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The psychological scars of suicide: Accounting for how risk for suicidal behavior is heightened by its past occurrence

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ABSTRACT

Not only is suicidal behavior strongly predicted by its past occurrence, but the risk for recurrence appears to increase with each subsequent attempt. The current paper discusses a potential explanation for this phenomenon, that suicide attempts may leave a residual psychological scar that heightens risk for future attempts. This possibility is evaluated against two alternatives: (i) risk for first and subsequent suicide attempts is accounted for by a shared diathesis pre-existing the first lifetime attempt, and (ii) different rates of developmental decline in risk factors account for differences in prospective number of attempts. In this discussion, a formalized conceptual framework of psychological scarring is presented, along with considerations of particular relevance to its study. Finally, the clinical implications of determining the processes underlying the association between suicide attempts and heightened risk for recurrence are discussed.

1. Introduction

One of the strongest predictors of suicidal behavior[1] is its past occurrence (Beghi and Rosenbaum, 2010; Joiner et al., 2005). In fact, this association is one of the most robust findings in the suicide literature, with one recent meta-analysis finding a medium-to-large effect size for this relationship (Ribeiro et al., 2016).[2] Moreover, among adults, the risk for a future suicide attempt increases by approximately 32% with each subsequent attempt (Leon et al., 1990). A similar pattern of increased risk has been observed in studies with adolescents (Spirito et al., 2000). Furthermore, with each successive attempt, the time to the next attempt appears to decrease (Goldston et al., 2015). A basic question that naturally follows, and yet remains largely unaddressed in the empirical literature, is *why?* What processes account for the homotypic continuity often observed with this behavior and the increased risk associated with each successive attempt? Addressing this question is of theoretical and clinical importance, especially given the stated need for research in this field to advance beyond identifying potential risk factors to uncovering the mechanisms through which they may exert their deleterious effect (Brent, 2011; Nock, 2009).

Several possibilities exist that may account for this association between past and future suicidal behavior. One intriguing possibility is that a dynamic process of risk underlies the relation between past and future suicidal behavior. Specifically, an initial suicide attempt may leave a residual psychological "scar," placing the individual at persistently increased risk thereafter for another attempt, which, in turn, potentially furthers this scarring in what is essentially a recursive process. Such a possibility of a psychological scarring effect was originally proposed in the study of depression in relation to cognitive vulnerability to this disorder (Lewinsohn et al., 1981). It may similarly account for the increase in risk that is associated with each successive suicide attempt (Leon et al., 1990; Spirito et al., 2000), and the briefer

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[1] Although the term "suicidal behavior" has been used in the literature at times to include suicidal ideation and suicide plans, its application in the current paper is restricted primarily to suicide attempts. To a lesser degree, this term is applicable to suicide deaths, but only where they may be an outcome of heightened possibility following a prior suicide attempt.

[2] It is worth noting that the area under the curve (AUC) analysis for studies evaluating self-injurious thoughts and behaviors as predictors of suicide attempts yielded a small-to-medium effect. This analysis, however, combined suicide attempts with other self-injurious thoughts and behaviors (e.g., suicidal ideation) as predictors, likely owing to the fewer studies that allowed for AUC analysis. Given that, of these predictors, suicide attempts had the largest effect size after non-suicidal self-injury in predicting future attempts, it would be reasonable to hypothesize that the AUC would be larger if the analysis were restricted to just suicide attempts as the predictor. Additionally, an observation of direct relevance here is that although a significant proportion of individuals with a history of attempting suicide eventually make another attempt, an appreciable proportion do not, raising the interesting possibility within the current context, that only some suicide attempts may result in psychological scarring. This possibility is discussed later in this paper.

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temporal intervals between attempts as the number of prior attempts increases (Goldston et al., 2015). This notion of suicidal behavior predisposing individuals to experiencing its recurrence has been touched upon to varying degrees in the literature. For instance, the state dependence model, or crescendo hypothesis, posits that notable changes occur following a suicide attempt that increases risk for future recurrence (Clark et al., 1989). In contrast to the concept of psychological scarring as defined below, however, the crescendo hypothesis views these changes as including elements external to the individual (e.g., reduced social support) or that are time-limited rather than as enduring diatheses.

The current paper builds upon these prior discussions by presenting a detailed articulation of psychological scarring in relation to suicidal behavior. That is, the objectives of the current effort are: (i) to provide definitional clarity regarding what constitutes a psychological scar; (ii) to propose mechanisms through which it may occur, drawing on existing theoretical perspectives; (iii) to review the existing literature relevant to psychological scarring and suicidal behavior; (iv) to present notable considerations relevant to its assessment and to offer recommendations for future research in this area; (v) to evaluate alternative accounts of the relation between past and future suicidal behavior (i.e., a shared pre-existing diathesis, and different rates of developmental decline in suicide risk factors); and finally (vi) to discuss the clinical implications of elucidating the processes through which suicidal behavior is associated with risk for its future recurrence.

1.1. Accounting for recurrent suicidal behavior: dynamic processes of risk

Of particular importance to advancing our understanding of this phenomenon is the need for a clear and precise definition of what constitutes a psychological scar, given the considerable heterogeneity with which it has been operationalized in the broader clinical literature. In first proposing this concept of a psychological scar in the context of depression, Lewinsohn et al. (1981) stated: "regardless of whether [the vulnerability factors] antedate depression, [the vulnerabilities] are a more or less permanent residual of an episode of depression" (p.214). The current paper builds upon this definition. Specifically, within the currently proposed formulation, a psychological scar has several defining properties (see Table 1 for a summary). Note that what are described here are the characteristics of diatheses that may serve as candidates for the scarring effects of suicide attempts, rather than the view that these diatheses may themselves produce scarring effects. First, a diathesis that is susceptible to a scarring effect must be stable but also malleable. Stated simply, it cannot be immutable; immutable diatheses cannot be altered by the occurrence of suicidal behavior. Under this definition, for example, certain alleles may function as stable diatheses for suicide, but cannot be candidates for a scarring effect. The altered expression of these alleles as a consequence of epigenetic influences, however, is a possibility. As the diathesis must be, in some measure, trait-like in nature, this also excludes from consideration temporally discrete phenomena consequent to a suicide attempt. For instance, negative affect would not qualify as a potential target of a scarring effect, but the *propensity* to experience such affect in response to a stressor (i.e., affective reactivity, as a component of emotion regulation) may be a potential candidate.

Table 1
Properties of potential diatheses scarred by suicide attempts.

Stability of pre-existing diathesis
• The diathesis must be stable but also malleable, rather than immutable
Effect of initial suicide attempt on diathesis
• Diathetic loading must increase (i.e., scar) as a consequence of an initial suicide attempt
Effect of diathetic scar on risk for subsequent suicide attempts
• The diathetic scar (i.e., the *increase* in diathetic loading) must produced increased risk for future suicide attempts
Stability of diathetic scar
• The diathetic scar produced by a suicide attempt must be stable and persistent

Second, the diathesis that is susceptible to a scarring effect must increase in response to a suicide attempt. That is, although it is possible that psychological scarring may also occur outside the context of suicidal behavior (e.g., consequent to exposure to childhood adversity; Miller and Cole, 2012), there must be a significant elevation in the diathesis after a suicide attempt has occurred compared to immediately preceding it.

Third, a psychological scar is of clinical relevance insofar as it can account for future suicidal behavior. It must therefore satisfy the definition of a risk factor (in contrast to risk marker), temporally preceding and being associated with greater risk for the outcome of interest (Kazdin et al., 1997; Kraemer et al., 1997). Importantly, it is not sufficient in the present context for the diathesis, as assessed after the index suicide attempt, to predict subsequent attempts. Such a finding demonstrates only that the diathesis more generally, rather than its *change*, is associated with prospective suicidal behavior, for it does not account for inter-individual variability in the diathesis that pre-existed the initial suicide attempt. Instead, the increase in the diathesis from before the index attempt to after its occurrence, assessed in relation to subsequent attempts, is required adequately to evaluate the predictive validity of a psychological scar.

Fourth, the change in the diathesis must be sustained, persisting after the suicidal crisis has passed, temporally contiguous with the subsequent suicidal behavior with which it is hypothesized to share a causal relationship. Although this does not preclude the possibility of there being a state component to the change in the diathesis, it cannot be purely an epiphenomenon of suicidal behavior. That is, in order to satisfy the aforementioned third characteristic of a psychological scar, the change in diathesis must be an abiding consequence, rather than solely a concomitant, of suicidal behavior (Barnett and Gotlib, 1988), for epiphenomena are unable to confer risk for an outcome that temporally occurs outside their own existence (Barnett and Gotlib, 1988; Kraemer et al., 2001). A logical implication of this property of psychological scars is that they are necessarily chronic, rather than acute, risk factors for suicidal behavior. This is not to say, however, that psychological scars are uninvolved in precipitating suicidal outcomes. Rather, reflecting the multi-determined nature of suicidal behavior, they may share a moderational relationship with acute risk factors in accounting for imminent suicidal risk. More specifically, acute risk factors (e.g., life stress; Bagge et al., 2013; Liu and Miller, 2014) may be more likely to trigger suicidal outcomes in the presence of these chronic diatheses.

Consistent with this view, the fluid vulnerability theory (Bryan et al., 2014; Rudd, 2006; Wolfe-Clark and Bryan, 2017) posits that individual variation in baseline risk for suicidal behavior exists. This baseline risk is chronically elevated in individuals with many vulnerabilities, such that the severity of acute risk factors (e.g., life stress) required to trigger suicidal behavior is less in these individuals than in those with few vulnerabilities and attendant low baseline risk. Although baseline risk is relatively stable and experiences short-lived perturbations in response to acute risk factors, various experiences can result in longstanding changes to baseline risk, including abuse (Wolfe-Clark and Bryan, 2017), and of particular relevance to the current context, suicidal behavior (Bryan et al., 2014).

Regarding the processes through which psychological scars may occur and potentially relevant diatheses, the interpersonal theory of suicide (Joiner, 2005; Van Orden et al., 2010) offers one possible account. According to this theory, individuals with active suicidal ideation will only act on these thoughts if they have acquired the capability for suicide, characterized by a diminished fear of death and a heightened tolerance for physical pain. Furthermore, this theory posits that the acquisition of the capability for suicide occurs through the process of habituation, with repeated exposure to fear-provoking and physically painful events leaving the individual inured to such experiences in the

future. Being inherently fear-provoking and physically painful, suicidal behavior is proposed within this theory to be the most direct means of acquiring the capability for suicide, which, in turn, is hypothesized to account for the strong association between past and future suicidal behavior. Whether this acquired capability for suicide does indeed increase following a suicide attempt remains to be examined.

Another potential account of how psychological scarring may occur with suicidal behavior, as well as the affected diathesis, can be found in the differential activation hypothesis. Originally conceived as a cognitive reactivity model of depression (Teasdale, 1988), it has also been extended to account for the relation between depression and suicidality (Lau et al., 2004; Williams et al., 2007). The differential activation hypothesis may be generalized more broadly still to account for suicidal behavior outside the context of clinical depression (Beck, 1996), an important consideration given that approximately 25% to 50% of suicide attempts occur independent of a lifetime history of major depression (Nock et al., 2013; Nock and Kessler, 2006). Specifically, this cognitive vulnerability model, based upon semantic network theory, proposes that life stress, and the negative affect it elicits, activate a previously latent network of negative cognitions. In the case of individuals vulnerable to suicidality, some of these cognitions may be related to suicide (e.g., suicidal ideation). According to cognitive formulations of suicide risk (Wenzel and Jager-Hyman, 2012) when suicide-relevant cognitive networks are activated in individuals at risk for suicide, they tend to exhibit attentional biases toward suicide-relevant stimuli, difficulty disengaging their attention from these stimuli, and attentional fixation (i.e., a fixed focus on suicide as the only solution to their problems). These suicide-relevant cognitions, in turn, elevate proximal risk for suicidal behavior. Of particular relevance to the potential psychological scars of suicidal behavior, and in a manner akin to Hebbian learning at the neural level (Hebb, 1949), the association between this network of suicidogenic cognitions and suicide attempts may strengthen with their repeated temporal pairing over time. More specifically, with repeated suicide attempts, the link between negative affect, the network of suicidogenic cognitions, and the suicidal behavior strengthens, such that the severity of negative affect required to initiate this chain leading to suicidal behavior diminishes in the future. The psychological scar in this case may be the strengthened latent cognitive network as manifested in the form of increased *sensitivity* (i.e., the lower threshold or greater ease with which the latent cognitive network is activated by negative affect), increased magnitude of the cognitive network when activated (i.e., *reactivity*), and increased *duration* of activation of the cognitive network. This strengthened network of suicide-relevant cognitions following a suicide attempt may be a psychological scar that places the individual at increased risk for future suicidal behavior.

There is a notable paucity of studies directly evaluating the existence of psychological scars resulting from suicide attempts. To detect the presence of a psychological scar, such studies would need to assess the candidate diathesis prior and subsequent to the index suicide attempt, and thus would necessarily be prospective in nature. A prospective design would also be required to demonstrate that any detected scar is etiologically relevant to future suicide attempts and directly to compare this model with the alternative possibility that elevations in pre-existing diatheses are what account for risk for future attempts.

In an early relevant study (Clark et al., 1989), two computational models were compared, one involving stable pre-existing risk factors equally accounting for first and recurrent suicide attempts (the trait hypothesis) and another involving prior suicide attempts directly conferring increased risk for recurrence (the state dependent model). Both models were found to fit the data equally well, but the trait hypothesis was adopted on the basis of parsimony. This study, however, did not directly evaluate changes in suicide risk factors as a function of suicidal behavior, relying instead on mathematical models. In addition, if the trait hypothesis holds true, the relation between past and future suicide attempts should reach non-significance after accounting for the pre-existing risk factors, which were not assessed in this study. Additionally, as noted above, the conceptualization of risk within the state dependent model is inconsistent with the definitional criteria for a psychological scar. In a series of more recent studies, past suicidal behavior was associated with its subsequent recurrence, even after accounting extensively for traditional risk factors (e.g., Axis I and II disorders and family history of psychopathology; Joiner et al., 2005). In a study that did compare risk factors before and after a suicide attempt, a deterioration was observed in terms of substance use, suicidal ideation, life stress, internalizing psychopathology, and family relationships (Wong et al., 2008). None of these are stable diatheses, however, and therefore they are not plausible candidates for psychological scarring. Thus, direct evaluation of potential psychological scars of suicidal behavior awaits future research.

Although several other studies exist comparing characteristics of current or prospective suicidal behavior as a function of prior lifetime history of history of this behavior (Joiner and Rudd, 2000; Neeleman et al., 2004), they are unable to determine whether observed differences between single and repeat attempters are better accounted for by a shared pre-existing diatheses or a scarring phenomenon, because they employed essentially cross-sectional analyses and thus were unable to assess potential changes in the relevant diatheses before and after index suicide attempts. These studies are nonetheless informative insofar as they may identify potential candidates for a scarring effect to be evaluated directly in future longitudinal research. Specifically, if a risk factor does not distinguish single lifetime attempters from repeat attempters in between-subjects comparisons, it is an unlikely candidate for psychological scarring, and thus may be removed from consideration in subsequent research involving longitudinal within-subjects evaluations. Contrastingly, differentiating risk factors in between-subjects comparisons (e.g., sensitivity to life stress; Joiner and Rudd, 2000; neuroticism; Neeleman et al., 2004) may be promising targets for future investigation.

Studies of stress sensitization and suicide attempts, the notion that the amount of life stress required to precipitate a recurrent suicide attempt is lower than that for the first attempt as a consequence of increased sensitization during the initial attempt (Monroe and Harkness, 2005; Post, 1992) warrant mention here, for they have relevance to the possibility of psychological scars following suicide attempts. Specifically, stress sensitization is a necessary but not sufficient condition for psychological scarring to occur in the context of suicide attempts; if they increase vulnerability to future attempts, the life stress required to trigger those subsequent attempts should be lowered, but stress sensitization could occur in response to other events as well (e.g., childhood adversity; McLaughlin et al., 2010). A few early studies in this area (Pettit et al., 2006, 2004) found the number of previous suicide attempts to be positively correlated with life stress prior to the index attempt, a pattern inconsistent with stress sensitization. These studies did not differentiate, however, between independent stress (i.e., stressors that occur independent of the individual's influence) and dependent stress (i.e., stressors that are at least in part influenced by the individual's behaviors or characteristics), an important consideration inasmuch as individuals with a history of more attempts may naturally experience higher rates of dependent stress (i.e., stress generation). A recent study reported contradictory results, finding no association between life stress and number of attempts, again with dependent stress undifferentiated from independent stress (Goldston et al., 2015). Future research is therefore required to resolve this issue, particularly by covarying dependent stress while evaluating the association between independent stress and number of suicide attempts prior to the index attempt.

With regard to potential avenues for future study, one promising candidate is the strength of the aforementioned suicidogenic cognitive network when activated, as indexed by implicit measures of suicide-relevant cognitive processes (e.g., Ellis et al., 2016; Nock et al., 2010;

Nock and Banaji, 2007; Tucker et al., 2017). Implicit cognitions have been found to be prospectively predictive of future suicide attempts (Barnes et al., 2017; Nock et al., 2010). They therefore meet the definition of a risk factor for this behavior (Kazdin et al., 1997; Kraemer et al., 1997), the third aforementioned criterion for a psychological scar. To the degree that implicit measures of self-injurious cognitions are potentially trait-like but also subject to change (Glenn et al., 2016), they would satisfy the first aforementioned criterion for psychological scars as well, leaving potential change in implicit cognitions following a suicide attempt (i.e., sensitivity, reactivity, and duration of activation) and the stability of this potential change as the main criteria to be empirically assessed. Additionally, eye-tracking, dot-probe, and possibly memory tasks, could be used to interrogate possible increases in attentional biases toward suicide-relevant stimuli and difficulty disengaging from these stimuli subsequent to suicide attempts.

These evaluations of changes in implicit suicidal cognitions may be complemented with functional neuroimaging techniques. For instance, the right inferior frontal gyrus is a brain region involved in interference resolution (Berman et al., 2011). Reduced activation of this region, following a suicide attempt compared to before it, on task trials pairing the concept of self with suicide-relevant stimuli may be indicative of a scarring effect. Additionally, a recent study supports the plausibility of identifying a biological signature for suicidal behavior based on neural activity in response to death- and life-related stimuli (Just et al., 2017). Whether a potential neural signature becomes increasingly pronounced after a suicide attempt is a promising subject for future investigation.

It should also be noted that although the likelihood of recurrence is greater with each successive suicide attempt, a sizeable proportion of individuals do not reattempt, a potential implication of which is that suicidal behavior may not always leave a psychological scar, or at the very least may vary in the severity of its resulting scar. A question that naturally follows is under what conditions is psychological scarring more likely to occur? Based on the interpersonal theory of suicide (Joiner, 2005; Van Orden et al., 2010), one possibility may be found in the severity of the suicide attempt. Attempts of high actual medical lethality (e.g., involving treatment in an intensive care unit) or perceived lethality (particularly in the case of youth who often demonstrate a poor understanding of the potential lethality of their attempts; Sapyta et al., 2012) are naturally more painful and fear-provoking, thus leading to a greater increase in the acquired capability for suicide. The seriousness of intent underlying an attempt (perhaps in conjunction with an accurate comprehension of the medical lethality of the attempt; Brown et al., 2004) may also heighten the likelihood and severity of psychological scarring within the framework of the differential activation hypothesis, through greater attendant self-identification with suicidality. Yet another possibility is that the probability and degree of psychological scarring may differ over the course of suicidal behavior, with the earlier attempts being more likely than later ones to result in this phenomenon. That is, the likelihood and severity of psychological scarring may generally decline following successive attempts, inasmuch as a ceiling effect or saturation point in the relevant diatheses may eventually be reached.

If psychological scarring only occurs for a percentage of suicide attempts, it stands to reason that the ability to document this phenomenon may be weakened, in some measure, by comparing the relevant diatheses before and after the index attempt among *all* attempters within a sample. In contrast, efforts to detect psychological scarring may be optimized by adopting a "prospective-retrospective" design to identify the most likely candidates for this phenomenon. This would involve (i) assessing the relevant diatheses before and after the index attempt in a sample of attempters, (ii) following this sample prospectively to identify which individuals experience prospective reattempts, and (iii) retrospectively returning to and comparing the measures of the diatheses taken before and after the index attempt, but only among this subsample of prospective reattempters. If psychological scars increase risk for subsequent attempts, restricting analyses of the diatheses to the subsample of prospective reattempters may hold particular promise for detecting this phenomenon.

1.2. Accounting for recurrent suicidal behavior: elevated pre-existing diatheses

An alternative possibility to a psychological scarring effect is that relatively stable vulnerability factors that confer risk for an initial suicide attempt may similarly confer risk for future attempts, essentially placing individuals with high loadings on these diatheses at chronically greater risk for suicidal behavior (Clark et al., 1989). In the absence of other explanations, the theoretical implication of this possibility is that prior suicide attempts have no causal role *per se* in elevating risk for future attempts. Rather, the increased risk associated with each prior attempt is illusory, being better accounted for by a third variable, a shared pre-existing vulnerability. If this holds true, repeat suicide attempters should already exhibit higher diathetic loadings than do single attempters prior to their respective first lifetime attempts. More specifically, individuals with an eventual second suicide attempt should be a more homogenous subset of an initial group of eventual suicide attempters with respect to their diathetic loadings prior to their first lifetime attempt, with a pattern of increasing homogeneity being evident in subsets with increasing numbers of eventual attempts (see Fig. 1 for an illustrative example). If this is the case, in studies documenting an association between the number of prior suicide attempts with risk for future recurrence, the number of past attempts may simply have been functioning as a proxy for differences in severity in these stable diatheses. Congruent with possibility, there is some evidence that a significant heritable component to vulnerability in the form of suicide capability (Smith et al., 2012).

1.3. Accounting for recurrent suicidal behavior: differential decline in pre-existing diatheses

A third potential explanation that warrants discussion here is that, rather than an *increase* in diathetic loading over time as a product of successive suicide attempts, a slower *decrease* in pre-existing diatheses among prospective repeat attempters may be what accounts for their apparent temporal increase in risk relative to single lifetime attempters. From a developmental perspective, an example of a risk factor that may be especially relevant within this context is impulsivity. This behavioral

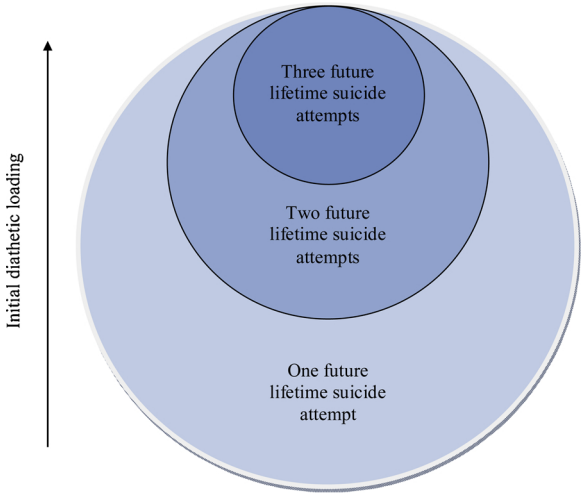

Fig. 1. Initial diathetic loading prior to first lifetime suicide attempt.

tendency, particularly impulsive aggression, has been implicated in risk for suicidal behavior (Brent, 2009; Hawton and van Heeringen, 2009; Liu et al., 2017).[3] Impulsivity is especially pronounced in early adolescence, and declines naturally as the individual progresses into early adulthood (Harden and Tucker-Drob, 2011; Steinberg et al., 2009), a result of maturation of associated prefrontal cortical neural circuitry (e.g., ventromedial prefrontal cortex; Casey et al., 2008; Christakou et al., 2011) that occurs across this period of development. It is worth noting that the age-related decline in this risk factor parallels that for suicidal behavior, which peaks in mid-to-late adolescence and decreases appreciably and consistently throughout most of adulthood (Nock et al., 2008). In keeping with the developmental concept of multifinality (Cicchetti and Rogosch, 1996), however, significant individual differences likely exist in trajectories of prefrontal cortical maturation and associated decline in impulsivity. Individuals at risk for suicidal behavior should be no different in this regard. Thus, it may be that certain individuals are at chronically greater risk for suicidal behavior because of slower development of prefrontal circuitry associated with self-regulatory behaviors, such as impulse control, and this may be especially the case in prospective repeat attempters.

Although this phenomenological possibility may have some potential relevance to the etiology of suicidal behavior, it does not model existing data on the course of suicidality well, and thus, on its own, cannot adequately account for the increased risk for suicidal behavior associated with its past occurrence. In particular, if this phenomenon were solely to account for differential risk for recurrence of suicidal behavior, a gradual lengthening in intervals between successive suicide attempts should be observed, with this simply occurring at a slower rate in individuals with many prospective attempts relative to those with few, as a function of corresponding differences in developmental decline in associated risk factors. This is not consonant, however, with the recent finding of a pattern of increasingly shorter intervals between successive suicide attempts over time (Goldston et al., 2015).

2. The mutual compatibility of elevated pre-existing diatheses and dynamic processes of risk

It is important to note that the first two possibilities – that psychological scarring processes and heightened pre-existing diatheses account for the greater risk for suicidal behavior associated with its past occurrence – need not be mutually exclusive. For instance, it may be possible that (i) certain diatheses are initially greater in prospective repeat suicide attempters than in future single lifetime attempters, prior to their respective first attempts, but (ii) also have the potential to worsen with each successive attempt in prospective repeat attempters in what is essentially a positive-feedback loop. If this is indeed the case, a pattern of divergence should emerge, with the disparity initially observed in these diatheses across individuals widening over time (see Fig. 2, left panel). As an example of this possibility, non-suicidal self-injury (NSSI) has consistently been associated with suicidal behavior (Asarnow et al., 2011; Ribeiro et al., 2016). Within the framework of the interpersonal theory of suicide (Joiner, 2005; Van Orden et al., 2010), it may be that habituation to the pain and fear associated with bodily harm (i.e., the acquired capability for suicide) is a diathesis mediating the association between NSSI and suicidal behavior (Joiner et al., 2012). It therefore stands to reason that individuals with a history of NSSI would already load higher on this diathesis prior to any prospective suicide attempts. Supportive of this view, NSSI has been found prospectively to predict increases in acquired capability for suicide (Willoughby et al., 2015, but also see Bryan et al., 2016 for findings of stability of capability for suicide with exposure to potentially painful and fear-provoking experiences). The greater acquired capability for suicide, in turn, may be expected to place these individuals at elevated risk for first and subsequent attempts. As suicide attempts are themselves hypothesized within the interpersonal theory of suicide to increase the acquired capability for suicide (Joiner, 2005; Van Orden et al., 2010), differences between single lifetime attempters and repeat attempters in this diathesis prior to their respective prospective first suicide attempt should be magnified as each individual's course of suicidal behavior unfolds over time.

It is also conceivable that (i) certain risk factors distinguish eventual single lifetime attempters from prospective repeat attempters, prior to their respective first suicide attempts, but remain unaltered by future attempts over time, whereas (ii) a discretely different set of risk factors are initially indistinguishable between future single lifetime attempters and prospective repeat attempters, before their respective first attempts, but begin to differentiate these two groups over time as a result of a psychological scarring process consequent to repeated suicide attempts in the latter group (see Fig. 2, right panel). For example, females have consistently been found to be at higher risk for attempting suicide (O'Connor and Nock, 2014). The notion that biological sex may be at risk for changing as a consequence of suicide attempts is clearly a nonsensical one. Conversely, it is plausible that cognitive vulnerability, as conceptualized within the differential activation hypothesis (Teasdale, 1988; Williams et al., 2007), may initially not differ between prospective single lifetime attempters and repeat attempters, but alter and begin to distinguish these two groups over the course of repeated suicide attempts in the latter.

An important implication of this possibility is that it cannot be assumed, in the absence of empirical verification, that diatheses that fail initially to distinguish prospective single lifetime attempters from future repeat attempters, before their respective first attempts, are irrelevant to understanding risk for recurrence of suicidal behavior. Rather, longitudinal research is required to determine whether such diatheses remain unchanged in response to repeated suicidal behavior.

3. Clinical implications

Elucidating the mechanisms through which past suicidal behavior is associated with increased risk for its recurrence is clinically meaningful insofar as it may aid our ability to identify individuals at chronic risk for this outcome, and insofar as it may yield potential candidates for targeted intervention. That is, inasmuch as increased risk for suicidal behavior is governed by a dynamic process of psychological scarring resulting from its past occurrence, identifying the diatheses susceptible to this effect is important for producing promising, modifiable targets of clinical intervention. The emphasis of clinical efforts here may be on intrapersonal, rather than external, factors. Long-term monitoring of these diatheses may also aid in differentiating individuals are at risk for reattempting from those who are not, and thus which individuals may be most in need of intervention.

In addition to their utility for safety monitoring, the possibility may exist for direct modification of these diatheses, thereby reducing risk for recurrence of suicidal behavior. For example, cognitive modification interventions that increase positive self-associations and aversion to self-injurious stimuli may prove clinically valuable insofar as they may be incompatible with, and thus decrease, suicide-related self-schemata of potential relevance to the differential activation hypothesis. Moreover, increased aversion to self-injurious stimuli may potentially lead to dishabituation to such stimuli, and thus reducing the acquired capability for suicide. Such an intervention has recently been developed specifically for self-injurious thoughts and behaviors, and has been

[3] Although a meta-analysis (Anestis et al., 2014) observed a small effect for the association between impulsivity and suicidal behavior, a more recent meta-analysis (Liu et al., 2017) found the strength of this association to be moderated by time such that large effects were observed when analyses were restricted to suicide attempts within a month of assessment of impulsivity and small effects in the case of lifetime suicide attempts. This element of temporal sensitivity has direct relevance to the current discussion of developmental considerations in the association between impulsivity and suicidal behavior.

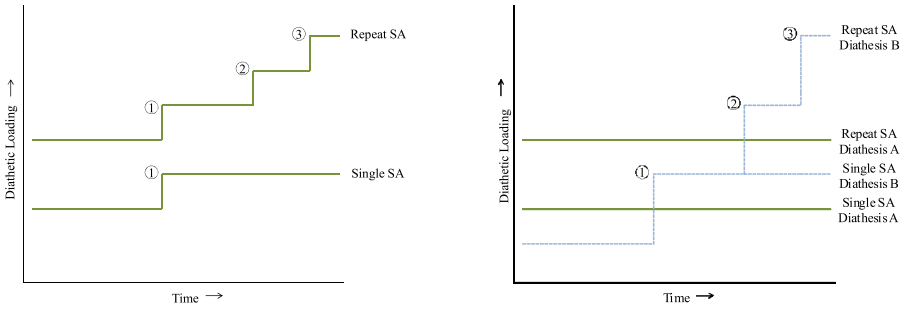

Fig. 2. Mutual compatibility of elevated pre-existing diatheses and psychological scarring.
Illustrated in these panels are two potential means through which pre-existing diatheses and psychological scarring may co-occur collectively to account for the increased risk for suicidal behavior associated with its past occurrence. In the **left panel**, prospective repeat lifetime suicide attempters have a higher initial loading on a diathesis than do prospective single lifetime attempters, and this difference pre-exists their respective first lifetime attempts. This difference in diathetic loading widens over time as a function of scarring of the diathesis that occurs with each successive suicide attempt. In the **right panel**, prospective repeat lifetime attempters, again, have a higher initial loading on a diathesis (Diathesis A) than do prospective single lifetime attempters, and this difference pre-exists their respective first lifetime attempts. In this scenario, however, this diathesis remains unaltered by prospectively occurring suicide attempts. Additionally, prospective single and repeat attempters do differ prior to their respective first lifetime attempts on another diathesis (Diathesis B), but a difference emerges over time as a function of scarring of the diathesis that occurs with each suicide attempt, with repeat attempters eventually loading higher on this diathesis than do single attempters. In both panels, note the shortening time intervals between successive attempts, in the case of repeat attempters, as a function of increased collective diathetic loading with each attempt. The occurrence of each lifetime suicide attempt is numbered. SA = Suicide Attempt.

shown to have promise for reducing these outcomes (Franklin et al., 2016). Determining whether these interventions do indeed diminish risk for suicidal behavior through these processes is a promising avenue for future investigation. Additionally, cognitive behavioral therapy has been developed for suicidal behavior (Wenzel and Jager-Hyman, 2012), which is particularly relevant to the aforementioned cognitive diatheses of attentional fixation and suicide-relevant cognitions.

Alternatively, to the extent that high loadings on particular, stable diatheses may account for risk for first and recurrent suicidal behavior, identification of these diatheses is especially important for determining which individuals may be most in need of preventative intervention, as well as for informing our understanding of likelihood of reattempts when individuals are encountered in clinical settings at the time of their first suicide attempt. To the degree that the relevant diatheses are immutable (e.g., genetic diatheses), clinical interventions focusing on coping with time-delimited risk factors external to the individual (e.g., life stress) with which these diatheses could interact may prove most beneficial.

With the recent finding of a 28% increase in suicides in the U.S. over the last 18 years (Centers for Disease Control and Prevention, 2018) and reduction of suicide having been identified by WHO as a global imperative (World Health Organization, 2014), the need for better understanding of processes of risk for suicidal behavior is more pressing than ever. Clarifying the involvement of stable and plastic processes of risk in the association between past and future suicidal behavior may be crucial for advancement in this regard.

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