

# Suicide in Older Adults: The Role of Emotions and Cognition

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**Abstract** Suicide in older adults is a significant clinical concern. In this review of recent findings, we concentrate on the role of emotions and cognition in suicide risk and behavior in older adults. We discuss the epidemiology of suicide in older adults, integrate recent findings on non-psychotic major depression, schizophrenia and suicidal ideation, explore the relationship of emotion regulation with suicide, present recent advances on suicide in demented patients, and describe the latest developments on cognition and decision processes in suicide.

**Keywords** Suicide · Older adults · Suicidal ideation · Emotion regulation · Decision making · Cognitive control deficits · Major depression · Schizophrenia · Dementia · High lethality

## Introduction

Suicide is a major public health concern with devastating effects on families and the community. There were 39,518 suicides in the US in 2011, an average of 108 suicides per day. A workshop in 2008 supported by the National Institutes of Health and the American Foundation for Suicide Prevention

(AFSP) reviewed and summarized research on the impact of suicide on family members and social networks [1]. Suicide survivors need to deal with the aftermath of the suicide, feelings of guilt, blame, helplessness, despair, and tension within the family. Survivors are also at high risk for mental disorders and for future suicides [1].

Our review focuses on suicide in older adults, whose suicide rates are alarmingly high. It highlights new avenues of investigation and does not intend to be comprehensive. To better understand the processes that lead to suicide, we also explore recent research on the role of emotions, cognition, and decision making in suicide in the elderly. This understanding may help design interventions to reduce modifiable risk factors for suicide and non-lethal attempts, which is an NIMH research priority [2].

## Epidemiology of Suicide in Older Adults

According to the Center for Disease Control, the suicide rates in all ages in the US have steadily increased from 2000-2011, reaching 12.7/100,000 in 2011 [3]. Among different age groups, the suicide deaths of adults aged 50-74 years old almost doubled from 2000 to 2011, while the highest risk group for suicide is still older white males 85 years or older (Suicide rate in 2011: 47.3/100,000). The increase in suicides of 50-74 year old adults may be a cohort effect, since “baby boomers” have traditionally higher rates of suicide than earlier or subsequent birth cohorts [4]. Therefore, we may expect the suicide rates of older adults to increase as this cohort becomes older. Taken together, these statistics highlight the importance of understanding and preventing suicide in middle-aged and older adults.

Gender and race differentially affect suicide risk and behavior. Men have fewer [5] but more medically serious suicide attempts, report stronger suicide intent and use more lethal

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means, including hanging and use of firearms [6, 7]. In a recent systematic review, suicide behavior is differentially affected by gender and marital status [6]. Even though married men and women have the lowest suicide risk, marital status influences suicide rates of men and women differently; widowed men had 3.3 times as high suicide risk as married men whereas married and widowed women had comparable rates [6]. The highest rates of suicide in women were for divorced or separated women and the lowest was for married women [6, 8]. Regarding race, Caucasians have the highest suicide rates [4], while Asians and Caucasians have the highest rate of suicidal ideation and African-Americans the lowest [9].

### Recent Findings on Major Depression, Schizophrenia, and Suicidal Ideation

**Major Depression** Psychiatric disorders are present in most suicides, and in some studies they have been identified in up to 97 % of suicide deaths [4]. Mood disorders and especially major depression are the most consistently found psychiatric illnesses in suicide completers, with psychotic and anxiety disorders at lower risk [4]. In the National Epidemiologic Survey “On Alcohol and Related Conditions (NESARC) Wave 1 Study” on older patients with major depression, 42 % felt that they wanted to die, 25 % thought a lot about suicide, and 4.7 % attempted suicide [10].

Suicide rates in middle-aged and older patients who are on antidepressants vary with age and gender [11, 12]. The mean suicide rate in a Danish cohort of men and women aged 50-59 who redeemed antidepressant prescriptions is 185 and 82 per 100,000 respectively, whereas for men and women aged 80 years old and older it was 119 and 28 per 100,000 [12]. Whereas suicide rates in both men and women who redeemed antidepressant prescriptions decreased by 2 and 3 % respectively for any additional year of age, suicide rates in patients who were not on antidepressants increased from 28 in 100,000 (50-59 years old) to 68 in 100,000 (80 years old and older) [12]. The results were similar for SSRI's, TCA's and other types of antidepressants. The study did not examine the efficacy of antidepressants and the findings need to be further explored, because a high proportion of older adults 80 years old and older have comorbid cognitive impairment, which is associated with poor or slow response to antidepressants.

**Schizophrenia** Suicide and suicidal ideation is prevalent in middle-aged and older adults with schizophrenia. Compared to a community sample of middle-aged and older adults without a history of schizophrenia or schizoaffective disorder, middle-aged and older schizophrenics have a higher prevalence of current (10 % vs. 2 %) and lifetime (56 % vs. 7 %) suicidal ideation, as well as past suicide attempts (30 % vs.

4 %) [13]. In a nationwide cohort study in Denmark, the relative risk for suicide for middle-aged and older adults with schizophrenia vs. those without schizophrenia is elevated in both men (RR=3.5 [3.0-4.2]) and women (RR=7.9 [6.6-9.5]). The suicide rate ratio of those adults with vs. those without schizophrenia declines with increasing age [14]. Risk factors for suicide for schizophrenic older adults include multiple hospitalizations, previous and recent suicide attempts, comorbid mood and personality disorders and substance abuse [13, 14]; specifically, the risk of suicide in those with dual diagnoses of mood disorder and schizophrenia is twice as high as those with diagnosis of schizophrenia alone [14].

**Suicidal Ideation** Suicidal ideation is a consistent predictor of suicide attempts and completed suicides [15]. Suicidal ideation expressed to health care providers is less frequent in older compared to younger adults [16], but the suicide rates in older adults are much higher than those in younger adults [15]. The rate of suicidal ideation in women is twice as high as in older men, even though the suicide rate for older men is much higher than older women [16]. The relationship of gender with suicidal ideation is more complicated, however, as gender interacts with age. In a study in Canada, women younger than 75 years were 1.6 times more likely to report suicidal ideation than women 75 years old or older, whereas men 75 years old or older were twice as likely to report suicidal ideation than men younger than 75 years old [17].

Suicidal ideation occurs mostly in the context of psychiatric illness. In the PRISMe Study (Primary Care Research in Substance Abuse and Mental Health for the Elderly), 46 % of patients with either depression or anxiety and 61 % of those with co-occurring depression and anxiety reported suicidal ideation, ranging from thoughts that life is not worth living and wishes of being dead to thoughts of killing oneself [9]. Major depression and generalized anxiety disorders are the strongest predictors of suicidal ideation in combat and non-combat older veterans, while PTSD is independently associated with both groups [18]. In depressed older adults, suicidal ideation is associated with higher severity of depression, previous suicide attempts, greater medical, and psychiatric comorbidity (i.e., panic disorder and alcohol abuse), loneliness, and lower subjective social support [19–21]. In a study of Korean elders, depression mediated the relationship of social support and low income with suicidal ideation [22]. The course of suicidal ideation in late-life depression is predicted by depression severity [20, 23], a previous attempt, and seriousness of suicidal intent [20]. Finally, persistent suicidal ideation is independently predicted by depressive symptoms and life stressors [24].

Suicidal ideation is associated with non-suicide mortality. Suicidal ideation at the beginning of a longitudinal study was associated with a 23 % increase in the risk of non-suicide

mortality, mainly cardiovascular deaths, within the ensuing 17 years after controlling for demographic variables, medical health, symptoms of depression and anxiety, and possible dementia [25]. The Prevention of Suicide in Primary Care Elderly: Collaborative Trial (PROSPECT) documented that older adults with a “wish to die” receiving Usual Care, but not to the PROSPECT intervention, were 1.6 to 1.7 times more likely to die within the following 5 years, independent of their depression status (no depression, minor or major depression) [26].

Suicidal ideators may differ from suicide attempters. Compared to middle-aged and older inpatient suicide ideators, middle-aged and older suicide attempters have lower social support, an older age of onset of mood disorders ( $\geq 46$  years), and lower incidence of pharmacotherapy during the index episode [27]. Compared to inpatient and outpatient non-attempters, older adults who attempted suicide had an earlier age at onset of depression, greater number of depression episodes, more severe depression, greater number of psychotic symptoms and more left-sided white matter lesions [28].

## Dementia and Suicide

Suicide in dementia is under-investigated and reports on suicide risk and behavior in demented patients are inconclusive. In a recent study of demented older adults in VA healthcare settings, there were 81 suicides per 100,000 subjects [29]. In a large longitudinal study in Denmark, adults aged 50–69 years old with dementia had an eight fold higher risk of suicide than those without dementia, whereas the risk decreased in those aged 70 years old and older (threefold higher suicide risk) [30]. In a study comparing patients with early semantic dementia (N=25) and those with Alzheimer’s disease (N=111) [31], five patients with semantic dementia had suicidal behavior and two of those committed suicide, whereas only one patient with Alzheimer’s disease attempted suicide but did not kill himself. Three patients with semantic dementia and suicidal behavior had a history of suicidal behavior prior to the dementia diagnosis. Patients with semantic dementia and suicidal behavior had more depression and greater insight into their deficits [31].

The methods of suicide in demented patients differ in reports from the US vs. the UK. In a study of US veterans with dementia who died by suicide (99 % males) [29], the preferred methods were firearms (72.6 %), self-poisoning and hanging (9.5 % each), sharp object (2.9 %), jumping from a high place or moving object (2.4 %), and drowning (1.2 %). In a study of suicide completers (53 % males) who were diagnosed with dementia in England and Wales [32], the preferred methods were self-poisoning (28 %), drowning (19 %), hanging (17 %), and jumping (8 %); firearms were used in less than 1 % of suicides.

Suicide declines with increased cognitive impairment, but there are conflicting reports on whether recently diagnosed demented patients are at higher risk [30, 32–34]. The presence of a major depression in these patients may contribute to increased suicide risk [35]. Predictors of suicide in older VA patients suffering from dementia include white race, depression, history of inpatient psychiatric hospitalizations and prescriptions for antidepressants and anxiolytics, whereas nursing home stay was associated with lower suicide risk [29].

Suicidal ideation occurs in about 40 % of older adults with major depression and of cognitive impairment, ranging from mild cognitive deficits to moderate dementia [36]. Suicide intent in cognitively impaired older adults may also be expressed as passive self-harm behaviors, including refusal to eat, drink or take medications [37]. Future research needs to focus on these passive self-harm behaviors that are more prevalent in demented patients, are unlikely to be recorded as suicides, and are associated with mortality [27, 33].

## Emotion Regulation and Suicide

Negative emotions (including sadness, hopelessness, anxiety, guilt, worthlessness, anger, and irritability) and lack of positive emotions (anhedonia, apathy) are common in psychiatric disorders but may also present in the absence of a clinical diagnosis.

Most studies on the relationship of negative emotions and suicide in older adults focus on hopelessness. Hopelessness is a risk factor for both suicidal ideation and behavior in older adults [23, 38–42]. Correlation rates of hopelessness with suicidal ideation range from 0.5 to 0.7. Suicide attempters express greater hopelessness after remission of depression than suicide ideators and non-suicidal patients [42]. Taken together, these findings highlight the importance of hopelessness as a proximal risk factor for suicidal ideation and suicidal behavior in older adults.

In addition to hopelessness, other negative emotions have been associated with suicidal thoughts and behavior. In a study of suicide attempters vs. non-attempters, suicide attempters reported lower positive emotions than non-attempters, with anxiety being the most significant emotional predictor of suicide attempts [43]. Within the group of attempters, higher negative emotions, including anger and guilt, and lower positive emotions were associated with a greater number of attempts [43]. In depressed older adults, guilt and worthlessness were associated with over six times greater odds of having suicidal ideation [44]. Reduction of negative emotions (such as depression, pessimism, anxiety, self-reproach) preceded and predicted a reduction in suicidal ideation in older adults with major depression, cognitive

impairment, and disability receiving home-delivered psychosocial treatments [36].

Maladaptive emotion regulation is a suicide risk factor in older adults. Elevated emotional coping (including emotion regulation strategies such as ruminating, blaming oneself, and venting of negative emotions), avoidance coping and thought suppression is associated with increased suicide risk beyond depressive symptoms [15]. Problem- and emotion-focused coping is associated with reasons for living and reduced suicidal ideation [45]. Patients with low extraversion and high neuroticism, variables associated with maladaptive emotion regulation, distinguished suicide attempters from non-suicide attempters [46]. Emotional interference when making decisions responding to stress may increase the risk for suicide behavior [47]. Cognitive impairment may also interfere with older adults' ability to regulate emotions. Depression and hopelessness mediate the association of cognitive impairment with increased suicidal ideation suggesting that cognitively impaired older adults may have difficulty modulating negative emotions and, as a result, become suicidal [39].

The high co-occurrence of negative emotions with diagnoses of depression and anxiety disorders calls for research to examine whether negative emotions in the absence of psychiatric diagnoses constitute a risk for suicidal ideation or behavior. Separating the effects of negative emotions from the effects of other depression and anxiety symptoms is challenging because negative emotions may have a direct and indirect effect on other depression and anxiety symptoms, such as somatic, cognitive, and vegetative symptoms.

### Cognition and Decision Processes

Suicide is a heterogeneous behavior resulting from a convergence of individual vulnerability, state related brain changes, and environmental pressures. Neither the traditional medical model, which emphasizes the role of psychopathology (especially depression, psychosis, and alcohol and drug abuse), nor the psychosocial models that emphasize the role of social isolation and burdensomeness adequately explains the age-related increase in suicide rates. Accelerated age-related cognitive changes may contribute to the inability to solve problems, and to the ultimate decision to take one's life. The importance of different vulnerability factors relative to suicidal behavior may change across the lifespan. Decision making deficits due to cognitive decline, and in particular poor cognitive control, are more common in old age, while the pathway involving impulsive aggression is more common in young adulthood [48].

An emerging literature suggests that the tendency to make disadvantageous decisions is the link between some aspects of the diathesis and suicidal behavior. Extending the stress-diathesis model originally described by Mann [49], Szanto

and colleagues propose that the trait-like diatheses — impaired cognitive control, deficits in social processing, and impulsivity — are expressed in poor decisions.

### Decision-making Biases as a Link between the Stable Diathesis and the Suicidal Crisis

Impaired decision-making on the Iowa Gambling Task has been reported in euthymic younger suicide attempters with mood disorders. In particular, suicide attempters failed to switch from high-initial payoff, high-loss options to low-initial payoff, long-term winning options [50]. In a similar decision-making task without working memory demands (Cambridge Gambling Task), older suicide attempters exhibited impaired performance compared to depressed non-suicidal and healthy controls [51]. While these findings support the notion of altered decision making in suicide attempters, the mechanisms of impairment on such a complex task remain unclear.

### Cognitive Aging, Decision Processes, and Suicidal Behavior

Population studies have linked poor cognitive abilities [52, 53] to suicidal behavior. It remains unclear to what extent accelerated cognitive aging explains higher suicide rates in older adults [34]. There may be a certain phase of cognitive decline or a particular cognitive profile that predisposes one to suicidal behavior. For example, a Danish population study found a marked increase in suicide rates in dementia patients after an inpatient admission [30]. It is likely that age-related neurodegenerative and vascular changes [54, 55] modify older adults' vulnerability to suicide. The ability to make cognitively demanding decisions declines in old age even in non-demented elderly [56]. Older adults are more likely to be the victims of misleading advertising or other scams, and also make less advantageous decisions in the laboratory than younger individuals [57, 58]. This is partly explained by an age-related decline in cognitive control [59], related to the disproportionate effect of aging on the prefrontal cortex [60].

### Cognitive Control Deficits and High-lethality Suicide Attempts

Deficits in cognitive control represent the most consistent finding in both middle-aged [61–65] and older [66–68] suicide attempters, as well as in euthymic first-degree relatives of suicide victims [69]. Interference control (active suppression of task-irrelevant processing) is very sensitive to aging and has been linked to attempted suicide [68, 70, 71], in particular to



higher lethality suicide attempts [61, 62, 70]. Another basic deficit in cognitive control, which undermines decision-making in complex environments, is linked to high-lethality suicide attempts [67]. Using a probabilistic reversal learning task, we have also found that older suicide attempters showed deficits in learning compared not only to depressed non-suicidal patients, but also compared to suicide ideators [72]. It is unclear, however, whether these deficits are selective, and whether attention and working memory are also affected [62, 73]. Poor decision making can result from several distinct decision-making biases, suggesting the existence of different pathways en route to suicidal decisions, one of which has been linked to impulsivity.

### Decision-making Deficits Related to Impulsivity in Late-life Suicide

Impulsivity is a complex, multidimensional construct [73–75] inclusive of several components: response initiation prior to complete processing (lack of premeditation), response inhibition (ability to cease or delay an action), and myopic choice (the preference for immediate reward over larger delayed reward) [76, 77]. Risk-taking impulsivity is also often considered as a separate component. It is possible that the importance of these components vary across the life-cycle in suicidal individuals, given the larger co-occurrence of substance abuse and conduct disorder in younger compared to older suicide attempters. Using Kirby's Monetary Choice Questionnaire [78], Dombrowski and colleagues [79] found that the preference for immediate reward over larger delayed reward differentiated between low lethality (mostly impulsive) and high lethality (mostly premeditated) suicidal acts. We have also reported that older suicide attempters neglected key information when making decisions [80•], linking specific decision making patterns to low-medical lethality, poorly planned attempts [79, 80•]. The neural expression of cognitive control deficits and impulsive traits and their consequent effects on decision-making that may facilitate suicide are only beginning to be understood [80•].

### Social Cognition and Social Decision Making

Abnormal responses to social stimuli had been described in younger people vulnerable to suicidal behavior [81]. Lack of feeling connected to others [82] and poor social problem solving [83] can amplify the risk for suicide. Szanto and colleagues reported that older suicide attempters committed significantly more errors in social emotion recognition and showed poorer global cognitive performance than elders with no psychiatric history [84]. Attempters had restricted social networks: they were less likely to talk to their children, had

fewer close friends, and did not engage in volunteer activities, compared to non-suicidal depressed elders and those with no psychiatric history.

Economic bargaining games can model social influences on decision-making. Using an economic bargaining game that involves unfairness (the Ultimatum Game), Szanto and colleagues showed that high-medical lethality suicide attempters, had disadvantageous tendencies in resolving conflicts on this game [47]. In contrast to the control groups and low-medical lethality suicide attempters, they did not adjust their responses to unfairness based on the money at stake. One of the deficits that may contribute to these patterns of suboptimal social decision-making is interference of emotions with reward prediction. Indeed, maladaptive interference of social emotions in striatal reward responses during an economic exchange have been described [85].

### Conclusion

Suicide in older adults is a major public concern, as the suicide rates in this population are alarmingly high. Compared to the suicide rate in the US in all ages (Year 2011: 12.7/100,000), the suicide rate for 85 year old or older white males is almost four times higher (47.3/100,000). Investigating the role of emotions, cognition, and decision making in suicidal behavior will help identify modifiable risk factors.

For example, the stress-diathesis model of suicide emphasizes the importance of the individual's diathesis as the target for both detection of risk and therapeutic interventions. Over the last decade there has been an accumulation of evidence that understanding cognitive deficits and decision processes associated with suicidal behavior and their relationship to other risk factors may help to identify people at risk for suicide, and facilitate the development of individualized treatment strategies. Extending the stress-diathesis model, Szanto and colleagues propose that the trait-like diatheses — impaired cognitive control, deficits in social processing, emotion dysregulation, and impulsivity — are expressed in poor decisions. Deficits in the proposed domains may contribute to suicidal behavior. Personalized treatment may reduce suicide risk and behavior by intervening in these domains [86•].

### Compliance with Ethics Guidelines

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