HISTORY OF BULLYING, ABUSE, AND OTHER STRESSFUL LIFE EVENTS IN INDIVIDUALS WITH EATING DISORDERS

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Dissertation submitted for the degree of Ph.D. at the

Institute of Clinical Medicine

Faculty of Medicine

University of Oslo

2021

UNIVERSITY OF OSLO

Oslo universitetssykehus

Series of dissertations submitted to the
Faculty of Medicine, University of Oslo

ISBN 978-82-348-0071-9

Cover: Hanne Baadsgaard Utigard.
Print production: Graphics Center, University of Oslo.

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Acknowledgements

I am grateful to a number of people who have contributed to the completion of this thesis. First of all, I would like to thank my main supervisor Lasse Bang. Without him there would be no EDGE project at all, and the help he has provided throughout the process of study planning, article writing, analysis, and thesis frustration has been invaluable. It would not have been possible to get to this stage without the casual over-the-shoulder help from the other side of our office at RASP. Thank you for always being ready for a chat, and for helping me with big and small issues along the way.

I also thank Øyvind Rø, my co-supervisor and research team leader at RASP, for always believing that I could do this even when I didn't believe it myself. His expertise and feedback has been absolutely priceless in the completion of this thesis. I am also grateful to Heidi Langbakk-Skille for always being a supportive and flexible leader. To the other team members at RASP, thanks for being the best colleagues and for always keeping your door open for a chat and being ready to share frustrations and breakthroughs. Thanks especially to Line Wisting, who helped out with the project and data collection.

My other collaborators and co-authors, Cynthia Bulik and Ole Andreassen, have been excellent at providing feedback and discussing good and bad ideas and article drafts, and I thank them for the fabulous work they have put in!

I would also like to extend a special thank you to the user organisations ROS and Spisfo for being positive towards this study and helping us out with the recruitment process yet again. Also, thank you to everyone who participated in this research from all over Norway, and to Helse Sør-Øst who funded the project.

Thanks to mum, dad, Dog, and the rest of my family and friends for always being there for me, through good and bad days. And lastly, to Tom, for being you. None of this would have seen the light of day if it wasn't for your support every single moment of these past few years. Thanks for sharing my ups and downs, and for guiding me back on the right track when I got lost. Journey before destination.

Selma Øverland Lie

Oslo, December 2021

Abbreviations

AN = anorexia nervosa

AN-BP = anorexia nervosa binge-eating/purging type

AN-R = anorexia nervosa restricting type

BN = bulimia nervosa

BED = binge-eating disorder

BMI = body mass index

CI = confidence interval

DSM-5 = The Diagnostic and Statistical Manual of Mental Disorders, 5th edition

ED = eating disorder

EDE-Q = Eating Disorder Examination-Questionnaire

OR = odds ratio

PTSD = posttraumatic stress disorder

RBQ = Retrospective bullying questionnaire

SLE = stressful life event

SLESQ = Stressful life events screening questionnaire

List of papers

Paper I:

Lie, S. Ø., Rø, Ø., & Bang, L. (2019). Is bullying and teasing associated with eating disorders? A systematic review and meta-analysis. International Journal of Eating Disorders, 52(5), 497-514. doi:10.1002/eat.23035

Paper II:

Lie, S. Ø., Bulik, C. M., Andreassen, O. A., Rø, Ø., & Bang, L. (2021). The association between bullying and eating disorders: A case–control study. International Journal of Eating Disorders, 54(8), 1405-1414. doi:10.1002/eat.23522

Paper III:

Lie, S. Ø., Bulik, C. M., Andreassen, O. A., Rø, Ø., & Bang, L. (2021). Stressful life events among individuals with a history of eating disorders: A case-control comparison. BMC Psychiatry, 21(501). doi: 10.1186/s12888-021-03499-2

Summary

Background: Eating disorders (EDs) are a group of mental disorders that are characterised by dysregulated food intake that can have severe negative effects on mental and physical health. The three main EDs are anorexia nervosa (AN), bulimia nervosa (BN), and binge-eating disorder (BED), each presenting with a variety of behaviours and cognitions related to food, body image, weight, and appearance. While some risk factors for EDs such as adolescent age, female gender, and body dissatisfaction are commonly accepted, the aetiology of EDs is still uncertain and is believed to include a range of different biological, psychological, social, and environmental factors. Previous research has shown that many individuals with EDs report adverse life experiences, which has led to the notion that such events can be potential risk factors for EDs. Childhood sexual abuse has been the most commonly studied type of adversity, and has shown an association with particularly binge-eating types of EDs. Bullying has also received some attention in the field, and has been associated with BN, BED, and general ED psychopathology. However, more research is needed to explore history of different types of adverse events in individuals with EDs to better understand whether such experiences can be related to development or maintenance of these disorders.

Method: This thesis was a part of the "EDGE: Eating disorders – genes and environment" project investigating a range of different risk factors for EDs. A case – control study was conducted to compare history of bullying, abuse, and other potentially stressful life events in individuals with (n = 495) and without (n = 395) a lifetime ED. The study was administered through online questionnaires, and recruitment strategies included online advertising through social media as well as through psychiatric clinics, ED user organisations, and universities. All Norwegian

residents over the age of 16 years were eligible to participate in the study, with the only inclusion criteria being Norwegian language competency and access to the secure identification system BankID. The main self-report measures used in this thesis were the ED100K for case - control classification and diagnostic subtyping, the Retrospective Bullying Questionnaire (RBQ) for bullying history, and the Stressful Life Events Screening Questionnaire (SLESQ) for exposure to other stressful events. Logistic regression analyses were conducted to compare cases and controls, and to investigate the different ED subtypes. In addition, a systematic review and meta-analysis was conducted on bullying and teasing to summarise previous research on the topic.

Results: Paper I was a systematic review and meta-analysis of studies comparing bullying and teasing in individuals with and without clinical EDs. Overall results showed more bullying and teasing experiences in individuals with BN and BED, but findings were inconclusive for AN. In addition, we identified a range of methodological issues in previous studies, mainly inconsistent definitions of bullying and teasing terms, varying measures often based on single items, and a lack of studies assessing bullying experiences prior to ED onset. To address some of these shortcomings, Paper II presented findings from the case - control study and found that bullying was more common in individuals with EDs than controls, and that this was true for different types of bullying such as verbal, indirect, and digital bullying. This association was stronger for binge-eating/purging compared to restricting ED subtypes. Individuals with EDs were also more frequently bullied prior to onset of their ED compared to the same time frame for controls - thus providing tentative support for the notion that bullying may be a risk factor for some EDs. Paper III showed similar results for other types of stressful life events, with individuals with

binge–eating/purging ED subtypes more commonly reporting exposure to both sexual and non-sexual types of stressful events.

Conclusions: Overall, the findings from the three papers included in this thesis provide a contribution to our understanding of exposure to different types of potentially stressful experiences in individuals with EDs. Our results showed that bullying and other negative experiences are common in individuals with EDs. We consistently found stronger associations between such experiences and binge-eating/purging types of disorders such as BN and BED than AN, which may point to aetiological differences between the EDs. This may be an important topic to pursue in treatment as it could be related to the development, maintenance, or outcome of EDs. Limitations of the study, including potential issues relating to representativeness of the sample and retrospective self-reporting of events, are discussed. Whether the events investigated in this study are specifically related to EDs or if they are more generally associated with a range of mental health issues is still not known, and further studies are needed.

Sammendrag

Bakgrunn: Spiseforstyrrelser er mentale lidelser som kjennetegnes av forstyrret atferd og tanker knyttet til mat, kropp, og utseende. De tre hoveddiagnosene er anoreksi, bulimi, og overspisingslidelse. Personer med spiseforstyrrelser er ofte overopptatt av mat, og tanker rundt mat, måltider, og kropp reduserer livskvalitet og har negativ påvirkning på andre deler av livet. Det er også høy forekomst av depresjon, angst, og somatiske komplikasjoner i disse pasientgruppene. Det er mange faktorer som virker inn på risiko for å utvikle spiseforstyrrelser, deriblant genetiske/biologiske, kulturelle, og miljømessige sårbarheter og opplevelser. Belastende livshendelser er blant risikofaktorene som har blitt undersøkt i relasjon til spiseforstyrrelser, og forskning har vist at særlig spiseforstyrrelsessymptomer som overspising og kompensatorisk atferd (f.eks. oppkast eller avføringsmidler) er vanlig hos personer som har opplevd belastende livshendelser. I spiseforstyrrelsesfeltet har det vært et særlig fokus på seksuelt misbruk i barndom, og personer som opplever dette har høyere forekomst av spiseforstyrrelser enn i befolkningen for øvrig. Mobbing er også ofte nevnt av både pasienter og klinikere som en risikofaktor for å utvikle spiseforstyrrelser, men det er enda mye som er uklart. Det er få studier som ser på ulike typer hendelser (mer enn bare barndomstraumer), som sammenligner personer med og uten spiseforstyrrelsesdiagnoser (i motsetning til å måle spiseforstyrret atferd i normale populasjoner), og som undersøker forekomsten av belastende livshendelser i personer med de ulike diagnosene anoreksi, bulimi, og overspisingslidelse.

Metode: Prosjektet «EDGE: Eating disorders – genes and environment» undersøker en rekke genetiske og miljømessige risikofaktorer for spiseforstyrrelser. Denne doktorgraden inngår i EDGE-prosjektet, og så nærmere på forskjellige

belastende livshendelser, med et særlig fokus på mobbing. Personer med (*n* = 495) og uten (*n* = 395) en livstidshistorie med spiseforstyrrelser ble rekruttert til å delta i en kasus – kontroll studie som ble gjennomført som en nettbasert spørreundersøkelse. Rekrutteringskanaler inkluderte sosiale medier, brukerorganisasjoner for spiseforstyrrelser, psykiatriske klinikker, og universiteter. Alle personer over 16 år som behersket norsk og hadde tilgang på BankId kunne delta. Spørreskjemaet ED100K ble brukt for å definere spiseforstyrrelsesdiagnoser, Retrospective Bullying Questionnaire (RBQ) for mobbeopplevelser, og Stressful Life Events Screening Questionnaire (SLESQ) for å kartlegge andre belastende livshendelser. Alle skjema var basert på selvrapporterte hendelser og symptomer. Logistiske regresjoner ble utført for å se etter sammenhenger mellom opplevelser og definerte spiseforstyrrelser. I tillegg utarbeidet vi en systematisk oversikt og meta-analyse av tidligere studier som hadde undersøkt mobbing og erting hos personer med spiseforstyrrelser.

Resultater: I første artikkel (Paper I), viste vi gjennom systematisk gjennomgang og meta-analyser at særlig personer med bulimi og overspisingslidelse hadde opplevd mer mobbing og erting enn kontroller. Det var varierende resultater for anoreksi, men også færre studier. Vi identifiserte også begrensninger i tidligere studier, blant annet varierende kvalitet på mobbe-mål, manglende definisjon av begreper (mobbing og erting), og få studier som undersøkte om mobbing skjedde før utvikling av spiseforstyrrelsen. I artikkel 2 (Paper II) brukte vi derfor en konservativ definisjon på mobbing og målte forskjellige typer mobbing, og viste at personer med spiseforstyrrelser oftere rapporterte verbal, indirekte, og digital mobbing enn kontroller. Sammenhengen var sterkere for bulimi- og overspisingslidelser enn for anoreksi. Vi fant også forskjeller når vi kun sammenlignet tiden før spiseforstyrrelsen

begynte, noe som støtter mobbing som en mulig faktor i utviklingen av spiseproblematikk. Artikkel 3 (Paper III) viste lignende resultater, og vi fant at både seksuelle og ikke-seksuelle belastende livshendelser var mer utbredt blant personer med bulimi og overspisingslidelse enn hos kontroller.

Konklusjon: Til sammen viste disse tre artiklene at mange med spiseforstyrrelser har opplevd ulike belastende livshendelser. Dette kan være relevant å adressere i behandling, da det kan være av betydning for utvikling, opprettholdelse, og bedring av spiseforstyrrelsesproblematikk. Det er også interessant at vi i alle de tre individuelle arbeidene fant sterkere sammenhenger mellom belastende hendelser og bulimi og overspisingslidelse enn anoreksi, og dette kan indikere at det kan være ulike faktorer som er viktige for de forskjellige spiseforstyrrelsene. Flere metodiske problemstillinger og begrensinger med studien blir diskutert, blant annet relatert til utvalg, selvrapportering, og retrospektive data. I sin helhet bidrar dette arbeidet med økt forståelse for forekomsten av belastende livshendelser hos personer med spiseforstyrrelser, men fremtidig forskning må til for å vise hvordan disse faktorene henger sammen og om sammenhengene er spesifikke for spiseforstyrrelser eller mer generelle faktorer som påvirker mental helse.

1. Introduction and background

1.1. Introduction to thesis

Eating disorders (EDs) are debilitating mental disorders characterised by dysregulated food intake, distorted body image, negative self-image, and preoccupation with food, body weight, and body shape. The aetiology of EDs is not clear, but research has identified a range of factors involved in the development and maintenance of these disorders. Negative or adverse experiences throughout life can cause stress and have large consequences for an individual's well-being and long-term mental health. Exposure to potentially stressful events and experiences are common both in childhood and adulthood, and it is important to understand how these are associated with adverse health outcomes, including EDs. Childhood maltreatment, particularly sexual abuse, has been associated with the development of EDs, but there is limited research for other types of stressful life events in this patient population. Bullying is a particularly common phenomenon among children and adolescents, and has been linked to a range of negative consequences lasting well into adulthood. While bullying has been tentatively associated with ED development, research is inconclusive as to the nature of the association. Being victimised or experiencing negative social environments either in childhood or adulthood can influence an individual's self-image, and lead to emotional distress and development of maladaptive coping mechanisms. Thus, while there has been a great deal of interest in the role of abuse, bullying, and other stressful life events in the aetiology of EDs, there is also a need for more studies comparing these types of experiences in individuals with and without EDs.

The current thesis aimed to explore the associations between a range of different stressful life events and EDs. A particular focus was given to bullying, as this is commonly experienced among school-age children and often implicated as a risk factor or trigger for EDs although the evidence thus far has been mixed. This thesis also aimed to explore how history of stressful life events differs between the different EDs. Knowledge about adverse experiences in individuals with EDs could provide insight into potential risk factors, and have implications for development, maintenance, and treatment outcome for these individuals.

In the following sections, I will give an overview of eating disorders and the challenges associated with this diagnostic group. I will then discuss risk factor research in the EDs, and review the available literature on stressful life events and bullying as potential environmental risk factors. In the methods section, I will outline the process leading up to a published systematic review on bullying and EDs comprising the first article in this thesis, before going into more detail about the research project and data collection forming the basis for the other two PhD papers. I will briefly outline the main findings from each of the three papers, and deliberate on methodological choices and overarching strengths and weaknesses associated with this thesis. Lastly, I will discuss the overall impact and implications of my research and how it informs the field of eating disorders.

1.2. Eating disorders

1.2.1. Characteristics and diagnostic criteria

Eating disorders (EDs) are a group of mental disorders involving a dysregulated food intake to a degree that it negatively affects an individual's physical and/or mental health (American Psychiatric Association, 2013). Dysregulated food

intake may take the form of restricting food intake, binge-eating (i.e., eating an unusually large amount of food coupled with a sense of the eating being out of control), and compensatory behaviours to avoid weight gain (for example excessive exercise, fasting, or purging behaviours such as self-induced vomiting or laxative use), and patients typically cycle through these behaviours. According to the Diagnostic and Statistical manual for Mental Disorders, Fifth edition (DSM-5; 2013), the three main eating disorders are anorexia nervosa (AN), bulimia nervosa (BN), and binge-eating disorder (BED).

AN is characterized by a) restricted energy intake with subsequent significantly low weight (defined as below minimally normal for adults, and below minimally expected for children and adolescents), b) intense fear of gaining weight, and c) body-image disturbances (e.g., lack of recognition of the severity of underweight, undue influence of weight on self-evaluation). Two subtypes are specified: restricting subtype (AN-R) defined as no binge eating or purging in the last three months, and binge-eating/purging subtype (AN-BP) defined as recurrent binge-eating or purging episodes in the last three months. BN is characterized by a) recurrent episodes of binge eating and compensatory behaviours, b) undue influence of body weight or shape on self-evaluation, and c) episodes of binge eating and compensatory behaviours must occur with a frequency of at least once a week for at least three months. Similar to BN, BED is defined as a) having recurrent episodes of binge eating, but with an absence of compensatory behaviours, and b) these episodes occur at least once a week for at least three months. Additionally, c) the binge-eating episodes must be characterised by three or more characteristics (such as eating more rapidly than normal) and accompanied by marked distress.

In addition to these three main EDs, the DSM-5 also includes the category "other specified feeding and eating disorders" (OSFED), consisting of other presentations that do not reach the full criteria for any of the main EDs. This includes for example atypical presentations of AN, BN, or BED, purging disorder, and night eating syndrome. The feeding disorders pica, rumination disorder, and avoidant/restrictive food intake disorder are also included in the DSM-5 eating and feeding disorder section, along with an "unspecified feeding or eating disorder" encompassing other characteristics of EDs that do not fit into any one of the other categories. In the current thesis, the focus will be on the three main EDs.

For all EDs, the peak age of onset is in middle-to late adolescence (16-20 years of age; Stice, Marti, & Rohde, 2013), thus coinciding with a range of both physical and psychological changes during puberty and early adulthood. Average age of onset is lower for AN than for BN, and especially BED has a higher proportion of individuals with onset in adulthood (Mitchison & Hay, 2014; Smink, van Hoeken, & Hoek, 2012; Steinhausen & Jensen, 2015; Treasure, Duarte, & Schmidt, 2020). EDs in general are more common in females than males, with an expected sex ratio of 10:1 (APA, 2013), although EDs in men are believed to be more common than what is reported in official numbers due to misdiagnosing, underreporting, and stigma (Murray, Griffiths, & Nagata, 2018; Strother, Lemberg, Stanford, & Turberville, 2012).

1.2.2. Prevalence and incidence

How common a disorder or a phenomenon is in the population can be estimated with measures of prevalence and incidence. Prevalence refers to the total number of cases within a population at a given time, and can be measured either as lifetime prevalence (proportion of people with a disorder at any point in their lifetime,

e.g., individuals who have had an ED at any point in their lifetime) or point-prevalence (proportion of people who within a defined time period is defined as active cases, e.g., individuals currently fulfilling criteria for an ED). Incidence refers to the rate of occurrence of new cases with a disorder or exposure within a given time period (annual diagnostic rate, e.g., new ED cases per year).

Prevalence of EDs varies between age groups, ethnicities, and world regions, with one review finding European prevalence rates of 1 - 4% among women, and 0.3% among men (Keski-Rahkonen & Mustelin, 2016). A recent study of a large sample of US adults found lifetime prevalence estimates of 0.8%, 0.28%, and 0.85% for AN, BN, and BED, respectively (Udo & Grilo, 2018). In the Nordic countries, the point-prevalence of eating disorders was estimated to 2.3 - 8% for females and 0 - 2.5% for males in a recent review (Dahlgren, Stedal, & Wisting, 2018). When a lenient definition of EDs is used, and subthreshold cases are included, the prevalence of EDs can be as high as 22% (12.8% for boys and 32.9% for girls) among adolescents, meaning that more than one in five experience symptoms of an ED (Mitchison et al., 2020). Although the total number of diagnosed EDs have increased in the later years, the actual incidence and prevalence rates are believed to be relatively stable when taking into account the general increase in diagnosed mental disorders and changes to diagnostic assessments (Litmanen, Fröjd, Marttunen, Isomaa, & Kaltiala-Heino, 2017; Steinhausen & Jensen, 2015; Treasure et al., 2020). However, there are some indications that the incidence of EDs (especially AN) are increasing in younger, high risk age groups of adolescent girls (Reas & Rø, 2018; Smink et al., 2012).

Although prevalence estimates differ across countries, socioeconomic, and ethnic groups, disordered eating, unhealthy weight control behaviours, and clinical

EDs can occur in all ages and societies (Galmiche, Déchelotte, Lambert, & Tavolacci, 2019; Larson, Loth, Eisenberg, Hazzard, & Neumark-Sztainer, 2021; Udo & Grilo, 2018). Sex differences in prevalence rates are especially pronounced for AN and BN, while there are smaller differences for BED (Galmiche et al., 2019; Smink et al., 2012). Official prevalence estimates based on registries and clinical diagnoses are also lower than community reports, as they only reflect those who seek or receive treatment for their ED and many cases go un-detected (Hart, Granillo, Jorm, & Paxton, 2011; Striegel Weissman & Rosselli, 2017).

1.2.3. Treatment

Currently, there are limited evidence-based treatments for EDs, and treatment outcomes are not always satisfactory (Keel & Brown, 2010; Steinhausen, 2002; Steinhausen & Weber, 2009). Family based treatment is the recommended method for adolescents with EDs (primarily for AN and BN), while cognitive behavioural therapy is the most commonly employed and evaluated specialised treatment for adults, showing moderate effects (Treasure et al., 2020). In addition, nutritional rehabilitation and weight gain is crucial for individuals with low body mass index (BMI; kg/m^2) and restricted energy intake (Hilbert, Hoek, & Schmidt, 2017). Pharmacological treatment with antidepressants (selective serotonin reuptake inhibitors) are also sometimes used in treatment (Hilbert et al., 2017). In addition, treatment may differ depending on comorbid disorders, and tailored to different subgroups within ED patients who may require specific interventions (Castellini et al., 2018). Transdiagnostic approaches to understanding and treating EDs also allow for individual variation in clinical presentation and have been suggested to better reflect the clinical reality of ED patients (Fairburn & Cooper, 2011; Fairburn, Cooper, Shafran, & Wilson, 2008). To further improve and develop recommendations for ED

treatment across the globe, there is a need for more research to understand how EDs develop in order to deliver targeted treatments and limit the negative effects on both the individual and the society.

1.2.4. Medical complications, mortality and prognosis

EDs are associated with medical complications, including issues related to the cardiac and renal systems, gastrointestinal complaints, problems with reproductive health, brittle nails/skin/hair/bones, and stunted growth (Gibson, Workman, & Mehler, 2019; Golden, 2003; Rome & Ammerman, 2003; Treasure et al., 2020). Many of the most serious complications (such as cardiovascular problems) are due to low weight in patients with AN. Purging behaviours, such as vomiting or misuse of laxatives or diuretics, are associated with a range of somatic complications such as tooth erosion, electrolyte disturbances, cardiac irregularity, renal failure, and gastrointestinal issues (Forney, Buchman-Schmitt, Keel, & Frank, 2016; Mehler & Walsh, 2016). BED is also associated with increased medical comorbidity, obesity in particular (De Zwaan, 2001; Udo & Grilo, 2018). Subsequently, mortality rates are elevated in these disorders, and are particularly high in AN due to dangerously low weight and malnutrition (Arcelus, Mitchell, Wales, & Nielsen, 2011; Milos, Spindler, Hepp, & Schnyder, 2004; Smith, Ortiz, Forrest, Velkoff, & Dodd, 2018). In addition, risk of suicide and suicidal ideation is elevated in ED populations (Arcelus et al., 2011; Keshaviah et al., 2014; Milos et al., 2004; Smith et al., 2018).

Recovery rates for EDs vary greatly between studies due to differences in both patient characteristics and methodology, including severity of illness, treatment, follow-up time, comorbidities, and definitions of recovery. Several reviews point to around 10% recovery rates for AN and 30% for BN for short-term follow up, while this

increases to around 50-70% recovery rates for both AN and BN with longer follow up (Brown, Klein, & Keel, 2015; Keel & Brown, 2010; Steinhausen, 2009). For BED, the research is more limited but indicates higher short-term recovery rates at around 50%, increasing to about 75% for longer follow up times - similar to what is seen for AN and BN (Brown et al., 2015; Keel & Brown, 2010).

In addition to high relapse rates and long recovery times, diagnostic crossover between subtypes is high, with many individuals transitioning from restriction to binge/purge symptoms or showing variation in engagement in compensatory behaviours (Serra et al., 2021; Stice et al., 2013; Tozzi et al., 2005). This also complicates the ability to define and measure recovery rates. Age of onset, duration of illness, treatment access, premorbid history, and comorbid psychiatric illness are known factors affecting prognosis and remission (Steinhausen, 2009).

1.2.5. Psychiatric comorbidity

Psychiatric comorbidities are common in ED populations, and have been associated with a less favourable outcome (Steinhausen, 2009). Research has shown that there is a high co-occurrence of EDs with other psychiatric disorders such as major depression, generalised anxiety disorder, obsessive-compulsive disorder, social phobia, agoraphobia, and posttraumatic stress (PTSD) disorder (Bang et al., 2020; Blinder, Cumella, & Sanathara, 2006; Coelho, Thaler, & Steiger, 2015; Hudson, Hiripi, Pope, & Kessler, 2007; Steinhausen, 2009; Swinbourne & Touyz, 2007). Although many of these previous studies have focused mainly on AN and BN, BED is also associated with significant psychiatric comorbidity (Grilo, White, & Masheb, 2009).

The exact prevalence estimates of comorbidity in EDs varies, and one study investigating inpatients with EDs found that 97% of individuals had at least one other DSM-defined mental disorder, with mood and anxiety disorders being the most common across all the EDs (Blinder et al., 2006). In another study of individuals with a history of EDs, 73% also had a lifetime history of major depressive disorder, with the highest rates found for binge/purge subtypes of EDs (Fernandez-Aranda et al., 2007). About one third of these individuals presented with depression prior to ED development, and most individuals developed both disorders within three years of each other. A study by Kaye et al. (2004) found that 64% of individuals with AN or BN also had a lifetime history of at least one type of anxiety disorder, with the majority of cases developing in childhood before first onset of ED symptoms.

PTSD is also significantly more common among patients with EDs than in normal populations, especially in binge-eating/purging subtypes (Brewerton, 2007). A recent quantitative synthesis found a pooled prevalence of 24% of PTSD in ED populations, and 20% of EDs in PTSD populations, pointing to a possible overlap and shared pathways between these disorders (Ferrell, Russin, & Flint, 2020).

Other comorbidities such as substance use disorders and sexual dysfunction are also commonly observed in ED samples (Blinder et al., 2006; Coelho et al., 2015; Hudson et al., 2007). Overall, the presence of any comorbid DSM disorder in ED populations is highest for BN, but remains significantly higher for both AN and BED compared to individuals without EDs (Hudson et al., 2007). Some studies also suggest AN is associated with higher rates of schizophrenia (Hartmann, Thomas, Wilson, & Wilhelm, 2013; Zhang et al., 2020) and autism spectrum disorders (Zucker et al., 2007).

Additionally, there is a high comorbidity between EDs and personality disorders (Farstad, McGeown, & von Ranson, 2016). Borderline, avoidant, and obsessive-compulsive personality disorders are the most frequently diagnosed in EDs. Specifically, borderline is most frequent in BN while avoidant and obsessive-compulsive are more common in AN (Farstad et al., 2016; Martinussen et al., 2017). Borderline, avoidant, and obsessive-compulsive personality disorders have all been associated with BED, pointing to a more heterogeneous pattern of personality psychopathology in this patient group (Friborg et al., 2014; Sansone, Levitt, & Sansone, 2004).

The high co-morbidity of EDs with other mental disorders and psychopathology complicates the picture of aetiology and development, as it becomes difficult to ascertain what are causes and effects of the ED and what is due to other mental disorders or external factors. For example, malnutrition can by itself cause a range of psychiatric symptoms such as depressed mood, negative affect, and obsessive tendencies, as was shown in the legendary Minnesota starvation experiment (Keys, Brožek, Henschel, Mickelsen, & Taylor, 1950). In addition, psychiatric comorbidities can represent predisposing vulnerability factors for ED development, or there could be other factors that increase an individual's risk of both EDs and other mental health difficulties (Coelho et al., 2015; Meier et al., 2015).

1.2.6. Societal impact

EDs are thus severe and potentially enduring mental disorders that affect many individuals and require the attention of a variety of health services. Consequently, EDs are associated with a substantial global burden in terms of years lost to disability and lives lost to early mortality, especially in females aged 15-19

years (Erskine, Whiteford, & Pike, 2016). The economic cost of EDs is an under-researched field, but significant personal and public costs are associated with EDs due to hospitalisation, treatment delivery, medication, complications related to ED behaviours, extended sick-leave, interrupted education, and unemployment (Striegel Weissman & Rosselli, 2017). Individuals with EDs are also more likely than their peers to struggle with infertility, have a low quality of life, and to require extensive support from caregivers and relatives (Schmidt et al., 2016).

1.3. Risk factors and correlates

Within the context of mental health research, risk factors are all types of biological, social, and psychosocial factors that make it more likely that an individual develops a mental illness. These can be events, predispositions, or contextual factors that are associated with a specific outcome. Further, a causal risk factor is a variable risk factor (can change within an individual spontaneously or by intervention) that changes the risk of the outcome when manipulated (Kraemer et al., 1997). A risk factor, by definition, must be preceding the outcome of interest, whereas a correlate can show the same associations with the outcome but without the requirement of precedence (Kazdin, Kraemer, Kessler, Kupfer, & Offord, 1997; Kraemer et al., 1997).

Many methods and study designs are used to investigate risk factors in health research, and cohort design studies are among the most informative. Prospective cohort studies have the ability to follow a cohort from a given population over time and observe outcomes and exposures longitudinally. However, as is the case when studying outcomes that have low base-rates, this is not always feasible as it requires very large samples (Riffenburgh & Gillen, 2020). Case-control studies provide some of the same advantages, but without the need for extremely large samples in order to

obtain enough cases (i.e., with a given outcome) to achieve statistical power to detect effects, and are suitable for use in research on risk factors and correlates (Clayton & McKeigue, 2001; Kopec & Esdaile, 1990). However, the major limitation of such studies is that they cannot prove causality, but only show associations between variables. From an epidemiological perspective, EDs have low prevalence in the general population, and a large proportion of risk factor research in the field of EDs has utilised a case-control approach, including the research project in the current thesis.

The following paragraphs aim to give a larger perspective of the complex interplay of ED risk factors from many different domains, as it is important to keep in mind that the variables of interest in this thesis do not appear in isolation but rather must be understood in the larger context of ED development and maintenance factors.

1.3.1. Sociocultural risk factors

Sociocultural models of EDs posit that exposure to the typical “Western” thin body ideal leads to internalisation of this ideal and body dissatisfaction, and thus foster subsequent dietary restraint, restriction, negative cognitions, binge-eating and/or purging behaviours, and other general ED psychopathology (Striegel-Moore & Bulik, 2007; Weissman, 2019). The links between thin body ideals, peer environment (through social comparison and peer influence), and thoughts and cognitions regarding one’s own body in the Western culture might provide a context that contributes to risk - although the mechanisms are complex (Becker, Keel, Andersonfye, & Thomas, 2004). Factors such as body dissatisfaction, dieting, and pressure to be thin are well-established risk factors for EDs, and are strongly linked

to core ED symptoms (Stice, 2002; Stice, Gau, Rohde, & Shaw, 2017; Stice & Shaw, 2002; Striegel-Moore & Bulik, 2007). In addition, gender (female) and age (adolescence), are strong and robust markers for EDs associated with increased risk (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004). However, not all females exposed to thin body ideals and social pressures to be thin develop EDs, highlighting the importance of considering multiple paths and factors involved.

1.3.2. Genetic risk factors

Genetic factors play a substantial role in eating disorder risk. Heritability estimates from twin studies are high, and range between 48-74% for AN, 55-62% for BN, and 39-45% for BED (Yilmaz, Hardaway, & Bulik, 2015). In addition, AN and BN show overlapping genetic profiles that could indicate a shared vulnerability contributing to both of these ED types (Bulik et al., 2010). Recent genome-wide association studies (GWAS) have identified the first genetic risk loci for AN and found significant genetic correlations with both psychiatric and metabolic traits, pointing to significant biological underpinnings for this disorder (Duncan et al., 2017; Watson et al., 2019). To date, no GWAS have investigated genetic risk loci associated with BN and BED, although ongoing efforts will provide new insights into potential genetic markers for these disorders in the future (Bulik, Thornton, et al., 2021). In addition, low premorbid BMI is associated with increased risk of AN, while high BMI and obesity is associated with bulimic and binge-eating disorders (Hudson et al., 2007). As BMI is under high genetic influence (Locke et al., 2015), it is possible that part of the genetic influence on ED risk is associated with variations in body size. This is further supported by significant genetic correlations between AN and BMI (Watson et al., 2019). Thus, further work is needed to understand the complex interplay of genetic risk factors in the aetiology of EDs.

1.3.3. Personality traits

Certain personality traits and characteristics, such as perfectionism, neuroticism, negative urgency, avoidance motivation, and impulsiveness have been associated with EDs (Cassin & von Ranson, 2005; Farstad et al., 2016). Neuroticism was identified as a prospective risk factor for subsequent development of AN in a study by Bulik et al. (2006). Impulsiveness has been linked directly to binge-eating and purging behaviours (Farstad et al., 2016). Personality traits may represent vulnerability factors for different mental health outcomes, and understanding how personality interacts with environmental influences can help understand the aetiology of EDs. Personality factors are part of the larger interplay of relevant risk factors, for example by influencing how different individuals react to external stressors, or how sensitive they are to rewards and/or punishment in specific contexts. Personality traits and related phenotypic expressions are also genetically influenced (Ward et al., 2020), and thus might account for some of the genetic contributions to clinical ED features.

1.3.4. Summary of risk factors for EDs

Within the field of eating disorders, a range of risk factors have been identified, with the most conclusive support for female gender, adolescent age, thin-ideal internalisation, negative affect, and body dissatisfaction (Jacobi et al., 2004; Stice et al., 2017; Striegel-Moore & Bulik, 2007). However, the aetiology of EDs is complex, and there is likely an interplay of genetic, neurobiological, psychological, and psychosocial risk factors (e.g. Jacobi et al., 2004; Kaye, Wierenga, Bailer, Simmons, & Bischoff-Grethe, 2013; Thaler & Steiger, 2017). Specific psychosocial risk factors will be described in further detail in the remaining parts of this thesis.

1.4. Brief introduction to the main themes of the thesis

The current thesis focuses on psychosocial risk factors for EDs, namely bullying and other types of adverse experiences. Within the field of EDs, researchers have explored the role of life experiences and trauma in EDs for decades, starting with case reports and anecdotal evidence from the mid-1980s onwards (for an overview, see Smolak & Levine, 2015). Since then, research has established that past traumatic experiences and comorbid PTSD are common in ED populations (Brewerton, 2007; Briere & Scott, 2007; Rijkers, Schoorl, van Hoeken, & Hoek, 2019), and individuals with a history of abuse or trauma have been identified as being at high risk for developing EDs (Madowitz, Matheson, & Liang, 2015; Russon et al., 2019; Schou-Bredal et al., 2020).The following sections will give an overview of research on adverse experiences in the context of EDs and introduce the specific aims and hypotheses of this thesis.

1.5. Adverse life experiences

Traumatic experiences are well-established psychosocial risk factors for a range of adverse mental health outcomes, including EDs. There are many different types of events that, although not considered “traumas” in the traditional sense, may be experienced as highly stressful and could be associated with negative health effects. In the currents thesis, the term stressful life events (SLEs) refers to a variety of adverse events that people can experience. In this context, this includes stressful experiences such as having a severe illness, being in an accident, death of a close relative or friend, and being the victim of abuse (e.g., rape, physical assault) or bullying.

In previous ED research there has been a particular focus on adverse experiences in childhood (Afifi et al., 2017; Caslini et al., 2016; Molendijk, Hoek,

Brewerton, & Elzinga, 2017), but such experiences in adulthood are also associated with ED symptoms in healthy populations (Collins, Fischer, Stojek, & Becker, 2014; Loth, van den Berg, Eisenberg, & Neumark-Sztainer, 2008). Less is known about lifetime SLEs in clinical ED populations. Thus, there are still unanswered questions about the association between EDs and SLEs, whether individuals with a history of SLEs are particularly at risk for EDs compared to other mental disorders, and the mechanisms involved. If individuals with EDs are more commonly exposed to stressful events than their peers, this could have implications for prevention, treatment, and prognosis and is important to address to lessen the burden of EDs for individuals and the society.

Furthermore, experiencing multiple SLEs is common, and being exposed to childhood violence has been associated with significantly higher risk of adult sexual and physical abuse (Aakvaag, Thoresen, Wentzel-Larsen, & Dyb, 2017). Thus, exposure to SLEs might increase the risk of future victimisation or other adverse events. Within the field of EDs, some researchers have investigated multiple exposures, but there is a need for more research on the prevalence and effect of multiple stressful events in individuals with EDs (Larsen et al., 2017; Smyth, Heron, Wonderlich, Crosby, & Thompson, 2008).

To summarise the available research on the associations between SLEs and EDs, a structured literature search was conducted to identify systematic review articles published in the field. An overview of identified systematic reviews and meta-analyses detailing the association between different SLEs and EDs is presented in Table A1 (appendix). The table highlights the disproportionate amount of research focusing on childhood abuse compared to other potentially stressful lifetime exposures. The following sections will present the state of the research within the

most commonly investigated adversities in the ED field, and identify important knowledge gaps.

1.5.1. Childhood maltreatment

Childhood maltreatment can be defined as acts of omission or commission by a parent or other caregiver that results in harm or possibility or threat of harm to a child (Leeb, 2008). Such acts include sexual, physical, and emotional abuse and neglect, all of which are associated with significant long-term effects on physical and mental well-being (Gilbert et al., 2009). Childhood maltreatment is prevalent across the globe, with one meta-analysis finding prevalence rates of 18% for sexual abuse for females and 7.6% for boys, and overall prevalence of 22.6% for physical abuse, 36.3% for emotional abuse, 16.3% for physical neglect, and 18.4% for emotional neglect (Stoltenborgh, Bakermans-Kranenburg, Alink, & van IJzendoorn, 2015).

Childhood maltreatment has been associated with disordered eating behaviours in non-clinical populations (Wolf & Elklit, 2020), and exposure to different types of maltreatment such as child sexual abuse, emotional abuse, and neglect are common among individuals with an ED diagnosis (Caslini et al., 2016; Kimber et al., 2017; Molendijk et al., 2017; Pignatelli, Wampers, Loriedo, Biondi, & Vanderlinden, 2017). Two review articles have been especially influential in describing the associations between childhood maltreatment and EDs. Caslini et al. (2016) found an association between any child abuse (physical, sexual, or emotional) and overall EDs, with subtype analyses showing that AN was only associated with physical abuse while BN and BED were associated with all types of abuse. Another review and meta-analysis by Molendijk and colleagues (2017) found that all types of childhood maltreatment were prevalent in all types of ED, and was associated with

psychiatric co-morbidity, suicidality, earlier age of onset, higher severity, and more binge/purge symptomatology. Childhood maltreatment was more prevalent in EDs compared to both healthy controls and psychiatric controls, although the findings were less conclusive when comparing EDs to other psychiatric groups (Molendijk et al., 2017).

While the aforementioned reviews clearly indicate an association between different forms of childhood maltreatment and eating disorders, the most conclusive evidence is found for sexual abuse (Madowitz et al., 2015; Solmi et al., 2020; Vrabel, Hoffart, Rø, Martinsen, & Rosenvinge, 2010). Emotional abuse in childhood have garnered some interest in the later years, and has been proposed to especially affect self-esteem and self-image which are influential factors in ED development (Kent & Waller, 2000; Waller, Corstorphine, & Mountford, 2007). The review by Kimber et al. (2017) showed that emotional abuse is common in binge-eating/purging EDs, but that available evidence is inconclusive with regards to the strength and nature of the association. Depression and alexithymia have also been identified as mediators of the relationship between childhood maltreatment and EDs in clinical and community populations (Kong & Bernstein, 2009; Mazzeo & Espelage, 2002).

Several models have been proposed to explain how stressful experiences early in life could increase risk for EDs. The identity disruption model posits that early trauma or stress experiences could disrupt identity-formation and self-concept, and thus provide a mechanism for the development of unhealthy eating behaviours through body dissatisfaction and internalisation of body ideals (Vartanian, Hayward, Smyth, Paxton, & Touyz, 2018). Other models highlight the importance of family dynamics and relationships between parent and child, and are supported by evidence of inter-generational associations between childhood maltreatment and ED

behaviours among mothers and their daughters (Talmon & Tsur, 2021). Research on childhood sexual abuse specifically has also suggested the use of ED behaviours as defensive strategies, such as using starvation to make oneself invisible or undesirable to potential perpetrators (Ross, 2009). One biologically based theory posits that individuals with EDs who have experienced early life maltreatment or trauma constitute a specific subgroup within the EDs, where neuro-endocrine alterations result in a vulnerability to develop or maintain EDs when dealing with potential stressors in life (Marciello et al., 2020; Monteleone et al., 2021; Monteleone et al., 2020). Other biological models point to childhood sexual abuse as a trigger for a cascade of interrelated conditions and alterations in brain chemistry that influence addiction behaviours, obesity, and disordered eating (Wiss, Brewerton, & Tomiyama, 2021). However, there is still a scarcity of studies that investigate whether any of these mechanisms are specific to EDs or whether they are general correlates of mental health issues.

Binge eating and bulimic types of EDs have shown more consistent associations with childhood maltreatment than more restrictive (AN) behaviours (Micali et al., 2017; Sanci et al., 2008; Yoon, Emery, Hazzard, Mason, & Neumark-Sztainer, 2022), perhaps suggesting aetiological differences. Binge eating also shows associations with PTSD symptoms, and is implicated as a possible mechanism of affect regulation (Nelson, Cuellar, Cheskin, & Fischer, 2021). However, studies comparing different subtypes of EDs with different types of childhood maltreatment are limited, and findings to date are inconclusive and diverging. There is not one theory that can fully explain how and why certain types of childhood trauma are or are not associated with different EDs, and further research is needed.

1.5.2. Bullying and teasing

While bullying can be referred to as a type of interpersonal trauma, it is often treated separately from other traumatic events and traditionally draws on a different literature (Idsoe et al., 2021). The most well-known and oft-used definition of bullying describes aggressive behaviour that is intentional, occurs repeatedly, and targets an individual that has difficulty defending themselves (Olweus, 1994). In contrast, unintentional hurtful comments or fighting between two individuals of equal standing (e.g., size or power) is not considered bullying. Relatedly, the term “teasing” is often encountered in the literature. Teasing often has the connotations of being less severe than bullying and not necessarily harmful. However, it is often used interchangeably with bullying in some studies, making it hard to delineate these two concepts (Keltner, Capps, Kring, Young, & Heerey, 2001; Mills & Carwile, 2009). The main focus of the current thesis will be on bullying as defined above, and a more detailed discussion of the terms bullying and teasing is discussed in Paper I.

Bullying occurs in different forms, including physical (e.g., hitting, kicking), verbal (e.g., name-calling, threatening), and indirect (e.g., exclusion from social groups, spreading rumours about someone) bullying (Björkqvist, Lagerspetz, & Kaukiainen, 1992). Indirect bullying is sometimes called “relational bullying” in the literature, but will be the preferred term in the current thesis to avoid any confusion with verbal bullying – which can also be viewed as relational (for example name-calling). Bullying can also occur digitally (also called cyberbullying) by means of social media or other online fora.

Bullying is common among adolescents, with one recent meta-analysis finding a lifetime prevalence rate of 25% for traditional bullying and 7% for digital bullying (Jadambaa et al., 2019). Traditional and digital forms of bullying are correlated, and

there is an overlap in individuals who are involved as both victims and perpetrators across contexts (Jadambaa et al., 2019; Modecki, Minchin, Harbaugh, Guerra, & Runions, 2014). Bullying occurs across genders, and although males are more frequently involved in bullying - especially as perpetrators - gender differences are reduced during adolescence and both males and females are involved in bullying both as victims and perpetrators (Smith, López-Castro, Robinson, & Görzig, 2019). Verbal bullying is common for all genders, physical bullying is more common among males, and girls are relatively more often involved in indirect and digital forms of bullying (Björkqvist, 2018; Smith et al., 2019).

In the ED field, bullying has received attention as a potential risk factor, and researchers have explored how bullying relates to EDs. Childhood bullying is associated with several adverse health effects that can persist into adulthood (Arseneault, Bowes, & Shakoor, 2010; Ttofi, Farrington, Lösel, & Loeber, 2011), and may also affect ED development and maintenance. Prospective studies have found that bullying and weight-teasing in adolescence predicts subsequent ED symptoms and behaviours, although it is unclear whether this effect persists into adulthood (Copeland et al., 2015; Haines, Neumark-Sztainer, Eisenberg, & Hannan, 2006). In a series of case-control studies by Fairburn and colleagues, bullying and weight-related teasing was found to be significantly more common in individuals with BN and BED than healthy controls, while this was not the case for AN (Fairburn, Cooper, Doll, & Welch, 1999; Fairburn et al., 1998; Fairburn, Welch, Doll, Davies, & O'Connor, 1997). General bullying and EDs has also been explored by others, with mixed findings (e.g., Kaltiala-Heino, Rimpelä, Rantanen, & Rimpelä, 2000; Karwautz et al., 2011; Striegel-Moore, Dohm, Pike, Wilfley, & Fairburn, 2002; Troop & Bifulco, 2002), but at

the outset of this thesis no systematic overview existed. Therefore, we conducted a systematic review and meta-analysis to fill this knowledge gap (Paper I of this thesis).

Weight- and appearance-related teasing has received particular attention in the ED field due to the relevance for core ED cognitions and symptoms, such as self-image and focus on body and social comparison. The meta-analysis by Menzel et al. (2010) showed significant associations between weight-related teasing and body dissatisfaction, dietary restraint, and bulimic behaviours. Day et al. (2021) found that ED behaviours and negative body image in adolescence was associated with teasing and bullying. Binge eating in children was associated with weight-teasing by family in a review by Saltzman and Liechty (2016). In addition, the umbrella review of previous meta-analyses by Solmi et al. (2020) also identified appearance-related teasing as a nonspecific risk factor for all EDs.

Digital bullying victimisation has also been associated with body dissatisfaction and self-esteem among adolescents (Frisén, Berne, & Lunde, 2014; Ramos Salazar, 2021). Although research is still relatively scarce on digital bullying and EDs, there are indications that this form of bullying is associated with ED psychopathology, similarly to other types of bullying (Marco & Tormo-Irun, 2018; Marco, Tormo-Irun, Galán-Escalante, & Gonzalez-García, 2018). Use of online content and social media has also been associated with higher appearance pressures and negative feedback, which might contribute to development and maintenance of EDs (Saul & Rodgers, 2018). With the increasing use of internet and digital communication, especially among the younger generations, an added focus on modern technologies and digital behaviours will be an important part of future bullying research.

So far, the literature implicates bullying and teasing experiences as potentially important factors to consider in EDs, but there are still unanswered questions. Moreover, there are inconsistencies in the field regarding terms and definitions, as demonstrated especially by the use of bullying and teasing interchangeably and the use of single-item measures. More research is needed to explore how, or whether, different types of bullying relate to ED development, maintenance, and long term outcome.

1.5.3. Other types of adversities

Other types of adverse experiences have received less attention in ED research, and less is known about whether exposure to such events throughout life relate to ED development, maintenance, and clinical presentations. Some studies have explored different adverse events in childhood and adulthood and findings are heterogeneous. One of the review articles listed in Table A1 focused on non-abusive family adversities and found stronger associations for loss and family disruption and BN/BED than AN (Grogan et al., 2020). A large-scale Danish register-based study found that stressors in childhood such as parental divorce or adversities were associated with BN and BED (but not AN), and there was evidence for a cumulative effect of multiple adverse experiences (Larsen et al., 2017).

Some studies have also explored prevalence of EDs in individuals with different trauma exposures, and an over-representation of different EDs have been found in for example military veterans (Arditte Hall, Bartlett, Iverson, & Mitchell, 2017; Arditte Hall, Bartlett, Iverson, & Mitchell, 2018; Cuthbert, Hardin, Zelkowitz, & Mitchell, 2020). Adult victims of sexual assault also show high prevalence of EDs (Schou-Bredal et al., 2020). While most research is based on female samples, a

recent study of college males found increased risk of EDs following a recent sexual assault, with a particularly high risk among sexual minority men (Ganson, Rodgers, Lipson, Cadet, & Putnam, 2020). Individuals with EDs may also be at higher risk of developing PTSD as a result of exposure to adverse events, and co-morbidity is high between diagnosed PTSD and EDs (Brewerton, 2007). In normal populations, symptoms of PTSD have been shown to mediate the relationship between adulthood sexual assault and ED symptoms (Dubosc et al., 2012), further implicating a role of trauma and PTSD in EDs that warrants further exploration.

A review by Bundock et al. (2013) found an association between intimate partner violence and EDs, but was unable to establish the directionality of the relationship. Interestingly, Kimber et al. (2017) found that child exposure to violence between adult caregivers was associated with EDs, but the review identified only 3 studies investigating this. Another study investigated the association between exposure to natural disasters and EDs, but found no significant effects (McFarlane & Van Hooff, 2009). However, there are indications that different stressful events, such as life-threatening accidents, muggings, and death of a loved one, can also be associated with EDs and warrant further investigation (Mitchell, Mazzeo, Schlesinger, Brewerton, & Smith, 2012; Smyth et al., 2008). Thus, more research is needed to explore exposure to different types of events, to complement the relatively large body of research on (sexual) childhood abuse.

1.6. Synopsis and introduction to aims

Overall, prior studies have highlighted an association between SLEs, bullying, and mental health issues, including ED symptoms. However, there are fewer studies that have directly compared individuals with clinical EDs to controls. For bullying especially, research is limited and most studies have investigated the association

between bullying and EDs in non-clinical (e.g. student) samples. No comprehensive review existed at the outset of the current thesis summarising bullying studies in ED populations, and it is unclear whether individuals with EDs experience more bullying than controls. For SLEs other than bullying, previous research has often focused on highly traumatic experiences such as childhood sexual abuse, and few consider other types of stressful events. To address this, more research is needed covering a range of different SLEs in individuals with and without EDs, and investigating the effect of multiple exposure. There is also a scarcity of studies attempting to determine whether events such as abuse or bullying occur prior to ED onset and therefore can be considered potential risk factors.

Lastly, existing studies suggest a stronger association between binge-eating/purging types of EDs and both bullying and other stressful events, but there is a need for more insights into differences between the ED subtypes. To overcome some of the shortcomings of previous research, we assessed lifetime history of DSM-5 defined EDs, investigated a variety of different events, and explored bullying history in particular using a conservative definition of bullying, and distinguishing between bullying types.

1.7. Aims and hypothesis

The overall aim of the current thesis was to advance our knowledge on the occurrence of stressful experiences in individuals with EDs. The specific aims were:

1. To investigate the association between eating disorders and exposure to bullying (Papers I-II).
2. To investigate the association between eating disorders and exposure to abuse, violence, and other stressful life events (Paper III).

Specific hypotheses were generated for each of these aims, and were addressed in the individual papers included in this thesis. The overall hypothesis was that stressful life events are more common in individuals with lifetime EDs than in controls, and that these experiences commonly occur prior to ED onset. Based on prior research, we hypothesised that the associations would be stronger for binge-eating/purging subtypes of EDs than restricting subtypes. Such findings would show that stressful life experiences are common in ED populations, and highlight these as potential risk factors and important topics for both research and treatment.

2. Methods

2.1. Project organisation and design

This thesis is part of the Eating Disorders – Genes and Environment (EDGE) project conducted by the Regional Department for Eating Disorders (RASP) at Oslo University Hospital. EDGE was developed to investigate environmental and genetic risk factors for EDs. One of the primary objectives for EDGE was to collect DNA samples from individuals with a lifetime history of EDs, and share these with the "Eating Disorders Working Group of the Psychiatric Genomics Consortium" for inclusion in future genome-wide association studies of EDs (Duncan et al., 2017; Watson et al., 2019).

Data included in this thesis were based on a case-control study of individuals with and without history of an ED. All participants completed online questionnaires, and gave consent to link data with information available through national health registries. In addition, participants could volunteer for the genetic part of the study in a separate consent form. Only selected variables from the larger dataset are included in the current thesis, but the extensive nature of the study may be of relevance for

the generalisability of the findings. This is discussed in further details in the discussion section. As part of this thesis, we also performed a systematic review of case-control studies assessing the association between bullying and EDs.

2.2. Paper I: Systematic review and meta-analysis

While preparing the data collection for the EDGE project, it became evident that there was little consensus in the field of bullying and eating disorders. Findings were diverging, and studies varied with regards to both outcome parameters and how the term 'bullying' was defined and operationalised. The term 'teasing' was often used in the literature without a consistent definition. There was therefore a need for a systematic review, as no articles to date existed that summarised all the available studies on bullying and EDs. In Paper I, we conducted a systematic review and meta-analysis of studies investigating the association between EDs and bullying and teasing, including a discussion of the measures and definitions used in previous literature. We explored findings available for generic bullying, teasing related to appearance/weight, and weight-unrelated teasing, and considered the evidence available for each of the EDs.

2.2.1. Identification of literature

A systematic structured search was performed in accordance with the PRISMA guidelines (Liberati et al., 2009) using terms related to EDs and bullying/teasing to obtain relevant articles. Details on the search terms and literature identification process are described in Paper I. All articles identified in the search were screened by the first and senior authors, and relevant original articles were reviewed in full text. Ten percent of all full-text articles were reviewed by both reviewers to ensure interrater agreement

2.2.2. Study selection criteria

Only case-control studies investigating individuals fulfilling diagnostic criteria for an ED diagnosis were included. There were several reasons for this. Firstly, there was already a comprehensive review available on the associations between body dissatisfaction, weight-related teasing, and disordered eating behaviours (Menzel et al., 2010). Second, while there were many studies investigating associations between bullying/teasing and features of EDs and related constructs, the evidence was more inconclusive regarding whether bullying is more common among individuals with clinically diagnosed EDs than individuals without EDs. Only studies with an appropriate reference group were included. Twenty-two studies fulfilled the criteria and were included in the qualitative synthesis.

For the quantitative meta-analysis, 12 of the 22 studies were included. In addition to the criteria mentioned above, these studies also had to a) quantitatively compare bullying experiences occurring prior to ED onset in individuals with and without EDs, and b) either provide a measure of effect size (Cohen's *d*, Hedges' *g,* or odds ratio [OR]), or contain the information needed for us to conduct such analysis on the reported data.

2.2.3. Analysis Paper I

All 22 included studies were synthesised and main findings summarised in text and in a comprehensive table. All relevant effect sizes and main findings from studies were reported and discussed.

The comparisons and effect sizes in the twelve studies included in the quantitative review were categorised according to type of victimisation; generic bullying victimisation (k = 6), appearance-unrelated teasing (k = 6), and appearance-

related teasing (k = 10), where k refers to the number of effect sizes available. For each of these types of victimisation, we performed random effects meta-analyses to obtain pooled ORs and estimated heterogeneity between studies using Cochran Q (reported with p-value) and I^2. The analysis was performed in RStudio version 1.1.447 (RStudio, 2016) using the metafor package for meta-analysis (Viechtbauer, 2010).

2.3. Research project for Paper II and III: A case – control study

Paper II and III used data from the EDGE project, and investigated bullying and other stressful life events in individuals with and without a lifetime history of EDs.

2.3.1. Recruitment and data collection procedures

Study participants both with and without lifetime EDs were recruited through social media platforms, distribution of flyers at specialised eating disorder treatment clinics throughout Norway, and flyers/posters at Norwegian universities. A website was set up specifically for this study, where participants could find relevant information and the link to sign up. This website was also used to post updates on the data collection and preliminary results from the study. Information about the study was also distributed through the ED user organisations Rådgivning om spiseforstyrrelser (ROS) and Spiseforstyrrelsesforeningen (SPISFO) to reach individuals with ED history. Social media recruitment channels included Facebook posts (both promoted and through post sharing by our research team members and user organisation groups) and Twitter updates. Given the case-control nature of the study, recruitment strategies were aimed at getting equal numbers in both ED and control groups. At different stages in data collection, social media recruitment was altered to target specific demographic groups to encourage a spread in age, gender,

and background of the participants. Despite targeted efforts to reach more male participants through advertisements encouraging males specifically to volunteer, attempts to achieve gender balance were abandoned due to the low number of males in the case group. Efforts were instead focused on achieving a sufficient number in both case and control groups and making sure the ED group included individuals with different ED subtypes. Due to an overrepresentation of AN individuals, additional recruitment efforts were aimed at encouraging individuals with BN and BED to participate.

All Norwegian residents over the age of 16 years were eligible for the study. Participants were required to log in to the study platform using the secure system BankID and electronically sign an informed consent form. The online questionnaires could be completed on a PC, MacBook, tablet, or smart phone, and took approximately 20-60 minutes to complete.

Prior to commencing data collection, the full study procedure and assessment package was piloted by a group of individuals from ED user organisations and by members of the research team. Based on feedback from the pilot, some of the questionnaires were shortened and demographic background items cut to reduce the total time spent completing the study.

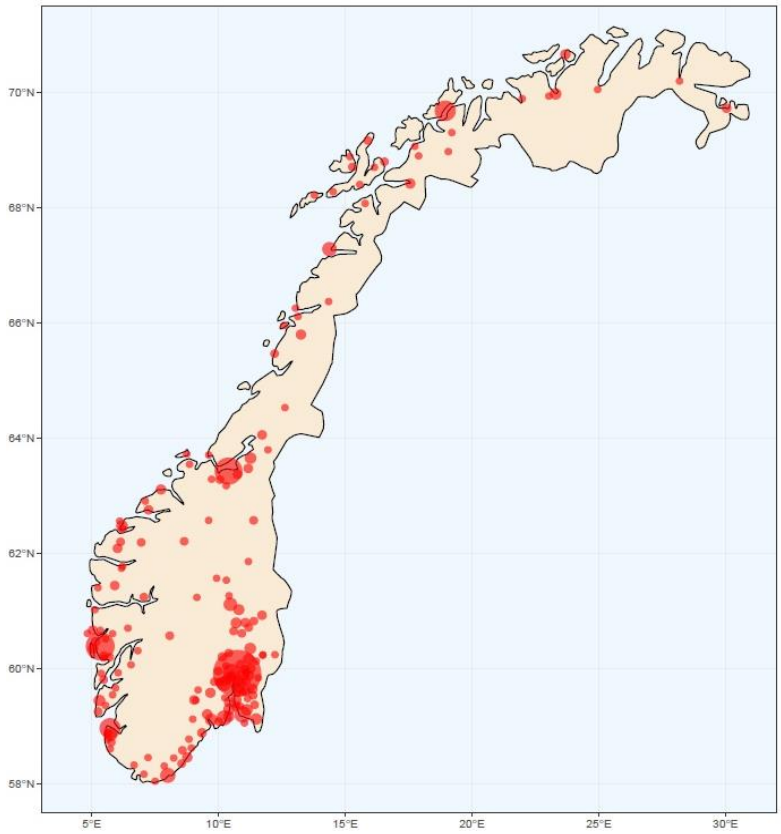

Figure 1. ***Illustration of geographical spread of participants across Norway. Red dots represent municipalities with at least one participant, larger dots indicate a higher number of participants within the municipality.***

2.3.2. Participant characteristics

A total of 916 individuals (95% female) participated in the study during the data collection period between June 2019 and January 2020. Individuals from all across Norway participated in the study, with clusters around the big cities. The geographic spread of participants is illustrated in Figure 1. Individuals were classified using the ED100K self-report measure (see below) as either ED cases or controls based on lifetime presence of ED symptoms. A total of 62% of the ED group fulfilled criteria for a current ED based on an algorithm in the ED100K measure. Additionally, 42% of the control group and 90% of the ED group reported receiving treatment for a mental disorder at some point in their life. Participant characteristics are shown in

Table 1. Age ranged from 16 to 78 years, with a similar average age for both case (M ± SD = 29.08 ± 9.76 years) and control (30.16 ± 11.66 years) groups.

Table 1. ***Descriptive statistics for individuals with and without lifetime EDs (overall ED and split by subtype).***

Lifetime ED status	**Any ED (*n* = 495)**	**AN-R[a] (*n* = 65)**	**AN-BP (*n* = 114)**	**BN/BED (*n* = 180)**	**AN/BN/BED (*n* = 133)**	**No ED (control) (*n* = 395)**
	M (SD)	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**
Age (years)	29.08 (9.76)	27.20 (9.19)	27.49 (9.82)	30.46 (9.71)	29.70 (9.93)	30.16 (11.66)
Current BMI	23.85 (7.29)	19.97 (2.68)	19.78 (3.55)	29.45 (8.29)	21.51 (4.46)	23.94 (4.41)
ED onset age (years)[b]	15.09 (4.58)	15.75 (3.41)	15.39 (4.92)	14.76 (4.66)	15.01 (4.28)	-
EDE-Q global score	3.32 (1.54)	2.62 (1.40)	3.50 (1.69)	3.19 (1.36)	3.68 (1.59)	1.28 (1.26)
	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Gender						
Female	485 (98%)	64 (98%)	112 (98%)	173 (96%)	133 (100%)	265 (92%)
Male	10 (2%)	1 (2%)	2 (2%)	7 (4%)	0 (0%)	30 (8%)
Above cut-off EDE-Q[c]	351 (71%)	34 (52%)	79 (69%)	130 (72%)	105 (79%)	62 (16%)
Education						
Primary school	68 (14%)	8 (12%)	20 (18%)	22 (12%)	17 (13%)	40 (10%)
Upper secondary	170 (34%)	19 (29%)	46 (40%)	55 (31%)	48 (36%	112 (28%)
University ≤ 4 yrs	152 (31%)	16 (25%)	28 (25%)	63 (35%)	45 (34%)	123 (31%)
University > 4 yrs	91 (18%)	20 (31%	18 (16%)	32 (18%)	21 (16%)	114 (29%)
Other	14 (3%)	2 (3%)	2 (2%)	8 (4%)	2 (2%)	6 (2%)

Abbreviations: AN = anorexia nervosa (AN-R = restricting subtype, AN-BP = binge-eating/purging subtype); BED = binge-eating disorder; BMI = body mass index; BN = bulimia nervosa, ED = eating disorder; DERS = The Difficulties in Emotion Regulation Scale; EDE-Q = Eating Disorder Examination-Questionnaire; GAD-7 = Generalised Anxiety Disorder scale 7; PHQ-9 = Patient Health Questionnaire-9.

Notes:

[a] *n* = 3 participants with AN excluded from subtype analysis due to missing information on variables needed for subtype classification.

[b] Self-reported ED onset age defined as first age of onset of clinically significant symptoms.

[C] Eating Disorder Examination-Questionnaire (EDE-Q) global score > 2.5

2.3.3. Case - control classification

Participants were classified as either case or control using the ED100K self-report measure (see below), according to DSM-5 criteria for AN, BN, and BED. The distribution of the different EDs is listed in Table A2 in the appendix, and the full diagnostic classification criteria used for the different ED categories are shown in Tables A3-A5. Due to a subset of the participants responding with “I don’t know” or “I don’t want to answer” to some of the questions required for case classification, we

allowed the following exceptions to the full DSM-5 diagnostic criteria. For AN, lowest BMI ever could be outside of diagnostic range if the participant reported having received treatment for AN. For BN, a missing value (that is; the participant has answered "I don't know") was allowed for either weekly frequency or duration of binge-eating episodes and compensatory behaviours, as long as all other criteria were fulfilled. For BED, a missing value was allowed on either weekly frequency or duration of binge-eating episodes, as long as all other criteria were fulfilled. For all diagnoses, participants who reported having received treatment for the respective diagnoses along with some minor additional criteria (e.g., having reported binge-eating episodes and compensatory behaviours for BN) were classified as cases regardless of whether they fulfilled the main criteria for the disorder.

Successful classification of 890 individuals resulted in 495 individuals with a current or lifetime ED in the case group, and a control group consisting of 395 individuals without a history of EDs. We were unable to ascertain ED status for the remaining 26 participants, and these were excluded from the case-control analyses. Discriminatory questions within the ED100K were used to distinguish lifetime ED diagnoses from one another. Individuals who met criteria for either BN and/or BED at some point in their life were combined in a BN/BED group (n = 180) in the subtype analyses due to the large overlap and crossover between these two subtypes. In our sample, 70 individuals met criteria for BED only, 58 BN only, and 52 met criteria for both BN and BED, consistent with literature showing a high degree of diagnostic crossover between these EDs over the course of a lifetime (Brown et al., 2015; Castellini et al., 2011). To obtain groups of sufficient size and avoid too many different categories (see Table A2 in the appendix), a combined group was preferred as both BN and BED represent binge-eating/purging subtypes of EDs. Individuals

meeting criteria for only AN during their lifetime were divided into the two subtypes AN-R (*n* = 65) and AN-BP (*n* = 114) based on presence or absence of binge/purge behaviours. While we also recognise that there is a high degree of crossover and instability between AN subtypes, we opted to keep a strict definition of AN-R (no lifetime binge eating or purging). This is in line with the reasoning above, as we wanted to explore the hypothesis that the life events under investigation are primarily associated with binge-eating/purging EDs. A fourth diagnostic group comprised those individuals who at some point in their life had met criteria for both AN *and* BN/BED (AN/BN/BED; *n* = 133). The high number of individuals in this combined ED group also shows the high level of diagnostic crossover in ED diagnoses and this was not unexpected when considering lifetime EDs.

2.3.4. Self-report measures

ED100K (version 2). The ED100K is a self-report measure developed for diagnostic classification of AN, BN, and BED based on the DSM-5 criteria for EDs (Thornton et al., 2018). It has been previously validated, and showed good predictive validity when compared to interview-based methods such as the Structured Clinical Interview for DSM-IV (Thornton et al., 2018). The ED100K was used for diagnostic classification in the current project to be consistent with the measures used in other ongoing international research on genetic correlates of EDs (Bulik, Thornton, et al., 2021; Thornton et al., 2018), as one of the aims of the EDGE project was to contribute to this global initiative. The original ED100K was translated into Norwegian using wording similar to other validated Norwegian ED diagnostic tools, and then back translated into English to assert correspondence. The ED100K contains statements assessing lifetime frequency, severity, and duration of ED behaviours and symptoms along with the age at which these features first emerged, and enables

classification of individuals as either ED cases or controls. Lifetime AN, BN, and BED is determined based on presence of core features (e.g., binge-eating, low weight, compensatory behaviours) for each disorder (Tables A3-A5 in the appendix contains the full list of diagnostic criteria).

Retrospective Bullying Questionnaire (RBQ). The RBQ is a self-report measure developed for use in adult populations to retrospectively assess episodes of bullying during school-age (Schäfer et al., 2004). The questionnaire is available free of charge and was shared by the developers upon request. The original measure includes questions about verbal, physical and indirect bullying, and covers both primary school and middle school occurrences. For the purpose of our study, a Norwegian translated and adapted version was developed. The English version was translated into Norwegian and then back-translated to ensure correspondence. While not being formally validated in its adapted form, the use of the RBQ to assess frequency of bullying experiences was considered suitable for this study due to its retrospective nature and the ability to explore different types of bullying.

The questionnaire was adapted and shortened to include physical, verbal (both body-related and body-unrelated), indirect, and digital bullying victimisation, as well as bullying perpetration. All questions enquired about the age of 6-18 years (corresponding to school-age in Norway). At the beginning of the measure, participants were presented with a formal definition of bullying based on the work by Olweus (1994). For each type of bullying (physical, verbal, indirect, digital), participants were asked if they had experienced this type of bullying (“yes”/”no”), what types of experiences (for example, for physical bullying: kicked/hit, stolen from, other), how often this occurred (“never”, “rarely”, “sometimes”, “frequently”, or “constantly”), how serious they considered the bullying to be (“not at all”, “only a bit”,

“quite serious”, “extremely serious”), and at what age the bullying started. The section about verbal bullying was followed by a question on whether or not the verbal bullying was related to weight, body, or appearance. Two questions addressed whether they had been involved in the bullying of others (perpetration). At the end of the questionnaire, participants were asked how long the bullying attacks usually lasted (“just a few days”, “weeks”, “months”, or “a year or more”), whether they had avoided going to school because of bullying, and whether they had ever had thoughts about suicide or self-harm because of bullying. Individuals who reported having experienced bullying with a frequency of “sometimes” or more and considered the seriousness to be “quite serious” or higher, were considered bully victims. This was in line with formal definitions of bullying, and adopting these strict criteria contributed to ensuring a consistent understanding of the term “bullying” across all participants and making it more likely that the experiences we measured were experienced as serious or stressful events.

Stressful Life Events Screening Questionnaire – adapted (SLESQ). To comply with the study aim of investigating a range of different adverse life events, the SLESQ was chosen as the most appropriate measure. SLESQ was first developed by Goodman and colleagues (1998), and has been recommended for use in different research settings (Briere & Scott, 2007; Norris & Hamblen, 2004). SLESQ probes lifetime occurrence of various stressful life events and enabled us to include many different events in the same measure. This included events that are not considered in more traditional trauma measures such as for example accidents or bereavement. The questionnaire was also specifically developed for use in both non-clinical and clinical populations, it has been previously validated (Goodman et al., 1998), and we had free access to a Norwegian translated version (Thoresen & Øverlien, 2013). It

was also appropriate for retrospective assessment of events, and includes age at which the different events first occurred. To suit our research purposes, we adapted the measure for use in an online format and removed some of the questions about very specific events to reduce the length of the full study. The complete list of included items can be seen in Table A6 in the appendix. For each of the items (type of life event), participants indicated whether or not they had experienced this ("yes"/"no"), and their age at first occurrence. For some of the events (rape, other sexual assault, emotional abuse, physical abuse), there were follow-up questions regarding frequency of these experiences. Note that the item labels "rape" and "other sexual assault" were used for analysis and discussion only, while the questionnaire items themselves included descriptions of the different types of sexual experiences without such labels (see Table A6). This is in line with recommendations against using loaded words (such as "rape") when assessing trauma to acknowledge the diversity of possible experiences (Briere & Scott, 2007).

Eating disorder examination – questionnaire (EDE-Q). The EDE-Q (Fairburn & Beglin, 2008) was used to assess current ED psychopathology. The questionnaire is widely used as a diagnostic tool and is available in a Norwegian, validated translation (Rø, Reas, & Lask, 2010; Rø, Reas, & Stedal, 2015). The questionnaire examines presence of ED symptoms and behaviours in the past 28 days, using 7-point scales. Scores are averaged to obtain total scores per subcategory (restriction, eating, weight, and shape concern) and a total global score. A global score of 2.5 has been established as the optimal Norwegian cut-off threshold to discriminate between patients with EDs and healthy controls (Rø et al., 2015). In this thesis, EDE-Q was not used as a main outcome variable, but rather as an additional measure of clinical characteristics to describe the participants.

2.3.5. Statistical analyses

To assess the association between different lifetime events and EDs, logistic regressions were performed to obtain ORs with 95% confidence intervals (CIs) for each subtype of ED. The main analyses were conducted using the R software (R Core Team, 2019), with some additional analysis conducted in SPSS (IBM Corp, 2017).

Paper II. Logistic regressions were performed with ED outcome as the dependent variable (dichotomised) and type of exposure as the independent variable. Separate regressions were performed for bullying overall and each type of bullying for any ED vs controls, and each ED subtype vs controls. In addition, the subtypes were compared with each other. To investigate the time before ED onset specifically, conditional regressions were performed using a matched case – control sample. This was a paired subset of the full sample consisting of 348 cases and 348 controls matched on gender and age, where the onset age for ED was calculated for the case in each pair and used to compare only time prior to this age within the pair. This procedure is explained in further detail in the method section of Paper II.

Paper III. In Paper III, logistic regressions were performed for each of the different SLEs included in the SLESQ measure for each ED subtype versus controls. Unlike Paper II, we did not specifically compare experiences prior to ED onset or directly compare the subtypes with each other, as these analyses would likely suffer from low power to detect effects due to the low occurrence of many of the events within the different groups. To investigate the cumulative effect of multiple SLE types, regressions were performed with three categorical levels of the independent variable ("no SLEs", "one or two SLEs", and "three or more SLEs") for each ED subtype. This method was preferred over using a continuous measure due to the distribution of

number of SLE types being heavily right-skewed with most participants (> 75%) having experienced between zero and four SLE types.

All regression models for Papers II and III were conducted with age, gender, and education as covariates. Age was included to control for age-related recall effects, since the age range varied greatly between participants and the exposure measure relied on memories of events that took place in the past. We controlled for gender due to the large proportion of females in our sample, as female gender is a known risk factor for EDs (Jacobi et al., 2004) and prevalence of different types of SLEs also differ between genders (Merrick, Ford, Ports, & Guinn, 2018). Education was included in the list of co-variates as the closest approximation in our data to a measure of socioeconomic status.

Due to the relatively large number of comparisons conducted on this dataset, all *p*-values were corrected for multiple comparisons using the Bonferroni-Holm method. The Bonferroni-Holm correction is based on sequential comparisons of *p*-values within a family of tests using adjusted rejection criteria for each comparison, and provides a more powerful correction method for multiple testing than a classical Bonferroni method (Holm, 1979). All the reported results and statistics from the papers and in this thesis are based on these corrected significance levels, where $p_{corrected} < 0.05$ was considered statistically significant.

2.3.6. Sample size and power

As one of the objectives of the larger EDGE project was to participate in a global genetic study, projected sample size was determined based on how many it was feasible to recruit over a two-year period to maximize EDGE's contribution. Power analyses for the logistic regressions relevant for the specific statistical tests in

the current thesis were therefore not performed. However, general sensitivity analyses conducted prior to data collection indicated that 500 participants in each group would allow us (assuming 95% power and an alpha level of 0.05) to detect small standardised differences in means using *t*-tests (critical $d = 0.23$) between cases and controls, and small-to-medium differences in frequencies with X^2 tests (critical $w = 0.21$). For within-cases comparisons (i.e., AN, BN, and BED), we would be able to detect small-to-medium differences using analysis of variance tests (critical $f = 0.17$).

Due to practical circumstances and time constraints, data collection was concluded after seven months with a total of 916 participants distributed across groups when it became difficult to reach more people effectively. At this sample size, the study was close enough to the estimated sensitivity analyses for the case – control comparisons to assume sufficient power to detect effects. The ED subtype analyses were first intended as a secondary aim to the overall ED versus control comparisons, but the decision to focus more on subtypes was made post hoc in line with recent findings and discoveries in the field (Solmi et al., 2020; Weissman, 2019). Therefore, sensitivity or power analysis to estimate sample size was not conducted with this specific aim in mind, and these analyses could be underpowered. This is discussed further in the discussion section below.

2.3.7. Ethical considerations

The study was approved by the Norwegian Regional Ethics committee (project ID 2017/0606). All participants provided written informed consent using BankID (Norwegian secure online login system). The study questionnaires were administered online through TSD (Service for Sensitive Data); a service providing secure data

collection and storage in compliance with the “Personal data act” and “Health research act” operated by the University of Oslo. Data was stored directly on the server before being de-identified and exported to secure hospital servers for analysis. Only researchers involved in the project had access to the data files.

The questionnaires included in this study may have been challenging for some individuals to complete due to the sensitive topics under investigation. As the study was administered online, the research team did not have the ability to assess the current mental health or distress of the participants. The content and nature of the topics (e.g., trauma, bullying, self-harm) were mentioned in the consent form to allow people to prepare and make an informed decision to partake in the study or not. In addition, all participants were given the option to be contacted by a member of the research team for a non-committal conversation before or after completing the online assessments. A small number of participants (*n* = 15) were provided support from the project administrator or trained clinicians in the team, mostly relating to how to get treatment for their ED. This contingency plan was of importance for the current study to limit any potential negative effects triggered by study participation for both ED and control individuals. Prior to data collection, the possible triggers and distressing topics raised in the study were discussed with members of ED user organisations for feedback on how to best present the questions.

3. Results

3.1. Paper I

The qualitative and quantitative review of previous studies revealed an association between EDs and both generic and weight based bullying. While the findings were relatively consistent for BN and BED, studies including AN samples

were more mixed. Very few studies compared differences between AN subtypes. The meta-analysis showed that individuals with EDs were two- to threefold more likely than controls to have experienced bullying or teasing prior to ED development, and the association was stronger for weight-based teasing than for generic bullying. The study also highlighted a range of methodological limitations in the prior studies, including small samples, varying definitions of the terms bullying and teasing, single-item measures of bullying, and a distinct scarcity of studies investigating whether bullying occurred prior to ED onset.

3.2. Paper II

This article compared bullying history in individuals with and without EDs and found that overall, individuals with a lifetime ED were more likely to have experienced bullying than controls. They were also more likely to have experienced bullying prior to ED onset. This association held true for different types of bullying; both body-related and body-unrelated verbal bullying, indirect bullying, and digital bullying. Physical bullying did not differ between ED and control groups. Subtype comparisons showed that individuals with BN and/or BED were significantly more likely to have experienced bullying than both controls and individuals with AN-R. Although the subtype comparisons were based on a smaller number of participants in each group and therefore might suffer from low power, these findings are in line with our previous meta-analysis (Lie et al, 2019) and other studies.

3.3. Paper III

Previous research has implicated childhood sexual abuse as a risk factor for EDs, but less is known about other types of stressful life events. We found that both sexual (rape and other sexual assault) and non-sexual (emotional abuse) events were more common among individuals with EDs than controls. This was the case for

individuals with AN-BP, BN/BED, and AN/BN/BED, but not for AN-R. Loss of a close relative or friend was significantly associated with BN/BED only, and having experienced a serious/life threatening illness was significantly associated with AN-BP and AN/BN/BED. We also found stronger effects for individuals who had experienced multiple types of SLEs, which is consistent with a cumulative effect of lifetime stress. These findings were in line with previous studies highlighting a role of SLEs in binge-eating/purging types of EDs more than in restrictive EDs.

4. Discussion

4.1. Overview of findings

The overall aim for this thesis was to investigate the associations between eating disorders and exposure to stressful life events, with a particular focus on bullying. We wanted to explore whether individuals with EDs more commonly report such experiences than controls without EDs, and whether there were differences between the ED subtypes.

In Paper I, we conducted a systematic review and meta-analysis of previous literature focusing on bullying and teasing among individuals with EDs. The results of this review supported an association between bullying and EDs, in particular for binge-eating/purging types of EDs while the evidence was less conclusive for AN. We also identified shortcomings in the literature pertaining to a range of different definitions and operationalisations of bullying and the associated term ‘teasing’.

Paper II and Paper III used data collected in the EDGE project to compare history of bullying and other types of stressful life events in individuals with and without a lifetime history of EDs. In both papers, we found that associations between

bullying and other SLEs were particularly strong for individuals with binge-eating/purging types of EDs. This is consistent with both our own meta-analysis and previous reviews and studies (Lie, Rø, & Bang, 2019; Molendijk et al., 2017).

Throughout the three papers, different types of adverse or stressful experiences were more common among individuals with EDs than controls, in line with our main hypothesis. Further research is needed to explore whether this is specific to EDs or whether the association represents a general correlate for mental health problems or comorbid disorders. Knowledge about these associations and how they relate to clinical presentation and symptomatology may be important for treatment and to understand factors involved in the aetiology of EDs.

The following paragraphs provide an overarching discussion of the findings related to both bullying and other SLEs, while we refer to the respective papers for more in depth analyses and discussions of the specific results.

4.2. Discussion of findings

4.2.1. Papers I-II: Is history of bullying associated with EDs?

In the process of reviewing previous studies on bullying and EDs, we noted a scarcity of original research articles on this topic. Particularly, there were few studies focusing on clinical EDs as opposed to ED symptoms in non-clinical populations. While the overall conclusions supported an association between victimisation by bullying and teasing and EDs, we reported a lack of comprehensive bullying measures and the need for more research exploring differences between ED subtypes. The results are consistent with a previous meta-analysis in the field (Menzel et al., 2010), but to our knowledge this was the first review focusing specifically on bullying history prior to ED diagnosis for ED patients and controls.

In Paper II, we addressed some of the identified methodological shortcomings from Paper I and used a case-control design to show that individuals with lifetime EDs have experienced more bullying victimisation than controls. This effect held for verbal (both body-related and body-unrelated), indirect, and digital types of bullying. In line with the findings from Paper I, individuals with BN/BED reported more bullying than both controls and individuals with AN-R (but not AN-BP), consistent with the notion that bullying is more strongly associated with binge-eating and purging EDs than restricting subtypes.

Findings from paper II are in accordance with previous studies investigating clinical EDs (Hilbert et al., 2014; Krug et al., 2015), and non-clinical studies focusing on specific behaviours and symptoms such as binge eating or purging (Copeland et al., 2015; Kwan, Gordon, Minnich, Carter, & Troop-Gordon, 2017). Importantly, many previous studies have used ambiguous definitions and operationalisations of bullying which do not clearly separate bullying from more mundane experiences, including teasing or negative comments. By using a strict bullying definition and a comprehensive bullying measure we were able to show that individuals with EDs have indeed experienced bullying to larger extent than individuals without EDs.

In our case-control study, we did not find any significant associations between bullying and either of the AN subtypes. This is in contrast to some studies finding increased weight-related teasing in individuals with AN than controls, particularly in the binge-eating/purging subtype (Karwautz et al., 2011; Machado, Goncalves, Martins, Hoek, & Machado, 2014). Many studies also do not report results separately for AN subtypes, which makes it difficult to compare results. The meta-analysis by Menzel et al. (2010) found associations between weight/appearance-related teasing and body dissatisfaction, bulimic behaviours, and dietary restraint, but did not explore

other specific features of restricting EDs that could shed light on the observed subtype differences in our study. These differences could be due, in part, to the strict definition we used for bullying, which may be more strongly associated with binge eating and purging than other forms of teasing and negative comments. However, subtype results for AN-R may have been limited by low power due to the small sample size. More research focusing on ED subtype differences is needed, as the current and previous studies show inconsistencies between AN and the other EDs with regard to bullying victimisation.

For bullying, we also used a matched subset of the case-control sample to compare bullying experiences prior to ED onset to the same time period for controls. This method has been used in previous studies (Fairburn et al., 1997; Hilbert et al., 2014), and we were able to match a large proportion of our sample on gender and age and used self-reported onset of clinically significant ED symptoms as the reference (index) age. Results of these comparisons largely corresponded with the lifetime analyses, and significant effects were found for overall bullying and verbal (body-related), and indirect bullying. In the subtype analyses, BN/BED was significantly different only from the control group. While we are still limited to retrospective and self-reported data, this analysis allowed us to determine some precedence of bullying prior to ED development and the significant effects support the notion that bullying may be a risk factor for binge-eating/purging types of EDs.

The inclusion of different types of bullying is a strength of our study. One of the shortcomings of previous literature identified in the systematic review was the use of non-specific, often single-item, measures (Lie et al., 2019), and the current study allowed for a more thorough exploration of the types of bullying experiences present for individuals with EDs. Importantly, we found significant effects for bullying types

not directly related to weight and appearance. This could indicate that bullying can have detrimental effects over and above the link between overt teasing about weight/appearance and body dissatisfaction (Menzel et al., 2010).

Another important finding in Paper I was the scarcity of studies investigating digital (or cyber) bullying in ED populations. More studies were published around the same time and after the time of our review that find associations between ED psychopathology and body dissatisfaction and digital bullying victimisation (Marco & Tormo-Irun, 2018; Marco et al., 2018; Pistella, Ioverno, & Russell, 2019; Ramos Salazar, 2021). In our case – control study, we found a significant association between digital bullying and EDs, with relatively low prevalence in both groups (6.1% for ED, 1.8% for controls). When only considering the time prior to ED development, this effect was not significant. While digital bullying in our study was less common than in some previous studies (Eyuboglu et al., 2021; Islam, Khanam, & Kabir, 2020; Jadambaa et al., 2019), this is likely a function of our sample characteristics. As we collected data from participants above the age of 16 years, with an average age of around 30 years, one would assume that our sample has experienced less digital bullying during their school years than younger cohorts. Given the increased use of internet and social media among adolescents (Bakken, 2021) and the potential for exposure to both bullying and other unwanted victimisation and comparisons experiences (Englander, 2018; Saul & Rodgers, 2018), digital bullying is an important topic for future research.

It is also worth noting that in both paper I and II we found little evidence to suggest that bullying perpetration is associated with EDs. Previous research has shown associations between perpetration and mental health problems, including EDs (Copeland et al., 2015; Copeland, Wolke, Angold, & Costello, 2013). In paper I we

reported that the few studies exploring this topic have conflicting results. In paper II, we did not find an association in our sample, and perpetration was uncommon in both case and control groups. It is conceivable that there was an underreporting, as such behaviours are stigmatised. Further research is needed to determine if there are associations between bullying perpetration and EDs.

4.2.2. Paper III: Are other stressful life events associated with EDs?

In line with our hypotheses and previous research, Paper III found significant associations between EDs and different SLEs. The overall case-control comparison of individuals with and without lifetime EDs for any SLE was significant, and subtype analyses indicated that the effect was driven by binge-eating/purging types of EDs.

Exposure to sexual assault or abuse was more common in individuals with EDs (binge/purge types) than controls, in line with previous research (Caslini et al., 2016; Kent & Waller, 2000; Molendijk et al., 2017). These associations are of similar magnitudes to the meta-analysis of childhood sexual abuse by Molendijk et al. (2017). This is also in line with studies showing that adult experiences of sexual assault are associated with EDs, and that recent exposure to such events predict ED symptoms in non-clinical populations (Arditte Hall et al., 2018; Collins et al., 2014; Fischer, Stojek, & Hartzell, 2010). Moreover, we found that the average age of first sexual assault exposure was between 12-17 years for all ED groups. These findings indicate that the association between sexual assault and EDs are not limited to early childhood sexual abuse.

We also found significant associations between emotional abuse and all binge/purge type EDs. Emotional abuse has received less attention in ED research than sexual abuse, but our findings further support the notion that this form of SLE is

common in individuals with EDs (Kimber et al., 2017; Molendijk et al., 2017). The association with only binge/purge subtypes is in line with a recent study showing that emotional abuse is associated with a 40% increased risk of binge-eating in a community sample of adolescents (Emery, Yoon, Mason, & Neumark-Sztainer, 2021). Emotional abuse has been linked to later difficulties in processing, regulating, and expressing emotions, which has been highlighted as a potential mechanism for the association with disordered eating (Waller et al., 2007).

Of the remaining SLEs considered in our study, the only other significant associations were for bereavement in the BN/BED group and exposure to a life-threatening disease/illness in the AN-BP and AN/BN/BED groups. Previous studies have also found that individuals with AN are more likely to experience serious illness (Hedman et al., 2019; Zerwas et al., 2017). However, it is also possible that some individuals in our study responded affirmatively to this item due to direct or indirect consequences of their ED. For example, individuals with severe AN may have suffered adverse somatic consequences due to underweight and purging which could have required hospitalisation or specialised treatment and thus constitute a severe illness. With regards to bereavement, a Swedish/Danish register study found that death of a close relative prior to age 10 was a significant risk factor for BN (Su et al., 2016), in line with our findings. In contrast, another Danish study found no association between parental death before age 5 and any ED (Larsen et al., 2017). Age of exposure could therefore be a factor influencing this association, and the average age for bereavement in our study was between 13 and 21 years with large variation within groups.

The remaining SLEs we considered, including physical abuse and being threatened, did not show significant associations with EDs. Some of these events

were very uncommon in our sample, and our analyses of these may have been underpowered. Interestingly, a large number of individuals in all ED groups reported exposure to “Other stressful life event”. This was significantly more common in all ED groups than the control group, including AN-R. Unfortunately, we were unable to determine what kind of experiences these were, as we did not include follow-up questions. It is possible that bullying may be accounting for some of these “other” events, as there were no questions about bullying victimisation in the measure of stressful life events. Although we cannot ascertain what types of events these constitute, the high prevalence of other SLEs across all ED groups further highlights that many different types of experiences are associated with EDs and warrant further investigation.

In sum, we found that individuals with a history of EDs had significantly more frequent history of certain SLEs compared to controls. Individuals with a history of binge eating/purging were particularly more likely to have experienced SLEs than controls compared to restricting ED subtypes. These findings mirror our results with regards to bullying experiences; which also showed stronger associations with binge/purge ED subtypes. However, in our investigation of other SLEs we did not perform analyses specifically on time prior to ED onset, and refer to future explorations to gather insight into whether such experiences represent risk factors or correlates of ED behaviours. Together, our studies showed that many different types of adverse life experiences are associated with EDs. We further explore the nature of these associations in the following sections.

4.2.3. What is the nature of these associations?

The increased frequency of experiences of bullying and other SLEs in the ED group compared to controls may be due to several factors. EDs, especially AN and BN, often develop during adolescence and thus coincide with the physical, psychological, and social changes associated with puberty. During this time, some individuals may be particularly vulnerable to the effect and impact of negative experiences or social rejection, and may respond to such events with maladaptive cognitions and behaviours leading to EDs (Bulik, 2002). In light of this, previous research has found that early experiences of shame and negative perception of oneself in comparison with others is related to ED psychopathology, and that shameful experiences are interpreted as traumatic by ED patients (Matos, Ferreira, Duarte, & Pinto-Gouveia, 2015). Bullying victimisation - particularly episodes of bullying/teasing directly targeting body weight or shape - could therefore be experienced as especially stressful for young individuals vulnerable to EDs. This is also consistent with our findings for emotional abuse, which is another type of experience that may affect perception of self and lead to negative attitudes and cognitions. Similarly, the stronger associations for body-related verbal bullying in our case-control study combined with the associations with weight-teasing observed in the systematic review point towards these types of experiences as potentially potent factors involved in EDs. This is also consistent with a recent systematic review finding elevated weight-control behaviours in adolescents reporting weight-based victimisation, and suggests that these ED behaviours can function in part as defensive strategies to improve social ranking and perceptions of oneself (Day, Bussey, Trompeter, & Mitchison, 2021).

However, it is also possible that individuals with current EDs attract negative attention from others or engage in risky behaviours that may results in adverse experiences. Research has shown that peer victimisation may occur as a result of a pre-existing mental disorder or due to behaviours experienced as “different” from the norm (Reijntjes, Kamphuis, Prinzie, & Telch, 2010). Exhibiting signs or symptoms of ED behaviours might therefore put someone at risk of such victimisation. In our analyses of bullying experiences, we did attempt to delineate bullying occurring prior to ED onset from that occurring after onset using a matched case-control sample and a conditional regression analysis. Bullying prior to ED onset was significantly more common in EDs than controls, thus providing tentative support for a partly directional relationship. Further research delineating the potential bi-directional mechanisms involved in the associations between EDs and bullying or other SLEs would help us better understand these relationships.

Our results can also be seen in light of neurobiological findings. For example, the stress response and physiological alterations involved in hypothalamic-pituitary-adrenal (HPA) axis activation during development can render some individuals at higher risk of psychological difficulties later in life (Claes, 2004; Marciello et al., 2020; Monteleone et al., 2020; Murray & Holton, 2021). Moreover, in addition to traditional traumatic events and physical stressors, recent findings support that emotional abuse also contributes significantly to this altered stress response (Monteleone et al., 2021). As a result of a dysregulated physiological response to psychosocial stress, these individuals may then be vulnerable to development of maladaptive coping strategies and cognitions underlying EDs (Monteleone et al., 2021; Monteleone et al., 2020). In addition, exposure to multiple types of adverse experiences may have a negative dose-response effect on the physiological stress response (Monteleone et al., 2018).

This is in line with our results and other studies finding a stronger association between SLEs and ED behaviours in individuals exposed to multiple types of negative experiences (Yoon, Emery, Mason, & Neumark-Sztainer, 2021). Based on previous studies, we would also expect similar patterns for other psychiatric diagnoses and not just for EDs (Larsen et al., 2017; Thoresen, Myhre, Wentzel-Larsen, Aakvaag, & Hjemdal, 2015).

While bullying and other SLEs in our study were significantly more common among individuals with EDs than controls, the control group also had a high prevalence of different types of SLEs. In total, 65% of the controls reported at least one SLE type (based on the SLESQ measure in Paper III) and 19 % had been bullied (based on the RBQ in Paper II). Other studies have also found similar numbers for non-clinical samples, with one study reporting that 65% of a general sample reported at least one adverse life experience (Dong et al., 2004). The prevalence of different types of experiences in our study is comparable to findings from a Norwegian report of violence and abuse against children and adolescents (Hafstad, 2019). The distribution of SLE types was also similar in our control participants and in the ED groups, with sexual SLEs and emotional abuse being the most frequent.

We also expected to see frequent bullying in the controls, as bullying in school is a common problem among adolescents (Hooper, Puhl, Eisenberg, Crow, & Neumark-Sztainer, 2021; Islam et al., 2020; Jadambaa et al., 2019). Recent reports from Norway underscore this as an ongoing issue, with 4.5% of youth in year 5-13 in school reporting being bullied by peers at school several times a month and 2.2% experiencing frequent digital bullying (Wendelborg, 2021). As such, our sample seems to reflect a natural distribution of adverse lifetime events in the population. The observed differences in exposure history for individuals with EDs compared to

controls could therefore be dependent on other contributing factors affecting the relationship between adverse events and clinical presentation. PTSD symptoms could for example play a mediating role between adverse experiences and ED psychopathology, with more severe and long-lasting negative consequences for individuals who experience high levels of PTSD symptoms (Brewerton et al., 2020; Kiefer, Goncharenko, Contractor, DePina, & Weiss, 2021; Wolf & Elklit, 2020).

4.2.4. Differences between ED subtypes

Throughout all the papers included in this thesis, we consistently found stronger associations between SLEs and binge-eating/purging types of EDs than for restricting EDs. This supports the notion that AN may have different underlying aetiological pathways than disorders characterised by binge eating and purging (Stice et al., 2017). For example, AN-R was not associated with bullying (Paper II), nor any of the other SLEs (Paper III). This is also in line with studies finding more binge-eating and/or purging symptomatology in individuals with a history of adverse experiences (Day, Bussey, Trompeter, Hay, et al., 2021; Molendijk et al., 2017).

There are many possible explanations for why negative life events may be more common in BN/BED than AN. Binge eating/purging and other bulimic behaviours are associated with impulsivity and negative urgency, and can represent maladaptive coping methods in response to stressors (Fischer, Smith, & Cyders, 2008; Waxman, 2009). Thus, stressful events may trigger these behaviours for some individuals. A recent article found that binge eating, but not overeating, was associated with physical and sexual abuse (Yoon et al., 2021). Loss of control is the central feature distinguishing binge eating from overeating, and may represent an important mechanism in the relationship between adverse events and binge eating

behaviours (Yoon et al., 2021). This is also consistent with research showing more impulsive behaviours and sensation seeking tendencies in individuals with BN/BED compared to the more habitual and controlling features of restrictive EDs such as AN (Brewerton, Cotton, & Kilpatrick, 2018; Waxman, 2009). Such characteristics could also render these individuals more exposed to some stressful or high-risk situations, thus bidirectional effects between these factors may occur. Victimisation experiences such as abuse and/or bullying could also negatively affect body image and self-image, which in turn increases risk of bulimic ED behaviours (Gattario, Lindwall, & Frisén, 2020; Stice et al., 2017). For bullying, verbal comments about overweight, appearance, or unusual eating behaviours could be specifically related to features of the ED in individuals at risk or in the early stages of BN/BED. However, the observation that bullying prior to ED development was significantly higher in EDs (BN/BED) than controls in our current study, shows that bullying often precedes ED onset.

Binge-eating has also been suggested as a mediating factor in the relationship between sexual abuse and development of obesity (Gustafson & Sarwer, 2004), indicating that binge eating may occur as a way of coping with an external stressor such as abusive experiences. Similarly, the average onset age of the other SLEs investigated in our study (Paper III) suggests that these experiences often preceded or coincided with the emergence of ED symptoms. This supports findings from previous studies reporting abusive or traumatic experiences prior to onset of bulimic ED symptoms (Dansky, Brewerton, Kilpatrick, & O'Neil, 1997; Johnson, Cohen, Kasen, & Brook, 2002; Zelkowitz, Zerubavel, Zucker, & Copeland, 2021).

In addition to differences in personality factors and the role of sociocultural influences on AN, BN, and BED, recent advances in genetic research suggest a

different pathway and perhaps a higher degree of biological underpinnings of AN relative to the other EDs relating to metabolic features and reward sensitivity (Bulik, Carroll, & Mehler, 2021; Treasure et al., 2020). It is possible that AN risk is influenced more by genetic or internal factors (e.g., personality) than by environmental stressors, while the latter might be more potent factors influencing BN/BED risk. Thus, our findings across all studies in this thesis support a differential risk profile for AN (particularly AN-R) compared to EDs on the other end of the binge-eating/purging spectrum. Further, a transdiagnostic approach and focus on specific ED behaviours (e.g. binge eating) may be more suitable in exploring the association between SLEs and ED risk than categorical diagnoses.

4.3. Methodological considerations

4.3.1. Choice of assessment instruments

In planning this project, many measures were considered for inclusion in the study assessments before deciding on adapted versions of the RBQ and the SLESQ. For bullying, the RBQ was chosen despite not being previously used or validated in Norwegian. This measure was specifically made for adult retrospective assessment of bullying and allowed for comparisons of different types of bullying as well as measures of frequency and severity. As one of the limitations identified in Paper I (Lie et al., 2019) was the lack of comprehensive measures and use of single-item questions to assess bullying in previous literature, this was an important factor in choosing the RBQ. It was also available free of charge upon request from the developers, and we had the ability to adapt the measure to suit our research aims. This involved adding questions regarding weight-teasing and digital bullying. Previous research has often used the Perception of Teasing Scale (POTS)

developed especially for weight/appearance teasing in relation to body image (Lundgren, Anderson, Thompson, Shapiro, & Paulosky, 2004; Thompson, Cattarin, Fowler, & Fisher, 1995). However, as we wanted to explore generic bullying and use a definition in line with research by Olweus (1994), the POTS did not suit our purpose.

The other events under investigation in this thesis were measured by the questionnaire SLESQ which included a range of specified events. The SLESQ was adapted from a previously used Norwegian version (Thoresen & Øverlien, 2013), and was deemed more appropriate than for example the oft-used Childhood Trauma Questionnaire (Bernstein et al., 2003) as it includes a wider range of lifetime events. As was the case with the RBQ, this measure also included questions about time of events and was freely available for research purposes.

While we collected a range of demographic data as part of the assessments, we did not include information about minority background or socio-economic status. This was mainly to reduce the length of the assessment battery, but it represents a limitation of our study as we are not able to investigate impact of such group memberships on results. The original study protocol also included linkage of data to demographic information available through Statistics Norway, but this information was not available in time for the current thesis. We do note that the population of Norway is primarily of Northern European decent.

4.3.2. Case - control classification

One of the aims of the current study was to compare individuals with and without a lifetime history of clinical EDs, as opposed to exploring ED psychopathology and symptoms in non-clinical populations. In order to achieve this,

we needed a measure that could reliably classify cases and controls based on criteria defined by the DSM for an ED diagnosis using self-reported data. The ED100K measure was chosen due to the objective for the EDGE project to contribute towards the larger genetic initiative and the need for consistent diagnostic criteria across collaborating studies (Thornton et al., 2018). While we refer to our participants as either ED cases or controls, it is important to note that we did not apply diagnostic interviews or cross-check diagnoses with official health registries. Although not formally validated in Norwegian, the extensive process of translating and back-translating the validated English measure should yield similar accuracy for detecting cases as the original. As such, our diagnostic groups are based on retrospective self-reports of lifetime ED symptoms as assessed by the ED100K questionnaire. While this is subject to recall biases and differences in each individual's perception of ED history, we also classified people as ED cases if they had ever received treatment for an ED. The commonly used and validated ED symptom measure EDE-Q was included and used to compare the case-control categories in the current study, but was not used as an outcome measure as it measures symptoms only in the past 28 days.

The use of self-reported, lifetime ED diagnoses is associated with some limitations that could affect the validity of both diagnoses and outcome variables. As more than 60% of the ED sample fulfilled requirements for a current ED, this could lead to bias in how they view past experiences. Therefore, some of the reports of the more subjective experiences as well as the severity ratings may be attributable to effort after meaning effects, or the tendency to search for explanations and triggers in the past to understand one's current situation (Smyth et al., 2001; Wonderlich et al., 2015). Self-reported onset of ED behaviours could also suffer from retrospective

bias, although we did control for current age in our regression models. Moreover, the matched case-control sample used for the comparison of bullying prior to ED onset also shows that even if self-reported onset may have been reported as earlier than a formal diagnosis would, there were still significantly more experiences of bullying in cases compared to controls.

The way of classifying individuals in the ED group into different ED subtypes was subject to careful consideration, and is an important point of discussion. The subtyping of AN into AN-R and AN-BP was based on criteria requiring no binge eating or purging at any point in the AN-R group, resulting in this being a strict and exclusive group. The AN-R group in our sample may therefore be overly homogenous compared to clinical presentations of this diagnosis. Previous research have found frequent transitioning from restricting to binge-purge symptomatology associated with a worsening of clinical ED presentation (Serra et al., 2021), and we therefore cannot rule out the possibility that the individuals in our AN-R sample are those who have not developed binge/purge symptoms yet but that this could still occur in the future. As we specifically wanted to address differences between binge/purge type disorders and restrictive subtypes, we wanted to limit behavioural crossover and wanted the AN-R group in particular to remain a “pure” restrictive subtype, as it is often considered phenotypically different from other EDs. However, only a small number of individuals in our study met the criteria for lifetime AN-R (*n* = 65) only, and thus the subtype analyses for this group could be suffering due to low power.

The number or people who fulfilled criteria for more than one ED in their lifetime led to the majority of individuals being placed in the combined BN/BED group and the AN/BN/BED group. While this was not unexpected given the frequent

transitioning between diagnoses in ED populations (Stice et al., 2013), it does limit our ability to tease apart the associations found for these groups. For example, the combination of BN/BED in one group limits the exploration of whether binge eating or purging alone are strongly associated with SLEs, as for example Day and colleagues (2021) found associations between weight-teasing and purging, but not binge eating.

We acknowledge that are many ways to subgroup participants, and the literature does not support one universal and consistent approach. Other alternatives include earliest onset (first clinically significant ED presentations denote diagnosis regardless of subsequent diagnostic transition), or use of a hierarchical approach (i.e., AN trumps BN, BN trumps BED etc.). However, we discarded these approaches as we believed they would lead to more mixed diagnostic groups and because we know that many individuals with eating disorders have symptoms long before receiving their first diagnosis. Additionally, our ED classification only considered the three main EDs; AN, BN, and BED. We therefore cannot rule out that some of our participants may have had clinical presentations consistent with other types of EDs at some point in their lives. Ultimately, we are limited by the use of self-reported symptoms and cannot verify any diagnoses or symptoms reported by our participants.

4.3.3. Sample characteristics and representativeness

The target population of the current study was individuals with a lifetime history of an ED. Additionally, our control group comprised individuals without such a lifetime history. The generalizability of our findings depend on the extent to which we were able to sample representative groups of these populations. In our study we did

not use randomly sampling, so it is important to evaluate the extent to which our samples are representative and identify potential sampling biases.

First, to reach a sufficient number of individuals with and without a lifetime history of EDs, a targeted recruitment approach was necessary. The use of mainly online methods of recruitment and data collection may have biased our sample towards younger participants, who tend to spend more time on social media. This is consistent with the median age in our sample being 27 years. We were also concerned that we would end up with a geographically biased sample, but our final sample showed geographical spread across Norway (illustrated in Figure 1).

The nature and scope of our study may also have affected people's willingness to participate. Participation in the EDGE study entailed providing comprehensive consent to allow linkage to information in health registries. This, in combination with the all online recruitment and thus no face-to-face interactions with the research team may have discouraged some people from taking part in the study.

Individuals in the ED group were recruited mainly through user-organisations (i.e., their Facebook home-page), which may have biased our ED sample towards more severe ED histories. It is also possible that the involvement of user-organisations biased our sample towards certain diagnostic groups, which may limit representability to EDs in the general population. Notably, the high proportion of individuals with AN (20% of total sample) relative to the other diagnoses is in contrast to the distribution of EDs in the general population, where bulimic and binge-eating disorders tend to be dominating (Treasure et al., 2020). It is our experience that there tends to be an over-representation of AN when recruiting ED patients through user

organisations and clinics. This could be because these individuals are more likely to engage with these organisations.

Additional measures of anxiety and depression (not presented in this thesis) showed high scores in the case groups, but we did not formally assess comorbid diagnoses of depression or anxiety disorders. In addition, we did not assess symptoms of PTSD, which would have been interesting in light of the literature showing this as a significant factor in the relationship between stressful events and EDs (Brewerton, 2007). We also acknowledge the possibility that the voluntary participation advertisements and description of the project may have resonated more with individuals who had a history of both EDs and traumatic history or bullying, and therefore the presence of such experiences might be exaggerated in our sample.

4.3.4. Lack of males

Related to issues of whether our sample was representative, we had difficulty recruiting male participants in both case and control groups. This resulted in a predominantly female sample (95%). While we expected a low number of males with a lifetime ED history due to the even lower base rate of EDs in males than females (Keski-Rahkonen & Mustelin, 2016; Reas & Rø, 2018), the control group was also dominated by female participants. The user-organisations aiding in the recruitment of ED cases also have a majority of female members. As mentioned in the methods, we initially made recruitment content specifically targeting males, but abandoned these efforts when it became clear that we would not achieve a high enough male participation rate to conduct analyses based on gender. However, instead of excluding the few male participants we did get, we decided to include them in the analyses and add gender as a covariate. We also note that the current study did not

include a non-binary category of gender, as the options were limited to either male or female in response to the question “What was your biological sex at birth?”. We therefore could not explore possible effects of gender subgroups and sexual and gender minority in the relationship between EDs and SLEs in this study. The low number of males in our study is a limitation, and our findings must be viewed in light of this gender imbalance.

4.3.5. Choice of comparison group

The control group in the current study consisted of all participants who did not meet DSM-5 criteria for a past or current ED. As no other criteria were enforced, this group therefore potentially included individuals with other mental health disorders. In total, 42% of the control group reported that they had received help for a mental health issue at some point in their life and 15% were currently in treatment. Free-text responses indicated a range of different reasons for seeking treatment, including anxiety, depression, divorce, grief, PTSD, etc., in the control group. The control group also included a number of individuals scoring above cut-off on screening measures of eating disorders (EDE-Q), as well as depression and anxiety (measures not included in the current thesis). Thus, our comparison group does not represent “super healthy” controls, but rather individuals with a natural variation in mental health issues and disorders similar to general population estimates (Baumeister & Härter, 2007; Merikangas et al., 2010; Torre et al., 2021). Other variables such as average age, current BMI, and education, did not show large differences between the case and control groups and we are therefore confident that the groups are comparable for the purpose of this study.

We view it as a strength in our study that we included participants who had a natural variation in mental health status and with some levels of disordered eating, as this is to be expected in the general population (Lipson & Sonneville, 2017). We still observed differences in the outcome variables for both bullying and other SLEs between case and control groups, despite the inclusion of a comparison group where some degree of ED symptoms were allowed. A further extension of this study could be to also include a clinical psychiatric comparison group to investigate whether these findings are specific to EDs or if similar patterns can be found in other diagnostic groups.

Overall, the control group must also be seen in the context of the aforementioned potential biases and limitations relating to our sampling and study methods. We also cannot rule out the possibility of a self-selection effect, and our sample may therefore reflect a selected subset of the population and is not necessarily representative of the general population in Norway.

4.3.6. Design and retrospective bias

As we have discussed in the previous sections, it is important to acknowledge that the retrospective design and self-report methods used in the current study introduce potential biases and limitations to our results. Firstly, we relied on the participants' own subjective recall of events and therefore cannot ascertain whether there are differences in actual occurrence of adverse experiences. Although an objective measure of SLEs is difficult in this regard, especially when it comes to emotional abuse or bullying, this is a potential source of bias important to keep in mind when attempting to interpret the observed associations. All else held equal, the same type of adverse event can be experienced as more or less stressful and

important by different people, and for the same individual at different time points in life. Individuals with EDs may search for potential causes and experiences to understand their problems, which may contribute to increased prevalence of reported negative experiences in this population. It is also worth noting that many of the experiences we investigated occurred during childhood and adolescence, and therefore relied on people's recall of events happening years, or even decades, ago. Secondly, the targeted recruitment for this study may have resulted in self-selection of individuals with a particular interest in EDs and trauma experiences, and may have led to a social expectancy to report SLEs. Thirdly, although we report age of events, and compare period prior to ED onset in Paper II, we are limited by the retrospective reports and can only report associations between our outcome variables. We therefore cannot decipher causation or directionality of these associations, and must refer to future explorations to gather insight into whether such events are risk factors or consequences of ED behaviours.

4.4. Future directions

As well as contributing with new knowledge about the history of bullying, abuse, and other stressful life events in the EDs, we have also identified areas that are still under-explored and highlight directions for further research. As our studies have shown that many individuals with EDs have been bullied, further research on such experiences are warranted. One of the main limitations of previous research on bullying and EDs is the lack of follow-up or longitudinal studies. While we compared bullying history prior to ED development in the current study, we are limited by the retrospective nature of our data. Given our significant findings and preliminary evidence from related prospective studies (Copeland et al., 2015; Hilbert, Hartmann, Czaja, & Schoebi, 2013), this is an important line of research to pursue. As the use of

internet and social media among young people is increasing, digital bullying and harassment should be a particular focus moving forward and investigations into how such experiences shape body image and self-esteem are important.

Also for other types of SLEs, our findings of early exposure to a range of events are consistent with tentative longitudinal evidence (Romans, Gendall, Martin, & Mullen, 2001; Zelkowitz et al., 2021), but more prospective research is needed. The limited access to prospective studies of risk factors in the EDs is often due to low base rate of EDs in the population, and the need for large sample sizes to ensure enough ED cases. Focusing on high-risk groups, for example individuals with a high environmental risk load (e.g., athletes), could allow for easier implementation of follow-up studies. Prospective studies are also necessary to determine whether SLEs are contributing factors to the onset of EDs, or whether there are other mechanisms that trigger both EDs and susceptibility for potentially harmful or stressful situations (such as for example temperament or family dysfunction). In line with research on PTSD as a mediator between trauma history and EDs (Wolf & Elklit, 2020), the role of PTSD symptoms in relation to a range of different SLEs and EDs should be further investigated.

Future studies should also explore further the effects of multiple SLEs, as the current findings support a cumulative association where individuals with EDs more often report multiple types of SLEs than controls. This must be investigated further, as many types of traumatic experiences are interrelated (Dong et al., 2004) and there is a higher chance of re-victimisation in adulthood after childhood exposure (Aakvaag et al., 2017). Relatedly, as our studies show that individuals with EDs have experienced many forms of stressful experiences, future research would benefit from

assessing a range of events and not rely on a single type of event (e.g., childhood sexual trauma).

While our subtype analyses were limited by small sample sizes for some of the groups, we did see a stronger association between different SLES and binge-eating/purging types of EDs that warrants further exploration. This supports a trans-diagnostic approach, and research focusing specifically on these behaviours (binge eating and purging) regardless of diagnosis would add further insight into the nature of this association. This implementation in future studies would allow for exploration of how SLEs relate to for example binge eating or purging behaviours in high or low risk populations irrespective of diagnosis.

Furthermore, we did not compare EDs with other psychiatric control groups in the current study. Future studies are needed to ascertain whether the common occurrence of SLEs in EDs is different from what is seen in other psychiatric groups. This would aid our understanding of whether SLEs are general markers for mental health problems, or if there are specific contexts where different SLEs have particularly high associations with certain ED behaviours for some people, for example by functioning as a coping mechanism.

4.5. Clinical and societal implications

The current study showed that individuals with EDs commonly experience many different SLEs. While there have been efforts to incorporate trauma-focused interventions in ED treatment in relation to PTSD symptoms for this patient population (Brewerton, 2019; Trottier & Monson, 2021; Trottier, Monson, Wonderlich, MacDonald, & Olmsted, 2017), we demonstrate a potential value of also considering a wider range of exposures in treatment independent of comorbid PTSD. As previous

research has found associations between childhood adversities and a more complex clinical presentation and worse prognosis (Castellini et al., 2018), exposures to different types of negative experiences may indicate a need for specialised treatment strategies. A history of bullying and/or other SLEs is common in ED populations, and may be linked directly to cognitions and mechanisms relating to ED symptoms even in the absence of typical PTSD symptoms. ED behaviours such as binge eating or purging may be tied to negative experiences and serve as a way of coping with such stressors, and these associations should be explored in treatment.

As our results showed that many individuals experience SLEs prior to ED development, early interventions and prevention of bullying in schools could contribute to lessen the burden of EDs among adolescents. Especially during the formative years of childhood and adolescence, an added focus on disruptive family environments and negative experiences in and outside of school could help identify people at risk of engaging in maladaptive behaviours that may lead to EDs or other mental disorders. Our results indicate that young people who have experienced bullying victimisation or other SLEs constitute a risk group for which selective preventive efforts may be directed.

History of SLEs can also be important for predicting prognosis and determining the right course of treatment. In terms of bullying specifically, weight/body-related bullying may be a particular vulnerability factor in development of body image disturbances or maladaptive eating, but also other forms of bullying can have important effects on emotional and psychological well-being during the formative years of adolescence. The high potency of indirect, verbal, and digital forms of bullying highlights the importance of scrutinising the interactions between peers both in real life and on social media and online channels.

In a larger, epidemiological perspective, there are many stressful and traumatic events that individuals are exposed to throughout a lifetime, and exploration of how these influence risk for EDs and other psychiatric difficulties is an important step towards understanding risk and protective factors for mental health.

5. Conclusions

This thesis has focused on the association between various stressful life events and EDs and discussed how this relates to our understanding of the aetiology of EDs. By conducting a systematic review of previous articles on bullying and EDs, we identified the need for more research and raised several methodological issues. In a case-control study, we addressed several of these issues by using a strict definition of bullying, a more comprehensive measure of bullying, and investigating different types of bullying experiences. We also compared history of other SLEs in individuals with and without EDs, including many different types of events that one can encounter during a lifetime.

We found that many individuals with EDs have experienced bullying, abuse, and other stressful events, and that these experiences are more common in individuals with a lifetime ED history than controls. In our study, the association between SLEs and EDs was particularly strong for EDs characterized by binge-eating/purging behaviours (i.e. BN and BED), compared to restricting subtypes (i.e. AN). This is in line with prior studies on traumatic experiences and other stressful life events, and may point to a differential mechanism for binge-eating and purging behaviours than restriction. We also found evidence that multiple types of SLEs occur more often in ED individuals than controls, highlighting the importance of considering cumulative effects and re-victimisation in future studies. Our methods

and results are retrospective in nature and rely on self-report measures, which can be a potential source of bias and prevents us from drawing causal conclusions. However, we do believe that the observed findings have contributed to improve our understanding of the role of bullying and other stressful events as potential risk factors for EDs, and can be useful for future research and work towards improving prevention and treatment of these debilitating disorders.

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7. Paper I-III

I

Paper I:

Lie, S. Ø., Rø, Ø., & Bang, L. (2019). Is bullying and teasing associated with eating disorders? A systematic review and meta-analysis. International Journal of Eating Disorders, 52(5), 497-514. doi:10.1002/eat.23035

Received: 24 August 2018 | Revised and accepted: 11 January 2019

DOI: 10.1002/eat.23035

International Journal of EATING DISORDERS WILEY

REVIEW

Is bullying and teasing associated with eating disorders? A systematic review and meta-analysis

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Abstract

Objective: Involvement in bullying and teasing has been associated with adverse health outcomes, including eating disorders (EDs). The purpose of this systematic review and meta-analysis was to examine the association between bullying/teasing and EDs.

Method: A systematic search was conducted. We included research articles that examined the association between bullying/teasing (victimization and perpetration) and EDs. Studies were required to compare ED cases with a reference group. We performed a qualitative synthesis of included studies. Additionally, a random-effects meta-analysis of odds ratios were performed to compare rates of bullying/teasing victimization between cases and healthy controls.

Results: A total of 22 studies were included for review. Compared to healthy controls, those with EDs were significantly more likely to have been bullied and teased. Evidence of this association was particularly strong for bulimia nervosa and binge-eating disorder, but was more mixed for anorexia nervosa. It was unclear whether such victimization was more common in EDs compared to psychiatric controls. The meta-analysis showed that compared to healthy controls, those with EDs were twofold to threefold significantly more likely to have been teased about their appearance and bullied prior to onset of their ED. Few studies examined bullying perpetration. A number of methodological shortcomings of studies were noted.

Discussion: Being victimized through bullying and teasing is associated with EDs, and may constitute a risk factor. Our review underscores the need for more studies, and highlights gaps in the literature. As many patients have been victims of bullying and teasing, addressing such experiences in treatment may be valuable.

Resumen

Objetivo: El involucramiento en bullying y acoso ha sido asociado con efectos adversos en la salud, incluyendo los trastornos de la conducta alimentaria (TCA). El propósito de esta revisión sistemática y meta-análisis fue examinar la asociación entre bullying/acoso y TCAs.

Método: Una búsqueda sistemática fue realizada. Incluimos los artículos de investigación que examinaron la asociación entre bullying/acoso (victimización y perpetración) y los TCAs. Se requirieron estudios para comparar los casos de TCA con un grupo de referencia. Realizamos una síntesis cualitativa de los estudios incluidos. Adicionalmente, se realizó un meta-análisis de los efectos aleatorios de los odds ratios para comparar las tasas de victimización de acoso/bullying entre los casos y los controles sanos.

Resultados: Se incluyeron un total de 22 estudios para la revisión. En comparación con los controles sanos, las personas con TCA tenían una probabilidad significativamente mayor de haber sido acosadas o ser víctimas de bullying. La evidencia de esta asociación fue particularmente fuerte para BN y TpA, pero fue más mixta para AN. No estaba claro si esa victimización era más común en los TCA en comparación con los controles psiquiátricos. El meta-análisis mostró que, en comparación con los controles sanos, los que tenían TCA tenían de dos a tres veces más probabilidades de haber sido objeto de acoso sobre su apariencia y de haber sufrido bullying antes del inicio del TCA. Pocos estudios examinaron la perpetración de acoso. Se observaron una serie de deficiencias metodológicas de los estudios.

Discusión: Ser víctima de acoso y bullying está asociado con los TCAs, y puede constituir un factor de riesgo. Nuestra revisión subraya la necesidad de más estudios y destaca las lagunas en la literatura. Como muchos pacientes han sido víctimas de acoso y bullying, puede ser valioso abordar tales experiencias en el tratamiento.

KEYWORDS

anorexia nervosa, binge-eating disorder, bulimia nervosa, bullying, feeding and eating disorders, meta-analysis, risk factors, systematic review, teasing

1 | INTRODUCTION

Bullying refers to repeated negative and ill-intentioned behaviors directed against a person who has difficulty defending him or herself (Olweus, 1994). Such behaviors include being repeatedly physically attacked, stolen from, frozen out from social groups, subjected to lies and rumors, threatened, or teased. Although teasing is an ambiguous concept whose definition varies between contexts, hurtful, and repeated teasing is commonly regarded as a form of verbal bullying (Keltner, Capps, Kring, Young, & Heerey, 2001; Mills & Carwile, 2009). Recognizing the ambiguities which often make it difficult to equate teasing with verbal bullying, in the present article we consider teasing a construct related—but not necessarily equivalent—to bullying. As a result, we use the terms 'bullying' and 'teasing' separately.

While bullying and teasing typically occurs through physical acts, it can also occur through online forms of communication (e.g., social media), which is referred to as "cyber-bullying". Bullying in childhood and adolescence is common, with one meta-analysis reporting that 35% of adolescents are involved in traditional forms of bullying, while 15% are involved in cyber-bullying (Modecki, Minchin, Harbaugh, Guerra, & Runions, 2014). Verbal bullying—such as name-calling and teasing—are among the most common forms of bullying (Baldry, 1998; Rivers & Smith, 1994; Sweetingham & Waller, 2008).

Being bullied and teased during childhood or adolescence is associated with a range of adverse health outcomes, including psychosomatic problems (Gini & Pozzoli, 2013), emotional problems and depression (Reijntjes, Kamphuis, Prinzie, & Telch, 2010), psychotic symptoms (Schreier et al., 2009; van Dam et al., 2012), and suicide (Klomek, Sourander, & Gould, 2010; Van Geel, Vedder, & Tanilon, 2014). Adverse outcomes also extend into young adulthood, with higher rates of hospitalization and medication due to psychiatric illness (Copeland, Wolke, Angold, & Costello, 2013; Sourander et al., 2007; Sourander et al., 2009; Wolke, Copeland, Angold, & Costello, 2013). Ample of research has also shown that being teased specifically for one's appearance (i.e., body shape or weight) is associated with body dissatisfaction, dietary restraint, and bulimic behaviors (Menzel et al., 2010).

Those who bully and tease others also have adverse outcomes, including higher rates of antisocial personality disorder (Copeland et al., 2013) and offending (Farrington, Ttofi, & Lösel, 2011; Ttofi, Farrington, Lösel, & Loeber, 2011). Studies show that those who are both bullied and bully others are at particularly higher risk of later psychiatric illness and suicide compared to victims only or perpetrators only (Copeland et al., 2013; Kim & Leventhal, 2008; Winsper, Lereya, Zanarini, & Wolke, 2012).

Numerous studies (e.g., Fairburn et al., 1998; Gonçalves, Machado, Martins, Hoek, & Machado, 2016; Karwautz et al., 2011) have investigated bullying and teasing experiences among individuals with eating disorders (EDs). Such experiences could be associated with EDs in a number of ways. Being bullied or teased is associated with emotional problems (Reijntjes et al., 2010), which could contribute to the development or maintenance of EDs (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004). Also, bullying and teasing is most frequent during adolescence, coinciding with puberty and a time of significant psychological and biological maturation. As ED symptoms often debut during adolescence, disruptions in social relationships as a consequence of bullying and teasing may be of relevance to understand EDs (Duarte, Pinto-Gouveia, & Rodrigues, 2015; Striegel-Moore & Bulik, 2007). Furthermore, as bullying and teasing is social in nature, it can impart experiences of social submissiveness and isolation. Patients with EDs tend to show submissive behaviors and more unfavorable social comparisons than healthy controls (Troop, Allan, Treasure, & Katzman, 2003), which could be caused or exacerbated by bullying and teasing experiences. Last, teasing is often appearance-focused, leading to increased body dissatisfaction and dietary restraint (Menzel et al., 2010), which in turn are risk factors for ED onset (Stice, 2016).

Despite the interest in and support for the association between bullying/teasing and EDs, there has been no systematic review of the research findings to date. Providing such a review would be useful for our understanding of correlates and risk factors related to EDs. A previous systematic review focused on the association between appearance-related teasing and disordered eating, but did not consider bullying or ED diagnoses specifically. We therefore conducted the first systematic review and meta-analysis of studies examining the association between bullying/teasing and EDs. The purpose of our review was to provide a qualitative and quantitative synthesis of the research findings, and to provide an overview of the status of the research literature. Our primary aims were to evaluate the effect size of the association between: (a) bullying/teasing victimization and EDs, and (b) bullying/teasing perpetration and EDs.

2 | METHOD

2.1 | Identification of literature

A systematic search based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines (Liberati et al., 2009)

was conducted in collaboration with a Librarian at the University of Oslo Medical Library. There was no time restriction in the search and all articles published up to present day were considered (search conducted October 31, 2017). Index terms and keywords relating to EDs (e.g., eating disorders, anorexia, bulimia, binge-eating disorder), and bullying or teasing (e.g., cyberbullying, name-calling, victimization), were included in a systematic main search strategy. For a complete list of keywords see Supporting Information 1. Grey-literature including dissertations or theses were not included in the search.

The main search was performed using Ovid MEDLINE, psycINFO, and Scopus databases. An additional PubMed search was conducted to identify articles on risk factors for eating disorders that include bullying or teasing measures, but do not use "bullying" or related terms explicitly in title, abstract or keywords. This search was performed using "eating disorder*" as a major mesh-term and a title match for "risk factor" or "predictor". To complement our search strategy, we also performed backward citation chaining of all included articles and a previous meta-analysis focusing on appearance-related teasing, body dissatisfaction, and disordered eating (Menzel et al., 2010). Screening of titles and abstracts, and full-text reviews were performed by two reviewers (S.Ø.L and L.B screening and reviewing half each). Ten percent of all full-text reviews were performed independently by both reviewers, to estimate between-reviewers agreement in the decision to include/exclude articles.

2.2 | Study selection criteria

We included studies comparing rates of bullying and/or teasing (both victimization and perpetration) experiences between EDs and a reference group. Our systematic review was guided by the bullying definition provided by Olweus (1994), and teasing was considered a related construct. While we acknowledge the potential ambiguities in the definitions of and relationship between bullying and teasing, we included all studies measuring bullying or teasing experiences to cover all research relevant for our aims. We therefore did not require studies to strictly adhere to any given definition or operationalization of bullying and teasing. Instead, as part of our synthesis we comment on the operationalizations of bullying and teasing employed in studies.

Only original research articles quantitatively evaluating the association between EDs and bullying or teasing were included in the systematic review. These had to be published in peer-reviewed journals, with available full-text formats in English, Norwegian, Danish, or Swedish (full-texts in other languages were excluded). Studies were required to: (a) identify ED cases by evaluation of diagnostic criteria where cases were classified as fulfilling some or all criteria for clinical EDs, and (b) compare ED cases with an appropriate reference group, including both longitudinal and case–control comparisons.

Articles were excluded if they (a) did not investigate the association between EDs and bullying or teasing, (b) only focused on life events tangentially related to bullying or teasing such as sexual harassment or negative comments about appearance, and (c) only focused on ED-associated features such as body dissatisfaction or self-esteem.

2.3 | Qualitative synthesis

We performed a qualitative synthesis of all included studies, summarizing the evidence of an association between EDs and bullying/teasing victimization and perpetration. We distinguish between generic bullying (i.e., having been bullied), appearance-unrelated teasing (i.e., having been teased about something unrelated to one's appearance), and appearance-related teasing (i.e., having been teased about one's appearance), in line with the distinctions made in the included studies. Results of the qualitative synthesis are summarized in Table 1, where we provide study characteristics and main findings, including effect sizes (odds ratios [ORs] and Cohen's *d*'s). For some studies, we calculated *d's* ourselves to show magnitudes of effects for specific between-group comparisons. Some studies reported ORs in manners that would complicate interpretation across studies (e.g., log ORs or inverted ORs). For these, we calculated ORs ourselves so the direction is consistent across studies in Table 1 (i.e., OR > 1.0 signifies increased rates of bullying or teasing in EDs).

2.4 | Quantitative synthesis

A meta-analysis was performed to complement the qualitative synthesis. As there were few studies examining bullying or teasing perpetration, only studies of bullying or teasing victimization were included. Due to considerable heterogeneity across studies (e.g., type and timeframe of bullying and teasing, measures, sample characteristics), it was inappropriate to include all studies in a meta-analysis. Therefore, only studies that measured bullying or teasing victimization experiences which with some certainty occurred prior to ED onset were considered. This included studies that specifically measured bullying and teasing that occurred prior to ED onset, or in childhood. Furthermore, only comparisons between cases and healthy controls were included. This meta-analysis therefore provides tentative evidence towards bullying and teasing experiences as risk factors for EDs. We performed separate meta-analyses for generic bullying, appearance-unrelated teasing, and appearance-related teasing (three meta-analyses in total). Studies that measured current bullying or teasing victimization, had an unspecific timeframe of bullying and teasing (e.g., lifetime), or did not distinguish between generic bullying and appearance-unrelated or related teasing were not included. Some studies separately measured teasing perpetrated by peers and family. For these, we prioritized teasing by peers, as we reasoned that peer-teasing is arguably more likely to be carried out with the intent to hurt and therefore comparable to bullying. Moreover, a previous study showed that individuals with EDs are more frequently teased by peers compared to family (Sweetingham & Waller, 2008). Some studies also measured several specific types of teasing, such as teasing due to overweight, teasing about breasts, threatening teasing, and so forth. For these, we prioritized the most general form of teasing (e.g., appearance-related teasing as opposed to teasing about breasts) as the majority of studies measured teasing in this manner.

Statistical analyses were performed with RStudio statistical software version 1.1.447 (RStudio, 2016), using the meta for package (Viechtbauer, 2010). Meta-analyses were performed on log ORs calculated for the included studies. For studies reporting Cohen's *d*, we

TABLE 1 Studies of bullying and teasing in eating disorders sorted by diagnostic comparisons

Study, country	Design	Sample (n); mean age age-range, % female	Bullying/teasing measure	ED measure	Main findings (effect size)
Anorexia nervosa comparisons					
Fairburn, Cooper, Doll, and Welch (1999), UK[a]	Case–control	AN (67); 22 years HC (204); age-matched PC (102); age-matched Age-range: 16–35 years 100% female	ORFI Interview assessing generic bullying, appearance-unrelated teasing, and appearance-related teasing victimization prior to ED onset.	EDE SCID Clinician-derived	1. Rates of generic bullying victimization did not differ significantly between AN and HC (OR = 2.4), or AN and PC (OR = 1.0). 2. Rates of appearance-unrelated teasing victimization did not differ significantly between AN and HC (OR = 2.0), or AN and PC (OR = 2.2). 3. Rates of appearance-related teasing victimization did not differ significantly between AN and HC (OR = 1.5), or AN and PC (OR = 0.7).
Hilbert et al. (2014), Germany[b]	Case–control	AN (71); 26 years [BED (160); 31 years] [BN (66); 29 years] HC (323); 29 years All > = 18 years 100% female	ORFI Interview assessing generic bullying, appearance-unrelated teasing, and appearance-related teasing victimization prior to ED onset.	EDE SCID	1. Rates of bullying and teasing victimization (combined) were not significantly different between AN and HC (d = 0.15).
Kaltiala-Heino, Rimpelä, Rantanen, and Rimpelä (2000), Finland[b]	Cross-sectional	AN (35) [BN (93)] HC (8,659) Mean age 15 years for whole sample Age-range: 14–16 years 51% female	Author-specific 2-item measure Self-report assessing generic bullying victimization and perpetration in the ongoing school-term.	Author-specific self-report based on DSM-III	1. Rates of AN were not significantly different between bullying victims and those not involved in bullying (OR = 0.004). 2. Rates of AN were significantly higher for bullying perpetrators compared to those not involved in bullying (OR = 3.9*). 3. Rates of AN were significantly higher for those who were both victims and perpetrators of bullying compared to those not involved in bullying (OR = 6.4*).
Karwautz et al. (2011), UK[a]	Case–control	AN (128); 25 years HC sisters (128); 26 years Age-range:14–37 years 100% female	ORFI Interview assessing generic bullying, appearance-unrelated teasing, and appearance-related teasing victimization prior to ED onset.	EATATE	1. Rates of generic bullying victimization did not differ significantly between AN and HC sisters (OR = 2.75). 2. Rates of appearance-unrelated teasing victimization did not differ significantly between AN and HC sisters (OR = 1.0). 3. Rates of appearance-related teasing victimization were significantly higher for AN compared to HC sisters (OR = 3.0**). 4. Rates of teasing victimization about breasts did not differ significantly between AN and HC sisters (OR = 2.0).
Kim, Heo, Kang, Song, and Treasure (2010), South-Korea[a]	Case–control	AN Korean (52); 23 years HC Korean (108); 22 years Age-range: NA 100% female	CRQ Self-report assessing appearance-related teasing victimization prior to ED onset.	EDE-Q EATATE EDE	1. Frequency of being teased by mother about weight or shape was not significantly different between AN and HC (OR = 1.20). 2. Frequency of being teased by father about weight or shape was not significantly different between AN and HC (OR = 1.27). 3. Frequency of being teased by others about weight or shape was not significantly different between AN and HC (OR = 1.08).

(Continues)

TABLE 1 (Continued)

Study, country	Design	Sample (n); mean age age-range, % female	Bullying/teasing measure	ED measure	Main findings (effect size)
Machado, Goncalves, Martins, Hoek, and Machado (2014), Portugal[a]	Case–control	AN (86); 20 years HC (86); 20 years PC (68); 20 years Age-range: 13–33 years 100% female	ORFI Interview assessing appearance-unrelated teasing, appearance-related teasing, and threatening teasing victimization prior to ED onset.	SCID EDE	1. Rates of appearance-unrelated teasing victimization were significantly higher for AN compared to HC (OR = 3.30**) and PC (OR = 2.91*[c]). 2. Rates of appearance-related teasing victimization were significantly higher for AN compared to HC (OR = 4.31***) and PC (OR = 2.04*[c]). 3. Rates of threatening teasing victimization did not differ significantly between AN and HC (OR = 2.76); rates were not compared to PC.
Troop and Bifulco (2002), UK[a,b]	Case–control	AN (31); 28 years [BN (12); 26 years] HC (20); 29 years Age-range: NA 100% female	CECA Interview assessing generic bullying (verbal and physical) victimization prior to ED onset.	Clinician-derived based on ICD-10	1. Frequency of verbal and physical bullying victimization was not significantly different between AN and HC (*d*'s range from ±0.26 to ±0.59).
Bulimia nervosa comparisons					
Fairburn, Welch, Doll, Davies, and O'Connor (1997), UK[a]	Case–control	BN (102); 24 years HC (204); age-matched PC (102); age-matched Age-range: 16–35 years 100% female	ORFI Interview assessing generic bullying, appearance-unrelated teasing, and appearance-related teasing victimization prior to ED onset.	EDE SCID	1. Rates of generic bullying victimization were significantly higher for BN compared to HC (OR = 2.6*[c]), but not compared to PC (OR = 0.8). 2. Rates of appearance-unrelated teasing victimization did not differ significantly between BN and HC (OR = 1.2), or BN and PC (OR = 1.3). 3. Rates of appearance-related teasing victimization were significantly higher for BN compared to HC (OR = 2.5***), but not compared to PC (OR = 1.3).
Fosse and Holen (2006), Norway	Cross-sectional	BN (12) PC (95) Mean age 32 years for whole sample Age-range: 18–55 years 100% female	Author-specific 3-item measure Self-report assessing generic bullying victimization in childhood.	Author-specific self-report based on DSM-IV	1. Frequency of generic bullying victimization was significantly higher for BN compared to PC (*d* = 1.14***).
Gonçalves et al. (2016), Portugal[a]	Case–control	BN (60); 22 years HC (60); 22 years PC (60); 21 years Age-range: 14–38 100% female	ORFI Interview assessing appearance-unrelated teasing, appearance-related teasing, threatening teasing, and teasing by friends victimization prior to ED onset.	EDE SCID	1. Rates of appearance-unrelated teasing victimization did not differ significantly between BN and PC (OR = 0.36), significance test between BN and HC (OR = 1.27) was not performed. 2. Rates of appearance-related teasing victimization were significantly higher for BN compared to HC (OR = 7.43**[c]) and PC (OR = 2.89*[c]). 3. Rates of threatening teasing victimization did not differ significantly between BN and HC (OR = 6.0), or BN and PC (OR = 1.91). 4. Rates of teasing victimization by friends were significantly higher for BN compared to HC (OR = 5.4*[c]) and PC (OR = 2.1*[c]).

(Continues)

TABLE 1 (Continued)

Study, country	Design	Sample (n); mean age age-range, % female	Bullying/teasing measure	ED measure	Main findings (effect size)
Hilbert et al. (2014), Germany[b]	Case–control	[AN (71); 26 years] [BED (160); 31 years] BN (66); 29 years HC (323); 29 years All > = 18 years 100% female	ORFI Interview assessing generic bullying, appearance-unrelated teasing, and appearance-related teasing victimization prior to ED onset.	EDE SCID	1. Rates of bullying and teasing victimization (combined) were significantly higher for BN compared to HC (d = 0.56**).
Kaltiala-Heino, Rissanen, Rimpelä, and Rantanen (1999), Finland	Cross-sectional	BN girls (78); 15 years BN boys (13); 15 years HC (8,437); 15 years Age-range: 14–16 years 51% female	Author-specific 1-item measure Self-report assessing generic bullying victimization in the ongoing school-term.	Author-specific self-report based on DSM-III	1. Rates of BN were higher for girls who reported frequent bullying victimization compared to girls who did not report frequent victimization (OR = 3.3***). 2. Rates of BN were higher for boys who reported frequent bullying victimization compared to boys who did not report frequent victimization (OR = 13.1***).
Kaltiala-Heino et al. (2000), Finland[b]	Cross-sectional	[AN (35)] BN (93) HC (8,659) Mean age 15 years for whole sample Age-range: 14–16 years 51% female	Author-specific 2-item measure Self-report assessing generic bullying victimization and perpetration in the ongoing school-term.	Author-specific self-report based on DSM-III	1. Rates of BN were significantly higher for bullying victims compared to those not involved in bullying (OR = 3.0*). 2. Rates of BN were not significantly different between bullying perpetrators compared to those not involved in bullying (OR = 2.7). 3. Rates of BN were significantly higher for those who were both victims and perpetrators of bullying compared to those not involved in bullying (OR = 9.5*).
Kaltiala-Heino, Rissanen, Rimpelä, and Rantanen (2003), Finland	Cross-sectional	BN-type girls (810) BN-type boys (546) HC girls (3643) HC boys (3788) Mean age 15 years for whole sample Age-range: 14–16 years 51% female	Author-specific 1-item measure Self-report assessing generic bullying perpetration in the ongoing school-term.	Author-specific self-report based on DSM-III	1. Rates of BN-type pathology were significantly higher for girls who were frequent bullying perpetrators, compared to girls who were not (OR = 4.1***). 2. Rates of BN-type pathology were significantly higher for boys who were frequent bullying perpetrators, compared to boys who were not (OR = 2.5***).
Lehoux and Howe (2007), Canada	Case–control	BN (39); 25 years HC sisters (39); 26 years Age-range: 16–40 years 100% female	POTS weight-teasing subscale Self-report assessing lifetime appearance-related teasing victimization.	EDE	1. Frequency of appearance-related teasing victimization was significantly higher for BN compared to HC sisters (d = 0.88***).
Troop and Bifulco (2002), UK[a,b]	Case–control	[AN (31); 28 years] BN (12); 26 years HC (20); 29 years Age-range: NA 100% female	CECA Interview assessing generic bullying (verbal and physical) victimization prior to ED onset.	Clinician-derived based on ICD-10	1. Frequency of verbal and physical bullying victimization was not significantly different between BN and HC (d's range from −0.08 to −0.51).
Binge-eating disorder comparisons					
Duarte and Pinto-Gouveia (2017), Portugal[a]	Case–control	BED (73); 38 years HC (75); 28 years Age-range: 18–60 years 100% female	BIVES Self-report assessing appearance-related bullying and teasing victimization in childhood or adolescence.	EDE	1. Frequency of being bullied or teased by peers about appearance was significantly higher for BED compared to HC (d = 1.25***). 2. Frequency of being bullied or teased by parents about appearance was significantly higher for BED compared to HC (d = 0.60***).

(Continues)

TABLE 1 (Continued)

Study, country	Design	Sample (n); mean age age-range, % female	Bullying/teasing measure	ED measure	Main findings (effect size)
Fairburn et al. (1998), UK[a]	Case–control	BED (52); 25 years HC (104); age-matched PC (102); age-matched Age-range: 16–35 years 100% female	ORFI Interview assessing generic bullying, appearance-unrelated teasing, and appearance-related teasing victimization prior to ED onset.	EDE SCID	1. Rates of generic bullying victimization were significantly higher for BED compared to HC (OR = 5.5**), but not compared to PC (OR = 1.5). 2. Rates of appearance-unrelated teasing victimization did not differ significantly between BED and HC (OR = 0.5), or BED and PC (OR = 1.0). 3. Rates of appearance-related teasing victimization were significantly higher for BED compared to HC (OR = 2.4**), but not compared to PC (OR = 1.2).
Hilbert, Hartmann, Czaja, and Schoebi (2013), Germany	Prospective longitudinal	Baseline LOC (55) BED at follow-ups (14) Mean age 11 years for whole sample Age-range: 8–13 years 60% female	POTS weight-teasing subscale Self-report assessing lifetime appearance-related teasing victimization.	ChEDE	1. Frequency of appearance-related teasing victimization did not significantly predict subsequent development of BED over a two-year period (OR = 0.94).
Hilbert et al. (2014), Germany[b]	Case–control	[AN (71); 26 years] BED (160); 31 years [BN (66); 29 years] HC (323); 29 years All > = 18 years 100% female	ORFI Interview assessing generic bullying, appearance-unrelated teasing, and appearance-related teasing victimization prior to ED onset.	EDE SCID	1. Rates of bullying and teasing victimization (combined) were significantly higher for BED compared to HC (*d* = 0.39**).
Striegel-Moore, Dohm, Pike, Wilfley, and Fairburn (2002), USA[a]	Cross-sectional	BED (162); 30 years HC (251); age-matched PC (107); age-matched Age-range: 18–40 years 100% female	Oxford assessment Interview assessing generic bullying victimization prior to ED onset.	SCID EDE	1. Rates of generic bullying victimization were significantly higher for white BED women compared to white HC women (OR = 2.3**), but not compared to white PC women (OR = 1.38). 2. Rates of generic bullying victimization were significantly higher for black BED women compared to black HC women (OR = 3.3***), but not compared to black PC women (OR = 1.88).
Mixed EDs comparisons					
Elizathe, Arana, and Rutsztein (2016), Argentina	Cross-sectional	Mixed ED (17); 11 years HC (83); 11 years Age-range: 9–13 years 37% female	Author-specific 2-item measure Self-report assessing lifetime teasing victimization due to being overweight.	EDE	1. Rates of being teased due to being overweight were not significantly different between ED and HC (OR = 2.40).
Jackson & Chen (2007), China	Cross-sectional	Mixed ED (42); 16 years HC (42); 16 years Age-range: 12–21 years 86% female	POTS weight-teasing subscale Self-report assessing lifetime appearance-related teasing victimization.	EDDS	1. Frequency of appearance-related teasing victimization was significantly higher for ED compared to HC (*d* = 0.65**).
Krug et al. (2015), Spain/UK/Slovenia/Italy[a]	Case–control	Mixed ED (653); 27 years HC (611); 24 years Age-range: NA 100% female	CCQ Self-report assessing appearance-related teasing victimization before the age of 12.	SCID EATATE	1. Frequency of being teased about appearance by family during childhood/adolescence was significantly higher for ED compared to HC (*d* = 0.64***). 2. Frequency of being teased about appearance by peers during childhood/adolescence was significantly higher for ED compared to HC (*d* = 0.66***).

(Continues)

TABLE 1 (Continued)

Study, country	Design	Sample (n); mean age age-range, % female	Bullying/teasing measure	ED measure	Main findings (effect size)
Liu, Tseng, Chang, Fang, and Lee (2016), Taiwan[a]	Cross-sectional	Mixed ED (68) HC (374) Mean age 16 years for whole sample Age-range: 15–18 years 100% female	Author-specific 2-item measure Self-report assessing appearance-related teasing victimization for being overweight or underweight during the developmental stage.	SCID	1. Rates of teasing victimization due to overweight were significantly higher for ED compared to HC (OR = 2.99***). 2. Rates of teasing victimization due to underweight were not significantly different between ED and HC (OR = 0.16).
Mayes, Calhoun, Baweja, and Mahr (2015), USA	Case–control	Mixed ED (90); 14 years HC (186); 9 years PC (1,431); 9 years Age-range: 6–18 years 47% female	PBS Self-report assessing generic bullying victimization and perpetration during the past 2 months, rated by mothers.	Clinical interview	1. Maternal ratings of generic bullying victimization did not differ significantly between ED (30% were victims) and HC (17% were victims, effect size not reported). 2. Maternal ratings of generic bullying perpetration did not differ significantly between ED (7% were perpetrators) and HC (9% were perpetrators, effect size not reported).

Note. AN = anorexia nervosa; BED = binge-eating disorder; BIVES = body image victimization experiences scale; BN = bulimia nervosa; CCQ = cross-cultural risk factor questionnaire; CECA = childhood experiences of care and abuse interview; ChEDE = children's eating disorder examination; CRQ = childhood risk factors questionnaire; *d* = Cohen's *d* (0.20 = small, 0.50 = medium, 0.80 = large); DSM = diagnostic and statistical manual of mental disorders; EATATE = EATATE lifetime diagnostic interview; ED = eating disorders; EDDS = eating disorder diagnostic scale; EDE = eating disorder examination; EDE-Q = eating disorder examination-questionnaire; EDI = eating disorder inventory; HC = healthy controls; ICD = international classification of diseases; LOC = loss of control eaters; NA = not available; OR = odds ratio (positive OR signify higher rates in cases versus controls); ORFI = Oxford risk factor interview; PBS = pediatric behavior scale; PC = psychiatric controls; POTS = perception of teasing scale; SCID = structured clinical interview for diagnostic and statistical manual for mental disorders.

[a] Study was included in meta-analyses.

[b] Study included separate comparisons for multiple ED diagnoses, and so is repeated multiple times throughout the table.

[c] This comparison was statistically significant at the specified alpha-level, but was not considered significant in the original study as authors lowered (i.e., more stringent) their alpha-level to correct for multiple comparisons.

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

converted *d* to OR. As a result, note that the effect sizes in Table 1 may not be identical to the ones presented in the quantitative synthesis. We then performed random-effects meta-analyses, which accounts for between-study heterogeneity by allowing variance both between and within studies (Borenstein, Hedges, Higgins, & Rothstein, 2010). Three of the included studies included overlapping healthy control samples (Fairburn et al., 1997; Fairburn et al., 1998; Fairburn et al., 1999) and were therefore statistically dependent. To account for this dependency, the covariances between the log ORs in these studies were computed and incorporated into the models.

We present model results as ORs with 95% confidence intervals. For each model, heterogeneity between studies was estimated using Cochran *Q* (reported with *p* value) and I^2, and evaluated as low (25%), moderate (50%), or high (75%) heterogeneity. Due to the modest number of effect sizes included for each meta-analysis, we were unable to consider moderators such as ED diagnosis, or perform tests of publication bias which are inappropriate for small meta-analyses (Ioannidis & Trikalinos, 2007).

2.5 | Review structure

Our review is structured to provide a synthesis of the association between bullying/teasing and EDs. First, we provide an overview of characteristics and methodological quality of studies. Second, we provide a qualitative and quantitative synthesis on bullying and teasing victimization. Third, we provide a qualitative synthesis on bullying and teasing perpetration. Finally, a discussion of the main findings and methodological considerations is provided.

3 | RESULTS

3.1 | Articles identified

The systematic database search yielded a total of 868 articles, and an additional 294 through the supplementary PubMed mesh-term search. After removal of duplicates, titles and abstracts of all 741 remaining records were screened for eligibility. A total of 252 articles were deemed relevant for full text assessment. Three additional articles were identified through other sources. The random selection of 10% of all full texts that were reviewed independently by both reviewers yielded an agreement rate of 100%.

A total of 22 studies met the inclusion criteria and were included in the systematic review. All included articles were written in English. The main reasons for exclusion were lack of an appropriate diagnostic ED group, no measure of bullying, or not investigating the association between bullying and EDs (see PRISMA diagram in Figure 1).

3.2 | General study characteristics and methodological quality

Table 1 summarizes the study characteristics and main findings of studies included in the review. Twenty-one studies investigated bullying or teasing victimization, and only three assessed bullying or teasing perpetration. Overall sample size across all studies was 15,356 unique individuals, ranging from the smallest study of 55 participants (Hilbert et al., 2013) to a population study of 8,787 individuals (Kaltiala-Heino et al., 2000). The total number of ED cases was 3,448, which included 850 with anorexia nervosa (AN), 1906 with bulimia nervosa (BN), 471 with binge-eating disorder (BED), 204 with eating disorders not otherwise specified, and 17 in unspecified ED groups. No studies included other eating disorders. The total number of healthy controls was 10,062, and 1,863 for psychiatric controls.

Four of the included studies comprised adult samples, seven comprised child/adolescent samples, eight comprised both child/adolescent and adult samples, and age-range was not available for the remaining three studies (mean age was >18 years for these studies). Seven studies included males, but females were the majority in all but two studies (Elizathe et al., 2016; Mayes et al., 2015). Thirteen studies were classified as having case–control designs, eight having cross-sectional designs (with subsequent differentiation between cases and controls), and one having a prospective longitudinal design. All studies included cross-sectional data and analyses (i.e., compared two or more groups at one point in time), with the exception of the longitudinal study by Hilbert et al. (2013) which used longitudinal data and analyses. A healthy control group was included in 20 of the 22 included studies; seven of these included an additional psychiatric control group. One study included a psychiatric control group only (Fosse & Holen, 2006), and one longitudinal study (Hilbert et al., 2013) had no separate control group as they reported within-group comparisons. Three articles were based on the same overall sample (Kaltiala-Heino et al., 1999; Kaltiala-Heino et al., 2000; Kaltiala-Heino et al., 2003), but all were included as they reported different associations in each article (e.g., different EDs). Three studies included overlapping healthy and psychiatric control samples (Fairburn et al., 1997; Fairburn et al., 1998; Fairburn et al., 1999), but all were included as each study comprised unique cases. The majority of studies compared specific EDs (i.e., AN or BN) separately with control groups, but some compared a mixed ED group (referred to as "mixed EDs") with control groups.

Criteria in the "Newcastle-Ottawa Scale for assessing the quality of nonrandomized studies in meta-analyses" (Wells et al., 2018) were used to evaluate methodological quality of the included research. The methodological quality of included studies varied. Sample sizes differed greatly, and the majority of studies included <100 cases in their respective ED groups, which limits the statistical power of the studies. Most studies had adequate case definition, using established measures to evaluate the presence of DSM or ICD criteria. Sixteen studies used interviews to establish case status, five used self-reports, and one did not specify. Some studies (e.g., Fosse & Holen, 2006; Kaltiala-Heino et al., 1999; Kaltiala-Heino et al., 2000; Kaltiala-Heino et al., 2003) used author-specific self-report measures, but these were based on diagnostic criteria. A few studies (e.g., Elizathe et al., 2016; Kaltiala-Heino et al., 2003) included broadly-defined EDs as cases. These were nonetheless included as cases fulfilled some of the core diagnostic criteria for EDs. The representativeness of included cases is difficult to ascertain; many recruited cases from clinical settings which may not be representative of the population at large. Cross-sectional studies identified cases from community samples, which may ensure better representativeness but these cases could differ from ones recruited from clinical settings. Additionally, cases in some studies were recovered from their ED.

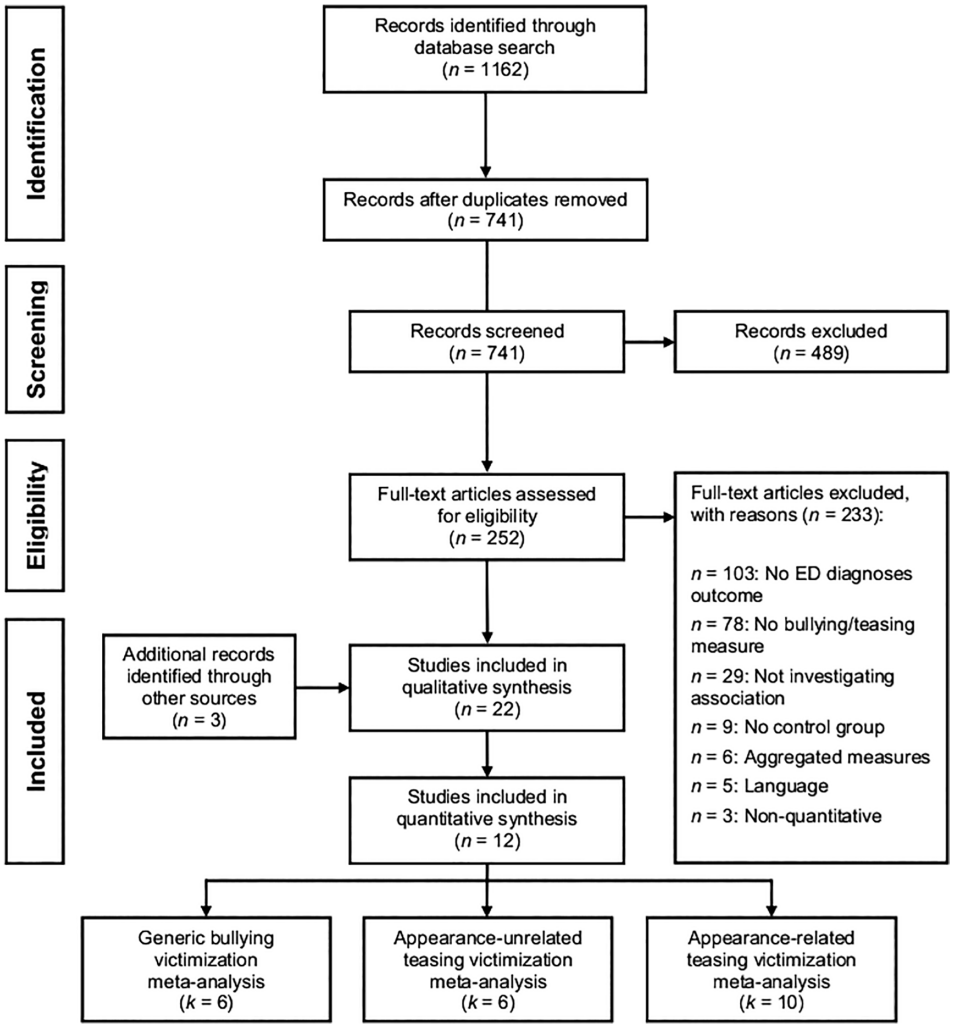

FIGURE 1 PRISMA flow diagram of included and excluded studies. ED = eating disorders

Healthy controls were most commonly recruited from the community, except for two studies which used healthy sisters of cases as controls (Karwautz et al., 2011; Lehoux & Howe, 2007). Some studies also included psychiatric controls recruited from treatment centers. All studies had adequate definition of controls; this was straightforward and involved a failure to meet the case definition. Studies typically controlled for, or matched groups for age and gender. Most studies had a case–control design which precluded calculation of response rates. However, response-rates were satisfactory (78–97%) in the cross-sectional studies that reported this (Fosse & Holen, 2006; Kaltiala-Heino et al., 1999; Kaltiala-Heino et al., 2000; Kaltiala-Heino et al., 2003; Liu et al., 2016; Striegel-Moore et al., 2002). The only longitudinal study (Hilbert et al., 2013) reported satisfactory (92–98%) retention rates.

The studies used the same measure to assess bullying or teasing experiences for both cases and controls. Measures varied considerably with regard to the timeframe (e.g., current, lifetime, prior to ED onset, or unspecified), type (e.g., generic bullying, unspecific teasing, teasing about appearance), and perpetrator (e.g., unspecified, by peers, by family) of bullying and teasing. Of the measures that assessed appearance-related teasing, the nature of the teasing was either specifically related to being overweight (e.g., called names like "fatso") or unspecific and about appearance in general (e.g., teased about one's body weight or shape). Only one study specifically assessed teasing due to being underweight (Liu et al., 2016). Most measures assessed multiple forms of bullying or teasing. The quality of these measures varied, and was poor for several. A total of 12 different measures of bullying and/or teasing were used. The Oxford Risk Factor Interview (Fairburn et al., 1997) was used in seven of the studies to measure history of bullying or teasing victimization occurring prior to ED onset, and was the most comprehensive measure as it included separate items assessing generic bullying, appearance-unrelated teasing, and appearance-related teasing. Several studies used 1–3 single item yes/no questions to assess bullying or teasing victimization. No studies measured cyber-bullying.

Many studies did not include a definition of bullying or teasing in their measures, and studies typically used the terms "bullying" or "teasing" without further definition. Also, many studies did not distinguish between different types of bullying, making it unclear what type of bullying experiences participants reported (e.g., verbal, physical, etc.). It is therefore unclear whether the responses of participants converge on similar conceptualizations of bullying or teasing, as participants may have been unsure what behaviors these terms refer to. These shortcomings raise concerns regarding whether studies

measured the same types of experiences. None of the studies defined teasing as having to be intended to hurt, repeated, or difficult to defend against. Therefore, bullying and teasing should be considered related but separate experiences for the remainder of this review.

3.3 | Victimization: Are individuals with EDs more frequently bullied and teased?

Of the 22 studies included, 21 examined bullying or teasing victimization. Table 1 provides details concerning each of the included studies, along with their main findings. Extraction of prevalence estimates (for descriptive purposes) of victimization was possible for 10 studies. Based on these, an average of 17% (9–30%) of individuals with EDs, 10% (4–17%) of healthy controls, and 17% (13–21%) of psychiatric controls reported having been bullied at some point. An average of 23% (8–61%) of individuals with EDs, 16% (7–29%) of healthy controls, and 24% (12–41%) of psychiatric controls reported having been teased about something unrelated to their appearance at some point. An average of 47% (36–59%) of individuals with EDs, 24% (13–37%) of healthy controls, and 33% (28–42%) of psychiatric controls reported having been teased about their appearance at some point.

3.3.1 | Qualitative synthesis

A total of 21 studies compared rates of bullying and teasing victimization between EDs and a control group. Twenty studies included a healthy control group, and eight studies included a psychiatric control group. An AN group was included in seven studies (with 21 relevant effect sizes), a BN group was included in eight studies (with 21 relevant effect sizes), a BED group was included in five studies (with 14 relevant effect sizes), and a mixed ED group was included in five studies (with seven relevant effect sizes). Of all studies, 15 (71%) reported significantly higher rates of some form of bullying or teasing victimization in EDs compared to a control group, while six (29%) reported no significant differences between groups.

For AN, findings were mixed, but pointed in the direction of increased victimization compared to healthy controls. While history of being a victim of teasing both unrelated and related to appearance was more common (ORs between 1.0–4.3) among individuals with AN compared to healthy controls, effect sizes were mostly nonsignificant (Fairburn et al., 1999; Hilbert et al., 2014; Kim et al., 2010), with some exceptions (Karwautz et al., 2011; Machado et al., 2014). Similarly, although some studies showed that history of being bullied were more than twice as common among individuals with AN compared to healthy controls, none of the effect sizes reached significance (Fairburn et al., 1999; Kaltiala-Heino et al., 2000; Karwautz et al., 2011; Troop & Bifulco, 2002). There was some evidence to suggest rates of teasing victimization were significantly higher for AN compared to psychiatric controls (ORs between 0.70–2.91), but evidence was scarce and mixed (Fairburn et al., 1999; Machado et al., 2014).

For BN, there was a clear association with bullying and teasing victimization. Compared to healthy controls, individuals with BN were significantly more likely to have been teased about their appearance and bullied (Fairburn et al., 1997; Gonçalves et al., 2016; Hilbert et al., 2014; Kaltiala-Heino et al., 1999; Kaltiala-Heino et al., 2000; Lehoux & Howe, 2007), with medium to large effect sizes (ORs between 2.50–7.43, *d*'s between 0.56–0.88). Although rates of appearance-unrelated teasing victimization were also higher for BN cases compared to healthy controls (ORs between 1.20–6.0), these differences were not significantly different (Fairburn et al., 1997; Gonçalves et al., 2016). Rates of bullying and teasing victimization were significantly higher for BN compared to psychiatric controls according to some sources, but evidence was mixed (e.g., ORs between 0.80 and 2.89, Fairburn et al., 1997; Fosse & Holen, 2006; Gonçalves et al., 2016).

Similar findings were obtained for BED. Compared to healthy controls, individuals with BED were significantly more likely to have been teased about their appearance and bullied (Duarte & Pinto-Gouveia, 2017; Fairburn et al., 1998; Hilbert et al., 2014; Striegel-Moore et al., 2002), with most effects sizes of medium and large magnitudes (ORs between 2.30 and 5.50, *d*'s between 0.39 and 1.25). Only one study examined rates of appearance-unrelated teasing specifically, which were nonsignificantly lower in BED compared to healthy controls (Fairburn et al., 1998). A few studies showed slightly higher rates of bullying and teasing victimization among individuals with BED compared to psychiatric controls (ORs between 1.00–1.88), but differences were nonsignificant (Fairburn et al., 1998; Striegel-Moore et al., 2002).

For studies of mixed ED groups, findings showed that a history of being teased about appearance was significantly more common among these individuals compared to healthy controls (Elizathe et al., 2016; Jackson & Chen, 2007; Krug et al., 2015; Liu et al., 2016), with medium effect sizes (*d*'s between 0.64 and 0.66, ORs between 2.40 and 2.99). No studies investigated rates of appearance-unrelated teasing in a mixed ED group. Only one study (Mayes et al., 2015) considered bullying, showing that although history of being victimized in the mixed ED group was almost twice as high compared to healthy controls, the difference was not significant. This study also showed that rates of bullying victimization were lower for EDs compared to other psychiatric disorders.

Some studies also directly compared rates of bullying and teasing victimization between specific ED subtypes. There was some evidence to suggest that while rates of bullying and teasing victimization were similar between bulimic (BN, BED, and AN-binging/purging subtype) ED subtypes, they were significantly higher (*d*'s between 0.23 and 0.40) for bulimic compared to restrictive (i.e., AN and AN-restricting subtype) ED subtypes (Fairburn et al., 1998; Hilbert et al., 2014; Krug et al., 2015). However, not all studies supported this (Fairburn et al., 1999; Karwautz et al., 2011; Troop & Bifulco, 2002).

In summary, studies generally showed that a history of having been bullied or teased was significantly more common among individuals with EDs compared to healthy controls. This association had the strongest support for studies of BN, BED, or mixed ED groups, where effect sizes were generally of medium to large magnitudes. Evidence was more mixed in AN, where effect sizes tended to be smaller and nonsignificant, although findings pointed in the direction of increased teasing victimization in AN compared to healthy controls. While rates of generic bullying and appearance-related teasing victimization was consistently higher in EDs compared to healthy controls (except for AN), evidence was weaker and more mixed for appearance-unrelated teasing. Whether rates of bullying and teasing were higher among EDs compared to psychiatric controls was unclear, as evidence was scarce and mixed. Direct

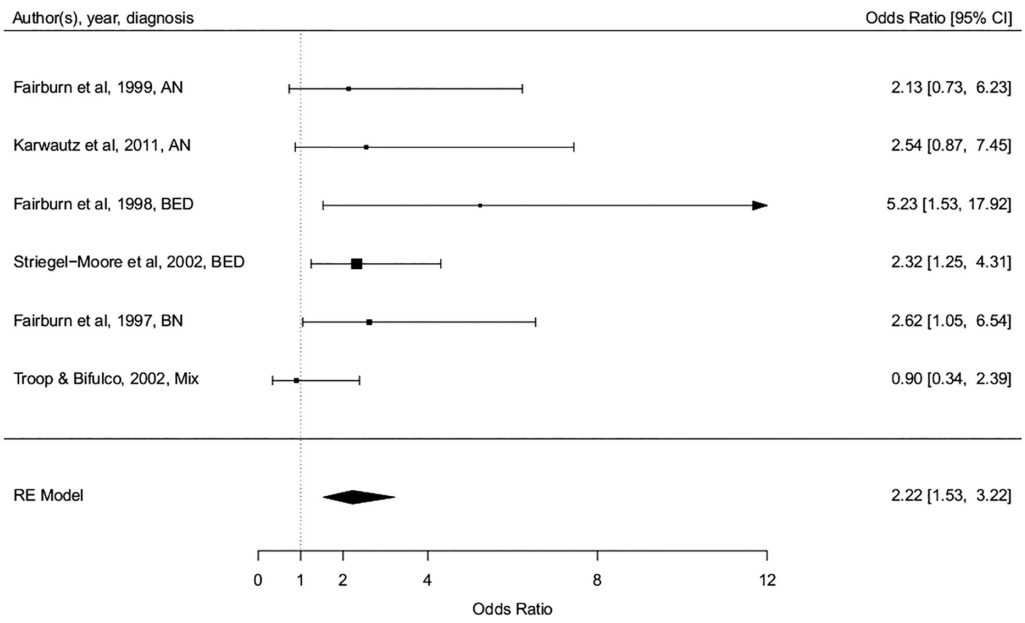

FIGURE 2 Summary effects of association between generic bullying victimization and eating disorders. AN = anorexia nervosa; BED = binge-eating disorder; BN = bulimia nervosa; CI = confidence interval; RE = random effects

comparisons between specific EDs raised the possibility that history of being bullied or teased is more common among bulimic as opposed to restricting ED subtypes, although findings were inconsistent.

3.3.2 | Quantitative synthesis

A total of 12 studies were eligible for the meta-analyses, all investigating rates of bullying and teasing victimization prior to ED onset. Data suitable for the comparison of generic bullying victimization rates between EDs and healthy controls were available from six studies, including 494 cases and 516 controls (Fairburn et al., 1997; Fairburn et al., 1998; Fairburn et al., 1999; Karwautz et al., 2011; Striegel-Moore et al., 2002; Troop & Bifulco, 2002). The random-effects pooled OR was 2.22 (CI: 1.53–3.22), which was statistically significant ($p < 0.0001$). Minimal heterogeneity was present ($I^2 = 0\%$, $p = 0.37$). See Figure 2 for a forest plot of the results.

Data suitable for the comparison of appearance-related teasing victimization rates between EDs and healthy controls were available from 10 studies, including 1,341 cases and 1,646 controls (Duarte & Pinto-Gouveia, 2017; Fairburn et al., 1997; Fairburn et al., 1998; Fairburn et al., 1999; Gonçalves et al., 2016; Karwautz et al., 2011; Kim et al., 2010; Krug et al., 2015; Liu et al., 2016; Machado et al., 2014). The random-effects pooled OR was 2.93 (CI: 1.97–4.37), which was statistically significant ($p < 0.0001$). High heterogeneity was present ($I^2 = 82.89\%$, $p < 0.0001$). See Figure 3 for a forest plot of the results.

Data suitable for the comparison of appearance-unrelated teasing victimization rates between EDs and healthy controls were available from six studies, including 495 cases and 478 controls (Fairburn et al., 1997; Fairburn et al., 1998; Fairburn et al., 1999; Gonçalves et al., 2016; Karwautz et al., 2011; Machado et al., 2014). The random-effects pooled OR was 1.50 (CI: 0.88–2.55), which was not statistically significant ($p = 0.13$). Moderate heterogeneity was present ($I^2 = 63.70\%$, $p = 0.02$). See Figure 4 for a forest plot of the results.

In summary, random-effects pooled ORs of both generic bullying and appearance-related teasing victimization prior to ED onset were twofold to threefold higher among individuals with EDs compared to healthy controls. Although the random-effects pooled OR of appearance-unrelated teasing victimization prior to ED onset indicated increased exposure among individuals with EDs compared to healthy controls, this effect was non-significant. These results are consistent with the overall qualitative synthesis.

3.4 | Perpetration: Do individuals with EDs more frequently bully and tease others?

Of all 22 articles included in this review, only three considered perpetration; all in the context of generic bullying behaviors. Table 1 provides details concerning these studies. All three studies included a healthy control group, and one study included an additional psychiatric control group. An AN group was included in one study (with two relevant effect sizes), a BN group was included in two studies (with four relevant effect sizes), and a mixed ED group was included in one study (with one relevant effect size).

Two of the articles described large population studies based on the same overall sample, but used different case definitions. One of these (Kaltiala-Heino et al., 2000) reported that rates of both BN and AN were higher among those who bullied others compared to those not involved in bullying (ORs 2.70 and 3.90), but the effect size was only significant for AN. However, the second study (Kaltiala-Heino et al., 2003) found that both boys and girls who bullied others were significantly more likely to have broadly-defined BN (ORs 2.5 and 4.1), compared to those who were not categorized as bullies. There were some evidence to suggest that those who were both bullied and

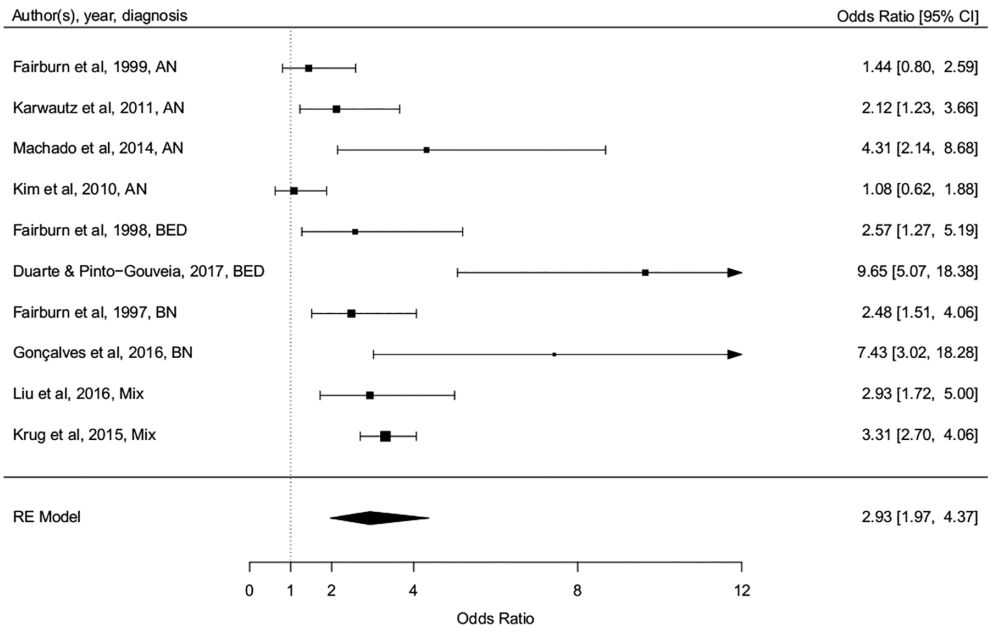

FIGURE 3 Summary effects of association between appearance-related teasing victimization and eating disorders. AN = anorexia nervosa; BED = binge-eating disorder; BN = bulimia nervosa; CI = confidence interval; RE = random effects

bullied others were particularly more likely to have AN (OR = 6.4) and BN (OR = 9.5) compared to those not involved in bullying (Kaltiala-Heino et al., 2000). In contrast, the last study found that rates of bullying others were lower in a mixed ED group compared to both healthy controls and psychiatric controls (Mayes et al., 2015). Of note, this study differed from others in that rates of bullying perpetration were based on maternal reports of their children's behavior.

In summary, based on the scarce body of evidence, the association between EDs and bullying perpetration was unclear. Some evidence suggests increased rates of bullying perpetration among individuals with EDs.

4 | DISCUSSION

This is the first systematic review and meta-analysis of the association between bullying, teasing, and EDs. Our review showed that individuals with EDs were significantly more likely to have been bullied and teased compared to healthy controls. This association was particularly strong for BN and BED, while evidence was more mixed for AN. Meta-analysis showed that compared to healthy controls, individuals with EDs were twofold to threefold significantly more likely to have been teased about their appearance and bullied prior to onset of their ED. However, it was unclear whether victimization was more common in EDs compared to psychiatric controls. Based on a scarce body of evidence, the association between EDs and bullying perpetration was unclear. A number of methodological shortcomings of the available studies were noted.

The main finding of this review was that a history of being bullied and teased is significantly more common among individuals with EDs compared to healthy controls. This is in line with previous studies showing an association between bullying and teasing victimization and ED symptoms (Copeland et al., 2015; Menzel et al., 2010). Rates of both general bullying and appearance-related teasing victimization were elevated in EDs compared to healthy controls, while evidence was more mixed for appearance-unrelated teasing. This indicates that being teased about one's appearance is more strongly associated with EDs, compared to general teasing experiences.

In terms of specific EDs, this main finding was most strongly supported for BN and BED, with medium to large effect sizes. Evidence was more mixed in AN, where effect sizes tended to be smaller and nonsignificant. However, studies generally showed that history of being teased was more common in AN compared to healthy controls, raising the possibility that many studies of AN were underpowered. Although mixed, there was some evidence to suggest that history of being bullied and teased were significantly more frequent in bulimic (i.e., BN, BED, AN-binging/purging subtype) as opposed to restricting (i.e., AN, AN-restricting subtype) ED subtypes (Hilbert et al., 2014; Krug et al., 2015). Such diagnostic differences are similar to previous studies reporting that adverse life events, such as childhood maltreatment, tend to be more strongly associated with bulimic ED subtypes (Caslini et al., 2016; Molendijk, Hoek, Brewerton, & Elzinga, 2017). This is also supported by findings from nonclinical populations that report stronger associations between bullying victimization and bulimic symptoms than between bullying victimization and dietary restraint (Kwan, Gordon, Minnich, Carter, & Troop-Gordon, 2017). Also, children and adolescents who are overweight or obese are bullied and teased more frequently than their normal-weight peers (Janssen, Craig, Boyce, & Pickett, 2004). As binge-eating is associated with overweight and obesity (De Zwaan, 2001), this could relate to the diagnostic differences.

Many of the studies included in our review retrospectively investigated rates of bullying and teasing victimization prior to ED onset.

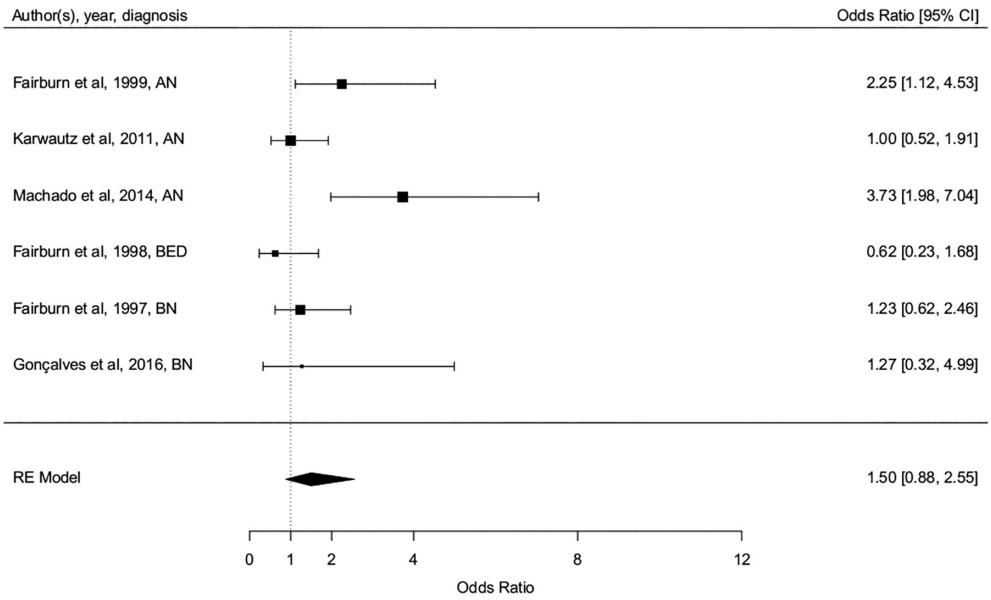

FIGURE 4 Summary effects of association between appearance-unrelated teasing victimization and eating disorders. AN = anorexia nervosa; BED = binge-eating disorder; BN = bulimia nervosa; CI = confidence interval; RE = random effects

Given the lack of longitudinal studies, such studies provide preliminary evidence of bullying and teasing as risk factors that predates the onset of EDs. Our meta-analysis of these studies showed that both generic bullying and appearance-related teasing victimization prior to ED onset were twofold to threefold significantly higher among individuals with EDs compared to healthy controls. A similar meta-analysis of appearance-unrelated teasing was not significant, although the pooled OR was in the direction of increased exposure among EDs. These results provide preliminary evidence that being teased about one's appearance or bullied may constitute risk factors for EDs. However, it is important to acknowledge that retrospective studies of bullying and teasing victimization prior to ED onset rely on the definitions of the events involved (i.e., does ED onset reflect time of diagnosis or time when core symptoms emerged), and on participants' ability to remember and report the timing of these. Therefore, there is some uncertainty regarding whether these studies managed to accurately record the timing of the victimization events and ED onset, and thus determine whether bullying or teasing contributed to the development of EDs. A significant number of studies in our meta-analysis used the Oxford Risk Factor Interview which defined ED onset as the age at which the first noteworthy and persistent behavioral characteristic of an ED began (Fairburn et al., 1997). Other studies used measures with less precise wordings. Considering these limitations, longitudinal studies are needed to confirm the results of our meta-analysis.

Several potential pathways might account for the association between bullying/teasing and EDs. Being victimized through bullying and teasing constitutes a considerable stressful event, and can lead to emotional problems (Reijntjes et al., 2010) which in turn can increase risk for EDs (Jacobi et al., 2004). Being teased about one's weight might expose individuals to feedback regarding their body which could lead to a preoccupation with appearance, increased social comparison, and body dissatisfaction. Both appearance-related teasing (Menzel et al., 2010) and unfavorable social comparisons (Myers & Crowther, 2009) are associated with body dissatisfaction, which is a robust risk factor for EDs (Jacobi et al., 2004; Stice, 2002). Related to this, it is interesting to note that our review showed that there was stronger evidence of an association between appearance-related teasing and EDs, compared to appearance-unrelated teasing and EDs.

However, it is important to acknowledge that there is likely to be a reciprocal relationship between bullying, teasing, and psychiatric disorders. For example, individuals with pre-existing psychiatric or developmental difficulties can be at higher risk of being victimized because they are viewed as "odd" or "different" by peers (Arseneault, Bowes, & Shakoor, 2010; Reijntjes et al., 2010). A recent longitudinal study found that disordered eating behavior in adolescence preceded bullying victimization by peers in a non-clinical population, underscoring the importance of considering bidirectional relationships between bullying/teasing and EDs (Lee & Vaillancourt, 2018).

In our review, it was less clear whether rates of bullying and teasing victimization were more common in EDs compared to other psychiatric disorders, as the studies examining this yielded inconsistent results (Fairburn et al., 1997; Fairburn et al., 1998; Fairburn et al., 1999; Fosse & Holen, 2006; Machado et al., 2014; Mayes et al., 2015; Striegel-Moore et al., 2002). Bullying and teasing victimization has been shown to also increase risk of other adverse health outcomes, such as emotional problems and depression (Reijntjes et al., 2010), and suicide (Klomek et al., 2010; Van Geel et al., 2014).

Only three of the included studies investigated perpetration, all in the context of generic bullying behaviors. Due to the scarce body of evidence, the association between bullying perpetration and EDs was unclear. Evidence from two large population-based studies (comprising the same overall sample) pointed in the direction of increased rates of bullying perpetration among individuals with EDs compared

to healthy controls (Kaltiala-Heino et al., 2000; Kaltiala-Heino et al., 2003). This is in line with a previous longitudinal study showing that childhood bullies have increased risk of ED symptoms (Copeland et al., 2015). In contrast, one study in our review found no such association between EDs and perpetration (Mayes et al., 2015). This study however, was small in comparison, included a very young sample, and was based on maternal ratings of their child's behavior. If bullying perpetration and EDs are associated, the direction and underlying mechanisms of this potential relationship is unclear. It is possible that individuals who struggle psychologically (e.g., with low self-esteem or EDs) resort to bullying others as a way to acquire social dominance, to overcome their own feelings of inferiority. However, a previous longitudinal study indicated that the act of bullying others itself increases ED symptoms (Copeland et al., 2015). This underscores the need to consider potential bidirectional relationships between bullying perpetration and EDs. Only one study (Kaltiala-Heino et al., 2000) examined individuals who were both victims and perpetrators of bullying. These individuals where significantly more likely to fulfil criteria for AN and BN compared to those who were neither a victim nor perpetrator, with particularly large effect sizes. This is in line with previous research showing that those who are both victims and perpetrators of bullying are at particularly high risk for adverse outcomes (Copeland et al., 2013; Winsper et al., 2012). Considering the lack of studies investigating bullying perpetration in EDs, more studies are needed.

None of the studies in our review investigated associations between cyber-bullying and EDs, which presents a considerable gap in the research literature. Such behaviors are common (Modecki et al., 2014), and have been linked to adverse mental health outcomes (Bannink, Broeren, van de Looij–Jansen, de Waart, & Raat, 2014; Goebert, Else, Matsu, Chung-Do, & Chang, 2011; Hinduja & Patchin, 2010). To keep up with the emergence of such new forms of bullying and teasing, future studies of bullying and EDs should include measures of cyber-bullying.

Our review highlighted a number of methodological shortcomings of the literature. Many studies were based on small sample sizes limiting their statistical power. Several studies did not differentiate between specific EDs, which according to our review may impact results. The lack of longitudinal studies was also identified as a limitation of the available evidence. The low prevalence rates of EDs in the general population presents a major challenge to longitudinal studies of risk factors for EDs. However, retrospective research designs that include measures able to assess time of onset of both bullying/teasing experiences and EDs can give a good indication of the temporal relation between events. Many of the retrospective studies in our review included such measures, which is a strength. However, such measures are vulnerable to recollection bias. However, as such retrospective studies are limited in their ability to establish temporal precedence of events (e.g., due to recollection bias), longitudinal studies are needed.

The biggest shortcoming of many of the included studies was the lack of comprehensive measures of bullying and teasing, and ambiguities in the definition of these terms. Many of the studies in our review used only a few items to assess bullying, often with a yes/no response option. Such short measures are likely unable to appropriately assess the presence, type, duration and severity of bullying, which may all be important factors that affect the development of psychiatric symptoms. Also, many of the bullying measures did not include a specific definition of the term "bullying". Without explicit reference to a definition of bullying, it is unclear whether participants' responses reflect experiences in line with formal bullying definitions. A previous meta-analysis also highlighted the variations and ambiguities in the terms used to characterize peer victimization, including bullying and teasing (Reijntjes et al., 2010). Furthermore, many studies did not differentiate between different types of bullying (e.g., physical, verbal, etc.).

A significant proportion of the articles in this review measured teasing. Teasing often has connotations of being less severe than bullying, and without a clear definition there is a risk of potential ambiguity which may affect participants' responses. In our meta-analyses, heterogeneity was minimal for effect sizes related to generic bullying, and considerably higher for effect sizes related to teasing, which could reflect some of these ambiguities. Additionally, studies varied in the extent to which they documented the exact nature of the appearance-related teasing measured. Some measured unspecific appearance-related teasing which included teasing about body or appearance in general, while others measured teasing specifically due to being overweight. One meta-analysis found that use of the term "teasing" (as opposed to "bullying") increased prevalence rates of such events, possibly due to the fact that individuals may be unsure how to characterize teasing and distinguish it from bullying (Modecki et al., 2014). One study showed that children/adolescents viewed bullying as teasing that gets out of hand (Guerra, Williams, & Sadek, 2011). Ambiguities of the teasing concept have been discussed previously (Keltner et al., 2001; Mills & Carwile, 2009). However, it is clear that teasing can constitute serious experiences with adverse outcomes, as highlighted in our review. Future studies would benefit from including definitions of bullying and/or teasing in their measures, to reduce the ambiguity of these concepts.

Our review has a number of strengths. We performed a systematic search spanning several databases, using a multitude of keywords to capture all relevant articles. This proved necessary, as many articles did not specifically include "bullying" or "teasing" in the title or abstract, or among the keywords. We also performed backward citation chaining of all included articles. Moreover, we used clear inclusion criteria to ensure we only included studies that examined associations between clinical EDs and bullying or teasing. Lastly, we supplemented our qualitative synthesis with a meta-analysis.

Our review has a number of limitations. First, we decided to focus on clinical EDs as opposed to ED-related symptoms. This entailed an exclusion of a sizable body of literature that examines the relationship between bullying and ED-related features, such as body dissatisfaction. However, this is covered in a previous meta-analysis (Menzel et al., 2010). We also excluded studies that examined behaviors tangentially related to bullying, such as harassment or other forms of peer victimization. Moreover, we included studies that measured many different forms of bullying and teasing, which introduces heterogeneity. However, this was necessary as

the studies distinguished between several forms of bullying and/or teasing behaviors. As our meta-analysis included a modest number of effect sizes, we were unable to examine moderators such as ED diagnosis, or to assess publication bias. Last, we did not include grey literature in our search. However, it is doubtful that inclusion of such literature would alter our main findings, and one recent study shows that inclusion of such literature has limited impact on reviews (Hartling et al., 2017).

In conclusion, our review shows that EDs are associated with bullying and teasing victimization, but more studies are needed. Clear gaps in the literature include the lack of longitudinal studies, and studies examining bullying perpetration and cyber-bullying. This should be considered in future studies. Future research would benefit from designs or measures that establish the temporal precedence among bullying or teasing events and EDs. Furthermore, future studies should use more comprehensive measures that include definitions of bullying and/or teasing, to clarify the events measured and ease comparisons between studies. Separating between specific ED diagnoses or subtypes would also be beneficial, as evidenced by our review. As many patients have been victims of bullying and teasing, addressing such experiences in treatment may be a valuable means to understand patients' body image concerns, and may open up avenues to discuss ED-related problems such as low self-esteem.

ACKNOWLEDGMENTS

None.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Lie Selma Øverland, Rø Ø, Bang L. Is bullying and teasing associated with eating disorders? A systematic review and meta-analysis. *Int J Eat Disord*. 2019;52:497–514. https://doi.org/10.1002/eat.23035

SUPPLEMENTARY MATERIALS 1

1. Ovid Medline search

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

Search Strategy:

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1 harassment, non-sexual/ or bullying/ (2719)

2 (Bullying or bully or bullied or cyberbull* or mobbing or victimization or teasing or teased or ridicul* or harass* or intimidat* or name-call* or (social* adj exclu*) or (verbal* adj taunt*) or (rumor adj spread*) or (rumour adj spread*)).ti,ab. (17702)

3 1 or 2 (18175)

4 "feeding and eating disorders"/ or anorexia nervosa/ or binge-eating disorder/ or bulimia nervosa/ or "feeding and eating disorders of childhood"/ or female athlete triad syndrome/ or pica/ (28533)

5 ((eating adj1 disorder*) or anorexia or anorectic or bulimia or bulimic or (binge adj eating) or arfid or ((Avoidant* and Food) adj Intake adj Disorder*)).ti,ab. (46810)

6 4 or 5 (54690)

7 3 and 6 (257)

8 limit 7 to (danish or english or norwegian or swedish) (243)

9 remove duplicates from 8 (231)

2. PsychINFO search

Database: PsycINFO <1806 to October Week 4 2017>

Search Strategy:

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1 bullying.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (9488)

2 bullying/ or relational aggression/ or cyberbullying/ (8009)

3 harassment/ (826)

4 teasing/ or victimization/ (19168)

5 (bullying or bully or bullied or cyberbull* or mobbing or victimization or teasing or teased or ridicul* or harass* or intimidat* or name-call* or (social* adj exclu*) or (verbal* adj taunt*) or (rumor adj spread*) or (rumour adj spread*)).ti,ab. (32244)

6 2 or 3 or 4 or 5 (42196)

7 Eating disorders/ (14184)

8 anorexia nervosa/ or binge eating disorder/ or bulimia/ or hyperphagia/ or pica/ or "purging (eating disorders)"/ (16232)

9 binge eating/ (2554)

10 ((eating adj1 disorder*) or anorexia or anorectic or bulimia or bulimic or (binge adj eating) or arfid or ((Avoidant* and Food) adj Intake adj Disorder*)).ti,ab. (34581)

11 7 or 8 or 9 or 10 (36815)

12 6 and 11 (493)

13 limit 12 to (danish or english or norwegian or swedish) (468)

14 limit 13 to "0100 journal" (307)

15 remove duplicates from 14 (306)

3. Scopus search

(TITLE-ABS

*KEY (*bullying *OR* bully *OR* bullied *OR* cyberbull* *OR* mobbing *OR* victimization *OR* teasing *OR* teased *OR* ridicul* *OR* harass* *OR* intimidat* *OR* name-call* *OR* "social exclusion" *OR* "verbal taunting" *OR* "rumor spreading" *OR* "rumour spreading" *) AND TITLE-ABS-KEY (* "eating disorder" *OR* "eating disorders" *OR* "disordered eating" *OR* anorexia *OR* anorectic *OR* bulimia *OR* bulimic *OR* "binge eating" *OR* arfid *OR (* avoidant* *AND* "Food Intake disorder" *))) AND (LIMIT-TO (DOCTYPE ,* "ar" *)) AND (LIMIT-TO (LANGUAGE ,* "English" *) OR LIMIT-TO (LANGUAGE ,* "Swedish" *))*

4. PubMed search

1 "Feeding and Eating Disorders"[Majr] AND "Risk Factors"[Mesh] AND ((risk[Title] AND factor*[Title]) OR predictor*[Title])

2 eating[title] AND disorder*[ti] AND ((risk[Title] AND factor*[Title]) OR predictor*[Title]) NOT medline[sb]

Paper II:

Lie, S. Ø., Bulik, C. M., Andreassen, O. A., Rø, Ø., & Bang, L. (2021). The association between bullying and eating disorders: A case–control study. International Journal of Eating Disorders, 54(8), 1405-1414. doi:10.1002/eat.23522

II

Received: 23 November 2020 | Revised: 7 April 2021 | Accepted: 7 April 2021

DOI: 10.1002/eat.23522

ORIGINAL ARTICLE

International Journal of EATING DISORDERS WILEY

The association between bullying and eating disorders: A case–control study

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Funding information
Helse Sør-Øst RHF, Grant/Award Number: 2017083; National Institute of Mental Health, Grant/Award Number: R01MH119084; Norges Forskningsråd, Grant/Award Number: 223273; Vetenskapsrådet, Grant/Award Number: 538-2013-8864

Action Editor: Ruth Weissman

Abstract

Objective: Childhood bullying is associated with a range of adverse mental health outcomes, and here we investigated the association between bullying exposure and eating disorders (EDs).

Method: In this case–control study, we compared bullying history in individuals with EDs with community controls. Participants (n = 890, mean age = 29.50 ± 10.60) completed an online self-report battery assessing bullying history and lifetime history of bulimia nervosa (BN), binge-eating disorder (BED), and anorexia nervosa (binge-eating/purging (AN-BP) or restrictive (AN-R) subtype). Logistic regressions were performed to estimate odds ratios (ORs).

Results: In the combined ED sample, individuals with a history of any ED were significantly more likely than controls to have experienced bullying victimization during childhood or adolescence (ORs = 1.99–3.30), particularly verbal, indirect, and digital bullying. Bullying prior to ED onset was also significantly more common than bullying within the same time frame for controls (ORs = 1.75–2.16). Further analysis showed that these effects were due to individuals with BN or BED reporting significantly more lifetime (p < .001) and premorbid bullying (p = .002) than controls, while individuals in the other diagnostic subgroups did not differ significantly from controls.

Discussion: Our results confirm an association between bullying and binge-eating/purging ED subtypes. Prospective studies are needed to establish bullying as a risk factor for EDs.

KEYWORDS

anorexia nervosa, binge-eating disorder, bulimia nervosa, bullying, case–control studies, feeding and eating disorders, risk factors

1 | INTRODUCTION

Bullying is a form of aggressive behavior that is intentional, occurs repeatedly, and targets a less powerful individual or someone who has difficulty defending themself (Olweus, 1994). These behaviors can be physical in nature (e.g., hitting, kicking, stealing), verbal (e.g., name-calling, threatening), or indirect (sometimes referred to as "relational," e.g., exclusion from social groups, spreading lies or rumors; Björkqvist, Lagerspetz, & Kaukiainen, 1992). Bullying can also occur digitally (cyber-bullying), for example teasing and exclusion on online platforms and social media. Involvement in bullying is common; a recent meta-analysis of children and adolescents found that 25% had been bullied and 12% had bullied others, with the prevalence being lower for digital bullying (7% and 3%, respectively; Jadambaa et al., 2019). However, digital bullying is a constantly evolving field of research, and other recent studies have reported prevalences of 17% (Eyuboglu et al., 2021), 13% (Kaiser, Kyrrestad, & Fossum, 2020), and 5% (Skilbred-Fjeld, Reme, & Mossige, 2020) for involvement in digital bullying.

Being exposed to bullying during childhood or adolescence can negatively impact social development and psychological well-being (Troop-Gordon, 2017). Bullying victimization has been linked to adverse mental health outcomes, including anxiety and poor self-esteem (Wolke & Sapouna, 2008), psychosomatic problems (Gini & Pozzoli, 2013), psychotic symptoms (Schreier, Wolke, & Thomas, 2009; van Dam et al., 2012), depression (Reijntjes, Kamphuis, Prinzie, & Telch, 2010), and suicidality (Islam, Khanam, & Kabir, 2020; Klomek, Sourander, & Gould, 2010), and these problems can persist into adulthood (Ttofi, Farrington, Lösel, & Loeber, 2011). Moreover, enduring effects of bullying victimization include higher rates of hospitalizations due to psychiatric illness and suicidality (Copeland, Wolke, Angold, & Costello, 2013; John et al., 2018; Winsper, Lereya, Zanarini, & Wolke, 2012; Wolke, Copeland, Angold, & Costello, 2013). Current evidence suggests that those who bully others (perpetrators) also have adverse mental health outcomes (Copeland et al., 2013; Skilbred-Fjeld et al., 2020; Sourander et al., 2009).

Despite the wealth of studies indicating an association between bullying and psychiatric disorders, few have investigated bullying history in eating disorders (EDs). Bullying victimization has been associated with a range of ED symptoms such as restricted eating, bulimic behaviors, and binge eating in both clinical and non-clinical populations (Copeland et al., 2015; Haines, Neumark-Sztainer, Eisenberg, & Hannan, 2006; Kwan, Gordon, Minnich, Carter, & Troop-Gordon, 2017), but only a few studies have directly compared bullying history in people with and without EDs. A recent review and meta-analysis showed that individuals with EDs were two- to threefold more likely to have experienced bullying prior to ED onset than healthy controls (Lie, Rø, & Bang, 2019). Bullying history appeared to be more frequent in individuals with bulimia nervosa (BN) and binge-eating disorder (BED) than in individuals with anorexia nervosa (AN), although few studies included AN samples. Even fewer studies considered differences between restricting (AN-R) and binge-eating/purging (AN-BP) AN subtypes. The same review highlighted the need for more comprehensive studies, and also revealed several methodological limitations; mainly the inconsistent definitions of the term "bullying" and a lack of studies investigating whether bullying occurred prior to ED onset (Lie et al., 2019). Moreover, only a few studies have investigated history of bullying others among individuals with EDs, with mixed evidence (Copeland et al., 2015; Kaltiala-Heino, Rimpelä, Rantanen, & Rimpelä, 2000; Kaltiala-Heino, Rissanen, Rimpelä, & Rantanen, 2003). While some studies have investigated digital bullying and ED psychopathology (Marco & Tormo-Irun, 2018; Marco, Tormo-Irun, Galán-Escalante, & Gonzalez-García, 2018), there is still limited evidence on the possible impact of digital bullying on the development of EDs. Therefore, more studies are needed to clarify the association between bullying and EDs, which will advance our understanding of etiology and inform treatment.

The current study expands on previous findings and knowledge gaps identified in a previous meta-analysis (Lie et al., 2019). We compared school-age bullying experiences among predominantly female individuals with a lifetime history of EDs and individuals with no ED history. To overcome some of the limitations of the existing literature; we assessed lifetime history of DSM-5 defined EDs, used a conservative definition of bullying, and distinguished between bullying types. Our primary aims were (a) to investigate whether bullying exposure is more common among individuals with EDs than controls, and (b) to retrospectively assess whether bullying exposure prior to ED onset age is more common than bullying within the same time frame for controls. Because previous studies have found specific associations between bullying and binge-eating/purging subtypes of EDs, we included a secondary aim (c) to investigate whether bullying exposure differed between binge-eating/purging and restrictive ED subtypes. We hypothesized that individuals with EDs would report more frequent bullying than controls, and that the association would be stronger for binge-eating/purging subtypes than restrictive subtypes.

2 | METHOD

2.1 | Design

This case–control study was conducted as part of the Eating Disorders: Genes & Environment (EDGE) project, which investigates genetic and environmental risk factors for the development of EDs and is approved by the Norwegian Regional Committee for Medical and Health Research Ethics (#2017/0606). Written informed consent was obtained from all participants.

2.2 | Participants and procedures

A total of 916 individuals participated in the study. The study was open to all Norwegian residents over the age of 16 years, and data were collected between June 2019 and January 2020. Individuals with and without a lifetime history of an ED were invited to participate. No other inclusion criteria were enforced. Participants were

recruited through user-organizations for EDs, specialized ED treatment units across Norway, online/social media platforms (e.g., websites, Facebook), and flyers and posters at Norwegian universities. All participants completed an online assessment battery.

The ED100K (see below) self-report measure was used to assess lifetime history of AN, BN, and BED. Individuals who either a) fulfilled lifetime DSM-5 criteria for an ED, or b) reported having received treatment for an ED and endorsed lifetime core ED features (e.g., low weight, binge eating, compensatory behaviors) were classified as cases. Those who did not fulfill the aforementioned criteria were classified as controls. A total of 495 participants (54%) were classified as cases and 395 (43%) as controls. We were unable to determine case status for 26 (3%) participants due to missing or ambiguous responses, resulting in a final sample of 890 participants (95% female, aged 16–78 years [M = 29.50 ± 10.60]). In the ED group, 64% fulfilled lifetime criteria for AN, 47% for BN, and 34% for BED, with many individuals having fulfilled criteria for more than one lifetime diagnosis. AN was further classified into AN-R and AN-BP subtypes, according to presence or absence of binge-eating and purging behaviors during the AN period (28% and 72% of those with AN, respectively).

To address aim 2, we performed case–control matching to specifically investigate bullying history prior to ED onset. Participants in the control group were individually matched for age and gender to those in the ED group. This resulted in 348 (total of 696 individuals) case–control pairs (98% female). Note that a control participant with matching age and gender was not available for all individuals in the ED group, which is why the matched sample is smaller than the total sample. For each individual with a history of EDs, we calculated the ED onset age, defined as the earliest age at which the first significant ED features emerged. This included frequent binge eating, compensatory behaviors (e.g., purging behaviors, fasting), and low weight (whichever occurred first). To compare bullying experiences occurring prior to ED onset in cases to the same time-frame for controls, all case–control pairs were assigned an "index age." This age corresponded to the ED onset age for cases, and controls were assigned the same index age as their matched case to ensure equal time available for exposure. This method is similar to previous studies retrospectively assessing risk factors for EDs (Fairburn, Welch, Doll, Davies, & O'Connor, 1997; Hilbert et al., 2014), and enabled us to compare bullying history within the same time-frame for each case–control pair.

2.3 | Measures

2.3.1 | ED100K

An adapted version (translated into Norwegian and then back-translated) of the self-report measure ED100K (version 2) was used to assess lifetime history of AN, BN, and BED according to DSM-5 (Thornton et al., 2018). The ED100K contains questions regarding frequency, duration, and severity of core ED features (weight history, binge eating, compensatory behaviors) as well as age when these features first emerged. The measure has previously validated against the Structural Clinical Interview (SCID) for DSM-5 (Thornton et al., 2018), showing good predictive validity.

2.3.2 | Retrospective bullying questionnaire (RBQ)

Bullying victimization and perpetration was measured using an adapted version (translated into Norwegian and then back-translated) of the RBQ self-report measure (Schäfer et al., 2004). The RBQ retrospectively assesses different types of bullying victimization (physical, verbal, and indirect) occurring in childhood/adolescence. We also added questions regarding digital bullying (e.g., teased or excluded on digital platforms) and differentiated between body-related ("teased or called nasty names related to body/weight/appearance") and body-unrelated ("teased or called nasty names not related to body/weight/appearance") verbal bullying. For each bullying type, the participant was asked whether they had been subjected to bullying ("yes" or "no"), how frequently the bullying occurred ("never," "rarely," "sometimes," "frequently," or "constantly"), how severe they viewed the bullying to be ("not at all," "only a bit," "quite serious," "extremely serious"), and how old they were when bullying occurred. Participants also indicated duration of bullying attacks ("just a few days," "weeks," "months," or "a year or more"). Two questions assessed involvement in the bullying of others (perpetration). A final section contained questions about school avoidance and self-harm/suicidal thoughts due to bullying victimization. At the beginning of the questionnaire, participants were presented with a formal definition of bullying (Olweus, 1994) and instructed to think back on the specified time period (6–18 years of age). For the purpose of our study and in keeping with the formal definition of bullying, participants were considered bully victims if they reported (a) having been bullied, (b) with a frequency of "sometimes" or more, and (c) viewed the seriousness of the bullying to be "quite serious" or worse. Participants were considered bully perpetrators if they confirmed they had bullied others.

2.3.3 | Eating Disorder Examination-Questionnaire (EDE-Q)

The EDE-Q self-report measure was used to assess ED psychopathology during the past 28 days (Fairburn & Beglin, 2008). The four subscales were averaged to obtain the EDE-Q global score. The Norwegian version of the EDE-Q has demonstrated satisfactory psychometric properties (Rø, Reas, & Lask, 2010). The present study showed excellent internal consistency of the EDE-Q for controls (α = .96) and the ED group (α = .95).

2.4 | Analysis

To investigate bullying occurring at any time during school-age (6–18 years of age, aim 1), ED status (dependent variable) and bullying

victimization exposure (independent variable) were entered into logistic regression models to obtain odds ratios (ORs) and corresponding 95% confidence intervals (CIs) for any bullying and for each type of bullying separately (physical, verbal [body-related and body-unrelated], indirect, and digital). These analyses addressed whether individuals with EDs have experienced more bullying victimization in their life than controls. The same analysis was repeated with bullying perpetration as the independent variable. Models were adjusted for current age, gender, and education level, but we also report unadjusted ORs.

To investigate premorbid bullying history (aim 2), conditional logistic regression models were conducted using the individually matched case–control pairs and considering only bullying prior to (or coinciding with) the index age (corresponding to age of ED onset) in each pair. As in the analyses above, separate models were performed for any bullying and each type of bullying victimization. We were unable to compare bullying perpetration due to the low occurrence prior to index age. Only education was included as a covariate, since the two groups were matched on age and gender. We also report unadjusted ORs.

To investigate potential differences between restricting and binge-eating/purging ED subtypes in bullying exposure (aim 3), the regression models above were repeated for ED subtypes. Subtype classification was based on the ED100k, and groups were mutually exclusive. Individuals who only met criteria for AN (and no other EDs) at any point in their life were further classified as either AN-R or AN-BP to explore the hypothesis that binge-eating/purging EDs are more strongly associated with bullying than restrictive types. We were unable to subtype three individuals with AN due to missing data, and these were excluded from the subgroup analysis. Due to a large overlap between BN and BED in our sample, all individuals with a lifetime history of BN and/or BED (but not AN) were combined in one group of EDs characterized by binge eating and purging. Those with a history of AN *and* BN or BED were combined in one last mixed ED group. This resulted in the following group distribution: AN-R (n = 65), AN-BP (n = 114), BN/BED (n = 180), AN and BN/BED (n = 133). We did not perform subgroup analysis on different types of bullying separately or bullying perpetration due to insufficient numbers in each group.

To investigate characteristics and correlates of bullying victimization, we performed independent samples t-tests (with Hedges' g; interpreted as small [<0.5], medium [0.5–0.8], and large [>0.8; Cohen, 1988]) to compare the ED group with controls on frequency, severity, duration, age of bullying onset, self-harm, and school avoidance.

Analyses were performed using R version 3.6.1 (R Core Team, 2019) and IBM SPSS statistics version 25 (IBM Corp, 2017). Alpha levels were corrected for multiple comparisons according to a Bonferroni-Holm adjustment corresponding to number of independent variables of interest within each family (aims) of tests. To ease interpretation, we report corrected p-values, with $p < .05$ considered statistically significant.

3 | RESULTS

3.1 | Participant characteristics

Sample descriptive statistics are shown in Table 1. The overall ED group did not differ from controls with regards to age or current body mass index (BMI, kg/m^2). As expected however, current BMI was lower than the control group (23.04 ± 4.41) for the AN-R (19.97 ± 2.68), AN-BP (19.78 ± 3.55), and mixed AN and BN/BED (21.51 ± 4.46) groups, while it was higher for the BN/BED group (29.45 ± 8.29, all $p < .001$). In the ED group, 89% reported having

TABLE 1 Descriptive statistics for total and matched samples

Total sample (n = 890)						
	ED (n = 495)		**Control (n = 395)**		**ED versus control[a]**	
	***M* (*SD*)**	**Range**	***M* (*SD*)**	**Range**	***p*-value**	**Effect size (g)**
Age (years)	29.08 (9.76)	16–69	30.16 (11.66)	16–78	.140	−0.01
EDE-Q global score	3.32 (1.54)	0–6	1.29 (1.26)	0–5.72	**<.001**	1.47
Current BMI	23.85 (7.29)	12.42–58.59	23.94 (4.41)	16.04–48.67	.831	−0.01
Matched sample (n = 696)						
	ED (n = 348)		**Control (n = 348)**		**ED versus control[a]**	
	***M* (*SD*)**	**Range**	***M* (*SD*)**	**Range**	***p*-value**	**Effect size (g)**
Age (years)	28.42 (9.59)	16–65	28.42 (9.59)	16–65	NA	NA
EDE-Q global score	3.36 (1.55)	0–6	1.34 (1.27)	0–6	**<.001**	1.43
Current BMI	23.69 (6.92)	12.42–58.59	23.94 (4.53)	16.41–48.67	.584	0.04
Index age (ED onset)	15.09 (4.58)	4–50	15.09 (4.58)	4–50	NA	NA

Abbreviations: BMI, body mass index; ED, eating disorder; EDE-Q, Eating Disorder Examination-Questionnaire; NA, not applicable (test not performed as groups were matched on the variable).

[a]Compared using independent samples t-tests, boldface indicates statistical significance ($p < .05$).

TABLE 2 Exposure to school-age bullying controlled for age, gender, and education

					ED versus control			
	ED (*n* = 495)		Control (*n* = 395)		Unadjusted		Adjusted	
	n	%	*n*	%	OR (95% CI)	Corrected *p*-value[b]	OR[a] (95% CI)	Corrected *p*-value[b]
Bullied (any type)	157	31.8	73	18.5	2.05 (1.50–2.83)	**<.001**	1.99 (1.45–2.76)	**<.001**
Physical	37	7.6	24	6.1	1.28 (0.75–2.20)	.738	1.18 (0.69–2.06)	1.000
Verbal	113	24.2	45	11.7	2.40 (1.66–3.53)	**<.001**	2.36 (1.62–3.50)	**<.001**
Body-related verbal	104	22.3	36	9.4	2.77 (1.86–4.21)	**<.001**	2.75 (1.83–4.22)	**<.001**
Body-unrelated verbal	66	14.1	30	7.8	1.94 (1.24–3.10)	**.013**	2.00 (1.27–3.24)	**.014**
Indirect	117	26.4	49	13.2	2.34 (1.63–3.41)	**<.001**	2.30 (1.59–3.37)	**<.001**
Digitally	29	6.1	7	1.8	3.55 (1.62–8.88)	**.012**	3.30 (1.49–8.38)	**.018**
Bullied others (perpetration)	44	9.4	37	10	0.84 (0.60–1.50)	.804	1.11 (0.69–1.79)	1.000

Abbreviations: CI, confidence interval; ED, eating disorder; OR, odds ratio (OR > 1 indicates more bullying in ED group than controls).
[a]ORs adjusted for age, gender, and education.
[b]*p*-values corrected for multiple comparisons using the Bonferroni-Holm correction, boldface indicates statistical significance ($p < .05$).

TABLE 3 Exposure to bullying prior to ED onset using a matched (gender and age) conditional regression controlled for education

						ED versus controls			
		ED (*n* = 348)		Controls (*n* = 348)		Unadjusted		Adjusted	
	n[a]	*n*	%	*n*	%	OR (95% CI)	Corrected *p*-value[c]	OR[b] (95% CI)	Corrected *p*-value[c]
Bullied (any type)	694	131	26.5	56	14.2	1.95 (1.32–2.88)	**.003**	1.75 (1.70–2.62)	**.026**
Physical	685	35	7.1	20	5.1	1.35 (0.76–2.41)	.309	1.86 (0.65–2.18)	.581
Verbal	654	100	20.2	35	8.9	2.26 (1.44–3.55)	**.003**	2.02 (1.26–3.25)	**.021**
Body-related verbal	658	93	18.8	28	7.1	2.52 (1.56–4.09)	**.001**	2.16 (1.30–3.56)	**.019**
Body-unrelated verbal	661	60	12.1	24	6.1	1.86 (1.09–3.16)	.067	1.57 (0.90–2.75)	.337
Indirect	625	95	19.2	34	8.6	2.43 (1.46–4.04)	**.003**	2.16 (1.27–3.67)	**.021**
Digital	666	14	2.8	4	1	2.75 (0.88–8.64)	.166	2.49 (0.77–8.06)	.337

Abbreviations: CI, confidence interval; ED, eating disorder; OR, odds ratio (OR > 1 indicates more bullying in ED group than controls).
[a]*n* refers to participants available for analysis of each variable and varies due to exclusion of pairs with missing data on age of onset for relevant bullying outcome variables.
[b]OR adjusted for education (age and gender inherent in the conditional matched-pair analysis).
[c]*p*-values corrected for multiple comparisons using the Bonferroni-Holm correction, boldface indicates statistical significance ($p < .05$).

received treatment for an ED. The ED group also had a higher EDE-Q global score than controls ($p < .001$).

3.2 | Are bullying experiences more frequent among individuals with EDs?

Overall prevalence of bullying victimization was 26%. Experiences of any bullying victimization were significantly more common among individuals with EDs (31.8%) than controls (18.5%), overall OR = 1.99 (see Table 2). Specifically, the ED group was significantly more likely than controls to have experienced verbal (both body-related and body-unrelated), indirect, and digital forms of bullying (ORs 2.0–3.3), but not physical bullying. Bullying perpetration was not significantly associated with EDs.

3.3 | Do individuals with EDs recall experiencing more bullying than controls in the time period prior to ED onset?

Mean age of bullying onset for the whole sample was 10.23 ± 2.66 years, and mean ED onset age was 15.10 ± 4.50 years (AN-R: 15.75 ± 3.41, AN-BP: 15.39 ± 4.92, BN/BED: 14.76 ± 4.66, AN and BN/BED: 15.01 ± 4.28). The majority of bullying victimization (84%) among individuals with EDs occurred prior to ED onset. Similarly, the majority of bullying in the control group (77%) occurred within the same time frame (i.e., prior to index age). Individuals with EDs were significantly more likely than controls to have experienced bullying victimization prior to index age (OR 1.75; see Table 3). This indicates that individuals with EDs were more likely to have been bullied before onset of their ED, compared to the same time-frame for

TABLE 4 Any school-age bullying by ED subtype, controlled for age, gender, and education (total sample)

		Unadjusted		Adjusted	
	n in ED group	OR (95% CI)	Corrected *p*-value[b]	OR (95% CI)[a]	Corrected *p*-value[b]
Control versus AN-R	65	0.80 (0.37–1.59)	1.000	0.79 (0.36–1.60)	1.000
Control versus AN-BP	114	1.90 (1.17–3.04)	.066	1.77 (1.08–2.88)	.151
Control versus BN/BED	180	3.15 (2.13–4.66)	**<.001**	3.05 (2.05–4.54)	**<.001**
Control versus AN and BN/BED	133	1.76 (1.11–2.77)	.099	1.65 (1.03–2.61)	.197
AN-R versus AN-BP	65 (AN-R) 114 (AN-BP)	2.37 (1.11–5.42)	.157	2.42 (1.10–5.77)	.197
AN-R versus BN/BED	65 (AN-R) 180 (BN/BED)	3.93 (1.95–8.63)	**.002**	3.83 (1.87–8.56)	**.004**
AN-R versus AN and BN/BED	65 (AN-R) 133 (AN and BN/BED)	2.20 (1.05–4.98)	.181	2.45 (1.11–5.87)	.197
AN-BP versus BN/BED	114 (AN-BP) 180 (BN/BED)	1.66 (1.01–2.75)	.181	1.65 (0.99–2.76)	.197
AN-BP versus AN and BN/BED	114 (AN-BP) 133 (AN and BN/BED)	0.93 (0.54–1.62)	1.000	0.94 (0.54–1.66)	1.000
BN/BED versus AN and BN/BED	180 (BN/BED) 133 (AN and BN/BED)	0.56 (0.34–0.90)	.106	0.54 (0.33–0.87)	.102

Abbreviations: AN-BP, anorexia nervosa binge-eating/purging subtype; AN-R, anorexia nervosa restrictive subtype; BN, bulimia nervosa; BED, binge-eating disorder; CI, confidence interval; ED, eating disorder; OR, odds ratio (OR > 1 indicates more bullying in the latter group).
[a]OR adjusted for age, gender, and education.
[b]*p*-values corrected for multiple comparisons using the Bonferroni-Holm correction, boldface indicates statistical significance ($p < .05$).

controls. Significant ORs were found for verbal, body-related verbal, and indirect bullying (ORs 2.02–2.16). Physical, body-unrelated verbal, and digital bullying prior to ED onset did not differ significantly between groups.

3.4 | Characteristics and sequelae of bullying victimization

There were no significant differences in frequency, severity, or age of bullying experiences between individuals with EDs and controls. Among those who had experienced bullying, EDs were associated with more thoughts of self-harm or suicide with a medium effect size ($t[112] = 3.82$, $p < .001$, $g = 0.54$). There were no differences in school avoidance ($t[126] = 2.21$, $p = .056$, $g = 0.31$), or duration of bullying attacks ($t[93] = 1.16$, $p = .249$, $g = 0.16$) between the ED group and controls.

3.5 | Do bullying experiences differ across ED subtypes?

Individuals with a lifetime history of BN and/or BED were significantly more likely to have been bullied at any point in their life (OR 3.05; see Table 4) and to have been bullied prior to index age than controls (OR 2.47; see Table 5). In addition, individuals with BN/BED were significantly more likely to have been bullied at any point in their life than individuals in the AN-R group (OR 3.83), but these groups did not differ significantly in bullying prior to ED onset. The AN-R, AN-BP, and mixed ED (AN and BN/BED) groups did not significantly differ from controls in overall bullying or bullying prior to ED onset. There were no other significant group differences. Figure 1 illustrates the differences between groups.

4 | DISCUSSION

In the present study, we found a significant association between bullying and EDs characterized by binge-eating and purging behaviors. The overall ED case–control comparisons (with all ED diagnoses combined) showed that individuals with a history of any ED had experienced significantly more school-age bullying overall than controls, and significantly more bullying prior to ED onset than controls within the same time frame. However, further analysis showed that the observed effects were driven by individuals with binge-eating/purging ED subtypes (BN/BED). We also found that individuals in the ED group reported more thoughts of self-harm and suicide as a result of bullying than controls. Bullying perpetration did not differ between individuals with EDs and controls. Our results are strengthened by the use of a conservative definition of bullying, and provide new insights into what types of bullying are most commonly experienced in individuals with EDs.

In our study, bullying experiences were common among individuals with binge-eating/purging type EDs, particularly verbal and indirect forms of bullying. When considering all EDs combined, individuals with a history of any ED were two- to threefold more likely

TABLE 5 Any bullying prior to ED onset by ED subtype, controlled for age, gender, education, and index age (matched sample)

		Unadjusted		Adjusted[a]	
	n in ED group	OR (95% CI)	Corrected *p*-value[b]	OR (95% CI)[a]	Corrected *p*-value[b]
AN-R versus control	49	1.02 (0.42–2.18)	1.000	1.07 (0.44–2.34)	1.000
Control versus AN-BP	83	1.91 (1.107–3.34)	0.199	1.73 (0.95–3.08)	.517
Control versus BN/BED	123	2.36 (1.46–3.80)	**0.004**	2.47 (1.50–4.06)	**.004**
Control versus AN and BN/BED	90	1.90 (1.08–3.25)	0.199	1.70 (0.96–2.90)	.517
AN-R versus AN-BP	49 (AN-R) 83 (AN-BP)	1.88 (0.79–4.87)	1.00	1.89 (0.75–5.14)	.948
AN-R versus BN/BED	49 (AN-R) 123 (BN/BED)	2.32 (1.03–5.76)	0.365	2.49 (1.06–6.45)	.407
AN-R versus AN and BN/BED	49 (AN-R) 90 (AN and BN/BED)	1.86 (0.79–4.78)	1.000	2.03 (0.81–5.63)	.948
AN-BP versus BN/BED	83(AN-BP) 123(BN/BED)	1.23 (0.67–2.32)	1.000	1.41 (0.73–2.75)	.948
AN-BP versus AN and BN/BED	83(AN-BP) 90 (AN and BN/BED)	0.99 (0.50–1.96)	1.000	1.00 (0.50–2.01)	1.000
BN/BED versus AN and BN/BED	123 (BN/BED) 90 (AN and BN/BED)	0.80 (0.44–1.46)	1.000	0.65 (0.35–1.21)	.948

Abbreviations: AN-BP, anorexia nervosa binge-eating/purging subtype; AN-R, anorexia nervosa restrictive subtype; BN, bulimia nervosa; BED, binge-eating disorder; CI, confidence interval; ED, eating disorder; OR, odds ratio (OR > 1 indicates more bullying in the latter group).
[a]OR adjusted for age, gender, education, and index age.
[b]*p*-values corrected for multiple comparisons using the Bonferroni-Holm correction, boldface indicates statistical significance ($p < .05$).

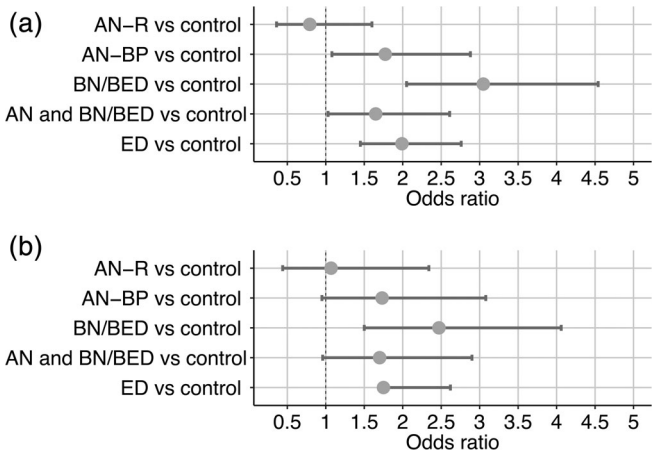

FIGURE 1 Overall association (odds ratios with 95% confidence intervals) of (a) any school-age bullying and (b) bullying prior to ED onset age with the different eating disorder subtypes compared to controls ($n = 395$). AN and BN/BED = anorexia nervosa and [bulimia nervosa and/or binge-eating disorder], AN-BP = anorexia nervosa binge-eating/purging subtype ($n = 114$), AN-R = anorexia nervosa restricting subtype ($n = 65$), BN/BED = bulimia nervosa and/or binge-eating disorder ($n = 180$), ED = eating disorder combined sample ($n = 495$)

than controls to have experienced verbal (both body-related and body-unrelated), indirect, and digital bullying victimization at some point in their life (but not physical bullying). These effects were largely replicated for bullying occurring in the time period prior to ED onset, consistent with the interpretation that bullying is a risk factor for binge-eating/purging EDs. Almost one third of individuals with EDs in our study reported experiences of bullying during school-age, which is important when considering psycho-social elements of EDs. While only 6.1% of individuals in our ED group and 1.8% of the controls had experienced digital bullying (even less in the time prior to ED onset; 2.8% and 1%, respectively), our participants had an average age of 30 years and many would therefore have finished school prior to the emergence of digital bullying. We would expect to find a different pattern of results for digital bullying in a younger sample, and highlight the need for more research on this subject.

Although the subgroup analyses showed that the BN/BED group was significantly more likely to have been bullied than controls, this was not the case for AN-R or AN-BP or individuals in the mixed ED group. Direct subtype comparisons showed that the BN/BED group reported significantly more lifetime bullying than the AN-R group, but did not significantly differ from the other two groups (AN-BP and AN and BN/BED. We note however, that sample sizes were modest for some of the diagnostic subgroups. Our study was powered for the comparison between ED and controls (aim 1), and thus our ability to detect significant differences between subtypes may have been limited by low power for comparisons between specific ED subtypes. Thus, our findings clearly indicate that individuals with BN/BED have experienced more bullying than controls, while findings are less conclusive for the AN-BP subtype and the mixed ED group. We found no evidence of elevated bullying victimization in the AN-R group. Therefore, our results strongly suggest that the BN/BED group drives the overall association between bullying and EDs, and that any presence of AN (particularly AN-R) makes this association less clear.

Overall, our results are in line with previous research on EDs and bullying victimization (Lie et al., 2019). We support previous findings that bullying victimization is more strongly linked to EDs characterized by binge eating and purging than those of a more restricting nature (Hilbert et al., 2014; Krug et al., 2015), and show that this is the case for different types of bullying. Similar patterns have been found for other traumatic childhood events, as for example childhood abuse tends to be more strongly associated with BN/BED than AN (Caslini et al., 2016; Molendijk, Hoek, Brewerton, & Elzinga, 2017). This could be indicative of a different etiology underlying restrictive EDs as compared to binge-eating/purging EDs, but more research is needed to explore this. The relationship between bullying and binge-eating/purging ED subtypes can be bi-directional, as individuals with psychological difficulties in childhood and adolescence can be more exposed to bullying as a result of being viewed as different or atypical by their peers (Arseneault, Bowes, & Shakoor, 2010). However, in our study we found that the majority of bullying victimization began early and prior to ED onset. While prospective studies would be needed to confirm this, our results are consistent with bullying as a risk factor preceding ED development. Our ORs are also comparable to those found for other mental disorders and bullying, such as depression, suicidality, and anxiety disorders (Copeland et al., 2013; Islam et al., 2020; Ttofi et al., 2011). As such, bullying is associated with a range of adverse mental health outcomes, including EDs. To assess whether bullying is a specific risk factor for EDs over and above the general risk for adverse mental health outcomes, future studies would benefit from including psychiatric control groups.

While we aimed to contribute to the scarce literature available on bullying perpetration and EDs, perpetration was not significantly associated with EDs in the current study. A few studies have previously found that bullying perpetration is also associated with EDs, but findings are mixed (Copeland et al., 2015; Kaltiala-Heino et al., 2000; Kaltiala-Heino et al., 2003). In our study, only 9% and 10% of the ED and control group, respectively, reported having bullied others at some point in their life, which prohibited us from performing follow-up analyses of these.

Individuals in the ED group reported more thoughts of self-harm or suicide due to bullying than controls. There were no differences in frequency or severity of bullying between the ED group and controls, so it is unlikely that the increase in self-harm is due to more severe victimization in our ED group. Instead, this could reflect susceptibility for maladaptive coping which may be related to a vulnerability to develop EDs. Studies have found that exposure to traumatic experiences is related to self-harm and suicidal behaviors in ED populations (Franko & Keel, 2006; Paul, Schroeter, Dahme, & Nutzinger, 2002), and it is possible that this relationship is also present for victimization by bullying. However, our measure of self-harm was a single question and further investigation would be needed before conclusions can be drawn.

There are several potential mechanisms through which bullying can influence risk of developing EDs. Disruptions in social relationships or unfavorable social comparisons during childhood and adolescence as a result of peer-victimization can be of importance for the development of EDs (Duarte, Pinto-Gouveia, & Rodrigues, 2015; Myers & Crowther, 2009; Striegel-Moore & Bulik, 2007). Bullying or teasing about weight or appearance has been linked to body dissatisfaction and a negative body image (Menzel et al., 2010), which are present in EDs and constitute risk factors for developing behavioral ED symptoms (Stice, 2016). This could be the case especially for verbal body-related bullying, which showed a strong association with EDs in our study. Victimization by bullying can also be viewed as a traumatic stressor causing emotional problems, which in turn can increase risk of EDs (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Reijntjes et al., 2010). The ORs reported in the current study are indeed comparable to the association found between binge-eating/purging ED subtypes and other traumatic life events such as child maltreatment and abuse (Caslini et al., 2016; Larsen et al., 2017; Molendijk et al., 2017).

Our study has a number of limitations. Firstly, diagnostic classification was based on self-report. However, we used a comprehensive and previously validated measure for determining ED case status based on DSM-5 criteria, and note that 89% of the ED group reported having received treatment for an ED. Moreover, although we had a large total sample size, our secondary diagnostic subgroup analysis comprised modest sample sizes. We also combined BN and BED in one group while separating between AN-R and AN-BP to facilitate exploration of differences between binge-eating/purging subtypes and restrictive subtypes of EDs. Also, as we measured lifetime EDs, the subtype results may not accurately reflect the distribution of individuals within each subtype at any given time as it is common for people to transition between different EDs throughout their lifetime. Secondly, we relied on self-reported, retrospective assessments of bullying, which could lead to recall bias. However, we controlled for current age in the analysis to reduce age related recall effects and our overall prevalence of bullying was in line with previous studies (Jadambaa et al., 2019). We also used a conservative definition of bullying based on frequency and severity of self-reported experiences to adhere to formal bullying definitions. Our prevalence estimate of digital bullying may differ from other recent studies due to the wide age range of our participants (16–78 years). Thirdly, we note that the psychometric properties of the adapted and translated versions of the ED100K and the RBQ have not been validated in their current forms. Lastly, our sample was predominantly female, which limits generalizability, and we did not collect data regarding race, ethnicity, and immigration status. We note that the population in Norway is relatively homogenous and primarily of northern European descent.

In conclusion, the current study found that having a history of various forms of bullying victimization is common among individuals with binge-eating/purging ED subtypes. Compared to controls, individuals with a history of binge-eating/purging EDs were more likely to have been bullied, and reported more bullying in the time period prior to ED onset than controls. These effects were strongest for BN and BED, in line with previous findings. Our results indicate that bullying victimization may be a risk factor for development of binge-eating/purging subtypes of EDs, but prospective studies are needed to address this and explore the mechanisms involved. As the

consequences of bullying can have severe implications, further studies are warranted to investigate correlates of bullying such as self-harm. The high prevalence of bullying victimization in individuals with EDs points to the importance of exploring bullying experiences in ED treatment to better understand the antecedents and triggers that contribute toward the development and maintenance of EDs for each individual patient.

ACKNOWLEDGMENTS

The authors would like to thank all participants for their willingness to contribute to this study, and to the Norwegian user organizations ROS and SPISFO for their support and assistance. This study (via Dr. Bang) is funded by the South-Eastern Norway Regional Health Authority (#2017083). Dr. Bulik acknowledges funding from the Swedish Research Council (Vetenskapsrådet, award: 538-2013-8864) and the National Institute of Mental Health (R01MH119084). Dr. Andreassen from Research Council of Norway (#223273).

CONFLICT OF INTEREST

CM Bulik reports: Shire (grant recipient, Scientific Advisory Board member); Idorsia (consultant); Pearson (author, royalty recipient). Dr. Andreassen reports: Speakers honorarium from Lundbeck, consultant to HealthLytix. The remaining authors report no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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How to cite this article: Lie SØ, Bulik CM, Andreassen OA, Rø Ø, Bang L. The association between bullying and eating disorders: A case–control study. *Int J Eat Disord*. 2021;54:1405–1414. https://doi.org/10.1002/eat.23522

Paper III:

Lie, S. Ø., Bulik, C. M., Andreassen, O. A., Rø, Ø., & Bang, L. (2021). Stressful life events among individuals with a history of eating disorders: A case-control comparison. BMC Psychiatry, 21(501). doi: 10.1186/s12888-021-03499-2

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Lie et al. BMC Psychiatry (2021) 21:501
https://doi.org/10.1186/s12888-021-03499-2

BMC Psychiatry

RESEARCH Open Access

Stressful life events among individuals with a history of eating disorders: a case-control comparison

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Abstract

Background: Experiencing stressful life events (SLEs) can negatively impact mental health and increase risk for psychiatric disorders including eating disorders (EDs). Previous research has shown that childhood sexual abuse is associated with some EDs, but less is known about the association between other non-sexual SLEs and EDs.

Method: A case-control study of individuals with ($n = 495$, age mean ± SD = 29.1 ± 9.8 years) and without ($n = 395$, age = 30.2 ± 11.7) self-reported lifetime history of EDs was conducted to compare history of self-reported SLEs. Participants reported history of sexual (e.g., rape, other sexual assault) and non-sexual (e.g., emotional abuse, assault, bereavement) life events using an adaptation of the Stressful Life Events Screening Questionnaire. Individuals with EDs were divided into ED subtypes along the restricting – binge eating/purging spectrum to examine subtype differences. Logistic regressions were conducted for each SLE and ED subtype to obtain odds ratios (ORs). We report *p*-values corrected for multiple comparisons.

Results: Exposure to any SLE was significantly more common in individuals with EDs than in controls (OR = 2.47, $p < .001$). Specifically, rape, other sexual assault, and emotional abuse were significantly more common among individuals with a history of binge-eating/purging ED subtypes (ORs = 2.15–3.58, p's < .01) compared with controls. Furthermore, history of life-threatening disease and loss of a close relative/partner/friend were associated with some ED subtypes. The association between SLEs and EDs was stronger for individuals who had experienced multiple SLEs.

Conclusion: By investigating a range of different SLEs, we showed that both sexual and non-sexual SLEs were more common in individuals with a history of EDs (binge-eating/purging subtypes) than controls. Results highlight the importance of assessing a variety of past SLEs in risk assessment for different EDs.

Keywords: Eating disorders, Bulimia nervosa, Anorexia nervosa, Binge-eating disorder, Trauma, Stressful life events, Risk factor, Adverse events, Sexual abuse, Emotional abuse

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Introduction

Anorexia nervosa (AN), bulimia nervosa (BN), and binge-eating disorder (BED) are eating disorders (EDs) characterized by dysregulated food intake. Both genetic and environmental risk factors have been implicated in the development and maintenance of EDs [1, 2]. Negative or stressful life events (SLEs) are among many environmental risk factors that have garnered interest in the ED field. In the context of this paper, we consider all negative and potential stressful life events together, including various forms of abuse, assault, bereavement, car accidents, being threatened, been diagnosed with a serious disease, etc. Many of these events are commonly referred to as 'traumas', but considering the diversity of events included we collectively refer to these as SLEs. Childhood maltreatment, particularly sexual abuse, is among those most studied and has been implicated as a risk factor for the development of EDs [3–5], and a predictor of treatment dropout [6, 7]. A meta-analysis by Molendijk and colleagues [4] found that childhood maltreatment was two to four times more common among individuals with EDs than healthy controls, and was associated with more severe ED symptoms, earlier onset age, and more frequent binge-eating and purging behaviours.

To date, associations between SLEs and EDs are more consistent for binge-eating/purging subtypes (i.e., BN and BED) than restricting (i.e., AN) subtypes [3, 4, 8–12]. A recent review of published risk factor meta-analyses investigating a range of risk factors found evidence for childhood sexual abuse as a risk factor for BN, while the evidence was weaker for the other ED subtypes [13]. A stronger association between adverse events and binge-eating/purging behaviors has also been reported in individuals with AN, where both childhood and adult sexual abuse were more commonly associated with the binge-eating/purging subtype (AN-BP) than the restricting subtype (AN-R), and was associated with more post-traumatic stress disorder (PTSD) symptoms, emotion dysregulation, and treatment dropout [14–16]. Thus, converging evidence suggests that SLEs, both in childhood and later in life, may be selectively associated with binge-eating/purging EDs. The evidence is more mixed for AN, and few studies directly address differences between AN-R and AN-BP.

Although the majority of research on SLEs in EDs has focused on childhood sexual abuse [5, 17–19], other types of childhood SLEs have also been associated with EDs, including physical and emotional abuse [4, 20, 21]. Studies investigating lifetime SLEs in different populations have found increased risk of ED symptoms in victims of sexual assault [22–24] and in female war veterans who have experienced traumatic events and/or assaults [25]. A range of relatively common childhood events such as parental illness, parental divorce, changing schools, and bullying, have also been asociated with EDs [26–28]. Despite a rich literature highlighting many different types of traumatic or stressful events as significant predictors of risk for mental problems [29], we know little of how common various SLE exposures are among individuals with EDs.

As such, exisiting research supports an association between different SLEs and some EDs, with the most conclusive evidence available for highly traumatic experiences such as sexual abuse. Less is known about other stressful life experiences, and studies investigating other types of SLEs throughout life and their potential associations with different EDs are scarce. Also, few studies have directly investigated how different SLEs are associated with specific EDs (including the two AN subtypes). This has been identified as an important topic for research in recent literature [13, 30], and could have implications for our understanding of the etiology and treatment strategies for EDs.

The current study explored history of SLEs in individuals with a lifetime history of EDs and controls. Specifically, we investigated a) whether exposure to a variety of SLEs differed between individuals with a history of EDs and controls, and b) if the association was stronger for individuals who had experienced multiple types of events. Moreover, we explored differences in SLE exposure across different ED subtypes and report results separately for each subtype compared with controls. The main hypothesis was that SLEs would be more prevalent in individuals with EDs than in controls. We also hypothesised that the association between SLEs and EDs would be stronger for binge-eating/purging subtypes than restrictive subtypes, and that it is more common for individuals with EDs to experience multiple types of SLEs.

Methods

Design

The present study used data from the Eating Disorders: Genes & Environment (EDGE) project; a cross-sectional study of Norwegian adults investigating a variety of risk factors for EDs. The study was approved by the Norwegian Regional Committee for Medical and Health Research Ethics (#2017/0606), and all procedures were performed in accordance with ethical guidelines and regulations. All participants provided written informed consent.

Participants and procedures

Norwegian residents over the age of 16 were invited to participate in the study by completing an online test battery including questions regarding ED history and experiences of SLEs. Individuals with and without lifetime EDs were invited to participate, and recruitment was targeted at user organisations for EDs and specialised ED

treatment units in Norway to reach individuals with a lifetime ED. Recruitment through online/social media platforms (e.g., websites, Facebook), and flyers and posters at Norwegian universities targeted both case and control participants. Data were collected between June 2019 and January 2020.

The ED100K (see below) was used to classify cases and controls according to the presence or absence of lifetime DSM-5 EDs [31]. A total of 890 participants were classfied as either cases ($n = 495$) or controls ($n = 395$) according to DSM-5 criteria. Individuals with BN and/or BED (BN/BED $n = 180$) were combined in one group due to the considerable overlap between the two subtypes in lifetime diagnoses. In addition, previous research has found associations between SLEs and the shared symptomatology of these subtypes (i.e., binge-eating), suggesting that there may be underlying processes that are distinct for binge-eating/purging type disorders when compared to EDs characterised by restricting behaviours [4, 32]. AN was divided into the two subtypes (AN-R $n = 65$ and AN-BP $n = 114$) to further explore this hypothesis. A mixed ED group (AN/BN/BED $n = 133$) included all individuals who at some point in their life had met criteria for both AN and BN and/or BED, further emphasising the high crossover between the ED diagnoses over time. We were unable to determine subtype for three individuals in the ED group who were excluded from the subtype analyses. We also calculated the ED onset age, defined as the earliest age of clinically significant symptoms (e.g., low weight, frequent binge eating, compensatory behaviours such as purging, etc.).

Measures

ED100K. The self-report measure ED100K (version 2) was used to assess lifetime history of AN, BN, and BED according to DSM-5 criteria [33]. The ED100K has shown good predictive validity for the different ED types when validated against the Structural Clinical Interview (SCID) for DSM-5 [33], The measure was adapted to fit the study design and was translated into Norwegian (then back-translated to ensure correspondence). The ED100K contains questions about frequency, duration, and severity of core ED features (e.g., weight history, binge eating, compensatory behaviors) and the age of onset for these features. This enabled us to distinguish between ED cases and controls as well as assigning the individuals with EDs to different subtypes.

Stressful life events screening questionnaire - adapted (SLESQ). The SLESQ is a validated instrument to assess history of different types of stressful events in clinical and non-clinical populations [34]. The current study used an adapted version of the Norwegian translation developed by Thoresen and Øverlien [35]. Twelve different items (SLEs) were included in the current study; disease (serious/life threatening), accident (serious/life threatening), assault (e.g., physical attack or robbery), bereavement (loss of a close relative, partner, or friend), rape, other sexual assault (unwanted sexual contact/touching), childhood physical abuse (before 18 years of age), adulthood physical abuse (after 18 years of age), emotional abuse, threatened (with a weapon or by threat of force), witnessed (witnessed a situation where another person was hurt, died, or was abused), and other (any other situations of serious threat to life, health, or safety; this item was not specified further). The complete list of questions is included in Table 1. For each of these items, the participants indicated whether they had experienced the event ("yes" or "no"), and at what age (first occurrence). For some items (rape, other sexual assault, adulthood physical abuse, childhood physical abuse, emotional abuse, threatened), we also asked how many times the event in question had occured. In addition to the individual items, all participants who responded "yes" to one or more events were coded as "yes" on an overall "Any SLE" variable.

Eating disorder examination-questionnaire (EDE-Q). The EDE-Q is a self-report measure assessing ED psychopathology in the past 28 days [36], and a Norwegian translation has been previously validated [37]. For the present study, only the global EDE-Q sum scores were used to compare current ED symptoms and behaviours in cases and controls. The measure demonstrated good internal consistency: $\alpha = .96$ for controls and $\alpha = .95$ for the ED group.

Analysis

For the main analysis, logistic regressions were performed for SLEs comparing each of the ED diagnostic groups with the control group. Odds ratios (ORs) and 95% confidence intervals (CIs) are reported as a measure of effect for each comparison. In all regression models, ED outcome (subtype) was the dependent variable, and the specific SLE (e.g., rape) was entered as a dichotomous predictor (independent variable). We added gender, age, and education as covariates in all models as these variables have been associated with EDs [1], and to reduce recall bias. Unadjusted regression models were conducted without covariates, but these are not reported as the overall pattern of results was similar to the adjusted model.

To investigate whether individuals with EDs had experienced a higher number of SLEs than controls, three levels of SLE exposure were defined: none, one or two types, three or more types. As the measure of SLE number was heavily skewed (majority, > 75%, of participants had experienced between zero and four SLE types), this categorisation was preferred over the continuous

Table 1 Items included in the adapted version of the Stressful Life Events Screening Questionnaire (SLESQ), English translation

Item number	Description
1: Life-threatening disease	Have you ever had a life-threatening illness/disease?
2: Accident	Were you ever in a life-threatening accident?
3: Physical assault	Was physical force or a weapon ever used against you in a robbery or assault?
4: Bereavement	Has an immediate family member, romantic partner or very close friend died as a result of accident, homicide, or suicide?
5: Rape	Has anyone (parent, other family member, romantic partner, stranger, or someone else) ever forced or threatened you into having intercourse, oral, or anal sex against your will, or when you were in some way helpless?
6: Other sexual assault	Other than experiences you have already described, has anyone ever touched your genitals or made you touch theirs against your wishes, or when you were in some way helpless?
7: Childhood physical abuse	When you were a child, did a parent, caregiver or other person ever kick you repeatedly, beat or otherwise attack or harm you?
8: Adulthood physical abuse	As an adult (> 18 years), have you ever been kicked, beaten, slapped around or otherwise physically harmed by a romantic partner, date, sibling, family member, stranger, or someone else?
9: Emotional abuse	Has a parent or a romantic partner systematically ridiculed you, humiliated you, or called you worthless?
10: Threatened	Other than the experiences already covered, has anyone ever threatened you with a weapon, like a knife or gun?
11: Witnessed a traumatic event	Have you ever witnessed another person being killed, seriously injured, or sexually or physically assaulted?
12: Other	Other than the events you have already described, have you ever been in any other situations that was extremely frightening or horrifying, or where you felt very helpless?

measure to specifically compare low (0), medium (1 or 2), and high (≥3) exposure to SLEs while securing relatively even numbers in all groups. This variable was then used to perform logistic regressions comparing the different levels of SLE exposure as predictors for ED outcome (with gender, age, and education as covariates).

Separate analyses of variance (ANOVAs) were used to compare differences in continous variables between case and control groups.

In all models, alpha levels were adjusted using the Bonferroni-Holm correction for multiple comparisons within each family of tests. To ease interpretation, we report corrected p-values and $p < 0.05$ was considered statistically significant. All analyses were conducted using R version 4.0.3 [38].

Results

Participant characteristics

Table 2 shows sample characteristics. The sample comprised individuals between the ages 16–78 years (M = 29.5 ± 10.6), and was predominantly female (95%). The lifetime ED group did not differ from controls on age or current body mass index (BMI, kg/m^2 based on self-reported weight and height). The majority (89%) of the ED group reported having received treatment for an ED, and they had a higher EDE-Q global score than controls ($p < .001$). The control group had significantly higher

Table 2 Descriptive statistics for individuals with and without lifetime EDs (overall ED and split by subtype)

Lifetime ED status	Any ED (n = 495)		AN-R (n = 65)		AN-BP (n = 114)		BN/BED (n = 180)		AN/BN/BED (n = 133)		No ED (control) (n = 395)	
	M (SD)	Range	M (SD)	Range	M (SD)	Range	M (SD)	Range	M (SD)	Range	M (SD)	Range
Age (years)	29.08 (9.76)	16–69	27.20 (9.19)	16–58	27.49 (9.82)	16–66	30.46 (9.71)	16–65	29.70 (9.93)	16–69	30.16 (11.66)	16–78
EDE-Q global score	3.32 (1.54)	0–6	2.62 (1.40)	0–5.37	3.50 (1.69)	0.14–5.9	3.19 (1.36)	0.18–6	3.68 (1.59)	0–6	1.28 (1.26)	0–5.72
Current BMI	23.85 (7.29)	12.42–58.59	19.97 (2.68)	14.77–32.33	19.78 (3.55)	12.42–38.62	29.45 (8.29)	18.44–58.59	21.51 (4.46)	12.98–46.48	23.94 (4.41)	16.04–48.67
ED onset age (years)	15.09 (4.58)	4–50	15.75 (3.41)	6–26	15.39 (4.92)	8–50	14.76 (4.66)	4–35	15.01 (4.28)	6–49	–	–
Number of SLEs (0–12)	2.59 (2.31)	0–12	1.74 (2.22)	0–8	2.60 (2.40)	0–12	2.74 (2.26)	0–11	2.85 (2.28)	0–9	1.56 (1.87)	0–11

Abbreviations: *AN* anorexia nervosa (AN-R = restricting subtype, AN-BP = binge-eating/purging subtype), *BED* binge-eating disorder, *BMI* body mass index, *BN* bulimia nervosa, *ED* eating disorder, *EDE-Q* Eating Disorder Examination-Questionnaire, *SLE* = stressful life events

completed education ($p = .002$); more individuals had completed university education ≤4 years in the control group (28.9%) than the ED group (18.4%). The average age of ED onset was 15 years, and the average age reported for any SLE was between 10 and 14 years for the dfferent ED subtypes. Frequency and age for the different SLEs are listed in Table 3.

Are SLEs more common in individuals with EDs than controls?

A total of 81% of all individuals with lifetime EDs had experienced one or more SLEs, compared to 65% in the control group. Many of the SLEs assessed were events that are commonly experienced throughout a lifetime (e.g., bereavement) and we therefore expected the majority of both cases and controls to report at least one SLE. Of the total ED sample, 56% had experienced one or more SLEs prior to ED onset. Of all the individuals in the ED group who reported a history of SLEs, 68% reported that at least one of the SLEs had occurred prior to ED onset age. The overall case-control comparison of exposure to any SLE in individuals with and without lifetime EDs yielded an OR of 2.47 (95% CI 1.80–3.40, $p < .001$). Individuals in the AN-BP, BN/BED, and AN/BN/BED groups had significantly higher frequency of any SLE than individuals in the control group (all p's < .05; see Table 4). Individuals with AN-R did not differ significantly from controls in overall SLE history ($p > .05$).

What types of SLEs are associated with the different EDs?

The most commonly reported specified SLE in both ED and control groups was emotional abuse (43 and 21%, respectively). The second most common was other sexual assault (35% of ED group, 19% of controls), followed by rape for the ED group (28% of ED, 14% of controls) and child physical abuse for the controls (22% of ED, 16% of controls). This pattern was similar for each of the ED subtypes, except for AN-R where other sexual assault (26%) was more common than emotional abuse (23%). This is shown in Table 3.

Of all the specified SLEs in the study, three events reached significance (all $p < .05$) for the three groups AN-BP, BN/BED, AN/BN/BED compared with controls: rape, other sexual assault, and emotional abuse (Table 4). Disease was significant for the AN-BP ($p = .029$) and the AN/BN/BED ($p = .018$) groups, and bereavement was significant for the BN/BED group only ($p = .038$). In addition, individuals in all ED groups (including AN-R) scored significantly higher than the control group on the SLE category "other", which was also the most commonly reported of all the SLE items across all groups.

Follow up analysis for the SLEs reaching significance for the three binge/purge ED groups (rape, other sexual

Table 3 Descriptives and age of stressful life events for individuals with lifetime eating disorders and controls

SLE type	An-R (*n* = 65)			AN-BP (*n* = 114)			BN/BED (*n* = 180)			AN/BN/BED (*n* = 133)			No ED (*n* = 395)		
	n	%	Age[b] (years) M (SD)	*n*	%	Age[b] (years) M (SD)	*n*	%	Age[b] (years) M (SD)	*n*	%	Age[b] (years) M (SD)	*n*	%	Age[b] (years) M (SD)
Any SLE[a]	43	66.2	11.4 (7.5)	91	79.8	10.7 (6.5)	153	85	11.5 (7.1)	115	86.5	10.4 (6.7)	255	64.6	14.7 (10.6)
Disease	7	10.8	27.9 (16)	18	15.8	17.4 (9.9)	15	8.3	17.6 (15.4)	23	17.3	21.1 (11.2)	30	7.6	27.1 (19.3)
Accident	2	3.1	24 (0)	7	6.1	23.3 (10.6)	13	7.2	13.3 (5.4)	9	6.8	19.6 (7.4)	30	7.6	20.4 (14.2)
Assault	3	4.6	7.5 (3.5)	11	9.6	18.7 (9.8)	21	11.7	18.7 (7.1)	19	14.3	18.8 (7.0)	24	6.1	20.4 (7.9)
Bereavement	5	7.7	13.4 (8.9)	27	23.7	18.3 (8.5)	40	22.2	16.8 (7)	25	18.8	21.4 (9.3)	51	12.9	19 (9.66)
Rape	8	12.3	17.3 (10.7)	33	28.9	12.8 (5.9)	57	31.7	15.1 (5.1)	39	29.3	12.3 (6.2)	56	14.2	16.3 (6)
Other sexual assault	17	26.2	14.3 (7.8)	41	36	13.2 (5.6)	59	32.8	13.3 (6.1)	47	35.3	13.2 (5.7)	72	18.2	15.7 (6.8)
Childhood physical abuse	9	13.8	8 (5.3)	22	19.3	7.3 (4.5)	43	23.9	8.4 (3.9)	29	21.8	7.2 (5.0)	62	15.7	8.1 (4.3)
Adulthood physical abuse	7	10.8	19 (8.1)	14	12.3	22.4 (6.3)	31	17.2	20.4 (6.8)	18	13.5	21.8 (2.3)	24	6.1	21.8 (5.7)
Emotional abuse	15	23.1	8.1 (5.4)	43	37.7	10.1 (6.6)	80	44.4	11.9 (6.6)	60	45.1	20.2 (8.2)	79	20	13.3 (8.8)
Threatened	2	3.1	18.5 (14.9)	8	7.0	16.8 (5.1)	12	6.7	13.8 (7.7)	12	9.0	14.4 (8.8)	24	6.1	20.3 (8.8)
Witnessed a traumatic event	5	7.7	10 (3.5)	17	14.9	13.1 (7.9)	17	9.4	12.9 (7.6)	18	13.5	17.1 (13.3)	31	7.8	15.6 (8.7)
Other	33	50.8	13.2 (6.6)	55	48.2	13.3 (7.2)	105	58.3	15.7 (8.6)	80	60.2	13.8 (8.3)	132	33.4	18.9 (12.0)

Abbreviations: *AN* anorexia nervosa (AN-R = restricting subtype, AN-BP = binge-eating/purging subtype), *BED* binge-eating disorder, *BN* bulimia nervosa, *ED* eating disorder, *SLE* stressful life event

[a]"Any SLE" measures all individuals reporting at least one of the listed SLE types

[b]Age at which the SLE occurred

Table 4 Associations between SLEs and ED subtypes (controlled for gender, education, and age)

SLE type	An-R (*n* = 65)		AN-BP (*n* = 114)		BN/BED (*n* = 180)		AN/BN/BED (*n* = 133)	
	AN-R vs control OR (95% CI)	*p*-values corrected*	AN-BP vs control OR (95% CI)	*p*-values corrected*	BN/BED vs control OR (95% CI)	*p*-values corrected*	AN and BN/BED vs control OR (95% CI)	*p*-values corrected*
Any SLE[a]	1.22 (0.70–2.18)	1.000	**2.29 (1.39–3.91)**	**.017**	**3.01 (1.91–4.88)**	**< .001**	**3.58 (2.11–6.37)**	**< .001**
Disease	1.90 (0.71–4.60)	1.000	**2.71 (1.37–5.27)**	**.029**	1.09 (0.54–2.11)	1.000	**2.60 (1.40–4.80)**	**.018**
Accident	0.48 (0.08–1.71)	1.000	0.95 (0.36–2.18)	.000	1.04 (0.51–2.04)	1.000	0.93 (0.40–2.00)	.964
Assault	0.91 (0.21–2.83)	1.000	1.70 (0.75–3.64)	.923	1.96 (1.03–3.69)	.224	2.45 (1.24–4.81)	.066
Bereavement	0.62 (0.21–1.50)	1.000	2.09 (1.20–3.59)	.055	**1.97 (1.23–3.14)**	**.038**	1.75 (1.00–3.02)	.268
Rape	0.93 (0.39–2.00)	1.000	**2.17 (1.29–3.61)**	**.029**	**2.59 (1.68–4.00)**	**< .001**	**2.15 (1.32–3.47)**	**.017**
Other sexual assault	1.67 (0.87–3.10)	1.000	**2.36 (1.46–3.81)**	**.005**	**2.15 (1.42–3.26)**	**.003**	**2.35 (1.48–3.70)**	**.003**
Childhood physical abuse	0.99 (0.42–2.08)	1.000	1.37 (0.77–2.39)	1.000	1.76 (1.11–2.76)	.103	1.56 (0.93–2.60)	.439
Adulthood physical abuse	1.18 (0.66–2.09)	1.000	1.06 (0.67–1.67)	1.000	1.05 (0.72–1.52)	1.000	0.80 (0.51–1.23)	.964
Emotional abuse	1.32 (0.67–2.47)	1.000	**2.54 (1.57–4.09)**	**.002**	**3.27 (2.20–4.89)**	**< .001**	**3.20 (2.04–5.05)**	**< .001**
Threatened	0.52 (0.08–1.93)	1.000	1.10 (0.44–2.50)	1.000	1.03 (0.48–2.11)	1.000	1.45 (0.66–3.05)	.964
Witnessed a traumatic event	1.10 (0.36–2.78)	1.000	2.06 (1.05–3.92)	.185	1.19 (0.62–2.22)	1.000	1.71 (0.88–3.21)	.439
Other	**2.52 (1.43–4.47)**	**.019**	**2.21 (1.40–3.50)**	**.007**	**2.94 (2.01–4.33)**	**< .001**	**3.10 (2.02–4.80)**	**< .001**

Abbreviations: *AN* anorexia nervosa (AN-R = restricting subtype, AN-BP = binge-eating/purging subtype), *BED* binge-eating disorder, *BN* bulimia nervosa, *ED* eating disorder, *SLE* stressful life events

[a]"Any SLE" measures all individuals reporting at least one of the listed SLE types

*p-values corrected for multiple comparisons using Bonferroni-Holm, boldface indicates statistical significance ($p < 0.05$)

assault, and emotional abuse) revealed no significant differences in age of event between groups except for a slightly lower age for rape in the mixed AN/BN/BED group (M = 12.3 ± 6.2) than controls (M = 16.3 ± 6.0; p = .028). The frequency of sexual assault was also higher in the BN/BED (M = 2.5 ± 1.19) group than in controls (M = 1.59 ± 0.86; $p < .001$). No other group differences in frequency were significant. In the ED sample as a whole, the proportion of reported SLEs that had occurred prior to ED onset age was 43.1% for rape, 56.6% for emotional abuse, and 49.4% for other sexual assault.

Is the association between SLEs and EDs stronger for individuals with a history of multiple SLEs?

Individuals with EDs reported experiencing a higher number of different SLEs (M = 2.6, M_{dn} = 2) than individuals in the control group (M = 1.6, M_{dn} = 1; $p < .001$). The overall case-control comparison showed that individuals in the ED group were significantly more likely to have experienced three or more SLEs (OR 2.08, 95% CI 1.49–2.90), than one or two SLE types (OR 1.82, 95% CI 1.30–2.57) compared with controls (see Table 5). Apart from the AN-R subtype, a pattern emerged that was consistent with a cumulative effect of multiple SLE types for all subtypes (AN-BP, BN/BED, AN/BN/BED). Thus, there was support for an association between binge-eating/purging EDs and SLEs that was stronger for individuals with more extensive SLE history.

Discussion

The current study investigated the history of a variety of different lifetime SLEs in individuals with and without lifetime EDs, differentiated by subtype. Individuals with binge-eating/purging subtypes of EDs had experienced SLEs more often than controls, and it was more common for these groups to be exposed to multiple types of events. Rape, other sexual assault, and emotional abuse were significantly more common in the ED group as a whole than in the control group, and this held true for all ED subtypes with the exception of AN-R. This is consistent with previous research reporting a stronger association between a range of SLEs and binge-eating/purging EDs than restrictive AN [4, 12, 26, 39, 40]. The event category "other SLE" was significantly more common in all ED groups, and certain SLEs (bereavement and life-threatening disease) were more common for only some ED subtypes. The average onset age for both ED onset and SLE was during adolescence, and the majority of SLEs in the ED group occurred prior to ED onset. More than half of the ED group had experienced at least one SLE prior to developing significant ED symptoms, which raises the possibility that such events can be a trigger contributing to the onset of EDs. By assessing a number of different SLEs throughout life, we showed that both non-sexual and sexual SLEs are associated with binge-eating/purging EDs and thus add to the growing knowledge of sociocultural factors in EDs.

Our findings support the observation that exposure to SLEs is more prevalent among individuals with binge-eating/purging EDs than controls. These individuals were between two and three times more likely than controls to have experienced any SLE, with the highest individual associations being for sexual and emotional abuse. The association was also stronger for those with a higher number of different SLEs. This finding is consistent with other research showing a cumulative effect of multiple adversities on a range of negative health outcomes [41]. The strength of the associations in the present study is comparable to previous studies finding OR's in the range of 2–3 for different types of adversities including emotional, physical and sexual child abuse, sexual assault, family disruption, parental psychiatric illness, parental teasing, and bullying [3, 26, 40, 42–45]. We have previously reported associations between school-age bullying and EDs in the same sample as the present study, with a similar pattern of results [28]. Together, these findings

Table 5 Associations between multiple SLEs and ED groups (overall and by subtype) versus controls (controlled for age, gender, and education)

Diagnosis	No SLEs	One or two SLEs	Three or more SLEs	One or two SLEs vs no SLEs		Three or more SLEs vs one or two SLEs	
	n (%)	*n* (%)	*n* (%)	OR (95% CI)	*p*-values corrected*	OR (95% CI)	*p*-values corrected*
No ED (control)	140 (35%)	167 (42%)	88 (22%)	–	–	–	–
Any ED[a]	92 (19%)	192 (39%)	211 (43%)	**1.82 (1.30–2.57)**	**.004**	**2.08 (1.49–2.90)**	**< .001**
AN-R	22 (34%)	28 (43%)	15 (23%)	1.17 (0.64–2.17)	1.000	1.14 (0.56–2.27)	1.000
AN-BP	23 (20%)	39 (34%)	52 (46%)	1.52 (0.87–2.73)	.446	**2.58 (1.55–4.34)**	**.002**
BN/BED	27 (15%)	69 (38%)	84 (47%)	**2.13 (1.30–3.57)**	**.017**	**2.24 (1.48–3.42)**	**.001**
AN/BN/BED	18 (14%)	55 (41%)	60 (45%)	**2.71 (1.54–4.99)**	**.005**	**1.94 (1.22–3.10)**	**.021**

Abbreviations: *AN* anorexia nervosa (AN-R = restricting subtype, AN-BP = binge-eating/purging subtype), *BED* binge-eating disorder, *BN* bulimia nervosa, *CI* confidence interval (95%), *ED* eating disorder, *OR* odds ratio, *SLE* stressful life event

[a]"Any ED" refers to all individuals with a lifetime ED (any subtype)

*p-values corrected for multiple comparisons using Bonferroni-Holm, boldface indicates statistical significance ($p < 0.05$)

indicate that history of SLEs is common among individuals with EDs, underscoring the importance of environmental factors in these patient groups.

Various SLEs were more common in individuals with AN-BP, BN/BED, and AN/BN/BED than controls, whereas this was not the case for the AN-R group. While we note that these analyses could be underpowered due to a relatively small sample size for the AN subtypes ($n = 65$ for AN-R, $n = 114$ for AN-BP), other studies have found similar subtype differences regarding AN-R [14, 16]. Why individuals with restricting ED subtypes would be less likely to have experienced SLEs is unclear. One interpretation is that SLEs and traumas cause behaviors that are characterized by impulsivity, as many studies have found associations between SLEs and other impulsive behaviours and maladaptive coping such as suicide attempts [46] and substance abuse [47, 48] in addition to the more ED specific behaviours binge eating and purging [4, 10, 49]. Behavioural impulsivity has also been shown to mediate the relationship between childhood abuse and binge eating and purging in non-clinical populations [50, 51]. Relatedly, personality traits such as sensation seeking and disinhibition have been associated with both BN/BED and victimisation experiences [52]. In addition, SLEs might differentially affect BN and BED – and different types of SLEs could be related to specific types of binge/purge symptoms. This would be obscured due to the combination of BN and BED in one group in the current study, and would need to be explored in future research.

In line with findings implicating an association between impulsive psychopathologies and SLEs, it has been suggested that AN-R in particular might have a different etiology than other EDs [1, 26, 53]. Different genetic pathways and interactions between genetic profile and traumatic events could thus account for the observed difference between restricting and binge-eating/purging EDs [54–56]. Genetic research on AN has also found both psychiatric and metabolic genetic correlations [57], and it is noteworthy that heritability estimates are higher in restricting than binge-eating/purging EDs, possibly suggesting a more biological etiology [58]. These observations along with the findings in the present study, may indicate that environmental stressors and triggers are more important in the etiology of binge/purge ED subtypes than restricting subtypes, which could have clinical implications for prevention and treatment.

In terms of specific SLEs, our results highlight that a range of SLEs are commonly experienced by individuals with EDs. This is in line with previous findings (e.g., [4, 59]). Sexual traumas (rape and other sexual assault) were significantly associated with binge-eating/purging ED subtypes in the current study. This is consistent with previous literature highlighting sexual abuse in childhood [3–5] and sexual assault and harassment in adulthood [23, 42, 60–63] as risk factors for ED psychopathology and diagnosis. We also found that emotional abuse was significantly associated with binge-eating/purging EDs. This was common for both cases and controls (20–45%), and resulting ORs were particularly high (2.54–3.27). Emotional abuse has previously been studied mainly in childhood and adolescence and although fewer studies are available than for sexual abuse, the research supports a role of childhood emotional abuse in EDs [4, 16, 20, 21]. Additionally, bereavement was significantly associated with BN/BED, which is consistent with a recent review highlighting non-abusive family-related risk factors [64]. Having a serious or life-threatening disease was significantly associated with AN-BP and AN/BN/BED. This could be consistent with previous research implicating immune system disturbances as risk factors for EDs [13, 65, 66], but we cannot rule out the possibility that some participants might have responded "yes" to this item because of their ED—for example in the case of somatically unstable AN or other complications. The final SLE category "other stressful life events" was also significant for all ED groups. This could include a range of different life experiences (for example divorce, financial difficulties, etc.), and indicates that there could be many more SLEs other than «typical» traumatic experiences that could be of interest to investigate in ED populations.

On average, most of the significant events occurred during early to middle adolescence in the present study. Thus, the average age for the significant SLEs associated with EDs was between 10 and 21 years for the different diagnostic groups, indicating that many of these events would have coincided with ED onset age (average 15 years). Indeed, in 68% of the individuals with EDs who reported SLEs, at least one event occured prior to our calculated ED onset age based on presence of symptoms. This is consistent with the notion that these events could be risk factors for the development of EDs [2], and in line with a handful of longitudinal studies finding increased risk of disordered eating in individuals who have experienced childhood maltreatment or other traumas [67–70]. Moreover, in a study by Brewerton et al. [71], history of victimisation and PTSD symptoms were associated with child onset binge eating, as opposed to adult onset. Thus, the timing of ED onset and SLE occurrence is an important factor to include in future studies. As there are still unanswered questions regarding the mechanisms of the associations between EDs and SLEs, further prospective studies are needed to explore this and extend to a wider range of lifetime experiences.

Although childhood physical abuse has previously been linked to EDs [3, 4], both childhood and adulthood physical abuse were among the SLEs not significicantly

associated with EDs in the present study. Some of these non-significant associations could be due to low power, as some events were infrequent in both ED and control groups. For example, being threatened was only experienced by 3–9% of individuals in all groups. The low prevalence for some events can be due to cultural and societal factors, as for example childhood maltreatment is less common in Scandinavian countries compared to the US and many other countries [72–74]. As such, we contribute to the current understanding of stressful life events and EDs by highlighting the role of sexual and emotional stressors, while not ruling out the possibility that other types of events may be important.

The current study used a convenience sample, and recruited participants mainly through online channels. Many of the participants were reached through ED-specific social media accounts and user-forums. This might have biased our sample towards more severe ED presentations, with a higher proportion of AN in the ED case group than what we would expect in the general population. In addition, this sampling method is likely to reach predominantly younger participants, and the sample had an average age of ≈ 30 yrs. (Mdn = 27). We therefore acknowledge that the ED case groups in the current study may not be representative of the ED population at large. However, as previous research has also found, there seems to be a subgroup of individuals with EDs who have a history of SLEs that may be related to the development, maintenance, severity, or clinical presentation of their symptoms. The co-occurrence and relationship between ED symptoms and SLE history has implications for treatment strategies for this group, and we refer to other studies providing in-depth discussions and experiences about the clinical interventions and treatment delivery for these individuals [75–77].

Our study has a number of limitations. First, we used self-report measures both for establishing ED status and for documenting SLEs. However, we used a comprehensive and previously validated measue (ED100K) for ED assessment and a validated measure for SLEs. Second, the retrospective nature of our study may introduce recall bias, which we attempted to account for by controlling for current age. This design also precludes us from drawing causal inferences, and further studies are needed to explore potential bi-directional relationships or third-variables that could affect the associations between SLEs and EDs. For example, we did not measure PTSD symptoms in the current study and we cannot determine whether the observed differences were influenced by such symptoms. Third, we did not consider events such as for example military experiences or natural disaster, and there could be other events that are associated with EDs not explored in the current study. Fourth, we did not include a psychiatric control group, and the sample was predominantly female. We also lack information regarding race or ethnicity of our sample, but note that the population of Norway is primarily of Northern European descent. Last, we did not directly compare ED subtypes as these comparisons would likely suffer from low power, and we combined BN and BED into one group which prevented us from investigating potential differences in SLE history for these two subtypes.

Conclusions

The current study showed that SLEs were more frequently reported by individuals with binge-eating/purging EDs than controls. While previous studies of SLEs have typically focused on sexual abuse, we queried a number of different events and found that both sexual (e.g., rape, other sexual assault) and non-sexual (e.g., emotional abuse, bereavement) events were more common among individuals with a history of EDs. These events may consistute risk factors, but prospective studies are needed to establish this further. Future studies are also needed to explore if timing of events is important, and whether there is a dose-response relationship between SLEs and EDs. In addition, an interesting avenue for further research is the exploration of potential gene – environment interactions, which may be relevant in the study of risk factor assessment for EDs [78]. Our results highlight that one or more SLEs are more commonly reported in individuals with ED subtypes marked by binge eating and purging than in controls, and encourage thorough assessment of SLEs to inform case conceptualization, treatment strategies, and risk assessment for this patient group.

Abbreviations

AN-BP: Anorexia nervosa binge-eating/purging subtype; AN-R: Anorexia nervosa restricting subtype; BED: Binge-eating disorder; BN: Bulimia nervosa; ED: Eating disorders; OR: Odds ratio; SLE: Stressful life event

Acknowledgements

The authors would like to thank all the participants for their willingness to contribute to this study, and to the Norwegian user organizations ROS and SPISFO for their support and assistance.

Authors' contributions

SØL contributed to data collection, data analysis, interpretation of results, and drafted/revised the manuscript. CMB contributed to the conception and planning of the study, interpretation of results, and in revising the manuscript. OAA contributed to the conception and planning of the study, interpretation of results, and in revising the manuscript. ØR contributed to the conception and planning of the study, interpretation of results, and in revising the manuscript. LB secured funding for the study, and contributed to the conception and planning of the study, data collection, interpretation of results, and in revising the manuscript. All authors read and approved the final manuscript.

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Funding
This study (via Dr. Bang) is funded by the South-Eastern Norway Regional Health Authority (#2017083). Dr. Bulik acknowledges funding from the Swedish Research Council (Vetenskapsrådet, award: 538–2013-8864). None of the funding bodies had any role in the design, data collection, data analysis, interpretation of data, or drafting the manuscript.

Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study and all procedures were approved by the Regional Ethics Committee in Norway, South-East region (REK sør-øst, project id# 2017/1606). All participants signed informed consent to participate. All procedures were performed in accordance with ethical guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
CM Bulik reports: Shire (grant recipient, Scientific Advisory Board member); Idorsia (consultant); Lundbeckfonden (grant recipient); Pearson (author, royalty recipient). OA Andreassen received speaker's honorarium from Lundbeck and Sunovion. Consultant to HealthLytix. The other authors have no conflicts to declare.

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Received: 28 May 2021 Accepted: 24 September 2021
Published online: 13 October 2021

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Publisher's Note

8. Appendix

List of additional tables included in the appendix:

Table A1: Overview of previous published systematic reviews on bullying and stressful life events in EDs.

Table A2: Distribution and overlap of ED diagnoses in the case – control study sample.

Tables A3-A5: Diagnostic criteria for AN, BN, and BED in the ED100K questionnaire used in the current study.

Table A6: Questions included in the adapted Stressful Life Events Screening Questionnaire, English translation.

Table A1. ***List of systematic review articles published prior to July 2021 investigating the association between eating disorders and bullying, abuse, and other stressful life events[a].***

Author(s)	Year	Number of studies included	Type of adversity	Meta-analysis?	ED type/outcome/population	Results
Bullying and teasing						
Day et al.	2021	79	Bullying and teasing	No	ED behaviours and body image disturbance in adolescents	ED behaviours and negative body image more likely in adolescents who have been bullied/teased.
Lie et al.[b]	2019	22	Bullying, teasing (weight related and non-weight related)	Yes	ED diagnoses; AN, BN, BED subtypes	Bullying/teasing associated with BN/BED, inconclusive evidence for AN.
Menzel et al.	2010	57	Appearance related teasing	Yes	ED behaviours and body dissatisfaction	Significant associations between weight- and appearance-related teasing and body dissatisfaction, dietary restraint, and bulimic behaviours
Saltzman and Liechty	2016	15	Family teasing	No	Binge eating in children	Weight teasing by family correlates with binge eating in children.
Childhood maltreatment and other SLEs						
Bundock et al.	2013	8	Intimate partner violence (IPV)	No	ED by type (AN, BN, BED, general ED)	Suggestive evidence of higher exposure to IPV in EDs, differences by subtype. Need for more studies.
Caslini et al.	2016	32	Childhood sexual, physical, and emotional abuse	Yes	ED outcome (AN/BN/BED)	Overall EDs associated with any child abuse. Specifically, sexual, physical and emotional abuse related to BN and BED. AN only to physical abuse.
Chen et al.	2010	37	Sexual abuse	Yes	ED diagnosis	Sexual abuse associated with EDs, and other mental disorders (depression, anxiety, PTSD, sleep disorders, suicide attempts, anxiety).
Dworkin et al.	2017	14 (for EDs)	Sexual assault victimization	Yes	Disordered eating/ED diagnoses	Sexual assault associated with disordered eating, smaller effects

						compared to other disorders (PTSD, anxiety, depression).
Goldstein et al.	2019	38	General trauma/abuse in relation to suicidal behaviour in EDs	No	AN, BN, and suicidality	Suicidal behaviour in BN associated with different types of abuse.
Grogan et al.	2020	26	Family-oriented non-abusive adversities	No	ED diagnoses; AN, BED, BN subtypes	Higher rates of family disruption and loss in BN and BED than controls, inconclusive findings for AN.
Hayes et al.	2021	15	Sexual harassment	Yes	ED psychopathology	Association between sexual harassment and EDs, but more prospective studies needed.
Kimber et al.	2017	23	Child emotional abuse, emotional neglect and exposure to intimate partner violence	No	ED diagnosis and ED behaviours	Emotional abuse and neglect prevalent in BN and BED, but limited evidence available. Few studies available on exposure to intimate partner violence.
Mitchison and Hay	2014	57 (for environmental factor review)	Different types of abuse, other stressful events, bullying, etc.	No	ED diagnoses, subtypes	The most robust associations found for physical and sexual abuse and life stressors in general. High variability in study findings.
Molendijk et al.	2017	82	Childhood maltreatment (CM)	Yes	ED diagnosis	CM higher in all EDs than in healthy controls and other psychiatric groups. CM associated with co-morbid illness, suicidality, earlier ED onset, higher severity, and more binge/purge pathology.
Palmisano et al.	2016	70 (10 for SLE and BED)	Life adverse experiences	No	BED and obesity	Majority of studies supported an association between adverse experiences, obesity, and BED.
Pignatelli et al.	2017	7 (emotional neglect) and 6 (physical neglect)	Emotional and physical childhood neglect	Yes	ED diagnosis	Neglect more common in ED compared to healthy populations.
Rabito-Alcon et al.	2021	18	Childhood trauma and mediating factors	No	Clinical ED and ED psychopathology in non-clinical samples	A range of factors moderated the association between ED and trauma,

						including dissociation and emotion regulation.
Rijkers et al.	2019	9	PTSD	No	ED all types	Higher prevalence of PTSD in EDs, and PTSD associated with more severe ED symptoms.
Solmi et al.	2021	9	Appearance-related teasing and childhood sexual abuse (among others)	Umbrella (systematic) review of meta-analyses	EDs overall and by subtype	Review of previous meta-analyses of risk factors for EDs revealed that the most credible evidence found for child sexual abuse as risk factor for BN, and weight-teasing as risk factor for all EDs.
Smolak and Murnen	2002	53	Childhood sexual abuse	Yes	Clinical ED, and ED psychopathology in abuse victims	Overall small but significant association between child sexual abuse and EDs.
Wonderlich et al.	1997	53	Childhood sexual abuse	No	ED diagnosis	Childhood sexual abuse significant risk factor for BN.

Abbreviations: AN = anorexia nervosa; BN = bulimia nervosa; BED = binge-eating disorder; CM = childhood maltreatment; ED = eating disorders; OR = odds ratio; PTSD = posttraumatic stress disorder; SLE = stressful life event

Notes:

[a] Only systematic reviews using defined and reproducible literature search terms and providing a synthesis of the identified literature in either a critical summary or a meta-analysis are included in this table. Narrative and scoping reviews are not included. Only studies exploring stressful, traumatic, or other adverse/negative life events were included, reviews exploring pre- and peri-natal exposures were excluded as we consider this a separate research field to the main themes of the current thesis. The main search was conducted in July 2021, and updated in November 2021.

[b] Lie et al. (2019) is included in this thesis as Paper I.

Table A2. ***Overview of ED100K diagnoses in the total sample (n = 916).***

Diagnosis	*n*	% of sample
AN only[a]	182	19.9
AN and BN[b]	90	9.8
AN and BED[b]	15	1.6
BN only	58	6.3
BN and BED	52	5.7
BED only	70	7.6
AN, BN, and BED[b]	28	3.1
No ED	395	43.1
Missing[c]	26	2.8

Abbreviations: AN = anorexia nervosa, BED = binge-eating disorder, BN = bulimia nervosa, ED = eating disorder.

Notes:

[a]AN-R 65 (36%), AN-BP: 114 (62%), missing AN subtype: 3 (2%)

[b]AN and BN, AN and BED, and AN,BN, and BED make up the AN/BN/BED group (*n* = 133) used in analyses in Papers II-III

[c]Missing data on variables needed to establish case status, excluded from case-control comparisons.

Table A3. ***Criteria for anorexia nervosa (AN).***

Anorexia nervosa	Criteria
AN (n = 315)	a) Lowest BMI ever < 18.55 **OR** reported having received treatment for AN **AND** b) Reported fear of weight-gain. **AND** c) Reported undue influence of weight or shape on self-evaluation **OR** feeling fat despite at low weight **OR** denying any negative consequences of low weight **OR** perceiving body or parts of body as bigger than it really was.
	OR d) If reported having received treatment for AN/atypical AN **AND** was gated into AN section (i.e. reported any of the other criteria for AN), they receive an AN diagnosis regardless of the criteria above.
No AN	a) Did not fulfill criteria for AN . **OR** b) For those who had missing values on critical questions (and thus missing on AN diagnosis); Reported not having suspected they have ever had AN **AND** never received treatment for AN.
Undeterminable (missing)	a) Not fulfilling any of the above criteria. E.g. someone reporting missing on critical variables leading to missing on AN diagnosis AND did not fulfill "No AN" criteria above due to they having suspected they have had AN (or had missing on this question).

Table A4. ***Criteria for bulimia nervosa (BN.)***

Bulimia nervosa	Criteria
BN (n = 228)	a) Reported episodes of binge-eating with a frequency of once a week or more, for a duration of three months or more. Missing values on weekly frequency **OR** duration is allowed if all other criteria are met. **AND** c) Reported episodes of compensatory behaviors with a frequency of once a week or more, for a duration of three months or more. Missing values on weekly frequency **OR** duration is allowed if all other criteria are met. **AND** d) The binge-eating and compensatory episodes occurred together at the same time at least once a week for a duration of three months or more. **AND** b) Reported undue influence of weight or shape on self-evaluation. **AND** f) The binge-eating episodes did not occur exclusively during periods of AN.
	OR g) If reported having received treatment for BN/atypical BN **AND** BE episodes **AND** any ICB occurring together with BE episodes for a duration of three months, they receive a BN diagnosis regardless of the criteria above.
No BN	a) Did not fulfill criteria for BN. **OR** b) For those who had missing values on critical questions (and thus missing on BN diagnosis); Reported not having suspected they have ever had BN **AND** never received treatment for BN.
Undeterminable (missing)	a) Not fulfilling any of the above criteria. E.g. someone reporting missing on critical variables leading to missing on BN diagnosis AND did not fulfill "No BN" criteria above due to they having suspected they have had BN (or had missing on this question).

Table A5. ***Criteria for binge-eating disorder (BED).***

Binge-eating disorder	Criteria
BED (n = 165)	a) Reported episodes of binge-eating with a frequency of once a week or more, for a duration of three months or more. Missing values on weekly frequency **OR** duration is allowed if all other criteria are met. **AND** d) Reported 3 or more of the required BED characteristics. **AND** e) Reported significant distress associated with the binge-eating episodes. **AND** f) The binge-eating episodes did not occur exclusively during periods of AN or BN.
	OR g) If reported having received treatment for BED **AND** reported BE episodes, they receive a BED diagnosis regardless of the criteria above.
No BED	a) Did not fulfill criteria for BED. **OR** b) For those who had missing values on critical questions (and thus missing on BED diagnosis); Reported not having suspected they have ever had BED **AND** never received treatment for BED.
Undeterminable (missing)	a) Not fulfilling any of the above criteria. E.g. someone reporting missing on critical variables leading to missing on BED diagnosis AND did not fulfill "No BED" criteria above due to they having suspected they have had BED [or had missing on this question].

Table A6. ***Items included in the adapted version of the Stressful Life Events Screening Questionnaire (SLESQ), English translation.***

Item number	Description
1: Life-threatening disease	Have you ever had a life-threatening illness/disease?
2: Accident	Were you ever in a life-threatening accident?
3: Physical assault	Was physical force or a weapon ever used against you in a robbery or assault?
4: Bereavement	Has an immediate family member, romantic partner or very close friend died as a result of accident, homicide, or suicide?
5: Rape	Has anyone (parent, other family member, romantic partner, stranger, or someone else) ever forced or threatened you into having intercourse, oral, or anal sex against your will, or when you were in some way helpless?
6: Other sexual assault	Other than experiences you have already described, has anyone ever touched your genitals or made you touch theirs against your wishes, or when you were in some way helpless?
7: Childhood physical abuse	When you were a child, did a parent, caregiver or other person ever kick you repeatedly, beat or otherwise attack or harm you?
8: Adulthood physical abuse	As an adult (>18 years), have you ever been kicked, beaten, slapped around or otherwise physically harmed by a romantic partner, date, sibling, family member, stranger, or someone else?
9: Emotional abuse	Has a parent or a romantic partner systematically ridiculed you, humiliated you, or called you worthless?
10: Threatened	Other than the experiences already covered, has anyone ever threatened you with a weapon, like a knife or gun?
11: Witnessed a traumatic event	Have you ever witnessed another person being killed, seriously injured, or sexually or physically assaulted?
12: Other	Other than the events you have already described, have you ever been in any other situations that was extremely frightening or horrifying, or where you felt very helpless?