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ORIGINAL ARTICLE

Unnatural deaths in reindeer-herding Sami families in Sweden, 1961–2001

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ABSTRACT

Objectives. Unnatural deaths among Indigenous populations, including the Swedish Sami, occur more often than among the general population. To find prevention strategies, we explored the circumstances of the unnatural deaths of members of reindeer-herding Sami families.

Study design. The number of deaths from among a cohort of 7,482 members of reindeer-herding Sami families were retrieved from the National Board of Health and Welfare for the years 1961–2001.

Methods. An evaluation of the information from autopsy records at the National Board of Forensic Medicine, police reports, and available medical records identified 158 unnatural deaths. These were then analysed in detail.

Results. Transport-related deaths and suicides were the most common unnatural deaths among Swedish reindeer-herding Sami family members. Suicides contributed to 23% of all deaths, road traffic accidents to 16%, and snowmobile fatalities to 11%. The accidents generally reflected an “outdoor lifestyle” and the working conditions were characterized by the use of off-road vehicles such as snowmobiles. Half of the number of victims tested positive for alcohol and alcohol abuse was documented in 15% of all victims.

Conclusions. The results indicate that alcohol is an important factor in preventing unnatural deaths among reindeer-herding Sami, together with increased safety of both on-road and off-road transportation.

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Keywords: unnatural deaths, Sami, reindeer-herding, Indigenous populations, suicide, alcohol

INTRODUCTION

One of the most serious problems affecting Indigenous populations is excessive mortality caused by injuries. In Nunavut in northern Canada, injuries accounted for 34% of all deaths during 2001–2003 compared to only 6% in the whole of Canada. Similar mortality data have been reported from Greenland (21%) when compared to Denmark (6%) (1). In the northern parts of Sweden and Norway, mortality due to injuries corresponds to national data (5%), while Finnish Lapland shows a slightly higher proportion of unnatural deaths (10% vs. 8% nationally) (1). Generally, it seems as if Indigenous populations in circumpolar regions, especially men, might suffer a particularly high risk of fatal accidents (2–5).

The Sami are the Natives of northern Scandinavia and the Kola Peninsula. In Sweden there are approximately 20,000 to 40,000 Sami, of which about 2,000 belong to reindeer-herding families (6). Reindeer-herding Sami men have a higher mortality from external causes of injury than Sami not involved in reindeer husbandry (6,7). Excess risks have been observed concerning transport related deaths and deaths caused by poisoning and drowning (8).

Previous investigations into the mortality of the Swedish Sami (6–8) were exclusively based on mortality data from the National Board of Health and Welfare. These statistical data, however, do not permit detailed analyses of individual cases. Since it was considered of particular interest to reveal in more detail the circumstances that led to these deaths, including a possible relationship to alcohol and occupational activities,

the general objective of the present study was to obtain detailed accounts of these deaths among reindeer-herding families.

MATERIAL AND METHODS

A cohort of 7,482 members of reindeer-herding Sami families (4,451 men and 3,031 women), constructed in a previous study (8), was further investigated regarding causes and manner of deaths. The period of study stretched from 1 January 1961 to 31 December 2001. During the follow-up period, a total of 198 unnatural deaths were identified in the National Board of Health and Welfare, either as an underlying (n=151) or contributing (n=47) cause. Death certificates were obtained from the Register for these 198 deaths. Additional information was retrieved from the National Board of Forensic Medicine (either manually or through the aid of a computer).

For *cases not found* in the files at the National Board of Forensic Medicine (n=92), medical records were obtained from hospitals and local health care centres, including records from clinical autopsies. Based on this information, the deaths were reclassified as having an unnatural (n=52 of which 9 were clinically autopsied) or a natural (n=40) *underlying* cause. These natural deaths (n=40) were excluded from further analyses.

Occupational injuries are, according to the Swedish work injury insurance scheme, defined as injuries resulting from accidents or other harmful influences at work, including accidents when commuting to and from work. The regulations apply to all economically active persons, employees, employers and self-employed persons, as well as those under-

going training, and the official statistics of work-related deaths include only those activities that constitute gainful employment (9). This official definition was, however, not used in the present study, since the information about circumstances surrounding the deaths was sometimes scarce and in several cases it was impossible to judge whether the deaths were work-related or not. Furthermore, the distinction between labour and leisure time among the Sami is difficult to define due to the nature of the reindeer-herding lifestyle. Because of these difficulties, we have included hunting and fishing in the definition of a reindeer-herder's work, and we have included all deaths regardless of when the fatal injury took place.

Consequently, work-related deaths were defined as deaths that occurred while fishing, hunting, reindeer-herding (collecting, rounding up or sorting reindeer herds, and slaughtering reindeer), maintenance of inventory and "other work activities" (e.g., work in another profession).

Deaths *not* classified as work-related were classified into (i) *not* work-related and (ii) *unknown* if work-related. The study was

approved by the Ethics Committee at Umeå University, Sweden.

Statistics

The data were processed using SPSS 14.0. The chi-square test was performed in Epi Info 6. The level of significant difference was chosen as $p < 0.05$.

RESULTS

General

In total, 158 unnatural deaths (143 males, 15 females) were identified in the cohort of reindeer-herding Sami family members. The median age of the victims was 47 years (Table I), 52 for males and 37 for females.

The deaths were classified as unintentionally inflicted (69%), intentionally inflicted (26%), or undetermined whether unintentionally or intentionally (5%) (Table II). Among the unintentional deaths, transport-related fatalities were the most common, followed by falls, drowning, intoxication and other causes (e.g., excessive cold and asphyxia) (Table II).

Table I. Unnatural deaths among Sami family members in Sweden 1961–2001, by age.

Age group	Unintentional deaths					Intentional deaths		Undetermined manner of death	Total
	Transport-related	Falls	Drowning	Intoxication	Other	Suicide	Homicide		
0-9	0	0	0	0	1	0	0	0	1
10-19	5	0	0	0	2	2	0	0	9
20-29	12	1	1	0	1	10	2	0	27
30-39	6	0	2	1	5	6	0	3	23
40-49	8	4	0	2	1	10	2	1	28
50-59	8	2	0	1	4	3	0	1	19
60-69	10	4	2	1	2	5	0	3	27
70-79	6	1	1	0	6	1	0	0	15
80-100	2	5	1	0	1	0	0	0	9
Total	57	17	7	5	23	37	4	8	158

Table II. Unnatural deaths among Sami family members in Sweden, 1961–2001, by blood alcohol content.

	Blood alcohol tests			Blood alcohol concentration (g/l)				
	Total n (%)	Tested n (%)	Positive/ tested n (%)	0.10-0.19	0.20-0.49	0.50-0.99	1.00-1.99	≥2.00
Unintentional deaths								
Transport-related	57 (36)	36 (63)	18 (50)	0	1	1	11	5
Road traffic	25 (16)	15 (60)	7 (47)	0	0	1	5	1
Snowmobile	17 (11)	14 (82)	6 (43)	0	0	0	3	3
Water transport	11 (7)	6 (55)	5 (83)	0	1	0	3	1
Aircraft	4 (7)	1 (25)	0	0	0	0	0	0
Falls	17 (11)	7 (41)	2 (29)	0	0	0	2	0
Drowning	7 (4)	3 (43)	1 (33)	0	0	0	0	1
Intoxication	5 (3)	3 (60)	2 (67)	0	0	0	0	2
Other accident	23 (15)	11 (49)	6 (55)	1	0	0	2	3
Intentional deaths								
Suicides	37 (23)	22 (59)	12 (55)	0	0	3	4	5
Homicides	4 (3)	2 (50)	1 (50)	0	0	0	0	1
Undetermined manner of death								
	8 (5)	7 (87)	4 (57)	0	0	0	1	3
Total	158 (100)	91 (56)	46 (51)	1	1	4	20	20

Unintentional deaths

Transport-related accidental deaths

Among the 57 Sami who died in transport-related accidents, 44% were killed in road traffic incidents and half of these were killed in single-vehicle incidents. Other groups killed were pedestrians, truck and tractor drivers and moped/motorcycle riders (Table III). Head injuries (60%) and chest injuries (20%) were the most common causes of death. Only 1 of the road traffic deaths was classified as being work-related.

A snowmobile was the means of transportation in 30% of the transport-related accidental deaths; all of the deceased were drivers. The majority (82%) of snowmobile injuries occurred off-road in mountainous regions. Nine victims died after driving through thin ice into the water in lakes and rivers, 3 collided with immobile objects and 5 were found dead close to their snowmobiles. The causes of death in snowmobile related deaths were drowning (41%), blunt-force injuries (29%), hypothermia (18%) and asphyxia (12%). In 59% of the snowmobile-related deaths,

Table III. Transport-related deaths among Sami family members in Sweden, 1961–2001, by type of transport.

Transport-related deaths	n	%
Road traffic	25	44
Single vehicle	7	
Multi-vehicle	7	
Pedestrian	6	
Truck/tractor	3	
Moped	2	
Snowmobile	7	30
Water transport	11	19
Air transport	4	7
Total	57	100

the drivers were alone, and 47% were considered work-related.

All victims of water transport-related accidents (9%) were occupants of small boats who died while fishing or during transport. Half of these deaths occurred in the daytime and half in late evening (7 p.m. to midnight). None of the accidents occurred after midnight. Four of the deaths in this group were classified as work-related.

Four victims (7%) were occupants of a small aeroplane. Three of these were occupants of the same aircraft and 2 of them were children. It was unknown whether or not the incidents were classified as work-related.

Falls

Most deaths from accidental falls (65%) were ground-level falls caused by slipping or tripping and took place either indoors or outdoors. The remaining victims fell down a set of stairs, off scaffolding, from a height or from a horse. Only one of the deaths was classified as work-related.

Drowning

Deaths from drowning occurred in almost all of the cases after falling through thin ice when skiing, fishing or herding reindeer. Almost half of the drowning deaths were considered work-related. Drowning deaths related to snowmobile accidents were not included in this group.

Intoxication

Four deaths by intoxication were caused by ethanol or methanol. One victim was killed by methylene chloride in a work-related incident.

Other

This group included individuals killed by hypothermia (30%), gunshot wounds (17%), suffocation (13%), misadventure during surgical and medical care (13%) or other external causes of death (26%) (electrocution, fire, fighting, accident caused by machinery, accidental explosion and avalanche). In 30% of these cases, death was considered work-related according to our definition.

Intentional deaths*Suicides*

The mean age of suicide victims was 40 years (range 17–75 years) and 86% were males (Table I). The causes of death were gunshot wounds (59%), hanging (16%), intoxication with alcohol and/or other drugs (11%), intoxi-

cation with carbon monoxide (3%), drowning (3%) and stabbing (3%).

Homicides

Four deaths were classified as homicides. Two victims were stabbed, 1 was beaten to death and 1 was shot.

Undetermined whether unintentional or intentional

Three deaths in this group were caused by intoxication from ethanol, 3 were caused by intoxication from methanol or toluene, 1 from ethanol and other drugs, and 1 from subdural hematoma.

Alcohol-related deaths

In total, 51% of the victims tested positive for ethanol in the blood, and all of these were males (Table II). The mean blood ethanol concentration of the positive cases was 1.0 g/l (range 0.10–6.20 g/l) (Table II). In 3 more cases, ethanol was present in the urine only. Ethanol was not more commonly found among the intentional deaths when compared to the unintentional deaths (54% vs. 48%, $p=0.785$).

There was no significant difference concerning alcohol involvement according to age or manner of death (data not shown). Alcohol abuse was documented in 24 out of the 158 cases (15%). Of these 24 cases, 21 had an alcohol-related diagnosis as the underlying or contributing cause of death (e.g., chronic alcoholism), and 3 had a history of high alcohol consumption documented in the medical records only.

Liver cirrhosis was detected in 4 out of 102 documented cases (4%) and moderate or severe liver steatosis in 33/101 (33%) victims. Among those with moderate to

severe steatosis, 27 out of 30 tested positive for ethanol, with a blood concentration of 0.5 to 4.8 g/l (mean 1.6 g/l).

Place of death

The majority of deaths (91/158; 58%) occurred outdoors. In 20% of the cases, the victim was found dead in his/her own house, in 9% in a building owned by another person, and in 13% in "other" places (e.g., a barn, a hut).

Work-related deaths

According to our definition, work-related circumstances were positively identified in 25 (23%) of the 109 unintentional deaths (fishing 6%, hunting 5%, reindeer-herding 6%, maintenance work 2% and "other work" 4%). About 35% of the unintentional deaths were *not* work-related, while 42% were impossible to classify due to the lack of relevant information in the available records.

DISCUSSION

The Swedish Sami men show a significantly higher mortality rate for external causes of death than a demographically matched reference population of non-Sami men (6). Similar findings were previously shown for reindeer-herding Sami in both Sweden and Norway who have a significantly higher mortality rate from unnatural deaths than the total population (4,7). There is, however, a lack of more detailed knowledge about the circumstances surrounding the deaths, the scope of the injuries and so on.

The present study shows that transport-related accidents and suicides are the most common external causes of death in reindeer-

herding Sami families in Sweden. Apart from road traffic deaths, there were several fatalities from snowmobile, boat and aircraft accidents. In fact, in this sparsely populated region, more than half of the transport-related deaths occurred off-road, reflecting the outdoor lifestyle in a combination with traditional lifestyle and modernization (7).

Suicides

The incidence of suicide was found to be high among males of reindeer-herding families, but not significantly higher than among other males living in the same region (8). In the present study, it was observed that shooting was the most commonly used method of suicide, which is consistent with a study of Alaska Natives (3). Shooting and hanging were also common methods among the Inuits in Canada and the Sami in Norway and Greenland (10–13). In the general male population of Sweden, the most common suicide methods were hanging and poisoning, followed by shooting (14–16). This difference in choice of suicide method is probably a mere reflection of availability and of the fact that, in Indigenous cultures, hunting and gun ownership is an integral part of the lifestyle.

Alcohol

In the present study, half of the victims of unnatural deaths tested positive for alcohol, which can be compared to the corresponding figure for unnatural deaths among the general male population in Sweden between 1992 and 1996, which was 43% (17). The interpretation of this difference can be discussed, but the share of alcohol-related deaths among reindeer-herding families is definitely high, and this indicates that alcohol is one of the important factors that must

be considered in attempts to lower the number of unnatural deaths.

A considerable involvement of alcohol in unnatural deaths have been reported for other Native populations (Canadian Natives (18); New Mexico Natives (19); Alaska Natives (3)). Furthermore, according to a questionnaire study, the Finnish Sami have a higher consumption of alcohol than the general Finnish population (20), and the mortality from chronic alcoholism has been reported to be on the increase among native Greenlanders (2). However, self-reported data on alcohol consumption among the Sami show conflicting results. The young Norwegian Sami consume less alcohol than the non-Sami in the same geographical setting, and the young Sami with a more traditional Sami lifestyle have the lowest alcohol consumption (21–23). No difference in alcohol consumption has been found in Swedish studies of reindeer-herding Sami, other Sami and non-Sami (24,25).

Furthermore, there was no significant difference in alcohol involvement between unintentional and intentional deaths among the Sami in our study as opposed to the situation of the general Swedish population in which alcohol involvement is twice as common among intentional deaths as among unintentional (17). This is an interesting finding that should be explored in more detail, suggesting that reindeer-herders are more often inebriated in *accidental* deaths, whereas alcohol is a more important factor when an individual of the general Swedish population commits suicide.

A high mean alcohol concentration as well as a high share of alcohol-related liver disease indicates alcohol abuse among many of the victims of unnatural death in the present study of Sami. Alcohol-related liver disease was found in 36% of the autopsies, a figure slightly higher

than what was found among snowmobile riders (31%) who were accidentally killed in northern Sweden between 1973 and 1998 (26).

Validity

Due to the long follow-up period (40 years), the quality and the extent of the documentation of the circumstances vary. This variation is, in part, a result of the improved quality in *all* aspects of the police and medico-legal investigations of unnatural deaths. This, as well as the fact that the sample was relatively small, indicates that the results should be interpreted with caution.

The true share of work-related deaths in this material is difficult to estimate, since 42% of the deaths were impossible to classify because of a lack of relevant information in the available records. Our suggested estimate of 23% (or more) for work-related deaths is, however, far higher than the share of work-related deaths in the general population of Sweden, corresponding to 2% of all unnatural deaths in 1997 (16,27).

It should be pointed out that the figures presented in the present study are directly applicable to the cohort of reindeer-herding Sami family members and not to the very small population of reindeer-herding Sami in Sweden. In addition to having problems of separating work-related deaths from those that are not work-related, there are difficulties in separating “reindeer-herders” from “non-herders.” Many Sami work part time in other professions and reindeer-herding is a typical family business in which many family members are involved. This means that the differences between the Sami population and the non-Sami population of northern Sweden are weakened. Further, making a distinction between a genuine Sami and a non-Sami is truly difficult (28). When

comparing the definition of “Sami” from studies in different countries, one must be aware of the variations that define the Sami lifestyle (29). Since a previous study has shown an increased risk for fatal accidents among reindeer-herding Sami compared to non-herding Sami (8), the main focus of the analyses should be on the living and working conditions of reindeer-herding Sami rather than on the Sami identity.

Prevention

Since the quantitatively largest groups were alcohol-related deaths, suicides, road traffic deaths and snowmobile-related deaths, preventive measures for these types of deaths could be prioritized. These categories are not in any way specific to the Sami, and the preventive measures are most probably similar to the corresponding groups of the general population.

The incidence of suicide in the Sami population is not significantly higher than in a non-Sami control population (8), but prevention is nevertheless important. In addition, specific measures that address mental health should be aimed at the prevention of alcohol use and abuse since our study shows that the involvement of alcohol in fatal incidents was high and strongly suggests that alcohol abuse was an important factor in the unnatural deaths in Sami families.

The prevention of road-traffic deaths is a huge task for society. In 1997, the road safety campaign “Vision Zero” was launched by the Swedish National Road Administration in order to minimize the number of deaths from and severe injuries caused by road traffic accidents (30). The snowmobile related deaths could be prevented by the use of a flotation snowmobile suit and helmet, in addition to access to a cellular phone and extra clothing and food (see further [26]). Since many accidental deaths happened

when the victim was alone, additional preventive measures may include modified work arrangements and improved communication equipment (8). Preventive measures should focus on the specific conditions under which the herders live and work, mainly their reliance on transportation by the means of snowmobiles and motorcycles. Solutions that could minimize the degree of solitary work should be encouraged (cf. 8).

Since our results suggest that alcohol abuse might be an important factor in the unnatural deaths of members of reindeer-herding Sami families, further studies of this problem should be conducted.

Conclusions

In the present study, the main groups of unnatural deaths among members of Swedish reindeer-herding families were transport-related deaths and suicides. Half of the deaths were alcohol-related. Improving safety of both on-road and off-road transportation is encouraged to prevent future incidents. In addition, health programs and policies aimed at changing alcoholic behaviour would be helpful.

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