Suicide and Life-Threatening BEHAVIOR
THE OFFICIAL JOURNAL OF THE AMERICAN ASSOCIATION OF SUICIDOLOGY

Suicide and Life-Threatening Behavior 47 (5) October 2017

DOI: 10.1111/sltb.12311

Treating the Capability for Suicide: A Vital and Understudied Frontier in Suicide Prevention

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Current efforts at suicide prevention center largely on reducing suicidal desire among individuals hospitalized for suicidality or being treated for related psychopathology. Such efforts have yielded evidence-based treatments, and yet the national suicide rate has continued to climb. We propose that this disconnect is heavily influenced by an unmet need to consider population-level interventions aimed at reducing the capability for suicide. Drawing on lessons learned from other public health phenomena that have seen drastic declines in frequency in recent decades (HIV, lung cancer, motor vehicle accidents), we propose that current suicidality treatment efforts trail current suicidality theories in their lack of focus on the extent to which individuals thinking about suicide are capable of transitioning from ideation to attempt. We summarize extant evidence for specific capability-centered approaches (e.g., means safety) and propose other options for improving our ability to address this largely overlooked variable. We also note that population-level approaches in this regard would represent an important opportunity to decrease risk in individuals who either lack access to evidence-based care or underreport suicidal ideation, as a reduced capability for suicide would theoretically diminish the potency of suicidal desire and, in this sense, lower the odds of a transition from ideation to attempt.

As the tenth leading cause of death in the United States (Centers for Disease Control and Prevention [CDC], 2015a,b), suicide is firmly established as a pressing public health concern. Fittingly, substantial research attention has been allotted toward the improvement of prevention and treatment efforts and, consequently, a number of evidence-based treatments for suicidality now exist. Indeed, treatments such as dialectical behavioral therapy (Linehan, Armstrong, Suarez, Allmon, & Heard, 1991) and brief cognitive behavioral therapy (Rudd, 2012) have demonstrated efficacy and/or effectiveness across well-powered randomized controlled trials in diverse samples of high-risk individuals (e.g., Linehan et al., 2015; Rudd et al., 2015). This development is unquestionably a positive one; however, the national suicide rate has continued to rise annually for several years (CDC, 2015a,b). Given this, although we

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can clearly acknowledge that those who receive these evidence-based treatments benefit greatly from those efforts, the overall impact of the treatments on suicide prevention as indexed by the national suicide rate has been remarkably limited.

The contrast between the robust evidence base for several treatments and the continually increasing suicide rate points toward a vital disconnect between the primary problem and the tools we are using to address it. An argument could be made that the best solution is to increase the reach of these established treatments, thereby allowing a greater proportion of those at risk to benefit from their effects. Although this would likely be beneficial, the plausibility of sufficient expansion of reach seems minimal given the training demands of such treatments and the shortage of properly trained therapists in the United States (Stewart & Chambless, 2007; Stewart, Chambless, & Baron, 2012). Furthermore, several populations at particularly high risk for suicide, such as older adults and military personnel, have been shown to underreport suicide ideation (Anestis & Green, 2015; Cukrowicz, Jahn, Graham, Poindexter, & Williams, 2013). As such, even if the reach of those treatments was widely expanded, many of those in need appear unlikely to seek out and thus benefit from such services. Consequently, expansion of reach would be limited in its ability to impact those currently not benefiting from our established tools. In this sense, it is not clear that such expansion represents a fruitful target—at least in isolation—in efforts aimed to lower the national suicide rate.

If further development and expansion of available psychosocial and psychopharmacological interventions represents an insufficient approach toward stemming the rising suicide rate, this indicates that our national suicide prevention strategy needs to be altered to reflect novel and diverse approaches toward addressing risk. Fortunately, history may provide a useful guide toward adjusting our approach, as several other public health concerns have ultimately been successfully countered through the development of broader, multifaceted prevention and treatment efforts.

LESSONS LEARNED FROM OTHER PUBLIC HEALTH CONCERNS

A range of public health concerns have arisen throughout the course of our nation's history. Some, such as heart disease and certain forms of cancer, have proven difficult to manage or solve, and consequently have resulted in high death rates (CDC, 2014). Some public health phenomena, such as the human immunodeficiency virus (HIV), lung cancer, and traffic accident deaths, however, have seen rates drastically decreased over time (CDC, 2013a,b; Jamal, Agaku, O'Connor, E., King, Kenemer, & Neff, 2014; National Cancer Institute, 2015; National Institutes of Health [NIH], 2010; NHTSA, 2014a,b; U.S. Census Bureau, 1997). These reduced rates were a result of varied approaches aimed to reduce the odds of contracting HIV or lung cancer and experiencing or dying in traffic accidents. These three phenomena were chosen for the innovative and diverse prevention methods that ultimately focused on increasing the safety of the means that most commonly results in the development of the negative phenomenon (e.g., contraction of disease) and shifting public perception about the phenomenon itself.

Human Immunodeficiency Virus

HIV death rates in the United States peaked in 1995, with 19.1 deaths per 100,000; however, this rate has dramatically decreased and is now 2.2 per 100,000 (CDC, 2013a,b; Jamal et al., 2014; U.S. Bureau, 1997). In order to address this epidemic, intervention strategies were implemented at the national level to increase awareness and prevention. These strategies included distribution of free condoms, peer

education, and free, anonymous HIV testing. However, these only led to short-term behavioral changes and did not affect HIV rates dramatically (Gottlieb, 2001). Shortly thereafter, however, new approaches emerged. Given that injecting drug use is the primary mode of HIV infections in the United States (CDC, 2013a,b; Heimer, 1998), needle exchange programs (NEPs) were developed as a potential method for increasing the safety of a common means of transmission and therefore lowering the HIV infection rate. The goals of NEPs are to reduce needle sharing, increase the number of clean needles in an effort to drive used needles out of circulation, and ultimately reduce new infections of HIV by meeting the aforementioned goals. NEPs sought to meet these goals by providing sterile injecting equipment and referrals to medical care to active injecting drug users (IDUs) and by providing legal and social services (Drucker, Lurie, Wodak, & Alcabes, 1998). Despite concerns with NEPs increasing needle sharing by making needles more accessible, multiple studies have shown that NEPs did not increase needle sharing and actually decreased drug use among IDUs (Drucker et al., 1998; Lurie & Reingold, 1993; Normand, Vlahov, & Moses, 1995). After NEPs were implemented, there was a reduction in needle-sharing frequency (Lurie et al., 1993), and compared to individuals using NEPs, those not using NEPs had a 3.3-fold increased risk of HIV (Des Jarlais et al., 1996). A study compared HIV infection rates of injection drug users in cities with and without NEPs and found that there was a decrease of 5.7% per year in prevalence in cities with NEPs, but a 5.9% increase per year in those without NEPs (Hurley, Jolley, & Kaldor, 1997). Overall, HIV incidence has decreased by 80% among IDUs in the United States (Hall et al., 2008). One of the major benefits of NEPs is the opportunity to contact and educate IDUs who have not been reached by preventative interventions. In addition, NEPs not only offer clean needles and syringes to people who are at highest risk of HIVs, but also provide safe sex and drug use information, counseling, and referrals that make it a multifaceted and innovative approach in reducing HIV rates. Although improvements in effective drug treatments such as antiretroviral therapy for those who are already infected with HIV or AIDS stop the virus from progressing and increase the survival rate, such valuable therapies are not optimal tools for reducing the onset of the illness. Rather than focusing exclusively on the development of treatments for those who are already infected, it thus appears more effective to also place a heavy emphasis on harm reduction, means safety (i.e., making sure IDUs use clean needles to reduce the likelihood of contracting the virus), and educating the public of HIV to raise awareness.

Lung Cancer

Lung cancer is the leading cause of cancer death and second most diagnosed cancer in men and women (CDC, 2012a,b). Fortunately, however, rates of incidence and death began declining in the early 1990s, likely due in large part to the fact that smoking prevalence has declined from 42.4% in 1965 to 17.8% (one in five American adults) in 2013 (CDC, 1993; CDC, 2014). The lung cancer incidence rate in the early 1990s was at nearly 70 per 100,000 and reduced to 48.6 per 100,000 by 2013; the death rate decreased from approximately 60 per 100,000 in the 1990s to 43 per 100,000 in 2013 (National Cancer Institute, 2015). Overall, rates for new lung cancer cases have been declining at an average rate of 1.7% per year over the last 10 years (Eheman et al., 2012). This progress can be attributed to several successful campaigns and changes that were aimed to reduce cigarette use, as cigarette smoking is the most common cause of lung cancer (CDC, 1999). When scientific evidence of the relationship between tobacco use and disease emerged, this information was disseminated to the public to increase

awareness. Cigarette advertising no longer appears in television or billboards, and there is an increased effort to restrict marketing and sales to adolescents. Policy changes enforcing minors' access to cigarettes, increasing the price of cigarettes, and increasing taxation on cigarettes has contributed to the overall decrease in smoking. Furthermore, a study by Song, Dutra, Neilands, and Glantz (2015) found that laws for 100% smoke-free workplaces are associated with lower rates of smoking and a decrease in the number of days of smoking that current smokers reported. The cigarette itself has changed as well, first with a filter added to reduce tar inhaled in the smoke and then with low tar cigarettes being manufactured and marketed. Again, the factors that contributed to the overall decline in cigarette smoking and consequently the national rates of lung cancer were novel and varied methods of means safety, such as changing the cigarettes by adding filters and making cigarettes harder and more expensive to access. When the most prominent method (i.e., cigarette smoking) for acquiring a negative outcome (i.e., lung cancer) becomes more difficult to obtain or use, the frequency of the negative outcome decreases as a result.

Motor Vehicle Accidents

Accidents (i.e., unintentional injuries) are the fourth leading cause of death in the United States, with motor vehicle traffic deaths the second highest accidental death at 10.7 deaths per 100,000 (CDC, 2013a,b); however, this is a dramatic decrease from 26.4 per 100,000 in 1969 (NHTSA, 2014a, b). Furthermore, overall highway deaths due to motor vehicle accidents have declined by 25% since 2004 (NHTSA, 2014a) and overall motor vehicle accidents decreased in the past 30 years, from 17.9 million in 1980 to 10.8 million in 2009 (U.S. Census Bureau, 2012) despite an increase in the national population from 226.5 million to 306.8 million (U.S. Census Bureau, 1997). Overall, there has been a long-term, downward trend in motor vehicle accidents and deaths, which can be attributed to several laws, policies, and campaigns. As seat belts reduce the risk of traffic accident death by 45% and serious injury by 50%, laws requiring drivers and passengers to use seat belts were enacted, "click it or ticket" national campaigns were implemented, and child passenger safety laws were enforced (NHTSA, 2010a,b). As a result, seat belt use increased from 11% in 1981 to 85% in 2010 (CDC, 1999; NHTSA, 2010a,b). Furthermore, as people not wearing a seat belt are 30 times more likely to be ejected from a vehicle during a crash, increased seat belt usage has saved an estimated 255,000 lives since 1975 (NHTSA, 2009). There also have been advancements in vehicle safety technology such as the installment of safer airbags in cars and antilock braking systems, which increase passenger safety (NHTSA, 2015).

Since the mid-1970s, wherein alcohol was a factor in over 60% of traffic fatalities, alcohol-related traffic deaths have been reduced by half, with the greatest declines in persons aged 16–20 years (NIH, 2010). States began enforcing a drinking age of 21 and zero tolerance laws for drivers younger than 21 years, as well as strict 0.08 blood alcohol content laws (NIH, 2010). After the enactment of state zero tolerance laws, fatal crash rates dropped from 24% to 9% (Committee on Injury, Violence, and Poison Prevention & Committee on Adolescence, 2006). As a result, the national prevalence for driving under the influence (DUI) for high school students 16 years or older declined by 54% from 22.3% in 1991 to 10.3% in 2011 (CDC, 2012a,b). Furthermore, those who have prior DUI convictions are much more likely to offend again. Thus, these individuals now face license suspension, are required to drive with an ignition interlock, and attend mandatory workshops and treatments as required by the court to prevent a repeated offense. Again, laws were designed and enforced to make it more difficult to drive while intoxicated and

reduce the likelihood by repeating this offense, which led to reductions in alcohol-related traffic deaths (NIH, 2010). In this sense, means safety was promoted through the improvement of the vehicle itself, the shifting of the behavior of drivers (in part through legislation), and public campaigns aimed at influencing the public perception of responsible car ownership and use.

Public Health Summary

Although HIV/AIDS, lung cancer, and motor accidents and drunk driving all remain public health concerns, with most of them still among the leading causes of death in the United States, novel and multilevel solutions were enforced to address these issues and lower the rates. These successful campaigns were multifaceted and involved more than a single treatment or solution. Furthermore, all of them focused heavily on addressing the danger, accessibility, and cost of the specific methods more frequently associated with the development of the negative outcome. In this sense, there may be clear parallels in suicide prevention that could potentially aid in the immediate and sustained reduction of the national suicide rate.

APPLYING PAST LESSONS TO THE PREVENTION OF SUICIDE

In each of the previous examples, treatment efforts have been aided by a thorough understanding of the most potent sources of risk and the most viable opportunities for successful prevention and treatment efforts (e.g., re-used needles, cigarettes, drunk driving). Establishing a similar position of strength in suicide prevention likely hinges first on better developing our understanding of the mechanisms underlying various aspects of suicide risk. A recent meta-analysis indicated that the past half century of research on general risk factors has led to no improvement in our ability to prospectively predict death by suicide (Franklin, Fox, et al., 2016; Franklin, Ribeiro, et al., in press). Furthermore, research has repeatedly demonstrated that the vast majority of individuals who think about suicide will not make an attempt and the vast majority of those who make an attempt will not die by suicide (Goldsmith, Pellmar, Kleinman, & Bunney, 2002; Nock et al., 2008). To address the inadequacy of traditional approaches, the focus within suicidology has shifted to an "ideation to action framework" (Klonsky and May, 2014), emphasizing the need to understand how various factors contribute to suicide ideation and/or the transition from ideation to attempt. Along these lines, several prominent theoretical perspectives on suicide highlight the ideation to action framework, providing a lens through which researchers and clinicians can understand risk in a more precise and nuanced manner and presenting a number of possible pathways for addressing the current gap between our prevention tools and the national suicide rate.

Suicide Theories Consistent with the Ideation to Action Framework

According to the interpersonal theory of suicide (ITS; Joiner, 2005; Van Orden, Witte, Gordon, Bender, & Joiner, 2010), individuals are at greatest risk of suicide ideation when they feel a sense of burdensomeness to others, lack a sense of belonging, and feel hopeless that these states will change. However, the ability to carry out a suicide attempt is developed through separate means. Individuals acquire the capability to engage in suicide attempts through exposure to painful and provocative events, such as experiences that heighten individuals' pain tolerance and fearlessness about death. Examples of such painful and provocative events include starvation (Selby et al., 2010), risky illegal behaviors (Mitchell, Jahn, & Cukrowicz, 2014), and combat (Bryan, Cukrowicz, et al., 2010; Bryan, Morrow, et al., 2010). Additionally,

research has indicated that genetic factors may influence individuals' capability for suicide (Smith et al., 2012). Ultimately, the presence of suicide ideation and the capability to engage in suicidal behavior must be jointly present for an individual to engage in suicidal behavior. The ITS has been tested and supported across diverse populations, including undergraduates (Joiner et al., 2009), community samples (Van Orden & Joiner, 2008), and U.S. military personnel (Anestis et al., 2015).

The ITS has influenced more recent theories of suicide. O'Connor's Integrated Motivational–Volitional Model of Suicidal Behavior (IMV; O'Connor, 2011) is a three-phase model conceptualizing suicidal behaviors as independent of symptoms of psychological disorders, including depression. This theoretical framework posits that multiple factors lead to the development of suicide ideation, including individuals' life events, dispositional factors, and triggering events. However, the proximal risk factor for suicide is the individuals' intent to engage in suicidal behavior, which is developed through feelings of entrapment brought about by defeat and humiliation, and the belief that suicide is the solution to life difficulties. The relationship between entrapment and suicidal ideation and intent is strengthened by factors that motivate suicide ideation, including feelings of burdensomeness and a lack of belonging. The transition from ideation and intent to suicidal behavior is most likely when volitional mediators, including the acquired capability for suicide, impulsivity, and access to means, are present. The IMV has been empirically tested and supported in a sample of individuals recently hospitalized for a suicide attempt (O'Connor, Smyth, Ferguson, Ryan, & Williams, 2013).

Klonsky and May (2015) have proposed and empirically tested the most recent of theory within the ideation to action framework. The Three Step Theory (3ST) posits that individuals develop suicide ideation when their pain (whether it be physical or psychological) is greater than their connectedness (whether it be to others, a job, or other things in individuals' lives that are meaningful) and they feel hopeless about the future. Like Joiner's (2005; Van Orden et al., 2008) theory, the 3ST explains that an individual must be capable of engaging in suicidal behavior to make an attempt. However, the 3ST expands upon the ITS concept of acquired capability, as Klonsky and May argue that individuals not only acquire the capability for suicide through habituation to pain and fearlessness about death but are born with dispositional characteristics, such as a genetic predisposition for higher pain tolerance, that make suicidal behaviors less daunting. Individuals must also have access to methods to make a suicide attempt and knowledge of how to use the chosen method. These acquired, dispositional, and practical components comprise an individual's capacity to attempt suicide.

Theory Summary

A commonality across each of these theories is an emphasis on the fact that thoughts of suicide are only one component of risk and, on their own, are unlikely to result in suicidal behavior. Although defined somewhat differently across theories, each theory alludes to the notion that a capability for suicide must be present in order for an individual to make a serious or lethal attempt. Notably, however, none of the treatments mentioned earlier address the capability for suicide. Indeed, their content appears entirely focused on suicidal desire and, although such focus is in many ways laudable, it depends on individuals experiencing ideation to seek out treatment—if access is even plausible—and to openly endorse thoughts of suicide.

It thus appears that one particularly promising area in which we might improve the potential for our prevention tools to impact the overall national suicide rate would be through the development and widespread implementation of interventions aimed at systematically reducing the

capability for suicide. It should be noted that the capability on its own is not pathological (Joiner, 2005). Indeed, capability has been shown to be orthogonal to suicidal desire (Joiner et al., 2009) and, in some circumstances, at least certain aspects of the capability for suicide may provide highly adaptive. For instance, an increased comfort with blood and injury could prove extremely useful to emergency room physicians. Similarly, a decreased fear of death and increased comfort with specific lethal means (e.g., firearms) could enable survival and successful completion of dangerous missions in soldiers exposed to combat. Additionally, a limited fear of injury could allow professional athletes to place themselves at risk in order to succeed in specific game situations (e.g., a strong safety making an open field tackle on a larger ball carrier). Where danger emerges is when individuals with an elevated capability for suicide also experience suicidal desire. In such circumstances, the capability that may have proven useful in some circumstances would actually facilitate the transition from suicide ideation to suicidal behavior and substantially increase the odds that a suicide attempt will result in death. An example of this point can be seen in research demonstrating that soldiers exhibit elevated levels of fearlessness about death relative to civilians with multiple suicide attempts (Bryan et al., 2010), and also engage in fewer nonlethal suicide attempts for every death by suicide (Anestis & Bryan, 2013).

Given the aforementioned findings, although capability on its own is not pathological, it represents a vital prevention target due to its ability to increase the potency of suicidal thoughts. In this sense, reducing capability for suicide on a broader scale could represent an important public health approach toward suicide prevention, in that it would allow prevention efforts to reach those with ideation who deny suicidal thoughts (or who do not deny them, but lack access to evidence-based treatments for suicide risk). Decreased access to and safe use/storage of lethal means might represent an opportunity to address an important aspect of the capability for suicide without diminishing the ability of individuals to succeed in their chosen professions and environments.

DEVELOPING THEORY DRIVEN PREVENTION AND TREATMENT EFFORTS THAT BUILD ON LESSONS LEARNED FROM OTHER PUBLIC HEALTH CAMPAIGNS

In contrast to traditional interventions, which are implemented on an individual basis in response to specific consumers presenting with elevated suicide risk, capability-based prevention efforts may best be applied at a population level. Addressing capability at a population level could potentially operate as a form of suicide prevention for at-risk individuals who underreport ideation. Although such individuals still may not seek treatment, they would be less able to engage in serious or lethal attempts, thereby decreasing the odds of death by suicide. Such approaches would thus heavily mirror the successful approaches detailed earlier with respect to HIV, lung cancer, and motor vehicle accidents.

The most prominent example of such approaches currently in practice, albeit sporadically, is *means safety*. Historically, the impact of means safety can be seen through the drastic and sustained drops in suicide rates that have followed changes such as the detoxification of gas (Kreitman, 1976; Lester & Abe, 1998), reduced access to medications often lethal in overdose (Oliver & Hetzel, 1972), reduced packaging quantity of medications lethal in overdose (Hawton et al., 2013), and the installation of bridge barriers (e.g., Bennewith, Nowers, & Gunnell, 2007). Researchers have indicated that the impact of such means safety efforts is driven by the popularity of the method, noting that a decrease in use of a rarely fatal method is unlikely to yield a meaningful effect on the overall (or even means

specific) rate (Mann et al., 2005). This point is supported by recent research indicating that the implementation of prevention efforts that restrict access to lethal means at suicide hotspots (e.g., bridge barriers) are associated with more than 90% reductions in suicides in those areas, with no evidence of increases at other locations (Pirkis et al., 2015).

Within the United States, the most frequent method of suicide death is self-inflicted gunshot wounds, which annually account for less than 5% of all suicide attempts, but more than 50% of all suicide deaths (CDC, 2015a,b). Put another way, firearm suicides account for more suicide deaths than all other methods combined, thereby highlighting the potential utility of means safety approaches centered on firearms. Along these lines, research has presented a robust and consistent set of results indicating that means safety efforts focused on firearms can have profound and sustained impacts on overall suicide rates (e.g., Boor & Bair, 1990; Miller, Azrael, & Hemenway, 2002; Yang & Lester, 1991). Internationally, such effects were demonstrated most prominently in Israel. In 2006, the Israeli Defense Force changed its policy and no longer allowed soldiers to take their weapons home during the weekend, as firearm suicides during weekends accounted for a profound proportion of national suicides. Following this change, a 40% reduction in the suicide rate among soldiers aged 18–21 was reported (Lubin et al., 2010), with no subsequent increase in the use of other methods. Within the United States, recent data have indicated that several laws impacting access and exposure to handguns are associated with profound decreases in statewide overall suicide rates (Anestis & Anestis, 2015; Anestis et al., 2015). Given the inconsistent implementation of means safety procedures across geographic areas, however, the population-level impact of full implementation remains unclear.

Perhaps as important as data indicating the efficacy of implementing means safety measures are data indicating the dangers associated with removing such measures. Indeed, studies have shown that making lethal methods more readily accessible is associated with subsequent increases in the suicide rate. Such phenomena have been demonstrated from studies examining the effects of the removal of bridge barriers (Beautrais, Gibb, Fergusson, Horwood, & Larkin, 2009) as well as the removal of mandatory waiting periods for the purchase of handguns (Anestis & Anestis, 2015). Given data indicating the efficacy of implementing such approaches, the danger of removing such approaches, and the potentially remarkable cost-effectiveness of using such approaches (Whitmer & Woods, 2013), the utility of systematic implementation of means safety approaches as part of a population-level approach toward diminishing the capability for suicide seems rather clear.

A reasonable concern among individuals first hearing about means safety is the possibility that limiting access to one specific method for suicide will simply result in individuals dying by another method. If this were the case, means safety efforts would not lower the overall suicide rate because any life saved in one effort would be offset by the adoption of an alternative suicide method. To demonstrate the pervasiveness of this belief in the general population, Miller, Azrael, and Hemenway (2006) conducted a national survey examining public opinion about the likelihood of means substitution in suicide. They found that the majority of respondents believed that a bridge barrier at the Golden Gate Bridge would be ineffective at preventing suicide. In fact, over 70% of respondents believed that attempters who were unable to die by suicide at this location would certainly or almost certainly find an equally lethal method by which to attempt suicide (Miller et al., 2006).

Importantly, this argument has been largely refuted by available research. In his review of means restriction and means substitution research, Daigle (2005) found little evidence in favor of means substitution.

Following broad-scale efforts to restrict access to lethal means, including toxic gas, firearms, drugs, and bridges, there was little, if any, evidence of means substitution, whereas there were notable decreases in rates of suicide by these lethal methods and decreases in population-level suicide rates (Daigle, 2005). Similarly, Sarchiapone, Mandelli, Iosue, Andrisano, and Roy (2011) examined the effect of broad-scale means safety efforts and found that means substitution was uncommon across a variety of methods. Importantly, they found little evidence of means substitution following the implementation of gun laws in different regions. For example, in 1976, the introduction of a law that banned the possession of handguns in Washington DC resulted in a 23% decrease in suicides by firearm and saw no increases in suicide rates for other methods (Sarchiapone et al., 2011). Yip et al. (2010) examined suicide by charcoal burning in two regions of Hong Kong to determine the effectiveness of means safety efforts. They found that simply implementing a barrier to purchasing charcoal in one region (i.e., storing the charcoal in a locked container, necessitating employee assistance to obtain charcoal) resulted in decreased rates of suicide by charcoal burning, as well as decreased overall suicide rates. Furthermore, these decreases were observed only within the region undergoing the means safety manipulation.

Cox et al. (2013) performed a meta-analysis of suicide prevention efforts at "suicide hotspots" (locations that in some way facilitate suicidal behavior and have gained a reputation for this reason), which provided further support for this perspective. This study revealed that means safety efforts at suicide hotspots, such as the Memorial Bridge in Augusta, Maine, or the Hong Kong underground railway system, resulted in decreased suicide rates at these locations and such decreases did not result in increased suicide rates at other sites. In fact, they found that, in some cases, there was a decrease in population-level suicide rates following the implementation of means safety efforts at these specific hotspots. This indicates that means safety efforts may make it more difficult for an individual to engage in a lethal attempt at a specific suicide hotspot and also that these safety efforts do not result in substitution of one suicide hotspot for another. Results further indicate that means safety efforts at suicide hotspots may contribute to a reduction in population-level suicide rates, suggesting that individuals do not engage in another method of suicide when they are prevented from engaging in a lethal attempt at a suicide hotspot. Although some evidence for method substitution exists for more rarely used methods of suicide (e.g., Caron, 2004), such findings represent a small minority of the literature and do not contradict the larger literature demonstrating robust effects on overall suicide rates through means safety efforts.

EXPANDING OUR VISION FOR PREVENTION IN THE FUTURE

There has been a notable amount of research studies identifying factors associated with suicide risk and a recent movement to classify these risk factors into a clearer context to clarify the manner in which they impact specific aspects of suicide. More work, however, needs to be performed to organize previously identified suicide risk factors into an ideation to action framework (Klonsky and May, 2014). Thus, systematic reviews aimed to centralize and organize existing research on specific risk factors could prove invaluable. Following the ideation to action framework, it would be beneficial for these systematic reviews to focus on determining whether specific risk factors impact the development of suicide ideation, the progression from ideation to the act of making a suicide attempt, or both. By fitting existing knowledge regarding factors influencing suicidality into this model, we can then identify the risk factors and mechanisms that must be targeted in treatment and prevention efforts

aimed at systematically reducing the capability for suicide at varying levels (e.g., individual, local region, specific branch of the military, national population). Furthermore, while it is indeed important to continue adapting, testing, and refining existing treatments that have been found to be effective for the treatment of suicidal desire and ideation, it is equally, if not more, important to start directing our attention to the capability component that we have, thus far, been unable to treat. Learning from the successes of other movements to decrease various public health phenomena, a multifaceted approach seems to be most effective in creating desired change.

The majority of existing research on the capability for suicide has assumed capability to be a relatively stable variable that can begin as an innate quality that gradually increases in response to practical knowledge (3ST; Klonsky & May, 2015) and painful and provocative experiences (Joiner, 2005). Based on extant findings suggesting biological and physiological responses to different emotions, however, there is a possibility that capability may be subject to momentary changes. As such, it may be beneficial to distinguish factors that may contribute to momentary shifts in capability, which may facilitate the transition from ideation to making a suicide attempt. Such findings may give rise to the refinement and development of brief interventions focused on managing the capability for suicide at critical time periods during which suicide risk may be imminent.

In addition to considering potential state-like qualities in capability, the overall definition of the construct may need to be expanded and refined. Components such as increased prenatal testosterone (Ribeiro & Joiner, 2009), access to and familiarity with lethal means (Klonsky & May, 2015), and the increased plausibility of suicide succeeding the suicide of an acquaintance (i.e., social contagion; Klonsky, 2015) have been proposed to contribute to the capability for suicide. Indeed, it is plausible that the capability for suicide may be multifaceted—consisting of biological, psychological, and social components. Therefore, there may be a need to redefine *acquired capability* in order to understand the construct in its entirety, as this variable was originally developed in theory (Joiner, 2005), thereby leaving its full factor structure in need of testing. Future research should continue to strive toward refining the definition and measurement of the capability for suicide, as other aspects may potentially serve as superior targets for interventions aimed at reducing capability in populations in which increased fearlessness of death and pain tolerance are beneficial and necessary.

Recent developments in technology may also be leveraged in efforts to reduce the capability for suicide. A method that may give rise to novel or additional information to help us understand how to detect, manage, and reduce suicide attempts is the use of "Big Data," defined as data sets that are high in volume, velocity, and variety (Gartner, 2012). Examples of potentially useful Big Data sets for suicide researchers include those from national census data (e.g., Data.gov, U.S. Census), national health data (e.g., HealthData.gov, National Comorbidity Survey), large-scale projects (e.g., Army STARRS), repositories (e.g., Amazon Web Services, Gapminder), and web traffic and use data (e.g., Facebook Graph API, Google Trends). The use of these data sets allows researchers both to expand beyond their online and laboratory samples and to test hypotheses using large, published data sets. Big Data allow researchers to use techniques such as text analytics, audio analytics, video analytics, social media analytics, and predictive analytics to extract information, patterns, and relationships (for more information, see Gandomi & Haider, 2015). These results can then be used to examine potential differences in suicide between different states (Anestis et al., 2015) and countries (Goodwin, Wessely, & Fear, 2015), refining algorithms to improve the prediction of risk (Potash, 2015), identifying warning signs

for individuals at risk for making an attempt, and much more. Furthermore, the use of Big Data may inspire the development of online- or app-based interventions which may then extend the reach of suicide interventions to include populations that have not been seeking treatment on their own. An ongoing example of the potential for such work can be seen in Therapeutic Evaluative Conditioning (TEC; Franklin, Fox, et al., 2016; Franklin, Ribeiro, et al., in press). A mobile phone app aimed at adjusting the nature and valence of an individual's association with suicidal behavior, TEC has shown promising results in reducing such outcomes in three separate randomized controlled trials with limited demand on users, thus highlighting the potentially transformative role for technology in addressing the national suicide rate. Caution is still advisable with tools like TEC, as the effects of the treatment did not remain after the acute treatment phase and no new coping skills are introduced to replace self-harming behaviors; however, if capability is the primary target in such treatments, the provision of new coping skills may not prove necessary.

The development of capability to make a suicide attempt may also be addressed from adequate prevention efforts. Providing education regarding suicide and mental health can decrease the stigma associated with suicide as well as increase the availability of knowledge and resources accessible to individuals thinking about suicide and those who are in a position to help. More importantly, teaching effective coping skills may reduce the likelihood that an individual will use painful and provocative coping strategies to manage difficult emotions, thereby preventing one avenue for the acquisition of capability for suicide. The knowledge and ability to practice effective coping strategies may also protect individuals who have developed the capability for suicide through other avenues (e.g. career-related training, life experiences) from using their existing capability for a suicide attempt. Programs that provide education on suicide prevention and effective coping skills can be provided in various institutions and settings for individuals of all ages. In particular, the provision of school-based prevention programs teaching children effective strategies to tolerate distress and cope with emotions early in their development will likely be beneficial in reducing suicidality in the years to come. This point is consistent with the robust research base supporting the utility of treating NSSI as a suicide prevention tool. Repeated use of NSSI has been shown to contribute to both suicidal desire (Assavedo & Anestis, 2015) and the capability for suicide (Franklin, Hessel, & Prinstein, 2011) and as such, an early effort to cease NSSI behaviors may serve to reduce or at least diminish the rate of increase in the capability for suicide within a vulnerable population (Hawton, Witt, Taylor Salisbury, Arensman, Gunnell, Hazell, et al., 2015; Hawton, Witt, Taylor Salisbury, Arensman, Gunnell, Townsend, et al., 2015; Hawton et al., 2016; Owens, Horrocks, & House, 2002).

Overall Summary

Although there have important advances in our understanding of the factors contributing to suicidality and a strong, steady development of evidence-based treatments for suicidality, the national suicide rate continues to rise, signaling a need for a shift in our approach to suicide prevention. Successful social changes associated with other substantial public health concerns (e.g., HIV, lung cancer, and motor vehicle accidents) have shown that prevention efforts are most effective when they are multifaceted and extend beyond treatments for those who are already afflicted with the negative outcome. These efforts have focused largely on impacting the potency and availability of means that are often implicated in the development of the negative outcome, shifting cultural views on the outcomes, providing education regarding how the outcomes can be avoided, and changing laws associated with relevant outcomes (e.g., click it or ticket, information campaigns on the

dangers of smoking). Similar population-level prevention efforts could be impactful with respect to suicide, with a heavy focus on diminishing risk through decreasing access to and increasing safe storage of lethal means (e.g., firearms). As such, we propose that these accomplishments in reducing other public health concerns can serve as models for reducing deaths by suicide, a pressing current health concern that has not waned despite the depth and breadth of work that has been put forth.

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Manuscript Received: December 15, 2015
Revision Accepted: June 28, 2016