Which Comes First? An Examination of Associations and Shared Risk Factors for Eating Disorders and Suicidality

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Abstract

Purpose of Review This narrative review evaluates recent literature on the associations between eating disorders and suicidality and discusses potential shared mechanisms that may account for these relationships. Additionally, the review highlights shortcomings with the literature to date and suggests avenues for future research.

Recent Findings Individuals with anorexia nervosa, bulimia nervosa, and binge eating disorder experience elevated rates of suicidality compared to the general population. Suicide risk is higher when eating disorders occur with other psychological conditions. Additionally, genetic factors, emotion dysregulation, trauma, stressful life events, and lack of body regard may have roles in the development of both eating disorders and suicidality.

Summary Much of the risk for suicidality in eating disorders appears to be driven by comorbid psychopathology and genetic factors. However, the lack of longitudinal research makes it difficult to draw conclusions about the directionality or temporality of these relations; thus, novel methods are needed.

Keywords Eating disorders; anorexia nervosa · Bulimia nervosa · Binge eating disorders · Suicidality · Suicidal ideation; suicide attempt; suicide

Introduction

Eating disorders (EDs) are among the most serious and challenging mental illnesses to treat. Individuals with EDs experience disturbances in eating and food-related behavior and frequently have strong concerns surrounding weight and shape [1]. Commonly characterized by interpersonal and occupational disabilities, EDs are also frequently associated with elevated mortality. In fact, standardized mortality ratios (SMRs) for suicide within EDs are among the highest of any mental disorder [2–6]. Research has repeatedly found high rates of suicidal thoughts and behaviors across all ED diagnoses, underscoring the need to understand the co-occurrence of EDs and suicidal thoughts and behaviors. This need is all the more dire given that our ability to predict who will die by suicide has not improved in the past 50 years [7•]. The purpose of this narrative review is to evaluate the recent literature on the associations between EDs and suicidality and discusses potential shared mechanisms that may account for these relationships. Additionally, we highlight shortcomings with the literature to date and suggest avenues for future research.

We begin by first reviewing the degree to which ED diagnoses are associated with various forms of suicidality (ideation, attempts, and death). Of note, the majority of suicidality research has examined anorexia nervosa (AN) [8], with less research on bulimia nervosa (BN), and even less on binge eating disorder (BED). There is also a paucity of research using Diagnostic and Statistical Manual of Mental Disorders-5 diagnostic criteria; this makes it difficult to know whether recent changes to the criteria for ED diagnoses affect suicidality rates.

Suicidality in EDs

In this review, we will focus on suicidal ideation, suicide attempts, and suicide death. Given that non-suicidal self-injury by definition occurs without suicidal intent, it will not be a focus of this review.
Suicidal Ideation Cross-sectional research finds that individuals with EDs endorse elevated levels of suicidal ideation relative to the general population. It is estimated that one-quarter to one-third of those with AN, BN, and BED endorse current suicidal ideation [9–12]. Specifically, 20–43% of those with AN endorse current suicidal ideation [9, 10] and 23% report lifetime ideation. Estimates of current ideation in BN range from 15 to 23% [9], while lifetime rates lie between 26 and 38% [10]. Few studies have evaluated suicidal ideation in those with BED; among those that have, estimates run between 21 and 28% [9, 11]. As a point of comparison, lifetime rates of ideation in the general population are between 5.6 and 14.4% [13]—rates that are substantially lower than those in EDs. However, those with EDs report suicidal ideation less frequently than those with other serious mental illnesses, like schizophrenia and bipolar disorder, whose estimates are 40% [14] and 80% [15], respectively.

It is important to note some shortcomings with regard to the study of suicidal ideation among those with EDs. A recent meta-analysis conducted by Smith and colleagues [16] found that, to date, there are no longitudinal studies examining whether an ED factor (i.e., diagnosis or symptom) longitudinally predicts suicidal ideation. Even within the cross-sectional studies, suicidal ideation has been poorly measured, with many studies using only one item to assess suicidal ideation [10, 17–19]. Using such brief measures is problematic, as it makes it difficult to capture accurate levels of suicidal ideation, potentially leading to an underestimation of ideation [20].

Non-fatal Suicide Attempts EDs and suicide attempts onset at roughly the same age (approximately 16–18 for AN and bulimic behaviors [21, 22] and 16 for suicide attempts [13]). Lifetime suicide attempt estimates range from 9 to 25% in those with AN, with the binge-purge subtype (AN-BP) reporting attempts more frequently than the restrictive subtype (AN-R) [8, 23–25]. Zerwas and colleagues [26] found that those with anorexic features without low weight (i.e., atypical AN) are at an equally high risk for attempting suicide as those with AN. Although studies find that individuals with BN attempt at a similar rate to individuals with AN [25, 27, 28], those with AN demonstrate higher intent and lethality in their attempts [28, 29]. There is also some speculation that AN and BN only appear to have similar attempt rates, as small study samples may lead to a lack of power and an inability to differentiate between the two groups [5]. Although research on BED is sparser, studies show that 13.5% of individuals with BED have attempted suicide [11, 12, 23] and are four to five times more likely to have attempted suicide than comparison groups [30, 31]. Of note, Forrest and colleagues [31] found that suicide attempts tended to occur before BED onset among adults. Overall, although risk for suicide attempts appears elevated across all EDs, especially when compared to the 2–9% attempt rate of the general population [13], few studies have closely examined the time course of attempt (i.e., whether it precedes or follows ED onset). In fact, Smith and colleagues’ longitudinal meta-analysis [16] found that ED diagnosis and symptoms increased risk of subsequent attempt by only two-fold.

Fatal Suicide Attempts Suicide is the second leading cause of death among individuals with lifetime AN diagnoses [32]. Arcelus and colleagues found that of those with lifetime AN diagnoses who died prematurely, one in five died by suicide [2]. Further, those with lifetime AN diagnoses are between 18 and 31 times more likely to die by suicide than gender- and age-matched samples [5, 33]. Preti et al.’s meta-analysis revealed that individuals with lifetime BN diagnoses are seven times more likely to die by suicide than a comparison group [5]. Fatal attempts still need to be evaluated in those with BED with current meta-analytic studies lacking enough power to come to a reliable conclusion [5].

As with the ideation and attempt literature, the findings regarding suicide death should be interpreted in light of limitations. The most notable of these limitations is that the timing of the suicide death relative to the ED onset is unclear, as most studies do not ascertain whether the ED was present at the time of death. Post-mortem studies are capable of answering whether or not the individual had an ED at the time of death; however, to our knowledge, only two of these studies have examined EDs, and they focused on AN only [34, 35]. These studies found a much lower than expected incidence of AN at time of death (only 11 instances per 100,000 deaths listed AN as a factor), and AN was not associated with increased suicide rates relative to controls as listed on official death records. Taken together, this work suggests that an ED may distally, but perhaps not acutely, elevate risk for suicide. However, as discussed later, this conclusion is presently quite speculative given the need for more methodically rigorous studies designed to investigate the time course of suicide risk among those with EDs.

Directionality and the ED-Suicidality Association

Our review thus far highlights that although EDs are associated with suicidal ideation, attempts, and suicide death, little is known about the dynamic interplay between these conditions. We can envision various possible pathways whereby EDs are related to suicidality. It is possible that EDs either directly or indirectly contribute to suicidality, it is possible that suicidality either directly or indirectly leads to EDs, and it is also possible that EDs and suicidality share common biological and psychological dysfunction that then make a given individual more
likely to experience both concerns over the course of her life (see Fig. 1). We discuss each of these possibilities in turn.

**Do EDs Contribute to Suicidality?** The consistently noted associations between EDs and suicidality have led some researchers to speculate that EDs directly lead to suicidal outcomes. However, support for this pathway is lacking given the dearth of longitudinal studies investigating whether ED factors predict later suicide outcomes. The only limited support that does exist comes from a handful of longitudinal studies, and studies that test whether EDs predict suicidal behavior over and above risk factors for suicidal behavior, like other psychological disorders. In a meta-analysis, Smith et al. [16] identified only 14 studies that tested whether an ED factor longitudinally predicted an attempt or suicide death. They found that ED diagnosis and symptoms were significant but weak predictors of suicide attempts, but not death [16]. The cross-sectional comorbidity research shows that EDs remain significantly associated with suicidality after controlling for comorbidities, though the relationship is greatly attenuated [36]. In short, currently, there is not enough available research to conclusively evaluate whether EDs directly predict the onset of suicidality.

Joiner [37] was one of the first to discuss how ED symptoms may indirectly elevate an individual’s risk for death by suicide. In order to understand his rationale, it is important to first understand the theory of suicide he developed, the Interpersonal Psychological Theory of Suicide (IPTS) [37, 38]. The IPTS proposes that in order for a lethal suicide attempt to occur, an individual must both desire suicide and have the capability to take her own life. The desire for suicide develops when one both feels like a burden and like one does not belong, and feels hopeless about these states changing. However, according to the theory, suicidal desire on its own will not lead to a lethal suicide attempt; this desire must be accompanied by the ability to take one’s own life. Thanks to evolution, Joiner reasoned, dying by suicide is not an easy thing to do. Thus, in order to die by suicide, one must possess the capability to stare down death. He hypothesized this capability is comprised of fearlessness about death and pain tolerance, and develops from repeated engagement in behaviors that are either painful or frightening (e.g., non-suicidal self-injury, body enhancements, injuries, shooting a gun).

Joiner further suggested that suicidal behavior is elevated in EDs, and AN in particular, because ED behaviors, like dietary restriction, constitute painful and provocative experiences that should increase capability for suicide [37]. In other words, Joiner proposed that EDs indirectly increase risk for suicidal behavior via capability for suicide [37]. Specifically, Joiner’s theory hypothesizes that repeated encounters with painful and/or provocative experiences lead to greater capability for suicide through habituation and activation of opponent processes (see [38] for review). For example, an individual’s initial response to vomiting would likely include fear; however, with repeated exposure, the opponent process to fear (e.g., relief) becomes more pronounced. This account dovetails with literature on the maintenance of certain ED behaviors, like binge eating. In particular, despite being painful and leading to long-term negative outcomes, behaviors like binge eating often persist in part because they are negatively reinforced in the short-term through a reduction in negative affect or escape from aversive self-awareness [39]. Thus, although there is likely discomfort and pain associated with all ED behaviors, overtime repeated engagement in these behaviors may simultaneously build pain tolerance, reduce fear, and engage opponent processes.

However, it should be noted that support for Joiner’s [37] supposition is mixed. Specifically, research does consistently find elevated pain tolerance among those with AN and BN relative to those without EDs [40, 41]; however, findings regarding fearlessness about death have been less conclusive. Although research finds that some ED behaviors, like vomiting, laxative use, and over-exercise [42, 43], are associated with fearlessness about death, research has failed to find associations between either dietary restriction or AN and fearlessness about death [43]. Additionally, ED populations have not exhibited elevations on fearlessness about death relative to psychiatric comparison groups [44, 45].

Given the mixed findings regarding elevated capability among those with EDs, other work has examined whether the ED-suicide relationship may be driven in part by associations between ED symptoms and the desire for suicide, specifically, low belongingness and perceived burdensomeness. Previous work on other mental disorders finds that many disorders are related to both perceived burdensomeness and
thwarted belongingness (see [44] for a review). Within an ED sample, Pisetsky and colleagues [46] found that ED symptoms were related to burdensomeness and low belongingness. Similarly, within another ED sample, Smith and colleagues [44] found that burdensomeness was related to suicidal ideation, and both burdensomeness and thwarted belongingness were greater in the ED sample than a control group. Further, cross-sectional work finds that burdensomeness and low belongingness mediate the relation between ED symptoms and suicidal ideation in non-clinical and clinical ED samples [47, 48]. However, longitudinal work has provided mixed findings. For instance, among a non-clinical sample, Dodd and colleagues [49] found that dietary restraint was only indirectly related to burdensomeness and low belonging through negative life events. Additionally, among a treatment-seeking sample of individuals with EDs, Trujillo and colleagues [50] found that over a 2-month period, ED symptoms did not lead to increases in either burdensomeness or thwarted belongingness; however, they did find evidence for the opposite relationship—that burdensomeness lead to greater ED symptoms. Taken together, this work suggests that some ED symptoms are cross-sectionally related to elements of capability for suicide, burdensomeness, and low belonging. More longitudinal research is needed to evaluate the usefulness of the IPTS for ED populations.

Does Suicidality Contribute to EDs? To our knowledge, very few studies have examined whether or not suicidality precedes ED onset. Based on self-report, Forrest and colleagues [31] examined the time course of BED, suicide ideation, planning, and attempts in large, nationally representative samples of adolescents and adults. Interestingly, they found that for the majority of adolescents, BED onset before suicidality; however, for adults, the opposite was true—in general, suicide attempts preceded BED onset. As noted earlier, in a treatment-seeking adult ED sample, Trujillo and colleagues [50] found that burdensomeness (a risk factor for suicidal ideation) led to increases in ED symptoms 2 months later. Overall, not enough research has examined whether suicidality precedes ED onset, though this seems a worthwhile direction for future research.

Shared Mechanisms

An additional possibility is that shared risk factors, or “third variables,” influence both EDs and suicidality. As noted earlier, given that the average age of onset of AN, BN, and suicide attempts is roughly similar, this is an intriguing possibility.

Do EDs and Suicidality Share Common Biological Risk Factors? The co-occurrence of EDs and suicidality may be explained in part by shared biological factors that make an individual vulnerable to both outcomes. Few biological markers have been found to significantly and prospectively predict suicide risk, though one recent meta-analysis found that disruption in cytokines and low levels of fish oil nutrients were both significant, though weak predictors of suicidal behavior [51]. Both cytokine disturbances and compromised nutritional status are associated with EDs, and thus could provide one biological mechanism by which these two phenomena are linked [52]. Moreover, family and twin studies show that there is familial coaggregation of EDs and suicide (in other words, the association between EDs and suicide tends to run in families) [36, 45] and genetic research suggests that shared genetic factors could contribute to the co-occurrence of suicidality and EDs [53, 54]. However, this research is in early stages, and substantial future work is needed to determine more specific biological and genetic pathways for the co-occurrence of EDs and suicidality, as well as to determine the extent to which the biological and genetic association between EDs and suicidality is driven by third variables such as other psychiatric comorbidities and other psychological and temperamental factors (e.g., emotion dysregulation).

Do EDs and Suicidality Share Common Psychological Dysfunction? EDs are often experienced in the presence of comorbid psychopathology [55], and virtually everyone who dies by suicide suffers from at least one psychological condition at the time of death [56]. In particular, EDs are often comorbid with anxiety disorders, mood disorders, and substance use disorders [57–59]. Considering the effect of EDs on suicide risk when adjusting for the effects of comorbid disorders can identify whether the EDs themselves, comorbidities, or both EDs and comorbidities explain the relation between EDs and suicide. Yao and colleagues [36] examined risk of lifetime AN and BN diagnosis on suicide attempts and death using a national registry of over two million people in Sweden, with and without adjusting for comorbid major depressive disorder, anxiety disorders, or substance use disorders. Lifetime AN was associated with increased risk for suicide attempts and death among men and women, with and without adjusting for psychiatric comorbidities [36]. That being said, Yao et al.’s study [36] indicated the comorbidity-adjusted odds ratios (OR; OR attempts = 1.70, OR deaths = 2.67) were much smaller than the unadjusted ORs (OR attempts = 4.42, OR deaths = 6.46), demonstrating that suicide risk is higher when AN occurs with other conditions. Indeed, Kask and colleagues [60] found that the suicide SMR for AN with comorbidities was seven times greater than the suicide SMR for AN without comorbidities. In particular, comorbid mood disorders appear to be strongly linked to suicide attempts in people with AN, as Bulik and colleagues [8] identified that over 80% of people with AN reported that their most lethal or only attempts occurred during a depressive episode.
A largely similar pattern of comorbidity-independent suicide risk is observed in BN. When adjusting for comorbidities, BN is still associated with greater odds of experiencing lifetime ideation among adolescents [31•] and with elevated odds of experiencing lifetime suicide attempts among adolescents [31•] and adults [36•]. However, examinations of suicide deaths reveal that, when adjusting for comorbidities, the effect of BN on risk of suicide death is elevated (OR = 1.48) but not statistically significant [36•]. Similar to people with AN, co-morbid mood disorders are robustly associated with suicide attempts and death in people with BN [31•, 36•].

Only one study has examined comorbidity-independent suicide risk in BED [31•]. This analysis revealed that, at a univariate level, BED was associated with increased risk for suicide ideation, planning, and attempting among adolescents and adults. However, when accounting for comorbidities, BED was not significantly associated with increased risk for any suicide outcomes. Taken together, AN and BN are associated with significant elevations in risk for suicide ideation and attempts, and AN is associated with suicide death, over and above comorbidities. However, adjusting for comorbidities substantially weakens the ED-suicidality association. Thus, people with EDs and comorbid psychopathology—particularly mood disorders—appear to have the greatest suicide risk.

**Additional Shared Mechanisms** Comparing across the ED and suicide literatures allows for additional consideration of shared risk factors. For instance, research suggests potential roles for neurocognitive dysfunction [61, 62], emotion dysregulation [63, 64], trauma [65, 66], stressful life events [67, 68], and lack of body regard [69] in the development of both EDs and suicidality. A review of all of these potential shared factors is outside the scope of this review; however, we will narrow in on one component of body disregard—interoceptive deficits—as recent work suggests interoceptive deficits may be capable of distinguishing between those who think about suicide from those who attempt among those with and without EDs [70•, 71•].

Interception is the perception of the physiological condition of the entire body, including cardiac, pain, gastrointestinal, and emotional sensations [72]. Interoceptive deficits are a common symptom in people with EDs. While interoception has long been hypothesized and found to relate to EDs [73, 74], recent theoretical and empirical work suggests that interoceptive deficits may also be necessary to engage in self-injurious behavior [69, 70•]. That is, because people with interoceptive deficits are disconnected from their internal sensations, they may come to perceive their bodies in more objectified ways [75]. Harming an object is far easier than harming a feeling body. Thus, having diminished interception and viewing one’s body as an object may facilitate harming one’s body, should one desire to do so. In support of this idea, Forrest and colleagues [70•] found that people who had attempted suicide had significantly greater interoceptive deficits than people who had thought about or planned a suicide attempt but had never engaged in suicidal behavior. In other words, disconnection from physiological sensations differentiated people who thought about suicide from those who engaged in suicidal behavior. Importantly, this pattern of results replicated in two samples of people with EDs. Specifically, Smith and colleagues [71•] found that those with EDs who engaged in self-injurious behaviors had greater interoceptive deficits than individuals with EDs and no self-injurious behaviors. Further, ED individuals who attempted suicide multiple times had the most severe interoceptive deficits. Taken together, this work indicates that interoceptive deficits longitudinally predict EDs and are positively associated with engagement in self-injurious behaviors. Moreover, people with the most severe self-injurious behaviors appear to have the most pronounced interoceptive deficits.

**Future Directions**

Given the current state of the literature, there are clear directions for future research to advance our understanding of the relationship between EDs and suicidality. Much of the previous literature examining the relationship between EDs and suicide has relied on cross-sectional and retrospective designs, making it impossible to delineate the temporal relationship between these factors. In order to test the assumption that EDs are risk factors that longitudinally precede suicidality, Smith and colleagues conducted a meta-analysis and only included studies where there was at least one longitudinal analysis predicting suicide ideation, attempt, or death from an ED diagnosis and/or symptom [16•]. Surprisingly, only 14 longitudinal studies were identified, and no studies were found that predicted suicidal ideation from an ED-related variable. Further, the mean length of follow-up was about 10 years, which means we have no understanding of acute risk factors for suicide in ED populations. These findings point to the importance of designing future research in ways that can test whether EDs temporally precede and are causally linked to suicidality.

First and foremost, there is a dire need for more longitudinal research. Ideally, this research would investigate the development of both EDs and suicidality by collecting data from adolescents before the mean age of onset for these conditions (i.e., before 16), and follow these individuals overtime. Further, in addition to measuring ED symptoms and suicidality, this research would also benefit by including measures of possible shared risk factors, and it would be ideal to use both short- and long-term follow-ups, as suicide risk is dynamic and factors that predict long-term risk appear to be different than those that predict short-term risk [76•]. As we have summarized...
transitioning along the continuum of suicidality from ideation increasingly focus on the mechanisms involved in whether certain ED symptoms are more related to suicide risk than others [16•]. Further, both ED and suicide treatment research would also benefit from including measures of suicidality and disordered eating, respectively, as reductions in either of these conditions as a result of treatment for the other would suggest a causal relationship.

More broadly, as recently discussed by suicidology experts [7], we need to revolutionize the way we study suicidality in order to increase our understanding of suicide risk and improve prediction and prevention. This includes careful examination of the temporal dynamics of how suicidal ideation versus behavior develops over time, with particular attention to short-term periods of risk [78•, 79•]. As models of suicide increasingly focus on the mechanisms involved in transitioning along the continuum of suicidality from ideation to attempts [37, 80•], it is important for research to identify the periods when risk is greatest, in order to best inform prevention and treatment. Finally, it is increasingly clear that suicidal behavior is a complex problem influenced by multiple interacting risk factors [7]. Most research in the field to date has focused on testing the relationship between one (or a few) specific putative correlate or risk factor, with the result being that suicide prediction remains at near-chance levels [7]. However, given that risk may be determined by change in multiple risk factors in concert [78•], our models of suicide should account for this complexity. One technique which shows promise in improving on the prediction of suicide is machine learning, which develops algorithms to identify the relationships between multiple risk factors at once [76•, 81•]. Machine learning algorithms have the potential to identify complex interrelationships among known correlates and risk factors for suicide, to examine models of risk across different time frames, including short-term risk, and to compare algorithms across groups such as ED diagnostic category [76•]. Therefore, machine learning is capable of addressing several of the central questions about the nature of the relationship between EDs and suicide, and has the potential to dramatically improve our understanding of these complex phenomena.

Clinical Implications

Individuals with EDs have strikingly high rates of suicidality compared to the general population. It is essential that clinicians working with ED clients conduct regular and thorough suicide assessments; this is even more important when the ED co-occurs with other psychopathology. Clinicians working with ED clients who are experiencing suicidality should also be familiar with strategies to treat the suicidality, like dialectical behavior therapy [82].

Conclusion

Clearly, those treated for EDs experience high rates of suicidal ideation, attempts, and death. The overall lack of longitudinal research makes it difficult to draw conclusions about the directionality of these relations. Much of the risk appears to be driven by comorbid psychopathology and genetic factors. Thoughtfully designed and methodologically rigorous longitudinal studies that employ both short- and long-term follow-ups, as well as community and treatment-seeking samples, will help us understand the potentially dynamic interplay between EDs and suicidality.

Compliance with Ethical Standards

Conflict of Interest April R. Smith, Shelby N. Ortiz, Lauren N. Forrest, and Dorian R. Dodd declare no conflict of interest.

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Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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Using two eating disorder samples, the authors found that suicide attempters and those engaging in non-suicidal self-injury had the greatest interoceptive deficits. Findings suggest that lack of access to emotion regulation strategies might link interoceptive deficits and self-injury.