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Review article

Socio-demographic and psychological risk factors for suicidal behavior among individuals with anorexia and bulimia nervosa: A systematic review

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ABSTRACT

Objective: Suicide is the second leading cause of death among individuals with anorexia nervosa (AN) and is also elevated in bulimia nervosa (BN). We carried out a systematic review in which we analyzed the relationship between AN and/or BN and suicidality (i.e. suicidal ideation or attempted and/or death by suicide) and the major risk factors for suicidal behavior among AN and BN patients by synthesizing the qualitative data from relevant studies.

Evidence acquisition: According to PRISMA guidelines, we conducted a systematic search of the literature on PsycNET, PubMed, Google Scholar, and ScienceDirect. Search terms were "eating disorders" "OR" "anorexia" "OR" "bulimia" combined with the Boolean "AND" operator with "suicide."

Evidence synthesis: The initial search identified 8,590 records, of which 38 research reports met the predefined inclusion criteria and were analyzed. Eating disorders (EDs) were found to be associated with a marked increase in suicidal behaviors and ideation. ED type, impulsivity, and specific interpersonal features were associated with suicidal behavior.

Conclusions: Our findings highlight the importance of the combined role of socio-demographic and psychological factors to the co-occurrence of EDs and suicidal behavior. It is imperative that a thorough suicide assessment be conducted routinely for individuals with past and current EDs, and that clinicians be aware that this risk may be ongoing and occur throughout treatment, even after ED symptoms appear to be remitting.

Limitations: Study limitations include diagnostic definitions of and criteria for EDs, and the different terminology used by researchers to define suicide, including non-suicidal behaviors, which weakens the ability to draw conclusions regarding actual suicidal behaviors versus other self-harm behaviors.

1. Introduction

Suicide is one of the leading priorities in global public health. It accounts for 1.4% of all deaths worldwide, making it the 17th leading cause of death (WHO, 2017). Suicide is a result of a complex interaction between numerous variables: demographic factors, clinical symptoms, mental disorders, social support, personality traits, etc. (Gvion et al., 2014). Growing concerns in recent years regarding suicidal behavior in eating-disordered populations have led many studies to search for risk factors in order to improve assessment and treatment.

Eating disorders (EDs) are serious mental illnesses characterized by disturbances in eating and food-related behaviors, as well as in the experience of weight and shape. Lifetime prevalence rates range from 0.5% to 1.0% for anorexia nervosa (AN), 1–3% for bulimia nervosa (BN), and 2–2.5% for binge eating disorder (BED). EDs are related to a combination of negative affect, social parameters, cultural aspects, familial factors, low self-esteem, and body dissatisfaction (Polivy & Herman, 2002). According to the National Association of Anorexia Nervosa and Associated Disorders (ANAD), EDs have the highest mortality rate of any mental disorder. In two previous meta-analyses, it was found that AN patients committed suicide more often compared to the general population (Pompili et al., 2004; Preti et al., 2011). Moreover, completed suicide accounts for 20–40% of fatalities in AN, making it the second most common cause of death in ED patients (Harris & Barraclough, 1998; Papadopoulos et al., 2009). A meta-analysis by Arcelus et al. (2011) found that one out of every five AN individuals who died had committed suicide. Given that both suicidal behaviors and EDs are body-focused disorders, in recent years, the focus of the research has been on their co-occurrence.

Risk factors that were previously identified as associated with

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suicide attempts among patients with AN include longer duration of illness, lower body mass index (BMI), greater number of past treatments, drug and alcohol abuse (Favaro & Santonastaso, 1997), and major depression (Braun et al., 1994). For BN, associated factors include greater general psychopathology, greater number of past treatments, and increased impulsive behaviors, including self-injury (Favaro & Santonastaso, 1997).

It is currently unknown whether ED type and severity play a role in suicide attempts (SAs) or whether suicide attempters with EDs are affected by other characteristics. Understanding the features that may help identify individuals in this high-risk population is imperative for assessment, prevention, and intervention. Despite the extensive reported data in the literature supporting the association between AN, BN and suicidal behavior, no systematic review has been carried out so far. Against this preliminary background, the purpose of the current study is to provide a systematic review of original studies that focus on risk factors and associations between AN, BN and the core suicidal clinical factors: ideation, SA, and suicidal behaviors. Accordingly, in the following sections, we review the literature regarding both socio-demographic and psychological risk factors that may lead to suicide in an ED population.

2. Materials and methods

2.1. Information databases and searches

A comprehensive electronic search strategy was applied to identify peer-reviewed articles on the relationships between suicidality, EDs, and a wide range of psychological and socio-demographic factors. This strategy is in line with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009). PubMed, PsycNET, Google Scholar, and ScienceDirect databases were searched. Search terms were “eating disorders” “OR” “anorexia” “OR” “bulimia” combined with the Boolean “AND” operator with “suicide.” In addition, a manual search in Google Scholar was performed for hitherto unidentified studies.

2.2. Study selection

Studies were eligible if they were original, written in English, and presented data regarding a wide range of psychological factors or interpersonal factors associated with EDs and suicidality. To review recent findings, we searched papers dating from January 1, 2000 to October 31, 2017. Case studies, reviews, book chapters, conference papers, and incomplete studies were excluded. Two psychologists (one Ph.D., the other Ph.D student) examined the consistency of the search and suitability of the studies in light of the inclusion and exclusion criteria.

3. Data analysis

As studies on suicide risk factors in an eating-disordered population are highly heterogeneous, with different study designs, measures, and sample types, they could not be combined into a singular meta-analysis study. Consequently, we conducted a systematic review of the results of each study. Studies were first categorized based on clusters of risk factors (e.g. age, ED type, interpersonal factors etc.), then summarized by highlighting common features in each cluster, as well as information unique to each study.

4. Results

The search conducted in electronic databases initially provided n = 8,590 citations, as reported in the PRISMA flowchart (Fig. 1). After removing the duplicates, n = 3,789 records remained, of which n = 3,402 were eliminated given that they were reviews, meta-analyses, conference papers, commentaries, letters to the editor, books or book chapters, abstracts, non-English language papers, or did not meet other inclusion criteria. Of the 387 full text articles assessed for eligibility, n = 349 studies were excluded because they focused on neither inclusion nor exclusion criteria. Ultimately, n = 38 studies were selected for inclusion in this systematic review. 36 studies were cross sectional and 2 were longitudinal. In what follows, we will present the literature review results, which have been sub-grouped according to common risk factor themes. A detailed description of reviewed studies is presented in Table 1.

4.1. Background factors

Studies on background factors that may lead to suicide behaviors in EDs are scarce.

Socio demographic factors. Three studies examining the association between EDs and suicidality addressed socio-demographic characteristics, within a population of BN patients. Smith et al. (2016a, b) examined the association between specific forms of childhood abuse and neglect, and lifetime SAs in women with BN. They recruited 204 women aged 18–65 with full or subclinical BN. Participants completed the Childhood Trauma Questionnaire (CTQ) and reported whether they had ever attempted suicide. Individuals with BN who had experienced emotional and sexual abuse during childhood were found to have an increased risk for a lifetime SA. Nickel et al. (2006) examined socio-psychopathological predictors of prospective observed SAs in 28 bulimic women without a comorbidity of major depression by comparing them to 126 non-eating-disordered women with major depression, all of which had attempted suicide during the 12-month monitoring period. In contrast to those with major depression only, female BN patients who had attempted suicide were significantly younger, raised in either a single-parent family or children's home, lesbian or bisexual, and were not living in a partnership at the time they were questioned. Moreover, substance abuse at home, parental violence, and unemployment occurred significantly more often among BN patients. Experiences of physical and sexual abuse in childhood correlated in the BN group with SAs in adulthood. To explore the prevalence of lifetime SAs among BN patients, Forcano et al. (2009) compared ED symptoms, general psychopathology, impulsivity, and personality of individuals who had attempted suicide with those who had not in a group of 566 women with BN. They found that overall lifetime prevalence of SAs was 26.9%, and that BN was not associated with lifetime SAs. The BN variables with the strongest correlations with SA were minimum BMI, lower education, previous ED treatment, low self-directedness, and familial history of alcohol abuse.

Genetic factors. Yao et al. (2016) also addressed familial lability as a risk factor for suicide attempts in this population. This was tested in Sweden between January 1979 and December 2001 and was followed up from 2009 (n = 2,268,786). All individuals were linked to their biological full parents through the Swedish multi-generation register: maternal half siblings, paternal half siblings, full cousins, and half cousins. EDs were captured by three variables (any ED, AN, and BN) identified in any lifetime diagnoses recorded in the registers. The results suggest an elevated risk of SAs in individuals with a full sibling or full cousin with any ED compared with individuals without a full sibling or full cousin with an ED. Wade et al. (2015) focused on familial factors in terms of genetic aspects as well. They examined whether suicidal thoughts and EDs share a genetic risk that contributes to the expression of both phenotypes. To this end, Australian female twins (n = 1002) aged 28–40, all with lifetime diagnostic information related to EDs, suicidality, and major depression, were examined and underwent diagnostic interviews. It was found that an ED diagnosis more than doubled the likelihood of suicidal thoughts, with AN and BN conveying the greatest risk of suicidality. Moreover, the prevalence of lifetime suicidality among female twins with EDs was much higher (43%) than just suicidal thoughts (24%). Thus, Wade et al. indicated a common

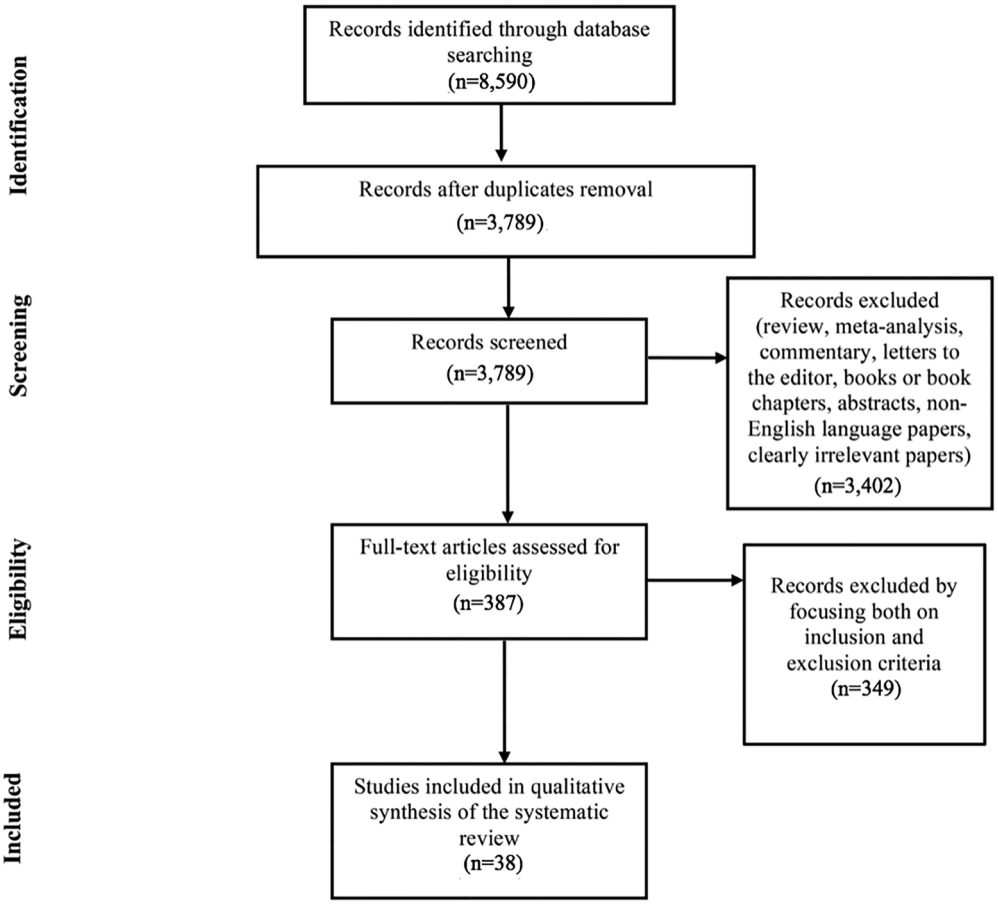

Fig. 1. PRISMA Flowchart of the systematic Search.

genetic influence on suicidality and ED phenotypes. To conclude, despite the paucity of research regarding the influence of background factors on the comorbidity of EDs and suicidal behavior, it appears that genetics and childhood neglect and abuse are major mediating risk factors for EDs as well as suicidal behavior.

4.2. Age

The literature suggests that adolescence is a critical period of development, during which one can develop EDs and other self-harm behaviors (Campbell & Peebles, 2014; Gvion & Fachler, 2017). Nevertheless, EDs are also prevalent among children (Pinhas et al., 2011) and adults (Mangweth-Matzek et al., 2006). A growing body of literature demonstrates that suicidal behaviors in ED patients are commonly associated with age however, only a few studies have compared the severity of suicidal behaviors and different psychological factors among diverse age groups.

Veras (2017) aimed to determine the risk of suicide attempts in adolescents with EDs, specifically those with symptoms of BN and depression. A population-based, cross-sectional study was conducted among 1379 public school students aged 10–17. Evaluation tools included questionnaires (Eating Attitudes, Bulimic Investigatory Test, Children's Depression Inventory) and the Mini International Neuropsychiatric interview. It was found that the probability of an adolescent in this population to be at risk for suicide attempts was higher when the adolescent was over 11 years old, of female gender, and had symptoms of BN and depression. A study held by Ruuska et al. (2005) also focused on adolescents and evaluated the differences in suicidal behaviors between those suffering from AN and BN, when considering age, ED duration, depression and general psychopathological symptoms (GSI). The study group consisted of 57 adolescent female outpatients called upon for assessment due to EDs. Suicidal ideation, deliberate self-harm, and suicidal attempts were assessed by means of self-report questionnaires. It was found that suicidal ideation and deliberate self-harm were reported in over half the cases. Bulimics had significantly more suicidal ideation and deliberate self-harm than anorectics, and the type of ED (BN), depression, and higher GSI were strongly associated with suicidal ideation and deliberate self-harm. Curet-Santisteban et al. (2017) also found that higher general psychopathological symptoms and the severity of the ED were associated with suicidal ideation and self-harm behaviors in adolescents (mean age = 14.74 years). Mayes et al. (2014) as well confirmed the results found in the study by Ruuska et al. (2005). Suicide ideation was found to be more prevalent in children (aged 7–18) with BN (43%) than children with AN (20%), while in this case suicide ideation and attempts were rated by the children's parents. All children with suicidal ideation in this study sometimes felt sad and anxious, and all children with SAs felt worthless.

Crow et al. (2014) addressed suicidal ideation and attempts in BN in both adolescents and adults. A total of 10,123 adolescents and 2980 adults in two nationally representative surveys of mental disorder were queried regarding ED symptoms and suicidal ideation and attempts. Less than 1.0% (0.9%) of adolescents and 1.0% of adults met the criteria for BN. Suicidal ideation was more common among adolescents with BN (53.0%) compared with those with either BED (34.4%), other psychopathologies (21.3%) or no psychopathology (3.8%). Similar trends emerged for the association between BN and self-reported suicidal plans or attempts. Among adults, suicide ideation and attempts were more common in BN than in the no-psychopathology group, but not significantly different from other psychopathology subgroups. It was found that there is a high risk of suicidal ideation and behavior among those with BN in both age groups. Reports of suicidal ideation and attempts were numerically greater among adolescents with BN than

Table 1
Distribution of the 38 relevant selected studies including the reference, number of subjects, aims, population, ED type, SB outcomes and main results of the investigation.

Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
Bodell et al. (2013) Comorbidity-independent risk for suicidality increases with bulimia nervosa but not with anorexia nervosa.	n = 364	To examine whether unique associations between eating disorders and suicidality exist and whether potential associations differ by eating disorder diagnosis.	Women from the second stage of a large epidemiological study examining eating and health related attitudes and behavior.	AN, BN and EDNOS	Thoughts of own death, suicidal ideation, plans, and/or attempts	A multiple regression model including eating and comorbid disorders indicated that bulimia nervosa (BN) was significantly associated with suicidality above and beyond risk predicted by comorbid disorders. No unique association was found for anorexia nervosa (AN) or eating disorder not otherwise specified while controlling for comorbidity.
Bulik et al. (2008) Suicide attempts in anorexia nervosa.	n = 432	To explore prevalence and patterns of suicidal attempts in individuals with anorexia nervosa (AN).	Females and males who enrolled in the NIH funded Genetics of Anorexia Nervosa Collaborative Study. The participants ranged in age from 16 to 76.	AN.	Suicide attempts	About 16.9% of those with AN attempted suicide. Significantly fewer persons with the restricting subtype (7.4%) reported at least one attempt than those with purging AN (26.1%), AN with binge eating (29.3%), and a mixed picture of AN and bulimia nervosa (21.2%). After controlling for major depression, suicide attempts were associated with substance abuse, impulsive behaviors and traits, Cluster B personality disorders, panic disorder, and post-traumatic stress disorder as well as low self-directedness and eating disorder severity.
Corcos et al. (2002) Suicide attempts in women with bulimia nervosa: frequency and characteristics.	n = 295	To estimate the lifetime frequency of suicide attempts in a large referred population of women with DSM-IV bulimia nervosa (BN), and to compare demographic and clinical characteristics of those who had attempted suicide and those who had not	Large referred population of women with DSM-IV bulimia nervosa (BN).	BN purging BN non-purging type, AN-BP	Suicide attempts	Suicide attempts were frequent (27.8% of women), often serious and / or multiple. Women who had attempted suicide differed significantly from those who had not for earlier onset of psychopathology, higher severity of depressive and general symptoms, and more impulsive disordered conducts, but not for the core symptoms or severity of BN.
Crow et al. (2008) Are body dissatisfaction, eating disturbance, and body mass index predictors of suicidal behavior in adolescents? A longitudinal study	n = 2516	To examine the relationships between disordered eating, body dissatisfaction, and obesity in a longitudinal design, in order to determine the extent to which these variables predicted suicidal ideation and attempts	Adolescents and young adults who completed surveys for Project EAT-II.	EWCB[a]	Suicidal thoughts and behavior	The results of this study show that in females but not in males, extreme and unhealthy weight control behaviors. Contrary to the hypothesis, body dissatisfaction, UWCB, and weight status were not predictive of suicidal behavior five years later in males or females.
Crow et al. (2014) Suicidal behavior in adolescents and adults with bulimia nervosa.	n = 13,103	To examine frequency and correlates of suicidal ideation and attempts in adolescents and adults with BN in two population-based samples.	Adolescents and adults with in two population-based samples.	BN	Suicidal ideation and behavior	Suicidal ideation was more common among adolescents with BN (53.0%) compared with those with binge eating disorder (BED) (34.4%), other psychopathology (21.3%) or no psychopathology (3.8%). Similar trends emerged for the association between BN and self-reported suicidal plans or attempts. Among adults, suicidality was more

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Table 1 (*continued*)

Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
						common in BN than in the no psychopathology group, but not significantly different from the anorexia nervosa (AN), BED, or other psychopathology subgroups.
Curet-Santisteban et al. (2017) Ideación suicida y conductas autolesivas en adolescentes con Trastornos de la Conducta Alimentaria	*n* = 109	To determine the prevalence of suicidal ideation and self-harm in adolescents with eating disorders. A second objective was to study the association between self-injurious behavior and suicidal ideation, severity of eating disorder symptoms and symptoms of depression and anxiety, motivation to change and perfectionism.	87.2% Females, mean age 14.47 years old.	AN, BN	Suicidal ideation	Forty-seven patients (43.1%) had suicidal ideation and 34 (31.2%), self-injurious behavior. The presence of suicidal ideation did not discriminate between patients with or without self-injurious behavior. Patients who self-harm had significantly higher scores on all scales of the EDI-2, except for "maturity fears", in the total scores of BDI-II, STAI and CAPS. An association between self-injurious behavior and motivation to change was found.
Favaro et al. (2008) Self-injurious behavior and attempted suicide in purging bulimia nervosa: associations with psychiatric comorbidity.	*n* = 95	To investigate the axis I and II comorbidity in subjects with bulimia nervosa who report self-injurious behavior and/or suicide attempt	ED patients recruited among those consecutively referred to the Outpatients ED Units of the Universities of Naples, Milan, Pisa and Padua (Italy). Participants were older than age 18. Mean age was 23.6 years (SD = 4.3) and mean duration of illness 65.5 months (SD = 58.4).	Lifetime BN purging type	Suicide attempts	No axis I diagnosis was associated with any type of self-injurious behavior, whereas social phobia and bipolar disorder were linked to attempted suicide. Significant independent predictors of impulsive self-injurious behavior were the presence of childhood sexual abuse, high harm avoidance scores, and high self-transcendence scores, whereas childhood sexual abuse, the presence of a cluster B personality disorder, and a low self-directedness were predictors of suicide attempts. Compulsive self-injurious behavior was significantly associated with harm avoidance and cluster C personality disorders. Harm avoidance was also associated with skin picking.
Fedorowicz et al. (2007) Factors associated with suicidal behaviors in a large French sample of inpatients with eating disorders.	*n* = 1009	To identify factors associated with suicidal behaviors among patients with eating disorders.	Patients hospitalized for the first time in the Eating Disorder Unit of the Clinique des Maladies Mentales et de l'Ence´phale at Sainte-Anne Hospital, Paris, France, between January 1988 and July 2004.	AN-R, AN-BP, BN and ED-NOS	Suicide ideation and attempts	The factor most strongly associated with suicide attempt or suicidal ideation was the diagnostic category, with the highest odds ratio for bulimia nervosa followed by anorexia nervosa of the binging/purging subtype. Among diagnostic subgroups, the strongest factors were drug use, alcohol use, and tobacco use.
Fennig and Hadas (2010) Suicidal behavior and depression in adolescents with eating disorders.	*n* = 46	To examine suicidal behavior and depression in adolescents with eating disorders, and to identify risk factors associated with suicidal ideation and attempted suicide	Israeli adolescent girls aged 11–18.	AN, BN	Suicide attempts and suicide thoughts	The risk of attempted suicide was associated with depression, a history of sexual abuse and longer duration of illness, but it was moderated by hospital treatment. Suicidal ideation was related only to depression.
Forcano et al. (2009) Suicide attempts in bulimia nervosa: personality and psychopathological correlates	*n* = 566	To explore the prevalence of lifetime suicide attempts (SA) in women with bulimia nervosa (BN), and compare eating	Participants who were admitted to the outpatient clinic of the eating disorders unit in	BN	Suicide attempts	Lifetime prevalence of suicide attempts was 26.9%. BN subtype was not associated with lifetime SA

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Table 1 (*continued*)

Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
		disorder symptoms, general psychopathology, impulsivity and personality between individuals who had and had not attempted suicide. They also determined the variables that better correlate with of SA.	the Department of psychiatry at the University Hospital of Bellvitge. The mean age of the participants was 26.1 years. The mean age of onset of the eating disorder was 19 years and the mean duration of illness was 7.1 years.			($p = 0.36$). Suicide attempters exhibited higher rates on eating symptomatology, general psychopathology, impulsive behaviors, more frequent history of childhood obesity and parental alcohol abuse ($p < 0.004$). Suicide attempters exhibited higher scores on harm avoidance and lower on self-directedness, reward dependence and cooperativeness ($p < 0.002$). The most strongly correlated variables with SA were: lower education, minimum BMI, previous eating disorder treatment, low self-directedness, and familial history of alcohol abuse ($p < 0.006$).
Forcano et al. (2011) Suicide attempts in anorexia nervosa subtypes.	$n = 104$	To explore the prevalence of lifetime suicide attempts in women with AN and compare those who had and had not attempted suicide on eating disorder symptoms, general psychopathology, and personality both relative to a healthy control group and then across AN subtypes.	patients presenting for assessment and treatment at the University Hospital of Bellvitge (Barcelona, Spain). Mean age of onset of the eating disorder was 19.7 years (SD = 4.3), and mean duration of illness was 5.0 years (SD = 4.5).	AN	Suicide attempts	The prevalence of suicide attempts differed significantly across the 3 groups ($P = .003$), with 0% in the controls, 8.65% in the restricting AN group, and 25.0% in the purging AN group. Depression measures were elevated in those with suicide attempts. Within the restricting AN group, those who attempted suicide scored significantly higher on Phobic Anxiety, measured by means of the Symptom Checklist–Revised, than those who did not ($P = .001$).
Forrest et al. (2016) Associations between eating disorder symptoms and suicidal ideation through thwarted belongingness and perceived burdensomeness among eating disorder patients	$n = 98$	To explore which ED symptoms are positively associated with suicidal ideation, and whether thwarted belongingness and perceived burdensomeness explain those associations.	Adult females with EDs participated in this study. Participants were recruited after beginning residential or partial hospitalization ED treatment at a southeastern ED treatment facility.	AN, BN, OSFED[b]	Suicidal ideation	The first model included current symptoms; current body dissatisfaction ($ab = 0.04$, 95% CI [0.01, 0.06]) and fasting ($ab = 0.12$, 95% CI [0.01, 0.22]) were indirectly related to increased suicidal ideation through higher burdensomeness, controlling for depression. The second model included lifetime symptoms; lifetime fasting ($ab = 0.18$, 95% CI [0.07, 0.29]) was indirectly related to increased suicidal ideation through higher burdensomeness, controlling for depression.
Foulon et al. (2007) Switching to the bingeing/purging subtype of anorexia nervosa is frequently associated with suicidal attempts	$n = 304$	Anorexia nervosa has the highest suicide mortality ratio of psychiatric disorders, suicide being associated with many factors. They assessed the first lifetime occurrence of factors related to Anorexia Nervosa and Suicide, considering their possible overlap.	Patients were recruited through present or past hospitalization in three centers in Paris, France, namely the Children Psychiatric Department of Robert Debre´ Hospital,the CMME in Sainte-Anne Hospital and the Psychiatric Department in Louis Mourier Hospital. The average age at	AN-R, AN-BP	Suicide attempts	Major depressive disorder ($p < 0.001$) and subtype switch from the restrictive to the bingeing/purging type ($p < 0.001$) were the two factors significantly more frequently occurring before suicidal attempts, and remained involved when a multivariate analysis is performed, whether syndromic or dimensional measures are being used. Taking into account lifetime

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Table 1 (*continued*)

Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
			interview was 22.3 years old			occurrence with a survival analysis, the switch to bingeing/purging type of anorexia appears as a major predictive factor, with a large increase of the frequency of suicidal attempts (OR = 15) when compared to patients with neither major depressive disorder nor bingeing/purging type.
Guillaume et al. (2011) Characteristics of suicide attempts in anorexia and bulimia nervosa: a case–control study	*n* = 1563	To explore whether the clinical characteristics of suicidal acts differ between suicide attempters with AN, BN or without an eating disorders (ED).	Participants were consecutively hospitalized and survivors of a current suicide attempt (SA) in a specialized unit of the Montpellier University Hospital. Patients included in the cohort had to be between 18 and 75 years old, French-speaking, and with all four biological grandparents originating from Western European countries (for genetic purposes).	AN, BN	Suicide attempts	AN patients were more likely to have made a serious attempt (OR = 3.4, 95% CI 1.4–7.9), with a higher expectation of dying (OR = 3.7,95% CI 1.1–13.5), and an increased risk of severity (OR = 3.4,95% CI 1.2–9.6). BN patients did not differ from the control group. Clinical markers of the severity of ED were associated with the seriousness of the attempt.
Holm-Denoma et al. (2008) Deaths by suicide among individuals with anorexia as arbiters between competing explanations of the anorexia–suicide link	*n* = 9	To examine competing explanations of the high rate of death by suicide among individuals with anorexia nervosa (AN)	Women seeking treatment at Massachusetts General Hospital and local clinics. Mean age of participants was 24.8 years (range: 13–45 years) at the study's onset. Mean duration of illness was 6.7 years (range: 3 months–24 years).	AN	Deaths by suicide	The findings converged with the latter hypothesis, as predicted by Joiner's theory of suicide, which suggests individuals with AN may habituate to the experience of pain during the course of their illness and accordingly die by suicide using methods that are highly lethal.
Koutek et al. (2016) Suicidal behavior and self-harm in girls with eating disorders.	*n* = 47	To examine comorbidity in female patients hospitalized with eating disorders and to better understand the reasons for high comorbid psychopathology among eating disorders, self-harm, and suicidal behavior.	Female patients admitted for eating disorders at the Department of Child Psychiatry of the University Hospital in Motol in 2013. In total, there were 47 girls aged between 10.25 to 18 years, with the average age of 15.5 years.	AN, BN, atypical Anorexia	Suicidal behavior	Suicidal behavior was present in 60% of patients and self-harm in 49%. Association was found between self-harm and suicidality. In all, 68% of girls with eating disorders had a positive score in the Children's Depression Inventory questionnaire and 62% of them in the Child Adolescent Suicidal Potential Index questionnaire. Clinical examination of girls with eating disorders should focus on identifying the risk of suicidal behavior and self-harm.
Kwan et al. (2017) An examination of the connections between eating disorder symptoms, perceived burdensomeness, thwarted belongingness, and suicide risk among undergraduate students	*n* = 574	Informed by the interpersonal theory of suicide, two studies examined the role of perceived burdensomeness and thwarted belongingness in explaining the association between eating disorder symptoms and suicide risk	Participants were recruited from psychology courses at a midwestern public university during the spring and fall semesters of 2010. Participants were between 18 and 25 years old, 259 men, 315 women.	ED symptoms	Suicide risk	Results indicated that various eating disorder symptoms had an indirect effect on suicide risk through perceived burdensomeness and thwarted belongingness.
Lian et al. (2017) Anorexia nervosa, depression	*n* = 8746	To examine the association between anorexia nervosa and	This study was conducted among 20	AN	Suicidal thoughts	Multilevel logistic model revealed that demographic

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Table 1 (*continued*)

Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
and suicidal thoughts among Chinese adolescents: a national school-based cross-sectional study		suicidal thoughts and explore the interaction between anorexia nervosa and depression.	sampled middle schools in 7 provinces in China from 2012 to 2013.			variables, including academic achievement, were not the predictive risk factors of suicidal thoughts. Those who suffered from worse severity of perceived anorexia nervosa were at increased risk of thinking about suicide. The interaction between depression and anorexia nervosa was significant, however, subgroup analyses showed that the associations were significant only among the adolescents without depression.
Mayes et al. (2014) Correlates of suicide ideation and attempts in children and adolescents with eating disorders	n = 90	This is the first study determining correlates of suicide behavior in children with eating disorders using multiple sleep, psychological, and demographic variables	Children and adolescents aged 7–18 years (M = 13.8). In all, 96.7% are female, 95.6% are White, and 57.8% have a parent with a professional or managerial occupation.	AN, BN, atypical anorexia	Suicide ideation and attempts	Suicide ideation was more prevalent in children with bulimia nervosa (43%) than children with anorexia nervosa (20%). All children with bulimia nervosa who experienced ideation attempted suicide, whereas only 3% of children with anorexia nervosa attempted suicide. Correlates of ideation were externalizing behavior problems and sleep disturbances.
Milos et al. (2004) Suicide attempts and suicidal ideation: links with psychiatric comorbidity in eating disorder subjects	n = 288	To examine associations between Axes I and II comorbidity and suicidality in a large sample of women currently suffering from an eating disorder.	Participants were consecutively recruited from the ED Inpatient Unit of the University Hospital Zurich, others consecutively recruited as outpatients of the Psychiatric Outpatient Department of the University Hospital Zurich and others via contacts with ED self-help groups in the Zurich area. The mean age at time of interview was 29.0 years (SD 9.6), with AN participants being younger (mean 26.8 SD 8.9) than BN (mean 29.5, SD 9.8) (z 2.4, P 0.017) and EDNOS participants (mean 31.7, SD 6.9) (z 3.1, P 0.002). The average age of ED onset (as reported by participants) was 17.5 years (SD 4.4) and did not vary significantly between ED diagnoses groups.	AN-R, AN-BP, BN, ED-NOS	Suicide attempts and Ideation	Past suicide attempts were reported by 26%. Subjects with a purging type ED more frequently had a history of attempted suicide than subjects with a non-purging type ED. A history of suicide attempts was associated with higher levels of Axes I and II comorbidity, in particular with affective disorders and Cluster B personality disorders. Current suicidal ideation was generally linked with higher levels of all types of Axes I and II comorbidity. Eating disorders are serious psychiatric disorders associated with high levels of comorbidity and suicidality
Miotto and Preti (2007) Eating disorders and suicide ideation: the mediating role of depression and aggressiveness	n = 930	To investigate the role of depression and aggressiveness as mediators in the links between eating disorder symptoms and suicide ideation among adolescents, taking into account age and sex as covariates.	The study involved 7 high schools in the district of Conegliano, which includes 3 small rural towns of northeast Italy: Conegliano, Vittorio Veneto, and Pieve di Soligo. The schools included in the study were randomly selected among all	ED symptoms	Suicide ideation	Eating disorder symptoms were positively related to suicide ideation, taking age and sex into account. Depression and aggressiveness acted as full mediators in the links between eating disorder symptoms and suicidality, and virtually abolished any direct influence of eating

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Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
			those operating on the territory (n = 21; 17 public and 4 private schools; age range, 14–19 years).			disorders on suicide ideation.
Nickel et al. (2006) Familial and sociopsychopathological risk factors for suicide attempt in bulimic and in depressed women: prospective study	n = 154	To examine sociopsychopathological predictors of prospective observed suicide attempts in bulimic women purging type without comorbid major depression (BNG) at the time of study entry and in women with major depression without comorbid eating disorder at the time of study entry (MDG).	Participants were women in a prospective study conducted between 1999 and 2005. The participants were from the general community, inpatients, and outpatients were recruited through separate advertisements for each group in print media, churches and medical practices in Germany, Austria, and Poland and were above 16 years old.	BN	Suicide attempts	The derived logistic models showed that patients from the BNG group had a history of higher incidence of sexual abuse in childhood, as well as abuse of laxatives and illicit drugs; they also lacked orientation in life, felt lonely despite family and friends, tended to direct their anger outward, and were unable to relax.
Pisetsky et al. (2013) Suicide attempts in women with eating disorders	n = 13,035	To evaluate whether the prevalence of lifetime suicide attempts/completions was higher in women with a lifetime history of an eating disorder than in women with no eating disorder and to assess whether eating disorder features, comorbid psychopathology, and personality characteristics were associated with suicide attempts in women with anorexia nervosa, restricting subtype (ANR), anorexia nervosa, binge/purge subtype (ANBP), lifetime history of both anorexia nervosa and bulimia nervosa (ANBN), bulimia nervosa (BN), binge eating disorder (BED), and purging disorder (PD).	Participants were female twins born between 1959 and 1985 and assessed as part of the Swedish Twin study of Adults: Genes and Environment (STAGE). Participants were between 20 and 47 years of age at the time of assessment.	AN-R, AN-BP, BN, BED, PD	Suicide attempts	Relative to women with no ED, lifetime suicide attempts were significantly more common in women with all types of eating disorder. None of the eating disorder features or personality variables was significantly associated with suicide attempts. In the ANBP and ANBN groups, the prevalence of comorbid psychiatric conditions was higher in individuals with than without a lifetime suicide attempt. The odds of suicide were highest in presentations that included purging behavior (ANBN, ANBN, BN, and PD), but were elevated in all eating disorders.
Pisetsky et al. (2017) Associations between emotion regulation difficulties, eating disorder symptoms, non-suicidal self-injury, and suicide attempts in a heterogeneous eating disorder sample	n = 110	To examine the associations between specific dimensions of emotion dysregulation and eating disorder (ED) symptoms and behaviors, non-suicidal self-injury (NSSI), and suicide attempts in a heterogeneous ED sample.	93.6% of the participants were female, (mean age = 33.5, SD = 12.2). Participants were recruited from a national ED treatment facility through advertisements in clinic waiting rooms and on social media. Inclusion criteria included age 18 years or older, currently in ED treatment, and ability to read and write English.	ED symptoms	Suicide attempts	The EDE-Q global score, a primarily cognitive measure of ED symptoms, was significantly positively correlated with DERS strategies, clarity, and awareness subscale scores and DERS total score ($ps <$ 0.01). Only the strategies subscale was uniquely positively associated with EDE-Q global score in a multivariate regression analysis. There was no association between the frequency of binge eating or frequency of driven exercise and any of the DERS subscale scores or total score ($ps >$ 0.01). Frequency of purging was significantly, positively associated with DERS impulse subscale score and total score ($p <$ 0.01). None of the DERS subscale scores were significantly different between those with and without NSSI or between those with and

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Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
						without a lifetime suicide attempt (*ps* > 0.01).
Runfola et al. (2014) Self-image and suicide in a Swedish national eating disorders clinical register	*n* = 2269	To examine the relation between self-image (assessed using the Structural Analysis of Social Behavior) and suicide attempts/completions in women with anorexia nervosa-restricting type (ANR), anorexia nervosa-binge/purge type (ANBP), bulimia nervosa (BN), binge eating disorder, and eating disorder not otherwise specified (EDNOS); and to assess whether these self-image variables add unique predictive value to suicide when considering other baseline predictors.	Swedish women with an eating disorder diagnosed between 2005 and 2009 were identified through the Swedish quality assurance database, Stepwise female sex; 3) 12–45 years of age at initial entry into Stepwise.	AN-R, AN-BP, BN, BED ad EDNOS	Suicide attempts and completions	Prevalence of detected suicide attempts/completions over the study period was 9.2%. Negative self-image variables were associated with prior suicide attempts in ANR and EDNOS and later suicide attempts/completions in women with BN. In a stepwise Cox proportional hazards model, only low self-affirmation predicted time to suicide attempts/completions in women with BN when accounting for age and prior suicide attempt.
Ruuska et al. (2005) Psychopathological distress predicts suicidal ideation and self-harm in adolescent eating disorder outpatients.	*n* = 57	To evaluate the differences in suicidal behavior between adolescent anorexia nervosa (AN) and bulimia nervosa (BN), and the association of age, menarche timing, duration of eating disorder (ED), depression and general psychopathological symptoms (GSI) with suicidal behavior in adolescent ED	The study was carried out in Tampere University Hospital Adolescent Psychiatry Clinic. All adolescent patients attending the clinic between 1 January 1996 and 16 July 1998 and meeting the inclusion criteria were recruited for the study. The inclusion criteria for this study were: (i) referred to the clinic because of eating problems, or (ii) referred for other reasons, but diagnosed with eating disorder during initial psychiatric assessment.	AN, BN	Suicidal ideation	In both ED groups, one adolescent had attempted suicide before assessment. Suicidal ideation and/or deliberate self-harm were reported in over half of the cases. Bulimics had significantly more suicidal ideation and deliberate self-harm than anorectics. In multivariate analysis, BN and depression predicted suicidal ideation, but only GSI persisted as predicting deliberate self-harm
Selby et al. (2010) Habitual starvation and provocative behaviors: two potential routes to extreme suicidal behavior in anorexia nervosa. Habitual starvation and provocative behaviors: two potential routes to extreme suicidal behavior in anorexia nervosa.	Study 1, *n* = 789 Study 2, *n* = 249	To explore whether repetitive exposure to painful and destructive behaviors such as vomiting, laxative use, and non-suicidal self-injury (NSSI) was a mechanism that linked AN-binge-purging (ANBP) subtype, as opposed to AN-restricting subtype (ANR), to extreme suicidal behavior	Participants consisted of primarily female (96%) individuals enrolled in a NIH funded Genetics of Anorexia Nervosa (GAN) Collaborative Study. This was a multi-site study that took place in various research and clinical settings across North America and Europe. All participants had to be over age 16. The standardized threshold for low weight was defined as a Body Mass Index (BMI) at or below 18 kg/m^2 for females and 19.6 kg/m^2 for males.	AN-R, AN-BP	Suicidal behavior	Two potential routes to suicidal behavior in AN appear to have been identified: one route through repetitive experience with provocative behaviors for ANBP, and a second for exposure to pain through the starvation of restricting in ANR.
Smith et al. (2013) Exercise caution: Over-exercise is associated with suicidality among individuals with disordered eating	Study 1, *n* = 204 Study 2, *n* = 171 Study 3, *n* = 467 Study 4, *n* = 512	To examine the relationship between over-exercise and suicidality.	Participants were recruited through eating disorder clinics and the community. Participants were female; age ranged from 18 to 57 (*M* = 25.67, S.D. = 8.85).	BN	Suicidal behavior	Over-exercise appears to be associated with suicidal behavior, an association accounted for by pain insensitivity and the acquired capability for suicide
Smith et al. (2016) Does the interpersonal–Psychological theory of suicide provide a	*n* = 278	To test whether the Interpersonal–Psychological Theory of Suicide (IPTS) provides a useful framework for	Participants were women at a female-only residential ED treatment facility in	AN, BN, OSFED	Suicidal desire	Within the ED sample, no hypothesized interactions were found, but perceived burdensomeness was

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Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
useful framework for understanding suicide risk among eating disorder patients? A test of the validity of the IPTS.		understanding elevated suicide rates among individuals with eating disorders (EDs).	the Southeastern United States as well as women at an inpatient general psychiatric treatment facility in the Southeastern United States who were receiving services based on the determination that they were unable to care for themselves adequately or were an imminent risk to themselves or others and women attending a public university in the midwestern United States and not reporting behaviors symptomatic of an ED.			associated with suicidal desire, and perceived burdensomeness and fearlessness about death were associated with past suicide attempts. The ED and psychiatric samples had greater thwarted belongingness, perceived burdensomeness, and suicidal desire than the non-clinical comparison group.
Smith et al. (2016) Is childhood trauma associated with lifetime suicide attempts in women with bulimia nervosa?	n = 204	To explore the association between specific forms of childhood abuse and neglect with lifetime suicide attempts in women with bulimia nervosa (BN).	Participants were recruited through advertisements at local eating disorder clinics and throughout the community at five Midwestern sites in the USA. Inclusion criteria were female gender, age range of 18–65 years.	BN	Suicide attempts	Childhood emotional, physical, and sexual abuse were significantly associated with the presence of a lifetime suicide attempt in women with BN. Childhood emotional and physical neglect were not associated with suicide attempts.
Stein et al. (2004) Attempted suicide and self-injury in patients diagnosed with eating disorders	n = 150	To investigate factors associated with suicidal behavior in ED patients.	The study included 150 patients (145 females, 5 males) treated in the outpatient eating disorders clinic at Western Psychiatric Institute and Clinic, University of Pittsburgh Medical Center, between 1997 and 1999.	AN, BN, BED, ED-NOS	Suicide attempts	It was found that 48 patients (32%) had a history of parasuicide (i.e., suicide attempts, self-injury, or both). A significantly greater percentage of parasuicidal patients than nonparasuicidal patients had EDs with bingeing/pursing symptomatology, used more than one type of purging method, and had a lifetime history of a drug use disorder, impulse control problems, and bipolar disorder, as well as a more extensive outpatient and inpatient treatment history.
Stein et al. (2013) Attitudes toward life and death and suicidality among inpatient female adolescents with eating disorders.	n = 96	To investigate whether attitudes about life and death are associated with suicidal behavior in EDs	Participants included adolescents and young adults hospitalized because of an ED in the Pediatric Psychosomatic Department at the Sheba Medical Center, Tel Hashomer, Israel, between 2003 and 2007, who complied with this study's inclusion and exclusion criteria. The inclusion criteria were being of female sex between the ages of 14 and 19 years, having a good understanding of the Hebrew language, completion of inpatient treatment, and responding to this study's questionnaires.	AN-R, AN-BP, BM, ED-NOS	Suicide attempts	Both ED groups showed less attraction to life and more repulsion from life than did the control group. The suicide attempters showed greater attraction to death, less repulsion from death and more negative attitudes toward their body than did the non-suicidal ED and control group. Fear of life was associated with elevated depression, body-related problems and childhood sexual abuse. Pathological attitudes toward death were associated with greater depression and body-related problems. Suicide attempts were found in the inpatients with EDs showing binge/purge ED pathology and maladaptive attitudes toward death.
	n = 1379				Suicide risk	

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Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
Veras et al. (2017) Risk of suicide in adolescents with symptoms of eating disorders and depression		To determine the risk of suicide in adolescents with symptoms of eating disorders and depression.	A population-based, cross-sectional study was conducted with 1379 students of public schools aged 10 to 17 years.	ED symptoms		It was estimated that the probability of an adolescent in the population analyzed of being at risk of suicide was higher when the adolescent was older than 11 years, of the female gender, had symptoms of an eating disorder and had depressive symptoms.
Wade et al. (2015) Does shared genetic risk contribute to the co-occurrence of eating disorders and suicidality?	$n = 1002$	To test the hypothesis that suicidality and EDs share genetic risk contributing to the expression of both phenotypes.	The sample of twins approached to participate in this study was originally derived from a cohort of 8536 twins (4268 pairs) born 1964–1971, who were registered as children with the Australian Twin Registry (ATR) over 1980–1982, in response to media appeals and systematic appeals through schools.	AN, BN, BED, PD	Suicidal thoughts	Any suicidal thoughts were reported by 24% of the sample, but prevalence of lifetime suicidality among female twins with EDs was much higher (43%), presence of an ED diagnosis more than doubling likelihood of suicidality (OR = 2.32, 95% CI: 1.63–3.31). AN and BN conveyed greatest risk of suicidality (OR = 2.03, 95% CI: 1.06–3.87; OR = 3.97, 95% CI: 2.01–7.85, respectively). Twin phenotype correlations showed monozygotic twins had uniformly higher estimates than dizygotic counterparts. A trivariate Cholesky model indicated a common genetic influence on suicidality and ED phenotypes (but not depression), and no nonshared environmental source.
Witte et al. (2016) Restrictive eating: Associated with suicide attempts, but not acquired capability in residential patients with eating disorders	$n = 100$	To analyze association of restrictive eating with suicide attempts. This study tests the hypothesis that restrictive eating is associated with acquired capability for suicide. Specifically, if restrictive eating accounts for the elevated suicide risk in anorexia nervosa (AN) compared to other eating disorders, restrictive eating should be more strongly associated with suicide attempts and acquired capability for suicide compared to non-restrictive eating disorder behaviors	Participants were adult, female patients receiving treatment at a residential eating disorder treatment center in the southeastern United States. This sample was, on average, 26.92 years of age.	AN, BN, ED-NOS	Suicide attempts	Results indicate that people with AN had lower body mass index (BMI), and people with bulimia nervosa (BN) had higher frequency of vomiting. Findings indicate that AN diagnosis was neither associated with past suicide attempts nor acquired capability, that BMI was positively associated with fearlessness about death, and that neither fasting nor dietary restraint were associated with acquired capability after controlling for other disordered eating behavior
Yao et al. (2016) Familial liability for eating disorders and suicide attempts: evidence from a population registry in Sweden	$n = 2\,268\,786$ $n = 152$	To examine the association between eating disorders and suicide attempts and whether familial risk factors contribute to the association.	The study population included individuals born in Sweden between January 1, 1979, and December 31, 2001, and had both biological parents identifiable in the population registers.	AN, BN, atypical AN, atypical BN, ED-NOS	Suicide attempts	Eating disorders were captured by 3 variables (any eating disorder, anorexia nervosa, and bulimia nervosa) identified by any lifetime diagnoses recorded in the registers. Suicide attempts were defined as any suicide attempts, including death by suicide, recorded in the registers. We examined the association between eating disorders and death by suicide separately, but the study was underpowered to explore familial liability for this association.

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Reference	Subjects	Aims	Population	ED type	SB outcomes	Main results
Youssef et al. (2004) Personality trait risk factors for attempted suicide among young women with eating disorders		To examine whether certain personality and character traits could provide improved understanding, and thus improved prevention, of suicidal behavior among young women with eating disorders.	Participants were Women aged between 18 and 24 years as part of a larger research program on Addictive Disorders, from the Inserm (Institut National de la Santé et de la Recherche Médicale—France).	AN-R, AN-BP, BN-P, BN—NP	Suicide attempts	Suicide attempts were most frequent in subjects with purging behavior (30.0% for BN-P and 29.7% for AN-P). Those attempting suicide among subjects with eating disorders were mostly students (67.8%). For women with AN-R the scales for 'Depression' and 'Antisocial practices' represented significant suicidal risk, for women with AN-P the scales for 'Hysteria', 'Psychopathic deviate', 'Shyness/Self-consciousness', 'Antisocial Practices', 'Obsessiveness' and 'Low self-esteem' were risk indicators and for women with BN-P the 'Psych-asthenia', 'Anger' and 'Fears' scales were risk indicators.
Zuromski and Witte (2015) Fasting and acquired capability for suicide: A test of the interpersonal-psychological theory of suicide in an undergraduate sample	n = 193	Within the framework of the interpersonal-psychological theory of suicide (IPTS; Joiner et al., 2005), their purpose was to enhance understanding of the relationship between restrictive eating and is effect on the acquired capability for suicide (ACS; i.e., increased fearlessness about death and heightened physical pain tolerance).	Participants were undergraduates enrolled in psychology courses at a large public university in the southeastern United States.	ED symptoms	Suicide attempts	Contrary to hypotheses, no differences emerged between groups on ACS, and frequency of fasting within the fasting group was not significantly associated with ACS. Consistent with hypotheses, the fasting group was more likely to have suicide attempt history.

[a] Extreme weight control behaviors.
[b] Other specified feeding or eating disorder.

adults with BN, but the difference was not statistically significant. To conclude, only a few studies refer to age as a risk factor for suicide in AN and BN. Age may serve as a mediating factor in the associations between BN, AN, and suicidal attempts. Age correlates with ED type, as BN is more frequent among older individuals as well as adolescents.

4.3. ED type

Several studies have shown significant associations between ED type and suicidality, with recent studies focusing on AN and BN binge/purge subtypes as being at a greater risk for suicide attempts. Youssef et al. (2004) recruited 152 women aged 18–24 with DSM-IV anorexia nervosa/restrictive type (AN-R), anorexia nervosa/purging type (AN-P), bulimia nervosa/non-purging type (BN—NP), or bulimia nervosa/purging type (BN-P). The assessment measures were the Minnesota Multiphasic Personality Inventory–second version (MMPI-2), the Beck Depression Inventory (BDI) used to control for current depressive symptoms, and a special questionnaire concerning SAs. They found that SAs were most frequent in subjects with purging behavior (30.0% for BN-P and 29.7% for AN-P). This was also found in a study by Forcano et al. (2011), with 25.0% of suicidal behaviors in the AN-P group compared to 8.65% in the AN-R group. Forcano et al., found that patients with the purging subtype are at three times more risk than those with the restricting subtype.

In a retrospective study on 304 patients with AN, Foulon et al. (2007) also found strong relationships between past SAs and bingeing/purging behaviors, both on the syndromic and dimensional levels. Pisetsky et al. (2013) evaluated characteristics of SAs in women participating in a Swedish twin study, in which data was collected on AN-R, AN binge-purge subtype (AN-BP), lifetime history of both AN and BN (ANBN), BN, BED, purging disorder (PD), and a lifetime of SAs. The suicide rates were elevated in all EDs but were highest in presentations that included purging behavior (ANBN, BN, and PD). It was emphasized that diagnostic crossover is a common occurrence in individuals with AN, with around 50% of those with initial AN-R migrating to a bulimic presentation at some point during the course of their illness, and suggested that suicide risk may fluctuate as the clinical presentation changes between restrictive and binge-purge forms. These studies all suggest that individuals who engage in purging behaviors are at a particularly elevated risk for suicide behaviors.

Runfola et al. (2014) examined the relationship between self-image (assessed using the Structural Analysis of Social Behavior) and SAs or completions in women with AN-R, AN-BP, BN, BED, and eating disorder not otherwise specified (ED-NOS). They recruited 2269 Swedish participants aged 12–45 who were identified through the Stepwise Eating Disorders Quality Register. Data regarding age, body mass index (BMI), ED severity (Eating Disorder Examination-Questionnaire scores), psychiatric comorbidity, suicide information global assessment of functioning, and self-image were abstracted and included as baseline predictors. Results demonstrated that all ED diagnoses were characterized by negative self-image. Negative self-image variables were associated with prior SAs in AN-R and ED-NOS and later SAs or completions in women with BN. Low self-love and high self-blame were found to be associated with prior SAs across all disorders (except BN). As the prevalence of SAs in BED was the lowest of all diagnostic groups, it may be the presence of purging (not binge eating) that is most strongly

associated with suicidal behavior. Contrary to these results, Bulik et al. (2008), who assessed 432 individuals with AN aged 16–76, found that individuals with a restricting subtype (7.4%) reported fewer attempts than those with either AN-P (26.1%), AN with binge eating (29.3%), or a mixed picture of AN and BN (21.2%).

Fedorowicz et al. (2007) examined 1009 patients who were hospitalized for an ED in France. They found that the most significant determinant of suicide attempts in patients with an ED was the type of ED. BN was the diagnostic category most strongly associated with a history of SAs, followed by AN of the bingeing/purging subtype. In addition, a history of SAs was identified in up to 30% of individuals with purging behaviors and seemed to be more prevalent in the BN-P subtype than the BN—NP subtype. Factors associated with SAs in each diagnostic category were significantly varied. Associated factors for AN-R included drug use and bulimic symptoms, which suggests that anorexic patients who are at most risk for suicide attempts are those whose profile is more similar to that of bulimic patients. Factors associated with SA in AN-BP also point to impulsivity and self-destructiveness: alcohol or drug use, self-induced vomiting, and laxative abuse. This suggests that symptomatology (such as bingeing and purging) is more important than the actual diagnostic category in determining the suicide risk of ED patients. Bodell et al. (2013) recruited 364 women from the second stage of a large epidemiological study examining eating and health related behaviors. SCID-I was used to determine lifetime psychiatric diagnosis and suicidality. They too found that BN was the only ED type that is independently associated with suicidality, whereas AN or ED-NOS where not uniquely associated with suicidality.

Guillaume et al. (2011) investigated the severity of SAs in regard to ED type (AN or BN). They recruited a group of 1563 suicide attempters which was narrowed down to 139 patients with a lifetime history of ED (44 with AN, 64 with BN, 7 with a combination of AN and BN symptoms, and 24 EDNOS). These patients were compared to 235 non-ED attempters matched for sex, age, and education using interview measures (Mini International Neuropsychiatric Interview; MINI) and questionnaires of suicidal intent and severity (Suicidal Intent Scale; SIS, Scale for Suicide Ideation; SSI and the Risk Rescue Rating Scale; RRRS). Contrary to the findings presented so far, they found that AN patients were more likely to have made a serious attempt with a higher expectation of dying and increased risk of severity. The majority of deaths in patients with AN were caused by employing methods with low rescue potential and high likelihood of death (e.g. jumping in front of a train or hanging). In contrast, the features of SAs in BN patients seem very similar to those of suicide attempters without ED, that is, not as lethal and severe as those of AN attempters. Selby et al. (2010) presented similar results. In two studies they explored whether repeated exposure to painful and destructive behaviors such as vomiting, laxative abuse, and non-suicidal self-injury (NSSI) serve as mechanisms that links the AN-BP subtype, as opposed to the AN-R subtype, to extreme suicidal behavior. In their first study, they examined 787 individuals diagnosed with one or other subtype of AN; and in their second study, they used a sample of 249 AN patients. Both studies yielded similar findings: individuals with AN-BP tend to endorse more suicidal behaviors than their AN-R counterparts, perhaps due to the painful and provocative behaviors they engage in. However, after accounting for these painful behaviors, AN-R patients appear to have a stronger association with suicidal behaviors. Two potential routes to suicidal behavior in AN seem to have been identified in their study: in AN-BP, through repeated experience of provocative behaviors, and in AN-R, through the exposure to pain by way of starvation. Franko et al. (2004) assessed suicidality in an eight-year prospective longitudinal study with 246 women with AN and BN. They too found that women with AN were more likely to attempt suicide than women with BN, and that severity of both depressive symptoms and drug use over the course of the study were the unique predictors of suicide attempts among women with AN. In a different study, Milos et. al (2004) recruited a sample of 288 women with EDs and assessed them through clinical interviews. They found that AN patients were also more likely to engage in suicidal ideation than BN patients. Their explanation also referred to the starvation presented by AN-R patients as a form of chronic self-harm behavior, which might explain the higher levels of suicidal ideation in this group. Taken together, although not specifically noted, its seems that all ED types and subtypes (AN, BN, binge/purge subtypes) were linked to suicidal behaviors and therefore may serve as moderating risk factors due to their unique characteristics and symptomatology.

4.4. Pain tolerance

Recent studies examining why people with EDs are at an increased risk for suicide have speculated that the acquired capability for suicide may be an important risk factor. Joiner's theory of suicidal behavior suggests that high lethality SAs are made only by people who are habituated to pain and fear through repeated exposure to painful situations. Holm-Denoma et al. (2008) examined alternative explanations for the high rates of death by suicide among individuals with AN by evaluating nine case reports of individuals with AN who died by suicide. They aimed to determine whether death by suicide occurred due to compromised physical health or because these individuals had made highly lethal SAs that would have killed any adult. Their findings are in line with Thomas Joiner's Interpersonal theory of suicide (IPTS; Joiner et al., 2005) and suggest that individuals with AN may habituate to the experience of pain during the course of their illness and accordingly, die by suicide using highly lethal methods. In a research article based on two studies, Selby et al. (2010) examined whether repeated exposure to painful and harmful behaviors (such as laxative abuse, vomiting, and NSSI) serves as a mechanism that is linked to AN-BP subtype, as opposed to AN-R, and leads to extreme suicidal behavior. Their first study utilized a sample of 787 individuals diagnosed with one or another subtype of AN, and their results underlined provocative behaviors as a mechanism linking AN-BP to suicidal behavior. Their second study, which used a sample of 249 AN patients, replicated the findings of the first. Those studies found that the relationship between AN-BP and extreme suicidal behavior is mediated in part by behaviors such as laxative abuse and NSSI. This supports the IPTS, which states that the ability to engage in suicidal behavior may develop through the repeated experience of such behaviors which, in turn, cause habituation to pain and fear.

Zuromksi and Witte (2015) compared undergraduates with one form of restrictive eating and fasting ($n = 99$) to controls with no forms of eating pathology over their lifetime ($n = 94$). Physical measurements of pain tolerance were obtained, and the subjects filled out a series of self-report questionnaires to examine ED symptoms and suicidal attempts (EDE-Q, Beck Suicide Scale; BSS, Acquired Capability for Suicide Scale; ACSS). It was found that the restrictive group was more likely to have a history of SAs. However, contrary to other studies in this field, differences were not found in the acquired capability for suicide between the two groups and frequency of fasting was not associated with the acquired capability for suicide. This was also found in a study by Witte et al. (2016) who examined whether restrictive eating is in fact more strongly associated with elevated suicide risk and a greater acquired capability for suicide. They recruited 100 female patients receiving treatment at a residential ED treatment center in the United States (diagnosed with AN, BN or ED-NOS). Physical measurements of pain tolerance were obtained, and the subjects filled out a series of self-report questionnaires (ACSS, EDE-Q). Like Zuromksi and Witte (2015), they too found that fasting was in fact associated with a history of SAs, however they did not find a strong association between fasting and the acquired capability for suicide.

A recent series of four studies by Smith et al. (2013) examined the relationship between over-exercise, pain tolerance, and SAs in 144 women with BN. In the first study, they found that over-exercise was a unique predictor of suicidal behavior, over and above other compensatory weight control behaviors, like self-induced vomiting and laxative

abuse. In the second study, in which 171 college students were recruited and observed over 3–4 weeks, the researchers found that overexercise was positively related to pain insensitivity. Taken together, these studies suggest that ED behaviors constitute painful and provocative experiences, and thus increase the acquired capability for suicide.

4.5. Interpersonal factors

In a third study held by Smith et al. (2016a, b) they have examined whether IPTS provides an efficient framework for understanding elevated suicide rates among individuals with EDs referring also to the interpersonal aspect. They tested whether the combination of thwarted belongingness and perceived burdensomeness was associated with suicidal desire, and whether the combination of thwarted belongingness, perceived burdensomeness, and fearlessness about death was associated with a history of SAs in a sample of 100 patients with an ED: AN (n = 34), BN (n = 27), other specified feeding or eating disorder (OSFED; n-30), BED (n = 1), and unspecified feeding or eating disorder (n = 8). They also compared between these IPTS constructs in an ED sample, in general psychiatric inpatients (n = 85), and in college students (i.e., non-clinical comparison group; n = 93). They found that perceived burdensomeness was associated with fasting, binge eating, and laxative abuse, while thwarted belongingness was associated with body dissatisfaction. In the ED sample, perceived burdensomeness was associated with suicidal desire, and perceived burdensomeness and fearlessness about death were associated with past SAs. The ED and psychiatric samples had higher levels of thwarted belongingness, perceived burdensomeness, and suicidal desire than the non-clinical comparison group. Following these results, Forrest et al. (2016) attempted to identify which ED symptoms are positively correlated with suicide ideation, and whether the interpersonal features (perceived burdensomeness and thwarted belongingness) may explain these correlations. Returning to Smith et al.'s sample, they examined two parallel mediation models to control for current depression. It was found that current body dissatisfaction and fasting were related to increased suicidal ideation through a higher sense of burdensomeness. In two studies, Kwan et al. (2017) addressed the role of perceived burdensomeness and thwarted belongingness in explaining the association between ED symptoms and suicide risk. They based their studies on previous research that concluded that individuals with EDs have limited social networks, less social support, more conflicts in relationships, and less satisfaction with their social support than individuals without EDs. They recruited 574 participants between the ages of 18 and 25 and used questionnaires for assessment in both studies. Their results indicated that more severe ED symptoms were associated with a higher sense of perceived burdensomeness and greater thwarted belongingness, both of which were associated with a higher suicide risk. Consistent with the findings of previous studies, perceived burdensomeness explained the association between ED symptoms and suicide risk more frequently than thwarted belongingness. Collectively, studies in these clusters indicate that facets of interpersonal difficulties combined with habituation to pain are major mediating risk factors for comorbidity of AN, BN and SAs.

4.6. Personality traits and features of psychopathology

Studies on patients suffering from AN, BN, and suicidal behaviors have shown significant associations between these diagnoses and depression, impulsivity, emotion regulation, and self-harm behaviors. Lian et al. (2017) performed a cross-sectional study and recruited 8746 Chinese adolescents to explore associations between AN, depression, and suicidal thoughts. The results of this study suggest a robust association between suicidal thoughts and depression. It was found that depression and AN may share an etiological mechanism of suicidal thoughts, indicating that depression makes a much greater contribution to an increased risk of suicidal thoughts than AN itself. Corcos et al. (2002) examined similar associations in 295 women (202 with BN purging type, 68 with BN non-purging type, and 25 with AN-BP type). They found that women who had attempted suicide differed significantly from those who had not in terms of earlier onset of psychopathology, higher severity of depressive general symptoms, and more impulsive behaviors. Depressive and general symptomatology were more severe in suicide attempters (74% of the suicidal bulimics had a depressive episode prior to the attempt) reflected in significantly higher scores on BDI and Symptom Checklist (SCL-90R) scales. A study by Foulon et al. (2007) also referred to major depression, as well as to the switch from AN-R to purging/bingeing subtypes, as risk factors for suicide in ED patients. 304 in-patients and out-patients with AN were recruited (according to DSM-IV) in three Parisian suburb hospitals between December 1999 and January 2003. Patients were assessed by a face-to-face interview (Diagnostic Interview for Genetic Studies [DIGS]). Current ED features were measured, and patients were interviewed by a trained clinician to assess BMI and the age at which AN, major depressive disorder, anxiety disorders, and, if applicable the switch to bingeing/purging subtype occurred for the first time. Major depressive disorder and subtype switch from the restrictive to the bingeing/purging type occurred much more frequently before SAs. The switch to AN-BP appears to be a major risk factor for suicide attempts, with a large increase in the frequency of SAs compared to patients with neither major depressive disorder nor bingeing/purging type.

Fennig and Hadas (2010) also addressed the association between suicidal behavior and depression in adolescents with EDs. A total of 46 Israeli adolescent females with AN or BN completed a self-report battery at the time of assessment or treatment. SAs and suicidal ideation were examined in relation to clinical (e.g. BMI, purging) and psychological (e.g. body dissatisfaction) features of the ED, as well as depression. Of all 24% of the subjects had attempted suicide, and 65% reported suicidal thoughts. Total of 58% were moderately to severely depressed. It was found that while the risk for attempted suicide was associated with depression, a history of sexual abuse, and a longer duration of illness, it was moderated by hospital treatment. The specific psychological features that were found to be related to attempted suicide included social insecurity and poor impulse regulation. Suicidal ideation was related only to depression. It was also found that a heightened sense of failure, loneliness, and helplessness, are all factors common to both EDs and major depression. Using the Eating Attitudes (EAT), Scale for Bulimia (BITE), and Body Attitude (BAT) self-report questionnaires, Miotto and Preti (2007) also identified symptoms of depression and aggressiveness as important antecedents and correlates of suicide ideation and completion in adolescents and adults with ED symptoms (including AN, BN, and binge/purge subtype). Depression and aggressiveness served as full mediators in the links between ED symptoms and suicide attempts and dismissed any direct influence of ED on suicide ideation. Likewise, Franko et al. (2004) found that the risk for non-fatal SAs is higher when AN co-occurs with other psychopathology (e.g. major depression, substance abuse). Their findings were reinforced in a study by Bulik et al. (2008) indicating that 80% of individuals with AN who had attempted suicide reported that their attempt had occurred when they were depressed.

Several studies found that across some ED diagnoses (AN, BN, BED, and ED-NOS) the risk for suicide is related to increased impulsivity and poor emotion regulation. In their study, Stein et al. (2004) recruited 150 (145 females, 5 males) outpatients in an ED clinic of which 31 (21%) had a history of one or more SAs, 17 (11%) had a history of self-injury without SAs, and 102 (68%) had no documentation of suicidal behavior. A structural clinical interview based on the Parasuicide History Interview–2 (PHI–2) was conducted. It was found that compared with the non-parasuicidal group, the parasuicidal patients had an elevated lifetime history of impulse control difficulties, as well as a substance use disorder (specifically drug abuse and dependence). These patients were also more likely to have used more than one purging

method (e.g., both self-induced vomiting and laxative abuse), thereby strengthening the association between the severity of compensatory behaviors and the risk of attempted suicide. Approximately half (48%) of those who attempted suicide (31% of all parasuicidal patients) had multiple SAs, and a significant percentage (42%) of those with a history of parasuicide had both self-injurious behaviors and at least one SA. Findings of similar associations between both types of self-destructive behavior and eating-related, as well as non-eating-related, impulse dysregulation, lend support to the view that these behaviors may be positioned on the same spectrum. Forcano et al. (2009) and Corcos et al. (2002) also referred to impulsivity as a risk factor in BN patients. They both found that women who had attempted suicide had higher severity of depressive and general psychopathology.

Forcano et al. (2009) examined 566 women with BN to determine the prevalence of lifetime SAs by comparing ED symptoms, general psychopathology, impulsivity, and personality traits in individuals who had attempted suicide with those who had not. They found that suicide attempters exhibited higher rates of eating symptomatology, general psychopathology, and impulsive behaviors. In a later study, Forcano et al. (2011) recruited 104 outpatients with AN-R, 68 outpatients with AN-BP, and 146 controls. They found that depression measures were elevated in those with SAs. Depressive symptoms also characterized those who had reported at least one SA. The presence of SAs was larger in those who have purging as part of their symptoms profile. Another study addressing self-regulation and purging behaviors as risk factors was conducted by Pisetsky et al. (2017). To examine the relationships between these variables, 110 participants (AN, $n = 10$; BN, $n = 23$; BED, $n = 26$ and OSFED, $n = 51$) completed the Difficulties in Emotion Regulation Scale (DERS), the Eating Disorder Examination Questionnaire (EDE-Q), and a lifetime suicide attempt questionnaire. The study focused on emotion regulation theories, which posit that individuals with EDs experience deficits in emotion regulation and therefore engage in purging behaviors as a means of regulating aversive emotion in the absence of more adaptive strategies. In line with these models, Pisetsky et al., found that difficulties in emotion regulation are elevated in ED groups compared to control groups and other psychiatric disorders. The researchers suggested that SAs are more prevalent in individuals who engage in purging behaviors, which are also associated with deficits in emotion regulation.

Another important comorbidity is between ED, suicidal behaviors, and self-harm. Koutek et al. (2016) recruited a sample of 47 girls admitted for AN, a-typical anorexia nervosa, and BN: 72% with depressive symptoms, 11% with obsessive-compulsive symptoms, 9% with anxiety disorder, 23% with substance abuse, and 57% with disharmonious personality development. Suicidal behavior was present in 60% of the patients and self-harm behavior in 49%. An association was found between self-harm and suicidality. Overall, 68% of the girls with EDs had a positive score in the Children's Depression Inventory questionnaire (CDI) and 62% in the Child Adolescent Suicidal Potential Index questionnaire. These patients showed a significant increase in the risk for suicidal behavior. In line with this study, Curet-Santisteban et al. (2017) emphasized the relationship between suicide and self-injurious behaviors in patients with ED (AN, BN, and ED-NOS). They evaluated 109 patients using the Eating Disorder Inventory (EDI-2), BDI-II, State Trait Anxiety Inventory (STAI), Child Adolescent Perfectionism Scale (CAPS), and the Anorexia Nervosa Stages of Change Questionnaire (ANSOCQ). Results indicated that 47 patients (43.1%) had suicidal ideation and 34 (31.2%) had self-injurious behavior. A significant percentage of adolescents with EDs presented suicidal ideation and self-injurious behavior, thereby rendering their clinical profile more severe. In the psychopathological profile, patients who engaged in self-injurious behaviors presented more severe EDs, depression and anxiety symptoms, perfectionism, and less motivation to change.

Studies have shown that body dissatisfaction and disturbances in body image represent another factor that is likely to be associated with suicide attempts in patients with AN and BN. In a study held by Stein et al. (2013), a total of 96 participants were recruited, of which 75 were diagnosed with either AN or BN, 32 had attempted suicide, 43 had not attempted suicide, and 21 served as a control group. Core ED symptoms, attitudes towards life and death, body related approaches, and depression and anxiety were assessed. It was found that both ED groups showed less interest in and more repulsion from life than the control group. Suicide attempters showed a greater attraction to death, less repulsion from death, and more negative attitudes toward their bodies than the non-suicidal ED and control participants. Pathological attitudes toward death were associated with greater depression and body-related problems. SAs were found among the EDs inpatients with binge/purge ED pathology and maladaptive attitudes toward death. This study suggests that while fear of life is a core feature of AN and BN, maladaptive attitudes toward death appear only in ED patients who have attempted suicide. Crow et al. (2008) found different results regarding body dissatisfaction, eating disturbances, and BMI as predictors of suicidal behavior in adolescents. They performed a longitudinal study and included 2516 older adolescents and young adults who completed surveys in the framework of project EAT-II, a five-year follow up study of adolescents who took part in project EAT. 15.2% of the males and 21.6% of the females reported suicidal ideation, while 3.5% of the males and 8.7% of the females reported SAs. BMI and body dissatisfaction did not predict suicidal ideation or SAs in males or females. It was found that body dissatisfaction is associated with psychosocial distress, which might have short-term but not long-term links to suicidal behavior. To conclude, many studies indicate personality features and comorbidity as influencing suicide in EDs. Thus, based on this review, it appears that depression, general psychopathology, impulsivity, and poor emotion control, as well as self-injurious behaviors serve as the major risk factors for suicide in EDs.

5. Discussion

The association between AN, BN, and suicidal ideation, behaviors and attempts is a particularly troublesome phenomenon. Therefore, when considering the potential clinical implications of this association, it is of great importance to address it and to identify its major risk factors. To the very best of our knowledge, the present study is the first review manuscript aimed at systematically investigating the published original research reports evaluating the emerging clinical links between AN, BN and suicidal behaviors. AN and BN are strongly associated with suicidal ideation and behavior, and ED patients have unique characteristics that may explain this association.

In women with BN, parental, sexual, physical, and emotional abuse (mostly in childhood) were significantly associated with the presence of lifetime SAs (Nickel et al., 2006; Smith et al., 2016a, b) and could be considered important mediating risk factors also in binge/purge subtypes due to their similarities to BN. A previous ED and familial history of an ED (any full sibling or cousin with any ED), also predicted an elevated risk of SAs in these patients (Forcano et al., 2009; Yao et al., 2016).

Few studies regarded age as a risk factor for suicide in the ED population. It was found that in children and adolescents, suicidal behavior was more prevalent among BN patients than AN patients, whereas adults with the bingeing-purging type of AN have a higher frequency of SAs than those with the restricting type (Crow et al., 2014; Mayes et al., 2014). Moreover, when the adolescent is over 11-years-old and of the female gender, the risk for suicide is higher (Veras, 2017). It is important to note that a significant percentage of adolescents with EDs present suicidal ideation and self-injurious behavior, which makes their psychopathological profiles more severe (Curet-Santisteban et al., 2017). These results underline the need to deepen the knowledge on the manifestations of suicidality from a perspective of age.

Regarding ED type, some studies found that BN was the diagnostic category most strongly associated with a history of SAs (Fedorowitz

et al., 2007; Runfola et al., 2014; Ruuska et al., 2005). Others stated that binge/purge subtypes are at the highest risk for suicide (Youssef et al., 2004; Foulon et al., 2007; Pisetsky et al., 2013), while a third group suggested that AN patients were more likely to engage in suicidal behaviors (Guillaume et al., 2011; Milos et al., 2014; Selby et al., 2010; Franko et al., 2004). Overall, based on the current literature, it now seems more likely that symptomatology (such as bingeing and purging that may have a component of impulsivity) is more important than the actual diagnostic category in determining the suicide risk of ED patients.

These interesting findings regarding symptomatology and the elevated risk in both restricting and purging subtypes may be explained in terms of the interpersonal theory of suicide (IPTS), especially given its unique approach to EDs. ED patients may habituate to the experience of pain during the course of their illness—through repeated over exercising, vomiting, and laxative abuse— which may result in suicide by using highly lethal methods (Holm-Denoma et al., 2008; Selby et al., 2010; Smith et al., 2013, Stein et al., 2013). Collectively, these studies suggest that ED behaviors constitute painful experiences, and by habituating to them, ED patients have an increased acquired capability for suicide. On the interpersonal level, ED patients are known to experience a heightened sense of failure, loneliness, and helplessness (Fennig & Hadas, 2010). Thus perceived burdensomeness and thwarted belongingness were both related to suicidal behaviors in this population (Smith et al., 2016a, b), while perceived burdensomeness explained the association between ED symptoms and suicide risk more frequently than thwarted belongingness (Forrest et al., 2016; Kwan et al., 2017). These findings highlight the importance of exploring transdiagnostic ED symptoms that may increase burdensomeness and thereby contribute to suicidal ideation in this high-risk population. The unique interplay between these predisposing social evaluative and physical factors in patients with EDs (and mostly AN) may explain the greater mediating risk of SAs in this group compared to other groups.

In terms of personality traits and features of psychopathology, a strong association was found in many studies between suicidal behavior, depression, and EDs (Fennig & Hadas, 2010; Foulon et al., 2007; Mitto & Preti, 2007; Stein et al., 2013). Some claimed that this link is especially strong in AN (Bulik et al., 2008; Franko et al., 2004; Forcano et al., 2011; Lian et al., 2017; Stein et al., 2004), while others stated that it is stronger in BN patients (Corcos et al., 2002). One study indicated that depression makes a greater contribution to increased risk of suicidal thoughts more than the ED itself (Lian et al., 2017). A subtype switch from restrictive to bingeing/purging was also a correlate to SAs (Foulon et al., 2007; Pisetsky et al., 2013). Impulsivity and poor impulse and emotion regulation were found as specific psychological features related to suicide (Corcos et al., 2002; Fennig & Hadas, 2010; Forcano et al., 2009; Koutek et al., 2016; Pisetsky et al., 2017) with a growing number of studies linking these characteristics to the binge/purge group (Forcano et al., 2011; Stein et al., 2013; Stein et al., 2004). Thus, these patients may also engage in self-injurious behaviors which render their psychological profile more severe and may contribute to multiple SAs (Curet-Santisteban et al., 2017; Koutek et al., 2016; Stein et al., 2004). The engagement in self-injurious behaviors together with poor impulse control may be a result of the need to regulate intensive negative emotions. Moreover, the strong link that was found to impulsivity, could explain the increased risk for suicide in patients with the purging subtypes of AN and BN.

5.1. Clinical implications for research and treatment

A number of clinical implications can be gleaned from the results of this review. The strong association between suicidal behaviors and AN and BN may be accounted for by comorbid psychopathology or by the specific interpersonal and psychological factors that characterize ED patients. These findings indicate ED patients as one of the most prevalent psychiatric populations with a severe risk for suicide, and therefore in need of comprehensive and systemic treatment to prevent suicidal behavior. This population also underlines the need for intensive treatment and monitoring. More specifically, creating interventions targeting depressive and impulsive features associated with AN and BN are essential to reduce the risk of SAs in women with these disorders and potentially extend their lives. It is important to note that due to the nature of AN and the low BMI in AN patients, even SAs that may not be considered severe, can ultimately prove lethal. Thus, it is essential, when working with AN and BN patients, to perform routine suicide risk and lethality assessments as standard components of clinical practice in the evaluation stage and in emergency rooms. Overall, our findings support the need to further establish the socio-demographic and psychological processes that may induce suicide ideation and suicidal behavior in this high-risk population.

6. Conclusion

Our findings provide a foundation for future research regarding the combined role of psychopathology, interpersonal difficulties, type of ED, age, and background factors to the co-occurrence of EDs and suicidal behavior. Clinical correlates of suicidality include purging behaviors, comorbid disorders (e.g., depression), poor emotion regulation, impulsive behaviors, history of childhood physical and emotional abuse, pain tolerance, and certain personality and interpersonal features such as perceived burdensomeness. Regardless of the limited scope of research and available data, it is important that health care professionals consider these risk factors when assessing the risk of suicidality among EDs. Thus, it is imperative that a thorough suicide assessment be conducted routinely for individuals with past and current EDs, as would be done for patients with mood disorders, and that clinicians be aware that this risk may be ongoing and occur throughout treatment, even after ED symptoms appear to be remitting.

7. Methodological limitations

One of the main drawbacks of our study pertains to the diagnostic definitions and criteria of EDs. Current limitations in the classification of EDs in the DSM-V (APA, 2013) comply with a more general understanding that there is a need for a framework that moves beyond categorical and symptom-based approaches. This has led contemporary theoreticians working within the framework of the Research Domain Criteria (RDoC) (Sanislow et al., 2010; Cuthbert & Insel, 2013; Cuthbert & Kozak, 2013) to focus on dimensions of behavior and neurobiology as key indicators of psychopathology. In line with this approach, impulsivity and compulsivity have been suggested as potential transdiagnostic factors (Brooks et al., 2017) which, we believe, can facilitate a better understanding of psychological profiles in EDs. Another limitation refers to the terminology of SAs in EDs. The definition for SA includes the severity of the attempt, knowledge regarding the probability to die from such an attempt, and the actual intention to die (Gvion & Levi-Belz, 2018). This precise definition of SAs is very significant especially in regard to subjects with AN due to the fact that a high percentage of mortality in this population is related to low BMI and poor physical health, and not necessarily to an intention to die or a severe suicide attempt. Therefore, the lack of a clear distinction between these parameters in the literature regarding AN and BN and suicidality constitutes a further limitation. Furthermore, researchers have used different terminology to define suicide: suicidal ideation, thoughts, gestures, behaviors and attempts, and have also linked these definitions to NSSI and Deliberate self-harm (DSH), thereby weakening the ability to draw conclusions regarding actual suicidal behaviors versus other self-harm behaviors. Finally, due to different study designs, measures and sample types, data could not be combined into a singular meta-analysis and a quality appraisal was not performed.

Conflict of interest

We declare no conflict of interest.

Authors statement

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