regarding the classification of muscle dysmorphia. Although defined as a subtype of BDD in *DSM-5* (APA, 2013), some researchers propose that it is better conceptualised as an eating disorder (Murray, Rieger, Touyz, & De la Garza García, 2010), and others argue that currently there is insufficient evidence to determine its classification (dos Santos Filho, Tirico, Stefano, Touyz, & Claudino, 2015). Chapter 6 found that, in males with pBDD and sBDD, males with and without muscle dysmorphia varied in few characteristics. This supports the conceptualisation of muscle dysmorphia as a subtype of BDD in these participants. However, we did not compare this group to males with eating disorders, and these types of simultaneous comparisons would provide further information about the characterisation of muscle dysmorphia.

As mental health service use appears to be relatively low in adolescent BDD, it is important to understand what factors act as barriers to treatment. A range of barriers have been identified in adults with BDD (Buhlmann, 2011; Marques, Weingarden, LeBlanc, & Wilhelm, 2011), but this has not been explored in adolescents. It is also important to continue to evaluate and improve the ability of clinicians to detect BDD, as this is vital in order to deliver appropriate treatment. As currently recommended treatments are often highly demanding of time and require substantial therapist training (Greenberg et al., 2016; Mataix-Cols et al., 2015), evaluation of stepped care approaches, self-help and minimally supported

manualised treatments have potential value in increasing the availability of treatment (Enander et al., 2016; Fang & Wilhelm, 2015).

Limitations of the Research

The aim of this thesis was to establish the prevalence, presenting features, and correlates of BDD in a community sample of adolescents, to examine issues of BDD symptom measurement and classification, and to explore sex differences across these domains. Despite the advances made in this research, there are some important limitations to acknowledge.

The use of self-report screening measures, although typically necessary for research in large samples, is likely to lead to some false positives (Brohede, Wingren, Wijma, & Wijma, 2013). For example, a participant may be distressed about their appearance due to a genuine physical disfigurement, or potentially due to gender dysphoria. Conversely, the exclusion of all individuals with primary weight concerns in the BDDQ-A may have underestimated both the prevalence of BDD, and the comorbidity between BDD and eating disorders. Further, there is a lack of measurement development and evaluation in adolescent BDD research. Although we explored the performance of the BIQ-C, the specificity of responses to BDD was not examined, that is, we did not examine how individuals with eating disorders responded to the BIQ-C. This may be important to evaluate as individuals with eating disorders may also report elevated scores on BDD symptom measures (Mitchison, Crino, & Hay, 2013). Further, it was not possible to determine the sensitivity and specificity of the BDDQ-A (Phillips, 2005) as diagnostic interviews were not conducted. To our knowledge, no study has examined sex-specific sensitivity and specificity of BDD screening measures. The findings of this thesis demonstrate the need to examine such sex-related measurement questions. BDD measure development is greatly needed both to ensure that all *DSM-5* criteria are properly captured for males and females, and to improve the screening of BDD in the presence of eating disorder symptoms.

All participants were from a community sample, however, they were not representative of all Australian adolescents due to their average to high levels of socio-educational advantage, the predominance of non-government schools, and the location of all schools within the Greater Sydney area. Previous research of mental disorders in Australian adolescents has found that disorder prevalence and help-seeking vary significantly depending on demographic features like location, family socio-economic status, and family type (Lawrence et al., 2015). Therefore, further research is needed to extend the thesis findings to other samples of adolescents. Further, some demographic variables differed between those with and without BDD, and between males and females. As BDD symptoms may vary between individuals of different cultures or sexual orientations (Boroughs, Krawczyk, & Thompson, 2010; Mayville et al., 1999), these factors should be examined directly in future research. Our sample may not have included those with more severe BDD symptoms, as severe BDD may be associated with difficulties attending school (Mataix-Cols et al., 2015; Phillips, Didie, et al., 2006). Assessment sessions were conducted at different points of the school year, and thus may reflect variations in school-related stress levels; for example, anxiety may be higher leading up to important exams. Some measures were only administered to males, so findings regarding the associations between BDD and quality of life and the strengths and difficulties questionnaire should be examined in female samples. Further studies of muscle dysmorphia should include measures of suicidality, substance use, and compulsive exercise, as these may be the most distinctive presenting features (Hartmann, Blashill, Greenberg, & Wilhelm, 2014; Pope et al., 2005).

Although pBDD and sBDD were associated with comorbid symptoms of depression, anxiety, and OCD, the study did not consider the specificity of these associations. For comorbid associations to be considered evidence of potential shared aetiological factors, it is important to establish whether the relationship is disorder specific (Allison, 1993). It should be determined, for example, that the comorbidity of anxiety disorders in those with BDD is higher than the comorbidity of anxiety in other disorders. As this study did not provide such

comparisons, it is unclear whether the comorbidity of anxiety, depression, and OCD in our sample is unique to BDD. Such methodological limitations are also common in many clinical studies of BDD, so the specificity of disorder associations should be investigated further using appropriate control groups.

Finally, the thesis examined a limited range of variables related to BDD at a single point in time. Longitudinal research will be particularly valuable in examining aetiological models, the stability of BDD, the long-term impacts of adolescent BDD, the risk of escalation from subthreshold to full-syndrome BDD, and the associations between disorders over time. It would also be valuable to gather more detailed information about the impact of BDD, for example, suicidality, social functioning, and educational attainment.

Conclusions

This thesis constitutes the largest known study of adolescent BDD, and as such, includes many novel findings. It established that the prevalence of pBDD was 1.7%, and sBDD was 3.4%. Both pBDD and sBDD were more prevalent in adolescents aged 15–18 years than in those aged 12–14 years. There was no sex difference in pBDD prevalence, but sBDD was more prevalent in females than in males. Both pBDD and sBDD were associated with distress and impairment, increased comorbidity, higher rates of past mental health service use, and poorer quality of life when compared to those without BDD. As predicted, sBDD was a less severe disorder presentation than pBDD on most measures.

The thesis also examined the measurement and classification of BDD symptoms across the whole sample. The findings supported the need to evaluate the psychometric properties of BDD measures in adolescent samples, and to consider sex differences in measurement properties. Importantly, the thesis also found that different cut-off scores should be used for males and females when screening for BDD using continuously scored measures. Statistical modelling of the associations between symptoms of BDD, anxiety, OCD, depression, and eating disorders supported a novel model whereby BDD formed a unique

factor, and where disorder associations differed by sex. These findings highlight the need to consider both developmental and sex differences in models of the classification of BDD.

Finally, sex differences were explored among those with pBDD and sBDD. Males and females were similar in the types of BDD symptoms reported, the chances of reporting elevated comorbid symptoms, and past use of mental health services. In males with pBDD and sBDD, muscle dysmorphia was not associated with greater BDD severity. As there are relatively low rates of mental health service use in adolescents with BDD, efforts to improve disorder detection should involve both clinicians and the general community.

Overall, this thesis has provided unique information about adolescents who met screening criteria for BDD, and about BDD symptoms in the general adolescent community. However, as adolescent BDD remains an understudied disorder, there is a great need for further research to replicate and expand the findings of this thesis. Ultimately, such research should aim to increase early detection of BDD, in order to reduce the burden of an underdiagnosed and often serious disorder.

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Appendix i.

Body Dysmorphic Disorder in Children and Adolescents: Advances in Theoretical and Clinical Research

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This is an invited chapter, based on the content of a symposium that I chaired at the World Congress of Behavioural and Cognitive Therapies in June, 2016, and where I presented findings from Chapter 5.

Schneider, S. C., Farrell, L. J., Turner, C. M., & Webb, H. J. (2016). Body Dysmorphic Disorder in Children and Adolescents: Advances in Theoretical and Clinical Research. In R. Menzies, M. Kyrios, & N. Kazantzis (Eds.), *Innovations and Future Directions in the Behavioural and Cognitive Therapies*. Brisbane, Australia: Australian Academic Press.

Overview

Body dysmorphic disorder (BDD) is an obsessive-compulsive spectrum disorder that involves excessive preoccupation with perceived defects in appearance. BDD typically begins in early to mid-adolescence, and prevalence estimates suggest that it is almost as common as OCD, yet comparatively poorly understood. BDD can be severely debilitating in young people, involving high distress and functional impairment, poor insight, elevated comorbidity, and high suicidality. Though research into BDD during the child and adolescent years is limited, recent studies have provided insights into the importance of early detection, the need for effective developmentally-appropriate interventions, and have informed cognitive-behavioural models of BDD. This chapter will review current findings and future directions for research across these domains.

Major Findings

The prevalence of BDD in young people is approximately 2%, but a range of factors contribute to poor disorder recognition. At least half of young people with BDD are convinced that their appearance concerns are realistic, and those that recognise their concerns as excessive are often reluctant to discuss these concerns with others. It can be difficult to understand the distress experienced by young people with BDD, especially as symptoms are often unobservable to others (e.g. obsessive thoughts about appearance) or may be performed in private (e.g. skin picking or mirror gazing).

Mental health professionals often fail to diagnose BDD. BDD concerns are rarely spontaneously disclosed to health professionals, even when they are the principal source of interference, highlighting the need to carefully screen for the presence of BDD in young people. Further, BDD is highly comorbid with depressive disorders, anxiety disorders, obsessive-compulsive disorder, eating disorders, and substance use disorders. As these disorders share some transdiagnostic features with BDD (such as low mood, persistent worry, excessive dieting and exercise, and repetitive checking behaviours), it is not uncommon to diagnose the comorbid disorder and miss the presence of BDD. In psychiatric populations,

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those with a diagnosis of BDD can be more severely unwell than those without, further emphasising the need for appropriate diagnosis.

Preliminary research into the treatment of BDD in young people indicates that cognitive behavioural therapy (CBT) and pharmacotherapy (typically using serotonin reuptake inhibitors) can be effective. Expert clinicians have highlighted the need to tailor existing adult CBT treatments to the developmental stage of the individual, for example, by modifying the language and tasks in CBT manuals to suit the participant's age. Additionally, the level of family involvement in treatment should be decided based on the quality of family relationships, level of involvement by family members in BDD behaviours, and attitudes towards BDD. Motivation for treatment may be particularly low among young people, especially when insight into BDD is poor, potentially requiring a greater focus on contingency management and motivational interviewing. Finally, suicidality appears to be particularly high in youth BDD, so suicide risk should be closely monitored and managed, with consideration to the use of pharmacotherapy. There currently exists very limited research examining interventions for BDD in young people, so there is a great deal to be learned about effectively treating this complex disorder.

Cognitive behavioural models of BDD have identified a range of potential risk factors across biological (e.g. genetics, neurobiology), psychological (core beliefs, personality, cognitive processes) and social (negative childhood experiences, values about appearance) domains. However, these models are primarily informed by research with adults. Evaluating these models in young people during the time of peak BDD onset is likely to provide richer and more accurate findings. For example, a recent study found a bidirectional longitudinal association between adversity in peer relationships and BDD symptoms in young people. That is, not only did increased relational victimisation by peers predict higher BDD symptoms one year later, but BDD symptoms predicted declines in the perception of acceptance by peers over time.

Clinical Implications

Identifying and treating BDD in young people represents a crucial opportunity to reduce the distress and impairment associated with this under-recognised disorder. BDD is typically not detected using standard clinical assessments, so specific probing or brief BDD screening tools should be adopted by clinicians. Questioning must be sensitive to the fact that the individual may be convinced that their concerns are justified. If possible, a multi-informant approach is recommended to provide additional information. Preliminary evidence suggests some promise for CBT and pharmacotherapy treatments in treating youth with BDD, though adaptations are required to suit the developmental stage and presenting characteristics of each client. Recommended treatment of BDD can be intensive (e.g. 12–22 sessions of CBT), though there is promising early evidence in adults that lower intensity internet-CBT may be appropriate for use with less severe BDD presentations. The evaluation and refinement of cognitive-behavioural models of BDD in youth may lead to new directions for clinical practice. In particular, a greater understanding of the individual vulnerabilities, precipitants and mechanisms underlying the onset and exacerbation of BDD symptomology will provide critical information that may enable richer and more effective methods of intervention and prevention.

Future Directions

Research into BDD among children and adolescents is in its infancy. Scientific knowledge is greatly needed across most key domains; population prevalence, clinical correlates, diagnostic sensitivity and specificity, enhancing treatment outcomes, and refining current models of BDD. Education of the public and mental health professionals is recommended in order to improve early detection and appropriate treatment of BDD. Despite these limitations, recent advances in the study of BDD in young people represent a growing recognition of the importance of this research during this crucial developmental period.

Further Readings

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Appendix ii

Macquarie University Ethics Approvals

Appendix ii of this thesis has been removed as it may contain sensitive/confidential content