

Brief report

Deaths by suicide among individuals with anorexia as arbiters between competing explanations of the anorexia–suicide link

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Abstract

Background: Suicide is a leading cause of death among individuals with anorexia nervosa (AN). In this paper, we examined competing explanations of the high rate of death by suicide among individuals with anorexia nervosa (AN).

Methods: Nine case reports of individuals with AN who died by suicide were evaluated to determine whether death by suicide occurred a) because physical health was so compromised that what would be a non-lethal suicide attempt in a healthy adult became a fatal suicide attempt, or b) because highly lethal suicide attempts that would have killed any adult, healthy or medically compromised, were made.

Results: The findings converged with the latter hypothesis, as predicted by Joiner's [Joiner, T., 2006. *Why People Die By Suicide*. Harvard University Press, Cambridge, MA] 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.

Limitations: This study utilized case reports instead of an experimental design, which impedes its ability to comment on whether there is a causal relationship between Joiner's theory and death by suicide among individuals with AN.

Conclusions: Clinicians are encouraged to carefully assess suicidality in AN patients, paying particular attention to issues related to lethality.

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Anorexia nervosa (AN) is an often chronic, debilitating condition with one of the highest premature death rates of all mental disorders (Sullivan, 1995). Should someone with anorexia die prematurely, the cause of death is as or

more likely to be suicide as compared to complications arising from compromised nutritional status (Crisp et al., 1992). For instance, Keel et al. (2003) followed 246 eating disordered women for over 12 years, and found that 11 had died, all but 1 of whom had AN. Suicide was the most common cause of death in the sample ($n=4$); the risk of death by suicide among anorexic women was approximately 57 times the expected rate.

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What accounts for the unique association between AN and suicide? Joiner's (2006) theory of suicidal behavior predicts that high lethality suicide attempts are made only by people who have habituated to pain and fear through repeated exposure to painful situations. Individuals with AN may attempt suicide using methods likely to result in death for anyone, regardless of medical status or degree of social isolation, because of their habituation to pain through the experience of medical conditions associated with starvation and/or other forms of self-injury. Consistent with this idea, Raymond et al. (1999) found high pain thresholds among individuals with AN. Alternatively, individuals with anorexia may be prone to suicide attempts, but their nutritional status renders them medically fragile and thus unable to survive suicide attempts with relatively less lethal likelihood. Another related possibility is that women with AN may be particularly socially isolated and thus unlikely to be rescued after a suicide attempt.

We describe nine cases of anorexic women who have died by suicide and use them to arbitrate between these competing accounts of AN and death by suicide. Based upon Joiner's (2006) theory, we predicted that individuals with AN who died by suicide used methods especially likely to result in death in conjunction with a relatively low probability of rescue (i.e., those that would kill healthy adults).

1. Method

1.1. Sample 1

1.1.1. Participants

The first sample ($N=136$) was drawn from 554 consecutive women seeking treatment at Massachusetts General Hospital and 21 women seeking treatment from 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). See Herzog et al. (1993) for more information.

1.1.2. Procedure

After an initial phone screening (including informed consent), trained researchers interviewed participants at intake and follow-up points (every 6–12 months). Average duration of participants' participation was 8.6 years. To assess the vital status of participants, searches were conducted through the National Death Index, regularly updated by the National Center for Health Statistics. Once the researchers learned of a participant's death, they obtained copies of autopsy and medical reports to determine the cause of death.

1.1.3. Measures

At intake, the Structured Interview for DSM-III Personality Disorders (Pfohl et al., 1983) and Schedule for Affective Disorders and Schizophrenia-Lifetime Version (Spitzer and Endicott, 1979) were administered. The Eating Disorders Longitudinal Interval Follow-up Evaluation (Herzog et al., 1993; Keller et al., 1987) was used at follow-ups. Inter-rater reliability for AN was high (.93 ICC). Four deaths by suicide occurred in this sample.

1.2. Sample 2

1.2.1. Participants

Case 5 was taken from a follow-up study on 81 male ANs cases being conducted at the University of Munich, Germany. Cases 6–9 were drawn from patients treated for AN in the Klinik Roseneck Hospital for Behavioral Medicine, Prien, Germany. The four cases reported from this hospital were patients with verified diagnoses of AN who died by suicide.

1.2.2. Measures and procedure

The majority of patients were assessed using the Structured Inventory for Anorexic and Bulimic Syndromes (Fichter and Quadflieg, 2001). As a standard quality measure, this hospital seeks out information on all deaths that are made known to staff. Generally, this information comes from systematic research within various research projects (e.g., Fichter et al., 2006). Once a patient death became known to hospital staff, the patient's relatives were contacted and asked to provide details concerning the circumstances of death. When available, information from death certificates and clinical charts were included as well.

1.3. General procedure

When determining the overall likelihood of suicide completion, one should evaluate the risk inherent in the attempt itself (i.e., method, damage inflicted) as well as the likelihood of rescue (Weisman and Worden, 1972). A subset of the authors met and used expert consensus strategies to determine the inherent risk/likely lethality of each method and the likelihood of rescue.

2. Results

Table 1 provides our conceptualization of each case's risk for death and likelihood of rescue. It also provides information such as age, BMI at death, subtype of AN, and method of suicide.

Table 1
Decedents and their deaths by suicide

Case	Age at death	Diagnosis(es) at intake*	Method	Likelihood of death	Likelihood of rescue	BMI at death	Fatal for someone with a normal BMI?
1	40	AN-R; alcoholism	Ingested Lysol (and other agents)	L to M	H	11.8	Possible
2	35	AN-BP, alcoholism	Carbon monoxide	H	L to M	14.6	Yes
3	37	AN-R	Jumped in front of train	H	L to M	18.2	Yes
4	29	AN-R, alcoholism	Drug overdose	L to M	L to M	19.9	Probably Yes
5**	17	AN-BP, depression	Jumped in front of train	H	L to M	13.5	Yes
6	24	AN-BP, BPD, substance dependence, panic attacks	Drug overdose; not found for 10 days	L	L	UNK	Yes
7	35	AN-R, OCD, panic attacks, depression	Jumped in front of train	H	L to M	11.7	Yes
8	21	AN-R, depression	Hanging	M to H	L to M	18	Yes
9	27	AN-BP, BPD	Hanging	M to H	M to H	13.1	Yes

*AN subtype at intake did not necessarily correspond with AN subtype at time of death. As is true of many individuals with chronic AN, periods of both restrictive symptomatology and binge/purge symptomatology were often observed over the course of the illness. **All are female except case 5. Note: L=low; M=moderate; H=high; AN-R=anorexia nervosa, restricting subtype; AN-BP=anorexia nervosa, binge/purge subtype; BPD=borderline personality disorder; OCD=obsessive-compulsive disorder; UNK=unknown.

Case #1 ingested an unknown quantity of chloral hydrate and 354.9 mL of Lysol Toilet Bowl Cleaner [which contains hydrochloric acid (HCl)], and then called 911. She died 4 h after being transported to the emergency room due to gastric hemorrhaging. Her blood alcohol at the time of death was 0.16%. Overdose of chloral hydrate can result in respiratory depression and low blood pressure (U.S. Drug Enforcement Administration, 2006). Unfortunately, no information is available on the amount of chloral hydrate that was consumed. According to the National Institutes of Health Consumer Products Database (National Institutes of Health [NIH], 2004), Lysol Toilet Bowl Cleaner contains 9.5% hydrochloric acid by volume. Thus, the decedent had consumed 33.7 mL of hydrochloric acid. One standardized way of determining the lethality of a substance is by using the LD50 [determined when various chemicals are tested on animals, and the dosage (given in mg per weight of the animal in kg) that produces death 50% of the time is identified]. Using the LD50 for HCl, the amount the decedent consumed would be lethal 50% of the time for an organism that weighs 39.1 kg (86 lb). Thus, the amount of HCl ingested alone may not have been fatal for an adult of normal weight. However, it is possible that the unknown quantity of chloral hydrate, in combination with HCl and alcohol, contributed to her death in some way. The decedent had a high likelihood of rescue in this case, as she herself called for help and was conscious when the EMTs arrived. In sum, it appears that risk of death was low to moderate and likelihood of rescue was high.

Case #2 had previously made one suicide attempt, which resulted in a 5 week hospitalization, by slitting her wrist and a tendon in her neck. Three days after

being released from the hospital, the decedent locked herself in a public restroom at a gas station. She stuffed towels in vents and under the door to restrict clean air from entering the restroom. She set a trashcan on fire and thereby died of carbon monoxide (CO) poisoning. She was in the bathroom approximately 2 h before being found. The cause of death was acute carbon monoxide intoxication and inhalation of products of combustion.

It is important to determine the concentration of carbon monoxide that would have been generated by a small fire, taking into account the size of the gas station bathroom. The information regarding the size of the trashcan and the bathroom is unavailable. However, assuming average parameters, the trashcan fire may have resulted in a concentration of 2300 ppm of CO. According to the Institute of Plumbing and Heating Engineering (IPHE, 2006) any CO concentration above 800 ppm can be fatal, and death comes more quickly with higher concentrations.

People of lower body mass succumb more quickly to CO poisoning (IPHE, 2006). Therefore, it is possible that if the decedent had more time before death, she may have changed her mind. Nevertheless, she deliberately remained in the bathroom despite the fact that she likely experienced the following symptoms prior to her death: nausea, vomiting, headache, dizziness, disorientation, and weakness. It would require high resolve to restrain oneself from unlocking the door and being rescued.

The likelihood of rescue in this case seems to be relatively remote. The decedent was located in an unfamiliar setting and had locked herself in the bathroom. She appeared to be intent on avoiding rescue, as she did not ask for help from anyone at the gas station. Therefore, the risk of death was high whereas the likelihood of rescue was low to moderate.

In the months preceding *Case #3's* fatal suicide attempt, the decedent had taken an overdose of an unknown medication which necessitated hospitalization. Her death was ultimately the result of jumping in front of a train, which caused multiple blunt traumatic injuries and killed her instantly. It seems clear that the injuries caused by the train were not exacerbated by her history of AN-R. Furthermore, she had a normal BMI at the time of her death. Thus, it seems that her death was a function of the lethality of her actions and not her previously malnourished state.

She jumped around 7:30 pm at commuter rail tracks in the Boston area. Commuter rail tracks are isolated even in large cities. Moreover, she did not jump during rush hour, which presumably would have increased her likelihood of rescue. Therefore, it appears as though her likelihood of rescue was low to moderate and the likelihood of death from the attempt was high.

Case #4's BMI at her time of death was 19.9 (normal range; 92% of ideal body weight). Thus, it is unlikely that her weight status contributed to her death. Moreover, her lowest recorded BMI was 17.0, which may not have been extreme enough to have inflicted serious, permanent damage to her organs. The decedent was found 4 days post-mortem in her car. Toxicology reports indicated the following concentration of substances in her system: 170 µg/mL acetaminophen; 0.86 µg/mL dihydrocodeine; 36.0 µg/mL (cavity fluid), 32.8 µg/mL (liver) doxylamine; and 26.8 µg/mL (cavity fluid), 169 µg/g (liver) desipramine. It is important to consider the decedent's history of alcoholism in our assessment, as individuals with a history of heavy alcohol use are at increased risk for harmful side effects when taking acetaminophen (National Library of Medicine [NLM], 2006b).

Acetaminophen (e.g., Tylenol®) overdose has the potential to cause the following symptoms: nausea/vomiting, sweating, convulsions, diarrhea, and/or coma. Death is typically not immediate; rather it occurs via liver failure several days after ingestion (NLM, 2006a). When individuals overdose on dihydrocodeine, they typically experience decreased respiration, seizures, dizziness, weakness, nausea, sweating, vomiting, and possibly coma (Netpediatrics, 2004). As an antihistamine, doxylamine has the propensity to produce drowsiness and should not be mixed with alcohol (Pfizer Consumer Healthcare, 2003). Overdose of doxylamine produces nausea/vomiting, impaired consciousness, seizures, and tachycardia. Overdose can be fatal and are typified by coma, seizures, and cardiac arrest. Desipramine is a tricyclic antidepressant, and an overdose can cause respiratory distress, blurred vision, nausea/vomiting, irregular heartbeat and coma (NLM, 2004).

The fact that her suicide attempt occurred in an automobile insinuates that she likely desired to avoid discovery by her family. Although the automobile was located in a suburban area of a large city, it was not discovered until 4 days after her death. Moreover, the decedent took 4 separate medications, any one of which can be lethal in overdose by itself; therefore, we determined the likelihood of death to be low to moderate and the likelihood of rescue to be low to moderate as well.

Case #5 had been hospitalized in a university psychiatry center, but had left the hospital in a sudden manner, 2 days after which he threw himself in front of a train. Our view of this case is similar to the one we expressed for *Case #3*. We posit likelihood of rescue was low to moderate and that likelihood of death was high.

Case #6 had a history of chronic suicidality, and had made a previous suicide attempt using an unknown method at age 23. She died by suicide after overdosing on unknown quantities/types of medication. Little is known about the method used because her body was not discovered until approximately 10 days after her suicide, after substantial decomposition had occurred. The latency to her body being discovered, despite her extensive social network, provides evidence that she was highly intent on dying by suicide. The degree of planning involved (i.e., taking precautions against being rescued) is an important indicator of lethality of intent. Therefore, although the most conservative viewpoint suggests that likelihood of death from the attempt may have been low (though it is more accurate to characterize it as indeterminate), the likelihood of rescue was remote.

Case #7 was described as being socially isolated when she attempted suicide with an unknown quantity and type of pain medication and also opened her wrist arteries. This action led to some degree of unconsciousness, from which she awoke (indicating, incidentally, that even severely underweight people can survive relatively low lethality attempts). She then threw herself in front of a train, which was the ultimate cause of death. Similar to *Cases #3* and *#5*, the decedent had a high likelihood of death and a low to moderate likelihood of rescue.

Case #8 died by hanging. Neither age nor sex, which may be considered rough indicators of overall body mass, appear to be significant predictors of mortality from hanging (Martin et al., 2005). This provides some evidence that the decedent was not necessarily more vulnerable to death due to her lower BMI. Martin et al. note that hangings lead to gradual suffocation due to the restriction of the jugular veins, carotid arteries, and windpipe. Because the mechanism for death in the prototypical self-inflicted hanging is suffocation, we posit that this provides further evidence that the

decedent's low BMI was not a determining factor in her death (indeed, lower weight should be protective against suffocation). In the time before her fatal suicide attempt, the decedent became increasingly withdrawn. In sum, the likelihood of death in the current case appears to be moderate to high and the likelihood of rescue appears to be low to moderate.

Case #9 had a history of at least six suicide attempts, typically involving lacerations to the arteries in her wrist and overdoses on unknown medications. Her fatal suicide attempt involved hanging herself with a hose in the shower while hospitalized. She was alive and in a coma when found, but died after four days of medical treatment. Similar to Case #8, we posit that the likelihood of death using this method was moderate to high and was not influenced by her low BMI. Because she was hospitalized, the likelihood of rescue was also moderate to high in this case.

3. Discussion

The current study considered the suicides of nine individuals with AN in an effort to evaluate two potential explanations of high rates of suicide in anorexic individuals: 1) attempt methods are less likely to be lethal, but death occurs because of compromised medical state and/or social isolation or 2) they use highly lethal suicide attempts, in the context of low rescue potential, that would likely kill any adult. The majority of available evidence supported the latter hypothesis. Seven of the nine participants had a low likelihood of being rescued following their attempt, and eight of the nine individuals used methods that would likely lead to death for anyone.

Many of the decedents had multiple prior suicide attempts. Joiner's (2006) theory of suicidal behavior predicts that these self-injurious events, in conjunction with painful experiences common among anorexics (e.g., starvation pain, frequent chest pain), lead to a fearlessness about death by suicide, as evidenced by use of highly fatal suicide methods. For instance, three individuals died by throwing themselves in front of a train, and two more died by hanging. These methods and the others that were utilized by this sample would have a high likelihood of lethality to any individual who engaged in them, regardless of their physical health status. Furthermore, given the lethality of these methods, it is unlikely that others would have been able to successfully rescue the decedents.

It is possible that some risk factors for suicide are more prevalent among individuals with AN than among those suffering with disorders. This idea seems unlikely given that high rates of impulsivity and hopelessness have been

recorded among those with other disorders known to have lower suicide rates (e.g., impulsivity: BN; Cassin and von Ranson, 2005; hopelessness: major depressive disorder; Beck et al., 1985). Comorbid substance misuse has also been cited as a risk factor for increased suicide risk (Franko et al., 2004); however, individuals with BN often have comorbid substance use diagnoses and do not die by suicide often. Additionally, Bulik, Sullivan, and Joyce (1999) demonstrated that certain personality patterns increased suicidality among individuals with AN, BN, and depression equally. Thus, many risk factors for suicide do not appear to exist uniquely among individuals with AN, and therefore seem unlikely to explain the relatively high rates of suicide completion and lethality of method among anorexics.

Strengths of the study included our utilization of thorough diagnostic evaluations, long follow-up periods, and high retention rates. With regards to weaknesses, the study was not experimental in nature, making it impossible to extrapolate a clear causal relationship between anorexic features and death by suicide. Rather, the study lends *convergent* support for Joiner's hypothesis about the link between AN and a relatively high rate of suicide. Another limitation is that both samples were only followed for 13 years. Definitive results would require the samples to be followed until all participants passed away, naturally or by suicide. Finally, there may have been a selection bias in that individuals in our study were treatment-seeking. Research by Wilfley, Pike, Dohm, Striegel-Moore, and Fairburn (2001) and Franko et al. (2004) suggests eating disorder patients seeking treatment exhibit more severe symptoms and poorer social adjustment than those not seeking treatment, which might confer a higher rate of suicidal behavior in treatment-seeking individuals.

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Conflict of interest

There are no conflicts of interest to report.

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