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Research report

Predicting suicide in older adults – a community-based cohort study in Taipei City, Taiwan

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ABSTRACT

Background: Older adults worldwide are at a greater risk of suicide than other age groups. There is a scarcity of prospective studies exploring risk factors for suicide in older people and their discriminative ability to identify future suicide.

Methods: We examined a prospective cohort of senior Taipei City residents between 2005 and 2009 ($N=101{,}764$). Cox proportional hazards regression analysis was used to determine significant risk factors and to construct a predictive score. The accuracy of the derived score in the prediction was tested by Receiver Operating Characteristic analysis.

Results: Male sex (Hazard Ratio [HR]=3.41, $p<0.001$), lower education (HR=3.31, $p<0.001$) and lower income (HR=2.52, $p=0.01$) were associated with an increased risk of suicide, as well as depressed mood (HR=1.44, $p=0.02$; per unit increase in a 4-point scale) and insomnia (HR=1.30, $p=0.03$; per unit increase in a 4-point scale). The derived prediction score yielded a sensitivity of 0.63 a specificity of 0.73 and an area under curve of 0.73. Removing depressed mood from the prediction model did not significantly alter suicide predictability ($P=0.11$).

Limitations: The dataset examined did not contain information regarding to important risk factors such as substance misuse and prescribed medications and the measures of mental health were relatively limited.

Conclusion: Prediction of suicide based on factors recorded in a routine health screen of elderly people was unsatisfactory; the strongest predictors were factors that cannot be easily altered. Further understanding of how the socioeconomic condition of seniors contributes to suicide may provide valuable insights for intervention targeting this growing population-at-risk.

1. Introduction

Older adults are at a greater risk of suicide than other age groups in many countries (World Health Organization, 2005). Paralleling trends in population aging, we may expect to see a rapid rise in the number of suicides in older adults over the next few decades. It is believed that Asian culture venerates elderly people (Perry and Seldon, 2000), however, suicide rates among the elderly population are particularly high in many East Asian countries including People's Republic of China, Japan, Korea, and Singapore, with the elder ($\geq$65 years old) to general population suicide rate ratio having been reported to range between 3 and 4 to 1. This is in contrast to ratios of less than 2 to 1, which are commonly reported in Western countries (Chen et al., 2012; Pritchard and Baldwin, 2002). Among citizens in Taiwan, people aged 65 and above have had the highest suicide rates for the past 20 years; the annual suicide rates in this age group have consistently exceeded 40 per 100,000 persons. Between 1992 and 2010, when overall suicide rates rised in Taiwan, a 27% increase in suicide rates was observed in older adults (Department of Statistics. Ministry of Health and Welfare, 2012).

Suicidal behaviors are much more likely to end in death among older adults who are usually more determined to die and tend to

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use more lethal methods (Chen et al., 2012; Kuo et al., 2012; Yip et al., 2012). Also, their frailer physical conditions put them at greater risk of death from self-inflicted injury (Chen et al., 2012; Conwell and Thompson, 2008). Current knowledge regarding the risk factors for suicide in older adults is mostly derived from retrospective psychological autopsy studies (Cavanagh et al., 2003; Conwell et al., 2002) While more sophisticated case-control methods have been adopted, the results of such investigations are still liable to selection and reporting bias (Cavanagh et al., 2003).

Though few in number, several community-based cohort studies have identified depression as a crucial risk factor for elder suicide (Ross et al., 1990; Sun et al., 2012). While the utility of depression alone has been shown to be limited in the prediction of suicide within a finite period, such as the forthcoming 12 months (Nordentoft et al., 2011; Pena and Caine, 2006), only several other predictors have been examined, including sleep disturbances and socioeconomic disadvantage (Purselle et al., 2009; Ross et al., 1990; Sun et al., 2012). Some attempts have been made to improve the discriminatory ability of predictive models by adding other risk factors to construct a 'risk profile' (Hung et al., 2013; Lo and Kwok, 2006; Pokorny, 1983), but evidence is scarce regarding the prediction of elder suicide utilizing a combination of risk factors (Lo and Kwok, 2006).

The Taipei City Government began providing free annual health examinations for the elderly population of Taipei City beginning in 2001. Each year, around 40,000–46,000 people participate in this program. The Taipei City Government has systematically registered the data from 2005 onwards, with the information being linked to death records for the years 2005–2010. In this exploratory study, we analyzed the dataset to prospectively examine risk factors and their utility in predicting suicide in older adults.

2. Methods

2.1. Study population

Our study sample was derived from the participants of the Taipei City Elder Health Examination Program between 2005 and 2009 ($N=102,454$). For those who utilized this program more than once, we used the information acquired from their first examination. Eligible participants for this health examination program were Taipei City residents aged 65 and older who voluntarily participated in the assessment. Taipei City Government informed elders about the program through multiple media channels (e.g. newspaper, TV, internet), community centers and encouraged medical professionals (e.g. general practitioners, nurses) to inform their elderly patients to participate the service. Each participant received health counseling, a physical and neurological examination, their biochemistry profile, a complete blood count, and a chest x-ray. Structured interviews were conducted to elicit past disease history, life-style behaviors, psychiatric symptoms and cognitive function. Participants received feedback (including test results and suggestions for referrals) 2 to 4 weeks after the examination. The study was approved by the Institutional Review Board of the Taipei City Hospital (TCHIRB-1020711-E).

2.2. Measurements

Suicide: The risk of suicide during the follow up period was estimated. The unique National Identity (ID) number was used to link the health examination database with death records in Taiwan's National Death Certification System for deaths occurring between Jan. 2005 and Dec. 2010. The linkage process was performed by the Department of Health in Taipei City. After it was completed, the National Identity number of each participant was fully encrypted to preserve anonymity.

The cause of death was classified according to the International Classification of Disease tenth revision (ICD-10) and recorded in the Death Certification System. Suicides were identified using the codes X60-X84. Previous studies indicated that many deaths categorized as undetermined intent were likely to be misclassified suicides (Chang et al., 2010); therefore we considered undetermined deaths suicides and included them in the analysis (Y10-Y34).

Psychological distress/depressed mood: This construct was measured by the Brief Symptoms Rating Scale (BSRS), a 5-item, self-reported questionnaire tapping into anxiety, depressed mood, hostility, inferiority and sleep difficulty in the preceding week. It had previously been used amongst elderly Taiwanese residents and was found to correlate significantly with suicide ideation and the component of mental health, as measured by the Medical Outcome Study Short Form-12 (Chen et al., 2009). The reliability and validity of the scale and appropriate cutoffs have been described elsewhere (Chen et al., 2005; Lee et al., 1990, 2003). The questions on the scale include – (1) feeling tense or keyed-up, (2) feeling depressed or in a low mood, (3) feeling easily annoyed or irritated, (4) feeling inferior to others, and (5) having trouble falling asleep. Responses are rated on a five-point Likert scale ranging from 0 to 4 (0, not at all; 1, a little bit; 2, moderately; 3, quite a bit; and 4, extremely). A response of either 3 or 4 was categorized as endorsing a particular psychological stress. The dichotomized results of the BSRS were used when presenting descriptive statistics (Table 1), however the BSRS score was treated as a continuous variable in the Cox proportional hazards model

Table 1
Sample characteristics of Taipei City elderly health exam attendees 2005–2009.

	Total ($N=101,764$) $N(\%)$	Suicide ($N=93$) $N(\%)$
Age (years)		
65–74	61116 (60.1)	44 (47.3)
75–84	34171 (33.6)	40 (43.0)
>=85	6355 (6.2)	9 (9.7)
Sex		
Male	51786 (50.9)	69 (74.2)
Female	49962 (49.1)	24 (25.8)
Marital status		
Married	72708 (72.6)	64 (68.8)
Others	27378 (26.9)	26 (28.0)
Educational attainment (years)		
<12	46349 (45.5)	45 (48.4)
>=12	40969 (40.3)	14 (15.1)
Lower Income		
Governmental income subsidy	95793 (94.1)	75 (80.6)
Not qualified for subsidy	5971 (5.9)	18 (19.4)
Psychological stress[a]		
Anxiety	2025 (2.0)	4 (4.3)
Hostility	1772 (1.7)	6 (6.5)
Depressed mood	1684 (1.7)	4 (4.3)
Inferiority	788 (0.8)	3 (3.3)
Insomnia	6028 (5.9)	10 (10.9)
Lived alone	5597 (5.5)	7 (7.5)
Physical disorders	70632 (69.4)	74 (79.6)
Cognitive function		
No impairment	97130 (95.4)	85 (91.4)
Mild impairment	2102 (2.1)	4 (4.3)
Moderate impairment	1037 (1.0)	1 (1.1)
Severe impairment	1253 (1.2)	2 (2.2)

Missing values: age 122, marital status 1678, education level 14,446, psychological stress 242, cognitive function 242.

[a] Psychological stress was measured by the Brief Symptoms Rating Scale, a response of 3 or 4 (symptoms severity rated as quite a bit or extremely) was defined as endorsing a particular symptom.