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Case-control study of suicide attempts in the elderly

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ABSTRACT

Background: Prior studies have inadequately explored the relationship between late-life suicidal behavior and subclinical/clinical symptoms. This study aimed to assess the risk associated with subclinical symptoms, mild cognitive impairment and clinical factors among late-life suicide attempters.

Method: Forty-three elderly patients aged 60 years and older who sought emergency services in a university-affiliated general hospital for attempting suicide and 43 comparison subjects participated in this study between March 2005 and December 2006. The comparison group was recruited by advertising in the community around the hospital. DSM-IV based diagnostic interview and screening instruments including the GDS, MMSE, BSRS-5 and APGAR were applied. Adjusted odds ratios were measured in the final multiple logistic regression model.

Results: Suicide attempters were more likely to meet a diagnosis of depressive disorder, after adjustments for BSRS-5 score and drinking habit. The adjusted odds of suicide among people with a BSRS-5 score of more than 5 points was 17.8 times higher than those with the BSRS score less than or equal to 5 points.

Conclusions: Our findings support the significant impact on late-life suicidal behavior from the assessment of subclinical symptoms, including anxiety, depression, hostility, sleep condition and interpersonal symptoms. The assessment of subclinical symptoms by the BSRS-5 may help in the future prevention of late-life suicidal behavior in primary care settings.

Key words: subclinical symptoms, late-life suicide, Brief Symptom Rating Scale

Introduction

Regardless of country, suicide rates are higher in the elderly than in any other age group (Pearson and Conwell, 1995; Bertolote, 2001). Because of its elevated rate and unique characteristics, late-life suicide is considered to be a major public health problem.

In order to determine suitable policy and specific strategies for intervention, it is important to identify risk factors associated with late-life suicide. Prior research indicates that the most salient determinant of a late-life suicide attempt is the diagnosis of major depressive disorder (De Leo and Ormskerk, 1991; Heikkinen and Lonnqvist, 1995; Harwood and Jacoby, 2000; Althaus and Hegerl, 2003). However, the symptoms of most older subjects do not meet the diagnostic criteria for a specific psychiatric disorder (Burke and Wengel, 2003). This makes identification of elderly persons at high risk of suicide more challenging for primary care physicians. Valid screening tools and an adequate knowledge about mental disorders are needed to evaluate suicidal risk in later life effectively.

Prior research shows that subclinical symptoms are significant because of their strong association with subsequent malfunctioning and suffering in the elderly (Lyness *et al.*, 2007). In the primary care setting, milder forms of depression are frequent precursors to more severe conditions (Moscicki and Caine, 2004). From a public health perspective, subclinical symptoms may serve as practical targets for early intervention if there is a link between late-life suicide and mild forms of mental disorders. However, none of the published studies on late-life suicide has specifically examined whether subclinical symptoms are independent risk factors for suicidal behavior.

The role of another factor, the diagnosis of dementia, in suicide attempts has long been debated. Some research supports the hypothesis that dementia is either a risk or a protective

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factor for suicide in the elderly, while other studies fail to demonstrate any association (Lyness *et al.*, 1992; Turvey *et al.*, 2002). One proposed explanation for its protective effect is that people with severe cognitive impairment lack the ability to perform suicidal acts, but people with mild cognitive impairments are still at risk (Chiu *et al.*, 2004). Nevertheless, prior studies inadequately explore the relationship between suicidal behavior and a mild level of cognitive impairment (Ayalon *et al.*, 2007).

This study aimed to compare the risk associated with clinical factors, as well as subclinical symptoms and mild cognitive impairment, in those who attempt suicide with the risk among controls. We examined the occurrence of mild cognitive impairment and subclinical symptoms among the elderly based on a case-control study design.

Method

The study subjects were patients aged 60 years and older who sought emergency services in a university-affiliated general hospital for attempting suicide between March 2005 and December 2006. Seventy-two elderly suicide attempters were identified during the study period, of whom 43 (60%) were included. The other 29 subjects were excluded because of a lack of contact information, refusal to participate, or their poor physical condition.

The comparison group was recruited by placing posters about the study in the community around the hospital. Those recruited were matched for age and randomly selected based on the enrolled date of cases. Those with a past history of suicide attempts were excluded. Eighty-six subjects, equally distributed between case and comparison groups, were included in the final analysis. After obtaining informed consent, we collected the following data from our subjects: demographic data, past history of physical problems, previous suicidal attempts and past history of mental illness.

Both groups were assessed by a qualified psychiatrist to determine a DSM-IV psychiatric diagnosis if necessary. In addition, the 15-item Geriatric Depression Scale (GDS-15), one of the most widely used instruments for the screening of depression in later life, was used to assess the severity of depression among suicide attempters and controls (Yesavage *et al.*, 1982). Based on literature, scores greater than five were defined as suggestive of depression and was considered an optimal cutoff point, yielding high sensitivity and specificity rates (D'Ath *et al.*, 1994).

In order to obtain a measurement of family function, individuals were asked to complete the family APGAR scale, which consists of five parameters: adaptability, partnership, growth, affection and resolve. The acronym "APGAR" is comprised of the first letter of each parameter. This instrument has been reported to be valid and reliable, and a score of less than six is generally defined as impaired family function (Smilkstein, 1978; Smilkstein *et al.*, 1982).

The 5-item Brief Symptom Rating Scale (BSRS-5) was composed of five symptom items, each of which had the highest correlation with the corresponding subscale score for Anxiety, Depression, Hostility, Interpersonal Sensitivity and Additional Symptoms including sleep disturbance, in the original version of BSRS-50. For example, the degree of distress from anxiety was assessed by the item "feeling tense or 'keyed up'". Response options ranged from 0 (not at all) to 4 (extremely distressed). The proposed cut-off score of 5 points for the total of all 5 items was used to identify persons with possible mental distress or subclinical symptoms. Cronbach's α coefficient, indicating the internal consistency of BSRS-5, was 0.84 (Chen *et al.*, 2005). All of the scores on the GDS, family APGAR scale and BSRS-5 were dichotomized in our study.

Two types of dementia screening tests, the Mini-mental state examination (MMSE) and Cognitive Abilities Screening Instrument – Chinese version (CASI), together with a diagnostic interview were used to assess the occurrence of impaired cognitive function (Teng *et al.*, 1994; Tsai *et al.*, 2004). These assessments and interviews were all completed one month after the indexed suicidal behavior and the subjects were asked to evaluate their condition before each suicidal act as completely as possible.

Statistical analyses, including χ^2 and t-tests, were undertaken to compare the case and comparison group. Potential significant factors related to elderly suicide in univariate analysis were identified as being significant at $p < 0.15$. Multiple logistic regression analysis was then employed to detect the significant factors and evaluate the individual impact of each factor on the occurrence of elderly suicide attempts. The significance level was defined as $p < 0.05$. Adjusted odds ratios were estimated in the final model. The project was reviewed and approved by the Ethics Committee of the Cardinal Tien Hospital.

Results

Demographic comparisons

Both the case and control groups comprised 43 participants. The mean age of the comparison group on interview was 78.6 ± 7.94 years (range 61–90 years) and was higher than that of the case group ($75.5 \pm$

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Table 1. Characteristics of late-life suicides (N = 43)

	NUMBER (%)
Suicidal methods	
Drug overdose	21 (48.8)
Sharp instrument	12 (27.9)
Drowning	4 (9.3)
Life stressors	
Health conditions	22 (51.2)
Parent-child relations	12 (27.9)
Affinity relations	12 (27.9)
Finances	6 (14.0)
Interpersonal relations	5 (11.6)
Reasons to suicide	
Depression	14 (32.6)
Family conflict	13 (30.2)
Long-term physical illness	10 (23.3)
Financial burden	5 (11.6)
Prior suicidal attempts	
Having a past suicidal history	23 (53.5)
< 2 years since first suicidal attempt	12 (27.9)
3–7 years since first suicidal attempt	4 (9.3)
Over 10 years since first suicidal attempt	7 (16.3)

8.67 years; range 60–92 years). Nonetheless, the age difference was not statistically significant. There was no difference in the gender ratio. Regarding educational attainment, the proportion of subjects with less than 6 years of education was 46.5% and 37.2% in the case and comparison groups, respectively, while the proportion of those with more than 14 years of education was 16.3% and 25.6%, respectively. Again, the differences were not statistically significant.

Only two suicide attempters and one comparison subject were employed at the time of interview. Approximately one third of both groups were married and lived with their spouse at the time of interview. More than 50% of comparison subjects were widowed, as compared to 45% of cases. This difference did not reach statistical significance.

Suicidal method, attributable causes, and repeated attempts in case subjects

Twenty-one of the suicidal subjects (48.8%) chose drug overdose as their means of suicide. The second most common method was using a sharp instrument, such as a knife (27.9%). Other methods included drowning (9.3%) and hanging (4.6%). Suicidal subjects revealed long-term life stressors and attributed their suicidal acts to certain precipitating factors (Table 1). Health conditions were the most frequent concern (51.2%).

Twenty-three of the subjects (53.5%) reported that they had had previous suicidal behaviors, with various time lapses from their first suicidal acts. More than half of repeated suicide attempters had made their first suicidal attempt within the past two years. Age on their first attempt ranged from 25 to 92 years, with a mean of 70 years. As for hospitalization after their suicide attempts, ten had been admitted to a psychiatric ward; seven to a medical ward, but more than half were not hospitalized.

Physical problems, psychiatric conditions, and cognitive functions

Four types of physical problems were identified in this study: cardiovascular disease, neurological disease, diabetes mellitus, and surgical or orthopedic problems (Table 2). There were no significant differences in the distribution of these problems between cases and comparison subjects. Suicide attempters tended to drink and smoke more. Compared to 16% of comparison subjects, 35% of suicide attempters reported a past history of psychiatric problems. Smoking, drinking and past history of mental illness were all significantly different between the two groups.

Although more cases reported impaired family function, there was no statistically significant discrepancy in the initial analysis. There were more subjects with BSRS-5 score >5 in the case group than in the comparison group (70% vs. 12%, $p<0.05$). All scores of the five BSRS items are significantly higher in suicide attempters than comparison subjects. The mean GDS score was much higher in the case group than the control group. They also had a significantly higher rate of GDS scores more than 5. Regarding cognitive function, the mean MMSE score was 21.9 and 24.5 in the cases and comparison groups, respectively. After adjustment for age and education, there was no significant difference in cognitive function impairment between elderly suicide attempters and the comparison subjects.

Based on the diagnostic interview one month after the suicidal behavior, about 60% of the cases met the diagnostic criteria for depressive disorder, while 16% had a diagnosis of dementia. In the comparison group, 14% had a diagnosis of depressive disorder and 9.3% had dementia. The presence of a depressive disorder was significantly higher in the case than in the comparison group ($p = 0.001$), while there was no significant difference in the frequency of people with a diagnosis of dementia in these two groups. Impaired cognitive function, indicated by MMSE score and the diagnostic interview, was independent of late-life suicidal behavior.

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Table 2. Comparisons of physical, psychiatric, and cognitive aspects between cases and controls

	SUICIDE ATTEMPTERS (N = 43)	CONTROLS (N = 43)
Measured by instruments		
Physical		
Cardiovascular problems	41.9%	41.9%
Neurological problems	30.2%	18.6%
Diabetes mellitus	16.3%	9.3%
Surgical problems	9.3%	9.3%
Psychological		
Smoking habit*	32.6%	9.3%
Drinking habit*	27.9%	9.3%
Past history of mental illness*	34.9%	16.3%
Impaired family function (APGAR score < 6)	40.0%	27.9%
BSRS-5 > 5*	69.8%	11.6%
Anxiety score*	1.4	0.5
Depression score*	2.1	0.6
Hostility score*	1.6	0.4
Interpersonal sensitivity score*	1.2	0.2
Sleep disturbance score*	2.1	0.9
GDS-15 > 5*	74.4%	14.0%
Cognitive		
MMSE	21.9	24.5
Measured by diagnostic interview		
Depressive disorder*	60.5%	14.0%
Dementia	16.3%	9.3%

*p value less than 0.15
BSRS-5 = 5-item Brief Symptom Rating Scale; GDS-15 = 15-item Geriatric Depression Scale; MMSE = Mini-mental State Examination

Table 3. Significant variables on the multiple logistic regression model

VARIABLE	COEFFICIENT (β)	SE	OR	95% CI	P VALUE
BSRS-5 > 5	2.88	0.68	17.76	(4.71, 66.96)	0.000
Depressive disorder	2.13	0.67	8.38	(2.27, 30.93)	0.001
Drinking habit	−2.12	0.80	0.12	(0.03, 0.58)	0.008
Constant	1.96	1.41	7.09		0.164

BSRS-5 = 5-item Brief Symptom Rating Scale; SE = standard error; OR = odds ratio; CI = confidence interval

Multiple logistic regression model

All six significant factors detected in univariate statistical analyses were analyzed for the final logistic regression model. Smoking habit, GDS score greater than 5 and past history of mental illness were excluded because of their insignificant effect on suicidal behavior. The identified risk factors and their effects on suicidal attempts in the final model are shown in Table 3. The adjusted odds of suicide among people with a BSRS-5 score greater than 5 is 17.8 times that of people with a BSRS score less than or equal to 5. After controlling for drinking and the BSRS-5 score, those diagnosed with depressive disorder were more likely to have made a suicide attempt than people without depressive disorder (odds ratio = 8.38, p = 0.001). After adjustment for depressive disorders and BSRS-5 score, drinkers had lower odds of developing suicidal behaviors than people who did not drink.

Discussion

The results indicate that drinking, BSRS-5 score, and diagnosis of depressive disorder based on diagnostic interviews all have significant associations with late-life suicide attempts. Based on prior research, more than 70% of elderly suicides have psychiatric illness, the most prevalent of which is major depressive disorder (Suominen *et al.*, 1996; Conwell, 1997; Lebowitz *et al.*, 1997). The findings here are consistent with prior study results in that

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older people with a diagnosis of depressive disorder had significantly higher odds of developing suicidal behavior. They further confirm that the recognition and treatment of depression is an important strategy for intervention in late-life suicidal acts.

For the primary care providers, a powerful screening instrument will be helpful in detecting psychiatric symptoms and assessing suicidal risk. The BSRS-5, an easily applicable instrument, meets this need in the clinical setting. In the current study, the BSRS-5 score was highly correlated with a late-life suicide attempt. Anxiety, depression, hostility, sleep condition and interpersonal sensitivity are all self-rated and put together to measure general mental health. This score's strong influence on the odds of a suicide attempt is independent of the effect of drinking and the diagnosis of depressive disorder. Lebowitz *et al.* (1997) indicated that subclinical depression is associated with an increased risk of major depression, physical disability, medical illness, and the frequent use of medical services. The identification and treatment of subclinical depression is warranted for early intervention in late-life suffering (Lebowitz *et al.,* 1997). Although the impact of anxiety on suicidal behavior is mentioned in a few studies (Hawgood and De Leo, 2008), there is relatively little information about the influence of anxiety on geriatric suicide. Spira *et al.* (2008) point out that subclinical levels of anxiety are related to sleep disturbance and overall functioning in the elderly. Sleep disturbance is also associated with suicide and suicidal ideation in younger populations and may affect the elderly as well (Ayalon *et al.*, 2007). Since the self-rated mental conditions have separate contributions to suicidal risk, the score on BSRS-5 can serve as a predictor of elderly suicidal behavior. The role of subclinical symptoms should be highlighted in the field of prevention of suicidal attempts in later life.

With regard to drinking behavior, this study only analyzed a drinking habit instead of the diagnosis of alcohol use disorder, since the number of older subjects who met the diagnosis of alcohol use disorder was small. In the literature it is reported that about 33% of males and 18% of females who committed suicide in later life also abused alcohol (Waern, 2003). Previous studies also demonstrate that drinking in older people has an elevated suicidal risk through mediation by other prevalent factors, such as depressive disorder, while drinking per se is not a risk factor (Blow *et al.*, 2004; Pirkola *et al.*, 2004). This study, with a focus on suicide attempters, shows that a drinking habit is more frequent in suicide attempters than in comparison subjects and is positively related to the appearance of attempted suicide in univariate analyses. Interestingly, once depressive disorder and BSRS-5 score are controlled, this factor shows a negative relationship in terms of the odds of making a suicide attempt. This means that a drinking habit is protective in the elderly if both the diagnosis of depressive disorder and subclinical symptoms are controlled. This further implies that non-pathological drinking is more common among non-attempters, which is consistent with a prior study suggestive of an inverse correlation between drinking and depression in the elderly (Turvey *et al.*, 2006). Nonetheless, further investigation is needed to elucidate the underlying mechanism.

This study employed both measurement instruments and diagnostic interviews to examine the relationship between cognitive functioning and late-life suicide. There is no evidence to support the relationship between suicide in later life and impaired cognitive function, as impairment neither increased risk nor prevented suicide. The severity of cognitive impairment and psychiatric comorbidity have been previously mentioned in this regard (Chiu *et al.*, 2004). People with severe cognitive impairment may be unable to attempt suicide and, as a result, are less likely to present with suicidal behaviors. Comorbidity with depression, early dementia, or mild cognitive deficit may place the elderly at increased risk for suicide. Mild cognitive impairment and depressive disorders have shown no significant difference between cases and comparison subjects in the current study. Poor cognitive functioning may decrease the efficacy of certain preventive strategies and the assessment for suicide prevention in the elderly.

This study has limitations. First, the cases of attempted suicide and the results are difficult to generalize to the population of completed suicides, although it has been proposed that elderly suicide attempters may be more similar to completers-than in a younger group (Pearson and Brown, 2000). Second, the selection of controls for comparison is from advertisements within the community and the volunteer effect should be considered. Third, two suicide attempters developed organic brain syndromes after their suicide attempts and their one-month post-event data had to be excluded. This may have skewed the results. Fourth, a low prevalence of suicide attempts in the small sample size limits the study's statistical power. The lack of statistically significant associations between late-life suicide and risk factors may be due to type II errors. For example, a Hong Kong study indicated that the estimated prevalence of dementia in elderly Chinese aged 70 or above was 6.1% (Chiu *et al.*, 1998). Only 9.3% of the comparison group, with a mean age of 78.6 years, and 16.3% of cases met the diagnosis of dementia. The attempters seem to have a higher proportion of those diagnosed with

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dementia. Although there is no significant difference in this study, the power issue should be kept in mind in interpreting the insignificant result. Lastly, the result is subject to recall bias because the attempters were asked to recall their state prior to the attempt.

In conclusion, this study confirms the hypothesis that depressive disorder is a salient predictor of elderly suicide attempts. However, it provides no evidence to support a relationship between cognitive functioning and late-life suicide. The findings on the assessment of subclinical symptoms, including anxiety, depression, hostility, sleep condition and inter-personal symptoms, may help in the prevention of late-life suicidal behavior, particularly in primary care settings. Longitudinal data and powerful statistical approaches should be adopted in order to construct a comprehensive causal model for late-life suicide and to plan an effective program for its recognition and prevention.

Conflict of interest

None.

Description of authors' roles

Dr. C. H. Chiu collected the data and wrote the paper, while Dr. I. C. Liu designed the study and was responsible for the statistical analysis.

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