

# Editorial

## RECENT AND NEEDED ADVANCES IN THE UNDERSTANDING, PREDICTION, AND PREVENTION OF SUICIDAL BEHAVIOR

Matthew K. Nock, Ph.D.

Suicidal behavior has perplexed humans since the beginning of recorded history. For thousands of years, the question of why some people intentionally end their own lives, and how we as society should respond to such behaviors, fell largely to those working in the domains of philosophy, religion, and the law. Over the past few hundred years, society has come to view suicide as a mental health issue, and in the past few decades we have seen exponential growth in research on this problem. Indeed, a search of the Thomson Reuters Web of Science for publications using the keyword “suicide” reveals an enormous increase in the number of papers published on this topic across the years (see Fig. 1).

Despite this increase in research, suicide continues to be a leading cause of death in the United States and worldwide. The US suicide rate has increased by nearly 25% over the past 15 years.<sup>[1]</sup> As such, it is more important than ever that we increase efforts to better understand, predict, and prevent suicidal behavior. In this editorial, I outline some of the key questions that must be answered in this area, offer suggestions for how we can answer them, provide a few examples of recent advances in each of these areas, and describe some of the most exciting areas of emerging research on suicidal behavior.

### WHO IS MOST AT RISK?

#### USING EPIDEMIOLOGY AND DATA SCIENCE TO IMPROVE UNDERSTANDING AND PREDICTION

In order to understand, predict, and prevent suicidal behavior, we need firm knowledge of who is most at risk for this outcome. In an effort to build this knowledge base, the majority of research on suicidal behavior over the past several decades has focused on describing the prevalence of and risk factors for suicidal behavior. Much of this research has relied on small, selected samples of participants (e.g., 100 psychiatric inpatients in New York, 200 high school students in Los Angeles, etc.), which limits the inferences that can be drawn from the results of such studies in two important ways. First,

the inclusion of selected participants from a specific geographic region or context (e.g., high school) raises questions about the external validity of the findings. Given that the rates of suicide death vary dramatically across geographic regions, it is reasonable to assume that other characteristics of suicidal behavior may do so as well. Second, given the low base rate of suicidal behavior, much larger samples are needed to study this behavior in a fine-grained way.

Recent advances in epidemiological research (e.g., development of reliable and valid survey instruments, electronic data collection methods) have facilitated the implementation of larger and more representative studies than ever before possible, which in turn has led to the availability of unprecedented information about mental health problems around the world, including suicidal behavior. As one example, the World Health Organization World Mental Health Survey (WMH) Initiative (<http://www.hcp.med.harvard.edu/wmh/>) is a consortium of researchers in over two dozen countries who have collected data on the epidemiology of suicidal behavior and a much broader range of mental health outcomes, and data from this project has provided new information about the prevalence, course, and risk factors of suicidal behavior.

Data from this large, representative, cross-national study have revealed that across all countries examined, the lifetime prevalence of suicide ideation, plans, and attempts is 9.2, 3.1, and 2.7%, respectively.<sup>[2]</sup> The prevalence of these outcomes varies substantially across countries; however, this study has shown that once suicide ideation is present, there is consistency in the characteristics of suicidal outcomes around the world. For instance, in every country examined, the onset of these behaviors increases dramatically during adolescence, approximately one third of people with suicide ideation transition to making a suicide attempt, and the highest risk period for the onset to first suicide attempt is in the first year after onset of ideation.<sup>[2]</sup> There also is consistency in the risk factors for suicidal outcomes, and a consistent pattern of findings revealing that most of the risk factors for suicidal outcomes actually predict only suicide ideation, but not the transition from suicide ideation to suicide attempt. The WMH project has identified several risk factors that predict the transition from ideation to attempt cross-nationally. As an example, virtually all mental disorders are associated with an increased risk

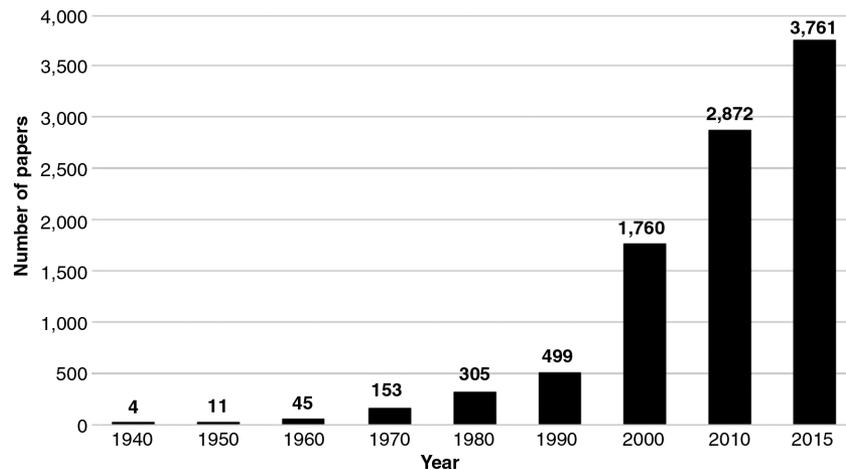


Figure 1. Number of publications listed in Web of Science with the keyword “suicide.”  
Note: Each bar represents publications for the year listed (not entire decade).

of subsequent suicide ideation, with depression showing the strongest effects. However, depression does *not* predict the transition from ideation to attempt. What does predict this transition is disorders characterized by anxiety, agitation, and poor behavioral control (e.g., post-traumatic stress disorder, conduct disorder, alcohol use disorder).<sup>[3]</sup> Interestingly, a similar pattern emerges in the associations between family history of mental disorders and suicidal outcomes among offspring. Specifically, parental history of depression and generalized anxiety disorder predict which people with ideation go on to make suicide plans, whereas parent history of panic and antisocial behavior are the only disorders to predict which people act on their suicide thoughts/plans and make a suicide attempt.<sup>[4]</sup>

Although findings such as these are helpful for enhancing understanding of suicidal outcomes, on their own, they provide limited help in the actual prediction of suicidal behavior. Indeed, each of the risk factors identified provides limited predictive power in terms of magnitude of effect (e.g., odds ratio) and specificity (e.g., most people with depression, anxiety, and these other risk factors do not attempt suicide). As such, an important direction for current and future work on suicidal behavior is the development of methods for combining information about risk factors in ways that can be used to actually predict these outcomes in clinic and community settings. Early attempts to combine information about risk factors that simply added up the number of risk factors present in each person revealed that even this relatively crude approach can predict which people with recent suicide ideation make the transition to suicide attempt in the next 12-months with a fairly high degree of accuracy.<sup>[5]</sup> The recent development of machine learning methods is providing much more powerful approaches for discovering new risk factors and combining risk factors in ways that improve our ability to predict suicidal behavior.<sup>[6]</sup> These recent advances represent just an initial step toward advancing understanding and prediction, and with

enhanced data collection and analytic abilities, much greater precision and accuracy will become possible.

## WHAT DO SUICIDAL THOUGHTS AND BEHAVIORS LOOK LIKE?

### USING MOBILE AND WEB-BASED TECHNOLOGIES TO ENHANCE UNDERSTANDING AND PREDICTION

Another major limitation in the study of suicidal behavior is that we have failed to carefully observe suicidal outcomes as they naturally unfold, and so have lacked a fundamental understanding of their basic properties. This point is not specific to the study of suicide and has been used to describe psychological research more generally. For instance, approximately 50 years ago the Nobel Laureate Niko Tinbergen noted that: “in its haste to step into the twentieth century and to become a respectable science, Psychology skipped the preliminary descriptive stage that other natural sciences had gone through, and so was soon losing touch with the natural phenomena” (p. 411).<sup>[7]</sup> This continues to be a problem in the study of psychology and psychiatry. In the case of harmful behaviors such as suicide and violence, it is understandable that researchers have rarely observed these behaviors unfold naturally. Indeed, it is not ethical to induce such behaviors in the laboratory, and we have lacked the surveillance abilities needed to follow people around in their day-to-day lives while waiting for these behaviors to emerge.

The development of mobile and web-based technologies now offers an unprecedented ability to capture suicidal thoughts and behaviors in their natural setting. Rather than trying to elicit these behaviors into the laboratory, we can bring the laboratory into the person’s natural habitat. For instance, personal daily assistants and smartphones can be used to gather data on the occurrence and characteristics of suicidal thoughts and

behaviors as they unfold in real time. Studies using such technologies have begun to provide never-before available information about the frequency, duration, intensity, triggers, and motivations for suicidal thoughts and behaviors.<sup>[8]</sup> Moreover, the ability to collect continuous biological data from wearable sensors, or even from standard smartphones themselves, has begun to transform the kinds of questions that can be tested about the nature of suicidal and related behaviors. Similarly, web-based and social media focused approaches are providing additional channels through which we can begin to better understand and predict suicidal thoughts and behaviors as they occur in people's everyday lives.

## HOW CAN WE BETTER MEASURE AND TREAT THE SUICIDAL MIND?

### USING PSYCHOLOGICAL SCIENCE TO IMPROVE UNDERSTANDING, PREDICTION, AND PREVENTION

Another major and longstanding challenge to scientific and clinical efforts in this area is that virtually all assessment methods rely on a person's explicit self-report about suicidal thoughts and intent. This is problematic because: people often are motivated to deny or conceal suicidal thoughts for fear of being intervened upon (e.g., involuntary hospitalization); suicidal thoughts are transient in nature and may not be present upon assessment but can return shortly thereafter;<sup>[8]</sup> and some people may lack conscious awareness of their current level of risk. Indeed, nearly 80% of people who die by suicide while in the hospital explicitly deny suicidal thoughts or intent in their last communication before dying.<sup>[9]</sup> As such, there is an enormous need for methods of assessing suicide risk that do not rely on explicit self-report.

Over the past few decades, psychological science has produced methods of measuring, and modifying, people's implicit cognition (i.e., unconscious mental processes that can influence behavior) in ways that can significantly benefit suicide research and clinical efforts. For instance, the Suicide Implicit Association Test (IAT), which is a brief (5 min) behavioral test that uses a person's reaction times when viewing suicide-related and other stimuli, has been shown to significantly predict future suicidal behavior above and beyond other factors such as the presence of a mental disorder and both patients' and their clinicians' prediction of whether they will make a future attempt.<sup>[10]</sup> More recent research has shown that brief, smartphone-based interventions that target implicit processes for change can significantly reduce self-injurious and suicidal behavior.<sup>[11]</sup>

Needed next steps in this area, as in work with traditional risk factors for suicidal behavior, involve: further exploration and probing of known risk factors in order to advance understanding of their association with suicidal outcomes, the development of methods of combining information from multiple risk factors in ways that

enhance predictive accuracy, and the creation of additional novel interventions targeting key processes believed to influence suicidal behavior and integration of such approaches with existing, traditional interventions.

## CONCLUSION

Suicide continues to confound scientists, clinicians, and the public. Given the high, and rising, rate of suicide mortality, we must devote greater resources to understanding and preventing. What is needed is not just more research, but more creative research that brings novel approaches and methods to the study and treatment of this problem. Recent and emerging research has advanced our understanding of who is at risk and how to better predict suicidal behavior—focusing especially on improving the prediction of which people who think about suicide go on to make a suicide attempt—providing information that is especially relevant to clinicians working with suicidal patients. This work has highlighted the differing roles that depression and anxiety play in the pathway to suicide. New work has also begun to use advances in technological development and psychological science to create new tools that can help us better understand, predict, and prevent suicidal behaviors. These advances and new possibilities are exciting, but have not yet translated into a reduction in the rate of suicide death. There is much work to be done, and with increased research funding, scientific creativity, and clinical translation, it will be.

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## REFERENCES

1. Curtin SC, Warner M, Hedegaard H. Increase in suicide in the United States, 1999–2014. NC HS Data Brief 2016;241. Available at: <http://www.cdc.gov/nchs/products/databriefs/db241.htm>. Accessed April 22, 2016.
2. Nock MK, Borges G, Ono Y, editors. Suicide: Global Perspectives from the WHO World Mental Health Surveys. New York: Cambridge University Press; 2012.
3. Nock MK, Hwang I, Sampson N, et al. Cross-national analysis of the associations among mental disorders and suicidal behavior: Findings from the WHO World Mental Health Surveys. *PLoS Med* 2009;6(8):e1000123.
4. Gureje O, Oladeji B, Hwang I, et al. Parental psychopathology and the risk of suicidal behavior in their offspring: results from the World Mental Health surveys. *Mol Psychiatry* 2011; 16(12):1221–33.
5. Borges G, Nock MK, Haro Abad JM, et al. Twelve-month prevalence of and risk factors for suicide attempts in the World Health Organization World Mental Health Surveys. *J Clin Psychiatry* 2010;71(12):1617–1628.

6. Kessler RC, Warner CH, Ivany C, et al. Predicting suicides after psychiatric hospitalization in US Army soldiers: the Army Study To Assess Risk and rEsilience in Servicemembers (Army STARRS). *JAMA Psychiatry* 2015;72(1):49–57.
7. Tinbergen N. On aims and methods of ethology. *Z Tierpsychol* 1963;20:410–433.
8. Nock MK, Prinstein MJ, Sterba SK. Revealing the form and function of self-injurious thoughts and behaviors: a real-time ecological assessment study among adolescents and young adults. *J Abnorm Psychol* 2009;118(4):816–827.
9. Busch KA, Fawcett J, Jacobs DG. Clinical correlates of inpatient suicide. *J Clin Psychiatry* 2003;64(1):14–19.
10. Nock MK, Park JM, Finn CT, Deliberto TL, Dour HJ, Banaji MR. Measuring the suicidal mind: implicit cognition predicts suicidal behavior. *Psychol Sci* 2010;21(4):511–517.
11. Franklin JC, Fox KR, Franklin CR, et al. A brief mobile app reduces nonsuicidal and suicidal self-injury: evidence from three randomized controlled trials. *J Consult Clin Psychol* 2016 [Epub ahead of print].