

SYSTEMATIC REVIEW

Long term physical health outcome following in-patient admission in adolescent males with anorexia nervosa—a systematic review

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Abstract

Background: Recent literature has shown that up to one in every four early onset Eating Disorder presentations are male. Males account for 10–25% cases of Eating Disorders. Despite the relatively high prevalence of Eating Disorders in males, the research is limited. Our systematic review focuses on long-term physical health outcomes such as Body Mass Index (BMI)/weight and mortality in males who had undergone psychiatric inpatient admission for Anorexia Nervosa (AN) between the ages of 13 and 17 years. All outcomes were measured at least one year post-discharge. **Methods:** Articles published in peer reviewed journals between January 2012 and January 2023 in CENTRAL, MEDLINE, Embase and PsycINFO were searched. Following the screening of 1422 abstracts, 63 full text articles were retrieved and assessed for eligibility. Three articles were included in the review, of which, one was a Randomised Control Trial. An updated search completed in May 2025, did not find additional articles for inclusion. **Results:** In total, 31 males were included across the three studies. Three out of the thirty-one males died at follow-up and all three came from the same study. There was an overall improvement in BMI and BMI percentiles in males across all studies. **Conclusions:** Due to scarcity in literature focussing on adolescent male AN, it may be difficult to apply our findings within clinical contexts. Our review highlights the importance of addressing this gap in research and issues around providing generic treatments to young people with AN during admission without much consideration to gender differences. **The PROSPERO Registration:** The systematic review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 14 April 2023 (CRD42023407092, <https://www.crd.york.ac.uk/PROSPERO/view/CRD42023407092>).

Keywords

Adolescent males; Anorexia nervosa; Physical health; Outcomes; Inpatient admission

1. Introduction

Eating disorder (ED) is one of the few psychiatric conditions with a skewed gender distribution [1].

There seems to be varying reports regarding the incidence and prevalence of ED amongst the sexes.

The Global Burden of Disease study revealed that in 2021, the prevalence of eating disorders in 10–24-year-olds globally was 467.9 per 100,000 females and 251.7 per 100,000 males. The global prevalence for Anorexia Nervosa (AN) in particular was 158.95 per 100,000 females and 63.94 per 100,000 males [2].

In a review of 29 cross sectional surveys, the incidence of AN in females was reported to be 10 times higher than males [3]. However, the more recent literature has shown that up to one in every four early onset ED presentations are male

[4, 5]. Weltzin *et al.* [6] have reported that males account for 10–25% cases of anorexia and bulimia. Gender differences have also been reported in studies focusing on Norway, Poland and South Asia. A self-report survey featuring Norwegian university students aged 18–22 found the prevalence of AN amongst students from 2018 to 2022 rose from 2.08% to 2.96% in females and had a minimal fall from 0.3% to 0.28% in males [7]. A survey and interview study in Poland found 1.6% of women and 0.3% of men aged 15–19 declared having AN from September 2020 to December 2024 [8]. Studies that have drawn on the 2021 Global Burden of Disease study data for South Asian countries have found the prevalence of 10–14-year-olds and 15–19-year-olds with AN or Bulimia Nervosa (BN) was 44.37 per 100,000 and 110.43 per 100,000 individuals respectively [9].

Males are more likely to present at a later age [10] and

a number of males in ED treatment programs have reported feelings of shame and isolation due to being diagnosed with what society considers a “female disorder” [11]. The complex aetiology associated with male AN requires an integrative approach incorporating familial, biological, cultural and psychodynamic elements in the treatment [5].

Males with AN are not immune to medical complications such as osteoporosis, arrhythmias and hepatitis [12]. In a study by Mehler *et al.* [13] male patients with AN have been shown to have a greater degree of osteoporosis than age-matched female patients with AN. Low levels of Vitamin D and testosterone in males with AN are likely contributors to osteoporosis and reduced bone density [12]. Malnutrition in males with AN can lead to considerable disturbances in the endocrine system with studies reporting low testosterone levels even after weight restoration in several subjects [5]. These disturbances could potentially impact male fertility in the long term however very little is known in this regard [14].

There has been some research that looked at mental and physical health outcomes for males with AN following hospital admission. Lindblad *et al.* [14] suggested good psychiatric prognosis for males with AN in the long term which is comparable to the general population. However, the only physical health outcome considered by this study was mortality; with no reports of deaths on follow up among a sample of 61 males with AN. There was no difference between males and females in the 10-year survival rate following hospitalisation for AN, however, men were reported to have died sooner after hospitalisation [10]. Studies that have explored physical and psychiatric outcomes following in-patient admissions in adolescent males are sparse. If males have been included in the samples, they have constituted a very small percentage of the sample and separate data analysis is usually not completed [15]. The systematic review completed by Strobel *et al.* [15] has reported scarcity in the literature on the overall outcomes among both adult and adolescent males with AN; the authors recommended that future research include larger samples of male patients with adequate follow-up intervals and carefully defined outcome criteria. Due to the majority of patients with AN being female, most treatments are designed to address the needs of this gender [15].

With this background in mind, we decided to complete a systematic review that focuses on long-term physical health outcomes such as BMI/weight, osteoporosis, mortality and impact on fertility in adolescent males who between 13 and 17 years of age had undergone psychiatric inpatient admission for AN. As the majority of research around male AN is more recent we will limit the review to papers published over the last 10 years. Other physical health outcomes which may be of relevance to men; for example, gender specific body dissatisfaction in ED, with males striving for a muscular body, as opposed to women who usually strive for a thin body will also be explored within the review. It is hoped that the review will capture the benefits of inpatient psychiatric admission if any and serve to highlight the gaps in the literature that could potentially pave the direction for future research in this area.

The aim of this review is to explore the long-term physical health outcomes among adolescent males following inpatient admission for AN, at least a year after discharge.

2. Materials and methods

2.1 Design

Given the limited existing research on males with AN, this study was conducted using a systematic review design to comprehensively search, appraise and summarise the relevant research on the topic. It was planned and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist (**Supplementary material 1**) [16]. It was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 14 April 2023 (CRD42023407092).

2.2 Search strategy

A systematic review was undertaken on 31 January 2023 by a Senior Information Specialist in the following databases: CENTRAL (via Cochrane Library), Ovid MEDLINE® ALL, Ovid Embase, and ProQuest PsycINFO. The search was restricted to articles published between January 2012 and the search date, and the search was limited to articles in English due to lack of funding to reliably translate texts in other languages.

The searches utilised free text terms (searching title and abstract) as well as advanced search syntax (truncation, Boolean logic AND/OR, and proximity searching) to ensure all relevant studies were identified. Relevant controlled vocabulary headings for each database were searched and terms identified. The search terms included the following themes, with synonyms to describe each: anorexia nervosa; adolescents; inpatients; outcomes. Full search strategies can be found in **Supplementary material 2**. References were imported into EndNote 20 reference software (Clarivate, Philadelphia, PA, USA) and duplicates were removed.

A screening checklist (**Supplementary material 2**) was devised, and screening of the titles and abstracts was completed by two of the authors independently, all authors then met to review conflicts and reach a consensus decision. The agreed abstracts then underwent full text screening by two authors independently, again all authors met to agree consensus decisions for any conflicts.

2.3 In/exclusion criteria

The review was limited to studies published in English in the last 10 years that focused on adolescent males (13–17 years) with a diagnosis of AN who had had inpatient psychiatric admissions. All study designs except meta-analysis, systematic reviews, case reports and case studies were included. Only studies that reported physical health outcomes at least one year after discharge were included. The main criteria considered were weight/BMI, osteoporosis, impact on fertility and death. Other relevant physical health outcomes specific to males with AN such as striving for a muscular body, low testosterone levels, *etc.*, were also included.

Population: Adolescent males between 13 and 17 years of age with a diagnosis of Anorexia Nervosa. Anorexia Nervosa can be a clinical or research diagnosis.

Intervention: A period of inpatient psychiatric admission.

Partial hospitalisations were included.

Outcomes: Physical health outcomes such as weight, Body Mass Index, Bone density/osteoporosis, infertility/low testosterone levels and mortality included. Physical health outcomes specific to males such as striving for a muscular body were also included.

Study design: All study designs except meta-analysis, systematic reviews, case reports and case studies were included. Only published studies in English over the last 10 years included.

Exclusion criteria included studies on other ED, outcomes in out-patient and or day hospital treatment populations, studies that only assessed psychiatric outcomes and those studies that measured outcomes solely after physical health interventions such as re-feeding (*i.e.*, did not involve psychological and psychiatric treatment).

2.4 Data extraction and synthesis

The search identified 2224 records. Once duplicates had been removed in EndNote, 1422 records remained. The remaining records were screened independently by the two co-authors and in the event of discrepancy between the two authors, full text review of the article was conducted. A checklist for screening was devised and agreed by the authors (**Supplementary material 2**).

Following screening, 12 abstracts were included and as we were not sure if 61 abstracts met the inclusion criteria, they were placed in the maybe section of Rayyan and full texts for these were explored. We were unable to extract the full texts for 10 abstracts as these were mostly conference presentations and were not published. Some of the authors who we were able to get in touch with confirmed that their studies had not been published. From the remaining 63 full texts that were reviewed, 60 were excluded as they did not meet our inclusion criteria and 3 were included.

Out of the 63 full texts screened, 16 reported outcomes that were combined for both sexes but otherwise met the inclusion criteria. The authors were contacted via email for outcomes specific to adolescent males and none of the authors were able to provide relevant male specific data. 3 full texts were included in the final review. Please see **Supplementary material 2** for the table of authors contacted for individual male outcomes.

From the updated search completed in May 2025, 2911 records were identified. 1018 duplicates and 1422 previous results were then removed, leaving 471 abstracts to be screened. 11 abstracts met the eligibility criteria for full text screening. All 11 articles were excluded as they did not meet eligibility criteria for inclusion. Unfortunately, there wasn't sufficient time following the updated search to contact individual authors for the articles where male and female data were combined. Please see Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow chart (Fig. 1) for further information.

2.5 Quality appraisal/risk of bias

The Risk Of Bias In Non-randomized Studies (ROBINS) I checklist was utilised to estimate risk of bias for the two non

randomised studies—Herpetz Dahlmann *et al.* [17] 2018 and Quadflieg *et al.* [18] 2022 that are included in the review and ROB 2.0 was applied to the Randomised Control Trial, Magill *et al.* [19] 2015. The risk of bias assessments has been summarised in (Table 1, Ref. [17, 18, 20]; Table 2, Ref. [19, 21]). Two reviewers (RD and JH) scored each study independently, then met to agree consensus scores.

Additionally, two reviewers (RD and MDE) used the 5 Grading of Recommendations Assessment, Development and Evaluation (GRADE) domains of “risk of bias, inconsistency, indirectness, imprecision and publication bias” to guide the assessment of certainty in the body of evidence for each outcome [22]. This is summarised in Table 3 (Ref. [22]).

3. Results

Among the 3 included studies, there was one randomised control trial, one case-control study and one cohort study (Table 4, Ref. [15, 17–19]).

The risk of bias for each of these studies was moderate, due to the low male sample sizes preventing generalisation of the findings.

In the Randomised Control Trial (RCT) by Magill *et al.* [19], skills training intervention for carers was compared with treatment as usual. Herpetz Dahlman *et al.* [17] conducted a prospective cohort study where the sample was followed up for an average duration of 7.5 years. In the case-control study by Quadflieg *et al.* [18] the 27 male participants had been recruited through a larger study conducted by Strobel *et al.* [23].

Regarding the number of male subjects included across the three studies, the largest sample came from the Quadflieg *et al.* [18] study which compared 20 male patients with matched female controls following in-patient multimodal Cognitive Behavioural Therapy. The RCT by Magill *et al.* [19] included one adolescent male with AN out of the total sample of 178 patients and three out of 52 subjects were male in the study by Herpetz Dahlman *et al.* [17].

3.1 Weight/body mass index (BMI)

All three studies reported outcomes for BMI. Quadflieg *et al.* [18] found an improvement in the mean BMIs and BMI percentiles for males and females from admission to follow-up. The effect size for the difference between males (15.00 (Standard Deviation (SD) 1.45) to 21.83 (SD 3.90)) and females (14.93 (SD 1.22) to 19.12 (SD 3.01)) was moderate for BMI (Cohen's $d = 0.78$) and small for BMI percentiles (Cohen's $d = 0.44$). In Magill *et al.*'s [19] study, the male patient showed an improvement in BMI at 12 month follow up post discharge. Additionally, in the study by Herpetz Dahlman *et al.* [17], the mean BMI at follow-up was 23.4 (SD 2.2). Two of the male patients were reported to have a BMI between 17.5 and 25 and the other male patient had a BMI over 25.

3.2 Mortality

Quadflieg *et al.* [18] found 3 out of the 27 males had died and 4 were lost at follow-up [18]. Mortality was not a formal outcome in the study by Herpetz Dahlmann *et al.* [17] 2018,

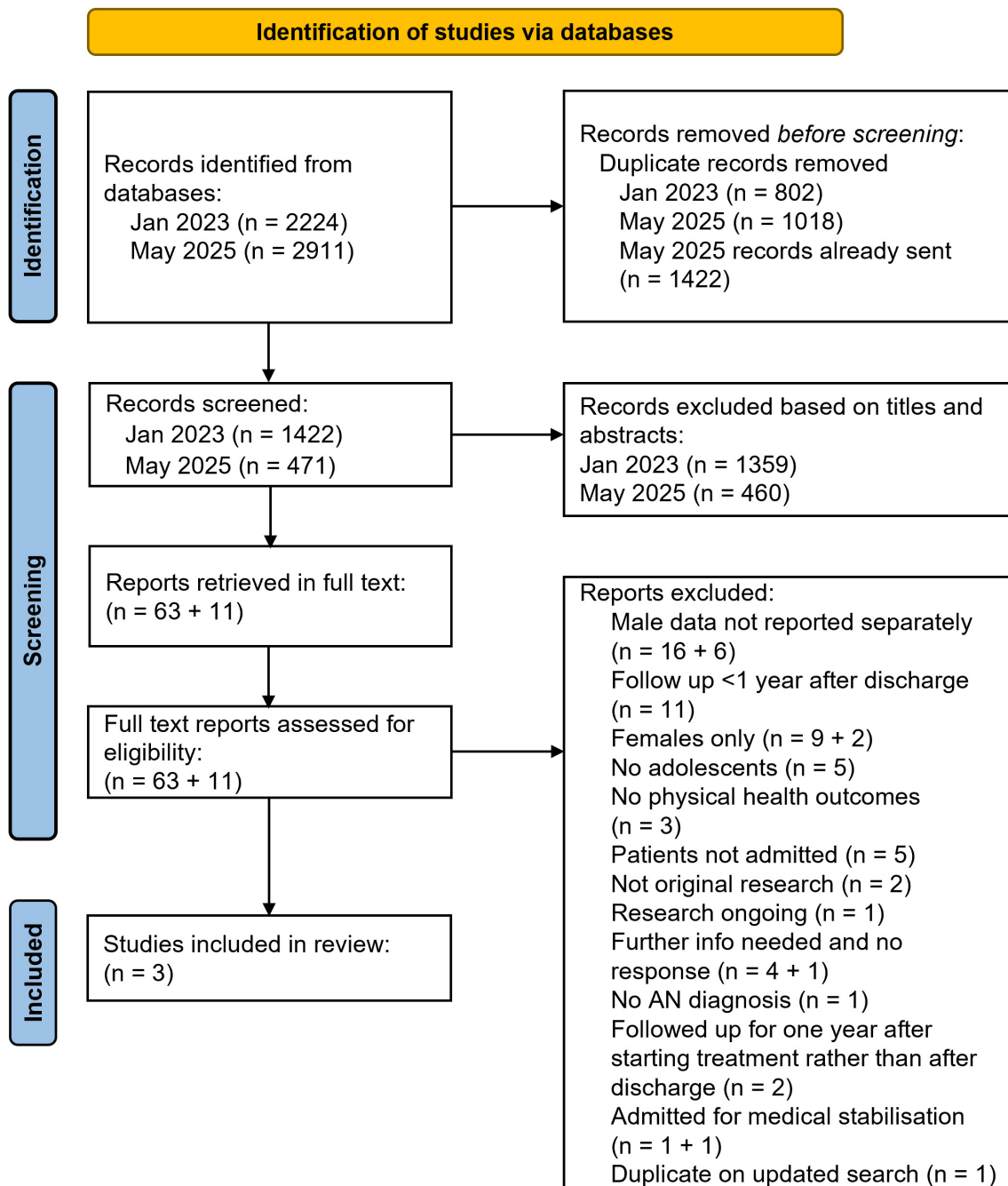


FIGURE 1. PRISMA flow diagram. AN: Anorexia Nervosa.

TABLE 1. Risk of bias rating using ROBINS I [20].

	Herpetz Dahlmann <i>et al.</i> [17] 2018	Quadflieg <i>et al.</i> [18] 2022
Bias due to confounding	Serious	Serious
Bias in classification of interventions	Low	Low
Bias in selection of participants into the study	Low	low
Bias due to missing data	Moderate	Moderate
Bias in measurement of outcome	Low	Moderate
Bias in selection of reported result	Low	Low
Overall risk of bias	Moderate risk	Moderate risk

TABLE 2. Risk of bias rating using ROB 2.0 [21].

	Magill <i>et al.</i> [19] 2015
Bias arising from randomisation process	Low
Risk of Bias due to deviation from intended interventions (effect of assignment to interventions)	Some concerns due to dropouts
Risk of Bias due to deviation from intended interventions (effect of adhering to interventions)	Low
Missing outcome data	Low
Risk of bias in measurement of outcome	Low
Risk of bias in selection of reported result	Low
Risk of bias judgement	Low

TABLE 3. Using GRADE domains [22].

	Number of Studies	Certainty of evidence	Domains contributing to downgrading
Weight/Body Mass Index (BMI)	3	Moderate	Inconsistency
Mortality	1	Low	Risk of bias, inconsistency, indirectness, imprecision
Body dissatisfaction and drive for thinness, Shape concern	2 (1 for each assessment tool)	Low	Inconsistency, imprecision
ED diagnosis at follow-up	2	Moderate	Imprecision

ED: Eating disorder.

TABLE 4. Summary of findings.

	Herpetz Dahlmann <i>et al.</i> [17] 2018 Germany	Quadflieg <i>et al.</i> [18] 2022 Germany	Magill <i>et al.</i> [19] 2015 UK
Study Design	Follow up of young people admitted with childhood onset AN to three university hospitals in Germany	Case control design. Male participants less than 18 years of age with AN were recruited through a larger study (Strobel <i>et al.</i> [15] 2019)	Pragmatic two-arm multicentre parallel group randomised controlled trial in inpatients with Anorexia Nervosa
Intervention during admission	Specialised treatment for AN based on a behavioural treatment program for weight restoration, individual and group nutritional counselling, individual age-adapted psychotherapy based on CBT principles, group therapy to enhance motivation and self-confidence and individual family sessions and parents' psychoeducation	Multimodal CBT—one or two weekly individual sessions and manualised group sessions	Skills Training Intervention (Experienced Caregivers Helping Others) and Treatment as Usual vs. Treatment as usual
Number of participants	49 females, 3 males	27 males of which 3 died at follow up and 4 were lost at follow up 20 females (controls matched for AN diagnosis, age at treatment and length of follow up)	178 patients and 268 caregivers were recruited. Of this 11 were adolescents with one male aged 17.5 years
Follow up durations	Mean follow up of 7.5 years	Mean follow up of 5.5 years	Follow up of 12 months post discharge

TABLE 4. Continued.

	Herpertz Dahlmann <i>et al.</i> [17] 2018 Germany	Quadflieg <i>et al.</i> [18] 2022 Germany	Magill <i>et al.</i> [19] 2015 UK
Main Findings	For the males, the range of ages were 20.0–23.2 years Average follow up of 7.5 years Heights were 175.3–182.0 Height SDS –0.8–0.2 BMI 21.2–25.7	At 5.5 years follow up, 10 males in remission, 4 met criteria for AN diagnosis, 1 for BN and 5 for ED-NOS At follow up, 7 females were in remission, 6 met criteria for AN diagnosis, 4 for BN and 3 for ED-NOS Lower scores on drive for thinness and body dissatisfaction among males (large effect size) BMI percentile showed a small effect size and BMI showed a medium effect size between the two groups	BMI at baseline—14.3 and at 12 month follow up post discharge was 18 (for the 17-year-old male) Shape concern score on EDE-Q reduced from 5.8 to 3.8 at 12 month follow up (for the 17-year-old male)
Limitations	Only 3 males. No assessment of the duration and type of outpatient treatment during the follow up period. Authors state that the number of males is too low to draw any reasonable conclusions	Follow up interviews through telephone ED diagnosis at admission was through self-rating questionnaires Assessments excluded symptoms such as drive for thinness	Sample not completely representative of target population Considerable loss to follow up Findings can't be generalised to adolescent males as the n is too small

AN: Anorexia Nervosa; CBT: Cognitive Behavioural Therapy; SDS: Standard Deviation Score; BMI: Body Mass Index; BN: Bulimia Nervosa; ED-NOS: Eating Disorder Not Otherwise Specified; EDE-Q: Eating Disorder Examination Questionnaire.

however the researchers reported that one of the female participants who were contacted for the follow-up study had died.

3.3 Body dissatisfaction and ED diagnosis at follow-up

Quadflieg *et al.* [18] found 4 males still met the diagnostic criteria for AN, 1 met the criteria for BN and 5 met the criteria for Eating Disorder Not Otherwise Specified (ED-NOS) at follow-up. This was in comparison to the 6, 4 and 3 female patients that met the criteria for AN, BN and ED-NOS respectively. Remission (within this study defined as not meeting criteria for any eating disorder diagnosis) was reported in 10 males and 7 females. The effect sizes between the groups for remission rates and ED diagnosis at follow-up were small (Cohen's ϕ 0.12–0.23). Larger effect sizes were noted among the female patients with drive for thinness and body dissatisfaction. Herpertz Dahlman *et al.* [17] found one of three patients met the diagnostic threshold for ED-NOS at follow-up. Additionally, the male patient in Magill *et al.*'s [19] study showed a reduction in the Shape Concern score on the Eating Disorder Examination Questionnaire (EDE-Q) from a 12 month follow up post discharge.

None of the included studies reported outcomes for bone density, osteoporosis, infertility or low testosterone levels.

4. Discussion

Our review summarises the findings of three studies where male physical health outcome data following a period of adolescent in-patient admission for treatment of AN were avail-

able. We understand this is a very small sample and it may be difficult to apply our findings within clinical contexts due to this reason. This was also reflected in the moderate risk of bias scores in two of the included studies that contained most of the included cohort of 31 male adolescents. However, our review highlights the dearth of research within the area and how often males with the condition tend to be overlooked, particularly though the common practice of combined male-female outcome reporting. From the 63 full texts that were screened, 16 reported combined outcomes.

The included papers amounted to a sample of 31 males, of which most came from the Quadflieg *et al.* [18] study. Three of the 27 male patients that were followed up in the study had died during the time of follow up which was conducted 5.5 years after discharge. The reasons for their death were not recorded in the study. We are unable to conclude if the deaths were a direct cause of Anorexia Nervosa or occurred as a consequence of unrelated causes. Remission was achieved in 50% (10 out of 20 males at follow up) which was higher than remission rates attained among the 20 females (7 out of 20 females at follow up); however, given the low sample size, this should be viewed as a hypothesis-generating observation rather than a conclusive finding. There were also lower numbers of males compared to females that met the diagnostic criteria for AN at follow up suggesting a better prognosis among male patients undergoing in-patient treatment in comparison to female patients. This finding should also be interpreted with caution given the small sample sizes involved. The other two studies by Herpertz Dahlman *et al.* [17] and Magill *et al.* [19] also showed improvements in mean BMI at the time of follow

up for males although the duration of follow up for Magill's RCT was considerably shorter.

Sixteen full texts were excluded because they reported combined male-female outcomes and separate male data could not be obtained, possibly due to the very low numbers of males included within the sample. For instance, in the RCT by Dalle Grave *et al.* [24] (2013), comparing two different forms of inpatient Enhanced Cognitive Behavioural Therapy (CBT-E), 97.5% of the 80 subject sample had comprised of females. Dalle Grave *et al.* [24] in another study published in 2014 that explored the effects of CBT-E in a 20-week inpatient treatment program had included only one male in the sample of 27 adolescents. In the Halvorsen *et al.* [25] study, the 37 patients who had received inpatient Family-Based Treatment (FBT) as adolescents were followed up; of which, 4 had been male. This also seems to be the trend for studies including adult and adolescent ED patients with outcome studies such as Hergenroeder *et al.* [26] including 80 females in the sample of 88 patients with AN.

There are limitations to the literature available within this review, such as the scarcity of evidence on physical health outcomes from adolescent males following in-patient admission, with only three studies meeting inclusion criteria and a very small total male cohort. The included studies present some tentative suggestions of higher rates of BMI increase and remission (if defined as lack of meeting diagnostic criteria for an eating disorder) amongst male patients compared to female patients, however the sample numbers are too small for this to be firmly concluded. The review also highlights the fact that many of the interventions available within inpatient adolescent units are provided to both sexes without taking into consideration the needs specific to adolescent males with the condition. For instance, Dalle Grave *et al.* [24] in their RCT, compared two different forms of CBT-E targeting an inpatient population which had included 23 adolescents most of whom were female. In the study by Calugi *et al.* [27] all male and female participants irrespective of history of childhood sexual abuse, were provided the modified version of CBT-E during admission, however, the study concluded that the abuse did not appear to compromise outcomes in patients with AN treated with CBT-E. The sample from this study also appears to be predominantly made of adults who were female and male outcomes weren't reported separately. A study by Halvorsen *et al.* [25] which investigated inpatient Family-Based Treatment (FBT) for adolescent anorexia did not tailor treatment specific to the needs of the 4 male patients in the sample of 37. There was also no separate reporting of male outcomes in this study. The Madden *et al.* [28] study also reported combined outcomes for male and female patients, all of whom completed the trial protocol including inpatient treatment and 20 sessions of FBT. 94% of the sample were female and treatment wasn't reported to be individualised or modified to meet the requirements of male patients. Braun *et al.* [29] have recorded higher psychiatric comorbidity in males with eating disorders. A more recent study by Akgül *et al.* [30] has corroborated these findings and reported that Depressive Disorders and Obsessive-Compulsive Disorders were more common among males with eating disorders. Addressing psychiatric comorbidity would constitute an important aspect

in the management of young male patients admitted for AN into in-patient settings and will need to be incorporated into care plans for this group of patients.

A limitation of this systematic review itself, is that it focused only on studies available in English and did not include grey literature. This restriction may have introduced language bias, potentially overlooking relevant research from non-English speaking countries where AN is also studied and treated. This may have also introduced some publication bias, with potential bias towards studies performed in western countries. It is therefore possible that more studies in this area have been published or completed than this review identified.

Participants from the Herpetz-Dhalmann [17] and Quadflieg *et al.* [18] studies had longer follow-up durations and could possibly have received other treatments for their condition following discharge thereby affecting physical health outcomes. Wide variability in the durations of follow up within the included papers could have affected outcomes and thereby preclude comparability. We understand there could have been several factors affecting outcomes following discharge; outpatient treatments that may have evolved with time, entering adulthood, other physical and mental health problems which could have influenced the AN presentation, *etc.*

Given that inpatient adolescent beds are scarce within the UK, we felt that this review would help with some decision making around the benefits of admitting adolescent males with a diagnosis of AN. The other issue that may require consideration in adolescent male AN is the conceptualisation of the illness itself with variability in symptom presentation among males and muscularity-oriented disordered eating emerging as an ED phenotype within this group [31]. Siegel *et al.* [32] suggested that the proportion of male adolescent anorexics with medical abnormalities seems high which may be due to difficulties in establishing the diagnosis and delays in seeking medical attention. Vo *et al.* [33], also reported similar significant abnormalities and have highlighted the importance of recognising early signs of malnutrition, particularly in those who present within the normal body mass index range for age given the lesser likelihood of the illness being detected among males. Mortality in male patients with AN, when alongside other psychiatric comorbidities is significantly elevated in comparison to the general population [34]; however, we aren't able to determine if this was the case with the three patients in our review who had died during follow up due to this information lacking within the study.

Given that it may be hard to come to conclusions based on the results of our review, it brings out the importance of addressing the gap in research and the issues around providing generic treatments to young people with AN during admission without giving much consideration to individual differences.

Transgender males haven't been included in this review and literature has reported that Lesbian, Gay, Bisexual, Transgender, Queer/Questioning, Intersex, Asexual (LGBTQA+) groups are at elevated risk of ED symptoms and behaviours [35]. The risk of engaging in ED symptoms are higher in transgender teens as compared to the cisgender teens [36]. Reasons for this have been thought to be around minority stress, gender norms, objectification and other external influences [37].

As Bulimia Nervosa presents with a distinct set of physical

symptoms such as electrolyte abnormalities, gastro intestinal symptoms, dental problems, *etc.* [38], this cohort is beyond the scope of our review. Future research could focus on the physical health symptoms specific to male patients with Bulimia Nervosa.

5. Conclusions

The scarcity of research in this area as highlighted by our review precludes the application of findings to routine clinical practice. However, we hope that clinicians and researchers can view male adolescent AN from the gender perspective and consider the differences in presentation within this cohort of young people, with cognitions such as drive for muscularity and physical markers such as testosterone levels and infertility. However, as these parameters haven't been clearly defined in male AN patients, systematic data collection and further research in this area could add more information and improve our understanding of presentation within the cohort of patients. With this improved understanding and increasing knowledge base, there could be scope for clinical guidelines to be adapted to include criteria specific to males; thereby setting standards for better diagnosis and improved management of the condition.

ABBREVIATIONS

ED, Eating Disorder; AN, Anorexia Nervosa; RCT, Randomised Control Trial; EDE-Q, Eating Disorder Examination Questionnaire; ED-NOS, Eating Disorder Not Otherwise Specified; FBT, Family-Based Treatment; CBT, Cognitive Behavioural Therapy; CBT-E, Enhanced Cognitive Behavioural Therapy; BMI, Body Mass Index; PROSPERO, International Prospective Register of Systematic Reviews; BN, Bulimia Nervosa; PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analyses; ROBINS, Risk Of Bias In Non-randomized Studies; GRADE, Grading of Recommendations Assessment, Development and Evaluation; SD, Standard Deviation; LGBTQA, Lesbian, Gay, Bisexual, Transgender, Queer/Questioning, Intersex, Asexual.

AVAILABILITY OF DATA AND MATERIALS

Data will be available on reasonable request made to the corresponding author.

AUTHOR CONTRIBUTIONS

RD—Conceptualisation (lead), Investigation (equal), Formal Analysis (equal), Writing—Original Draft Preparation (equal), Writing—Review & Editing (equal). MDSE—Investigation (equal), Formal Analysis (equal), Writing—Original Draft Preparation (equal), Writing—Review & Editing (equal), Funding Acquisition (lead). ABM—Investigation (supporting), Formal Analysis (supporting), Writing—Original Draft Preparation (equal), Writing—Review & Editing (equal). JH—Investigation (supporting), Formal Analysis (supporting), Writing—Original Draft Preparation (equal),

Writing—Review & Editing (equal). All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at <https://oss.jomh.org/files/article/2060281703169966080/attachment/Supplementary%20material.zip>.

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