Frailty and Suicidality in Older Adults: A Mini-Review and Synthesis

Jaffer Shah\textsuperscript{a,h}, Omneya A. Kandil\textsuperscript{b}, Mohamed Mortagy\textsuperscript{c}, Aya Abdelhameed\textsuperscript{d}, Asghar Shah\textsuperscript{e}, Michael Kuron\textsuperscript{f}, Yasser Omar Abdellatif\textsuperscript{g}

\textsuperscript{a}New York State Department of Health, New York, NY, USA; \textsuperscript{b}Faculty of Medicine, Alexandria University, Alexandria, Egypt; \textsuperscript{c}Department of Internal Medicine, New Giza University School of Medicine, New Giza, Egypt; \textsuperscript{d}Department of Internal Medicine, Faculty of Medicine, Alexandria University, Alexandria, Egypt; \textsuperscript{e}Division of Biology and Medicine, Brown University, Providence, RI, USA; \textsuperscript{f}Department of Biology, University of Virginia, Charlottesville, VA, USA; \textsuperscript{g}Center for Global Health Science and Security, Georgetown University, Washington, DC, USA; \textsuperscript{h}Medical Research Center, Kateb University, Kabul, Afghanistan

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Abstract
The prevalence of frailty, which is significantly associated with late-life suicidality, increases with age in older adults. This review addresses the compiled evidence on the relationship between suicidality and frailty within older populations, explores the latest findings, weighs the effectiveness of various intervention strategies, and outlines potential future investigations in this area. Growing evidence suggests that identifying and addressing risk factors, including mood disorders, prior suicide attempts, poor physical health, and social isolation/problems can decrease the risk of late-in-life suicide. Various studies have shown that interventions such as diet improvements, cognitive training, psychosocial programs, and depression medication could reduce the severity of frailty and suicidality, with physical exercise being the most effective intervention. Combined programs with multiple interventions can have an even greater impact on combating depression, lowering risk of falls, and improving gait speed in older adults.

Introduction
Advances in medicine and public health over the last century have paved the way for a drastic increase in life expectancy, and thus have increased the population of older adults across the globe [1]. Extensive research has shown that frailty, a condition of increased vulnerability to adverse health outcomes, is widespread among older adults. The risk for clinical diagnosis of frailty increases considerably with age and is associated with negative health outcomes. These include: increased risk of early mortality, falls, elevated medical costs, increased risk for hospitalization, and nursing home admission [2–5]. Suicidality is another major health concern associated with adverse health outcomes among the older adult population. In particular, the highest rate of suicidality is observed between the ages of 70 and 79 [6], though currently, studies examining the relationship between suicidality and frailty in older adults are scarce. In this review, we focus on what is known about the relationship between suicidality and frailty in older adults by highlighting the current perspectives, evaluating the recent findings, and exploring areas for further interventions and research. To this end, we start with: (a) func-
tional definitions of suicidality and frailty; (b) measurement tools used to assess frailty; (c) estimates of the prevalence of suicidality in frail older adults; (d) correlation and impact of suicidality on frail individuals; (e) potential theoretical pathways linking frailty and suicidality; and (f) intervention strategies for reducing suicidality by meeting the specific needs of frail older adults.

**Conceptualization of Suicidality and Frailty**

Although definitions of suicidality vary across cultures, a 2018 meta-analysis found four key features that are used to qualify an act as suicide: agency, knowledge of a fatal outcome, intent to achieve death, and outcome of death or irreversible harm [7], while the American Psychological Association extends the definition of suicidality to include suicidal ideation, or the act of thinking about or planning one's suicide [8]. In summary, suicidality is broadly defined to encompass suicide ideation, suicide attempts, and completed suicides [9].

Various definitions of frailty have been proposed over time. An early definition of frailty was provided by Fried et al. [10] as “a biologic syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, and causing vulnerability to adverse outcomes.” A review published by Lancet in 2013 defined frailty as “a state of vulnerability to poor resolution of homeostasis following a stress and is a consequence of cumulative decline in multiple physiological systems over a lifespan” [11]. In 2013, six international scientific societies agreed to define frailty as a syndrome with several contributors, characterized by decreased endurance, strength, and physiologic function, which increases an individual’s vulnerability for dependency and/or death [12]. In a subsequent meeting held in 2016 by the World Health Organization, an international group of experts in the field of aging defined frailty conceptually as “a clinically recognizable state in which the ability of older people to cope with every day or acute stressors is compromised by an increased vulnerability brought by age-associated declines in physiological reserve and function across multiple organ systems” [13].

**Measurement of Frailty**

Multiple tools have been developed to measure frailty, such as the Frailty Phenotype by Fried, the Frailty Index by Mitnitski, Rockwood’s Clinical Frailty Scale, Mossello’s INTER-FRAIL, and Gobbens’s Tilburg Frailty Index [14]. Among these tools, the Frailty Phenotype created by Fried and colleagues, which is based on five signs and symptoms, is perhaps the most widely used. It gathers five parameters – gait speed, involuntary weight loss of ten pounds or more in the last 6 months, self-reported fatigue and diminished activity, and grip strength – all of which appear to have the closest association to clinically reduced physiological function in a longitudinal Cardiovascular Health Study on 5,317 elders of 65 years. The Frailty Phenotype classifies the patient into one of three categories: robust with no abnormalities, prefrail with two or fewer abnormalities, and finally frail with three or more items outside of the normal range. This approach considers frailty to be the result of progressive physical and/or cognitive impairments due to physiological and metabolic changes [3]. A study was performed with multiple correspondence analysis to investigate relationships between frailty’s five components among participants with a mean age of 88. The study identified two main features of frailty, the distinguishing of which is essential for tailoring interventions for individual subjects [15]. One relates to functionality based on weakness, low physical activity, and slowness. The other relates to intrinsic conditions, including unintentional weight loss and exhaustion. Methods of measuring functionality are potentially more modifiable than unintentional weight loss and exhaustion from the intrinsic dimension. Although some studies have investigated the Frailty Phenotype’s ability to predict mortality and disability, they did not investigate the contribution of each of the Phenotype’s components to the condition and how they interrelate with each other [16]. Mitnitski’s Frailty Index is an accumulation of deficits model, which deals with aging as a continuous process, describing frailty as a collection of behaviors, signs, and limitations that increase with age and lead to poorer health status. Through this approach, each of these signs or behaviors is dichotomized as present or absent. The number of deficits present is then divided by the total number of deficits assessed to yield the Frailty Index, ranging from 0 to 1. Results above 0.7 are not encountered often [17]. Regarding differences between their clinical applications, the Fried phenotype only requires simple equipment, while calculating the Frailty Index requires a comprehensive assessment. Despite appearing dissimilar, there is actually an overlap between the results of the two approaches, as an individual’s Frailty Index score translates to the proportion of potential deficits present in him/her [18].

Novel screening tools could be employed at primary care centers to detect those who require further evalua-
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Frailty and suicidal ideation are significantly associated with suicide ideation, which they assessed by evaluating current suicidal ideation (Geriatric Suicide Ideation Scale [GSIS]). The GSIS contains a total and subscale score, which includes both suicide ideation and death ideation. The suicide ideation subscale ranges from 5 to 50, with higher scores reflecting greater active suicide ideation. An asset of the study is that it weighed the contribution of each component of the Frailty Phenotype to suicide ideation; they found that lower performance on frailty measures of gait speed and muscle weakness was significantly associated with a rise in levels of suicidal ideation [30]. Another study reported suicidal ideation among 17.9% of participants classified as frail, as well as a relative risk of 2.4 between being classified as frail and the patient’s wish that he or she would rather be dead in the preceding month [31].

In China, suicidal ideation was assessed among a total of 2,549 adults above 60 years, using questions from the National Comorbidity Survey. Cognitive frailty was measured by the Fried Frailty Phenotype and Mini Mental State Examination. The investigators concluded that participants with cognitive frailty were more likely to suffer from suicidal ideation [32].

Correlation and Impact of Suicidality in Frail Individuals

There are several factors that contribute to suicidality in frail individuals. These factors include mood disorders, previous suicide attempts, poor physical health, social isolation, social problems (such as divorce), and environmental conditions in nursing homes.

A cohort study conducted in Western Australia revealed that cognizance of mood disorders and previous suicide attempts that lead to poor physical health is crucial for the identification of suicidality in frail elders [33]. A case control study showed that 8.1% of elderly individuals who committed suicide were functionally impaired from psychiatric disorders, mainly depression [34]. An observational study measured the severity of depression using the 24-item Hamilton Depression Rating Scale (HDRS-24) found that suicidal ideation is significantly related to frailty and both subjective and objective measures of functional impairment, regardless of depression severity [30]. When gait speed was measured by a timed walk test, it was shown that decreased gait speed is associated with suicidal ideation.

Due to current social stigmas regarding mental health conditions and suicidality, suicidal older adults prefer to communicate with family and friends about their intentions, and only one-third of older adults suffering from common psychiatric conditions, such as depression,
seek help from a mental health professional [30], whereas nearly 45% visit their primary care physicians within a month of attempting suicide, and it has been shown that 19%–60% of older individuals who committed suicide lived alone at the time of death [30, 35, 36]. Previous literature has suggested that the gender difference in elderly suicide rates is a result of differences in coping techniques, as women learn flexibility more often than men, which presumably makes them better survivors [37].

Analysis of 1,080 long-term care facilities identified staff turnover, size of facility, auspices (private, church, public, or other), and per diem cost as four major environmental characteristics leading to suicide in frail residents [38]. Nursing home placement anxiety has also been identified as a risk factor for suicide in the elderly. Eight out of 60 people said they would rather die than be admitted to a nursing home [39], and indirect self-destructive behavior in nursing homes, such as refusing to eat or take prescribed medication, is considered to have a direct suicidal potential. An observational study investigated a sample of 99 frail male elderly nursing home patients using an ISDB rating scale. Patients reported being unsatisfied with the treatment programs that had a poor prognosis for discharge. Thus, the incidence of indirect self-destructive behavior was high [40].

**Theoretical Pathways Linking Frailty and Suicidality**

Bickford and colleagues posit a relationship between physical weakness (i.e., frailty), mood perception, and suicidal thought [30]. As such, there exists a process whereby the link between disability burden, as a result of frailty, and suicidal ideation may be a mutually reinforcing process of decline [2]. A decline in cognitive control results in a poorer ability to regulate emotions, thoughts, and actions [41], and there is literature that indicates that impairments in cognitive control, and thereby regulation of actions and thoughts, along with the ability to be flexible, may contribute to suicide among depressed people [42]. Furthermore, impairments that have resulted in suicidal behavior were those that hindered the individual’s independence and sense of utility, value, status, and/or enjoyment of life [43], which has been further studied in a conceptual model created by Cheung and colleagues [44]. This model, called the “physical illness-suicidal behavior conceptual model,” is dependent on: (1) reduced functional capacity and (2) reduced quality of life, both of which are negatively associated with physical impairment. In this model, depression interplays with functional and physical impairment, quality of life, and developing a sense of hopelessness, and may cause physical illness and reduce quality of life, while physical illness, in turn, may heighten the risk of depression. Furthermore, the model postulates that resilience, coping strategies, and social support moderate suicidal behavior. The primary merit of this model that distinguishes it from other models of suicidal ideation and behavior is that it accounts for the intersection of impaired functioning and resources among older adults for quality of life, depression, and individual resilience.

**Interventions to Prevent Frailty and Suicidality in the Geriatric Population**

Many interventions exist for the prevention of frailty and suicidality in the elderly population, such as exercise, nutrition, cognitive training, and psychosocial programs, as well as programs that encourage a combination of these interventions [45, 46]. Most randomized control studies exclude older patients with serious or unstable comorbidities, resulting in limited evidence to guide treatment for this demographic [47].

**Exercise**

Studies have found exercise to be the most effective intervention in decreasing frailty and increasing quality of life, and the second most effective intervention in improving cognition and lowering depression in the elderly population [48], as well as suggesting that exercise may be effective at lowering rates of suicidality and frailty in geriatric populations [49]. The LIFE study administered a physical activity program that consisted of a combination of walks at moderate intensity, resistance exercises, balance, stretching, and behavioral counseling. The incidence of major disability was lower after 1 year of follow-up [50]. The most recent recommendations advise people of all ages to spend a minimum of 30 min on moderate-intensity physical activities on most days of the week [51]. It is recommended, however, that such programs pay particular attention to the safety of the activities, as physical exercise in frail elders is associated with adverse effects, including shoulder pain, back pain, muscle aches, falls, and fractures [45].
Nutrition

The PROT-AGE group recommends that the optimal protein intake in older frail adults should be 1–1.2 g/kg/day [52]. The average resting energy expenditure for elderly people is 25 kcal/Kg/day, which could be increased to 32.5 kcal/Kg/day when accounting for normal physical activity [53]. A Mediterranean diet, for example, could therefore reduce the prevalence of frailty [54].

Research shows there to be nutritional associations with suicidality as well. For example, one team found a relationship between low levels of serum cholesterol concentration and a high risk of committing suicide, implicating diet as being a factor in the development of suicidal tendencies [55]. This is not conclusive, however, as another study found no significant difference in macronutrient intake between individuals that have attempted suicide and those who have not. Though its researchers did find that those who had previously attempted suicide had overall lower energy percentages from polyunsaturated fats and a lower dietary fiber intake than those who have not attempted suicide [56]. Therefore, more research could lead to potential dietary interventions for suicidality in older adults.

Group Sessions and Cognitive Training

Group sessions focusing on the process of aging and personal health administered to older adults resulted in a delay of progression of tiredness in daily activities for up to 1 year [57]. Special cognitive training programs, ones designed to stimulate memory, attention, information-processing, and problem-solving abilities, reduced the frailty score successfully [58]. Similarly, in older adults, social participation and feelings of social support have been found to be associated with a decrease in suicidal ideation [59]. These findings emphasize the effectiveness of group sessions and the importance of social support in the prevention of frailty and suicidality within the geriatric population.

Medication Management for Depression and Sarcopenia

Medication management is the most effective intervention for cognitive frailty and depression [45]. Currently, there are no FDA-approved agents for the treatment of sarcopenia, although there are many herbal compounds that are postulated to show modest effects on skeletal muscle. However, the data supporting efficacy with potential drug interactions and adverse reactions is limited [60].

Depression and Suicide Prevention

The IMPACT and PROSPECT trials [61, 62] showed that a primary care setting could be used to effectively reduce depression and suicidality and improve quality of life in elderly populations by offering a program that consisted of receiving support from depression care managers who offered education about treatment options, brief psychotherapy, close monitoring of depression symptoms, and medications, with regular follow-up sessions with patients. Other programs could possibly reduce depression and suicidality, such as community-based outreach and telephone counselling [63, 64]. Social connectedness through community engagement is also important for physical health enhancement, decreasing suicidality, and decreasing depression symptoms [65]. Multidisciplinary protocols for direct intervention by social workers, nurses, and psychologists showed a decrease in suicidal ideation and lower rates of major depression [66], and efforts to offer psychosocial counselling to patients who had attempted suicide showed a decrease in suicide deaths for up to 18 months after discharge from the emergency department [67].

Combined Interventions

A multicenter randomized control study was done to assess the effectiveness of combined interventions composed of a cognitive stimulation program and a physical exercise program. The combined program reduced depression and risk of falls, as well as improved gait speed [6].

Conclusion and Future Directions

The accumulated literature supports a link between frailty and suicidality among older adults. Researchers are identifying multiple risk factors that can lead to a high prevalence of suicide ideation. Mood disorders, previous suicidal attempts, poor physical health, social isolation, and nursing home placement anxiety are among the factors that influence late-in-life suicidality. Published studies drew theoretical pathways linking frailty and suicidality, which include physical illness, loss of functioning,
pain, depression, decreased quality of life, and the wish of death. Interventions, and the combination thereof, have been proven to be effective in reducing frailty and suicidality among older adults, and just as pertinently, the causes of frailty and suicidality, such as depression and physical impediment.

Despite the published studies, however, more evidence is needed to evaluate the causality between facility and late-life suicide. Future analyses should explore other social and health factors that can influence frailty-related suicide ideation among various age groups. Additional randomized control studies are needed to examine more effective interventions and to the extent to which the mental and medical services can both collaborate to detect and respond to this issue among high-risk populations.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Jaffer Shah designed the project, came up with the main conceptual ideas, and supervised the work. All authors contributed to the writing of the manuscript, provided critical feedback, and helped shape the topic and manuscript.

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