The DSM-5 diagnostic criteria for anorexia nervosa may change its population prevalence and prognostic value

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ABSTRACT

The definition of anorexia nervosa was revised for the Fifth Edition of the Diagnostic and Statistical Manual (DSM-5). We examined the impact of these changes on the prevalence and prognosis of anorexia nervosa. In a nationwide longitudinal study of Finnish twins born 1975–1979, the women (N = 2825) underwent a 2-stage screening for eating disorders at mean age 24. Fifty-five women fulfilled DSM-IV criteria for lifetime anorexia nervosa. When we recoded the interviews using DSM-5 criteria, we detected 37 new cases. We contrasted new DSM-5 vs. DSM-IV cases to assess their clinical characteristics and prognosis. We also estimated lifetime prevalences and incidences and tested the association of minimum BMI with prognosis. We observed a 60% increase in the lifetime prevalence of anorexia nervosa using the new diagnostic boundaries, from 2.2% to 3.6%. The new cases had a later age of onset (18.8 y vs. 16.5, p = 0.002), higher minimum BMI (16.9 vs. 15.5 kg/m^2, p = 0.0004), a shorter duration of illness (one year vs. three years, p = 0.002), and a higher 5-year probability or recovery (81% vs. 67%, p = 0.002). Minimum BMI was not associated with prognosis. It therefore appears that the substantial increase in prevalence of anorexia nervosa is offset by a more benign course of illness in new cases. Increased diagnostic heterogeneity underscores the need for reliable indicators of disease severity. Our findings indicate that BMI may not be an ideal severity marker, but should be complemented by prognostically informative criteria. Future studies should focus on identifying such factors in prospective settings.

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1. Introduction

Anorexia nervosa is a serious and potentially fatal illness (Walsh 2013). The definition of anorexia nervosa was recently revised for the DSM-5 (American Psychiatric Association 2013). One of the leading reasons for the revision was to reduce the number of patients who receive the diagnosis eating disorder not otherwise specified (EDNOS), who constituted up to 60% of patients in specialized eating disorder units (Fairburn & Bohn 2005; Zimmerman et al., 2008).

DSM-5 introduced three changes to the criteria defining anorexia nervosa: the weight loss criterion was revised, fear of weight gain does not need to be verbalized if behaviors interfering with weight gain can be observed, and amenorrhea was no longer required (American Psychiatric Association 2013; Attia et al., 2013). These diagnostic changes were supported by a number of studies that found few differences in demographics, eating disorder pathology, and psychiatric comorbidity between patients who meet strict diagnostic criteria for anorexia nervosa and their

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subthreshold counterparts (Eddy et al., 2008; Helverskov et al., 2011; Thomas et al., 2009).

Another new feature in the DSM-5 is the introduction of a body mass index (BMI) based severity rating. Previous research has shown that BMI-based severity is associated with disorder detection and access to treatment, but not with recovery rates (Smink et al., 2014).

A consensus reigns that the recent diagnostic changes in the DSM will increase the proportion of patients with anorexia nervosa and decrease the number of residual diagnoses (Machado et al., 2013; Ornstein et al., 2013; Keel et al., 2011; Nakai et al., 2013; Birgegard et al., 2012). Among community-based adolescents, the prevalence of anorexia nervosa increased by 50% (Smink et al., 2014). However, the impact of the changes has not been quantified in adult women. Furthermore, no previous studies have assessed the prognostic value of the diagnostic changes. Finally, there is little empirical evidence to substantiate the BMI-based severity assessment in anorexia nervosa. To address these questions, we conducted a nationwide population-based study to quantify the impact of recent changes in diagnostic criteria on the prevalence, incidence rate and prognosis of anorexia nervosa. We also examined the prognostic value of the BMI-based severity rating.

2. Method

2.1. FinnTwin16 birth cohorts

This nationwide longitudinal cohort study of health behaviors in twins and their families (Kaprio et al., 2002) identified twin births in 1975–79 from the central population register of Finland. The FinnTwin16 cohort was restricted to those pairs who both were alive at age 16 and resident in Finland. Data collection and analysis were carried out in accordance with the latest version of the Declaration of Helsinki and approved by the ethics committee of the Department of Public Health of University of Helsinki.

The twins and their parents were sent baseline self-report questionnaires when the twins were 16 y (wave 1). A returned questionnaire implied informed consent. Follow-up questionnaires were mailed to the twins when they were 17 y (wave 2), 18 y (wave 3), 22–27 y (wave 4), and finally 31–37 y (wave 5) (Kaprio 2013; Kaprio 2006). The analyses in the present paper are based on wave 4 when diagnostic interviews were conducted. Because of the dynamic nature of our cohort, after mortality updates, central database checks, and database cleaning, some totals differ slightly from those previously published (Keski-Rahkonen et al., 2007).

2.2. Screening for eating disorders, wave 4

At age 22–27 y (mean 24.4, SD 0.9), 2825 women (87% of the original cohort) returned their questionnaire that contained a self-report screen for eating disorder symptoms (Keski-Rahkonen et al., 2006). It included three subscales of the Eating Disorder Inventory (Garner 1991) self-reported eating disorders, eating disorder suspected by others, and questions on current and past minimum weight. Operational criteria for screen positive and negative participants have been described in detail previously (Keski-Rahkonen et al., 2006; Mustelin et al., 2015). We also asked the participants permission to interview them by telephone: if they consented to the interview, they sent us their phone number. All screen-positive women (N = 292), their screen-negative female co-twins (N = 130), and 210 randomly selected screen-negative women were invited to participate in diagnostic telephone interviews. The overall interview participation rate was 86.7%. Details of interview participation and diagnosed cases in each group are described in the Supplementary Figure. We found no evidence of non-response bias for interview participation: None of the screening measures differed significantly between participants and non-participants (Mustelin et al., 2015).

2.3. DSM-IV diagnoses

Five experienced clinicians, four MDs and one registered nurse from the Eating Disorder Unit of Helsinki University Central Hospital, conducted the interviews by telephone using the Structured Clinical Interview for DSM-IV (SCID) interview (First et al., 2003) to obtain current and lifetime diagnoses of anorexia nervosa, bulimia nervosa, binge-eating disorder, and major depressive disorder. Interrater agreement for diagnosis was good (mean κ = 0.87, range 0.64–1.00) (Keski-Rahkonen et al., 2006). Based on SCID interviews, we identified 55 probands suffering from anorexia nervosa as defined in DSM-IV. Criterion 'A' was met if weight loss resulted in a BMI of <17.5 kg/m^2 (Keski-Rahkonen et al., 2007).

2.4. DSM-5 diagnoses

Four MDs experienced in the diagnosis and treatment of eating disorders (AKR, AR, YS, LM) established consensus DSM-5 diagnoses by recoding the DSM-IV SCID interviews. The interviewers had written down the participants' self-reported minimum, maximum, and current weights, the interviewee's explanations for her weight status, and a narrative summarizing the time course of the symptoms and any special circumstances or considerations. The recoding was based on careful examination of each diagnostic criterion, taking into account all relevant information supplied in the case notes recorded by the interviewers. Criterion 'A' was met if weight loss resulted in a minimum BMI of <18.5 kg/m^2 following the WHO definition of underweight, a cut-off recommended to be used both in clinical interviews (Sysko et al., 2015) and epidemiological research (Brown et al., 2014). Criterion 'B' was met if it was apparent (based on the interview and the case notes) that the interviewee experienced intense fear of gaining weight or becoming fat or persistent behaviors that interfered with weight gain (American Psychiatric Association 2013). Similarly, criterion 'C' was met if the interviewee exhibited a disturbance in the way in which her body weight or shape was experienced, undue influence of body weight or shape on self-evaluation, or persistent lack of recognition of the seriousness of being at low weight (American Psychiatric Association 2013). Individuals whose weight loss could be explained by a medical illness did not receive a diagnosis of anorexia nervosa.

2.5. Case definition

The new DSM-5 category includes all DSM-IV cases as well as new cases that did not fulfill DSM-IV criteria. We compared cases fulfilling DSM-5 criteria but not DSM-IV criteria (from here on referred to as 'new DSM-5 cases') to DSM-IV cases.

2.6. Assessment of recovery

For each case of anorexia nervosa, the interviewers determined the last age at which any eating disorder symptoms occurred. We defined clinical recovery as restoration of weight and menstrual function (if applicable) and the absence of binges and purges for at least 1 year prior to assessment (Keski-Rahkonen et al., 2007). The 5-year clinical recovery rate was defined as the proportion of women with anorexia nervosa who reached clinical recovery within 5 years after onset.

2.7. Minimum BMI

Minimum BMI was calculated from the lowest weight and height at lowest weight as reported by the participants. Whenever possible, we also used the new Finnish growth reference (Saari et al., 2011) to calculate ISO-BMIs (age and sex adjusted body mass index for children and adolescents) for those participants who were under 18 years, but differences from actual BMI were negligible. Minimum BMI could not be calculated for three individuals because of missing data on height or minimum weight.

2.8. Detection of eating disorders by healthcare providers

In a questionnaire sent concurrently with the telephone interviews, participants reported whether a doctor or other health professional had ever given them a diagnosis of eating disorders.

2.9. Statistical analysis

We estimated the lifetime prevalence, 15-year incidence rate (age interval 10—24 years), and 5-year recovery rate of DSM-5 anorexia. Because the focus was on actual detected cases, we did not use sampling weights in the present paper.

We used the Kaplan—Meier method and the log-rank test to compare recovery over time among new DSM-5 cases vs. DSM-IV cases of anorexia nervosa and calculate 5-year probabilities of recovery. Cox proportional hazards models were used to calculate hazard ratios (HR), allowing inclusion on covariates in the model. The proportional hazards assumption was examined graphically using Nelson—Aalen plots and log—log plots and formally using Schoenfeld residuals; no violations of the assumption were detected.

For comparisons of measures between new DSM-5 cases and DSM-IV cases, we used Student's t-tests to compare group means for continuous measures, Pearson's χ^2 tests for categorical outcome measures, and the Wilcoxon rank-sum test to compare medians. To account for clustered sampling within the twin pair, p-values and confidence intervals (CI) were adjusted using standard procedures for survey data in the statistical package Stata 13.

In addition, we compared cases with amenorrhea against cases without amenorrhea and stratified the individuals by minimum BMI to test whether the severity rating suggested by DSM-5 was associated with outcome.

3. Results

3.1. Prevalence and incidence

We found 92 individuals with lifetime DSM-5 anorexia nervosa. Of these, 55 fulfilled DSM-IV criteria for anorexia nervosa (Keski-Rahkonen et al., 2007) whereas 37 were new DSM-5 cases. The inclusion of new DSM-5 cases increased the lifetime prevalence from 2.2% (95% CI 1.6—2.7%) to 3.6% (2.7—4.2%). The 15-year incidence rate (computed for the age interval 10—24 years) of anorexia nervosa increased from 140 (95% CI 110—180) to 230 (95% CI 180—280) per 100 000 person-years.

As a post hoc analysis, to quantify the impact of operationalizing the A criterion as BMI <18.5, we calculated an alternative lifetime prevalence using a stricter cut-off, BMI <17.5. This operationalization resulted in a total of 82 cases and a lifetime prevalence of 3.2% (95% CI 2.6—4.0%), i.e. 1.5 times the prevalence we estimated using DSM-IV criteria.

3.2. Differences between new DSM-5 vs. DSM-IV cases

The new DSM-5 cases had higher minimum BMI than the DSM-IV cases; the mean minimum BMI was 16.9 kg/m^2 among the new DSM-5 anorexia nervosa cases and 15.6 kg/m^2 among women with DSM-IV anorexia nervosa (p = 0.0007, Table 1). The age of onset was 18.8 vs. 16.5 years, respectively (p = 0.002). Of all women with DSM-5 anorexia nervosa, 42% had been diagnosed with an eating disorder by a health professional (27% of new DSM-5 cases and 53% of DSM-IV cases). The proportion of subjects with lifetime diagnoses of major depression or bulimia nervosa did not significantly differ between new DSM-5 cases and DSM-IV cases (Table 1). Of DSM-IV cases, 49 (89%) had experienced secondary amenorrhea; the rest had primary amenorrhea, used contraceptives, or information on menses was missing. Of the new DSM-5 cases, only 8 (22%, p < 0.0001) had experienced secondary amenorrhea.

3.3. Recovery

The median illness duration of DSM-IV anorexia nervosa was three years and that of new DSM-5 anorexia nervosa cases was one year (p = 0.002). The 5-year clinical recovery rate was 67% for DSM-IV anorexia nervosa cases, and 81% for the new DSM-5 anorexia nervosa cases (Fig. 1, p = 0.008). The 5-year recovery rate for all DSM-5 anorexia nervosa cases was 72%. Overall, the likelihood of recovery (represented by the hazard ratio, HR) was nearly twice as high among the new DSM-5 cases as compared to the DSM-IV cases (HR 1.8, 95% CI 1.1—2.8).

To explain the differences in outcome between new DSM-5 anorexia nervosa cases and DSM-IV cases, we stratified all DSM-5 cases based on various diagnostic criteria and adjusted for comorbid diagnoses. Minimum BMI as a continuous variable was not associated with likelihood of recovery (HR 1.0, 95% CI 0.95—1.1). Stratification by minimum BMI categories according to the DSM-5 severity rating is shown in Fig. 2 (p = 0.57). Women with minimum BMI <15 kg/m^2 appeared to have a lower short-term likelihood of recovery than the other groups, but the difference disappeared over time (Fig. 2). Amenorrhea followed a similar pattern; those who had presented with amenorrhea were slower to recover in short-term but differences evened out over time (Fig. 3, p = 0.07).

In a model adjusting for two comorbid psychiatric disorders, lifetime major depressive disorder (HR 0.58, 95% CI 0.37—0.92) and cross-over to bulimia nervosa (HR 0.44, 95% CI 0.25—0.76) were both associated with worse outcomes, but comorbidity did not explain the difference between new DSM-5 vs. DSM-IV cases: in the adjusted model, the HR remained unchanged at 1.8, 95% CI 1.1—2.7. Further, the outcome of new DSM-5 cases detected by the health care system did not significantly differ from undetected cases.

4. Discussion

The revised DSM-5 diagnostic criteria for anorexia nervosa increased its population prevalence by 60% among community-based young adult women. This dramatic change means that the new DSM-5 classification may successfully address a previously unmet need. However, changes in diagnostic definitions may also increase phenotypical heterogeneity of anorexia nervosa. In our setting, the new DSM-5 cases of anorexia nervosa differed in some key respects from DSM-IV cases: the new cases had a later age of onset, higher minimum BMI, shorter duration of illness, and a significantly higher likelihood of recovery than DSM-IV cases. This, in turn, creates a need for better tools in assessing the severity of illness. We tested the BMI-based severity rating introduced in DSM-5 in our setting, but found that it was not associated with

Table 1
Characteristics of DSM-5 vs. DSM-IV anorexia nervosa cases.

	DSM-5 anorexia nervosa (N = 92)		New DSM-5 anorexia nervosa cases[a] (N = 37)		DSM-IV anorexia nervosa (N = 55)		p-value[b] (new DSM-5 cases vs DSM-IV cases)
	Mean	*95% CI*	*Mean*	*95% CI*	*Mean*	*95% CI*	*Student's t-test*
Age of onset (years)	17.4	16.7–18.1	18.8	17.7–19.9	16.5	15.6–17.4	0.002
Minimum BMI (kg/m^2)	16.1	15.8–16.5	16.9	16.3–17.5	15.6	15.1–16.1	0.0007
BMI at age 24 (kg/m^2)	21.1	20.5–21.7	20.8	19.8–21.8	21.2	20.4–22.0	0.55
	n (%)		*n (%)*		*n (%)*		*chi^2 test*
Lifetime diagnosis of bulimia nervosa	21 (23)		7 (19)		14 (25)		0.47
Lifetime diagnosis of major depression	37 (40)		13 (35)		24 (44)		0.41

CI, confidence interval.
[a] DSM-5 cases ho did not fulfill DSM-IV criteria for anorexia nervosa.
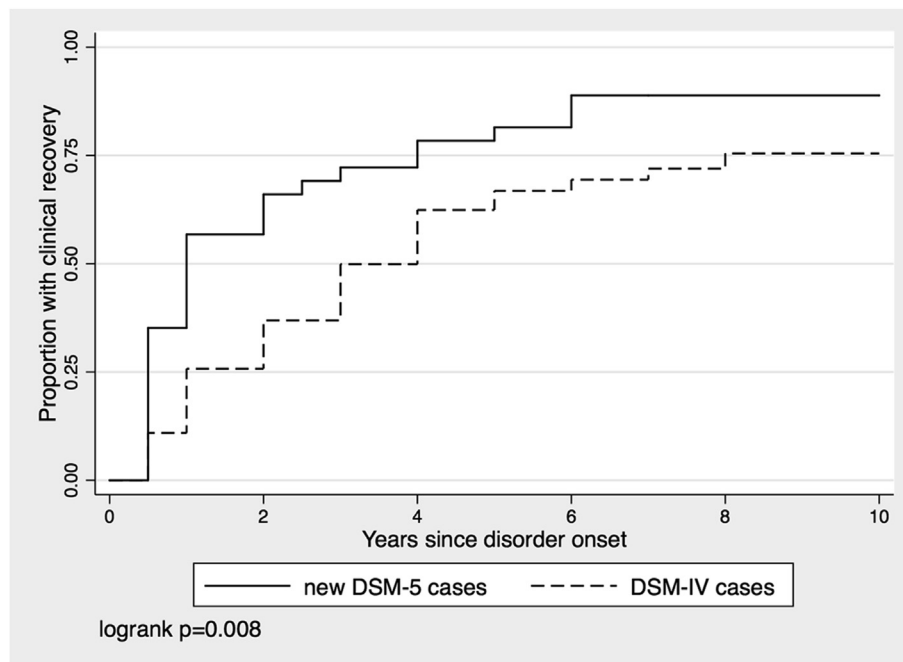[b] Corrected for clustering within twin-pairs.

Fig. 1. Recovery from DSM-5 anorexia nervosa: New DSM-5 cases vs. DSM-IV cases.

prognosis.

Our first goal was to quantify how the changing definition of anorexia nervosa may influence the prevalence and incidence rate of the disorder. As expected, relaxation of the diagnostic criteria led to a substantial increase in the occurrence of anorexia nervosa among young women. The 60% increase in our data is in line with an increase of 50% in lifetime prevalence of anorexia nervosa in a community sample of Dutch adolescents when comparing DSM-5 to DSM-IV criteria (Smink et al., 2014). Preliminary reports have anticipated this increase in the overall prevalence of anorexia nervosa (Mancuso et al., 2015; Keel et al., 2011; Nakai et al., 2013), but they have not yielded precise estimates for the entire population. Among Swedish twins (Bulik et al., 2006), the prevalence of anorexia nervosa in women nearly doubled when the amenorrhea criterion was omitted from the definition of anorexia nervosa. Our study confirmed that the occurrence of anorexia nervosa can increase substantially with the introduction of DSM-5.

Our data suggest that the changes in the diagnostic definitions may have increased diagnostic heterogeneity. The new cases who qualified for a DSM-5 diagnosis of anorexia nervosa differed in both clinical picture and prognosis from DSM-IV cases. We sought to understand factors that contributed to differences in prognosis. One potential factor is the operationalization of diagnostic criteria. The first potential difference was how a key symptom of anorexia nervosa, weight loss, was defined. For DSM-IV diagnoses, a minimum BMI of 17.5 kg/m^2 closely matches the criterion "body weight less than 85% of that expected" (Couturier & Lock 2006; Keski-Rahkonen et al., 2007). For DSM-5 diagnoses, 'a weight that is less than minimally normal or, for children and adolescents, less than that minimally expected' was operationalized as a minimum BMI of 18.5 kg/m^2 or its ISO-BMI equivalent following the WHO norms and the Finnish growth reference (Sysko et al., 2015; Saari et al., 2011; World Health Organization 2014). The one-unit change in the BMI threshold may have had some impact on our findings, but did not alone fully explain the changes in clinical presentation and prognosis; the same was true for the omission of the amenorrhea criterion. Finally, comorbid psychiatric disorders (major depressive disorder and bulimia nervosa) were independently associated with worse outcomes, but they did not explain the differences in outcome between new and old cases. In summary, we found no single factor that explained the major difference in outcomes; likely, all changes collectively contributed to it.
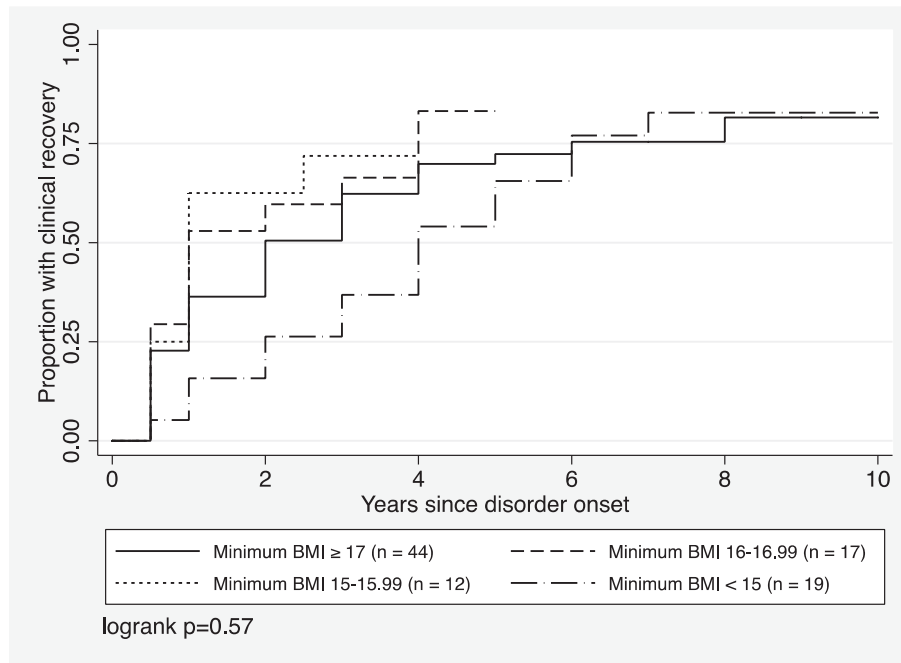
Fig. 2. Recovery from DSM-5 anorexia nervosa by minimum BMI category.
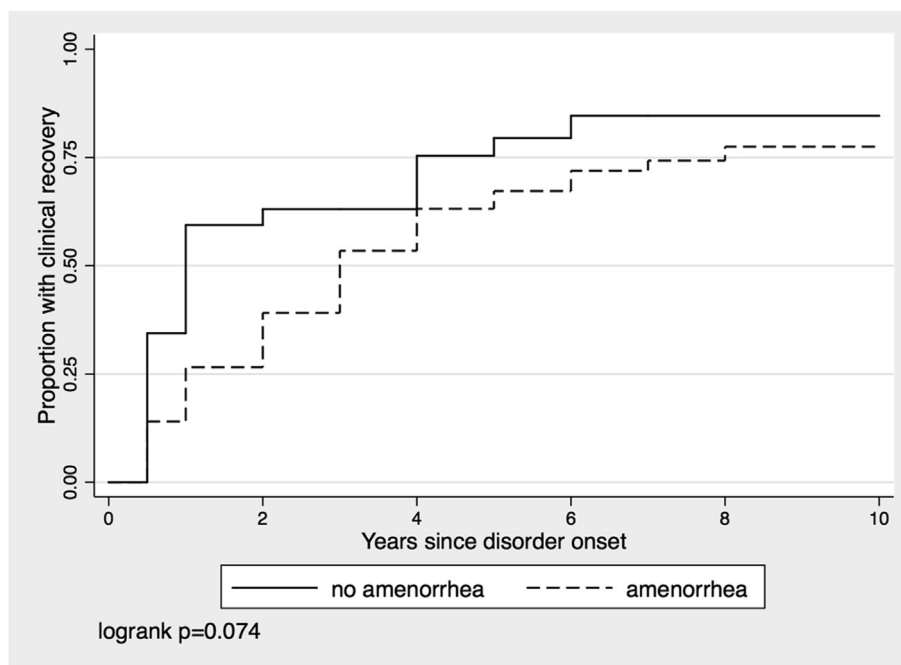

Fig. 3. Recovery from DSM-5 anorexia nervosa by presence of amenorrhea.

The increased heterogeneity observed in our sample reflects the transitioning diagnostic landscape in eating disorders. Broadening of categories and introducing new categories with the aim of reducing the use of the unspecified category was pioneered by the DSM-5 and will likely be paralleled by The International Classification of Diseases 11th Revision (ICD-11) (Al-Adawi et al., 2013). As providing clinical utility is a central goal of any diagnostic classification system, the increased heterogeneity observed in community samples is likely to transfer to clinical settings. This is highly relevant, as milder forms of illness may require less intensive treatment

approaches. Important clinical and prognostic information may be overlooked if old and new cases are treated as being equivalent. To date, the ICD-10 has chosen to distinguish between anorexia nervosa and atypical anorexia nervosa (F50.0 vs. F50.1). Several studies have found that this distinction is associated with differences in clinical presentation, treatment outcome and mortality (Dellava et al., 2011; Suokas et al., 2013; Silen et al., 2015).

An alternative way of making a diagnostic distinction is to use measures that reflect the severity of illness both in the short term and in the long term. BMI-based criteria for establishing the level of

severity of anorexia nervosa were a new addition to DSM-5.

In our sample, minimum BMI was not associated with outcome, whether used continuously or stratified as suggested by the DSM-5. This is in line with what was found in a population sample of Dutch adolescents (Smink et al., 2014). It is possible, however, that very low-weight individuals (BMI < 15 kg/m^2) in our setting were slower to recover than other women.

Because low BMI is associated with severe medical complications (Mehler & Brown 2015) and mortality (Hebebrand et al., 1997; Rosling et al., 2011) in inpatient populations, it cannot be disregarded as a measure of acute illness severity. However, given that the evidence is inconsistent for an association between low weight and likelihood of recovery (Steinhausen 2002; Maguire et al., 2008), BMI alone may not be an ideal severity-of-illness measure for anorexia nervosa, but should be complemented by criteria related to prognosis. Future studies should focus on identifying such factors in prospective settings.

To consider the validity of our results, potential sources of error and bias also need to be considered. Could we have overestimated the prevalence of anorexia nervosa? We believe the inverse to be true. A focus on actual detected cases means that we presented the lowest possible estimate of the true underlying prevalence; had we interviewed all women in the cohort, we would probably have detected some additional cases (Keski-Rahkonen et al., 2006). Some concerns have also been raised that twin studies may exaggerate the prevalence of anorexia nervosa because multiple births appear to be an independent risk factor of anorexia nervosa (Goodman et al., 2014). However, the lifetime prevalence of DSM-IV anorexia nervosa in our sample was virtually identical (2.1%) to that found in a Finnish non-twin population (Lähteenmäki et al., 2014). We believe that our prevalence estimates are high because we were able to find anorexia nervosa cases that had not been detected by the healthcare system.

Overestimation of DSM-5 prevalence could also have taken place if the DSM-IV vs. DSM-5 diagnostic assessments differed systematically. In theory, we could have been very strict in the DSM-IV telephone interviews (underestimating the true prevalence) and excessively lenient when recoding the DSM-5 diagnoses (overestimating the true prevalence), but we find this unlikely, because DSM-5 diagnostic recoding was led by two expert clinicians (AKR and AR) who conducted 60% of the original interviews. However, given that behaviors interfering with weight gain was not a part of the DSM-IV criteria, some participants may not have been asked about such behaviors, leading to underestimation of the DSM-5 prevalence.

Diagnoses were established based on telephone interviews, relying on self-reported rather than measured height and weight. The information obtained in the interviews was also partly retrospective, which may have introduced recall bias. Yet we consider it unlikely that systematic differences in reporting existed between DSM-IV cases and new DSM-5 cases.

Previous research has established that changes in diagnostic definitions and different operationalizations can have an impact on prevalences (Brown et al., 2014). Data from Sweden show that a similar or greater increase in prevalence could be attributed to the elimination of criterion D (amenorrhea) alone (Bulik et al., 2006). Further, by recoding diagnoses, we could avoid many potential sources of error arising from period, cohort and age effects. Thus, diagnostic assessment may have introduced some minor bias, but we do believe that it explains the large observed difference in outcomes.

Finally, our severity rating analyses were based on retrospectively assessed prognostic factors. They are suggestive but not conclusive. Statistical power was limited increasing the possibility of type II errors in testing, and our assessment of symptoms could

have been subject to recall bias. Because of this, large prospective studies should reassess and confirm the role of these factors in clinical practice. The potential limitations stated above are counterbalanced by the strengths of our systematic, nationwide, and population-based study design, high participation rates, and the high quality expert interviews.

It therefore appears that the substantial increase in prevalence of anorexia nervosa is offset by a more benign course of illness in new cases. Increased diagnostic heterogeneity underscores the need for reliable indicators of disease severity. Our findings indicate that BMI may not be an ideal severity marker, but should be complemented by prognostically informative criteria.

5. Conclusion

Applying the DSM-5 diagnostic criteria for anorexia nervosa to a community sample increased its lifetime prevalence substantially, by more than a half. The increase in occurrence was in some part offset by the more favorable prognosis of the new DSM-5 cases. Future prospective studies should further evaluate the role of this distinction and other factors that help to establish the severity of the disorder.

Contributors

L. Mustelin and A. Keski-Rahkonen designed the study, reviewed literature, conducted the statistical analysis, and wrote the first draft of the manuscript; Y. Silén participated in reviewing the literature. A. Keski-Rahkonen and A. Raevuori led the DSM-5 diagnostic recoding; L. Mustelin and Y. Silén participated. A. Keski-Rahkonen and A. Raevuori conducted part of the clinical interviews and A. Keski-Rahkonen supervised the interviewers. J. Kaprio supervised the twin cohort data collection. H.W. Hoek helped to design the original study and contributed to drafting and finalizing the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of interest

None of the authors declare any conflict of interest.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jpsychires.2016.03.003.

References

Al-Adawi, S., Bax, B., Bryant-Waugh, R., Claudino, A.M., Hay, P., Monteleone, P., et al., 2013. Revision of ICD – status update on feeding and eating disorders. Adv. Eat. Disord. 1 (1), 10–20, 03/01.

American Psychiatric Association, 2013. The Diagnostic and Statistical Manual of Mental Disorders: DSM-5, fifth ed. American Psychiatric Association, Washington D.C.

Attia, E., Becker, A.E., Bryant-Waugh, R., Hoek, H.W., Kreipe, R.E., Marcus, M.D., et al., 2013 Nov 1. Feeding and eating disorders in DSM-5. Am. J. Psychiatry 170 (11), 1237–1239.

Birgegard, A., Norring, C., Clinton, D., 2012 Apr. DSM-IV versus DSM-5: implementation of proposed DSM-5 criteria in a large naturalistic database. Int. J. Eat. Disord. 45 (3), 353–361.

Brown, T.A., Holland, L.A., Keel, P.K., 2014 Jan. Comparing operational definitions of DSM-5 anorexia nervosa for research contexts. Int. J. Eat. Disord. 47 (1), 76–84.

Bulik, C.M., Sullivan, P.F., Tozzi, F., Furberg, H., Lichtenstein, P., Pedersen, N.L., 2006 Mar. Prevalence, heritability, and prospective risk factors for anorexia nervosa. Arch. General Psychiatry 63 (3), 305–312.

Couturier, J., Lock, J., 2006 Nov. What is recovery in adolescent anorexia nervosa? Int. J. Eat. Disord. 39 (7), 550–555.

Dellava, J.E., Thornton, L.M., Lichtenstein, P., Pedersen, N.L., Bulik, C.M., 2011 May. Impact of broadening definitions of anorexia nervosa on sample characteristics. J. Psychiatr. Res. 45 (5), 691–698.

Eddy, K.T., Celio Doyle, A., Hoste, R.R., Herzog, D.B., le Grange, D., 2008 Feb. Eating disorder not otherwise specified in adolescents. J. Am. Acad. Child Adolesc. Psychiatry 47 (2), 156–164.

Fairburn, C.G., Bohn, K., 2005 Jun. Eating disorder NOS (EDNOS): an example of the troublesome "not otherwise specified" (NOS) category in DSM-IV. Behav. Res. Ther. 43 (6), 691–701.

First, M.B., Spitzer, R.L., Gibbon, M., Williams, J.B.W., 2003. Structured Clinical Interview for DSM-IV-TR axis I Disorders, Research Version. Nonpatient Edition. New York State Psychiatric Institute.

Garner, D.M., 1991. Eating Disorder Inventory-2, Professional Manual. Psychological Assessment Resources, Odessa,FL.

Goodman, A., Heshmati, A., Malki, N., Koupil, I., 2014 Apr 1. Associations between birth characteristics and eating disorders across the life course: findings from 2 million males and females born in Sweden, 1975-1998. Am. J. Epidemiol. 179 (7), 852–863.

Hebebrand, J., Himmelmann, G.W., Herzog, W., Herpertz-Dahlmann, B.M., Steinhausen, H.C., Amstein, M., et al., 1997 Apr. Prediction of low body weight at long-term follow-up in acute anorexia nervosa by low body weight at referral. Am. J. Psychiatry 154 (4), 566–569.

Helverskov, J.L., Lyng, B., Clausen, L., Mors, O., Frydenberg, M., Thomsen, P.H., et al., 2011 Jul–Aug. Empirical support for a reclassification of eating disorders NOS. European eating disorders review. J. Eat. Disord. Assoc. 19 (4), 303–315.

Kaprio, J., 2013 Feb. The Finnish Twin Cohort Study: an update. Twin research and human genetics. Off. J. Int. Soc. Twin Stud. 16 (1), 157–162.

Kaprio, J., 2006 Dec. Twin studies in Finland 2006. Twin research and human genetics. Off. J. Int. Soc. Twin Stud. 9 (6), 772–777.

Kaprio, J., Pulkkinen, L., Rose, R.J., 2002 Oct. Genetic and environmental factors in health-related behaviors: studies on Finnish twins and twin families. Twin research. Off. J. Int. Soc. Twin Stud. 5 (5), 366–371.

Keel, P.K., Brown, T.A., Holm-Denoma, J., Bodell, L.P., 2011 Sep. Comparison of DSM-IV versus proposed DSM-5 diagnostic criteria for eating disorders: reduction of eating disorder not otherwise specified and validity. Int. J. Eat. Disord. 44 (6), 553–560.

Keski-Rahkonen, A., Hoek, H.W., Susser, E.S., Linna, M.S., Sihvola, E., Raevuori, A., et al., 2007 Aug. Epidemiology and course of anorexia nervosa in the community. Am. J. Psychiatry 164 (8), 1259–1265.

Keski-Rahkonen, A., Sihvola, E., Raevuori, A., Kaukoranta, J., Bulik, C.M., Hoek, H.W., et al., 2006 Dec. Reliability of self-reported eating disorders: optimizing population screening. Int. J. Eat. Disord. 39 (8), 754–762.

Lähteenmäki, S., Saarni, S., Suokas, J., Saarni, S., Perala, J., Lönnqvist, J., et al., 2014 Apr. Prevalence and correlates of eating disorders among young adults in Finland. Nordic J. Psychiatry 68 (3), 196–203.

Machado, P.P., Goncalves, S., Hoek, H.W., 2013 Jan. DSM-5 reduces the proportion of EDNOS cases: evidence from community samples. Int. J. Eat. Disord. 46 (1), 60–65.

Maguire, S., Le Grange, D., Surgenor, L., Marks, P., Lacey, H., Touyz, S., 2008 Feb. Staging anorexia nervosa: conceptualizing illness severity. Early Interv. Psychiatry 2 (1), 3–10.

Mancuso, S.G., Newton, J.R., Bosanac, P., Rossell, S.L., Nesci, J.B., Castle, D.J., 2015 Jun. Classification of eating disorders: comparison of relative prevalence rates using DSM-IV and DSM-5 criteria. Br. J. Psychiatry J. Ment. Sci. 206 (6), 519–520.

Mehler, P.S., Brown, C., 2015 Mar 31. Anorexia nervosa - medical complications. J. Eat. Disord. 3 (11), 015-0040-8. eCollection 2015.

Mustelin, L., Raevuori, A., Hoek, H.W., Kaprio, J., Keski-Rahkonen, A., 2015 Dec. Incidence and weight trajectories of binge eating disorder among young women in the community. Int. J. Eat. Disord. 48 (8), 1106–1112.

Nakai, Y., Fukushima, M., Taniguchi, A., Nin, K., Teramukai, S., 2013 Jan. Comparison of DSM-IV versus proposed DSM-5 diagnostic criteria for eating disorders in a Japanese sample. European eating disorders review. J. Eat. Disord. Assoc. 21 (1), 8–14.

Ornstein, R.M., Rosen, D.S., Mammel, K.A., Callahan, S.T., Forman, S., Jay, M.S., et al., 2013 Aug. Distribution of eating disorders in children and adolescents using the proposed DSM-5 criteria for feeding and eating disorders. J. Adolesc. Health Off. Publ. Soc. Adolesc. Med. 53 (2), 303–305.

Rosling, A.M., Sparen, P., Norring, C., von Knorring, A.L., 2011 May. Mortality of eating disorders: a follow-up study of treatment in a specialist unit 1974-2000. Int. J. Eat. Disord. 44 (4), 304–310.

Saari, A., Sankilampi, U., Hannila, M.L., Kiviniemi, V., Kesseli, K., Dunkel, L., 2011 May. New Finnish growth references for children and adolescents aged 0 to 20 years: Length/height-for-age, weight-for-length/height, and body mass index-for-age. Ann. Med. 43 (3), 235–248.

Silen, Y., Raevuori, A., Juriloo, E., Tainio, V.M., Marttunen, M., Keski-Rahkonen, A., 2015 Sep. Typical versus atypical anorexia nervosa among adolescents: clinical characteristics and implications for ICD-11. Eur. Eat. Disord. Rev. J. Eat. Disord. Assoc. 23 (5), 345–351.

Smink, F.R., van Hoeken, D., Oldehinkel, A.J., Hoek, H.W., 2014 Sep. Prevalence and severity of DSM-5 eating disorders in a community cohort of adolescents. Int. J. Eat. Disord. 47 (6), 610–619.

Steinhausen, H.C., 2002 Aug. The outcome of anorexia nervosa in the 20th century. Am. J. Psychiatry 159 (8), 1284–1293.

Suokas, J.T., Suvisaari, J.M., Gissler, M., Lofman, R., Linna, M.S., Raevuori, A., et al., 2013 Dec 30. Mortality in eating disorders: a follow-up study of adult eating disorder patients treated in tertiary care, 1995 -2010. Psychiatry Res. 210 (3), 1101–1106.

Sysko, R., Glasofer, D.R., Hildebrandt, T., Klimek, P., Mitchell, J.E., Berg, K.C., et al., 2015 Jul. The eating disorder assessment for DSM-5 (EDA-5): development and validation of a structured interview for feeding and eating disorders. Int. J. Eat. Disord. 48 (5), 452–463.

Thomas, J.J., Vartanian, L.R., Brownell, K.D., 2009 May. The relationship between eating disorder not otherwise specified (EDNOS) and officially recognized eating disorders: meta-analysis and implications for DSM. Psychol. Bull. 135 (3), 407–433.

Walsh, B.T., 2013 May 1. The enigmatic persistence of anorexia nervosa. Am. J. Psychiatry 170 (5), 477–484.

World Health Organization, 2014. The International Classification of Adult Underweight, Overweight and Obesity According to BMI, 2014(02/21).

Zimmerman, M., Francione-Witt, C., Chelminski, I., Young, D., Tortolani, C., 2008 Mar. Problems applying the DSM-IV eating disorders diagnostic criteria in a general psychiatric outpatient practice. J. Clin. Psychiatry 69 (3), 381–384.