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The Importance of Temporal Dynamics in the Transition From Suicidal Thought to Behavior

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May and Klonsky's (2016) meta-analysis highlights a critical limitation of suicide-focused research, the conflation of risk factors for suicide ideation with risk factors for suicidal behavior, and calls for new research aimed at predicting which suicidal individuals will transition to suicide attempts. A critical limitation of existing models of suicide is the lack of attention to nonlinear change processes among relevant risk variables, which could conceal the true nature of the transition from suicidal thought to action. The fluid vulnerability of theory of suicide provides a working model for conceptualizing static versus dynamic aspects of suicide risk over time. Future research focused on understanding the transition from suicidal thought to action should incorporate theoretical models and analytic methods capable of quantifying and describing nonlinear change processes.

Key words: **fluid vulnerability theory, ideation-to-action, risk factors, suicide.** ***[Clin Psychol Sci Prac, 2016]***

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"Why suicide?" is arguably the single most prominent question that has driven decades of conceptual and empirical efforts to understand and prevent suicidal behavior. As May and Klonsky (2016) highlight in their meta-analysis, however, a frustratingly large number of studies driven by this question are unable to provide useful answers about suicidal behavior in particular, although many are sufficient to answer the question, "Why *consider* suicide?" This unfortunate circumstance derives from the faulty conflation of suicidal thinking with suicidal behavior, a mistake that might explain (in part) the lack of positive change in global suicide rates over the past several decades despite marked advances during this same time frame in the development of treatments and interventions that effectively reduce suicidal behavior (Rudd et al., 2015). May and Klonsky's call for research focused on differentiating those who act upon suicidal thoughts from those who do not, which they term the ideation-to-action framework, is therefore timely.

Perhaps the most provocative and unsettling implication of May and Klonsky's results is that many of our well-established "suicide risk factors" may not actually be risk factors for suicide at all; rather, they may be risk factors for suicide ideation only, suggesting the possibility that we have been barking up the wrong tree for decades. This conflation of suicidal thoughts and behaviors is the primary focus of May and Klonsky's article, but another implication of their work is that our traditional research methods are unable to sufficiently capture how multiple risk variables are truly related to each other as well as the subsequent emergence of suicidal behaviors. The present state of affairs

described by May and Klonsky is therefore the consequence of our failure to explicitly consider the temporal dynamics that characterize various risk factors, suicidal desire, and suicidal behaviors.

Implicit to the ideation-to-action framework is a change process. As applied to the ideation-to-action framework, this change process entails a change from a starting point (suicidal thoughts) to an end point (suicide attempt) at some later time. The critical role that time plays in conceptualizing suicide risk is well recognized by any clinician who has made dispositional decisions based on his or her assessment of a patient's estimated future trajectory of risk in the near and long term. Conceptual and empirical work in suicidology has not explicitly modeled change processes, however, which limits our understanding of how and when suicidal behaviors emerge from suicidal thoughts. For example, the interpersonal-psychological theory of suicide, the integrated motivational-volitional model of suicide, and the three-step theory highlighted by May and Klonsky each posit specific and testable mechanisms that differentiate suicide ideators from suicide attempters, but none of these models provides a clear framework for understanding *when* the transition from thought to action will occur or how this transition is expected to unfold. The *process* of emergent suicide risk (i.e., how an individual gets from ideation to attempt) therefore remains largely unaddressed in contemporary models of suicide.

To illustrate the importance of time and emergent processes, consider the case of Jim, who dies by suicide on Monday. If we want to understand why Jim acted upon his suicidal thoughts, we are likely to uncover several or more of the risk factors for suicide ideation and suicide attempts discussed by May and Klonsky: depression, hopelessness, male gender, history of abuse, substance use disorder, etc. We are also likely to uncover evidence supporting hypothesized mechanisms of transition from ideation to action that are described by existing conceptual models of suicide (e.g., perceived burdensomeness and thwarted belongingness from the interpersonal-psychological theory). It seems plausible that most, if not all, of the risk factors present at the time of Jim's death on Monday were also present in his life on Sunday; quite possibly they were also present during the week (or even month) before his suicide. To truly understand why Jim's suicide occurred then, we must also consider why Jim's suicide occurred on Monday instead of the day before, the day after, or any other day. In other words, what changed that Jim reached his figurative "tipping point" only on Monday?

To consider this question, we plot two different hypothetical trajectories of suicide risk preceding Jim's death by suicide in Figure 1. Both trajectories are similar in that suicide risk fluctuates over time, although the week-to-week ebb and flow of risk is more pronounced for Trajectory A than for Trajectory B. Note that during the first 13 weeks, Trajectory A is characterized by a higher average level of risk than Trajectory B, but from weeks 14 to 22, the average risk levels for both trajectories are fairly similar. After week 23, Trajectory A is again characterized by a higher average risk level, although in the final 2 weeks of life, Trajectory B suddenly increases and "catches up" to Trajectory A. When considering these temporal patterns, it is likely that Jim's suicide would be described as "sudden" or "impulsive" if he had followed Trajectory B. If Jim had followed Trajectory A, however, his suicide might also be considered unexpected or "impulsive" because there was a general trend for *declining* risk in the weeks immediately prior to his death. Although the final risk scores for each trajectory are comparable to each other, the pathways that led up to each are quite different. These two trajectories therefore suggest different emergent processes over time despite a similar "tipping point."

We must therefore take into account how the timing of risk variable measurement relative to suicide might influence our understanding and identification of risk factors. If, for instance, these trajectories reflected week-to-week fluctuations in depression severity, our assessment of depression during week 1 might serve as a reasonable predictor of suicide in Trajectory A but not Trajectory B. If depression severity was measured during week 17, however, it might not be a reasonable predictor for either of the two trajectories. In sharp contrast, if we measured depression severity during week 38 or 39 (i.e., the final 2 weeks before death), it would be a very good predictor of suicide in both trajectories. This problem of temporal dynamics is one that applies to many existing models of suicide, including the three discussed by May and Klonsky. The interpersonal-psychological theory, for instance, would

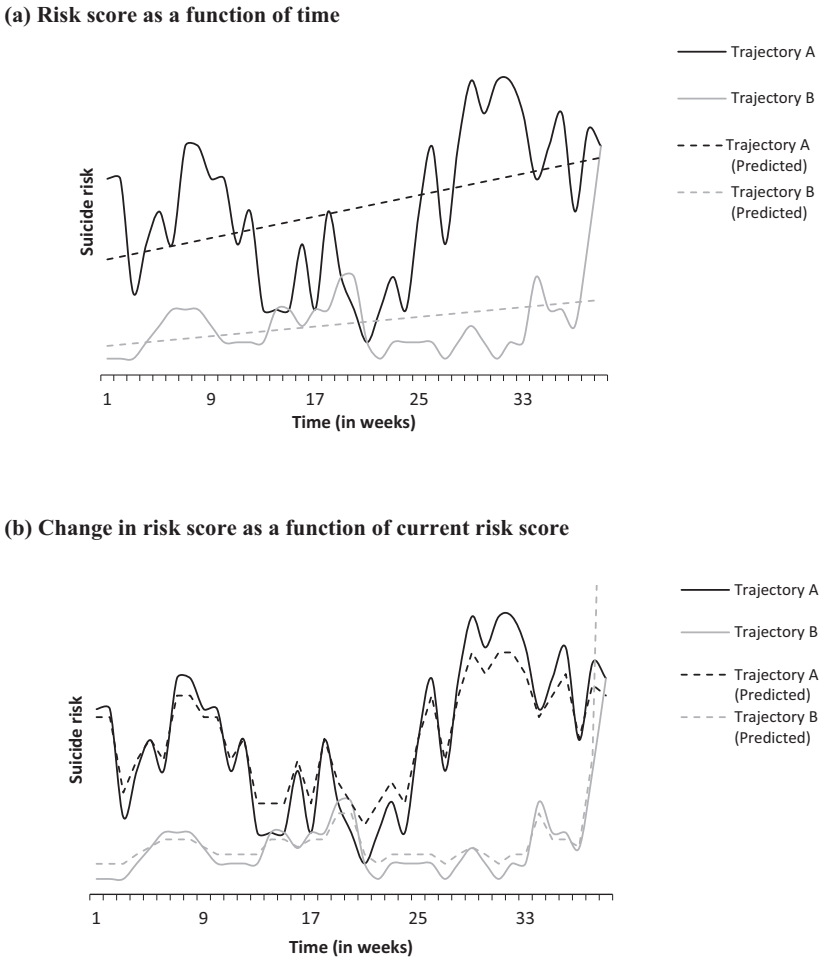

Figure 1. Two hypothetical trajectories of suicide risk leading up to Jim's death by suicide (solid lines), with predicted risk scores (dashed lines) overlaid from (a) regression modeling predicting risk score as a function of time and (b) regression modeling predicting change in risk score at the next time point as a function of current risk score.

posit that Jim died by suicide because he had a combination of elevated levels of perceived burdensomeness, thwarted belongingness, and acquired capability for suicide. This explanation is reasonable only if Jim followed Trajectory B, however, as this trajectory roughly corresponds to the theory's perspective of suicide as the consequence of more intense risk factors. This explanation is less satisfactory, however, if Jim followed Trajectory A. Why didn't Jim die earlier (e.g., between weeks 28 and 30), when his risk factors were the most severe? Why did Jim instead die when his risk factors were generally *improving*? The inclusion of change processes in our conceptual models of suicide may provide some clues.

One model that provides a framework for understanding the dynamic process of suicide risk over time is the fluid vulnerability theory (FVT; Rudd, 2006). According to the FVT, suicide risk is inherently dynamic, with fluctuations in risk occurring as a function of ever-changing interactions that occur among multiple risk and protective factors. Some risk and protective factors are static and/or relatively stable (e.g., gender, race, genetics, trauma, dispositional optimism), whereas others are more state-based and dynamic (e.g., mood, life stressors, insomnia, social support). Static risk factors are more likely to differentiate between suicide ideators and suicide attempters because individuals with many static risk factors (and/or few static

protective factors) have a greater predisposition or vulnerability to (a) experiencing suicidal crises and (b) transitioning from suicide ideation to attempts in response to acute risk factors. Such individuals are often described as having "chronic" risk for suicide because this risk persists over time. In addition to static risk, the FVT further posits that risk and protective factors are mutually influential and dynamic, such that change in one can affect change in another. This moment-to-moment interplay among multiple risk and protective factors is captured by the FVT's concept of the *suicidal mode*, the structural framework for understanding how cognitive, behavioral, affective, and physiological factors interact over time. The transition from suicidal thoughts to behaviors is therefore hypothesized to occur as a result of coordinated change processes among multiple domains of risk. When understanding the emergence of suicidal behavior from suicidal thinking, the severity of various risk factors may therefore be less important than the risk factors' patterns of change relative to one another.

What this means is that if we want to understand why Jim died on Monday instead of any other day, we would be less interested in quantifying the severity of various risk factors as we would be in quantifying the ebb and flow of his various risk and protective factors over time. Unfortunately, traditional research methods generally measure risk factors (and/or protective factors) and suicide-related outcomes at a single time point or, for longitudinal studies, at a later time point that is often many months or even years after the initial assessment. This approach is limited because it is unable to capture the inherently dynamic nature of many risk factors. Even when high-frequency assessments are made, our analytic methods generally cannot account for dynamic change processes. For example, if we were to model Jim's two hypothetical trajectories to suicide, we might regress risk level on time to identify the trend lines for each (the dashed lines in Figure 1a). In the case of Trajectory B, however, Jim's final two scores (arguably the two most important scores in the trajectory) are statistical "outliers" with high leverage values. When these two scores are included in the regression analysis, we obtain a statistically significant positive slope for Trajectory B ($B = .04$, $SE = .02$, $p = .026$), but when we exclude them, we obtain a statistically nonsignificant slope ($B = .01$, $SE = .01$, $p = .501$). This suggests that the risk level associated with Trajectory B remains relatively constant over time up until the final 2 weeks, at which point it suddenly increases. If we were to conduct a regression analysis on Trajectory A, we would find a statistically significant positive slope ($B = .08$, $SE = .03$, $p = .011$) with no outliers, although the smooth, gradual linear relationship implied by this analysis does not fully capture the turbulence that characterizes this trajectory.

An alternative analytic approach is to model the change process itself as the outcome, consistent with dynamical systems theory (Butner, Gagnon, Geuss, Lessard, & Story, 2015).[1] Using this approach, the predicted risk scores over time for each trajectory are plotted as dashed lines in Figure 1b and are overlaid on the original trajectories.[2] As can be seen, the plots resulting from this approach much more accurately capture the change process for both trajectories, to include the sudden increase in risk observed during the final 2 weeks of Trajectory B. If depression severity and hopelessness have change processes similar to Trajectory B, traditional analytic methods that do not explicitly incorporate change processes would mischaracterize the nature of their association with suicidal behavior.

Explicitly modeling change processes could also enable us to determine which risk factors serve as *drivers* for emergent suicidal behaviors. Such risk factors may determine how other risk factors influence the transition from suicidal thoughts to behaviors, although they do not differentiate ideators from attempters by themselves. For example, imagine you are in a busy city and want to take a taxi from home to work. There are many possible routes that could be taken, but the final route will depend on a number of contextual factors. For example, some roads have one-way traffic flow, other roads might be shut down for construction, and others may be blocked due to heavy traffic. In some cases, you and your taxi driver may be unaware of these obstacles until they are actually encountered. The final route would therefore be influenced by external factors encountered on a moment-to-moment basis, even though none of these external factors provide much information by themselves about whether you are located at home or at work. Depression, hopelessness, and other risk variables that do not differenti-

ate suicide ideators and suicide attempters may function in a similar way. This possibility is suggested by studies supporting an interactive effect of depression and posttraumatic stress disorder on suicide attempts and suicide death (see, for instance, the review by Panagioti, Gooding, & Tarrier, 2009), which suggests that depression may determine how posttraumatic stress disorder differentiates between ideators and attempters. This moment-to-moment interplay among risk factors is described by the FVT, but has not yet been integrated into the design of many research studies. In the absence of these methods, we may inadvertently disregard or turn our attention away from important drivers of the transition from suicidal thought to action.

To truly capture the essence of the transition from suicidal thoughts to behaviors, existing models of suicide will therefore need to go beyond the simple identification and elucidation of risk and protective factors that differentiate ideators from attempters; explicit consideration of change processes will be needed as well. The integration of conceptual models such as the FVT with existing models of suicide, and the adoption of newer research methods such as dynamical systems theory, may be especially useful. In sum, accounting for temporal dynamics could be a critical step forward in our understanding of suicide and could lead to much-needed advances in suicide prevention.

NOTES

1. To model the change process, we would calculate the change scores for each time point by subtracting the current time point's score from the next time point's score (i.e., $\Delta y = x_{t+1} - x_t$). This change score is then regressed on x_t, such that the current score predicts the score at the next time point. Similar to traditional regression, polynomial effects (e.g., quadratic, cubic) can be specified in addition to simple linear effects.

2. For Trajectory A, the resulting equation is $\Delta y = 1.548 - 0.301x_t$, and for Trajectory B, $F(1, 36) = 6.21$, $p = .017$, $R^2 = .155$, the resulting equation is $\Delta y = 0.536 + 0.111x_t - .456x_t^2 + .106x_t^3$, $F(3, 34) = 6.29$, $p = .002$, $R^2 = .357$.

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