

Early childhood adversities and risk of eating disorders in women: A Danish register-based cohort study

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1 | INTRODUCTION

Eating disorders are severe illnesses associated with elevated mortality (Arcelus, Mitchell, Wales, & Nielsen, 2011; Zerwas et al., 2015), suicidal behavior (Zerwas et al., 2015), and other adverse outcomes (Field et al.,

Abstract

Objective: Previous studies evaluating the association between early childhood adversities and eating disorders have yielded conflicting results. The aim of this study is to examine the association between a range of adversities and risk of anorexia nervosa (AN), bulimia nervosa (BN), and eating disorder not otherwise specified (EDNOS) in 495,244 women.

Method: In this nationwide, register-based cohort study, nine types of early childhood adversity (family disruption, residential instability, placement in out-of-home care, familial death, parental somatic illness, parental psychiatric illness, parental disability, severe parental criminality, and parental substance use disorder) were defined and exposure during the first 6 years of life was determined. Hazard ratios for eating disorders were calculated using Cox regression.

Results: Few adversities were significantly associated with AN, and for each, the presence of the adversity was associated with lower risk for AN. BN, and EDNOS were positively associated with several types of adversities. AN rates were unchanged or reduced by up to 54% by adversities, whereas rates of BN and EDNOS were unchanged or increased by adversities by up to 49 and 89%, respectively.

Discussion: Our findings indicate that childhood adversities appear to be associated with an increased risk of BN and in particular EDNOS, whereas they seem to be either unassociated or associated with a decreased risk of AN.

KEYWORDS

anorexia nervosa, bulimia nervosa, early childhood adversity, eating disorders, eating disorder not otherwise specified, epidemiology

2012). Various psychiatric disorders have been shown to be associated with adversities in childhood (Björkenstam, Burström, Vinnerljung, & Kosidou, 2016; Dahl et al., 2017; Laursen, Munk-Olsen, Nordentoft, & Mortensen, 2007; Mok, Webb, Appleby, & Pedersen, 2016). However, previous studies evaluating the association between early adversities

and anorexia nervosa (AN) and bulimia nervosa (BN) have yielded conflicting results, and for eating disorder not otherwise specified (EDNOS) little research has been conducted. Parental psychiatric illness and family disruption have been reported to increase the risk of both AN (Fairburn, Cooper, Doll, & Welch, 1999) and BN (Boumann & Yates, 1994; Webster & Palmer, 2000). Residential changes and high parental educational level are associated with increased risks of both AN (Ahrén, Chiesa, Klinteberg, & Koupil, 2012; Fairburn et al., 1999) and of eating disorders in general (Ahrén et al., 2013; Mok et al., 2016).

Parental death before age 10 has been associated with increased risk of BN (Su et al., 2016). A dose-response pattern with increasing risk of AN for higher number of adversity factors has been found (Fairburn et al., 1999), and household living on public assistance during child ages 0–15 years has been associated with decreased risk of pooled eating disorders (Björkenstam et al., 2016).

To expand the existing knowledge base and to evaluate to what extent early adversities influence the risk of developing various eating disorders, we examined the association between a range of measures of early childhood adversity and later risk of AN, BN, and EDNOS separately. Furthermore, we examined the effect of multiple adversities and compared the risk estimates for eating disorders to those for other psychiatric disorders with overlapping symptomatology and traits, that is, major depressive disorder (MDD), anxiety disorder, and obsessive compulsive disorder (OCD). The selection of included adversities was informed by a previous publication (Dahl et al., 2017), which examined the same panel of adversities in severe unipolar depressive disorder.

2 | METHOD

2.1 | Study population

Using Danish national registers, we conducted a population-based cohort study including all females born in Denmark to Danish-born parents between January 1, 1989 and December 31, 2007. Individuals who died or emigrated before age 6 were excluded from the study population, resulting in a study population of 495,244 women.

Identification of cohort members was possible by using the Central Person Register number, a unique personal identification number assigned to all Danish citizens (Pedersen, 2011). This is used as identifier in all national registers and enables accurate linkage between registers.

Neither patient informed consent nor approval from an ethics committee is required for registry-based studies in Denmark.

2.2 | Eating disorders and other psychiatric disorders

Information on contacts to Danish hospitals are registered in The Danish National Patient Register (NPR) (Lynge, Sandegaard, & Rebolj, 2011) or The Danish Psychiatric Central Research Register (PCRR) (Mors, Perto, & Mortensen, 2011). From 1994 and onwards, the diagnostic system has been the International Classification of Diseases, 10th revision (ICD-10).

The events of interest were an ICD-10 diagnosis of AN (F50.0, F50.1), BN (F50.2, F50.3), or EDNOS (F50.8, F50.9).

Date of onset was defined as the admission date of the first in- or outpatient contact after the 6th birthday (chosen to reduce diagnostic misclassification, for example, feeding disorders in infancy and childhood) leading to a discharge diagnosis of the disorder of interest.

To compare the magnitude of the possible associations between childhood adversities and eating disorders to those for other psychiatric disorders in the same setting and cohort, we conducted parallel analyses for MDD (ICD-10: F32, F33), anxiety disorder (F40, F41), and OCD (F42).

2.3 | Early childhood adversities

We investigated nine different adversities and each of these was defined dichotomously depending on whether the child had been exposed at least once during the first 6 years of life, that is, between ages 0 and 5 years. Information on parental adversities was obtained by identifying parents of each person in the cohort using the Danish Civil Registration System (CRS) (Pedersen, 2011) and linking to information from various other registers.

Family disruption was defined as the child not sharing her address with both legal parents, based on information from Statistics Denmark. Instances when family disruption was caused by death or imprisonment of a parent or the child being placed in out-of-home care (OOHC) were included as separate adversities and therefore not included as family disruptions.

Parental somatic illness was defined as at least one parent with a record in the NPR of having received a diagnosis of any of the severe and chronic illnesses encompassed in the Charlson Comorbidity Index (CCI) (Thygesen, Christiansen, Christensen, Lash, & Sørensen, 2011). For this study, dementia diagnoses were omitted from the CCI as they were included in the measure for parental psychiatric illness.

Residential instability was defined as the child having moved between two Danish municipalities more than once, based on residence information.

Parental psychiatric illness was defined as at least one parent receiving any psychiatric diagnosis [International Classification of Diseases, 8th revision (ICD-8): 290–315 for events prior to 1994; ICD-10: F00-F99 for events from 1994 onward] with the exception of substance use disorder (SUD) in the PCRR. SUD is included as a separate exposure variable.

Severe parental criminality was defined as at least one parent having been convicted of a criminal offense under the penal law, special legislation regarding drugs and weapons, or sections of the traffic act regarding impaired driving. Only severe offenses resulting in custodial sentences were included. Information on criminal transgressions and convictions is registered in The Danish National Crime Register (Kryvsgaard, 2002).

Parental disability was considered present if the primary occupation of at least one parent was recorded in the Integrated Database for Labor Market Research (Petersson, Baadsgaard, & Thygesen, 2011) as disability pensioner.

Familial death was defined as the child having lost a parent or a full or half sibling, based on information from the CRS.

Parental SUD was defined as at least one parent having received an SUD diagnosis in the PCRR (ICD-8: 291.x9, 303.x9, 303.20, 303.28, 303.90, 304.x9, ICD-10: F10–F19).

Placement in OOHC was defined as the child having been placed in a foster home or institution, with or without parental consent, based on information from The Register for Support for Children and Adolescents.

We furthermore included dichotomous measures for any adversity (at least one of the included adversities), any maternal and any paternal adversity (at least one of maternal/paternal somatic illness, psychiatric illness, severe criminality, disability, death, or SUD), and number of different adversities.

We originally intended to include childhood abuse (combined sexual, emotional, and physical abuse captured by contacts to hospitals) in this study. Unfortunately, after exploration of the prevalence of the events, we found that we had insufficient data to include this severe adversity and still comply with Danish legislation regarding personally identifiable information.

2.4 | Statistical analysis

Survival analyses were conducted using Cox proportional hazards models and the resulting estimates were hazard ratios (HRs) with 95% confidence intervals (CIs). A HR of 1.00 indicates that there is no association between exposure and outcome. Each person in the study population was followed from their 6th birthday and until their first diagnosis of interest after age 6, date of death or emigration from Denmark, or December 31, 2013, whichever occurred first (i.e., until age 25 at most). The reference groups in all analyses were persons with no registered adversities during early childhood. All estimates were adjusted for age in the nonparametric part of the model and for time-varying calendar-time, divided into 5-year intervals starting in 1995 (model 1). In two extended models, we further adjusted for possible confounders by including time-varying history of psychiatric comorbidity (any psychiatric illness excluding any eating disorder) (model 2), or urbanicity at birth (categorized in five groups depending on the population density of the municipality where the child was born), parental educational level the year of the child's 6th birthday [dichotomously defined as either both parents having low educational attainment (basic schooling, vocational training, or high school) or at least one parent having high educational attainment (short, medium, or long-term higher education)], and time-varying history of parental psychiatric illness (defined as at least one parent having received any psychiatric diagnosis) (model 3). For the last model, the adversities parental psychiatric illness and parental SUD were not included as exposures and were left out of the measure for any adversity and the number of adversities. Level of urbanicity at birth is a risk factor for being diagnosed with psychiatric illness in general and with eating disorders and AN in particular (Vassos, Agerbo, Mors, & Pedersen, 2016) and adjusting for urbanicity takes into account possible selection bias due to better access to hospital care in urban areas and thereby higher probability of having a psychiatric diagnosis in the registers. Similarly, parental educational levels

(Ahrén et al., 2012) and parental psychiatric illnesses (Fairburn et al., 1999) are risk factors for eating disorders in the offspring.

We further conducted sensitivity analyses, where only the first eating disorder diagnosis received was used in the definition of cases, that is, an individual was only considered an AN case if this was her first eating disorder diagnosis and she had not previously been diagnosed with BN or EDNOS. In the rare event of multiple eating disorder diagnoses on the same date, we let AN trump BN and EDNOS, and BN trump EDNOS.

We tested for a linear trend for the associations between number of adversities and risk of eating disorders in model 1 using likelihood-ratio tests. Cumulative incidences of AN, BN, and EDNOS by number of adversities were calculated using competing-risks regression with death as the competing event.

All analyses were conducted using Stata version 13.

3 | RESULTS

Our study population was followed for a combined total of 4.8 million person-years, during which 2,892 women (0.58% of the study population) were diagnosed with AN, 1,027 (0.21%) with BN, and 2,150 (0.43%) with EDNOS. Approximately one-third of all three eating disorder groups were diagnosed with at least one of the three comparison disorders MDD, anxiety disorder, or OCD during follow-up.

During the first 6 years of life, more than a third of the population (34.77%) had been exposed to any adversity, with the most common adversity being family disruption (21.74%) and the least common placement in OOHC (0.67%); see Table 1 for details (Supporting Information Table S1 for comparison disorders MDD, anxiety disorder, and OCD).

The mean number of adversities experienced by the cohort and by each case group is presented in Figure 1. AN stands out as the disorder with the lowest mean number of adversities.

3.1 | Association between early childhood adversities and risk of eating disorders

In Table 2 estimates for eating disorders are presented. The corresponding results for comparison disorders are presented in Supporting Information Table S2.

3.1.1 | Anorexia nervosa

Severe parental criminality, placement in OOHC, and any paternal adversity were all significantly associated with decreased risk of AN in model 1 with reductions in rates of AN of up to 54%, observed for placement in OOHC. These all remained significant in the extended models. In model 2, the estimates were in fact further decreased, and family disruption and any adversity were also significantly associated with decreased risk of AN. Indication of a decreasing linear trend was evident, although nonsignificant [change in HR per adversity: 0.95 (0.91–1.00), data not shown].

TABLE 1 Number of cohort members and cases exposed to early childhood adversities.

	Cohort (N = 495,244) N (%)	AN cases (N = 2,892) N (%)	BN cases (N = 1,027) N (%)	EDNOS cases (N = 2,150) N (%)
Family disruption	107,672 (21.74)	622 (21.51)	285 (27.75)	563 (26.19)
Parental somatic illness	41,776 (8.44)	205 (7.09)	69 (6.72)	181 (8.42)
Residential instability	37,613 (7.59)	213 (7.37)	86 (8.37)	191 (8.88)
Parental psychiatric illness	22,756 (4.59)	113 (3.91)	43 (4.19)	130 (6.05)
Severe parental criminality	10,384 (2.10)	42 (1.45)	19 (1.85)	58 (2.70)
Parental disability	9,016 (1.82)	40 (1.38)	7 (0.68)	50 (2.33)
Familial death	4,926 (0.99)	36 (1.24)	15 (1.46)	26 (1.21)
Parental SUD	4,540 (0.92)	24 (0.83)	12 (1.17)	26 (1.21)
Placement in OOHC	3,330 (0.67)	10 (0.35)	6 (0.58)	19 (0.88)
Any adversity	172,173 (34.77)	976 (33.75)	400 (38.95)	870 (40.47)
Any maternal adversity	39,380 (7.95)	206 (7.12)	66 (6.43)	208 (9.67)
Any paternal adversity	40,260 (8.13)	194 (6.71)	72 (7.01)	184 (8.56)
Number of adversities				
0	323,071 (65.23)	1,916 (66.25)	627 (61.05)	1,280 (59.53)
1	121,947 (24.62)	727 (25.14)	299 (29.11)	609 (28.33)
2	36,453 (7.36)	192 (6.64)	72 (7.01)	185 (8.60)
3 or more	13,773 (2.78)	57 (1.97)	29 (2.82)	76 (3.53)

Note: AN = anorexia nervosa; BN = bulimia nervosa; EDNOS = eating disorder not otherwise specified; SUD = substance use disorder; OOHC = out-of-home care.

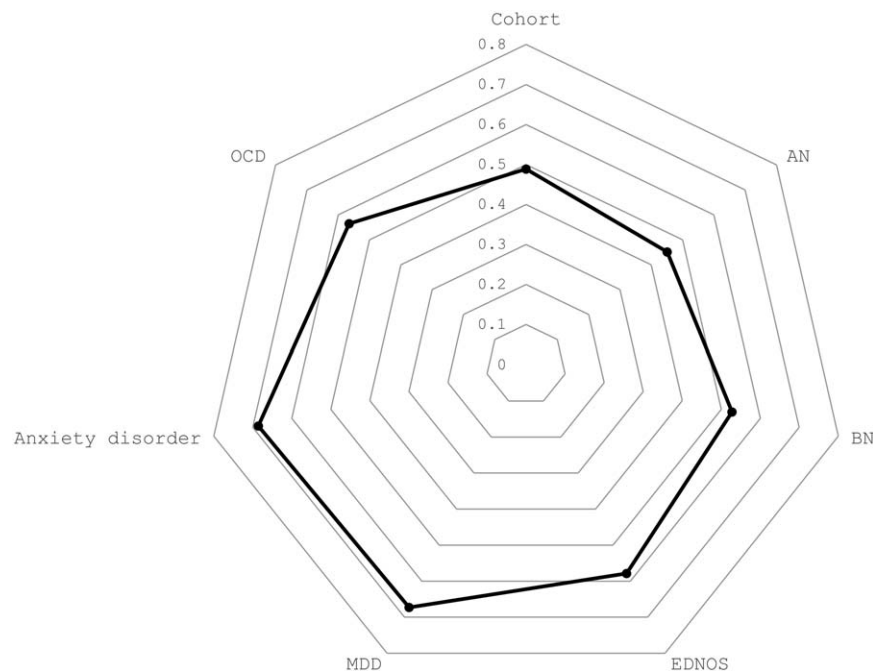


FIGURE 1 Mean number of adversities experienced between ages 0–5 years by the entire cohort and by case groups. The radar chart depicts the mean number of adversities by diagnostic group. The bolded line and the position of the data points on the spokes, reflects the mean number of adversities with points farthest from the center representing higher mean number of adversities and points closer to the center representing fewer mean numbers of adversities. Spokes represent the entire cohort and the separate diagnostic groups: AN = anorexia nervosa; BN = bulimia nervosa; EDNOS = eating disorder not otherwise specified; MDD = major depressive disorder; OCD = obsessive compulsive disorder

TABLE 2 Hazard ratios of AN, BN, and EDNOS for each adversity

	AN			BN			EDNOS		
	Model 1 ^a HR (95% CI)	Model 2 ^b HR (95% CI)	Model 3 ^c HR (95% CI)	Model 1 ^a HR (95% CI)	Model 2 ^b HR (95% CI)	Model 3 ^c HR (95% CI)	Model 1 ^a HR (95% CI)	Model 2 ^b HR (95% CI)	Model 3 ^c HR (95% CI)
Family disruption	0.93 (0.85-1.02)	0.85 (0.78-0.93)	0.94 (0.85-1.03)	1.30 (1.13-1.49)	1.13 (0.98-1.30)	1.23 (1.07-1.43)	1.26 (1.14-1.40)	1.07 (0.97-1.18)	1.16 (1.05-1.28)
Parental somatic illness	0.97 (0.84-1.12)	0.89 (0.77-1.03)	0.97 (0.84-1.12)	1.08 (0.85-1.39)	0.97 (0.75-1.24)	1.06 (0.83-1.36)	1.28 (1.10-1.50)	1.11 (0.95-1.30)	1.18 (1.01-1.38)
Residential instability	0.96 (0.83-1.10)	0.87 (0.75-1.00)	0.95 (0.82-1.09)	1.18 (0.94-1.48)	1.03 (0.82-1.29)	1.12 (0.89-1.40)	1.28 (1.10-1.49)	1.08 (0.93-1.26)	1.17 (1.01-1.37)
Parental psychiatric illness	1.09 (0.90-1.32)	0.91 (0.75-1.10)	N/A	1.49 (1.09-2.03)	1.16 (0.85-1.58)	N/A	1.89 (1.57-2.26)	1.38 (1.15-1.65)	N/A
Severe parental criminality	0.58 (0.42-0.78)	0.49 (0.36-0.67)	0.61 (0.44-0.82)	0.73 (0.46-1.16)	0.59 (0.37-0.93)	0.71 (0.45-1.13)	1.19 (0.92-1.55)	0.91 (0.70-1.18)	0.99 (0.76-1.30)
Parental disability	0.95 (0.70-1.30)	0.78 (0.57-1.07)	1.02 (0.75-1.41)	0.73 (0.35-1.54)	0.55 (0.26-1.16)	0.73 (0.34-1.54)	1.82 (1.37-2.41)	1.29 (0.97-1.71)	1.53 (1.15-2.05)
Familial death	1.10 (0.79-1.53)	0.98 (0.70-1.36)	1.12 (0.80-1.56)	1.33 (0.79-2.21)	1.13 (0.68-1.89)	1.25 (0.73-2.12)	1.19 (0.80-1.75)	0.96 (0.65-1.42)	1.10 (0.74-1.62)
Parental SUD	0.88 (0.59-1.32)	0.73 (0.49-1.09)	N/A	1.37 (0.78-2.43)	1.05 (0.59-1.86)	N/A	1.44 (0.97-2.12)	1.03 (0.70-1.52)	N/A
Placement in OOHHC	0.46 (0.25-0.85)	0.32 (0.17-0.59)	0.47 (0.25-0.87)	0.83 (0.37-1.86)	0.53 (0.23-1.18)	0.76 (0.34-1.71)	1.31 (0.83-2.06)	0.71 (0.45-1.12)	1.01 (0.64-1.60)
Any adversity	0.96 (0.89-1.03)	0.88 (0.81-0.95)	0.94 (0.87-1.02)	1.21 (1.07-1.37)	1.07 (0.94-1.21)	1.15 (1.01-1.32)	1.28 (1.17-1.39)	1.09 (1.00-1.19)	1.16 (1.06-1.27)
Any maternal adversity	1.09 (0.94-1.25)	0.95 (0.82-1.10)	1.07 (0.90-1.28)	1.21 (0.93-1.55)	1.00 (0.78-1.30)	1.01 (0.73-1.40)	1.65 (1.42-1.91)	1.31 (1.13-1.51)	1.39 (1.16-1.66)
Any paternal adversity	0.86 (0.74-1.00)	0.77 (0.66-0.89)	0.81 (0.68-0.95)	1.01 (0.79-1.29)	0.85 (0.67-1.09)	0.92 (0.70-1.21)	1.22 (1.05-1.43)	0.99 (0.85-1.16)	1.03 (0.87-1.23)
Number of adversities									
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1	0.98 (0.90-1.07)	0.93 (0.85-1.01)	0.96 (0.88-1.05)	1.24 (1.08-1.42)	1.12 (0.98-1.29)	1.20 (1.04-1.38)	1.23 (1.12-1.36)	1.11 (1.00-1.22)	1.17 (1.06-1.29)
2	0.92 (0.79-1.06)	0.81 (0.70-0.94)	0.88 (0.75-1.03)	1.07 (0.84-1.37)	0.89 (0.70-1.14)	0.94 (0.72-1.23)	1.32 (1.13-1.54)	1.06 (0.91-1.24)	1.13 (0.96-1.33)
3 or more	0.80 (0.61-1.04)	0.63 (0.49-0.82)	0.89 (0.63-1.25)	1.38 (0.95-2.00)	1.00 (0.69-1.46)	1.32 (0.81-2.16)	1.60 (1.27-2.02)	1.08 (0.85-1.36)	1.22 (0.89-1.67)

Note. AN = anorexia nervosa; BN = bulimia nervosa; EDNOS = eating disorder not otherwise specified; SUD = substance use disorder; OOHHC = out-of-home care; HR = hazard ratio; CI = confidence interval.
^aModel 1. Adjusted for age and calendar time. ^bModel 2. Adjusted for age, calendar time, and psychiatric comorbidity. ^cModel 3. Adjusted for age, calendar time, urbanicity at birth, parental educational level, and history of parental psychiatric illness. A total of 3,629 persons (0.73%) had missing information on urbanicity at birth or parental educational level and were excluded from these analyses. The comparison group is persons who were not exposed to any adversity.

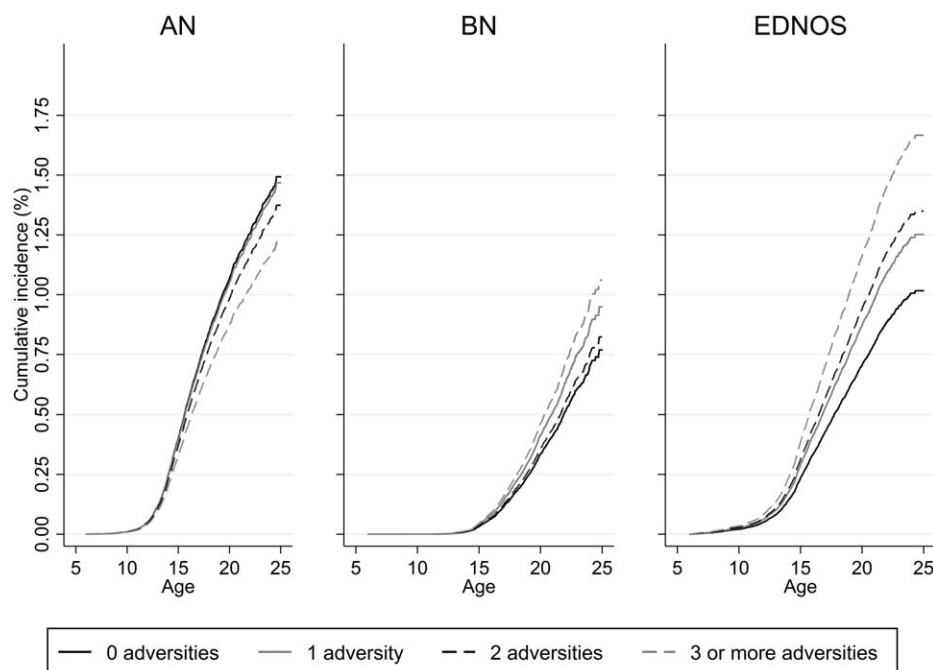


FIGURE 2 Cumulative incidence of AN, BN, and EDNOS by number of adversities experienced. Cumulative incidences were calculated using competing-risks regression with death as the competing event. AN = anorexia nervosa, BN = bulimia nervosa, EDNOS = eating disorder not otherwise specified

3.1.2 | Bulimia nervosa

Family disruption, parental psychiatric illness, and any adversity were all significantly associated with increased risk of BN in model 1 with increases in BN rates of up to 49%, observed for parental psychiatric illness. The associations remained significantly elevated in model 3. In model 2, only severe parental criminality was significantly associated with decreased risk of BN. Further, we observed an increasing linear trend for number of adversities, with more adversities associated with increased risk of BN [change in HR per adversity: 1.11 (1.02–1.20), data not shown].

3.1.3 | Eating disorder not otherwise specified

In model 1, several types of adversities were significantly associated with increased risk of EDNOS, with increases in rates ranging from 26% for family disruption to 89% for parental psychiatric illness. Any adversity, any maternal adversity, and any paternal adversity were also significantly associated with EDNOS. Only the estimates for parental psychiatric illness, any adversity, and any maternal adversity remained significant in model 2, whereas most remained significant in model 3. There was strong evidence of a significant linear trend for number of adversities and increasing risk of EDNOS [change in HR per adversity: 1.17 (1.11–1.24), data not shown].

3.1.4 | Sensitivity analyses

Only including the first eating disorder diagnosis ever received in the case definition did little to change the results. The estimates for all three eating disorders are very similar to those presented in Table 2,

but for AN they were mostly slightly decreased, and for BN and EDNOS mostly slightly increased (data not shown).

3.1.5 | Other psychiatric disorders

To determine the extent to which patterns of adversities seen in eating disorders differ from those observed in individuals with other psychiatric disorders, we conducted parallel analyses with MDD, anxiety disorders, and OCD. All types of adversities were significantly associated with increased risk of MDD in model 1 [with increases in rates ranging from 54% for parental somatic illness to 157% for parental psychiatric illness]. All but familial death were significantly associated with increased risk of anxiety disorder [with increases in rates ranging from 51% for parental somatic illness and residential instability to 211% for parental SUD]. Most adversities were also significantly associated with increased risk of OCD with increases in rates ranging from 23% for any paternal adversity to 87% for parental psychiatric illness. For all three comparison disorders, adjustments in models 2 and 3 did little to change the results and there was evidence of increasing linear trends for number of adversities (data not shown).

3.2 | Cumulative incidences

Figure 2 shows the cumulative incidences of AN, BN, and EDNOS from age 6 until age 25 for persons who were exposed to 0, 1, 2, or 3 or more adversities between ages 0 and 5. For AN, the cumulative incidence was highest for persons with no adversities and decreased with increasing number of adversities. For BN and EDNOS, the lowest cumulative incidence was observed for persons with no adversities, and it was increased for persons with one or more adversities.

4 | DISCUSSION

In general, we found that some childhood adversities (i.e., any paternal adversity, severe parental criminality, and placement in OOH) were associated with a decreased risk of AN, but most adversities were not found to be associated with AN. Conversely, we found that BN and, in particular EDNOS, were more similar to other psychiatric disorders [both in the literature (Björkenstam et al., 2016) and in our comparison groups] and tended to be positively associated with exposure to adversities in early childhood. Adjustment for psychiatric comorbidity further enhanced the inverse associations between early adversities and AN, whereas it somewhat attenuated estimates for BN and EDNOS, but a pattern of elevated risks remained. That AN stands out as different from both BN and EDNOS and from the other psychiatric disorders in this regard could suggest alternate risk pathways to the illness. Indeed, single-nucleotide-polymorphism (SNP)-based genetic correlations have revealed intriguing divergences in patterns of correlations with AN relative to other psychiatric and somatic traits and disorders. Although AN is clearly genetically correlated with other psychiatric traits, unlike other psychiatric disorders, AN also appears to have strong correlations with a variety of metabolic and anthropometric parameters, possibly suggesting differences in its genetic etiology (Anttila et al., 2016; Bulik-Sullivan et al., 2015; Duncan et al., 2017; Hinney et al., 2016; Scott-Van Zeeland et al., 2014). Although comparable SNP-based correlations are not yet available for BN and EDNOS, the fact that AN has a different genetic and environmental risk profile encourages deeper exploration.

The panel of adversities included in this study was inspired by the study by Dahl et al. (2017) on severe unipolar depressive disorder. For comparison, we kept the same panel of adversities regardless of whether they were significantly associated with eating disorders. We found little evidence supporting associations between childhood adversities and AN, which is in agreement with several studies that have also found no evidence for an effect of parental death (Fairburn et al., 1999; Su et al., 2016) or family disruption (Ahrén et al., 2012, 2013; Björkenstam et al., 2016; Stuart, Laraia, Ballenger, & Lydiard, 1990) on risk for AN. We found that any adversity related to the father was associated with a decreased risk of AN, which was mainly driven by paternal criminality. To our knowledge, the most comprehensive study to date evaluating the associations between childhood adversities and eating disorders is a Swedish register-based study by Björkenstam et al. (2016) including 107,704 persons born in Stockholm. Among the various adversities examined, only household living on public assistance during childhood, a proxy measure for relative poverty, was significantly associated with decreased risk of pooled eating disorders. They found no evidence for an association between severe parental criminality and eating disorders, but this could be due to their collapsing of all eating disorders into one group and that they started follow-up at age 15, when a large proportion of persons with eating disorder have already been diagnosed for the first time (Zerwas et al., 2015). We found no evidence of an association between any of the eating disorders and residential instability, which is in accordance with the results of Mok et al. (2016). However, Fairburn et al. (1999) did find that

exposure to residential instability as well as parental psychiatric illness and family disruption did increase risk of AN compared to healthy controls without any eating disorders. They also found a dose-response pattern of increasing risk of AN with multiple adversities, which was not evident in our data. These conflicting results could be due to differences in study designs, that is, prospective cohort versus case-control, and the resulting differences in recall bias.

Any adversity was associated with increased risk of BN. We found that exposure to parental psychiatric illness and family disruption in particular increased the risk of BN, which is in accordance with studies by Boumann and Yates (1994) and Webster and Palmer (2000). We observed a positive but nonsignificant effect of familial death, which is in agreement with studies by Stuart et al. (1990), who reported the same for household deaths, and Su et al. (2016) who reported that parental death before age 10 significantly increased risk of BN. The fact that the study by Su et al., which was based on both Danish and Swedish register data, found a significant effect while we did not could be attributed to statistical power issues.

To our knowledge this is the first study to explore the association between various childhood adversities and EDNOS in particular. Su et al. (2016) studied the effect of postnatal loss of parent on the risk of mixed eating disorders (including EDNOS, and overeating and vomiting associated with other psychological disturbances) and found no evidence of an association. This is in accordance with our result on familial death.

4.1 | Strengths and limitations

In Denmark, hospital-based treatment is free of charge, but socioeconomic factors still influence the probability of seeking treatment, and register information for the current study did not include primary care contacts. It is very likely that defining psychiatric and somatic illness using registers captures only the most severe cases and results could change, were all detected cases at all points of care to be included. The same can be said for other adversities that we studied; only parents who have been convicted were included in the severe parental criminality adversity and only parents who have been assigned disability pension by the municipality were included in the parental disability adversity. Family disruption was based on whether the child shared an address with both parents and we could not take into account whether the child had regular contact with both parents or not. Placement in OOH also only included families with marked dysfunction. All adversity measures were dichotomized based on available register information. This fails to take into account differences in the impact actually experienced by the child, which would be possible to capture in an interview- or questionnaire-based study.

One of the most widely studied environmental risk factors for eating disorders is childhood abuse (Caslini et al., 2016; Racine & Wildes, 2015; Rayworth, Wise, & Harlow, 2004; Smolak & Murnen, 2002; Webster & Palmer, 2000; Welch & Fairburn, 1996; Wonderlich, Brewerton, Jolic, Dansky, & Abbott, 1997). As previously mentioned, we originally intended to include childhood abuse (combined sexual, emotional, and physical abuse captured by contacts to hospitals), but

unfortunately found that we had insufficient data to do so without compromising Danish legislation regarding personally identifiable information.

In this study, the largest case group was individuals diagnosed with AN, followed by EDNOS and BN. This distribution differs from other studies, where EDNOS comprises the largest group and AN the smallest (Fairburn et al., 2007). Our study only included cases diagnosed with an eating disorder in a hospital, thereby overlooking those diagnosed in primary care only, those with sub-threshold symptoms, and those not seeking treatment (Swanson & Field, 2016). It is very likely that the inclusion of all of these, if possible, would change the case distribution.

This study only included women, as the incidence of hospital-diagnosed eating disorders is low in males (<10% of the incidence for women—please see Zerwas et al. (2015), which is similar to the present study in design, for details on incidences of diagnosed eating disorders in Danish men), and combined with the relatively rare exposures we were unable to calculate reliable estimates for men.

All adversities were only included for ages 0–5 years, that is, before the start of follow-up. This was done to limit issues regarding reverse causality. It is possible that the stress of a child suffering from severe psychiatric illness such as an eating disorder could influence the occurrence of some of the included adversities, for example, family disruption. By only including adversities experienced in this relatively short, early stage of life, we fail to take into account the impact of later and possibly very important experiences. Even so, we did find several significant associations between these early adversities and later psychiatric outcomes in this relatively young cohort, including for MDD, which generally occurs later in life compared to eating disorders (Pedersen et al., 2014), and for OCD, which in this study was similar to AN and EDNOS in number of cases.

To our knowledge, this is the largest study to date examining the associations between multiple types of early childhood adversity and risk of eating disorders in women. Our study included all women born in Denmark between 1989 and 2007 and was conducted using national registers. This made it possible to follow individuals for up to 19 years from their 6th birthday. Use of register-based information eliminates loss to follow-up, recall and reporting bias. The Danish registers are considered almost complete regarding information on vital and residential information, treatment in hospitals, public financial support, criminal convictions, and placement in OOH. The large cohort size made it possible to examine the associations between relatively uncommon exposures and outcomes, but also to obtain significant results even when the effect sizes are relatively small. However, our results do suggest that, unlike other psychiatric disorders, AN seems to be either unassociated or inversely associated with exposure to adversities in early childhood. Conversely, early childhood adversities seem to be associated with increased risks of both BN and in particular EDNOS, similar to what is observed for other psychiatric illnesses. Our findings support that experiences in early childhood impact mental health and disordered eating in adolescence and early adulthood, but also that AN is different from other eating disorders and psychiatric illnesses.

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CONFLICT OF INTEREST

Dr. Bulik is a grant recipient from Shire and member of a Shire scientific advisory board. No other authors have a declaration of interest to disclose.

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