Prognostic Models to Detect and Monitor the Near-Term Risk of Suicide

State of the Science

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Aspirational Goal 3 of the National Action Alliance for Suicide Prevention's Research Prioritization Task Force research agenda is to "find ways to assess who is at risk for attempting suicide in the immediate future." Suicide risk assessment is the practice of detecting patient-level conditions that may rapidly progress toward suicidal acts. With hundreds of thousands of risk assessments occurring every year, this single activity arguably represents the most broadly implemented, sustained suicide prevention activity practiced in the U.S. Given this scope of practice, accurate and reliable risk assessment capabilities hold a central and irreplaceable position among interventions mounted as part of any public health approach to suicide prevention.

Development of more reliable methods to detect and measure the likelihood of impending suicidal behaviors, therefore, represents one of the more substantial advancements possible in suicide prevention science today. Although past "second-generation" risk models using largely static risk factors failed to show predictive capabilities, the current "third-generation" dynamic risk prognostic models have shown initial promise. Methodologic improvements to these models include the advent of real-time, in vivo data collection processes, common data elements across studies and data sharing to build knowledge around key factors, and analytic methods designed to address rare event outcomes. Given the critical need for improved risk detection, these promising recent developments may well foreshadow advancement toward eventual achievement of this Aspirational Goal.

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Introduction

An estimated 678,000 U.S. citizens were treated for a suicide attempt in some type of medical setting in 2008.[1] This number suggests that a suicide risk assessment would have been done at least once every 2 minutes throughout that calendar year with a treatment-seeking, suicide-attempting patient. A larger number of additional assessments would have been conducted with individuals who had suicidal ideation but no recent suicidal behavior. With hundreds of thousands of risk assessments occurring annually, this single activity arguably represents the most broadly implemented, sustained suicide prevention activity practiced in the U.S. Given this scope of practice, accurate and reliable risk assessment capabilities hold a central, irreplaceable position among interventions mounted as part of any public health approach to suicide prevention.

The development of more accurate and reliable prognostic tools for detecting risk would therefore be one of the most substantial research advancements in suicide prevention science today. In clinical settings, such advancement would almost certainly precipitate models of care tailored more appropriately to actual risk levels, replacing existing probabilistic treatment models. In research trials, progress in risk detection would likewise clear the way for empirically validated tools capable of detecting heightened risk status and providing more nuanced indicators of treatment effectiveness across time.

Aspirational Goal 3 of the National Action Alliance for Suicide Prevention's Research Prioritization Task Force (RPTF) prioritized research agenda is to "find ways to assess who is at risk for attempting suicide in the immediate future." This goal is differentiated from other Aspirational Goals in that it addresses issues related to the task of identifying and predicting near-term suicide

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risk at the individual patient level (as opposed to research directed at group screening practices).

The topic is broad and complex, related bodies of research large, and space limited. This discussion of potential research pathways is therefore limited to examination of some more frequently encountered scientific challenges in research aimed at improving capacity to estimate the probability of near-term suicidal acts among suicidal individuals.

As per CDC definitions, *violence* is an umbrella term that encompasses both self- and other-directed aggressive acts. *Self-harm* is likewise an umbrella term that includes self-directed, violent acts with and without suicidal intent.[2] *Elevated* or *acute risk* as the term is used here refers to conditions that may progress rapidly to suicidal behavior. The term *imminent risk* is a legal but not scientific term that incorrectly implies that mental health professionals have the ability to precisely identify "imminence"—the high probability of an impending suicidal act.[3] This term is therefore not used in our paper. In contrast, *near-term risk* refers to a time period during which an increased propensity for suicidal behavior exists. No time frame is attached to the term because no research is available to inform an estimate of the usual duration of near-term risk conditions.[4] *Chronically elevated suicide risk* is a condition under which elevated risk continues over longer periods of time—often (but not always) due to specific, intractable neuropsychiatric conditions (e.g., certain brain lesions) or the presence of relatively immutable psychosocial or demographic factors.[5]

The official nomenclature of the CDC suggests that *suicidal intent* involves "evidence (explicit or implicit) that, at the time of [an] injury, the individual intended to kill [the] self or wished to die, and that the [suicidal] individual understood the probable consequences of his or her actions."[2] *Static risk factors* are defined here as those factors that are fixed and historic (e.g., demographics, trauma history), and *dynamic risk factors* are defined as variable internal or external factors that may fluctuate in intensity over a short period of time.[6] Finally, *risk assessment* is defined as the process of collecting data on factors that signal a person's elevated risk.

Challenges in Work to Detect and Monitor Near-Term Risk

Suicidal behaviors appear to originate out of complex, multi-level macro- to micro-level interactions involving biological, psychological, interpersonal, and sociologic factors. The research pathway toward better prediction of suicide risk includes studies to forge, calibrate, and cross-validate a series of well-articulated prognostic models that stratify risk and project outcomes for groups of high-risk individuals.[7]

In other biomedical fields, such models have improved reliability in establishing diagnosis, forecasting outcome, and predicting treatment response.[8] The prognostic modeling efforts in suicide prevention are undergirded by a rich research tradition in the more generalized violence prevention field where current risk detection and prediction modeling efforts represent a third "generation" of such efforts.[9] First-generation decisional models used expert opinion or structured clinical judgment as their "gold standard" to detect risk and identify suicidal behavior. In the U.S. tradition, studies by Littman, Faberow, and Shneidman[10] at the Los Angeles Suicide Prevention Center illustrate this approach.

Second-generation prognostic models incorporated static risk factors (or factors that may change over time but are measured only at baseline and treated in modeling as static) in risk detection and prognostication efforts. Pokorny's (1984) landmark study[11] of suicides among 4,800 consecutively admitted Veteran psychiatric subjects is perhaps the best-known second-generation U.S. prognostic modeling exercise. In that study, demographic factors and baseline ratings of psychopathology, hopelessness, inpatient behavior and hygiene were entered into regression analysis. In all, 28% of 100+ criterion variables included in the study were significantly correlated to suicide-related outcomes, limiting the clinical utility of any of them for differentiating outcomes. Other second-generation suicide risk modeling exercises have produced similar results.[12,13]

Third-generation violence prediction models incorporate dynamic risk elements into their algorithms. For instance, in the (other-directed) violence literature, factors such as current disinhibition due to substance use,[14] relative inaccessibility of protective social support[15] or of access to care[16] are regarded as "rapidly changing acute risk factors."[14] In suicide risk assessment, preliminary success with a third-generation model came when the Collaborative Program on the Psychobiology of Depression[17–19] successfully differentiated depressed patients who later completed suicide on the basis of a model that included severe comorbid state anxiety. Although this finding has not been replicated, several studies have produced supporting data using various designs.

A variety of potentially dynamic biopsychosocial conditions that may affect near-term risk status are currently under investigation, including changes in neurobiology,[20] cognitions,[21] disturbed interpersonal relationships,[22] increased negative life stress with accompanying decrement in coping efficiency,[23] affective states,[24] and implicit psychological associations.[25]