



Alcohol in Greenland 1950-2018: consumption, drinking patterns, and consequences

Peter Bjerregaard^a, Christina V. L. Larsen ^{a,b}, Ivalu K. Sørensen ^a and Janne S. Tolstrup^a

^aUniversity of Southern Denmark, Denmark; ^bInstitute of Nursing and Health Research, University of Greenland, Nuuk, Greenland

ABSTRACT

Alcohol is the single most important public health challenge in Greenland. We provide an overview of alcohol consumption, drinking patterns, and consequences of excessive use of alcohol in Greenland since 1950 through a synthesis of published results and analyses of population-based interview surveys. The import of alcohol fluctuated over the last 70 years with a peak in the 1980s at 22 litres 100% alcohol per person per year. In 1950 and 2015, the import of alcohol was similar at 8 litres. Several explanations have been put forward to explain the changes including restrictions, increased tax, demographic changes, treatment of alcohol disorders, and public health interventions. The proportion of abstainers increased from 1993 to 2018 while the proportion of participants with regular consumption decreased. About half of the population reported binge drinking at least monthly. Compared with Denmark, there were more abstainers and binge drinkers in Greenland, and fewer had a regular consumption. Although genetics may play a role for drinking patterns, social and cultural conditions are more important. Exposure to domestic alcohol problems and sexual abuse in childhood parallel the recorded import of alcohol and is a likely cause of transgenerational consequences such as youth suicides and alcohol problems.

ARTICLE HISTORY

Received 1 June 2020
Revised 23 July 2020
Accepted 19 August 2020

KEYWORDS

Alcohol; Greenland; Inuit; drinking patterns; adverse childhood experiences

Introduction

According to the Greenland Public Health Prevention Programme for 2013–2019, Inuuneritta II, risky use of alcohol and marihuana is the single most important public health challenge in Greenland [1]. This sentiment is shared by the general population [2]. A government commission in 2011 judged that this is a contributory factor to the problems that children, youth, and families face in contemporary Greenland [3]. Even though the consumption of alcohol has decreased considerably since the late 1980s there is still a significant legacy from the high consumption in the 1970s and 1980s. At that time, many children were exposed to alcohol misuse in their homes and families, and violence, sexual assaults, and suicides among present day's adults have been shown to be related to sexual assaults and exposure to alcohol misuse in childhood [4]. Studies among indigenous peoples in Alaska, Canada, and Greenland have all indicated a link between the colonial legacy of cultural loss, historical oppression, loss of language and substance misuse, sexual abuse, and suicides [4–7]

Traditionally, the Greenlanders didn't produce fermented beverages but were introduced to alcohol by the

whalers and colonisers from the sixteenth century and onwards. The Danish-Norwegian Crown tried to reduce the consumption of alcohol from the late eighteenth century and during the nineteenth and early twentieth century only Greenlanders employed by the Royal Greenland Trade Department and the Danish colonists were allowed to purchase alcohol, but alcohol was also used as payment and rewards to the ordinary Greenlanders [8,9]. Bertelsen estimated the consumption to be 0.6 litres of pure alcohol per person (including children) per year in 1935 which was only one-fifth of that in Denmark. Another estimate, however, for 1949/50 was already as high as 7.2 litres per person aged 14+ [9].

Several government reports [9] and major studies of the use of alcohol and the consequences of alcohol misuse in Greenland have been published including the doctoral theses of Sølling [10] and Lynge [11], and since 1993 countrywide population health surveys have been monitoring the use of alcohol. The purpose of the present article is to update and analyse information about total alcohol consumption, drinking patterns, and consequences of alcohol use in Greenland for the period from 1950 to 2018. Because of Greenland's status as a former colony of Denmark, comparisons are made between the two countries.

Material and methods

The total population of Greenland is 56,000 of whom an estimated 92% are Greenland Inuit (Kalaallit, Greenlanders) [12]. Genetically, Greenlanders are Inuit (Eskimos) with a 25% admixture of European, mainly Scandinavian genes [13]. The Greenlanders are closely related linguistically, culturally, and genetically to the Inuit/Iñupiat in Canada and Alaska and, somewhat more distantly, to the Yupiit of Alaska and Siberia [14]. Under Danish colonial system from 1721 to 1953, Greenland has had Home Rule since 1979 and a self-governing status since 2009. Urbanisation started in the early twentieth century and increased rapidly since the 1950s. In 1951, 68% of the population lived in villages with less than 500 inhabitants; by 2010, this proportion had decreased to 15%. All 80 communities in Greenland are located on a narrow coastal strip. There are no roads connecting the communities.

Import of alcohol

Statistical information on alcohol consumption was compiled from different sources. Information on the first decade (1950–1959) was based on a commission report [9] and subsequently for 1960–1972 on a doctoral thesis [10]. For 1973 and 1974, total consumption was calculated from import statistics for beer, wine and spirits published in the yearbooks of Statistics Greenland. Finally, from 1975 figures of total consumption of alcohol per person aged 15+ are available at the website of Statistics Greenland [15]. An estimate of the consumption of imiaq (home-brewed beer) was included from 1950 to 1972 while consumption of methylated spirits, duty-free import, etc., was not included. Information about alcohol in Denmark and Norway was obtained from the online databank of Statistics Denmark and Statistics Norway [16,17].

Survey data

Information about drinking habits, domestic alcohol problems and sexual abuse in childhood, and suicidal thoughts was collected from a country-wide population health survey in Greenland in 2018. A full description of the study methods is available elsewhere [18] and is summarised here. Data was collected from 2017 to 2019 as part of a countrywide cross-sectional health survey in Greenland that was carried out in cooperation between the National Institute of Public Health in Denmark and the Government of Greenland. The participants, aged 15 years and older, were selected through a stratified random sample of adults

in Greenland, who had been born in Greenland or Denmark. Data was collected by interview and clinical examination in 12 towns and 8 villages. The participation rate was 52%. Questionnaires were developed in Danish language, translated into Greenlandic, back translated and revised. Interviews and self-administered questionnaires gave information about socio-demographic factors, self-rated health and disease, and lifestyle including diet, physical activity, smoking, and alcohol use. Interviews were conducted in the language of choice of the participant, most often in Greenlandic, by native Greenlandic speaking interviewers who had been trained in the study procedures. Although great care was taken to anchor the survey in the Inuit community, the epidemiological methods were based on a Western scientific paradigm and the presence of colonial bias cannot be refuted. A total of 2539 inhabitants in Greenland participated in the survey of which 2436 were Inuit defined by the interviewers at enrolment based on their primary language and self-identification. Participants filled out a confidential paper questionnaire with questions about alcohol, among other things. A total of 1832 participants (72%) answered the questions about alcohol equivalent to 38% of the original sample. Drinking pattern was defined according to two questions, i.e. “Did you drink anything containing alcohol during the last 12 months?”; “How often do you drink beer, wine or liquor?” recoded into abstainers, drinking rarely, drinking monthly, drinking weekly. The amount consumed was estimated by multiplying answers to two questions about how often and how much alcohol was drunk. Binge drinking was estimated as the frequency of drinking five drinks or more on the same occasion at least monthly. Information about drinking patterns was further collected from a series of country-wide population health surveys in Greenland in 1993, 1999, 2005–2010, and 2014 which used a similar methodology as described above. In these surveys, binge drinking was estimated as drinking more than five drinks on the same occasion at least monthly.

Register of causes of death

The Register of Causes of Death covers all deaths among residents in Greenland from 1968 to present (2018). It is maintained and regularly updated by the National Institute of Public Health in Denmark in cooperation with the Chief Medical Officer’s office in Greenland. The register is compiled from two sources, namely the Civil Registration Register and the death certificates which are filled in by the physicians, collected by the Chief Medical Officer’s office in Greenland, and coded and entered on the computer

by the Danish Health Data Authority (*Sundhedsdatastyrelsen*). The register currently has information on 21,733 deaths of which 94.5% have a diagnosis coded according to ICD-8 during 1968–1973 and ICD-10 since 1994. Diagnoses were recoded into alcohol-related and non-alcohol-related diagnoses according to the guidelines of Centres for Disease Control and Prevention [19].

Results

Alcohol consumption

Figure 1 shows the estimated consumption of alcohol during 1950 to 2018. The overall pattern was an increasing trend from 1950 to 1987 followed by a decrease. The consumption was similar in 1950 and 2015. The general increasing trend from 1950 to 1987 was interrupted by two periods with reduced consumption. In 1956–1960 consumption was significantly reduced compared with the previous years. In 1979–1982 a countrywide restriction on the sale of alcohol was in existence. After the restriction was lifted, the consumption soared until 1987 when it peaked with a consumption of 22.0 litres per person aged 15+. Hereafter there has been a sustained decreasing trend, at first rapidly, then reaching a plateau from 1993 to 2000 followed by a continual decrease. In 2018 it reached 7.4 litres per person aged 15+ which is less than in Denmark, Sweden, and Finland but more than in Norway. Compared with Denmark, alcohol consumption has been higher in Greenland until 2008, while that of Norway has been lower throughout.

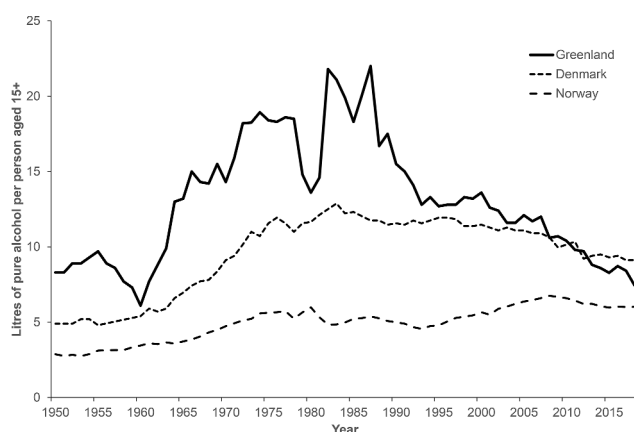


Figure 1. Estimated consumption of alcohol in Greenland, Denmark, and Norway. Litres of 100% alcohol per year per person aged 15+.

Sources [9,10,15–17]: National Statistics Greenland: Import. Denmark and Norway: Sale. Home brew not included except for Greenland before 1967.

Drinking patterns

Prior to 1954 when the general restriction on sale of alcoholic beverages to the Greenlanders was lifted, most of the consumption was imiaq, a home-brewed kind of beer brewed on sugar and malt (Figure 2). This was phased out over the next decade parallel with an increase in the consumption of imported beer. Since 1975, beer made up a relatively stable percentage of alcohol consumption in Greenland (72%) while wine drinking doubled, and the drinking of liquor decreased. In 1954 home brewing (of beer) still constituted a significant element accounting for an estimated 64% of the total consumption, but with easier access to imported beer and spirits, home brewing went out of fashion in the beginning of the 1970s [10]. In 1979 home brewing became illegal, but according to anecdotal information it is still being brewed in particular in villages with local restrictions on the sale of alcohol. It is no longer brewed on malt but on sugar, fruit syrup, berries, etc., and estimates based on sale of these ingredients would be extremely uncertain [20].

It is generally assumed that compared with Denmark the same average amount of alcohol is consumed by fewer individuals and concentrated on weekends, pay days and similar occasions. This is corroborated by police reports and observations by health care workers who, anecdotally, tell about a major alcohol-related workload on weekends and few alcohol-related chronic diseases. The Commission on Social Research in Greenland concluded that by the end of the 1950s, alcohol was predominantly consumed on special (family) occasions and to a large extent also on Saturdays and paydays, while the usual beverage for celebration was coffee. Daily consumption of alcohol was uncommon [9].

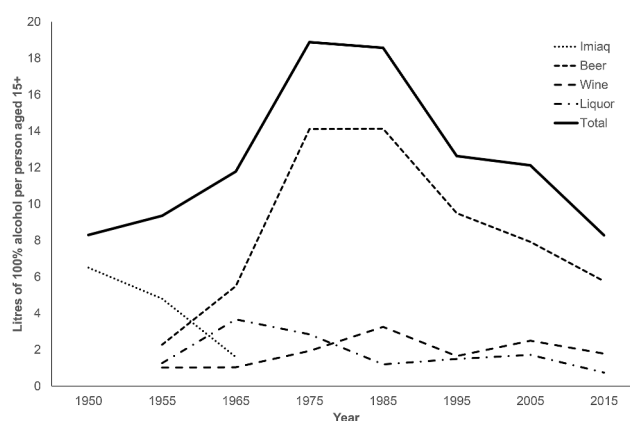


Figure 2. Distribution of alcohol consumption on types of beverage. Litres of 100% alcohol per person aged 15+. Greenland 1950–2015. Sources [9,15,38].

Table 1. Drinking patterns among Greenland Inuit and population in Denmark by survey year.

	Greenland ^c				Greenland ^c	Denmark ^d
	1993	1999	2005–2010	2014	2018	2008
	N=1323	N=1742	N=2528	N=1827	N=1608	N=3972
	%	%	%	%	%	%
Abstainers	17.4	17.3	21.2	28.1	18.8	7.7
Occasional consumption	31.1	33.6	31.2	31.2	40.4	16.1
Monthly consumption	27.8	26.0	25.8	22.2	29.5	34.2
Weekly consumption	23.7	23.0	21.8	18.5	11.4	41.9
Binge drinking	-	-	52.9	49.4	35.4	29.3
Drinks per person per week (mean) ^a	7.4	7.0	5.9	5.5	4.5	7.2
Drinks per person per week (mean) ^b	16.4	16.9	15.4	11.0	9.5	13.6

^aself reported^bimport/sales statistics^cweighted to the population of Greenland 2014^dweighted to the population of Denmark

Table 1 shows that from 1993 to 2014 the proportion of abstainers increased with time while the proportion of participants with regular (monthly and weekly) consumption decreased. About half of the population reported to drink more than five drinks per occasion. In Denmark, fewer were abstainers or occasional drinkers and there were fewer binge drinkers but considerably more regular (weekly) drinkers. The total reported consumption decreased from 7.4 to 4.5 drinks per person per week, a 40% decrease which was roughly similar to the decreased import in the same period (33%) but consumption was severely under-reported in both Greenland and Denmark.

In Figure 3 deciles of the population sorted according to the consumption of alcohol were plotted against the cumulated consumption. The figure shows that the consumption of alcohol has become increasingly skewed from 1956 to 2018, i.e. the difference between the population decile with the highest consumption and that with the lowest consumption has increased.

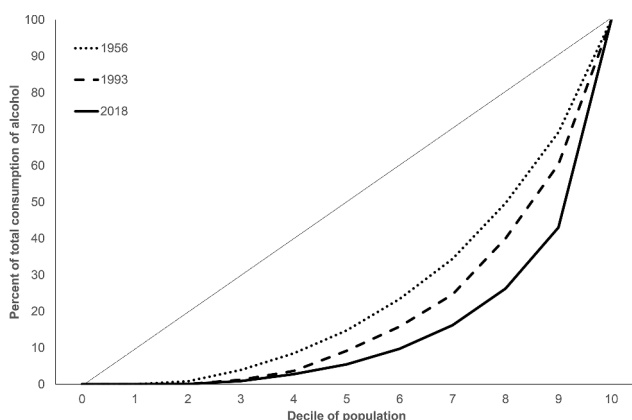


Figure 3. Consumption pattern of alcohol in Greenland. Distribution of consumption on population deciles sorted after increasing consumption. The dotted line indicates equal consumption across deciles. Sources [10] and Population Health Surveys in Greenland 1993 and 2018.

In 1956, the 20% of the population with the lowest consumption of alcohol drank 0.8% of the total consumption while the 20% with the highest consumption drank 50%. In 2018, the corresponding figures were 0.1% and 74%. However, as the total consumption fluctuated, the average consumption of the highest decile was rather constant; in 1956, 1993, and 2018 equivalating 23, 29, and 25 drinks per week, respectively.

Consequences

In 1947–48, a fact-finding mission to Greenland of the Danish National Board of Health mentioned occasional overindulgence of beer but no signs of chronic alcoholism [21]. In the 1950s, a Danish chief physician on a visit to Greenland on behalf of the National Board of Health stated that after the lifting of the restrictions, alcohol consumption had increased significantly, and that binge drinking was becoming a problem [22]. He further concluded that, in Greenland, the major alcohol-related problem was that a large proportion of the population indulged in repeated acute alcohol intoxication and not as in Denmark chronic alcoholism. Clemmesen [22] mentioned social and economic consequences of repeated acute intoxication including consequences for the children, and without being overly alarmed by the situation suggested a number of possible actions that might be taken to reduce risky alcohol use. In 1961, the Commission on Social Research in Greenland concluded that the most likely consequences of alcohol in Greenland were due to acute intoxication, such as sexually transmitted diseases, accidents, and offences against the criminal law [9]. However, it was not possible to establish a valid connection between alcohol consumption and these outcomes in a study from 1954 to 1959 [9]. Studies from 1971 by Sølling [23] demonstrated a relationship between alcohol and social stress. A study by Lyng

[24,25] showed that in households with alcoholism there was an increased prevalence of mental disorder while this was not the case in households with just a large alcohol consumption.

Although injuries due to alcohol are perceived as a major burden by the health services, few studies have been carried out. In one town (Ilulissat) in 1983, alcohol-related admissions to hospital made up 11.6% of all admissions. Two-thirds of the admissions were injuries, often due to violence, and most of the rest had psychiatric diagnoses or were social admissions due to relatives' drinking [26]. A study of violent injuries in the whole country during the last three months of 1983 showed that 81% of the victims of violence were intoxicated while 83% of the perpetrators were reported to be intoxicated. In Greenland, injuries due to violence made up 36% of all injuries, a figure that was more than 8 times higher than in Denmark [27]. Victims of violence reported a higher consumption of alcohol than non-victims (48% vs. 30% among men and 19% vs. 7% among women ($p < 0.001$)) [28].

Studies of alcohol-related deaths in Greenland estimated that during 1968–1983, 10.8% of deaths in adult Greenlandic males and 7.1% in females were alcohol related. Violent deaths including suicides made up 73.4% of alcohol-related deaths [29]. An update of the analysis of alcohol-related mortality showed different patterns for diseases and violent causes. For alcohol-related diseases, an increase from the first observations in 1969 until 2004 with a peak in 1984–1986 was followed by a decrease (Figure 4). For violent causes, two peaks were observed in 1972–73 and 1989. From 1994 when coding of diagnoses changed to ICD-10 the recording of alcohol-related violent deaths became unreliable. The most frequent alcohol-related fatal disease besides alcohol abuse/alcohol dependence



Figure 4. Alcohol-related mortality in Greenland 1968–2018. Natural deaths (diseases) and violent deaths (accidents and suicides). Source: Register of causes of death in Greenland.

syndrome (46%) were heart disease (12%), alcoholic liver disease (10%), and stroke (6%). According to a study of patients with alcohol addiction, Greenlanders had a lower prevalence of liver disease compared with Danes with similar alcohol patterns [30].

Suicides are a major challenge to public health in Greenland and alcohol is a possible direct facilitator for suicides. In 1973, 68% of patients with suicides or suicide attempts had alcohol problems themselves compared with 5% in a control group, and they also more often had a loose connection to the labour market as well as problems in relation to their family and relatives [31]. Among 110 suicides in 1993–1995, acute alcohol intoxication was mentioned in police reports or on death certificates in 30% of cases [32]. In 2010, alcohol intoxication was present in 7 of 14 emergency visits due to suicide attempts in the Greenland health care system [33]. Recent epidemiological studies from Nunavut and Greenland have confirmed this [34,35].

Transgenerational consequences

Since 1993, the population health surveys in Greenland have collected information about exposure to domestic alcohol problems during childhood and sexual abuse during childhood. The results were largely similar in all the surveys and only results from the most recent survey, in 2018, are presented. Figure 5 shows the prevalence of domestic alcohol problems during childhood by birth cohort. An increase in often reported problems until the early 1970s was replaced by a constant prevalence around 30% for a decade and followed by a slightly decreasing prevalence until the birth cohorts of the late 1990s. An increasing import of alcohol was thus paralleled by an increasing prevalence

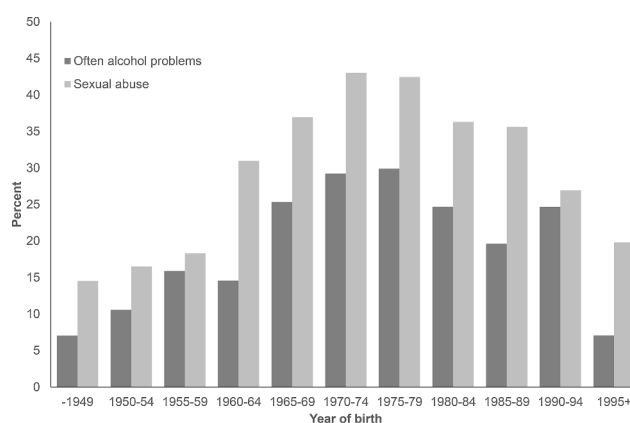


Figure 5. Prevalence of domestic alcohol problems in childhood (N=2124) and sexual abuse (N= 1765) before age 18 by birth cohort. Population health survey in Greenland 2018 [18]. N =2124.

of domestic alcohol problems and the effect of a decreasing import of alcohol was not obvious until several years after the decrease began.

Sexual abuse in childhood and youth was significantly associated with domestic alcohol problems during childhood and as Figure 5 shows, the prevalence of domestic alcohol problems and sexual abuse during childhood and youth by birth cohort very much resembled the pattern of alcohol import shown in Figure 1.

Universally, adverse childhood experiences (ACEs) play an important role in the pathogenesis of suicidal attempts among other things [36]. There was an increasing trend of suicides from before 1950 until 1999 with some ups and downs that were not directly parallel to the variation in import of alcohol. Table 2 shows that ACEs, in particular domestic alcohol problems and sexual abuse, were significantly associated with alcohol problems in adult life and suicidal thoughts. Adjusted odds ratios for exposure to alcohol problems in childhood were more than 2 for weekly binge drinking and problematic alcohol use and even higher for serious suicidal thoughts. The patterns were by and large similar for men and women.

Discussion

The overall trend of alcohol import showed an increase from 1950 to 1987 followed by a decrease. The initial increase was interrupted by two periods with reduced consumption in 1956–1960 and in 1979–1981. The first decrease remains unexplained. The decrease in

1979–1981 is explained by a general restriction on the sale of alcohol in Greenland effective from August 1979, to March 1982.

At the population level, the consumption of alcohol was underreported in the population health surveys [37]. This could be due to a general underreporting by all participants, but it is reasonable to assume that those living a life with much alcohol were less likely to participate in studies, something that was anecdotally confirmed by the interviewers. Only 52–65% of the population samples participated in the surveys and among participants only 72–87% gave information about alcohol consumption. In 2018, those who did not wish to or were not able to fill out the self-administered questionnaire about alcohol were more often older, women, and less affluent. Among participants aged 70 + less than 50% answered the questions about alcohol (unpublished analyses). This impedes the analyses of which population segments caused the reduction of alcohol consumption since 1987. It is even less possible to analyse the earlier increase since the population health surveys only cover the period since 1993 which is well past the phase of increased consumption.

Since the restriction on the sale of alcohol to the general population was lifted in late 1954 and home brewing was made illegal in 1979, restrictions have been local and temporary except for the period shortly after the introduction of Home Rule, between August 1979 and March 1982, when adult citizens were issued with 60 “points” each month allowing the purchase of 72 beers or 12 (later 24) bottles of wine or

Table 2. Associations between ACEs (domestic exposure to alcohol during childhood and child sexual abuse) and disease outcome in adult life. Odds Ratios adjusted for age, sex, and sexual abuse in a logistic regression model. Population health survey in Greenland 2018. Greenlanders only.

	Adjusted for age and sex			Adjusted for age, sex, and sexual abuse		
	OR	95% c.i.		OR	95% c.i.	
Sexual abuse in childhood or youth (N=1322)						
No domestic alcohol exposure	1.0	-	-	-	-	-
Occasional exposure	1.55	1.16	2.08	-	-	-
Often exposure	3.02	2.18	4.19	-	-	-
	p<0.0001					
Weekly binge drinking (n=1523)						
No domestic alcohol exposure	1.0	-	-	1.0	-	-
Occasional exposure	1.79	1.28	2.52	1.70	1.18	2.45
Often exposure	2.38	1.63	3.48	2.11	1.40	3.18
	p<0.0001			p<0.0001		
Problematic alcohol use (N=1497)						
No domestic alcohol exposure	1.0	-	-	1.0	-	-
Occasional exposure	1.91	1.51	2.41	1.77	1.37	2.28
Often exposure	2.15	1.62	2.85	1.96	1.45	2.66
	p<0.0001			p<0.0001		
Suicidal thoughts ever (N=1524)						
No domestic alcohol exposure	1.0	-	-	1.0	-	-
Occasional exposure	1.61	1.20	2.15	1.36	0.99	1.88
Often exposure	3.55	2.60	4.85	2.80	1.99	3.95
	p<0.0001			p<0.0001		

Sources: Population health surveys in Greenland and Denmark [62].

Reply categories differed slightly between Greenland 1993–2014 and Greenland 2018/Denmark 2008.

three bottles of liquor. Local restrictions have been applied when the sale of alcohol has been prohibited in specific villages or municipalities, in particular in East Greenland, Qaanaaq and villages north of Upernavik in North Greenland. This has often been on the wish of the local authorities and due to specific circumstances. Also, the sale of alcohol in shops and restaurants has been limited to certain hours of the day [38].

Demographic changes such as a shift in the age pattern were minor and cannot explain the decrease in alcohol consumption. Other demographic changes, in particular a decrease in the proportion of Danish migrants in Greenland, may have played a role. From 1988 to 1993 the percentage of Danes in Greenland decreased from 17.6% to 13.7% [39] and these have been shown to have a 42% higher average consumption of alcohol than the Greenlanders [10]. It was further estimated that around 1970 about half of the excess consumption of alcohol in Greenland compared with Denmark was due to the higher consumption among Danish men in Greenland [10]. According to the Population Health Survey in 1993, 61% of Danes in Greenland drank alcohol weekly compared with 24% of Greenlanders (Bjerregaard, unpublished observation).

In 1971 the Greenlandic Sobriety Commission published their report which showed that the increasing consumption of alcohol paralleled the rise in income. It has been proposed that the dramatic decrease in import after 1987 was partly due to a significant increase in tax and partly to a period of economic stagnation [11]. At the macro level, a comparison of alcohol import and relative alcohol prices showed that until the early 1990s there was an inverse association between prices and import trends but after this import continued to decrease in spite of a decrease in relative alcohol prices [40]. At the societal level, other developments paralleled the increase in reported alcohol problems in childhood, for example urbanisation and the proportion of immigrants [4].

A number of initiatives designed to curb excessive use of alcohol took place after the mid-1980s. The alcohol situation in Greenland was a central issue at an international conference on family health in Ilulissat in 1985 and a subsequent conference on alcohol politics in Nuuk. In 1988 the Government of Greenland adopted a target to reduce the consumption of alcohol from 1987 to 1991 by 50%. Although the target was not met, there was a remarkable reduction from 22 to 15 litres of pure alcohol per person aged 15+ (32%). The Greenland Council for Prevention (PAARISA) had its first meeting in 1987 and in 1990–1991 launched a campaign against excessive drinking which, among other things, included the alcohol-free “Week 18” still in function [41]. These initiatives may have had an impact

on alcohol consumption but were never evaluated. Lyngé [11] mentioned that a number of Greenlanders took part in alcohol treatment according to the Minnesota model first in Iceland, later in Denmark, and since 1995 at Qaqiffiit in Greenland. Thus, several trendsetters became abstainers and as role models may have had a positive effect on attitudes to alcohol in the community [11]. We would further like to point out that Greenlanders who grew up during the period when alcohol consumption was at its highest (1970–1990) and who experienced severe domestic alcohol problems during childhood were now coming of age and some of them may have opted to refrain from alcohol. However, in a period of rapid transition it is difficult to pinpoint one development among many as the main cause of a decrease in alcohol import.

Our analyses show that the drinking patterns of Greenlanders since 1993 have shifted towards more abstainers and fewer people with a regular consumption in tandem with a decrease in average alcohol consumption and have confirmed that binge drinking and abstention/very low consumption are the two most widespread patterns of alcohol consumption. This was in contrast with the drinking patterns in Denmark where a weekly consumption was the most common pattern and fewer than in Greenland were binge drinkers. The health authorities in Greenland currently recommend that women consume a maximum of 7 drinks and men 14 drinks per week. In addition to this, it is recommended to drink no more than 4 drinks on the same occasion, the Max4Tassa campaign [42]. Even with the noticeable underreporting of consumption more than one-third of the population exceeded these recommendations (unpublished analyses). While Denmark was high on the European list of countries according to youth alcohol consumption, Greenland was almost at the bottom. In Greenland, 13% of the 15-year-old boys and 11% of girls reported weekly alcohol intake compared with 26% and 37% in Denmark [43]. Among Inuit in Nunavik, Canada, alcohol use increased significantly between 1992 and 2004, particularly among young adults. Inuit alcohol users consumed significantly more alcohol per drinking episode than other Canadians in both time periods. In 2004, 23% were abstainers and 50% were regular drinkers (at least monthly). Binge drinking was widespread [44]. This was rather similar to the drinking pattern in Greenland during 2005–2010. Among the Sami in Northern Norway, the only other indigenous people in Scandinavia, drinking was less prevalent than in the majority population [45].

Based on the well-known genetically determined pattern of alcohol metabolism among certain Asian peoples, the Asian origin of Inuit, and the perceived high prevalence of alcohol-related problems it has been speculated, mostly by non-professionals, that the

drinking pattern of the Inuit might be genetically determined in spite of the fact that the above mentioned Asian genetic pattern normally would reduce the risk of alcoholism. However, studies among Alaska Natives, Siberian Eskimos, Chuckchi, and Greenlanders showed an absence of the protective Asian genotype pattern that included an inactive ALDH2 [46–49]. In a study of 4162 Inuit from Greenland [47] a remarkable result was a low prevalence of an ALDH1B1 TT genotype among Inuit which was associated with a low odds ratio for heavy drinking, positive CAGE, and binge drinking. On the other hand, the ADH1C GG genotype of the Inuit was directly associated with heavy drinking and with a positive CAGE test for alcoholism [50]. The combination of a slightly higher frequency of the GG genotype among the Inuit than in the general population of Denmark and an increased risk for heavy drinking and positive CAGE related to this genotype indicates that the Inuit may be genetically at higher risk for an undesired drinking pattern but this is speculative. Although genetics thus may play a role for the alcohol consumption pattern in Greenland, social and cultural conditions are without doubt more important explanatory factors and the explanation for the variation in alcohol consumption since 1950 can of course not be related to genetics.

Our perspective on drinking patterns and misuse of alcohol is based on the model for Inuit health in a social context as described in the Public Health Programme of the Government of Greenland [51] and later indicators of public health [52]. The Public Health Programmes have increasingly focused on the importance of early childhood conditions and transgenerational issues. A parallel to these programmes can be found in the Inuit Health Document by Inuit Tapiriit Kanatami [53].

Our data for the study of transgenerational effects is cross-sectional and as such cannot claim to show causality. We have asked adult participants in surveys about their childhood exposures and current health conditions and while current conditions cannot influence childhood exposure, they may influence the way survey participants remember and report their childhood [54]. However, the high rates of sexual abuse in childhood are corroborated by studies among school children aged 15–18 years [55]. Domestic alcohol exposure and youth suicides are among the most severe public health issues in Greenland and the hypothesis that domestic alcohol exposure in childhood is a contributing cause of youth suicides would be strengthened if birth cohorts growing up in years with high import of alcohol had high rates of youth suicides and those growing up in years with low import of alcohol had lower rates of youth suicides. Unfortunately, the population health

surveys in Greenland have only just begun to include the relevant birth cohorts.

Similar transgenerational effects have been observed in other circumpolar areas [5–7] and internationally [36]. Our results concerning the effect of childhood conditions on suicidal behaviour supplement the findings of Lyngé [11,56] who found that the socioeconomic and structural features of the home were less important than the emotional environment for the development of personality disorders and alcoholism (among women) and of Bjerregaard and Lyngé who found an association between reported alcohol problems during childhood and suicidal thoughts as adult [57]. A logical sequence of transgenerational events would be that modernisation leads to dysfunctional homes due to poor parental behaviour (alcohol and violence). This in turn results in suicidal thoughts, suicides and probably also substance misuse among the children of those parents. Our survey results have shown statistical associations between alcohol use and outcomes such as violence and suicidal thoughts which have confirmed the views of the health professionals, but this does not necessarily mean that alcohol is the major cause of these outcomes. It has been suggested that, in Greenland, alcohol intoxication acts like a “time out” when existing aggressions are allowed to manifest themselves [58]. On the other hand, the temporal parallel between import of alcohol and the recall of domestic alcohol problems in childhood, and the association of domestic alcohol problems and sexual abuse in childhood with later suicidal thoughts and problematic use of alcohol as an adult together with the anecdotic experience of health and social workers point towards evidence that is strong enough to act on.

Around the restriction period from 1979 to 1982 a reduction in alcohol-related mortality was followed by a peak similar to the post-restriction peak in consumption of alcohol. This took place for both alcohol-related diseases and injuries [29]. There is no explanation for a subsequent peak in alcohol-related mortality due to disease during 1998–2012 when alcohol consumption decreased and was relatively low.

Since 2007, prevention of risky use of alcohol has been a main theme in public health strategies. In the first public health programme “Inuuneritta I (2007–12)” the goal was to reduce the overall alcohol intake in the adult population and to prevent children and youth from using alcohol and drugs. Action taken under this strategy was mostly campaign-based combined with public meetings and debates as well as educational material targeted children in schools [59]. The second programme “Inuuneritta II (2013–19)” continued to focus on an overall reduction of alcohol intake specifically targeting the protection of

children. The objective of the preventive strategies was to make sure, that children and youth would not witness adults using alcohol or drugs and that pregnant women would abstain from the use of alcohol and drugs. Furthermore, children and youth should be prevented from starting to use alcohol and drugs [1]. Actions taken under the second public health programme were similar of nature to those described for the first programme but with a stronger emphasis on restrictions through legislation. In 2016 a new strategy for the treatment of alcohol dependency (Allorfik) was created. This public service offers free treatment of dependency of alcohol, other drugs, and pathological gambling [60]. Before this, the Department of Health channelled treatment through a private treatment centre (Katsorsaavik) or the health services, while between 1995 and 2012 the private treatment centres Qaqiffiit were used [61].

In 2017 a new legislation based on recommendations from the World Health Organisation stipulated regulations for visibility, accessibility, and marketing of alcoholic beverages. In the shops, alcohol was to be kept separately from other goods, it was banned to advertise for alcohol, and the regulations of sale in bars and restaurants were strengthened. However, the new legislation was overruled the following year and visibility and advertisement were again allowed. Other government actions aiming at regulating the consumption of alcohol have included increased tax. This was done latest in January 2020.

It is recommended that future epidemiological studies of alcohol include analyses of sex-specific time trends in alcohol use in relation to age and birth cohort. It is not known if certain social subgroups of the population are responsible for the decreased consumption since 1987 and further studies of social differences in temporal trends and drinking patterns are recommended. These are impeded by the low participation rate for questions about alcohol and the unfortunate fact that only about half of the total consumption is reported in the population health surveys.

Conclusion

A combination of various official statistics shows that the import of alcohol has fluctuated over the last 70 years with a peak in the 1980s at 22 litres 100% alcohol per person per year while the import of alcohol was similar at 8 litres in 1950 and 2015. Several explanations have been put forward to explain the changes including restrictions, increased tax, demographic changes, treatment of alcohol disorders, and public health interventions but they all remain speculative. The drinking pattern of Greenland Inuit is

characterised by many abstainers, few regular drinkers, and widespread binge drinking. Exposure to domestic alcohol problems and sexual abuse in childhood paralleled the recorded import of alcohol and was a likely cause of transgenerational consequences such as youth suicides and alcohol problems.

Acknowledgments

The contribution of Ingelise Olesen, who managed the population health surveys, the interviewers, and the participants who gave their time willingly, is highly appreciated.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Christina V. L. Larsen  <http://orcid.org/0000-0002-6245-4222>
Ivalu K. Sørensen  <http://orcid.org/0000-0002-4956-6326>

References

- [1] Department of Health. Inuuneritta II. 2013-imiit 2019-imut innuttaasut peqqissuunissaannut Naalakkersuisut periusissaat anguniagaallu [The Government of Greenland's strategies and goals for public health 2013–2019. In Greenlandic and Danish]. Nuuk: Department of Health; 2012 [cited 2020 May 14]. Available from: <https://www.peqqik.gl/Footerpages/Publikationer/Rapporter>
- [2] Bjerregaard P, Aidt EC. Atuagassarititat, inooriaaseq peqqinerlu [Life style, living conditions, and health. In Greenlandic and Danish]. Copenhagen, SIF's Writings on Greenland vol. 20, National Institute of Public Health and Naalakkersuisut, 2010.
- [3] Naalakkersuisut. Skatte- og Velfærdscommissionens betænkning. Nuuk; 2011 [cited 2020 Jan 3]. Available from: <https://naalakkersuisut.gl/da/Naalakkersuisut/Departementer/Finans/Skatte-og-velfaerdscommissionen/Betaenkning>
- [4] Bjerregaard P, Larsen CVL. Health Aspects of Colonization and the Post-Colonial Period in Greenland 1721 to 2014. *J Northern Stud.* 2016;10:85–106.
- [5] Wexler LM. Inupiat youth suicide and culture loss: changing community conversations for prevention. *Soc Sci Med.* 2006;63:2938–2948.
- [6] Kirmayer LJ, Brass GM, Tait CL. The mental health of Aboriginal peoples: transformations of identity and community. *Can J Psychiatry.* 2000;45:607–616.
- [7] Greenwood ML, de Leeuw SN. Social determinants of health and the future well-being of Aboriginal children in Canada. *Paediatr Child Health.* 2012;17:381–384.
- [8] Bertelsen A. Grønlandsk medicinsk Statistik og Nosografi. II. Sundhedsvilkaarene i Grønland [Greenland medical history and nosography. II. Health conditions in Greenland. In Danish]. *Meddelelser Om Grønland.* 1937;117/2:1–248.

- [9] Udvalget for Samfundsforskning i Grønland [Commission on Social Research in Greenland]. Alkoholsituationen i Vestgrønland [The alcohol situation in Greenland. In Danish]. Copenhagen. 1961.
- [10] Sølling L. Alkoholforbruget i Grønland [Thesis]. København: University of Copenhagen, 1974.
- [11] Lyng I. Mental disorders in Greenland. Past and present. *Meddr Grønland Man Soci.* 1997;21:1–73.
- [12] Young K, Bjerregaard P. Towards estimating the indigenous population in circumpolar regions. *Int J Circumpolar Health.* 2019;78(1):1653749.
- [13] Moltke I, Fumagalli M, Korneliusson TS, et al. Uncovering the genetic history of the present-day Greenlandic population. *Am J Hum Genet.* 2015;96:54–69.
- [14] Young TK, Bjerregaard P, eds. *Health Transitions in Arctic Populations.* Toronto: University of Toronto Press; 2008. p. 119–133.
- [15] Statistics Greenland. Statistics Bank 1975 ff. [cited 2019 Dec 18]. Available from: http://bank.stat.gl/pxweb/en/Greenland/Greenland__AL__AL10/ALXALK.px/?rxid=da5e6b89-b13c-4250-98d8-3b3e6330c2dd
- [16] Statistics Denmark. 2020 [cited 2020 May 17]. Available from: <https://www.statistikbanken.dk/statbank5a/default.asp?w=1280>
- [17] Statistics Norway. 2020 [cited 2020 Apr 18]. Available from: <https://www.ssb.no/statbank/table/04188/>
- [18] Larsen CVL, Hansen CB, Ingemann C, et al. Befolkningsundersøgelsen i Grønland 2018. Levevilkår, livsstil og helbred [Population Health Survey in Greenland 2018. Living conditions, lifestyle, and health. In Danish and Greenlandic]. Copenhagen: National Institute of Public Health. SIF's Grønlandsskrifter nr. 30; 2019 Available from: www.sdu.dk/sif
- [19] Centers for Disease Control and Prevention. Alcohol related ICD codes. 2020 [cited 2020 May 6]. Available from: https://nccd.cdc.gov/DPH_ARDI/Info/ICDCodes.aspx
- [20] Mølgaard A. Imigassamik tuniniaqqusinnginneq immiormik kinguneqartartoq. Immiorneq Avannaani atugaasoq/Spiritusrestriktioner fører til ulovligt hjemmebryggeri. Hjemmebrænding er udbredt i Nordgrønland [Restrictions on the sale of alcohol lead to illegal home brewing. Home brewing widespread in North Greenland. In Greenlandic and Danish]. *Sermitsiaq.* 2020;3:6–7.
- [21] Ministry of Social Affairs. Grønlandskommissionens Betænkning [Report of the Greenland Commission. In Danish]. Copenhagen: SL Møller; 1950.
- [22] Clemmesen C. Oversigt over alkoholproblemet på Grønland [Overview of the alcohol problem in Greenland. In Danish]. *Ugeskr Læger.* 1958;120:1374–1379.
- [23] Sølling L. Undersøgelse af sammenhæng mellem alkoholforbrug og social belastning [Study of the association between alcohol consumption and social stress. In Danish]. Ædruelighedskommissionens delbetænkning 2, bilag I. Nuuk; 1971.
- [24] Lyng I. Alkoholmisbrug i lægelig belysning [Medical points on alcohol abuse. In Danish]. Ædruelighedskommissionens delbetænkning 2, Bilag II. Nuuk; 1971.
- [25] Lyng I. Alcohol problems in western Greenland. In: Shephard RJ, Itoh S, editors. *Circumpolar Health.* Toronto: Health and Welfare Canada; 1976. p. 543–547.
- [26] Pedersen OS, Olsen NK, Pedersen M, et al. Alkoholbetinget sygdom på et grønlandsk distriktssygehus [Alcohol related disease in a hospital district in Greenland. In Danish]. *Ugeskr Læger.* 1984;146:2187–2190.
- [27] Jørgensen B, Johansen LG, Roed S, et al. Voldsulykker i Grønland [Accidents due to violence in Greenland. In Danish]. *Ugeskr Læger.* 1984;146:3398–3401.
- [28] Curtis T, Larsen FB, Helweg-Larsen K, et al. Violence, sexual abuse and health in Greenland. *Int J Circumpolar Health.* 2002;61:110–122.
- [29] Bjerregaard P. Alcohol related deaths in Greenland. *Arctic Med Res.* 1988;47(suppl 1):596–597. In: Linderholm H, Backman C, Broadbent N, Joëlsson I, eds. *Circumpolar Health 87.*
- [30] Lavik B, Holmegaard C, Becker U. Drinking patterns and biochemical signs of alcoholic liver disease in Danish and Greenlandic patients with alcohol addiction. *Int J Circumpolar Health.* 2006;65:219–227.
- [31] Grove O, Lyng I. Suicide and attempted suicide in Greenland: A controlled study in Nuuk. *Acta Psych Scand.* 1979;1979(60):375–391.
- [32] Leineweber M, Bjerregaard P, Baerveldt C, et al. Suicide in a society in transition. *Int J Circumpolar Health.* 2001;60:280–287.
- [33] Nexøe J, Wilche JP, Nielsen B, et al. Violence- and alcohol-related acute healthcare visits in Greenland. *Scand J Public Health.* 2013;41:113–118.
- [34] Chachamovich E, Laurence J, Kirmayer LJ, et al. Suicide among Inuit: results from a large, epidemiologically representative follow-back study in Nunavut. *Can J Psychiatry.* 2015;60:268–275.
- [35] Grundsøe TL, Pedersen ML. Risk factors observed in health care system 6 months prior completed suicide. *Int J Circumpolar Health.* 2019;78:1617019.
- [36] Dube SR, Anda RF, Felitti VJ, et al. Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: findings from the Adverse Childhood Experiences Study. *Jama.* 2001;286:3089–3096.
- [37] Bjerregaard P, Becker U. Validation of survey information on smoking and alcohol consumption against import statistics, Greenland 1993–2010. *Int J Circumpolar Health.* 2013;72:20314.
- [38] Statistics Greenland. Indførsel af alkohol til Grønland 1975–1998 [Alcohol import to Greenland 1975–1998. In Danish]. Nuuk: Nyt fra Grønlands Statistik; 1999:20:1181455011.
- [39] [cited 2020 May 5]. Available from: http://bank.stat.gl/pxweb/da/Greenland/Greenland__BE__BE01__BE0120/BEXST1.PX/?rxid=b3cf239f-f24c-4365-9c1c-c8f6821b2cc6
- [40] Aage H. Alcohol in Greenland 1951–2010: consumption, mortality, prices. *Int J Circumpolar Health.* 2012;2012:71.
- [41] Statistics Greenland. Yearly report. Nuuk: Statistics Greenland; 1992.
- [42] Department of Health. Max4Tassa Campaign. 2020 [cited 2020 May 5]. Available from: <https://www.peqqik.gl/da-DK/Emner/Kampagner/Max4tassa>
- [43] Inchley J, Currie D, Budisavljevic S, et al., editors. *Spotlight on adolescent health and well-being. Findings from the 2017/2018 Health Behaviour in School-aged Children (HBSC) survey in Europe and Canada.* International report. Volume 2. Key data. Copenhagen: WHO Regional Office for Europe; 2020.
- [44] Fortin M, Bélanger RE, Boucher O, et al. Temporal trends of alcohol and drug use among Inuit of Northern Quebec, Canada. *Int J Circumpolar Health.* 2015;74:2914.

- [45] Spein AR, Sexton H, Kvernmo SE. Longitudinal drinking patterns in indigenous Sami and non-indigenous youth in northern Norway. *J Ethn Subst Abuse*. 2006;5:103–117.
- [46] Avksentyuk AV, Nikitin YP, Kurilovich SA, et al. Drinking and genetic factors among Russians and Chukotka Natives in Siberia. *Drugs Soc*. 1994;8:3–48.
- [47] Bjerregaard P, Mikkelsen SC, Becker U, et al. Genetic variation in alcohol metabolizing enzymes among Inuit and its relation to drinking patterns. *Drug Alcohol Depend*. 2014;144:239–244.
- [48] Segal B. ADH and ALDH polymorphisms among Alaska Natives entering treatment for alcoholism. *Alaska Med*. 1999;41:9–12, 23.
- [49] Thomasson HR, Khartoniuk AM, Avksentyuk A, et al. Alcohol and alcohol dehydrogenase allele frequencies in Eskimo, Native American, and Siberian Peoples. *Alcoholism*. 1992;16:605. Poster abstract 29.
- [50] Zierau F, Hardt F, Henriksen JH, et al. Validation of a self-administered modified CAGE test, CAGE-C. In a somatic hospital ward. *Scand J Clin Lab Invest*. 2005;65:615–622.
- [51] Government of Greenland. Innuttaasut peqqissuunissaannut. Naalakkersuisut periusissaat anguniagassaallu 2007-2012 [Public Health Programme. The Greenland Government's strategies and aims for public health 2007-2012. In Greenlandic and Danish]. Nuuk: Grønlands Hjemmestyre; 2007.
- [52] Bjerregaard P, Niclasen BV, Frederiksen N, et al. Qanoq ippugut? Kalaallit Nunaanni innuttaasut peqqissusaat 2014 [How are things? Public health in Greenland 2014. In Greenlandic and Danish]. Nuuk: Departementet for Sundhed; 2015.
- [53] Inuit Tapiriit Kanatami. Social determinants of Inuit Health in Canada. Ottawa: ITK; 2014.
- [54] Williams LM. Recovered memories of abuse in women with documented child sexual victimization histories. *J Trauma Stress*. 1995;8:649–673.
- [55] Curtis T, Larsen HB, Helweg-Larsen K, et al. Unges trivsel i Grønland 2004 [Wellbeing of youths in Greenland 2004. In Danish]. *Inussuk – Arktisk Forsknings J*. 2006;1:1–119.
- [56] Lyngé I. Mental disorders and conditions of life in childhood among Greenlanders. *Arct Med Res*. 1995;54(Suppl. 1):60–67.
- [57] Bjerregaard P, Lyngé I. Suicide – a challenge in modern Greenland. *Arch Suicide Res*. 2006;10:209–220.
- [58] Breinholt F Vold i Grønland: nogle teoretiske og praktiske overvejelser [Violence in Greenland: some theoretical and practical considerations. In Danish]. *Tidsskr Grønland*; 1990. p. 255–269.
- [59] Kamper-Jørgensen F, Pars T, Dalentoft L. Midtvejsevaluering af folkesundhedsprogrammet Inuuneritta [Mid term evaluation of the Public Health Programme, Inuuneritta. In Danish]. Nuuk: Department of Health, 2011 [cited 2020 May 14]. Available from: <https://www.peqqik.gl/Footerpages/Publikationer/Rapporter>
- [60] Allorfik. [cited 2020 May 5]. Available from: <https://www.allorfik.gl/>
- [61] Curtis T, Olesen I, Bjerregaard P. Notat om det offentlige brug af Qaqiffiit [Use of Qaqiffiit in the treatment of alcoholism by the authorities in Greenland. In Danish]. Copenhagen: National Institute of Public Health; 2002.
- [62] Kristiansen L, Ekholm O, Grønæk M, et al. Alkohol i Danmark. Voksnes alkoholvaner og holdning til alkoholpolitik 2008 [Alcohol in Denmark. Drinking habits and attitudes to drinking policy among adults 2008. In Danish]. Copenhagen: National Institute of Public Health; 2008.