

## RESEARCH PAPER

**Prevalence and risk factors for self-reported chronic disease amongst Inuvialuit populations**E. Erber,\* L. Beck,<sup>†</sup> E. De Roose<sup>‡</sup> & S. Sharma<sup>§</sup>

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Arctic, chronic disease, Inuvialuit, prevalence, risk factors.

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**Abstract**

**Background:** Chronic disease prevalence amongst Canadian Arctic populations is increasing, but the literature amongst Inuvialuit is limited. The present study aimed to provide baseline data that could be used to monitor changes in chronic disease risk factors and long-term health in the Arctic by determining prevalence and risk factors of self-reported chronic disease amongst adult Inuvialuit in remote communities.

**Methods:** Self-reported demographics and history of chronic disease (hypertension, heart disease, diabetes and cancer) were collected in three communities between July 2007 and July 2008 in the Northwest Territories. Food frequency questionnaires recorded dietary intake, International Physical Activity Questionnaires recorded physical activity and anthropometric measures of height and weight were obtained.

**Results:** Response rates ranged from 65–85%. More than 20% of the 228 participants aged 19–84 years reported having a chronic disease. Age-adjusted prevalence was 28, 9, 9 and 6 per 100 for hypertension, heart disease, diabetes and cancer, respectively. Compared with non-cases, participants reporting hypertension were more likely to have a higher body mass index and a lower level of education. Hypertension was more common amongst participants reporting heart disease and diabetes than Inuvialuit not reporting these morbidities.

**Conclusions:** Inuvialuit participants in this study were most affected by hypertension and diabetes compared with heart disease or any cancer. Female participants had a higher prevalence of heart disease compared with the Canadian average. Primary preventive strategies are necessary to mitigate the increasing rates of chronic disease risk factors in this population. Further studies with a larger sample size and measured chronic disease are necessary to confirm the findings obtained in the present study.

**Introduction**

Lifestyle and dietary changes, such as a decrease in physical activity and an increase in consumption of high fat, high sugar and non-nutrient-dense foods, are associated with high prevalence of chronic disease risk factors in Canadian Arctic populations, including Inuvialuit (Daniel & Gamble, 1995; Kuhnlein *et al.*, 2004; Young & Katzmarzyk, 2007). In 1994–1995, 63% of Inuvialuit rated

their health as excellent or very good, whilst, in 2003, this perception decreased to 56% (Northwest Territories (NWT) Health and Social Services, 2005). In Inuvialuit regions of the Canadian Arctic, more than 30% of people aged 12 years and older suffer from one or more long-term health conditions, and the life expectancy is nine years below the Canadian average (NWT Health and Social Services, 2005; Inuit Tapiriit Kanatami, 2008).

Data specifically on Inuvialuit are limited; however, the prevalence of heart disease has been estimated to be three-fold higher amongst all Inuit in Canada compared with the national average (Heart and Stroke Foundation of Canada, 1999). Cancer mortality is approximately 10% higher in the NWT compared with the national level (Inuit Tapiriit Kanatami, 2008, 2009; Public Health Agency of Canada, 2009). Cancer, followed by heart disease, is now the leading cause of death in Canadian territories, and rates are increasing (Trovato, 2000; NWT Health and Social Services, 2005; Statistics Canada, 2009).

Health disparities between Inuvialuit and the general Canadian population are apparent, and the much higher prevalence of risk factors amongst Canadian Arctic populations threatens to widen the gap further. Inuit have a higher prevalence of socioeconomic risk factors, such as lower income, unemployment, low levels of education and lower access to health care, compared with the general Canadian population (Young, 2003). In addition, Inuvialuit have significantly higher rates of obesity and two-fold higher rates of smoking and alcohol consumption than the Canadian average. Additionally, 45% of NWT residents are considered to be physically inactive, another major risk factor associated with the development of chronic disease (NWT Bureau of Statistics, 2003; Statistics Canada, 2003; Tanuseputro *et al.*, 2003; Young, 2003; NWT Health and Social Services, 2005; Self *et al.*, 2005; Inuit Tapiriit Kanatami, 2008).

Many chronic diseases are preventable through environmental and behavioural changes, such as increasing access to traditional and healthy shop-bought foods, and increasing opportunities for physical activity. The present study aimed to describe the self-reported prevalence of morbidity of four chronic diseases (hypertension, heart disease, diabetes and cancer) and important chronic disease risk factors amongst adult Inuvialuit in three communities in the NWT, Canada.

## Materials and methods

### Recruitment, sampling and data collection

Detailed information on recruitment, sampling and collection of food frequency questionnaires (FFQ), International Physical Activity Questionnaires (IPAQ), which also collected height and weight, and surveys on psychosocial and socioeconomic factors between July 2007 and July 2008 in three remote communities in the NWT has been reported elsewhere (Sharma, 2010).

Institutional Review Board approval was obtained from the Committee on Human Studies at the University of Hawaii and the Office of Human Research Ethics at the University of North Carolina at Chapel Hill, as well as

the Beaufort Delta Health and Social Services Authority Ethics Review Committee. The Aurora Research Institute licensed this study.

### Statistical analysis

The age-adjusted prevalence of hypertension, heart disease, diabetes and cancer in this sample of Inuvialuit adults was computed overall and by gender. The estimated prevalence was age-standardised by the direct method to the truncated Surveillance Epidemiology and End Results 1996 Canadian Standard Million (National Cancer Institute, 2008) using the formula

$$ASR = \frac{\sum a_i w_i}{\sum w_i} \cdot 100$$

( $i$  indicating a given age group,  $a_i$  defining the proportion of cases in age group ' $i$ ' amongst total observed subjects in the same age group and ' $w_i$ ' indicating the standard population in age group ' $i$ ').

Additionally, the frequency of chronic disease risk factors amongst cases compared with non-cases was determined. The risk factors presented were chosen based on those identified in previous literature (Deering *et al.*, 2009). Mantel-Haenszel chi-square tests controlling for age and gender were used to determine the difference in self-reported risk factors (body mass index, smoking, alcohol intake, level of education, marital status, percentage of people in the household currently in employment, percentage of people in the household currently on income support, level of physical activity, family history of specific chronic disease, fruit and vegetable consumption, traditional food consumption, non-nutrient-dense food consumption, hypertension and diabetes) between participants reporting a chronic disease and those not reporting a morbidity.

All statistical analyses were performed using SAS statistical software, version 9.1 (SAS Institute, Inc., Cary, NC, USA). All tests and  $P$ -values were two-sided and were considered statistically significant at  $\alpha \leq 0.05$ .

## Results

The response rates ranged from approximately 65–85% depending on the community; however, records were incomplete, which did not allow for an accurate response rate calculation. In total, 228 Inuvialuit adults, 53 men and 175 women, participated in this study (Table 1). The mean (standard deviation, SD) age was 41 (13) years amongst men and 44 (14) years amongst women.

Most participants were overweight or obese (65%) and smoked (71%) (Table 1). Over half of Inuvialuit

**Table 1** Reported demographics and lifestyle factors amongst adult Inuvialuit in the Northwest Territories, Canada\*

Characteristics		Total ( <i>n</i> = 228)	Men ( <i>n</i> = 53)	Women ( <i>n</i> = 175)
Age ( <i>n</i> = 228)	≤30 years	43 (19)	15 (28)	28 (16)
	31–50 years	121 (53)	27 (51)	94 (54)
	>50 years	64 (28)	11 (21)	53 (30)
Body mass index ( <i>n</i> = 192)	Normal (<25 kg/m <sup>2</sup> ) <sup>†</sup>	67 (35)	16 (36)	51 (35)
	Overweight (25–29 kg/m <sup>2</sup> )	39 (20)	11 (24)	28 (19)
	Obese (≥30 kg/m <sup>2</sup> )	86 (45)	18 (40)	68 (46)
Smoking ( <i>n</i> = 225)	No	66 (29)	15 (29)	51 (29)
	Yes	159 (71)	37 (71)	122 (71)
Alcohol ( <i>n</i> = 224)	Never	105 (47)	18 (35)	87 (51)
	>0 g/day	119 (53)	34 (65)	85 (49)
Education ( <i>n</i> = 225)	None – some junior high school	70 (31)	14 (26)	56 (33)
	Junior high school completed – high school completed	99 (44)	31 (58)	68 (30)
	Some college/trade school – university completed	56 (25)	8 (15)	48 (28)
Marital status <sup>‡</sup> ( <i>n</i> = 223)	Not married	97 (44)	30 (57)	67 (40)
	Married	123 (56)	23 (43)	100 (60)
Employed household <sup>§</sup>	No	58 (26)	15 (28)	43 (25)
	Yes	168 (74)	38 (72)	130 (75)
Household on income support <sup>¶</sup>	No	155 (69)	35 (66)	120 (69)
	Yes	71 (31)	18 (34)	53 (31)
Physical activity ( <i>n</i> = 192)	Low (<600 metabolic equivalent-minutes per week)	22 (11)	6 (13)	16 (11)
	Medium (600–2999 metabolic equivalent-minutes per week)	83 (43)	14 (31)	69 (47)
	High (≥3000 metabolic equivalent-minutes per week)	87 (45)	25 (56)	62 (42)
Family history of any chronic disease ( <i>n</i> = 228)	No	158 (69)	40 (75)	118 (67)
	Yes	70 (31)	13 (24)	57 (33)
Fruit & vegetable consumption ( <i>n</i> = 225)	Median (times per day)	1.2	0.8	1.4
Traditional food consumption ( <i>n</i> = 225)	Median (times per day)	1.1	1.0	1.1
Non-nutrient-dense food consumption ( <i>n</i> = 225)	Median (times per day)	9.1	8.9	9.1

\*Number and percentage, might not add up to the total *n* as a result of missing responses.

<sup>†</sup>Includes underweight (<18.5 kg/m<sup>2</sup>) participants, only two participants were underweight.

<sup>‡</sup>Not married includes never married, separated, divorced and widowed; married includes married and common law.

<sup>§</sup>At least one resident in the household is employed versus no residents are employed

<sup>¶</sup>At least one resident in the household is on income support versus no residents are on income support.

consumed alcohol (53%) (data not shown). Approximately three quarters of Inuvialuit in the present study lived in a household with at least one person in employment and nobody on income support. The level of physical activity was generally medium or high. The median intake of fruit and vegetables and traditional foods was 1.2 times per day [interquartile range

(IQR) = 1.3] and 1.1 times per day (IQR = 1.6), respectively, compared with 9.1 times per day (IQR = 4.0) for high sugar, high fat and non-nutrient-dense food items. These lifestyle factors were similar between men and women.

Out of the 228 participants, 53 (23%) self-reported having one chronic disease, whilst 17 (7%) reported

**Table 2** Age-adjusted prevalence of selected self-reported chronic diseases amongst adult Inuvialuit in the Northwest Territories, Canada

Chronic disease	Total		Men		Women	
	<i>n</i> (%)	Age-adjusted prevalence per 100	<i>n</i> (%)	Age-adjusted prevalence per 100	<i>n</i> (%)	Age-adjusted prevalence per 100
Hypertension	56 (25)	28.09	13 (25)	26.66	43 (25)	27.21
Heart disease	13 (6)	9.37	2 (4)	3.20	11 (6)	9.25
Diabetes	14 (6)	9.25	4 (8)	6.41	10 (6)	8.35
Cancer	10 (4)	5.90	0 (0)	0	10 (6)	6.90

having two chronic morbidities (data not shown). Amongst all cases, 24% indicated having two chronic diseases, whilst 3% reported three different chronic morbidities. Amongst both men and women, almost one-third (32%) of participants reported having a chronic disease. Hypertension was reported most often.

The overall age-adjusted prevalence amongst adult Inuvialuit was 28 per 100 for hypertension, nine per 100 for

heart disease, nine per 100 for diabetes and six per 100 for cancer (Table 2). The prevalence of heart disease, diabetes and cancer were higher in women than men, whilst the prevalence of hypertension was similar by gender.

Examination of risk factors for chronic diseases revealed that participants who reported hypertension were more likely to be obese and to have lower levels

**Table 3** Risk factors for heart disease and hypertension amongst cases and non-cases of adult Inuvialuit in the Northwest Territories, Canada\*

Risk factors	Categories	Hypertension			Heart disease		
		Cases (n = 56)	Non-cases (n = 170)	P-value <sup>†</sup>	Cases (n = 13)	Non-cases (n = 214)	P-value <sup>†</sup>
Body mass index	Normal (<25 kg/m <sup>2</sup> )	9 (17)	58 (42)	<b>0.004</b>	2 (18)	65 (36)	0.53
	Overweight (25–29 kg/m <sup>2</sup> )	16 (31)	23 (17)		2 (18)	37 (21)	
	Obese (≥30 kg/m <sup>2</sup> )	27 (52)	57 (41)		7 (64)	78 (43)	
Smoking	No	17 (31)	48 (29)	0.76	7 (54)	59 (28)	0.10
	Yes	38 (69)	120 (71)		6 (46)	152 (72)	
Alcohol	Never	32 (58)	73 (44)	0.20	6 (46)	99 (47)	0.64
	>0 g/day	23 (42)	94 (56)		7 (54)	111 (53)	
Education	None – some junior high school	27 (49)	42 (25)	<b>0.04</b>	3 (23)	66 (31)	0.39
	Junior high school completed – high school completed	18 (33)	80 (48)		5 (38)	94 (45)	
	Some college/trade school – university completed	10 (18)	46 (27)		5 (38)	51 (24)	
Marital status <sup>‡</sup>	Not married	27 (48)	70 (43)	0.54	6 (46)	91 (44)	0.79
	Married	29 (52)	92 (57)		7 (54)	115 (56)	
Employed household <sup>§</sup>	No	14 (26)	44 (26)	0.80	6 (46)	52 (25)	0.10
	Yes	40 (74)	126 (74)		7 (54)	160 (75)	
Household on income support <sup>¶</sup>	No	35 (65)	118 (69)	0.33	11 (85)	143 (67)	0.24
	Yes	19 (35)	52 (31)		2 (15)	69 (33)	
Physical activity	Low (<600 metabolic equivalent-minutes per week)	8 (16)	14 (10)	0.12	2 (18)	20 (11)	0.25
	Medium (600–2999 metabolic equivalent-minutes per week)	27 (53)	55 (40)		7 (64)	75 (42)	
	High (≥3000 metabolic equivalent-minutes per week)	16 (31)	70 (50)		2 (18)	85 (47)	
Family history of specific chronic disease	No	20 (36)	110 (65)	0.08	5 (38)	123 (57)	0.28
	Yes	36 (64)	60 (35)		8 (62)	91 (43)	
Fruit & vegetable consumption	<1.2 times per day	41 (73)	128 (75)	0.84	9 (69)	161 (75)	0.81
	≥1.2 times per day	15 (27)	42 (25)		4 (31)	53 (25)	
Traditional food consumption	<1.1 times per day	43 (78)	125 (74)	0.98	10 (77)	159 (74)	0.79
	≥1.1 times per day	13 (23)	45 (26)		3 (23)	55 (26)	
Non-nutrient-dense food consumption	<9.1 times per day	1 (2)	2 (1)	0.52	0 (0)	3 (1)	0.46
	≥9.1 times per day	55 (98)	168 (99)		13 (100)	211 (99)	
Hypertension	No	–	–	–	6 (46)	164 (77)	<b>0.03</b>
	Yes	–	–		7 (54)	49 (23)	
Diabetes	No	47 (84)	165 (97)	<b>0.01</b>	11 (85)	201 (94)	0.34
	Yes	9 (16)	5 (3)		2 (15)	12 (6)	

\*Number and percentage, might not add up to total *n* as a result of missing responses.

<sup>†</sup>*P* for difference was obtained by Cochran–Mantel–Haenszel chi-square tests controlling for age and gender; bold values indicate statistical significance at  $\alpha \leq 0.05$ .

<sup>‡</sup>Not married includes never married, separated, divorced and widowed; married includes married and common law.

<sup>§</sup>At least one resident in the household is employed versus no residents are employed.

<sup>¶</sup>At least one resident in the household is on income support versus no residents are on income support.

**Table 4** Risk factors for diabetes and cancer amongst cases and non-cases of adult Inuvialuit in the Northwest Territories, Canada\*

Risk factors	Categories	Diabetes			Cancer		
		Cases ( <i>n</i> = 14)	Non-cases ( <i>n</i> = 212)	<i>P</i> -value <sup>†</sup>	Cases ( <i>n</i> = 10)	Non-cases ( <i>n</i> = 217)	<i>P</i> -value <sup>†</sup>
Body mass index	Normal (<25 kg/m <sup>2</sup> )	1 (11)	66 (36)	0.27	3 (30)	64 (35)	0.21
	Overweight (25–29 kg/m <sup>2</sup> )	3 (33)	36 (20)		3 (30)	35 (19)	
	Obese (≥30 kg/m <sup>2</sup> )	5 (56)	79 (44)		4 (40)	82 (45)	
Smoking	No	6 (43)	65 (30)	0.82	2 (20)	64 (30)	0.44
	Yes	8 (57)	149 (70)		8 (80)	150 (70)	
Alcohol	Never	8 (57)	97 (47)	0.99	4 (40)	101 (47)	0.40
	>0 g/day	6 (43)	111 (53)		1 (10)	112 (53)	
Education	None – some junior high school	7 (50)	62 (30)	0.81	5 (50)	64 (30)	0.56
	Junior high school completed – high school completed	5 (36)	93 (45)		3 (30)	96 (45)	
	Some college/trade school – university completed	2 (14)	54 (26)		2 (20)	54 (25)	
Marital status <sup>‡</sup>	Not married	8 (62)	89 (43)	0.15	3 (30)	94 (45)	0.65
	Married	5 (38)	116 (57)		6 (60)	116 (55)	
Employed household <sup>§</sup>	No	4 (29)	54 (26)	0.97	3 (30)	55 (26)	0.76
	Yes	10 (71)	156 (74)		7 (70)	160 (74)	
Household on income support <sup>¶</sup>	No	11 (79)	142 (68)	0.50	7 (70)	147 (68)	0.98
	Yes	3 (21)	68 (32)		3 (30)	68 (32)	
Physical activity	Low (<600 metabolic equivalent-minutes per week)	2 (25)	20 (11)	0.27	1 (10)	21 (12)	0.98
	Medium (600–2999 metabolic equivalent-minutes per week)	5 (63)	77 (42)		5 (50)	77 (43)	
	High (≥3000 metabolic equivalent-minutes per week)	1 (13)	85 (47)		4 (40)	83 (46)	
Family history of specific chronic disease	No	9 (64)	165 (78)	0.67	5 (50)	152 (70)	0.36
	Yes	5 (36)	47 (22)		5 (50)	65 (30)	
Fruit & vegetable consumption	<1.2 times per day	11 (79)	158 (75)	0.39	4 (40)	166 (77)	0.10
	≥1.2 times per day	3 (21)	54 (25)		6 (60)	51 (24)	
Traditional food consumption	<1.1 times per day	10 (71)	158 (75)	0.54	8 (80)	161 (74)	0.19
	≥1.1 times per day	4 (29)	54 (25)		2 (20)	56 (26)	
Non-nutrient-dense food consumption	<9.1 times per day	0 (0)	3 (1)	0.91	0 (0)	3 (1)	0.51
	≥9.1 times per day	14 (100)	209 (99)		10 (100)	214 (99)	
Hypertension	No	5 (36)	165 (78)	<b>0.01</b>	7 (70)	163 (75)	0.82
	Yes	9 (64)	47 (22)		3 (30)	53 (25)	
Diabetes	No	–	–	–	10 (100)	202 (94)	0.37
	Yes	–	–		0 (0)	14 (6)	

\*Number and percentage, might not add up to total *n* as a result of missing responses.†*P* for difference was obtained by Cochran–Mantel–Haenszel chi-square tests controlling for age and gender; bold values indicate statistical significance at  $\alpha \leq 0.05$ .

‡Not married includes never married, separated, divorced and widowed; married includes married and common law.

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of education than Inuvialuit adults reporting normal blood pressure ( $P = 0.004$  and  $P = 0.04$ , respectively) (Table 3). Hypertension was more common amongst participants who also reported heart disease than those who did not ( $P = 0.03$ ), whilst adult Inuvialuit in the present study reporting diabetes were also more likely to have hypertension and vice versa ( $P = 0.01$  for both) (Tables 3 and 4).

## Discussion

More than 20% of Inuvialuit adults in the present study suffered from heart disease, hypertension, diabetes or cancer. Almost three-quarters of participants were smokers and over half drank alcohol, which has been previously reported in the NWT communities (NWT Health and Social Services, 2005; Inuit Tapiriit Kanatami, 2008).

The prevalence of most chronic morbidities examined in the present study was higher than the Canadian average, as well as the previously reported prevalence amongst Inuvialuit in the NWT. The prevalence of hypertension was 27% in men and women in the present study, which was higher than both the NWT average (12% in men, 11% in women) and the Canadian average amongst those aged  $\geq 12$  years (13% in men, 15% in women) in 2003 (Statistics Canada, 2003; NWT Health and Social Services, 2005). The prevalence of heart disease was 3% amongst male and 9% amongst female participants, which was comparable to estimates for men in the NWT aged  $\geq 12$  years (4%) and Canadian men aged  $\geq 35$  years (4%) but higher than estimates for women in the NWT (3%) and Canada (4%) in 2003 (Heart and Stroke Foundation of Canada, 1999; NWT Health and Social Services, 2005). The prevalence of diabetes for men and women in the present study was 6% and 8%, respectively, compared with 4% of male and female NWT residents aged  $\geq 20$  years in 2001 and 5% in Canadian men and 4% in women aged  $\geq 12$  years in 2003 (Statistics Canada, 2003; NWT Health and Social Services, 2005). Cancer combined all types of cancers, and specific types of cancer were not recorded in the present study. Furthermore, it was a rare condition in the present study sample and, therefore, it is not possible to compare the prevalence with other populations or for specific sites. The higher prevalence of hypertension in men and women as well as the higher prevalence of heart disease and diabetes amongst women than previously reported for the NWT might indicate that either prevalence is increasing over time or that the communities studied here are at higher risk and might not be representative of other NWT communities. Unfortunately, comparison across different populations within Canada is limited as a result of differences in age groups, diagnostic endpoints and methodologies, such as the use of age adjustment as well as the use of surveillance data versus self-reports.

Hypertension was the most frequently reported chronic disease and was observed significantly more often amongst participants reporting heart disease and diabetes than those who did not. This illustrates the importance of addressing factors influencing the risk for hypertension in these communities. Lower education, as a proxy for socioeconomic status, and high body mass index were significantly more prevalent amongst Inuvialuit reporting hypertension than participants reporting normal blood pressure. A healthy lifestyle, including a diet rich in fruit and vegetables and regular physical activity, is an effective upstream approach for the prevention and management of hypertension (Kelley & Kelley, 2000; Whelton *et al.*, 2002; Appel *et al.*, 2003; Chobanian *et al.*, 2003; Neter *et al.*, 2003; Appel *et al.*, 2006).

Chronic diseases have severe economic, social and personal implications. These morbidities can have negative effects on physical and mental health-related quality of life (Quandt *et al.*, 2007). Given the high economic and personal burden of complications resulting from chronic diseases and the lack of health interventions for the prevention of chronic morbidities amongst Inuvialuit, culturally appropriate, intensive prevention strategies are necessary. These include health education and dietary interventions, as well as environmental interventions aimed at increasing food security, improving access to health care and increasing opportunity for physical activity (Daniel & Gamble, 1995; Public Health Agency of Canada, 2008).

Limitations of the present study include the self-reported nature of the data on chronic diseases and some of their risk factors. However, the questionnaires fulfilled the study aim to present the levels of chronic disease risk factors amongst Inuvialuit, and self-report of chronic illnesses has been shown to be valid and reliable (Skinner *et al.*, 2005). Clinical records are not always available as residents may need to fly to regional centres to access larger health care clinics and screening for diseases (Inuit Tapiriit Kanatami, 2009). The main goal of the present study was to present an overall picture of prevalence and risk factors of chronic diseases in this population and, therefore, information on the specific types of heart disease, diabetes and cancer were not collected. Another limitation of the present study was that more women than men participated because this was part of a larger study to assess diet of the main food shopper and the person preparing the food who are primarily women. Because of a small sample size, the findings presented here might have resulted in high sampling variability of prevalence estimates and might not be representative of other Inuvialuit communities. Some significant findings might be false-positives as a result of multiple comparisons.

The present study was able to capture the high prevalence of self-reported chronic disease and risk factors amongst Inuvialuit adults in the participating communities. Because of the limited literature amongst Inuvialuit populations, the data obtained in the present study are intended to raise awareness of high prevalence of chronic disease and their risk factors, which should become the focus of intervention programmes in this population. The high prevalence of hypertension found in the present study may lead to a sodium reduction intervention amongst Inuvialuit. Furthermore, these data are essential to provide a baseline to monitor changes in chronic disease risk factors and long-term health in this vulnerable population amidst environmental and lifestyle transition.



### Conflict of interests, source of funding and authorship

The authors declare they have no conflicts of interest. The project was supported by American Diabetes Association Clinical Research award 1-08-CR-57, the Government of the Northwest Territories Department of Health and Social Services, Health Canada, the Public Health Agency of Canada and the Northwest Territories and Nunavut Public Health Association. SS developed the conception and design of the study. EDR oversaw all data collection and field activities. EE contributed to data analysis, and all authors were responsible for data interpretation. EE, SS and LB drafted the manuscript. All authors critically reviewed its content and have approved the final version submitted for publication.

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