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To cite this article: T. Kue Young , Ann Ragnhild Broderstad , Yury A. Sumarokov & Peter Bjerregaard (2020) Disparities amidst plenty: a health portrait of Indigenous peoples in circumpolar regions, International Journal of Circumpolar Health, 79:1, 1805254, DOI: [10.1080/22423982.2020.1805254](https://doi.org/10.1080/22423982.2020.1805254)

To link to this article: <https://doi.org/10.1080/22423982.2020.1805254>



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Published online: 30 Aug 2020.



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REVIEW ARTICLE



# Disparities amidst plenty: a health portrait of Indigenous peoples in circumpolar regions

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## ABSTRACT

This paper describes the extent and variation in health disparities between Indigenous and non-Indigenous people within Alaska, Greenland and the northern regions of Canada, Russia and the Nordic countries. We accessed official health statistics and reviewed research studies. We selected a few indicators of health status, health determinants and health care to demonstrate the health disparities that exist. For a large number of health indicators Indigenous people fare worse than non-Indigenous people in the same region or nationally, with the exception of the Sami in the Nordic countries whose health profiles are similar to their non-Sami neighbours. That we were unable to produce a uniform set of indicators applicable to all regions is indicative of the large knowledge gaps that exist. The need for ongoing health monitoring for Indigenous people is most acute for the Sami and Russia, less so for Canada, and least for Alaska, where health data specific to Alaska Natives are generally available. It is difficult to produce an overarching explanatory model for health disparities that is applicable to all regions. We need to seek explanation in the broader political, cultural and societal contexts within which Indigenous people live in their respective regions.

## KEYWORDS

Arctic; indigenous people; health disparities; Canada; Alaska; Russia; Nordic countries; Greenland

## Introduction

The eight members of the Arctic Council [1], collectively referred to as the Arctic States, are among the world's most developed countries. According to the United Nations Development Programme's Human Development Index, a composite of life expectancy, gross national income, and education, 7 of the 8 Arctic States (Norway, Iceland, Sweden, Denmark, Finland, Canada and the United States) ranked among the top 15 countries in the world in 2018, while Russia ranked 45<sup>th</sup> [2]. Yet there are varying degrees of health disparities within some of these countries, especially between Indigenous and non-Indigenous people.

This paper describes the extent and variation in health disparities between Indigenous and non-Indigenous people in the northern regions of the Arctic States. It aims to provide the evidence base to policy makers and stakeholders in order to redress the disparities and improve the health of Indigenous people.

Our paper focuses on Alaska, northern Canada, Greenland, northern Scandinavia and Arctic Russia. Iceland and the Faroe Islands are not covered as they are not the homelands of Arctic Indigenous peoples.

## Background

In a previous paper, we estimated the size of the Indigenous population to be just over 1 million, with Indigenous people accounting for as much as 85–90% of the population in some regions [3].

The traditional homelands of Indigenous peoples in the Arctic extend across modern political boundaries created by the colonising European and North American nation-states. The Inuit homeland extends from Chukotka in Russia, across Alaska and northern Canada, to Greenland. Members of the Athabaskan (Athapaskan) language family can be found in Alaska and the northern regions of Canada. In northwestern Europe, Sápmi, the homeland of the Sami, extends across northern and central Norway, Sweden, Finland and the Kola Peninsula in Russia [4].

In Alaska, the collective term "Alaska Natives" is used to refer to all Indigenous people – Aleut, Iñupiat, Yupiit, Athabaskan Indians, Tlingit-Haida and Tsimshian. The last two groups reside in the temperate zone in southern Alaska. The 2010 USA census enumerated nearly 150,000 Alaska Natives and American Indians (AIAN) in Alaska, just under 15% of the population of the state.

Inuit accounted for 48,000, Athabascans 12,000 and Aleut 7,700. The number would be higher if individuals who reported multiple ethnicities were included [3].

In Canada, the 2016 census identified 47,000 Inuit living in Inuit Nunangat (“homeland”) consisting of 4 regions (Inuvialuit region in Northwest Territories, Nunavut, Nunavik region in Québec and Nunatsiavut region in Newfoundland and Labrador). The other major northern Indigenous group are First Nations, primarily of Athabaskan ancestry, living in Yukon (6,700) and the Northwest Territories (13,000) [5]. Indigenous people constitute a substantial minority in the population of Yukon (just under 25%) and the Northwest Territories (about 50%), while in Nunavut, they are the overwhelming majority (85%).

The total population of Greenland is 56,000 of whom 92% are Greenland Inuit (who refer to themselves as Kalaallit, or Greenlanders in English) [3]. Genetically, Greenlanders are Inuit with a 25% admixture of European, mainly Scandinavian, genes [6]. Denmark, the Faroe Islands and Greenland together constitute the Kingdom of Denmark.

The majority of the Sami population lives in Norway where they are officially designated as an Indigenous people. No reliable or updated estimate of the Sami population exists, except in Russia, where they are identified as an ethnic group in the census. Assimilation policies strongly affected the Sami culture and the use of the Sami languages, with the result that today many Sami do not consider themselves Sami or speak a Sami language. Today, Sami people live in multiethnic communities as minorities, except in a few municipalities in Finnmark in Norway where they constitute the majority group [7].

Of all the Arctic States, the Russian Federation has the largest area that is located in the North, extending from the northwestern corner of Europe to the easternmost tip of the Asian continent. Over the decades, various decrees and legislations have defined the Far North and “equivalent” areas, Indigenous people and the areas of residence of Indigenous people. “Indigenous, numerically small people of the North, Siberia and Far East” (*korennyye malochislennyye narody Severa, Sibiri i Dal'nego Vostoka*, hereafter referred to as KMNS) are defined as people who live in their traditional ancestral territories, adhere to their original way of life and believe themselves to be independent ethnic entities, with a population under 50,000 people [8,9]. The number of such officially recognised groups steadily increased from 26 in 1993 to 47 in the 2010 census. The 2010 census counted 181,000 KMNS people in the Russian North. The 50,000 upper limit of population size excludes some groups that would otherwise be

considered as Indigenous, such as the Yakuts, Komi and Komi-Permyak. If these large groups are also counted as Indigenous, the total population increased to 870,000 [3].

## Methods

We accessed publicly available existing data from official statistics and research studies. We did not strive to be comprehensive or exhaustive, but selected a few indicators to demonstrate the health disparities that existed and their variation across regions and Indigenous groups. There was no pre-determined framework on which these indicators were chosen. These indicators are widely used and generally available to assess health system performance. They were grouped under three major categories – health determinants, health status and health care. The list of chosen indicators within each category may differ among regions due to variation in availability. We focused on adults in general, recognising that there are also significant health issues that are unique to demographic groups such as infants, children, adolescents, seniors, pregnant women, etc. While we fully recognise the importance of gender differences we decided not to report data separately by gender due to inconsistent availability.

We compared Indigenous with non-Indigenous people within each region, or alternatively with the national average. For Greenland, the comparison group is the population of Denmark. Comparison between Indigenous people in one region with Indigenous people in another region is not advisable, as definitions and methodologies vary across regions and countries. For example, age-standardised rates cannot be directly compared as each country uses a different standard population.

We did not conduct a systematic review of the literature, starting with a wide net of all published papers and winnowed down according to pre-set criteria of relevance and methodologic rigour. As each of the co-authors are familiar with the key studies within specific regions or populations, we selected articles that best illustrated disparities in different dimensions of health.

## Alaska

Health data are available from federal and state agencies and also from the Alaska Native Tribal Health Consortium (ANTHC) Epidemiology Center. All data identify and report Alaska Natives separately but further breakdown into tribal groups are generally not available. ANTHC publishes a comprehensive *Alaska Native Health Status Report* [10] which we draw on extensively.

We use “Whites” in Alaska and in the United States nationally as comparison, as they generally represent the group with the most favourable health outcomes.

Data on socioeconomic status as reported by ANTHC originate from the U.S. Census Bureau’s American Community Survey [11]. Data on health-related behaviours are derived from the Behavioural Risk Factor Surveillance System (BRFSS), a telephone survey conducted by the Centers for Disease Control and Prevention (CDC) in all U.S. states [12].

Mortality-based indicator data are from the Division of Public Health, Alaska Department of Health and Social Services [13] as well as the CDC’s National Vital Statistics System (NVSS) [14]. For disease incidence we select cancer incidence and tuberculosis, with data derived from the CDC’s USA Cancer Statistics [15] and Online Tuberculosis Information System [16].

### **Northern Canada**

In Canada, ethnic identity is generally not available from official statistics but is available in some surveys. Vital and health statistics collected by the territorial governments of Yukon, Northwest Territories and Nunavut do capture Indigenous status but ethnospecific data are not released publicly.

We have previously investigated the availability of Indigenous-specific data in the three northern territories in national surveys including the Canadian Community Health Survey (CCHS), the Aboriginal Peoples Survey (APS) and the First Nations Regional Health Survey (FNRHS) [17]. A variety of self-reported health, health-related behaviours and health care use data are available from these sources.

Statistics Canada developed a geographic approach to assess population health, which can be applied to Indigenous people [18]. Communities (“geozones”) with a predominantly Indigenous population are classified as “Indigenous”. The method applies well for small remote communities where the great majority of residents are Indigenous but it does not account for Indigenous people living in cities which are predominantly non-Indigenous. In general data are more available for Inuit regions than First Nations.

The geographic approach is used by Indigenous Services Canada to produce a Community Well-Being Index for First Nations and Inuit communities. It consists of education, income, labour force activity and housing and is derived from the census [19]. We used this index as a summary measure of social determinants.

Statistics Canada has also created a cohort that follows Canadians who reported Indigenous identity in the 2011 census and linked them prospectively to the

national vital statistics system [20]. This method was used in computing life expectancy [21] and suicide mortality [22] among Indigenous people.

Indigenous-specific data on tuberculosis are available from the Public Health Agency of Canada [23]. For cancer, data covering the 2004–08 period were collected in an earlier study in collaboration with the territorial health departments of Northwest Territories and Nunavut as part of a circumpolar cancer review [24].

### **Greenland**

The Greenland Inuit are a majority in their own semi-autonomous country. Because of Greenland’s status as a former colony of Denmark, comparisons are made with the general population in Denmark. The population of Greenlanders living in Denmark is difficult to identify and few studies have been carried out on their health. The Central Population Register and other official registers in Greenland and Denmark do not collect information on the ethnicity of citizens. For residents in Greenland place of birth in Greenland is a reasonably valid indicator of Inuit ethnicity.

Statistics Greenland [25] and Statistics Denmark [26] have information about demography, living conditions and social conditions in each country. For some indicators Statistics Greenland provides separate data for those born in Greenland and those born outside Greenland. Since Greenland Inuit make up 92% of the total population, data for the whole of Greenland can be a good estimate of the conditions among Inuit. Health statistics for Greenland and Denmark are also available from the NOWBASE statistical database of the Nordic Council of Ministers [27].

In Greenland, a series of population health surveys have been carried out since 1993 by the Department of Health in Greenland and the National Institute of Public Health in Denmark. The 5<sup>th</sup> cycle was completed in 2019 [28]. These have information about health, lifestyle, living conditions and certain clinical observations and include questions on ethnic identity. In Denmark similar surveys (*Den Nationale Sundhedsprofil*) are carried out regularly but only as questionnaire surveys [29].

Another source of Greenland health statistics are various reports of the chief medical officer (*Landslægeembedet*) [30].

### **Northern Scandinavia**

Sami are not separately identified in official statistics in Norway, Sweden and Finland. The chief source of health

information is research studies where Sami are identified using various criteria. For example, survey participants are asked specific questions on language use and cultural belonging (objective criteria) or asked if they consider themselves to be Indigenous (subjective criteria).

In Norway, there are Sami administrative areas where Sami account for between 5% and 95% of the population. However, information on such areas refer to the total, multi-ethnic population of the areas and not specifically on Sami, which are in the minority in most municipalities.

In Norwegian Sápmi, three major surveys have contributed to our understanding of health and living conditions among the Sami.

- (1) The Study on Health and Living Conditions in Regions with Sami and Norwegian Populations (the SAMINOR Study), was organised and conducted by the Centre for Sami Health Research (CSHR) in Tromsø and other partners. The first SAMINOR survey was carried out during 2003–2004 in 24 municipalities in northern and central Norway and encompassed some 16,000 participants [31]. This was followed by SAMINOR 2 Questionnaire Survey in 2012 [32]. The SAMINOR 2 Clinical Survey was carried out in 2012–2014 in ten municipalities that were part of previous surveys [33].
- (2) The cross-sectional survey *From Rural to Urban Living* was conducted in 2014 by CSHR consists of first-generation and second-generation Sami internal migrants [34].
- (3) The county-based health and living survey (*Fylkeshelseundersøkelsen*) was conducted in Troms, Finnmark and Nordland in 2019–20. The survey includes an additional questionnaire for the Sami and Kven populations [35].

A Swedish Sami cohort covering the period 1960–2000 containing 41,000 individuals was created from a variety of sources: those who were registered to breed reindeers from Statistics Sweden's occupational register and the national register of reindeer enterprises, and those eligible to vote in the Swedish Sami parliament [36].

In Finland, a cohort covering the period 1979–1998 included over 2000 Sami in two northern municipalities (Utsjoki and Inari). All residents were identified from the national population register and their Sami status was ascertained by cross-referencing with an earlier genealogical study and also from personal knowledge of the

study's lead author familiar with the communities [37]. This cohort was extended to 2005 and again to 2010 [24].

### Arctic Russia

While information on ethnicity (or "nationality") is available from the census, last conducted in 2010, it is not recorded in official statistics. Until 2010, the Federal State Statistics Service (Rosstat) published annually a compendium of statistics on a variety of social and economic indicators on areas of residence of KMNS [38]. These data do not refer to Indigenous individuals exclusively but reflect the conditions experienced by all residents living in those areas. There are, however, limited statistics on health status from this source.

Information on Indigenous people's health in Russia is mainly derived from research studies where Indigenous status can be ascertained. We reviewed the published literature in both Russian and English and identified those articles that provided comparative health data between Indigenous and non-Indigenous people.

## Results

### Alaska

Table 1 presents several health indicators for Alaska Natives compared to Alaska Whites and US Whites. The majority of data are as published in ANTHC's *Alaska Native Health Status Report* [10]. Further details can be obtained from ANTHC's reports on mortality [39], cancer [40] and injuries [41].

It is clear that for most indicators, Alaska Natives fare worse than Whites in either Alaska or the United States as a whole. A notable exception is that Alaska Natives population tend to have better coverage in breast and colorectal cancer screening than Alaska Whites. Of note is that Alaska Whites tend to have better outcomes than US Whites.

Alaska is the only region in the Arctic that has a separate health care system for Indigenous people. The Alaska Tribal Health System is a network of programmes, services and facilities operated by regional tribal organisations. Under the authority of the Alaska Tribal Health Compact of 1994, it took over responsibility for health care from the US Indian Health Service [42].

ANTHC reports 13,073 hospital admissions and 58,480 patient-days in 2015 in the Alaska Tribal Health System [10]. With a "user population" of 153,070, the crude hospitalisation rate was about 85/1000, compared to the Alaska statewide rate of 71/1000 and US

national rate of 104/1000 [43]. The rate of patient-days was 382/1000 in the tribal health system, compared to the Alaska rate of 512/1000 and US national rate of 566/1000 [43]. A lower overall hospitalisation rate by itself is not indicative of better health system performance. The rate of hospitalisation focusing on ambulatory care sensitive conditions is more useful.

### Northern Canada

Table 2 presents selected health indicators for Canadian Inuit in Inuit Nunangat and First Nations in the northern territories compared to Canadians nationally. It is evident that there are gaps, especially for First Nations. Some publications provide data for all northern Indigenous peoples combined and these were not used.

For most health indicators, Inuit tend to fare worse than First Nations in the North, while both are worse than other Canadians. Some gaps are particularly wide, especially smoking prevalence, suicide mortality and tuberculosis incidence. Trend data show that these have not improved or changed only slightly over time. Both northern First Nations and Inuit have diabetes prevalence that is comparable to the Canadian national rate, and considerably lower than First Nations in southern Canada.

Indigenous people in northern Canada access the same health care system as other residents, although there are differences between the remote communities where the population is predominantly Indigenous and the urban areas where the population is predominantly non-Indigenous. CCHS for the period 2007–13 demonstrated the reduced access to physician services by Inuit in Nunavut, compared to Canadians nationally and even to First Nations in the Northwest Territories and Yukon [49].

Per capita health expenditures on a territory-wide basis are considerably higher in the North, with Yukon, Northwest Territories and Nunavut having 1.7, 2.1 and 2.3 times the level of Canada nationally. In fact, per capita expenditures in Nunavut and the Northwest Territories exceed even the highest ranking-country in the world, the United States [49].

### Greenland

Table 3 compares health determinants, health status and health care between Greenland and Denmark. Some Greenland data are available for Indigenous people while others refer to the total population.

In Greenland, income was lower and unemployment higher than in Denmark. Also, in Greenland a lower

**Table 1.** Alaska – Selected health indicators.

	Alaska Natives	Alaska Whites	US Whites
<b>Health Determinants</b>			
1. Educational attainment high school + (%)	82	95	89
2. Income (USD)	45,997	79,475	57,407
3. Current smoking (%)	36	18	19
4. Obesity/overweight (%)	70	65	62
<b>Health Status</b>			
5. Self-reported health very good/excellent (%)	38	58	51
6. Life expectancy at birth (years)	71	78	79
7. Infant mortality rate (per 1000 livebirths)	6.7	3.3	5.2
8. Unintentional injury mortality rate (per 100,000)	99	39	42
9. Suicide mortality rate (per 100,000)	41	18	14
10. Heart disease mortality rate (per 100,000)	208	133	168
11. Cancer incidence rate (per 100,000)	553	415	465
12. Tuberculosis incidence rate (per 100,000)	37	0.5	0.6
<b>Health Care</b>			
13. Breast cancer screening (%)	75	71	77
14. Cervical cancer screening (%)	78	84	79
15. Colorectal cancer screening (%)	69	64	71

#### Notes and sources:

- (1) % of adults aged 25+ who completed high school, from 2011–15 ACS reported in ANTHC [10]
- (2) Median household income from all sources excluding subsistence activities, in US dollars, from 2011–15 ACS reported in ANTHC [10]
- (3) % of adults aged 18+ who have smoked at least 100 cigarettes in their lifetime and currently smoke some days or every day, from 2011–14 BRFSS reported in ANTHC [10]
- (4) % of adults aged 18+ with body mass index (BMI) >25 (kg in self-reported weight/m<sup>2</sup> height), from 2011–14 BRFSS 2011–14 reported in ANTHC [10]
- (5) % of adults aged 18+ who reported overall health as excellent or very good; age-standardised to the 2000 US population, from 2011–14 BRFSS reported in ANTHC [10]
- (6) Life expectancy at birth computed from 2009–13 data by Alaska Division of Public Health and NVSS, and reported in ANTHC [10]
- (7) Death rate of infants under 1 year of age per 1000 livebirths, from 2009–13 data by Alaska Division of Public Health and NVSS, and reported in ANTHC [10]
- (8)(9)(10) Death rates age standardised to the 2000 US population, from 2012–15 data by Alaska Division of Public Health and NVSS, and reported in ANTHC [10]
- (11) Incidence rates age standardised to the 2000 US population, from 2012–16 data obtained from CDC's USA Cancer Statistics [15]
- (12) Crude incidence rate from 2014–18 data obtained from CDC's Online Tuberculosis Information System [16]
- (13) % women aged 50–74 who received mammography within past 2 years, from 2010–14 BRFSS reported in ANTHC [10]
- (14) % women aged 21–65 who had at least one Pap smear within past 3 years, from 2010–14 BRFSS reported in ANTHC [10]
- (15) % adults aged 50+ who had ever undergone flexible sigmoidoscopy or colonoscopy, from 2010–15 BRFSS reported in ANTHC [10]

proportion of adults had any education beyond basic school.

The average alcohol consumption in Greenland was slightly lower than in Denmark. Fewer Inuit reported to drink more than 14/7 drinks per week (men/women) and more Inuit did not drink at all (not shown in table) but binge drinking was more prevalent. Smoking was three times more prevalent

**Table 2.** Northern Canada – Selected health indicators.

	Inuit		First Nations			All Canadians
	North/ Nunavut	Canada	Yukon	NWT	Canada	
<b>Health Determinants</b>						
1. Community well-being index scores	61	61	72	63	58	78
- Income	67	68	74	72	54	76
- Education	35	26	54	36	40	56
- Housing	65	66	83	70	71	95
- Labour force activity	75	76	78	75	69	84
2. Daily smoking (%)	63	52	40	37	43	16
<b>Health Status</b>						
3. Self-reported health very good/excellent (%)	40	45	40	53	44	63
4. Life expectancy at birth (years)	70	73	68	-	75	84
5. Suicide mortality rate (per 100,000)	94	72	-	24	24	8
6. Tuberculosis incidence (per 100,000)	276	211	42	55	22	5
7. Cancer incidence (per 100,000)	434	-	-	258	-	303
8. Prevalence of diabetes (%)	3	5	7	2	16	7
<b>Health care</b>						
9. Contact with a medical doctor (%)	49	59	79	59	78	80
10. Has a regular doctor (%)	23	39	74	24	80	85

*Notes and sources*

- (1) Mean (max 100) of individual community scores computed from published tables by Indigenous Services Canada, based on 2016 census [44]  
(2) Inuit (aged 15+) data are from 2012 APS [45]; northern First Nations data (aged 12+) are from a merged dataset of CCHS, 2007–2010 [17]; First Nations data (aged 18+) are from the 2008–2010 FNRHS [46]  
(3) Inuit (aged 15+) data are from 2012 APS [47]; First Nations (aged 18+) data from the 2008–10 FNRHS [46]  
(4) National Inuit and First Nations data from the 2011–16 CanCHEC cohort [21]; data for Yukon First Nations from Yukon Bureau of Statistics for the decade ending in 2016 [48]  
(5) Death rate age-standardised to the 2011 Indigenous population of Canada; based on the 2011–16 CanCHEC cohort [22]; Yukon data suppressed due to small number of cases, likely < rate for NWT  
(6) Crude incidence rate for the year 2012 [23]  
(7) Incidence rate for the 2004–08 period age-standardised to the World Standard Population [24]  
(8) Inuit (aged 15+) data from 2012 APS [47]; First Nations (aged 18+) data from the 2008–10 FNRHS [46]  
(9)(10) Inuit (aged 15+) data from 2012 APS; northern First Nations data (age 12+) from merged 2007–2013 CCHS [49]; national First Nations (off-reserve) data are from APS 2012 [50]

in Greenland than in Denmark and overweight slightly more prevalent.

Life expectancy was considerably lower in Greenland with a gap of nine years. Suicide mortality was eight times higher in Greenland and the incidence of tuberculosis more than twenty times higher while cancer incidence was comparable.

Health care in Greenland had much less resources than in Denmark. The number of physicians and qualified nurses was about 50% compared with Denmark and the expenditure on health care 65% even though health care in Greenland, as opposed to Denmark, includes free medicine and adult dental care and even though transport of patients is costly in Greenland.

### Northern Scandinavia

There have been reviews on Sami health [53,54]. Table 4 is adapted from the systematic review by Mienna and Axelsson [54].

As all residents access the same regional health care services in Scandinavia, data on health care utilisation and resources cannot be attributed to Sami users specifically. Attempts have been made to determine if

officially designated Sami-speaking municipalities have similar health care access as other areas in Norway, for example on health expenditures [69], and specialist referral patterns [70]. These studies tend to show little differences among the different types of communities.

Surveys have been done to assess user satisfaction with the health care they received. Swedish Sami reindeer herders expressed significantly lower confidence in their primary health care and psychiatry providers compared with non-Sami [71]. In the SAMINOR 1 Study, Sami-speaking patients were less satisfied with the municipal GP service than Norwegian speakers [72].

### Arctic Russia

Table 5 summarises the key findings from several studies It is by no means exhaustive or comprehensive but serves to illustrate the types of health indicators that are available.

The studies in the table represent only a small fraction of the published literature. Further information on Indigenous people's health in Arctic Russia in the English language can be found in the monograph by Kozlov and others [9]. There are also in-depth regional studies, such as that of Dudarev on Chukotka [87] and Burtseva on Yakutia [88,89].

**Table 3.** Greenland – selected health indicators.

	Greenland		Denmark
	Indigenous <sup>a</sup>	Total population	
Health determinants			
1. Income (DKK)	-	305,133	352,501
2. Education attainment basic schooling only (%)	60	56	20
3. Unemployment rate (%)	-	9	5
4. Alcohol consumption (litres)	-	9	9
5. High consumption of alcohol (%)	9	-	18
6. Binge drinking at least monthly (%)	34	-	27
7. Daily smoking (%)	54	-	17
8. Obesity/overweight (%)	59	-	51
Health status			
9. Life expectancy at birth (years)	70	70	80
10. Infant mortality rate per 1000 live births	-	8.6	3.5
11. Suicide mortality per 100,000	68	71	11
12. Cancer incidence (per 100,000)	-	320	347
13. Tuberculosis incidence (per 100,000)	-	138	6
Health care			
14. Density of physicians (per 1000)	-	1.8	3.7
15. Density of qualified nurses (per 1000)	-	4.9	10.4
16. Per capita health expenditure (DKK)	-	23,859	36,891

**Notes and Sources:**

- a(5)-(8) refer to self-identified Indigenous Kalaallit in surveys; (2),(9) and (10) refer to residents of Greenland who were born in Greenland
- (1) Disposable household income in Danish kroner, 2014–16, from Statistics Greenland [25] and Statistics Denmark [26]
- (2) % of adults aged 25–64 with basic schooling only (*grundskole*, 10<sup>th</sup> grade), 2014–2016 data from Statistics Greenland [25] and Statistics Denmark [26];
- (3) Monthly average % of labour force aged 18–65 unemployed; 2014–2016 data from Statistics Greenland [25] and Statistics Denmark [26]
- (4) Import of litres of pure alcohol per person aged 15+ per year; 2014–2016 data from Statistics Greenland [25] and Statistics Denmark [26]
- (5) % adults aged 15+ who drink >14 (men) or > 7 drinks (women) per week; 2017–2019 data for Greenland from Larsen et al. [28], Danish data from Sundhedsstyrelsen [29]
- (6) % adults aged 15+ who consume 5 drinks or more on the same occasion at least monthly; 2017–2019 data for Greenland from Larsen et al. [28], Danish data from Sundhedsstyrelsen [29]
- (7) % adults aged 15+ who smoke daily; 2017–2019 data for Greenland from Larsen et al. [28], Danish data from Sundhedsstyrelsen [29]
- (8) % adults aged 15+; body mass index (BMI) 25+ calculated from weight and height; 2017–2019 data for Greenland (measured) from Larsen et al. [28], Danish data (self-reported) from Sundhedsstyrelsen [29]
- (9) Life expectancy at birth, both sexes combined, computed from 2014–2015 data; Greenland data from Statistics Greenland [25]; Danish data from Nordic Council of Ministers, Health Database [27]
- (10) Computed from information on live births and deaths at age 0 from Statistics Greenland [25] and Statistics Denmark [26]
- (11) 2011–2015 Indigenous data from the National Institute of Public Health's Greenland mortality database and Denmark's data from Eurostat [51]; 2010–13 data for total Greenland population from Statistics Greenland [25]; all rates standardised to the Standard European Population as revised by Eurostat in 2013
- (12) Incidence rate age-standardised to the World Standard Population; 2010–2014 data from NORDCAN [52]
- (13)-(16) 2014–2016 data from Nordic Council of Ministers, Health Database [27]

**Discussion**

We have reported health data from five Arctic regions from which some general observations can be made. For a large number of health indicators Indigenous populations fare worse than non-Indigenous people in the same region or nationally. An exception appears to be the Sami in the Nordic countries, who generally have health indicators similar to those of their non-Sami neighbours.

To keep the scope of the paper manageable we have not sought data relating to specific groups such as children, women, or the elderly. We urge other researchers to focus on these groups to complete the task of assessing health disparities.

That we were unable to produce a uniform set of indicators available in all regions is indicative of the large knowledge gaps that exist. With the exception of Alaska, data specific to Indigenous people is limited or non-existent from official agencies. There is clearly a need to establish health monitoring for all Indigenous groups in all regions. The need is mostly acute for the Sami and Russia, less so for Canada, and least for Alaska. As the Inuit make up 92% of the population in Greenland, the error is minor when one uses the whole of Greenland to represent its Indigenous population. It should also be noted that not all important evidence for policy making is included in our tables. Qualitative data can provide important insights into different dimensions of health status, health determinants and health care.

Improvement in health monitoring, which includes collecting health data specific to Indigenous people, is not merely an academic exercise. Back in 2011, the Nuuk Declaration on Arctic Health signed by the health ministers of the member states of the Arctic Council called for increased circumpolar sharing of knowledge to address common health challenges and strengthen collaboration in health monitoring [90]. Clearly, this goal has still not been achieved. In Canada, among the many calls to action by the Truth and Reconciliation Commission was the need to “establish measureable goals to identify and close the gaps in health outcomes” [91].

The present paper only looked at the health of Arctic Indigenous peoples in their ancestral northern homelands. As we described in detail in a previous paper [3], varying proportions of Arctic Indigenous peoples now live in urban areas in the south. Health disparities experienced by urbanised Arctic indigenous people have been little studied. It is

**Table 4.** Northern Scandinavia – Selected Health Indicators.

Indicator	Region	Methods	Results
Health determinants	SAMINOR 1: northern, central Norway	Questionnaire survey	Income and education similar between Sami and Norwegians; history of discrimination and higher level of assimilation associated with poor health [55]
	Västerbotten, Sweden	Questionnaire survey, clinical exam	Behavioural risk factor profile similar; Sami herders (M) lower diastolic BP, more physically active and higher job demand and decision latitude than non-Sami [56]
General health	SAMINOR 1: northern, central Norway	Questionnaire survey	Self-reported health: Sami worse than Norwegians [55]
	Northern, central Sweden	Questionnaire survey, SF-36 scale	Quality of life: overall little difference; Sami (M) reindeer-herders higher than Swedes in physical function [57]
Mental health	Northern Norway	Retrospective cohort	Increased risk of suicide among Sami compared with non-Sami but suicide rates among Sami were moderate compared to several other Indigenous peoples [58].
	Northern Norway	Longitudinal questionnaire survey	No ethnic differences in prevalence of suicide attempts between Sami adolescents and their non-Sami peers [59].
Nutritional status	SAMINOR 1: northern, central Norway	Questionnaire survey, clinical exam	Obesity (BMI $\geq$ 30): Sami (M,F) > Norwegians; central obesity (based on waist circumference): Sami (F) >, Sami (M) < Norwegians [60]
	Västerbotten, Sweden	Food frequency questionnaire	Higher energy intake; higher proportion from protein and fat; no difference in BMI [61]
Chronic diseases	SAMINOR 1: northern, central Norway	Questionnaire survey, clinical exam and blood tests	No difference in diabetes prevalence and metabolic syndrome; higher BMI among Sami (M,F) [62] Angina symptoms and history of angina higher in Sami; no difference in history of myocardial infarction [63,64]
	Sweden	Retrospective cohort	Acute myocardial infarction incidence: no difference; stroke incidence higher in Sami [65] Cancer incidence: all sites, colon, prostate lower in Sami (M); stomach higher (M,F) [66]
	Norway	Retrospective cohort	Cancer incidence: all sites, colon, lung lower (M,F) in Sami; prostate lower (M) [66]
	Finland, Inari and Utsjoki	Retrospective cohort	Cancer incidence: all sites, prostate lower in Sami (M); breast lower in (F) [66]
Mortality	Sami areas in Norway	Retrospective cohort	Mortality rates similar between areas with low and high density of Sami [67]
	Sweden	Retrospective cohort	Sami vs non-Sami: lower SMR for cancer lower, injuries higher (M), circulatory and respiratory diseases no difference (F) [36]
	Finland, Inari and Utsjoki	Retrospective cohort	All-cause mortality lower in Sami (M), no difference in (F); lower ischaemic heart disease (F) and cancer (M) in Sami; accidents 1.7 times higher in Sami (M,F) compared to all Finland [68]

an important topic that deserves attention, even though their health is no longer the concern of northern regional health authorities.

With the exception of Greenland and Nunavut, Indigenous people are minorities in their respective regions. Minority status may contribute to some of the observed health disparities. The majority health and social systems may not be sensitive to the needs of marginalised minority populations in their midst. With their overwhelming majority status, Inuit in Greenland and Nunavut have also advanced the furthest in their quest for political self-determination. Greenland obtained Home Rule in 1979, took over responsibility for health care in 1992 and achieved quasi-autonomous self-government in 2009. The successful completion of land claims negotiations between Canadian Inuit and the federal government resulted in the creation of the Inuit-predominant territory of Nunavut in 1999. In both Greenland and Nunavut, health and social conditions have not improved to the extent that had been hoped for.

It is difficult to produce an overarching explanatory model for health disparities that is applicable to all the Arctic regions. Clearly, disparities in social determinants of health are observed, but again with the Sami at a much less relative disadvantage than Indigenous people in the other regions. One can seek explanation for health disparities in the broader political, cultural and social contexts within which Indigenous people live in their respective regions.

We have not proposed “solutions” for readdressing health disparities. Article 24 of the United Nations Declaration on the Rights of Indigenous People states that Indigenous peoples have an equal right to the enjoyment of the highest attainable standard of physical and mental health, and that states shall take the necessary steps to achieve realisation of this right [92]. We are hopeful that Arctic regional governments and Indigenous organisations are actively engaged in developing policies and strategies that reflect their distinct identities and are best suited to their circumstances

**Table 5.** Arctic Russia – selected health indicators.

Indicator	Region	Methods	Results
Health determinants	Khanty-Mansi AO	Questionnaire survey	Perceived main factors for poor personal health: medical care, water quality, money for medicines and food quality among highest ranked [73]
	Yakutia	Questionnaire survey	Family conditions among different ethnic groups: Indigenous residents tend to have large family size, one parent missing, low income and domestic conflicts [74]
General health	Chukotka AO	Questionnaire survey among adults aged 18–77	Rand SF-36: Indigenous residents score lower than non-Indigenous across all scales [physical, social functioning, general health, mental health]; no difference between Chukchi and other Indigenous groups [75]
Dental health	Evenkia AO	Dental examination survey aged 15+	Dental health index: Indigenous residents score worse than non-Indigenous; declines with age [76]
Cancer	Chukotka AO	Death certificates review, 1961–1990; rates age-standardised to world population	Indigenous 2 x (M) and 3.5 x (F) those of Russia nationally; lung and oesophageal cancer most important sites [77]
Hypertension	Yakutia	Blood pressure survey of adults aged 15+	Indigenous 23% vs 28% in non-Indigenous [78]
Nutritional status	Khanty-Mansi AO	Vitamin levels in blood samples	Khanty vs non-Indigenous: lower level of vitamin A, higher E, no difference in C [79]
	AO	Ca, I and Se in hair samples of school children	Iodine levels were low; calcium and selenium levels optimal [80]
Obesity	Nenets AO	Anthropometric and metabolic markers in women	No difference between Nenets and non-Indigenous women in prevalence of obesity based on BMI and waist-hip ratio [81]
Mental health	Yakutia	Questionnaire survey of adolescents on suicidal risks	Yakut and Evens higher in anxiety scale than Russians, but no difference in frustration, aggression or rigidity scales [82]
Suicide	Nenets AO	Autopsy records review, 2002–12; rates age-standardised to European population	Nenets 73/100,000 vs 51/100,000 in non-Indigenous; male rate 4.7 x female rate among Nenets [83,84]
Maternal health	Yamalo-Nenets AO	Clinical examination and blood tests of pregnant women	BMI $\geq$ 30: Nenets (3%), non-Indigenous (19%); abnormal gestational weight gain: Nenets (5%), non-Indigenous (28%); abnormal indicators of carbohydrate metabolism: Nenets (2%), non-Indigenous (10%) [85]
Environmental health	Yamalo-Nenets AO	Mercury level in blood samples	High levels in all residents; Indigenous males 5x higher and females 3 x higher than non-Indigenous [86]

## Disclosure statement

No potential conflict of interest was reported by the authors.

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