

## Risk factors observed in health care system 6 months prior completed suicide

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### ABSTRACT

Ten percent of all deaths in Greenland are caused by suicide. The aim of this study was to explore if applicable risk factors could be identified among the suicide victims within the health care system up to 6 months prior to the suicide. The study was performed as an age- and gender-matched case control study including all suicides in Greenland from 2012 to 2015, based on review of medical records for risk factors including suicide ideation, suicide attempts, incidence of alcohol intoxication, incidence of violence and treatment for psychiatric illness within the 6 month period leading up to the suicide. In total, 160 cases and 160 controls were included. Presence of any risk factors were observed in around a third of all suicide cases compared a tenth among the controls. The highest odds ratios for suicide were observed for suicide ideation and suicide attempts. However, no contact with the health care system was observed for two thirds of the suicides victims. Thus, focus on suicide ideation and suicide attempts among patients could help health care professionals to assess suicide risk and initiate prevention. Additional preventive strategies targeting the majority without contact to the health care system need to be explored.

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## Introduction

Suicide is the 20th most common causes of death on a global scale and around 1 million people die because of suicide every year in the world [1]. The prevalence of attempted suicide is estimated to be 20 times higher [2]. The highest rates of suicides are reported among Indigenous populations, and have been associated with mental health disorders, stressful life events and substance abuse [3–5]. Life expectancy in Greenland is around 68 for males and 73 for females [6] which is approximately 10 years less than that observed in Denmark [7]. This can partly be explained by high rates of suicides for people less than 35 years of age. 10% of all deaths in Greenland are caused by suicide [6]. Thus, the suicide rate in Greenland is among the highest reported in the world, especially among young men and women younger than 35 years of age [6,8]. The rate of suicide attempts is even higher and dominated by women aged 15–19 [9]. The prevalence of suicide for young men (age 15–35) is roughly 20 times higher than in Denmark while the prevalence is approximately 2 times higher for men over 35 [10]. The suicide rate in most western societies is around 2 times higher for men than women. In Denmark as an example, the suicide male women ratio is 1.8 [10]. In Greenland, the gender ratio difference is even higher, 4.3 times higher rate

among Greenlandic men compared to Greenlandic women. Also, the suicide rate has been reported as being higher in small settlements when compared to the larger towns [8]. In western societies, suicidal behaviour is strongly correlated to mental illness and substance abuse [11]. In addition in many western societies *help-seeking behaviour* has been found to predict suicidal behaviour and thus it is often possible to assess the prevalence of risk factors and initiate suicide prevention strategies [2,12]. In Greenland, *help-seeking behaviour* in the primary health care system prior to suicide remains largely unexplored. However, it has been shown that 10% of emergency contacts were alcohol related, that around 50% attempted suicides were related to alcohol intoxication, and that 59% of the presence of violence was alcohol related [13]. One qualitative study exploring 7 suicides in East Greenland reported frequent presence of alcohol related health care contacts, social problems and suicidal ideation prior to the suicide. The suicides were described as impulsive actions without any *help-seeking behaviour* observed immediately prior to committing suicide [10]. However, it remains unknown if these 7 suicides are representative for all suicides in Greenland.

Another study based on questionnaires among participants in a population survey showed that the relative risk of suicide in Greenland was higher if suicidal ideation

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had been present. Yet, the majority of suicides happened outside the group with suicide ideation present prior to suicide [8]. This leads to speculation as to whether or not suicidal ideation or other risk factors had been recorded in the patient medical record prior to suicides, which might have possibly led to a potential preventative action from within the health care system. There has been considerable political and scientific focus on suicide prevention among the Inuit population in the arctic, but no consensus on effective prevention strategies has yet been achieved [14–16]. In 2013, a national strategy for suicide preventions was launched in Greenland focusing on cross-sectorial initiatives, prevention in the education and health care system, and monitoring of both suicides and suicide attempts [17]. Yet, the prevalence of suicide in Greenland still remains high and effective prevention strategies are warranted. The age demographics of suicide are different in Greenland and other arctic Inuit societies compared to western societies and thus, different prevention strategies may be needed [5,8–10,14,15,18–36]. The potential for preventing suicide within the jurisdiction of the primary health care in Greenland remains largely unexplored.

Thus, the aim of this study was to explore if in Greenland applicable risk factors could be identified from within the primary health care system for suicide victims up to 6 months prior to the committed suicide.

## Methods

The study was performed as a case-control study based on review of data obtained from the central death register maintained at Nunatsinni Nakorsaaneqarfik (Chief Medical Officer) (CMO) and the electronic medical records in Greenland.

## Setting

The population in Greenland is approximately 56,000. The population is predominately Inuit, and the population lives in 18 town and approximately 60 settlements along the 4,000 km coastline of Greenland [7]. The public health care system in Greenland is divided into 5 regions delivering primarily primary health care free of charge to residents. Each region includes 1 regional hospital in the largest town, local health care clinics in minor towns and health care stations in settlements. More specialised services are provided by Queen Ingrid Hospital in Nuuk, the capital of Greenland. All patients diagnosed with a suicide attempt are offered referral to the department of psychiatry at Queen Ingrid Hospital. Since 2007, all patient data has been entered into the same electronic medical record system (EMR). The primary access point for healthcare is

through a health care worker, a nurse or a general physician at the local health care clinic. Furthermore, all deaths are registered electronically in a central register at the CMO based on data from death certificates.

## Study population

All suicides committed in Greenland during the period 2012–2015 were included as cases in the study. Age and gender matched control cases were identified in the EMR as the first unrelated person with same gender and a birthdate falling immediately after each suicide case.

## Study variables

The EMR was reviewed for information about age, gender, suicide attempts or ideation, any symptoms of mood disorder, any symptom of psychosis, alcohol intoxication, violence or medical treatment up to 6 months prior to the suicide.

Medical data from the last 6 months leading up to the suicide were recorded for both suicide cases and control individuals. Age was defined as the age at the time of death for cases. Time of death was defined as specified in the death certificate. Method of suicide was categorised as shooting, hanging, or “other” as recorded in the death certificate. The number of contacts with the health care system was recorded for both the cases and controls. Any primary care contact counted as 1 instance. If the patient was admitted to hospital that contact counted as 1 instance. The EMR was then reviewed for number of contacts within the last 6 months prior to the suicide for both cases and controls. Based on content in the EMR 6 months prior to the suicide the following risk factors were identified.

Suicide ideation was considered present if any suicide ideation expressed by the patient was described in the EMR. Any self-harm inflicted by the patient, recorded in the EMR concerning any contact to the health care system within 6 months prior to suicide, was considered a suicide attempt. Incidence of alcohol intoxication was considered present if any sign of alcohol intoxication was observed and then described in the EMR. Incidence of violence was considered present as a risk factor if any signs of violence either as perpetrator or victim or both were recorded. Psychiatric disease as a risk factor was considered present if any medication including antidepressants, antipsychotics, benzodiazepines or barbiturates was ever prescribed in the EMR. These medications included those from the Anatomical Therapeutic Chemical Classification System codes N06A, N05A, N05B, N05C and N03A [37].

## Statistics

Variables were described using medians and interquartile range (IQR). Estimates were calculated with 95% confidence intervals. Medians were compared using the Mann-Whitney U test. Frequencies were compared using Fischer's exact test. In addition, relative risks and odds ratios were calculated. A p value below 0.05% was used as the level of significance. The data was analysed both as a whole group and divided by age into a younger group below 35 years and an older group at or above 35 years old.

The study was approved of the Ethics Committee for Medical Research in Greenland and the Agency for Health and Prevention in Greenland.

## Results

A total of 160 cases and 160 controls were included. Of those, 72% were male (N = 115) and 28% female (N = 45) identically comprised in both the control and case group. We found the suicide rate in the period to be 2.6 times higher for men than for women. The median age and number of contacts by age gender and case or control group are illustrated in Table 1. In the young age group median age was lower among women – 20 years – compared to 22 years among men ( $p < 0.001$ ), while no age difference in the oldest age group was observed between men, 47 years, and women, 48 years ( $p = 0.761$ ). The median number of

contacts with the health care system was 2.0 (6.0) among both cases and controls. Women had significantly more contacts, median 6.0 (9.5), compared to 2.0 (4.0) from men ( $p < 0.001$ ). No difference in number of contacts was observed between cases and controls for each age and gender specific group (see Table 1). Forty-nine patients, 31% (49/160), in the case group and 40 patients, 25% (40/160), in the control group had no contacts at all. The number of contacts ranged from 0 to 61. Based on data from the death certificates we found that hanging (71%) and gunshot (19%) comprised the dominating methods observed while a mixture of methods was reported in the remaining 10% of suicides. The proportion of cases and controls with contacts to the health care system-related risk factors is shown in Table 2. All the risk factors used in this study were more frequently observed among suicide victims than among controls. In the young study group, no significant difference was observed for the risk factor "psychiatric disease", while no differences were observed for the risk factors "incidence of alcohol intoxication" and "incidence of violence" in the older study group (see Table 2). In addition, at least 1 risk factor was observed among 36.3% (N = 58) in the case group compared to only 10% (N = 16) in the control ( $p < 0.001$ ). The highest odds ratios were observed for "Suicide ideation" (OR = 22.7) and "Suicide attempt" (OR = 29.38), while more moderate odds ratios were observed for "Incidence of alcohol intoxication"

**Table 1.** Distribution of age, gender and number of contacts among young and older cases and controls.

	Age Median (IQR) (Min-max)	Number of contacts Median (IQR) (Min-max)	p value Cases vs. Controls
<b>Young age (below 35 years), men</b>	22 (7.0) (15–34)	1.0 (3.0) (0–20)	0.796
Cases (N = 65)		2.0 (3.0) (0–20)	
Controls (N = 65)		1.0 (2.0) (0–11)	
<b>Young age (below 35 years), women</b>	20 (4.0) (15–33)	4.5 (8.0) (0–39)	>0.999
Cases (N = 30)		4.5 (7.0) (0–22)	
Controls (N = 30)		5.0 (10.3) (0–39)	
<b>Older age (35 years or above), men</b>	47 (11.5) (35–65)	2.0 (5.0) (0–61)	0.219
Cases (N = 50)		2.0 (5.5) (0–61)	
Controls (N = 50)		2.0 (5.0) (0–21)	
<b>Older age (35 years or above), women,</b>	48(9.0) (35–72)	9.0 (13.3) (0–53)	0.605
Cases (N = 15)		10.0 (23.0) (0–53)	
Controls (N = 15)		7.0 (9.0) (0–24)	

**Table 2.** Risk factors among young and older cases and controls.

Risk factors	Less than 35 years old (N = 95 + 95)			At or above 35 years old (N = 65 + 65)			Total (N = 16 + 160)			Relative Risk (95% C.I.) ODDS Ratio (95% C.I.)
	Cases % (n)	Controls % (n)	p value	Cases % (n)	Controls % (n)	p value	Cases % (n)	Controls % (n)	p value	
Suicide ideation	11.6 (11)	0 (1)	<b>0.005</b>	14.1 (9)	0 (0)	<b>0.003</b>	12.6 (20)	0.5 (1)	<b>&lt;0.001</b>	<b>2.0 (1.7–2.4)</b> <b>22.7</b> <b>(3.0–171.4)</b>
Suicide attempt	7.4 (7)	0 (0)	<b>0.014</b>	9.4 (6)	0 (0)	<b>0.013</b>	8.1 (13)	0 (0)	<b>&lt;0.001</b>	<b>2.1 (1.9–2.4)</b> <b>29.4</b> <b>(1.7–498.6)</b>
Incident of alcohol intoxication	18.8 (18)	5.3 (5)	<b>0.007</b>	15.5 (10)	9.4 (6)	0.298	17.5 (28)	6.9 (11)	<b>0.004</b>	<b>1.5 (1.2–1.9)</b> <b>2.9 (1.4–6.0)</b>
Incident of violence	15.8 (15)	3.2 (3)	<b>0.005</b>	6.3 (4)	3.0 (2)	0.440	11.8 (19)	3.0 (5)	<b>0.003</b>	<b>1.7 (1.3–2.1)</b> <b>4.2 (1.5–11.5)</b>
Psychiatric disease	8.3 (8)	2.0 (2)	0.1	26.6 (17)	1.4 (1)	<b>&lt;0.001</b>	15.5 (25)	1.9 (3)	<b>&lt;0.001</b>	<b>1.9 (1.6–2.3)</b> <b>9.7 (2.9–32.8)</b>
Suicide ideation and/or attempt	13.7 (13)	1.1 (1)	<b>0.001</b>	16.8 (11)	0 (0)	<b>0.001</b>	15.0 (24)	0.6 (1)	<b>&lt;0.001</b>	<b>2.1 (1.8–2.4)</b> <b>28.1</b> <b>(3.8–210.1)</b>
Suicide ideation and/or attempt and/or Psychiatric disease	18.8 (18)	2.0 (2)	<b>&lt;0.004</b>	26.2 (17)	0 (0)	<b>&lt;0.001</b>	21.2 (35)	1.2 (2)	<b>&lt;0.001</b>	<b>2.1 (1.8–2.5)</b> <b>22.1 (5.7–93.8)</b>
Any risk factor*	36.7 (35)	9.5 (9)	<b>&lt;0.001</b>	35.2 (23)	10.8 (7)	<b>0.002</b>	36.3 (58)	10.0 (16)	<b>&lt;0.001</b>	<b>1.9 (1.6–2.3)</b> <b>5.0 (2.8–9.4)</b>

(OR = 2.9), “Incidence of violence” (OR = 4.2) and “Psychiatric disease” (OR = 9.69). Also, both the combination of risk factors, suicide ideation and or suicide attempts, and the combination suicide ideation and/or suicide attempts and/or psychiatric disease, were observed with high odds ratios at 28.1 and 22.1 respectively. Thus, among the young, 18.8% of suicide victims could be linked to at least 1 of these 3 risk factors compared with only 2% among controls. In the older group, 26.2% could be linked to these risk factors compared to none in the control group.

## Discussion

The risk factors used in this study were all significantly more frequent among suicide victims than among control individuals indicating that traditional risk factors described in the international literature [1,2,27,28,30,31,35,36,38,39] are applicable to the Greenlandic population. Especially, expression of suicide ideation and suicide attempts was observed with very high odds ratios indicating “help-seeking behaviour” among suicide victims in Greenland, providing a possible window for health care professionals to identify persons at increased risk of suicide and offering opportunities to consider possible interventions. Still, no risk factors were observed in the EMR for the majority of suicide cases – around 65% – indicating that opportunities to prevent these cases should probably be explored outside the health care system.

We found suicide ideation and suicide attempts in the 6 months leading up to the suicide to be significant risk factors. The same pattern is described in the international

literature on suicide [1,2,12,24,25,27–36,38–41]. This applied both to the case groups, those younger and older than 35 years of age. For the entire study group we also found that risk factors such as incidence of violence, incidence of alcohol intoxication, and use of antidepressants, antipsychotics or benzodiazepines described in the patient record significantly predicted suicide. In the younger group incidence of alcohol intoxication and violence seems to play a role as a risk factor related to suicidal behaviour whereas pharmaceutical treatment for psychiatric illness does not, which may indicate that problems with impulse control can be a factor among young suicide victims. In contrast, treatment for psychiatric illness represented a significant risk factor among suicide victims at or above 35 years old, which may reflect a higher proportion of diagnosed and medical treated psychiatric diseases in this group compared to the younger group. In both groups risk factors described in the international literature (suicide ideation, suicide attempt and psychiatric illness) were found to be significant. The gender distribution of suicide documented in this study is in accordance to previously reported studies [10,25].

When screening for suicidal behaviour in a primary care setting in Greenland 1 might propose that signs of impulse dysfunction such as violence and alcohol should be carefully taken into consideration in the younger population aged less than 35 years of age, but not the older group. However, both incidence of violence and alcohol intoxication are frequently observed in the Greenlandic primary health care system [13] and the specificity of these risk factors is consequently low. In contrast, suicide ideation and suicide attempts were strong

risk factors that should be included in general suicide risk assessment. Approximately 1 third of all suicides in the study period were related to known risk factors when assessing the patient records for both younger and older patients in Greenland compared to approximately 10% among non-suicidal patients. A more systematic approach to treating patients presenting these risk factors could be developed and examined in a Greenland context aiming to reduce the number of suicides in Greenland.

### Strengths and limitations

The major strength of this study was that all suicide cases in the study period on a national level were included. Furthermore, to our knowledge, this study was the first to assess the patient record for risk factors related to suicide for an entire country.

The major limitation is the length of the study period (6 months) and the small sampling of the population of Greenland (small sample size). It cannot be ruled out that more risk factors like adverse childhood experiences and loss of family or friends could be identified if a longer study period and more sources of information were used, but this was beyond the scope of the study. On the other hand, prevention efforts in the future might be more applicable if based on recent data leading up to suicide. Furthermore, it is possible that different levels of documentation in the EMR are dependent on the size of the clinic and the education level of the staff both of which could introduce a possible regional bias. However, by law all health care workers must document their actions in the EMR and the size of this bias was thus considered minimal.

In conclusion, we found that established risk factors including suicide ideation and suicide attempt were applicable to the Greenlandic patient population both for older and younger victims and could be identified in 20–30% of all cases. This knowledge may help health care professionals in Greenland to address these risk factors in a more systematic way, and represents an opportunity to develop a strategy of risk assessment and intervention that could be examined in a future research project. Furthermore, alternative preventive strategies and opportunities for study should also be explored outside the health care system, targeting suicide victims with no prior contact to the health care system.

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