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Comparative Analysis of Suicide, Accidental, and Undetermined Cause of Death Classification

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Abstract

Suicide determination is not standardized across medical examiners, and many suspected suicides are later classified as accidental or undetermined. The present study investigated patterns between these three groups using a Medical Examiner database and 633 structured interviews with next of kin. There were similarities across all three classification groups, including rates of mental illness and psychiatric symptoms. Those classified suicide were more likely to be male, to have died in a violent fashion, and have a stronger family history of suicide. Physical pain was very common, but acute pain vs. chronic pain distinguished the suicide group.

Keywords

suicide; pain; veteran

The determination of suicide as the cause of death involves a number of factors, most of which are directly handled by medical examiners and coroners (ME/C). Given the importance of understanding suicide risk factors combined with suicide being a low frequency event, great efforts are being made to elucidate suicide patterns using surveillance data from multiple states (Karch, Logan, McDaniel, Parks, & Patel, 2012). These data sets and the literature demonstrate a lack of specific guidelines for the consistent determination of suicide among ME/Cs in the U.S. and internationally (Goodin & Hanzlick, 1997; Hanzlick & Goodin, 1997; McCarthy & Walsh, 1975; O'Carroll, 1989; Ohberg & Lonnqvist, 1998; Phillips & Ruth, 1993; Rosenberg et al., 1988). It is likely that suicide may be under reported due to both the social stigma associated with suicide as well as the reluctance of a medical examiner or coroner to make this classification if supporting data are uncertain (Timmermans, 2005). Since ME/C's have immunity within their professional boundaries, it is unlikely that punitive or legal actions have an impact upon them for categorizing a death as suicide (Hanzlick, 1997); rather, it is more likely that making a definitive classification of suicide is impeded due to insufficient evidence.

In cases of violent acts leading to death, ME/C's typically determine classification as accidental, suicide, or undetermined (Rosenberg et al., 1998). Making this differential classification is often difficult due to inexact details and lack of information. In these cases, final determination rests with each individual ME/C, which can vary regionally. Indeed, when ME/C's are given vignettes of controversial but representative death scenarios, agreement upon classification is varied (Hanzlick & Goodin, 1997; Goodin & Hanzlick, 1997). Research comparing deaths classified as suicide versus other categories could help guide the formulation of standardized protocols determining suicide classification.

The purpose of this study was to examine all suspected suicides coming to a centralized office of the Utah Medical Examiner and to compare characteristics of the cases across each of three final classifications, Suicide, Accidental death, and Undetermined death. This study will provide a better understanding of different groups of decedents to help identify difficulties in classification and to reveal potential areas of clinical need. The state of Utah is fortunate to have a centralized Office of the Medical Examiner (OME) where data from investigations are collected and almost all autopsies are performed. In addition, the Medical Examiner is committed to suicide research and was supportive of specially trained OME staff collecting additional psychological data on all suspected suicides.

Method

Ascertainment

For the current study, all individuals whose deaths were identified as suspected suicides from October 2008 to October, 2009 were included. Suspected suicide is determined primarily by the detective who provides a report to the OME based upon interviews and evidence gathered at the scene. A smaller number of suspected suicides are discovered by the OME during autopsy. Detectives consider suicide when the following scenarios are evident or suspected: 1) the method used is firearm, hanging, or another method common in completed suicide; 2) the decedent left a suicide note; 3) inspection of the decedent's body demonstrates self-injury; 4) there is a known pharmacological overdose; 5) large quantities

of pills are missing from pillboxes; 6) the decedent has a history of suicide ideation or attempts; 7) there are written materials or a computer website history of topics related to suicide; or 8) a relative suspects suicide based on their knowledge of the decedent. At autopsy, a few cases are added as suspected suicides if a large concretion of pills (bezoar) is found in the decedent's stomach or intestines.

Manner of death was identified as "Accident" if there was a traumatic or non-traumatic event that caused death in an otherwise healthy individual. This included any drug overdose case where suicide could not be determined with certainty. Additionally, suffocation cases in which drugs and alcohol may have played a part in compromising an individual from self-preservation (e.g. positional asphyxia) were also deemed accidental. Situations that inflicted fatal injuries to an individual whether recreational or vehicular in nature were also determined as accidental as long as the injury was not clearly intentional. For example, a gunshot wound inflicted to an individual while cleaning or handling a weapon would be considered an accident even if intoxication were involved. Motor vehicle fatalities were considered accidental deaths where intent was not evident regardless of whether intoxication was involved.

Manner of death was classified as "Undetermined" for all other types of drug-related deaths where intent was suspected but unsubstantiated. Without explicit knowledge of intent the medical examiners did not make a determination of suicide. For example, if toxicology reports were inconclusive, even when the decedent had a history of drug related suicide attempts, the medical examiner may have certified the death as undetermined.

When manner of death was classified as Suicide, Accident, or Undetermined by the OME (i.e., not natural), next of kin were contacted and asked to participate in the current study by completing a structured interview by OME staff, supervised by one of the senior investigators (DG).

Structured Interview

The structured interview of next of kin was developed using knowledge gained from past psychological autopsy studies. The structured interview allows standardization of data collection of important information regarding suicide decedents, including demographic variables, veteran status, symptoms and diagnosis of mental illness, and quantification of the use of tobacco, alcohol, and other common drugs of abuse. Many additional areas related to known suicide risk factors are addressed, including ownership of and access to firearms. .

Interviewers were trained by an experienced clinician (DG) in the psychological autopsy method for this study. Training consisted of: 1) meetings to clearly define the approach during the development of the interview; 2) creation of telephone scripts to manage common problem situations; 3) review meetings so the questions were well understood and presented with consistency; 4) practice interviews with other interviewers; 5) supervised practice interviews on volunteers from the National Alliance on Mental Illness (NAMI) who had lost a relative to suicide and felt they could give critical feedback; and 6) regular supervisory meetings with DG during the interview process to discuss difficulties encountered, emotional reactions by the interviewer or interviewee, and improvements to interviewing

technique. All data collection and study protocol proceeded as approved by the Institutional Review Board of the University of Utah (IRB 00029290) and the Utah Department of Health.

Participants

From 1059 cases of suspected suicides in the study year, 96 cases were later determined to be natural deaths, leaving a total of 963 cases identified by the OME as candidates for Accidental, Suicide, or Undetermined classification. In total, 31% ($n = 297$) of next of kin could not be contacted, and 3% ($n = 33$) were contacted and declined to participate, resulting in 66% of next of kin who were contacted and gave consent to an interview by the psychological autopsy team. This yielded interview information for 633 decedents classified by the OME as Suicide ($n = 245$), Accident ($n = 178$), or Undetermined ($n = 210$). Occasionally, more than one informant was contacted and interviewed about a decedent, in which case the most complete questionnaire was retained for analysis. There were four deaths classified as “Homicide – assisted suicide” that were included in the suicide category.

Analysis

All analyses were done using the SAS software package (www.sas.com). We first investigated differences between the Accidental and Undetermined categories using logistic regression, including age and gender in each test. For all variables with no significant group differences, we then used logistic regression (again including age and gender) to test for differences between the Suicide group and a collapsed group including both Accidental and Undetermined categories. For the few variables where there were significant differences between the Accidental and Undetermined groups, subsequent tests of differences with the Suicide group included all three groups. For these 3-way analyses, we used multinomial logistic regression as implemented in SAS PROC CATMOD. In these analyses, we used the Suicide group as the referent group, and fit two models (Accident relative to Suicide, and Undetermined relative to Suicide). In each case, coefficients and significance were estimated within the particular comparison and reflect the independent contribution of each effect to the odds of group membership, controlling for all other predictors. Coefficients in these models are defined as follows. In the Accidental relative to Suicide model, for a unit change in the predictor variable (substantive risk variable, gender, or age), the coefficient represents the magnitude and direction of change in the logit (natural log of the odds) of classification in the Accidental group relative to the Suicide group. Coefficients for the Undetermined relative to Suicide model have an analogous definition for odds of classification in the Undetermined group relative to the Suicide group.

Substantive risk variables were all coded such that a “No” response was represented by 0, and a “Yes” response was represented by a 1. Therefore, when a “Yes” response raised the odds of classification in the Accidental or Undetermined groups relative to Suicide, the coefficient was positive. When a “Yes” response lowered the odds of classification in the Accidental or Undetermined groups relative to Suicide (and instead contributed to the odds of classification as Suicide), then the coefficient was negative. Gender was coded as 1 for male and 2 for female. For all tests in our analyses, gender coefficients were positive; indicating that being female increased the odds of classification in the Accidental or

Undetermined groups relative to the Suicide group. Finally, for the quantitative age variable, all coefficients were negative; indicating that being younger increased the odds of classification in the Accidental or Undetermined groups relative to the Suicide group.

Results

Sample Description

There were 427 males and 206 females in the cohort (67.46% male). Average age of death was 39.63 ($SD=13.48$; range 13 to 84). Most individuals were White (97.47%), reflecting documented homogeneous race distribution in Utah (www.utah.gov/about/demographics.html).

Age at death was not significantly different across the three groups ($F=1.26$, $p=0.29$). Means were: 40.70 ($SD=15.17$) for Suicide, 38.98 ($SD=11.99$) for Accident and 38.92 ($SD=12.55$) for Undetermined. However, gender distributions were significantly different by group ($\chi^2(2) = 20.74$, $p<0.0001$). Suicides had the most males (191/245 = 77.96%), followed by Accidental deaths (112/178 = 62.92%) and Undetermined deaths (124/210 = 59.05%). Table 1 gives descriptive characteristics of the three categories for variables measured in the interview.

Accidental vs. Undetermined

Initial comparisons were made between the Accidental and Undetermined groups. The overall average age for these two groups was 38.96 ($SD=12.27$); there was no significant difference in age between the two groups ($t=0.05$, $p=0.96$). The overall gender ratio was 236/389 = 60.67% male; there was no significant difference in gender between the two groups ($\chi^2(1) = 0.61$, $p=0.44$).

As seen in Table 2, these two groups differed for relatively few variables. The Undetermined group demonstrated higher endorsement of violent manner of death, decedent history of self harm, physical abuse to the decedent, decedent impulsiveness, and lower endorsement of decedent alcohol use. Not shown in the table, the Undetermined group was slightly more likely to have been prescribed psychiatric medication ($p=0.09$), and slightly less likely to have shown a recent substance abuse relapse ($p=0.09$), but these differences were trends only. Remarkably, all other variables tested were not significantly different between the Accidental and Undetermined groups.

Suicide vs. combined Accidental/Undetermined

In our next analysis, we compared Suicide to a collapsed group that included both Accidental and Undetermined for all variables in Table 1 that did not show significant differences between the Accidental and Undetermined groups. In a logistic regression model including only age and gender as predictors of the Suicide vs. combined Accidental-Undetermined groups, there were significantly more males in the Suicide group compared to the Accidental-Undetermined group ($\chi^2(1) = 21.81$, $p<0.0001$). Age was also significantly older, independent of effects of gender, in the Suicide group compared to the Accidental-Undetermined group ($\chi^2(1) = 4.17$, $p=0.04$).

The results of all other substantive variables are presented in Table 3. For each variable, percentages of the substantive variable are presented. The test for significance was done using logistic regression, controlling for effects of age and gender. The suicide group had significantly more veterans, an increased history of suicide, and more access to guns in the home. While rates of professionally diagnosed mental illness and psychiatric prescriptions were similar, the Suicide group was hospitalized more often. Interestingly, the Suicide group was less frequently prescribed medication for stress. Sexual abuse of the decedent was more frequent in the Suicide group. Across the board, the frequency of psychiatric symptoms was higher in the Suicide group in the two months prior to death. This difference was particularly pronounced for complaints of pain, social withdrawal, hopelessness, difficulty concentrating, mood swings, anger, and sadness. Drug-related causes of death and incidence of drug use were increased in the Accidental/Undetermined group compared to the Suicide group. The Accidental/Undetermined group also had more chronic pain, increased use of pain and sleep medication, and more chronic illness or intellectual disability than the Suicide group. The Suicide group showed an increase in relationship problems, but there were no other significant differences in social risk factors. The Suicide group appears to have sought help for social risk factors somewhat less often, though this difference did not meet significance ($p=0.07$).

Three-way comparisons: Suicide, Accidental, Undetermined

For variables where there was a significant difference between the Accidental and Undetermined groups in our preliminary analyses, we tested for differences among all three groups. The Suicide group was modeled as the referent group, and we fit two models: Accidental relative to Suicide, and Undetermined relative to Suicide. Results are shown in Table 4. No significant difference was found for physical abuse after accounting for age and gender effects. History of self-injury was significantly greater in the Suicide group, but only compared to the Accidental group. All other comparisons were significant. There were more violent deaths for the Suicide group than either of the other two groups. The Suicide group showed greater endorsement of impulsiveness, whereas the Accidental and Undetermined groups both showed more alcohol use and more inadequate pain relief relative to the Suicide group.

Discussion

This is the first psychological autopsy study to collect research data statewide on a one year cohort of all suspected suicides. This study was designed to compare decedents who were determined by the Office of the Medical Examiner to have died by Suicide, Undetermined death, or Accidental death, in an effort to determine how these groups are similar or different. We also investigated specific risk areas (within or across groups) that could be addressed in clinical practice or through social policy. In this analysis we hoped to explore the extent to which suicides might be classified in the other categories. We acknowledge the tendency of under-reporting suicide due to factors such as social stigma and limited ME/C resources.

We began with an understanding that some of the variables we examined are critical to the classification into a specific group and therefore some significant differences were expected. For example, a decedent that died by firearm or hanging would likely be categorized as a suicide, whereas a chronic pain patient who completed suicide by overdose on prescription medication, or a heroin addict that committed suicide via an opiate overdose, would be more difficult to categorize. Not surprisingly, the suicide group had higher rates of violent deaths than the other groups, and the undetermined/accidental categories had higher rates of illicit drug use and substance abuse.

A major finding of this study is that decedents who die by accidental or undetermined cause are very similar. This finding allowed us to collapse these two groups and compare them on most measures with the group classified as suicide. For example, the large majority of the decedents in the suicide category are male, while the other two groups have substantially lower percentages of male decedents. In general, when comparing the decedents in the Undetermined vs. the Accidental death groups, there were no significant differences in gender, living alone, past suicide attempts, suicidal talk, access to firearms, mental illness, and hospitalization for mental illness. In addition, the two groups were very similar in terms of most psychiatric symptoms and rates of substance abuse. Each of these described variables are known risk factors for suicide, and the lack of significant differences between those in undetermined and accidental classifications suggests a clear pattern of presentation in these cases. In terms of items that separate the two categories, the Undetermined group was more likely to have been physically abused, they were more impulsive, more aggressive, and were more likely to have a history of self-harm behaviors. By comparison, the Accidental death group had higher rates of alcohol problems.

A consistent finding in this study is the association pain with all three types of decedents. Interestingly, the suicide group had higher rates of acute pain prior to death (45 % vs. 20%, $p= 0.0001$) compared with the combined groups, but the undetermined/accidental deaths had higher rates of chronic pain (70% vs. 49%, $p= 0.0001$). A study of suicidality in chronic pain patients established the presence and degree of suicidal ideation was associated with both the level of depressive symptoms and with maladaptive cognitive strategies (Edwards, Smith, Kudel & Haythornthwaite, 2006). The acute complaint of pain in the suicide group may be a reflection of medical problems, or the association between mental illness and somatization. In any case, a direct clinical implication is the recommended addition of questions regarding both acute and chronic pain during any patient suicide risk assessment, or as part of a routine review of symptoms.

The higher rate of veteran deaths seen in the suicide category compared with the other two categories is consistent with the Interpersonal Theory of Suicide by Thomas Joiner, Ph.D., The theory proposes that along with the psychological state, an individual must also have the “capability” to commit the act (Joiner et al., 2009, Selby et al., 2010). Soldiers condition themselves to tolerate self pain and must adjust to the fear of self injury. According to the theory, aspects of military service and military training such as habituation to pain and familiarity with firearms may increase the risk of suicide by firearm.

Overall the individuals categorized as suicide had many similarities to the combined undetermined/accidental group. Both groups had similar high rates of mental illness, and both experienced a number of psychiatric symptoms. However, the suicide group had more acute psychiatric symptoms over the last two months of life, including social withdrawal, hopelessness, decreased concentration, mood swings, anger, and sadness. In addition, the apparent genetic risk for suicide (as indexed by family history) was higher in the suicide group. Genetic predisposition is a well known risk factor for completed suicide (Tidemalm et al., 2011; Voracek & Loibl, 2007). In the current study, those individuals who experienced a psychiatric hospitalization were more likely to be classified in the Suicide group. Published studies on suicidal patients who require inpatient psychiatric hospitalization find that this group is at higher suicide risk for decades after a psychiatric hospitalization, although the absolute risk decays over time (Nordentoft, Mortensen, & Pedersen, 2011; Qin & Nordentoft, 2005). The finding that the suicide group had more “relationship problems” is congruent with observations in other psychological studies that an acute stressor is often the final straw for many suicide decedents (Foster, 2011; Overholser, Braden & Dieter, 2012). Alternatively, the acute nature of a relationship breakup may also influence a medical examiner to consider suicide as the cause of death.

Conclusion

Decedents categorized as either undetermined or accidental deaths were very similar on most variables, and were able to be combined for most analyses against suicides. Decedents who were categorized as suicide included significantly more male decedents and more violent deaths, although these factors may self determine their category. On many key indicators of suicide risk, such as a history of mental illness and/or psychiatric symptoms, all three groups were similar, which may point toward the under-reporting of suicide due to difficulty in differential classification. Given the largely universal indication of pain across each category, suicide assessments should include questions about both acute and chronic pain.

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Table 1

Descriptive results for Accidental, Undetermined, and Suicide categories.

	Accidental		Undetermined		Suicide	
	<i>n</i> Yes/Total	%	<i>n</i> Yes/Total	%	<i>n</i> Yes/Total	%
Demographic/general						
Live alone	38/176	21.59%	56/209	26.79%	65/227	28.63%
Veteran status	13/177	7.34%	15/210	7.14%	44/244	18.03%
Suicidal history						
Previous attempt	34/163	20.86%	48/197	24.37%	89/209	42.58%
Talk about suicide	60/174	34.48%	65/205	31.71%	127/220	57.73%
Family history of suicide	35/170	20.59%	45/201	22.39%	81/212	38.21%
Violent/non-violent						
Violent method of death	8/178	4.49%	22/210	10.48%	192/245	78.37%
History of self-harm	18/172	10.47%	41/205	20.00%	32/216	14.81%
Gun access in home	49/163	30.06%	60/191	31.41%	127/215	59.07%
Gun access outside home	37/152	24.34%	32/177	18.08%	56/191	29.32%
Mental illness						
Professionally diagnosed	75/158	47.47%	101/194	52.06%	105/212	49.53%
Hospitalized for mental illness	33/75	44.00%	51/105	48.57%	63/112	56.25%
Prescribed psychiatric Rx	87/161	54.04%	122/192	63.54%	112/208	53.85%
Prescribed Rx for stress	100/160	62.50%	132/188	70.21%	105/207	50.72%
Physically abused	35/172	20.35%	64/193	33.16%	49/210	23.33%
Sexually abused	30/162	18.52%	36/191	18.85%	42/204	20.59%
Psychiatric symptoms						
Sadness	110/168	65.48%	139/198	70.20%	180/218	82.57%
Mood swings	87/163	53.37%	115/199	57.79%	154/210	73.33%
Hopeless	84/164	51.22%	92/192	47.92%	153/213	71.83%
Social Withdrawal	41/162	25.31%	56/196	28.57%	112/213	52.58%
Irritability	85/162	52.47%	106/197	53.81%	137/215	63.72%
Concentration	47/153	30.72%	59/178	33.15%	100/197	50.76%
Anger	64/166	38.55%	88/198	44.44%	128/217	58.99%
Aggression	25/166	15.06%	39/199	19.60%	62/216	28.70%
Anxiety	102/160	63.75%	137/193	70.98%	153/211	72.51%
Panic	47/155	30.32%	60/187	32.09%	71/195	36.41%
Insomnia	87/151	57.62%	105/185	56.76%	126/190	66.32%
Impulsiveness	49/162	30.25%	80/197	40.61%	80/212	37.74%
Hallucinations	10/155	6.45%	18/184	9.78%	22/198	11.11%
Appetite	41/150	27.33%	52/194	26.80%	73/196	37.24%
Appearance	38/165	23.03%	50/199	25.13%	73/216	33.80%
General behavioral changes	36/163	22.09%	56/194	28.87%	108/219	49.32%
Complaints of pain	37/171	21.64%	40/205	19.51%	95/212	44.81%
Drug use						

	Accidental		Undetermined		Suicide	
	<i>n</i> Yes/Total	%	<i>n</i> Yes/Total	%	<i>n</i> Yes/Total	%
Drug-related death	91/178	51.12%	112/210	53.33%	49/245	20.00%
Alcohol use	161/171	94.15%	182/207	87.92%	191/222	86.04%
Tobacco use	136/172	79.07%	163/206	79.13%	144/221	65.16%
Marijuana use	100/157	63.69%	114/190	60.00%	109/210	51.90%
Heroin use	60/154	38.96%	62/187	33.16%	32/203	15.76%
Cocaine use	72/148	48.65%	68/175	38.86%	53/199	26.63%
Meth use	53/147	36.05%	63/177	35.59%	41/195	21.03%
Hallucinogen use	29/143	20.28%	45/171	26.32%	45/193	23.32%
Any drug	168/174	96.55%	198/208	95.19%	203/226	89.82%
Substance abuse problem/relapse	89/163	54.60%	84/185	45.41%	79/215	36.74%
Pain and pain medication use						
Chronic pain	112/164	68.29%	141/198	71.21%	103/209	49.28%
Prescription med for pain in last year	123/163	75.46%	148/190	77.89%	109/207	52.66%
Inadequate pain relief	61/147	41.50%	62/157	39.49%	50/194	25.77%
Complain not enough pain Rx	27/119	22.69%	43/148	29.05%	26/105	24.76%
Use pain Rx for things other than pain	38/135	28.15%	49/177	27.68%	37/199	18.59%
Others concerned about use of pain Rx	84/122	68.85%	95/149	63.76%	48/104	46.15%
Sleep						
Sleep medication	104/157	66.24%	127/179	70.95%	112/197	56.85%
Sleep problems	128/166	77.11%	143/199	71.86%	156/218	71.56%
Chronic illness						
Traumatic brain injury	20/169	11.83%	25/194	12.89%	19/213	8.92%
Seizures	23/173	13.29%	31/203	15.27%	17/218	7.80%
Major illness ¹ or intellectual disability	119/177	67.23%	149/209	71.29%	118/227	51.98%
Social risk factors						
Relationship problem	45/171	26.32%	63/203	31.03%	108/218	49.54%
Financial problem	108/173	62.43%	115/202	56.93%	130/225	57.78%
Legal problem	55/164	33.54%	74/198	37.37%	65/220	29.55%
Death of a friend or family member	20/172	11.63%	30/206	14.56%	26/227	11.45%
Professional help for social risk factors	66/114	57.89%	93/150	62.00%	93/190	48.95%

¹Includes traumatic brain injury and seizures.

Table 2

Significant differences between Accidental and Undetermined groups; significance was tested using logistic regression, adjusting for effects of age and gender.

	Accidental % yes	Undetermined % yes	χ^2 , df=1
Violent/non-violent			
Violent method of death	4.49%	10.48%	4.82 *
History of self-harm	10.47%	20.00%	6.07 **
Mental illness			
Physically abused	20.35%	33.16%	7.33 **
Psychiatric symptoms			
Impulsiveness	30.25%	40.61%	4.43 *
Drug use			
Alcohol use	94.15%	87.92%	4.04 *

* $p < 0.05$

** $p < 0.01$.

Table 3

Significantly different variables between Suicide and the combined Accidental/Undetermined group using logistic regression controlling for effects of age and gender.

	Accidental-Undetermined % yes	Suicide % yes	χ^2 , df=1
Demographic/ general			
Veteran status	7.24%	18.03%	6.38 **
Suicidal history			
Previous attempt	22.78%	42.58%	28.66 ***
Talk about suicide	32.98%	57.73%	31.48 ***
Family history of suicide	21.56%	38.21%	14.80 ***
Violent/non-violent			
Gun access in home	30.79%	59.07%	38.41 ***
Mental illness			
Hospitalized for mental illness	46.67%	56.25%	4.90 *
Prescribed Rx for stress	66.67%	50.72%	8.11 **
Sexually abused	18.70%	20.59%	4.35 *
Psychiatric symptoms			
Sadness	68.03%	82.57%	14.09 ***
Mood swings	55.80%	73.33%	19.13 ***
Hopeless	49.44%	71.93%	23.72 ***
Social Withdrawal	27.09%	52.58%	35.16 ***
Irritability	53.20%	63.72%	5.70 *
Concentration	32.02%	50.76%	19.85 ***
Anger	41.76%	58.99%	17.00 ***
Aggression	17.53%	28.70%	10.02 **
Panic	31.29%	36.41%	3.73 *
Insomnia	57.14%	66.32%	3.95 *
Appetite	27.03%	37.24%	6.51 **
Appearance	24.18%	33.80%	6.70 **
General behavioral changes	25.77%	49.32%	29.24 ***
Complaints of pain	20.48%	44.81%	39.24 ***
Drug use			
Drug-related death	52.32%	20.00%	52.93 ***
Tobacco use	79.10%	65.16%	13.22 ***

	Accidental-Undetermined % yes	Suicide % yes	χ^2 , df=1
Marijuana use	61.67%	51.90%	7.24 **
Heroin use	35.78%	15.76%	27.18 ***
Cocaine use	43.34%	26.63%	19.11 ***
Meth use	35.80%	21.03%	11.58 ***
Any drug	95.81%	89.82%	10.28 ***
Substance abuse problem/relapse	49.71%	36.74%	9.84 **
Pain and pain medication use			
Chronic pain	69.89%	49.28%	24.16 ***
Prescription med for pain in last year	76.66%	52.66%	30.27 ***
Use pain Rx for things other than pain	27.88%	18.59%	4.41 *
Others concerned about use of pain Rx	66.05%	46.15%	9.42 **
Sleep			
Sleep medication	68.75%	56.85%	4.7 *
Chronic illness			
Major illness ¹ or intellectual disability	69.43%	51.98%	17.24 ***
Social risk factors			
Relationship problem	28.88%	49.54%	28.42 ***

¹ Includes traumatic brain injury and seizures.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$.

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Table 4

Chi-square tests of significant group differences from Table 1 using multinomial logistic regression.

	Suicide vs. Accidental				Suicide vs. Undetermined							
	Test variable		Age		Test variable		Age					
	Coeff.	χ^2	Coeff.	χ^2	Coeff.	χ^2	Coeff.	χ^2				
Violent method of death	-4.35	118.55***	0.0004	0	-0.01	1.44	-3.89	146.03***	0.23	0.69	-0.01	2.05
History of self-harm	-0.64	3.88*	0.88	14.41***	-0.02	3.82*	0.12	0.19	0.95	18.56***	-0.01	3.14
Physically abused	-0.34	1.65	0.98	16.86***	-0.01	2.4	0.34	2.07	1.01	18.93***	-0.02	4.44*
Impulsiveness	-0.47	4.67*	0.86	13.37***	-0.02	4.38*	-0.41	3.9*	0.95	18.15***	-0.02	4.45*
Alcohol use	1.08	7.82**	0.84	13.47**	-0.009	1.44	0.29	0.96	0.94	18.7***	-0.01	3.4
Inadequate pain relief	0.72	9.11**	0.77	9.73**	-0.01	1.75	0.64	7.12**	0.77	16.27***	-0.01	2.46

Note: Chi-square from maximum likelihood analysis of variance (SAS CATMOD procedure).

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$.