



Association between body mass index and suicidal ideation among seniors in Shandong, China[☆]

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ABSTRACT

Background: Recently, an emerging group of studies has reported the association between Body Mass Index (BMI) and suicidal ideation in the Western countries. However, this relationship is still unclear with controversial results, and we have little knowledge about this relationship in China which is one of few countries reported higher suicide rates.

Methods: This study aims to analyze the association between BMI and suicidal ideation among seniors (≥60 years old) in Shandong, China. A total of 3313 seniors were included in the data analysis. Suicidal ideation, weight, height, socio-demographic and psychological variables were evaluated in this study. Logistic regression was conducted to explore the association between BMI and suicidal ideation among male and female seniors.

Results: The results showed that 4.2% of the seniors reported suicidal ideation, and 3.4% for men, 4.9% for women. After controlling social-demographic variables, economic status, physical disease, social support and mental health, an inverse relationship between BMI and suicidal ideation was found for men, but not for women. Mental health was still an important factor associated with suicidal ideation.

Conclusion: The results inform health care professors that underweight in male seniors can be associated with higher risk of suicidal ideation in China.

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The World Health Organization (WHO) reported that approximately 804,000 suicide deaths occurred worldwide in 2012, representing an annual global age-standardized suicide rate of 11.4 per 100,000 population [1]. It implied that one person died by suicide every 40 s. In China, although the overall suicide rates had decreased significantly in the past years [2], the suicide rates among people aged 65 or above continued to increase [3]. Thus, suicide in Chinese seniors was a serious social and public health problem.

Suicidal ideation, one kind of suicide behavior, has been identified as an immediate precursor to suicide attempt and death worldwide [4,5]. In the past decades, lots of studies have explored the risk factors for suicidal ideation [6,7]. In China, there were also some studies which reported the risk factors of suicidal ideation in different population [8]. For example, some researches find that education, depression, social support, hopelessness, and negative life events were significantly associated with suicidal ideation among Chinese rural females [9].

Recently, an emerging group of studies had reported the association between BMI and suicide behavior. A systematic review and meta-analysis found an inverse association between BMI and completed suicide [10]. The similar results were also supported for suicide attempt among Swedish men and British adults [11,12]. However, this association was reported with controversial results for suicidal ideation. It was supported by a study among United States high school students [13], but not among United States adult women [14].

In exploring the association between BMI and suicidal ideation, previous studies also reported different finding for males and females. For example, a study in young adults reported an association between obesity and suicide risk for women, but not for men [15]. However, another study in German adults did not support the gender differences [16]. Even there was a study which did not support this association [17].

China is one of few countries which reports higher suicide rates in females and elderly worldwide [18]. However, to our knowledge, there is no study which reports the relationship between BMI and suicidal ideation among Chinese samples. Previous studies have showed that suicide in China was different from Western countries [18]. Thus, we have enough reasons to believe that the findings about this relationship in Western countries may be different in China.

To better understanding the relationship between BMI and suicidal ideation, the current study was designed to examine the potential

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relationships among Chinese seniors. It is helpful for us to further understanding the Chinese seniors' suicide behavior, and it also can promote our knowledge about the relationship between BMI and suicidal ideation worldwide.

1. Methods

1.1. Participants and procedure

This study was conducted in Shandong province, China. There were almost 100 million people in Shandong in 2014, and the people aged 60 and above accounted for about 15% of the total population [19]. Shandong also ranked the second in the number of total population of China [20]. In this study, participants were all seniors aged 60 years and older. Most of the people retired when they were 60 years old, and they were also in higher risk of psychological problem [21]. Besides, this age limit was also used in some WHO ageing reports [22].

In this study, a three-stage cluster sampling was used to select participants. First, we stratified all districts and counties in Shandong as three groups according to the GDP per capita (2011), respectively. Then, we randomly selected one district and one county from each group. Three urban districts (Huaiyin, Dongchangfu and Zhangdian) and three rural counties (Qufu, Chiping and Leling) were selected as the study sites. Likewise, three sub-districts and three townships were then selected in each sampling district or county according the GDP per capita. Third, we randomly selected three communities and three villages from each selected sub-district or township. In total, we selected 27 urban communities and 27 rural villages for this study. In the sampling communities or villages, all of the seniors (aged 60 years or above when interviewing) were recruited from November 2011 to January 2012. Totally, we interviewed 3922 seniors, and 3313 seniors (84.5% participated) with complete data were included in the analyses.

All of the seniors were first visited by the local health agency or the village administration to enhance the seniors' confidence. Upon the seniors' agreement on the written informed consent, they would be interviewed by one trained interviewer. All of the interviewers were graduate students (MSc in Health Management candidate and Ph.D. candidate) from Shandong University School of Public Health. They would receive a strict training process (sufficient understanding on this study and each question in the questionnaire) for the interview. We also have a pilot survey about this questionnaire. To ensure the quality, completed questionnaires were also carefully checked by quality supervisors (professors who participant in the design of this study) in the evening. The average time for each interview was about 40 min.

The study protocol was approved before the data collection began by the IRB of Shandong University School of Public Health. The investigation was performed after the acquisition of informed consent from all participants.

1.2. Measures

1.2.1. Suicidal ideation

Suicidal ideation (SI) was evaluated by the question that "Have you ever seriously consider about killing yourselves?" The answer can be chosen from "yes" or "no." This question was also used to estimate SI in the US National Comorbidity Survey (NCS) [23].

1.2.2. Body mass index (BMI)

To calculate BMI for the analysis, height (in centimeter) and weight (in kilogram) were measured by the trained interviewers. The interviewees were asked to remove their shoes for the measurement of height. BMI was calculated by the formulation (kg/m^2). For illustrating BMI more obviously, BMI was categorized into underweight (<18.5), normal (18.5–25.0), overweight (25.0–30.0), or obese (≥ 30) [24].

1.2.3. Mental health

Level of mental health was measured by the Chinese version of Kessler-10 (K10). It is a brief 3-minute screening instrument that aims to capture the overall level of nonspecific mental health present during the past 30 days [25]. The 10 items are about "depressed, severely depressed, worthless, everything is an effort, hopeless, tired, severely restless, restless, severely nervous and nervous." Each item was evaluated from 1 (never) to 5 (all the time). This scale was also used in the previous suicide studies [26]. The Chinese version of K10 had been validated and proved to be a good measurement in Chinese populations [27]. The internal consistency of this scale in the current study was Cronbach's α 0.93.

1.2.4. Social support

The Chinese version of Social Support Rating Scale (SSRS) was used to assess social support in our study [28]. It contains of 10 items which include the relationship with spouse, friends, siblings, children, colleagues, and social organizations. Each item was evaluated by four choices. The higher scores mean better social supports. The Chinese version of SSRS had been tested [29], and the reliability and validation were sound in Chinese suicide research. The internal consistency of this scale in this study was Cronbach's α 0.72.

1.2.5. Physical disease

Physical disease was estimated by one question which was also used in previous suicide studies [30]. The question is that "if you get a chronic disease which diagnosed by a doctor?" The answer could be chosen from 'yes' or 'no.'

1.2.6. Social-demographic variables

We also interviewed the variables contained age, gender, region, education, marital status and economic status. Region was the participants' registered residence region which was classified into urban and rural. Education was measured by illiteracy or semiliterate, primary, junior school, senior high school, college and above. As there were few senior who were educated higher than junior school, we recoded it into illiteracy or semiliterate, primary, junior school or above. Marital status was dichotomized as "single" and "couple" with the former including those who were divorced, separated, or widowed. Economic status was estimated by the self-report economic status compared with the similar age seniors in their communities or villages. The answers could be chosen from very bad, bad, average, good and very good. We dichotomized it into "not bad" and "bad." The former economic status contained "average," "good" and "very good," and the latter one contained "bad" and "very bad."

1.3. Statistical methods

IBM SPSS Statistics 24.0 (Web Edition) was used for data analysis. *t*-Tests or Chi-square tests were used to compare the difference on categorical and continuous variables. Logistic regression analysis was performed to examine the factors related to suicidal ideation. All of the factors were chosen as the independent variables. Categorical items with more than two responses were coded in dummy in the logistic regression. All tests were two-tailed and a *p* value of <0.05 was considered statistically significant.

2. Results

We listed the characteristics of the sample and analyzed the differences of suicidal ideation across the control variables in Table 1. For all of the seniors, age, rural region, education, married status, economic status, physical disease, social support and mental health were associated with suicidal ideation. We also analyzed the differences among female and male seniors, respectively. For male seniors, all of the control variables were also associated with suicidal ideation with an exception of

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