# It is illegal to post this copyrighted PDF on any website. Risk and Protective Factors for Suicide Mortality Among Patients With Alcohol Dependence

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#### ABSTRACT

**Objective:** People with alcohol dependence suffer from poor health outcomes, including excessive suicide mortality. This study estimated the suicide rate and explored the risk and protective factors for suicide in a large-scale Asian population.

**Method:** We enrolled patients with alcohol dependence (*ICD-9* code 303\*\*) consecutively admitted to a psychiatric center in northern Taiwan from January 1, 1985, through December 31, 2008 (N = 2,793). Using patient linkage to the national mortality database (1985–2008), we determined that 960 patients died during the study period. Of those deaths, 65 patients died of suicide. On the basis of risk-set sampling for the selection of controls, we conducted a nested case-control study and collected the information by means of a standardized chart review process. We estimated the standardized mortality ratio (SMR) for suicide mortality. Conditional logistic regression was employed for exploring the risk and protective factors for suicide.

**Results:** The study subjects had excessive suicide and all-cause deaths, with SMRs of 21.2 and 12.7, respectively. We pinpointed auditory hallucination (adjusted risk ratio [aRR] = 1.80, P = .04) and attempted suicide (aRR = 7.52, P = .001) as the risk factors associated with suicide. In contrast, protective factors included financial independence (aRR = 0.11, P = .005) and being married (aRR = 0.16, P = .02). Intriguingly, those with physical illnesses had a lower risk of suicide (aRR = 0.15, P = .01).

**Conclusions:** Compared with the general population, those with alcohol dependence faced excessive suicide mortality. For a comprehensive approach to suicide prevention, recognizing and improving the protective factors could have equal importance in mitigating the risk of suicide.

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**E** xcessive use of alcohol has become one of the leading worldwide health problems and results in morbidity, disability, and mortality. Unhealthy use of alcohol is associated with more than 200 disease and injury conditions as described in the *International Classification of Diseases* (10th revision,  $ICD-10^{1}$ ) (9th revision,  $ICD-9^{2}$ ). According to a World Health Organization report,<sup>3</sup> in 2012, 5.9% of all global deaths were attributable to alcohol. This is greater than, for example, the proportion of deaths from HIV/AIDS (2.8%), violence (0.9%), or tuberculosis (1.7%). Additionally, 5.1% of the global burden of disease and injury is attributable to alcohol as measured by disability-adjusted life years.<sup>3</sup>

People with alcohol dependence have a greater risk of mortality, including natural death (especially from gastrointestinal diseases and cardiovascular diseases) and unnatural death (such as suicide and accidental death).<sup>4,5</sup> The standardized mortality ratios (SMRs) for all-cause deaths range from 5.0 to 8.6 for people with alcohol dependence.<sup>6-8</sup> Of the various causes of death among people with alcoholism, suicide has an exceptionally high SMR.<sup>9</sup> Wilcox et al<sup>9</sup> reviewed studies from the United States, Kuwait, Sweden, Spain, United Kingdom, Scotland, and England and calculated a pooled SMR for suicide of 9.8. Most of the studies were conducted in the United States and Europe. The magnitude of the SMRs ranged from 5.0 to 83.3, possibly due to the low incidence of suicide in some countries and considerable heterogeneity across the studies.<sup>9</sup> Diverse study designs (ie, psychological, autopsy, cohort, and casecontrol studies) and various degrees of alcoholism severity across the study populations could account for the wide range of reported SMRs. For estimating SMRs, a large cohort of patients with alcohol dependence and a long-term follow-up are required. Presently, few, if any, studies have been conducted among alcohol-dependent patients in Asia.

Research is scarce regarding the determinants of suicide mortality among patients with alcoholism, especially in Asia. The identified factors associated with suicide mortality can be broadly categorized as demographic (eg, male),<sup>10</sup> psychopathologic (eg, continued drinking, major depressive episodes, mood disorders, and hopelessness),<sup>10–13</sup> history of suicidal behaviors (eg, suicidal communication),<sup>13</sup> interpersonal difficulties (partner-relationship difficulties and other interpersonal life events),<sup>10</sup> and social disadvantage (poor social support, unemployment, and living alone).<sup>13</sup> Aside from identified risk factors, we know little about the protective factors of suicide in people with alcoholism.

In the present study, we investigated a large Asian cohort with alcohol dependence over a long period, ascertained the suicide mortality for each individual, and determined the SMR for suicide. Additionally, we conducted a nested case-control study derived from the cohort and used multiple regression analysis to explore

# Hung et al It is illegal to post this copyrighted PDF on any websit Briefly, in this study, the inclusion criterion

- Compared with the general population, patients with alcohol dependence suffer from excessive suicide and all-cause deaths.
- Clinicians should be on heightened alert when patients present with auditory hallucinations and attempted suicide, as those characteristics are identified as risk factors for suicide.
- Identifying and strengthening protective factors, such as financial independence, may be a viable strategy for mitigating suicidal risk in patients with alcohol dependence.



the risk and protective factors for suicide mortality in patients with alcohol dependence.

#### METHOD

**Clinical Points** 

#### **Study Population**

We enrolled all consecutive patients who were admitted to a psychiatric service center in northern Taiwan (Taipei City Psychiatric Center) from January 1, 1985, through December 31, 2008 (N = 24,386), as the original cohort. The cohort has been used in prior studies of suicide mortality in schizophrenia<sup>14</sup> and methamphetamine use.<sup>15</sup> The methodology used is described extensively elsewhere.<sup>14,15</sup> Briefly, in this study, the inclusion criterion was a diagnosis at discharge that fulfilled the principal diagnosis of alcohol dependence (*ICD-9* code 303\*\*). We made sure the diagnosis of alcohol dependence remained consistent between 1985 and 2008 and was not replaced by other substance use disorders if a patient had several psychiatric admissions. Consequently, from January 1, 1985, through December 31, 2008, a total of 2,793 consecutive patients with alcohol dependence were admitted to the center and were included in the study cohort. The *index admission* was defined as the earliest hospitalization if a patient had multiple hospitalizations during the study period.

#### Mortality and Suicide Case Identification

We used each patient's national identification number as the identifier to link each cohort subject electronically with the Taiwan National Death Certification Database (http://www.mohw.gov.tw/ MOHW\_Upload/doc/Health10\_0043697000.pdf) from January 1, 1985, through December 31, 2008. The service for the application of the database is provided by the Collaboration Center of Health Information Application, Ministry of Health and Welfare, Taiwan (http://biostatistics.cmu.edu.tw/hdrc/data\_2.html). A statistician conducted the linking process for obtaining the mortality status for each subject and determined the cause of death for each of the deceased. Of the cohort, 960 deaths were identified (Figure 1).

Of those deaths, 65 subjects died of suicide. The causes of death were coded based on the *ICD-9* classification system. Thus, the codes for suicide mortality included *ICD-9* E950–959. According to the methods used, suicide was further classified as a drug overdose (E950), gases for domestic use (E951), charcoal burning and poisoning by other gases (E952), hanging (E953), drowning (E954), firearms and explosives (E955), cutting (E956), jumping from a high place (E957), other and unspecified means (E958), and the late effects of self-inflicted injury (E959). We then calculated the SMRs for all-cause and suicide deaths.

#### **Nested Case-Control Study**

We conducted a nested case-control study, derived from the study cohort, to explore the potential risk and protective factors associated with suicide. Two or fewer controls were selected randomly for each case under risk-set sampling rules, matched for age ( $\pm$ 5 years), gender, and the year of index admission. Controls were selected from patients in the study cohort who were alive at the time of death of the corresponding case subject. Study cases that were identified later in the study period were eligible to serve as controls for earlier suicide cases. Consequently, 61 cases had available controls, and 4 cases did not. Among the 61 cases, 60 were paired with 2 controls and 1 with only It is illegal to post this copyrighted PDF on any website I control. Therefore, 61 cases were paired with a total of 121 controls. SMRs for all-cause and suicide deaths were calculated by

#### **Data Collection**

A semistructured medical chart form has been used for all patients admitted to Taipei City Psychiatric Center, Taipei, Taiwan, since 1980.<sup>14</sup> The form contains over 95 items including sociodemographic information and a detailed psychiatric evaluation, including the diagnosis, mental state examination, family history, and physical diseases. Additionally, a fasting venous blood sample was routinely drawn for biochemical and serologic analyses on the first morning after hospitalization. After hospitalization, a 12-lead electrocardiography examination was immediately done for each subject. The drugs used during the index admission were also recorded.

By means of retrospective chart reviews, we collected (1) demographic information regarding education, marital status, occupational history, financial independence, and social support; (2) mental health information including psychiatric comorbidities, psychotropic prescriptions, psychopathology, and relevant clinical features (ie, history of suicide attempt and depression, aggressive behavior); and (3) information on the physical condition regarding reported physical disorders and laboratory data including electrocardiographic and biochemistry profiles.

The chart reviewers were blinded to mortality status of the patients. The combined review process was conducted by 2 trained clinical psychologists with double-checking performed by a senior psychiatrist (C-J.K.). All reviewers participated in a reliability study,<sup>15</sup> rating information for 4 case subjects and 8 controls independently. The  $\kappa$  values were greater than 0.7 for all key variables, including symptom profiles, comorbidity, and suicide attempt.

We applied the same criteria used previously<sup>14,15</sup> for the diagnosis of lifetime depressive syndrome, requiring at least 1 of the following conditions: (1) prescription of any antidepressant (selective serotonin reuptake inhibitors or tricyclic antidepressants) for the treatment of depression with clinical attention and (2) depressed mood plus at least 1 other symptom of a major depressive episode (according to *DSM-IV* criteria) recorded on the medical chart. A *suicide attempt* was defined as any serious, potentially lifethreatening act that was not self-mutilating in nature.

The data were collected based on a retrospective medical chart review process in a fully restricted medical records room. A waiver was granted for informed consent due to the minimal risk to the privacy of individual subjects. The identities of subjects were fully encrypted to preserve anonymity during the statistical analysis. This study was approved by the Institutional Review Board of the Committee on Human Subjects of Taipei City Hospital, Taipei, Taiwan.

#### Statistical Analyses

First, we estimated SMRs. The survival time for each subject was calculated from the index discharge to the end

of the study (eg, until censored or December 31, 2008). The SMRs for all-cause and suicide deaths were calculated by dividing the observed number of deaths by the expected number of deaths,<sup>16</sup> which was estimated based on the mortality rate of the general population in Taiwan.

Secondly, between case subjects and living controls, we initially used univariate logistic regression to examine the distribution of unmatched factors reportedly having an association with suicide in the current literature. Meanwhile, those variables with potential association (P < .20) were entered into the multivariate models. We conducted multivariate modeling based on a backward variable selection strategy using the Proc Phreg function of SAS software, version 9.2 (SAS Institute Inc, Cary, North Carolina, USA). A P value of .05 was considered significant.

#### RESULTS

#### **Standardized Mortality Ratios**

Among the cohort with alcohol dependence (N = 2,793), most of the subjects were men (n = 2,481, 88.8%); the mean (SD) age was 40.6 (10.5) years (Table 1). Compared to the general population, the cohort with alcohol dependence had excessive mortality for all-cause death (SMR = 12.7). The magnitude was almost equivalent for unnatural (SMR = 12.2) and natural deaths (SMR = 12.8). Among all causes of death, suicide had an exceedingly high SMR magnitude (21.2), only secondary to gastrointestinal disease (SMR = 33.9). (For a detailed description of SMRs for all causes of death, see Supplementary eTable 1 at PSYCHIATRIST.COM.)

#### **Demographic Information**

Among the 65 cases of suicide mortality, 62 (95.4%) were men with a mean (SD) age of 37.7 (8.6) years. The mean (SD) interval between the date of the index admission and suicide was 3.71 (3.16) years. Methods used for suicides included hanging (n = 27), drugs/poisons (n = 10), jumping from a high place (n = 8), drowning (n = 8), charcoal burning/gases other than in domestic use (n = 7), cutting (n = 3), gases in domestic use (n = 1), and other and unspecified means (n = 1). None used firearms for suicide.

On the basis of the nested case-control design, we selected 2 or fewer controls from the cohort for each case. The cases and living controls had similar distributions of age and gender (Table 2). Variables concerning being married, living with family, financial independence, socioeconomic status classified using the Hollingshead scale,<sup>17</sup> and educational level were included as candidate predictors. In the univariate analysis, being married was significantly associated with low risk of suicide. Variables with P < .20 were included in the multivariate analysis.

#### **Clinical Characteristics**

Regarding the clinical characteristics at the index admission (Table 3), the univariate analysis showed that case subjects had greater proportions than controls of any antipsychotic use (mainly first-generation antipsychotics)

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Table 1. Age Distribution, Length of Stay at the Index Admission, and Subsequent All-Cause and Suicide Deaths of Subjects With Alcohol Dependence<sup>a</sup>

	Men .	Women	Total			
Characteristic	(n=2,481)	(n=312)	(N=2,793)	X <sup>2</sup>	df	P Value <sup>b</sup>
Age, y, n (%)				2.85	3	.416
<25	81 (3.3)	15 (4.8)	96 (3.4)			
25–44	1,660 (66.9)	201 (64.4)	1,861 (66.6)			
45–64	677 (27.3)	90 (28.8)	767 (27.5)			
>64	63 (2.5)	6 (1.9)	69 (2.5)			
Length of stay, d, n (%)				0.75	2	.686
<15	1,292 (52.1)	162 (51.9)	1,454 (52.1)			
15–29	741 (29.9)	99 (31.7)	840 (30.1)			
>29	447 (18.0)	51 (16.3)	498 (17.8)			
Follow-up on December 31, 2008						
All-cause death, n	903	57	960			
SMR (95% CI)	12.9 (12.0 to 13.7)	10.1 (7.5 to 12.7)	12.7 (11.9 to 13.5)			
Suicide, n	62	3	65			
SMR (95% CI)	21.5 (16.1 to 26.8)	16.1 (-2.1 to 34.4)	21.2 (16.0 to 26.3)			

<sup>a</sup>All patients in the study sample were enrolled from 1985 through 2008 and linked with the national mortality database from 1985 through 2008. If a patient had several hospitalizations, the first one during the study period was considered the index admission.

<sup>b</sup>Gender difference.

Abbreviation: SMR = standardized mortality ratio.

# Table 2. Demographic Information of Case Subjects With Suicide Mortality and Living Controls (1:2 Ratio) Among Patients With Alcohol Dependence at the Index Admission<sup>a</sup>

	2026)	Controls	Unadjusted		
Index Admission Characteristic	(n=61)	(n=121)	Risk Ratio <sup>b</sup>	95% Cl	P Value
Age, mean (SD), y	37.7 (8.6)	37.9 (8.0)	0.98	0.86-1.11	.739
Gender, male	59 (96.7)	116 (95.9)			
Married	16 (26.2)	58 (47.9)	0.37	0.18-0.74	.005
Living with family	47 (77.0)	104 (86.0)	0.56	0.26-1.21	.139
Employed	23 (37.7)	63 (52.1)	0.55	0.28-1.06	.073
Hollingshead socioeconomic status, class IV or V	57 (93.4)	106 (87.6)	2.56	0.70-9.41	.157
Financial independence	25 (41.0)	66 (54.5)	0.60	0.33-1.11	.105
Age at onset of habitual drinking, mean (SD), y	26.6 (9.1)	26.4 (7.3)	1.00	0.95-1.04	.834
Years of education, mean (SD)	10.0 (2.5)	10.4 (2.8)	0.95	0.84-1.06	.329

<sup>a</sup>Values are n (%) unless otherwise stated.

<sup>b</sup>Estimated using univariate conditional logistic regression.

Symbol: ... = matched by design.

and auditory hallucinations. However, case subjects had a lower proportion of physical problems than did controls. The proportions of suicidal behavior among first- and second-degree relatives of the patients in both the case and control groups were small (1.7% for both).

When the case patient's lifetime history was examined, a suicide attempt within 1 year before the last follow-up was associated with a higher risk of completed suicide. Interestingly, depressive syndrome was not associated with such risk (P=.728). Variables with P<.20 were included in the multivariate analysis.

#### **Multivariate Logistic Regression Analyses**

Multivariate analyses (Table 4) showed that auditory hallucination at the index admission (adjusted risk ratio [aRR] = 1.80, P = .038) and suicide attempt within 1 year before the last follow-up (aRR=7.52, P = .001) intensified the risk of suicide. In contrast, 3 variables were associated with substantially lower risk of suicide, including being married (aRR=0.16, P = .021), financial independence (aRR=0.11, P = .005), and physical illnesses (aRR=0.15, P = .012).

## DISCUSSION

The present study investigated an extensive Asian cohort of inpatients with alcohol dependence to examine the risk and protective factors for suicide mortality. Utilization of the national death certification system allowed us to ascertain rare causes of mortality, such as suicide. The SMRs demonstrate the exceedingly high rates of suicide mortality among alcohol-dependent inpatients compared to the general population. Clinically relevant risk factors included auditory hallucinations and prior suicide attempts. In contrast, the effect of protective factors such as financial independence and being married is substantial. Intriguingly, physical illnesses attenuated the risk of suicide in alcoholism.

#### **Standardized Mortality Ratios**

The magnitude of the SMR for all-cause deaths in this study (12.7) was substantially higher than that reported in previous studies of patients with alcoholism, which ranged from 5.0 to 8.6.<sup>6–8</sup> As for suicide mortality, the SMR for our study (21.2) was also greater than that of prior reports (9.8).<sup>9</sup> One plausible explanation is that the present study recruited

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## It is illegal to post this copyrighted PDF on any website. Table 3. Clinical Characteristics of Cases With Suicide Mortality and Living Controls

Among Patients With Alcohol Dependence at the Index Admission and in a Lifetime<sup>a</sup>

	Cases	Controls	Unadjusted	
Characteristic	(n=61)	(n=121)	Risk Ratio	P Value
Index admission				
Comorbid methamphetamine use	3 (4.9)	2 (1.7)	3.00	.229
disorders				
Discharge against medical advice	15 (24.6)	21 (17.4)	1.52	.256
Antipsychotics	23 (37.7)	20 (16.5)	3.29	.003
First-generation antipsychotics	21 (34.4)	16 (13.2)	3.92	.002
Second-generation antipsychotics	3 (4.9)	4 (3.3)	1.62	.567
Mood stabilizer	1 (1.6)	5 (4.1)	0.40	.403
Antidepressant	9 (14.8)	16 (13.2)	1.14	.763
Benzodiazepine	51 (83.6)	107 (88.4)	0.65	.346
Psychosis-related symptoms				
Auditory hallucination	32 (52.5)	40 (33.1)	2.18	.015
Haptic hallucination	0 (0.0)	1 (0.8)	0.00	.992
Visual hallucination	13 (21.3)	24 (19.8)	1.10	.803
Persecutory delusion	13 (21.3)	17 (14.0)	1.68	.225
Abnormal electrocardiography	7 (11.5)	10 (8.3)	1.32	.627
Physical problems	43 (70.5)	99 (81.8)	0.46	.062
Family history of suicide				
First- and second-degree relatives	1 (1.6)	2 (1.7)	1.00	1.000
Laboratory markers, mean (SD)				
Fasting glucose (mg/dL)	93.2 (13.5)	97.2 (31.3)	0.99	.378
Blood urea nitrogen(mg/dL)	10.6 (3.7)	11.6 (4.1)	0.93	.110
Serum AST (U/L)	79.3 (64.0)	86.0 (111.5)	0.99	.717
Serum ALT (U/L)	44.4 (29.1)	51.2 (51.7)	0.99	.477
Serum cholesterol (mg/dL)	184.6 (42.7)	195.2 (54.1)	0.99	.258
Serum triglyceride (mg/dL)	187.5 (146.1)	197.4 (206.7)	1.00	.729
Leukocytes ( $\times 10^{3}/\mu$ L)	6,257.4 (1,898.5)	6,669.6 (2,380.1)	1.00	.238
Hemoglobin (mg/dL)	13.8 (1.9)	14.0 (1.7)	0.91	.343
Lifetime				
Depressive syndrome	50 (82.0)	97 (80.2)	1.20	.728
Number of suicide attempts within 1 year	0.7 (1.2)	0.2 (0.6)	2.50	.001
before the last follow-up, mean (SD)				

<sup>a</sup>Values are n (%) unless otherwise stated.

Abbreviations: ALT = alanine aminotransferase, AST = aspartate aminotransferase.

patients who had abused alcohol for an average of 11 years and were hospitalized for detoxification. Consequently, they were likely to suffer from alcoholism in its most severe form or at its advanced course of illness. Most of the subjects endorsed physical disorders (such as gastric ulcers or alcoholic hepatitis) and psychiatric disorders (such as depression). As a result, multiple medical and psychiatric comorbidities may contribute to the higher SMRs of allcause deaths in general and of suicide in particular.

#### **Means of Suicide**

Despite the similarity of frequently reported means of suicides among alcoholics in Western countries, such as hanging, poisoning, jumping from a height, and drowning,<sup>10,18</sup> a substantial portion of suicides in the Asian population were completed by means of charcoal burning. This practice has emerged as a novel method of suicide in Asia in the past decade.<sup>19,20</sup> As a means of suicide, charcoal burning demands meticulous planning and careful execution.<sup>21</sup> Thus, it is less used by patients with psychiatric disorders.<sup>21</sup> However, these findings are consistent with our prior research among patients from the identical institution; moreover, charcoal burning was not infrequent for suicides among patients with methamphetamine or heroin dependence.<sup>15,22</sup> The results indicate that, for suicide prevention in patients with

Table 4. Multivariate Conditional Logistic Regression of Risk Factors for Suicide Mortality Among Patients With Alcohol Dependence

	Adjusted		
Variable	Risk Ratio	95% CI	P Value
Index admission			
Married/nonmarried	0.16*	0.03-0.75	.021
Financial independence	0.11**	0.02-0.50	.005
Auditory hallucination	1.80*	1.03-3.13	.038
Physical illnesses	0.15*	0.03-0.66	.012
Blood urea nitrogen (mg/dL)	0.89	0.76-1.03	.113
Lifetime suicidal attempts within 1	7.52**	2.18-26.02	.001
year before last follow-up			
*P / 05 **P / 01			

alcoholism or other substance use disorders in Asia, charcoal burning is a particular method warranting recognition and careful intervention.

## **Risk and Protective Factors**

We pinpointed several pertinent factors associated with suicide in alcoholism. Risk factors included auditory hallucinations and suicidal attempts within 1 year before last follow-up. Factors associated with a lower risk of suicide included financial independence, being married, and physical illnesses.

#### Hung et al

**It is illegal to post this copy** Attempted suicide is a well-known predictor of subsequent suicide mortality in different patient populations.<sup>14,15,22–24</sup> Consistent with prior studies, our study showed that a history of recent suicide attempt is a risk factor for suicide in alcoholism. Auditory hallucination is another recognized risk factor for suicide. However, our prior study of patients with methamphetamine dependence showed that visual hallucination, not auditory hallucination, is a risk factor for suicide.<sup>15</sup> Auditory hallucinations typically occur in alcohol withdrawal syndrome.

Pharmacotherapy for study patients usually included antipsychotics, anchoring the observation that suicide cases experienced a higher proportion of antipsychotic use than did controls in the univariate analysis; nevertheless, antipsychotic use did not remain in the multiple analysis. We suggest that auditory hallucination reflects the severity of alcohol withdrawal, and thus, serves as a surrogate for disease severity, leading to an increased risk of suicide.

In prior studies<sup>14,25</sup> of suicide in schizophrenics, auditory hallucinations did not increase the risk of suicide, unlike our results in alcohol-dependent patients. In another study<sup>15</sup> among patients dependent on methamphetamine, visual hallucination was a risk factor for suicide. Thus, substance use disorders and schizophrenia, 2 different disease entities, showed substantially diverse findings. Thus, it is possible that the mechanisms of suicide behavior arise through various pathways. Future investigations to explore how suicide manifests are needed.

Depression is very common among patients with alcohol dependence.<sup>26</sup> The association between depression and suicide in alcoholism has been demonstrated in prior studies.<sup>13–15,22</sup> The data in this study were collected by a medical chart reviewing process. In this study, patients who had depression requiring significant clinical attention were identified by physician entries recorded as depressionrelated symptoms in the medical chart or by the prescription of antidepressants for treatment of depression. These notes written by physicians in the medical chart provided concrete evidence for the coding of depression during the data collection. Therefore, the definition of depressive syndrome comprises either use of any antidepressants during the residual phase or depressive mood plus another DSM-IV symptom of major depression (see Method). The same definition has been used in prior studies,<sup>14,15</sup> which adds support for its practical application.

However, we did not find an association between depressive syndrome and suicide in this study. One possible explanation is that depressive syndrome was too prevalent in the cases and controls to be a sensitive predictor of suicide. Additionally, suicide is a state-dependent phenomenon, and we were unaware whether the case patients were depressed just before their suicides. Since the data were obtained an average of 3.7 years prior to suicide mortality, participants that reported no depressive syndrome at the last follow-up could later become depressed immediately before completing suicide. Conservatively, we cannot conclude that no association between depression and suicide mortality future investigation.

We sought to explore protective factors for suicide in alcoholism. Financial independence was identified as 1 of the prominent predictors of lower risk of suicide. Similarly, financial independence was a protective factor among patients with methamphetamine dependence.<sup>15</sup> Financial independence may lead to increased self-efficacy and perceived control, thus lowering suicidal risk. Regarding the association between marital status and suicide, prior studies showed that poor marital integration was associated with suicides.<sup>27,28</sup> One study reported that suicide victims were less likely to be married, have children, or live with family.<sup>27</sup> Our study confirmed that marital status was protective against suicide in patients dependent on alcohol.

existed in the particular population studied. Thus, it deserves

A variety of medical illnesses are associated with increased risk of suicide.<sup>29–31</sup> However, our results showed the contrary. One possible explanation could be the competing risk, such that those with physical illnesses could die from physical disorders associated with alcoholism (such as cardiovascular or gastrointestinal diseases) instead of suicide. Thus, patients that died of suicide could have a lower proportion of physical illness. Another possibility is that physical illnesses alert patients of the necessity to attend medical or psychiatric services, which could diminish their risk of suicide.

#### Limitations

Certain limitations should be considered when interpreting the results of this study. First, by using the national death identification system to ascertain suicide mortality, we may have failed to capture some patients who died of suicide. This occurs when causes of death are misclassified, most frequently as accidental death, which is the most common cause and is used to avoid the stigma related to suicide.<sup>32</sup> Moreover, although the event is infrequent, our study subjects could have migrated outside of the country during the study period, and, thus, were not censored.

Second, our samples consisted of patients with severe alcoholism who were hospitalized at a mental health institution for treatment of alcohol-related disorders, most frequently withdrawal syndrome. The admission screening further precluded patients who had physical disorders warranting specialized treatment; such patients were referred to general hospitals. Hence, the generalizability of our findings is limited.

Third, the data presented were obtained retrospectively from routine clinical assessments; the primary goal was not intended for research purposes such as identifying risk factors of suicide. Therefore, predictors previously reported to be associated with suicide, such as the scale for the lethality of suicide, childhood adversities, interpersonal difficulties, inadequate social support,<sup>10,13,33</sup> and hopelessness,<sup>11,12</sup> were unavailable for examination, and, thus, deserve future investigation.

#### Implications

The present study shows that patients with alcohol dependence have exceedingly high suicide mortality rates.

## It is illegal to post this copyrig Clinicians should be on heightened alert when patients

present with auditory hallucinations and attempted suicide. Resources for financial management and vocational rehabilitation can be crucial for preventing suicide in the long term.

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**Author contributions:** Drs Hung, Cheng, and Kuo conceived and designed the study. Dr Kuo acquired the data. Ms Jhong performed the statistical analysis. Drs Chen and Tsai provided administrative and material support. Drs Hung, Cheng, and Kuo drafted the manuscript. Drs Hung, Tsai, and Chen made critical revisions to the manuscript for important intellectual content, and Drs Kuo and Chen supervised the study.

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Supplementary material: Available at PSYCHIATRIST.COM.

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# THE OFFICIAL JOURNAL OF THE AMERICAN SOCIETY OF CLINICAL PSYCHOPHARMACOLOGY

# **Supplementary Material**

- Article Title: Risk and Protective Factors for Suicide Mortality Among Patients With Alcohol Dependence
- Author(s): Galen Chin-Lun Hung, MD, MS; Chia-Tzu Cheng, MD; Jia-Rong Jhong, BS; Shang-Ying Tsai, MD; Chiao-Chicy Chen, MD, PhD; and Chian-Jue Kuo, MD, PhD
- DOI Number: 10.4088/JCP.15m09825

## List of Supplementary Material for the article

1. <u>eTable 1</u> Observed and Expected Deaths and Standardized Mortality Ratios (SMRs) of the Inpatient Cohort With Alcohol Dependence Stratified by Causes of Death Based on Linkage to the National Mortality Database (1985/1/1 to 2008/12/31)

# **Disclaimer**

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

# The online data supplement:

e-Table 1. Observed and expected deaths and standardized mortality ratios (SMRs) of the inpatient cohort with alcohol dependence stratified by causes of death based on linkage to the national mortality database (1985/1/1 to 2008/12/31)

	Men (n = 2,481)			Women (n = 312)			Total (n = 2,793)			
	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)	
All causes of death	903	70.2	12.9 (12.0–13.7)	57	5.6	10.1 (7.5–12.7)	960	75.8	12.7 (11.9–13.5)	
Unnatural causes of death	201	16.9	11.9 (10.3–13.5)	14	0.8	18.7 (8.9–28.5)	215	17.7	12.2 (10.6–13.8)	
Suicide	62	2.9	21.5 (16.1–26.8)	3	0.2	16.1 (-2.1–34.4)	65	3.1	21.2 (16.0–26.3)	
Accident	116	12.9	9.0 (7.4–10.6)	6	0.5	11.8 (2.4–21.3)	122	13.4	9.1 (7.5–10.7)	
Homicide	4	0.5	7.4 (0.2–14.7)	1	0.0	47.7 (-45.8–141.2)	5	0.6	8.9 (1.1–16.7)	
Natural causes of death	702	53.3	13.2 (12.2–14.2)	43	4.9	8.8 (6.2–11.4)	745	58.1	12.8 (11.9–13.7)	
Cardiovascular disease	112	12.7	8.9 (7.2–10.5)	7	1.3	5.3 (1.4–9.2)	119	14.0	8.5 (7.0–10.1)	
Cancer	141	18.6	7.6 (6.3–8.8)	7	1.6	4.3 (1.1–7.5)	148	20.2	7.3 (6.1–8.5)	
Endocrine disease	26	2.6	9.8 (6.1–13.6)	1	0.4	2.7 (-2.6–7.9)	27	3.0	9.0 (5.6–12.3)	
Neurological disease	10	0.7	14.1 (5.4–22.8)	0	0.1	0.0 (-)	10	0.8	13.0 (4.9–21.0)	
Respiratory diseases	32	2.9	10.9 (7.1–14.7)	2	0.3	6.4 (-2.5–15.2)	34	3.2	10.5 (7.0–14.0)	
Gastrointestinal disease	260	7.8	33.3 (29.3–37.3)	15	0.3	50.4 (24.9–75.9)	275	8.1	33.9 (29.9–37.9)	
Others	121	7.9	15.3 (12.6–18.1)	11	0.9	12.2 (5.0–19.4)	132	8.8	15.0 (12.5–17.6)	