Research paper

Body mass index and suicide methods

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ABSTRACT

Overweight and obesity is associated with lower rates of suicide. However, little is known about the association with different suicide methods. We studied the association between groups of body mass index and suicide methods. We identified all medicolegal autopsy cases with a cause of death due to external causes in Sweden during 1999–2013 (N = 39,368) and included 11,715 suicides and 13,316 accidents or homicides as controls. We applied multinomial regression models adjusted for age, sex, year and season of death. Obesity was associated with suicidal intoxication, OR 1.15 [95% confidence interval (CI) 1.02, 1.30] and negatively associated with all other suicide methods studied. Underweight showed a negative association with suicidal drowning and there was an indication towards a negative association with hanging in men OR 0.81 (95% CI 0.65, 1.01). We conclude that body mass index (BMI) is associated with the choice of suicide method. This may be of importance in a public health perspective, e.g. potential for prevention of intoxications. In the practice of forensic medicine, the physician's level of suspicion may rise if the apparent suicidal method is less common for the individual characteristics of the deceased, such as BMI.

1. Introduction

To develop preventive strategies and to initiate measures to reduce suicides, information about suicidal methods and how their use is associated with individual factors is of importance.[1] Increased body mass index (BMI) has previously been associated with a lower risk of suicide[2–7] although complete consensus is lacking.[8,9] Increased BMI has also been associated with mental ill-health, suicide ideation and suicide attempts.[5,10–12] It has been suggested that one factor behind the observed negative association between increased BMI and suicide might be the selection of methods with a lower lethality.[13] In line with this a recent study reported an observation that low BMI was positively associated with hanging.[14]

We set out to study the association between BMI and suicide methods. We identified all medicolegal autopsy cases in Sweden 18 years and older with an external cause of death from 1999 to 2013 (N = 39,368), of which 16,546 cases were considered to be suicides.

2. Materials and methods

2.1. Study population

In Sweden, all medicolegal autopsies are performed at one of the six departments of the Swedish National Board of Forensic Medicine. The criteria for a medicolegal autopsy are in essence that there is suspicion of non-natural death, and approximately 98% of all suicides in Sweden undergo a medicolegal autopsy.[15] Using the autopsy register maintained by the National Board of Forensic Medicine we identified all cases 18 years and older that were subjected to a medicolegal autopsy in Sweden from 1999 to 2013 (N = 76,778, Fig. 1). This period was chosen to obtain a cohort as large as possible, considering data availability. We excluded cases without a valid code for the cause of death (n = 195), according to the International Classification of Diseases (ICD) 9th or 10th edition. We identified cases with an underlying external cause of death according to the ICD-9th edition chapter "injury and poisoning" and the ICD-10th edition chapter "external causes of morbidity and mortality". We excluded cases with implausible body weights (<20 kg and >250 kg) and body heights (<120 cm and >210 cm) (Fig. 1). To avoid including cases with advanced decomposition we excluded those cases in which the autopsy had not been performed within 10 days or less after their passing, or in which a plausible
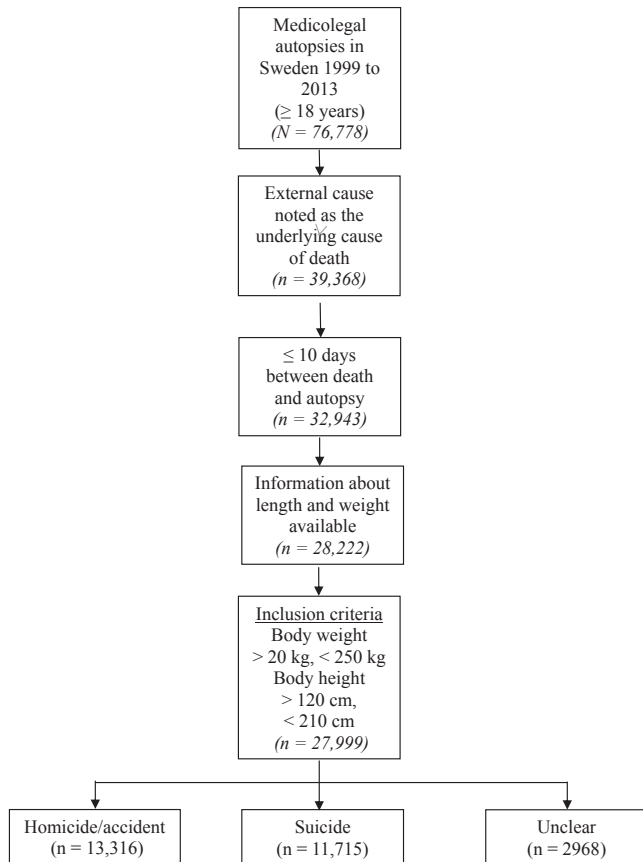
Fig. 1. The population subjected to a medicolegal autopsy in Sweden from 1999 to 2013 and the selection for inclusion in the study.

date of death was only determined to be within a certain month, but without an exact date. BMI was not possible to calculate in 4944 cases due to missing information, resulting in a study population of 27,999 cases (Fig. 1).

We identified cases of suicide by using the ICD-9th codes E950 to E959 and ICD-10th codes X60 to X84. Cases in which the manner of death was unclear (e.g. whether the death was accidental or suicidal) were identified using the ICD-9 codes E980 to E989 and ICD-10 codes Y10 to Y34. The remaining population had a manner of death either due to accidents or homicides, where the latter only comprised 195 cases. We merged the ICD-9 and -10 codes using the ICD-9 codes as baseline, see on-line Supplement 1. In this paper, the term hanging does include suicides by the more rare methods of suffocation and self-strangulation, if otherwise is not specified. Also, the term suicide by the use of firearms includes the more unusual method of using explosives. We identified cases of suicidal hanging (excluding self-strangulation and suffocation) by a specific code created by the Swedish National Board of Forensic Medicine in combination with the ICD-9th edition code E953.

2.2. Assessment of variables

Body mass index was calculated according to the formula (weight [kg]/height [m]^2), and categorized into four groups: (i) underweight (<18.5 kg/m^2), (ii) normalweight ($\geq$18.5 to <25) (iii) overweight ($\geq$25 to <30 kg/m^2) and (iv) obesity ($\geq$30 kg/m^2). In the analyses we used those having normalweight as reference. We also created a BMI variable with five groups by splitting the obesity group into two categories (iv) obesity ($\geq$30 to <40 kg/m^2) and (v)

extreme obesity ($\geq$40 kg/m^2).

We calculated the duration in days between the date of death and the medicolegal autopsy in those cases having complete information on the date of death.

Year of death was extracted and categorized into (i) 1999 to 2003, (ii) 2004 to 2008, and (iii) 2009 to 2013. In the analyses we used the years 1999—2003 as reference.

Sex was included as a dichotomous variable in the analyses, using males as reference.

We included age (years) as a categorical variable in the analyses (i) 18 to 29, (ii) 30 to 39, (iii) 40 to 49, (iv) 50 to 59, (v) 60 to 69, and (vi)$\geq$70. In the analyses the older age group was used as reference.

Season of death was categorized into winter (October to March) and summer (April to September) and we used the summer category as reference.

2.3. Methods

We grouped suicides according to the method used, i.e. intoxications with solid or fluid, intoxication by gas, hanging, drowning, use of firearm, sharp violence, jumping from height, and other methods. We applied logistic regression analyses to study associations between individual factors and overall suicide irrespective of method. Deaths due to accidents or homicides were used as reference. We applied two consecutive models separately in males and females. In the first model (a) we studied the unadjusted association between BMI and overall suicide, and in model (b) we adjusted for age, year of death and season of death.

To study the association between individual factors and methods of suicide we used multinomial regression analyses. We applied two consecutive models, in the first model (i), we studied the association between BMI (independent variable) and suicide method (dependent variable), and in the second model (ii) we adjusted for age, sex, season and year of death. We used accidental deaths and homicides as controls. We also modeled the association in strata of sex to detect any possible effect modifications between sex and BMI.

To address the results of a previous study[14] we also studied the specific association between BMI and suicidal hangings (excluding self-strangulation and suffocation) in a separate logistic regression model adjusted for season of death, age, year of death and sex, using accidental deaths and homicides as controls.

We present the results of the multinomial- and the logistic regression models using odds ratio (OR) and 95% CI. A finding was considered as conclusive when the 95% confidence intervals excluded 1,00. The data was analyzed using IBM SPSS version 22.0.0.0.

3. Results

3.1. Population characteristics

In total 11,715 suicide cases and 13,316 cases with an external cause of death due to an accident or a homicide were included in the analyses (Table 1). Men were in clear majority across all manners of death and constituted 71.5% of the suicide population (Table 1). Across the different manners of death we observed that the proportion of obese was lower in the group with suicidal deaths (11.4%) compared to accidents/homicides (17.3%) and unclear manners of death (20.4%) (Table 1). In the suicide population 6.1% (n = 82) qualified into the group extreme obesity and in the homicide/accident population the figure was 7.6% (n = 175) (not shown in table). An analysis of the cases with missing information on BMI indicated no association with age, sex or duration between death and autopsy, but a strong association with the year of autopsy