

A decade of research in Inuit children, youth, and maternal health in Canada: areas of concentrations and scarcities

Amanda J. Sheppard^{1,2*} and Ross Hetherington³

¹AboutKidsHealth, The Hospital for Sick Children, Toronto, Canada; ²Dalla Lana School of Public Health, University of Toronto, Toronto, Canada; ³Department of Paediatrics, University of Toronto, Toronto, Canada

Inuit Canadians are on average about 20 years younger and have a 10-year lower life expectancy than other Canadians. While there have been improvements in Inuit health status over time, significant health disparities still remain. This paper will review the peer-reviewed literature related to Inuit child, youth, and maternal health between 2000 and 2010, investigate which thematic areas were examined, and determine what proportion of the research is related to each group. Establishing areas of research concentrations and scarcities may help direct future research where it is needed. We followed a systematic literature review and employed peer-reviewed research literature on child, youth, and maternal health which were selected from 3 sources, MEDLINE, CINAHL, and the Circumpolar Health Bibliographic Database. The resulting references were read, and summarized according to population group and thematic area. The thematic areas that emerged by frequency were: infectious disease; environment/environmental exposures; nutrition; birth outcomes; tobacco; chronic disease; health care; policy, human resources; interventions/programming; social determinants of health; mental health and wellbeing; genetics; injury; and dental health. The 72 papers that met the inclusion criteria were not mutually exclusive with respect to group studied. Fifty-nine papers (82%) concerned child health, 24 papers (33%) youth health, and 58 papers (81%) maternal health. The review documented high incidences of illness and significant public health problems; however, in the context of these issues, opportunities to develop research that could directly enhance health outcomes are explored.

Keywords: *Inuit; children; youth; maternal health; literature review; Canada*

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According to the 2006 Census, more than half of the Canadian Aboriginal population lived in urban centres (1); however, approximately 80% of the Inuit population of Canada still live in their traditional territories (2). Between 1996 and 2006, the Inuit population of Canada increased by 26%. This is a young population with an average age of 22 years compared to 40 years for non-Aboriginal Canadians (1). The life expectancy of the Inuit is on average 10 years less than for non-Aboriginal Canadians (3).

While there have been some gains in Inuit health status through advances in medical science and delivery of certain types of care which have led to a decline in the incidence of infectious diseases; chronic diseases, injuries, substance abuse have increased and have become significant concerns (4). Furthermore, there are remarkable differences between Inuit and non-Inuit Canadians for many indicators of health.

Inuit Canadians have higher rates of preterm birth, stillbirth, and infant death compared to other Canadians (5). Compounding these rates is that 9% of Inuit teenagers are parents, whereas 1.3% of other Canadian teenagers are parents (3). Young mothers are less likely to breastfeed, and are more likely to smoke and drink alcohol (6,7). In fact, expecting Inuit mothers have the highest tobacco smoking rate in the country, at over 80% (8,9). These factors, and others, contribute to poor health outcomes among infants and children (9,10). The frequency of reported hunger among children is another important measure of a population's health status. Sixty-eight percent of Inuit children aged 6–14 years of age experienced being hungry, of which 57% reported being hungry every few months or more (11). The prevalence of hunger was 1.2% among other Canadian families (with children aged 11 years of less) based on 1994 data (12). An individual's self-reported rating of his/her health

status is a commonly used measure of a population's health status. Only 52% of Inuit males and 48% of females aged 15 and older reported that their health status was excellent or very good (13), compared to 60% among other Canadians as a whole (14). Moreover, Inuit currently experience the highest levels of overcrowded (38%) and inadequate housing (31%) in the country (compared to 3 and 7% among other Canadians respectively) (15,16).

Interrelated factors affect the health of Inuit populations and vary during a life course. These range from their social, economic, physical and demographic circumstances. According to Mary Simon, the President of Inuit Tapiriit Kanatami (ITK), "Solutions must be multi-faceted and multi-jurisdictional. Inuit know that change is needed and that youth are the key. Improving access to services and programs targeted at children, youth and their parents must be a priority in efforts to address the health inequities faced by Inuit" (17). Additionally, reviews of the Inuit health literature to date have highlighted a need for culturally-based health prevention interventions (18–20), the return of childbirth to home communities (21), an understanding of the mechanisms through which the determinants of health affect Inuit women (22), and control of otitis media in Inuit children and youth (10).

Towards advancing Inuit health outcomes at the population level as advocated by ITK and other organizations representing Inuit Canadians (23), improvements to child, youth and maternal health are paramount. The present review will examine the peer-reviewed literature related to Inuit child, youth, and maternal health between 2000 and 2010. It will determine what proportion of the research was related to each of the 3 population groups, and establish which thematic areas were most common. Directions for future research will be proposed based on these findings.

Materials and methods

Search strategy

The publications included in the peer-reviewed research literature on child, youth, and maternal health were selected from 3 sources, MEDLINE, CINAHL and the Circumpolar Health Bibliographic Database, a project of the Canadian Institutes of Health Research (CIHR) Team in Circumpolar Health Research.

The keyword "Inuit", with limits on the publication years from January 1, 2000 to December 31, 2010 was the first term used in the MEDLINE and CINAHL searches. Within these search results "children/child"; "youth/adolescents"; and "maternal" were accessed individually. Every resulting title was read to determine whether the paper's abstract should be read. After reading a paper's

abstract, the paper's eligibility was determined. Papers were excluded if they were not in English; the Inuit population under study was not Canadian; the Inuit sample was not de-aggregated from Aboriginal or Indigenous data; the paper was a review, a letter, an editorial, or a discussion piece; the paper was a presentation abstract; the study evaluated a sampling measure or technique or biomarker; or the paper had an arctic or environmental focus without relating the findings to a particular population. A similar search strategy was used with the Searches in the Circumpolar Health Bibliographic Database.

Data analysis

The papers were read and summarized based on thematic area. The themes that emerged were: birth outcomes; chronic disease; dental health; environment/environmental exposures; genetics; health care, policy, human resources; infectious disease; injury; interventions/programming; mental health and wellbeing; nutrition; social determinants of health; and tobacco. Population group (child, youth, maternal) was considered within each thematic area. The data were extracted from published manuscripts therefore no institutional research ethics board approval was needed.

Results

Descriptive findings

Seventy-two papers met the inclusion criteria (Table I). The most common theme was infectious disease. Environment/environmental exposures was second in frequency, and nutrition was third (Fig. 1). Child health was the most common focus of the papers included, followed closely by maternal health, then youth health. The cumulative thematic area content in Fig. 2 counts the same paper more than once if it relates to more than 1 population group. Frequency of publications ranged from 1 to 16 a year (Fig. 3). The majority of the studies were cross-sectional in design. Several of the more recent publications were derived from regional surveys, including the Inuit Child Health Survey 2007–2008.

Findings by thematic areas

Infectious disease

Infectious diseases were reported in 25 papers representing 35% of the papers included in the review. The majority of these (72%) focused on child health (Fig. 2). Eight papers focused on youth. This represented the largest proportion of the youth literature, at 33% (Fig. 2). Opposite to the experience among the Innu of Newfoundland and Labrador, women of Inuit communities in the region were hospitalization due to pneumonia more often than men (24). Hospital admission for lower respiratory tract infections (LRTI) was approximately

Table 1. Summary of Canadian Inuit child, youth, and maternal health peer-reviewed literature by thematic area (2000 to 2010)

Populations group(s)	Thematic area(s)	Title and reference
Children	Chronic disease	Emerging obesity among preschool-aged Canadian Inuit children: results from the Nunavut Inuit Child Health Survey (80)
Children	Dental health	Prevalence and risk factors for parental-reported oral health of Inuit preschoolers: Nunavut Inuit Child Health Survey, 2007–2008 (85)
Children	Environment/environmental exposures	The relationship between lead exposure, motor function and behaviour in Inuit preschool children (45)
Children	Genetics	Glycogen storage disease type III in Inuit children (84)
Children	Infectious disease	Hearing screening outcomes in Inuit children in Nunavik, Quebec, Canada (36)
Children	Infectious disease	High rates of hospitalisation for bronchiolitis in Inuit children on Baffin Island (37)
Children	Infectious disease	Epidemiology of <i>Haemophilus influenzae</i> serotype a, North American Arctic, 2000–2005 (26)
Children	Infectious disease	Longitudinal observations (1987–1997) on the prevalence of middle ear disease and associated risk factors among Inuit children of Inukjuak, Nunavik, Quebec, Canada (32)
Children	Infectious disease	Portrait of outpatient visits and hospitalizations for acute infections in Nunavik preschool children (90)
Children	Infectious disease	A fresh look at an old vaccine: does BCG have a role in 21st century Canada? (91)
Children	Infectious disease	High rate of <i>Simkania negevensis</i> among Canadian Inuit infants hospitalized with lower respiratory tract infections (92)
Children	Nutrition	Iron deficiency and anaemia prevalence and associated etiologic risk factors in First Nations and Inuit communities in Northern Ontario and Nunavut (93)
Children	Nutrition	Food insecurity among Inuit preschoolers: Nunavut Inuit Child Health Survey, 2007–2008 (59)
Children	Nutrition	Vitamin D status of Inuit preschoolers reflects season and vitamin D intake (56)
Children	Environment/environmental exposures; infectious disease	Effect of prenatal exposure to polychlorinated biphenyls on incidence of acute respiratory infections in preschool Inuit children (25)
Children	Chronic disease; interventions/programming	The benefits of sound field amplification in classrooms of Inuit students of Nunavik: a pilot project (73)
Children	Social determinants of health; tobacco	Cultural, socioeconomic, and health indicators among Inuit preschoolers: Nunavut Inuit Child Health Survey, 2007–2008 (9)
Children	Infectious disease; tobacco	Indoor air quality and the risk of lower respiratory tract infections in young Canadian Inuit children (41)
Children	Infectious disease; interventions/programming	Heat recovery ventilators prevent respiratory disorders in Inuit children (40)
Children	Genetics; nutrition	Adaptation of Inuit children to a low-calcium diet (83)
Children	Infectious disease; health care, policy, human resources	Bronchiolitis in Inuit children from a Canadian central arctic community, 1995–1996 (69)
Youth	Chronic disease	Causes and contributions to differences in life expectancy for Inuit Nunangat and Canada, 1994–2003 (82)
Youth	Infectious disease	Otitis media and hearing loss among 12–16 year-old Inuit of Inukjuak, Quebec, Canada (35)
Youth	Injury	Injury mortality risk assessment and targeting the subpopulations for prevention in the Northwest Territories, Canada (86)
Youth	Nutrition	Age differences in vitamin A intake among Canadian Inuit (55)

Table I (Continued)

Populations group(s)	Thematic area(s)	Title and reference
Youth	Mental health and wellbeing	Completed suicides among the Inuit of northern Quebec, 1982–1996: a case-control study (77)
Youth	Mental health and wellbeing; social determinants of health	Suicidality in a sample of Arctic households (76)
Youth	Infectious disease; interventions/programming	HIV testing experiences of Aboriginal youth in Canada: service implications (74)
Youth	Infections disease; social determinants of health	Determinants of sexually transmitted infections among Canadian Inuit adolescent populations (30)
Youth	Infections disease; mental health and wellbeing	Youth sexual health in Nunavut: a needs-based survey of knowledge, attitudes and behaviour (31)
Maternal	Birth outcomes	Reclaiming birth, health, and community: midwifery in the Inuit villages of Nunavik, Canada (68)
Maternal	Environment/environmental exposures	Organochlorine levels in maternal and umbilical cord blood plasma in Arctic Canada (49)
Maternal	Environment/environmental exposures	Exposure of the Inuit population of Nunavik (Arctic Quebec) to lead and mercury (48)
Maternal	Nutrition	Dietary assessment of Indigenous Canadian Arctic women with a focus on pregnancy and lactation (54)
Maternal	Nutrition	Contribution of selected traditional and market foods to the diet of Nunavik Inuit women (57)
Maternal	Birth outcomes; tobacco	Maternal smoking at first prenatal visit as a marker of risk for adverse pregnancy outcomes in the Qikiqtaaluk (Baffin) Region (8)
Maternal	Nutrition; environment/environmental exposures	Fish consumption and blood lipids in 3 ethnic groups of Quebec (Canada) (51)
Maternal	Health care, policy, human resources; birth outcomes	Converging epistemologies: critical issues in Canadian Inuit childbirth and pregnancy (65)
Maternal	Environment/environmental exposures; nutrition	Determinants of polychlorinated biphenyls and methylmercury exposure in Inuit women of childbearing age (50)
Maternal	Health care, policy, human resources; interventions/programming	The outcome of perinatal care in Inukjuak, Nunavik, Canada 1998–2002 (70)
Maternal	Health care, policy, human resources; birth outcomes	The Inuuitsivik Maternities: culturally appropriate midwifery and epistemological accommodation (66)
Maternal	Infectious disease; interventions/programming	Oncogenic human papillomavirus infection and cervical lesions in Aboriginal Women in Nunavut, Canada (94)
Maternal	Chronic disease; social determinants of health; tobacco; mental health and wellbeing	The health of Cree, Inuit and southern Quebec women: similarities and differences (79)
Maternal	Nutrition; social determinants of health; environment/environmental exposures	Food insecurity among Inuit women exacerbated by socioeconomic stresses and climate change (60)
Children; youth	Chronic disease	The relationship between socio-economic and geographic factors and asthma among Canada's Aboriginal populations (81)
Children; youth	Infectious disease	Hospitalization due to pneumonia among Innu, Inuit and non-Aboriginal communities, Newfoundland and Labrador, Canada (24)
Children; maternal	Birth outcomes	Heart defects and other malformations in the Inuit in Canada: a baseline study (62)
Children; maternal	Birth outcomes	Birth outcomes in the Inuit-inhabited areas of Canada (95)
Children; maternal	Birth outcomes	Degree of rural isolation and birth outcomes (63)
Children; maternal	Birth outcomes	Risks of adverse pregnancy outcomes among Inuit and North American Indian women in Quebec, 1985–97 (64)

Table I (Continued)

Populations group(s)	Thematic area(s)	Title and reference
Children; maternal	Environment/environmental exposures	Prenatal exposure to methylmercury and PCBs affects distinct stages of information processing: an event-related potential study with Inuit children (44)
Children; maternal	Environment/environmental exposures	The relation of lead neurotoxicity to the event-related potential P3b component in Inuit children from arctic Quebec (47)
Children; maternal	Environment/environmental exposures	Thyroid hormone levels of pregnant Inuit women and their infants exposed to environmental contaminants (96)
Children; maternal	Environment/environmental exposures	Neuromotor functions in Inuit preschool children exposed to Pb, PCBs, and Hg (43)
Children; maternal	Environment/environmental exposures	Beneficial effects of a polyunsaturated fatty acid on infant development: evidence from the Inuit of arctic Quebec (52)
Children; maternal	Environment/environmental exposures	The relation of environmental contaminants exposure to behavioural indicators in Inuit preschoolers in Arctic Quebec (46)
Children; maternal	Infectious disease	Neonatal vitamin A deficiency and its impact on acute respiratory infections among preschool Inuit children (33)
Children; maternal	Nutrition	Anaemia and iron status in Inuit infants from Northern Quebec (97)
Children; maternal	Birth outcomes; nutrition	Congenital heart defects in Canadian Inuit: is more folic acid making a difference? (53)
Children; maternal	Infectious disease; tobacco	Lower respiratory tract infections in Inuit infants on Baffin Island (38)
Children; maternal	Infectious disease; tobacco	Risk factors and viruses associated with hospitalization due to lower respiratory tract infections in Canadian Inuit children: a case-control study (39)
Children; maternal	Environment/environmental exposures; infectious disease	Acute infections and environmental exposure to organochlorines in Inuit infants from Nunavik (42)
Children; maternal	Environment/environmental exposures; infectious disease	Susceptibility to infections and immune status in Inuit infants exposed to organochlorines (34)
Children; maternal	Birth outcomes; interventions/programming	Primary birthing attendants and birth outcomes in remote Inuit communities – a natural “experiment” in Nunavik, Canada (67)
Youth; maternal	Health care, policy, human resources	Identifying the needs of Innu and Inuit patients in urban health settings in Newfoundland and Labrador (71)
Youth; maternal	Infectious disease	Prevalence and age distribution of human papillomavirus infection in a population of Inuit women in Nunavik, Quebec (27)
Youth; maternal	Infectious disease	Determinants of human papillomavirus infection among Inuit women of northern Quebec, Canada (28)
Youth; maternal	Social determinants of health	The social determinants of Inuit health: a focus on social support in the Canadian Arctic (78)
Children; youth; maternal	Health care, policy, human resources	Life expectancy in the Inuit-inhabited areas of Canada, 1989 to 2003 (72)
Children; youth; maternal	Infectious disease	Seroprevalence of <i>Toxoplasma gondii</i> among Nunavik Inuit (Canada) (29)
Children; youth; maternal	Nutrition	Local cultural animal food contributes high levels of nutrients for Arctic Canadian Indigenous adults and children (58)
Children; youth; maternal	Nutrition; interventions/programming	Participatory research for chronic disease prevention in Inuit communities (61)

11 times more frequent in Nunavik than in other Canadian regions (25). Within the Arctic regions of Canada and the United States, indigenous children had the highest rates of *Haemophilus influenzae*, serotype a (26). Rates of HPV were high among Inuit women

compared to other women in Canada and the diversity in HPV types may contribute to the overall burden of infection among Inuit women (27). Factors associated with the high risk HPV were younger age and having 11 or more lifetime sexual partners (28). One study

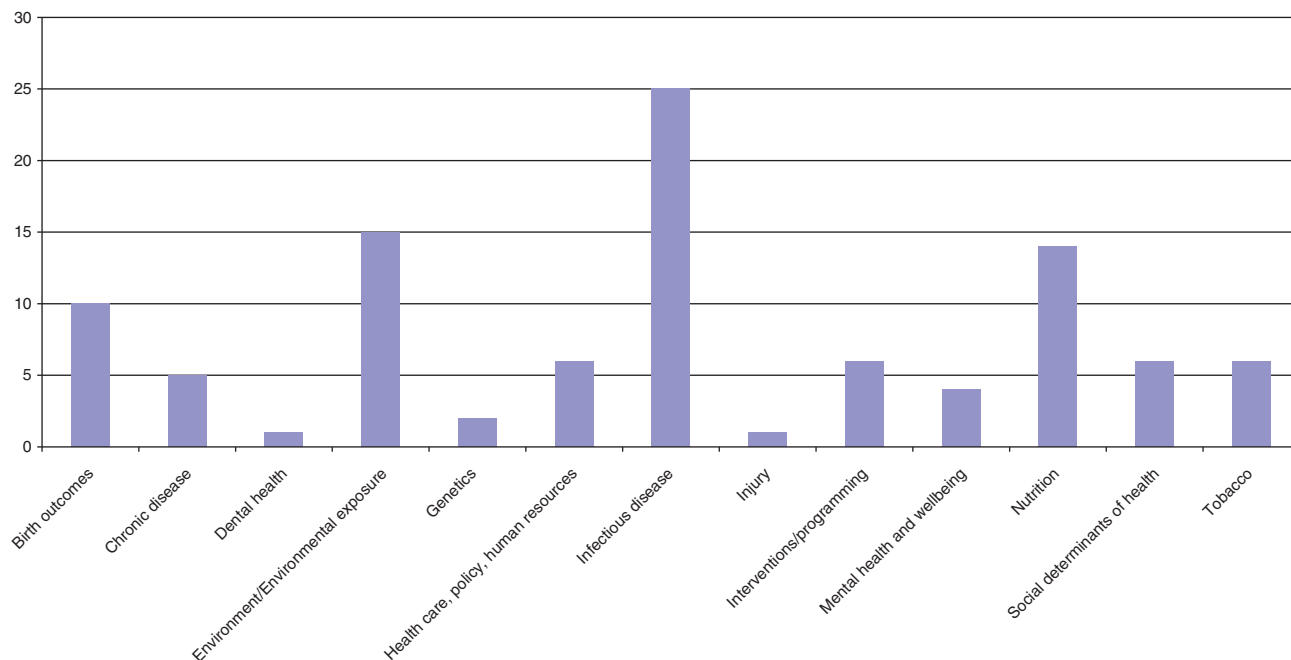


Fig. 1. The frequency of papers by thematic areas in 2000 to 2010 (n = 72).

examined factors that were associated with zoonotic infections, specifically *Toxoplasma gondii*, and demonstrated that age, gender, schooling, and community of

residence each influenced serostatus (29). A case study that examined characteristics that may be associated with sexually transmitted infections among Inuit youth

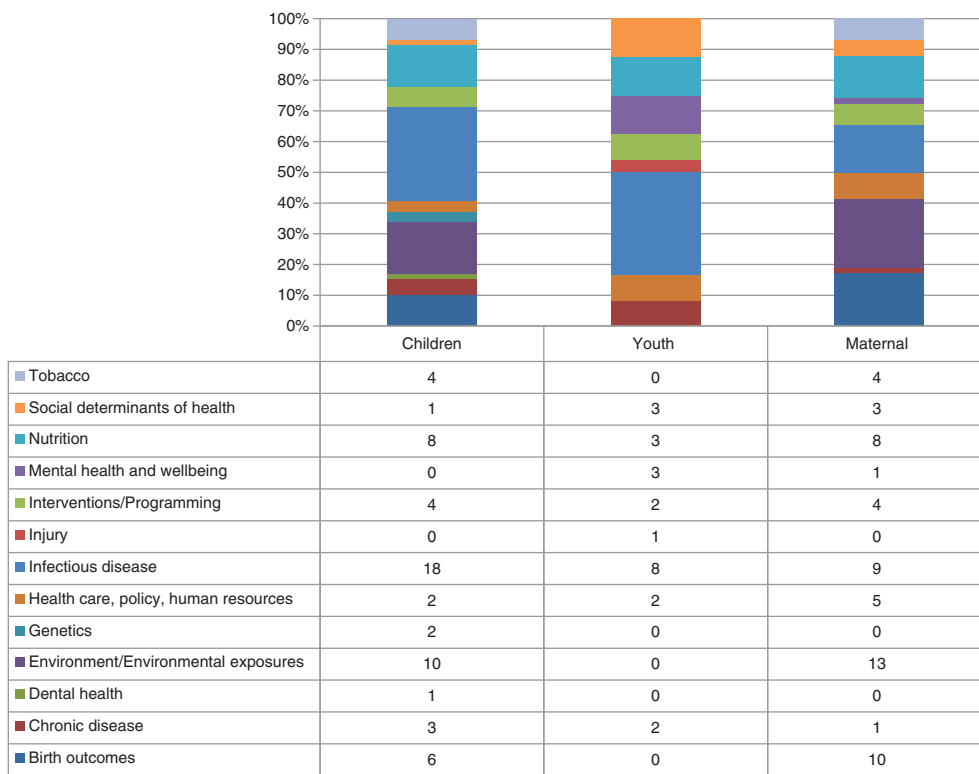


Fig. 2. Distribution of population group categories and the proportion of thematic area content by population group categories in 2000 to 2010.

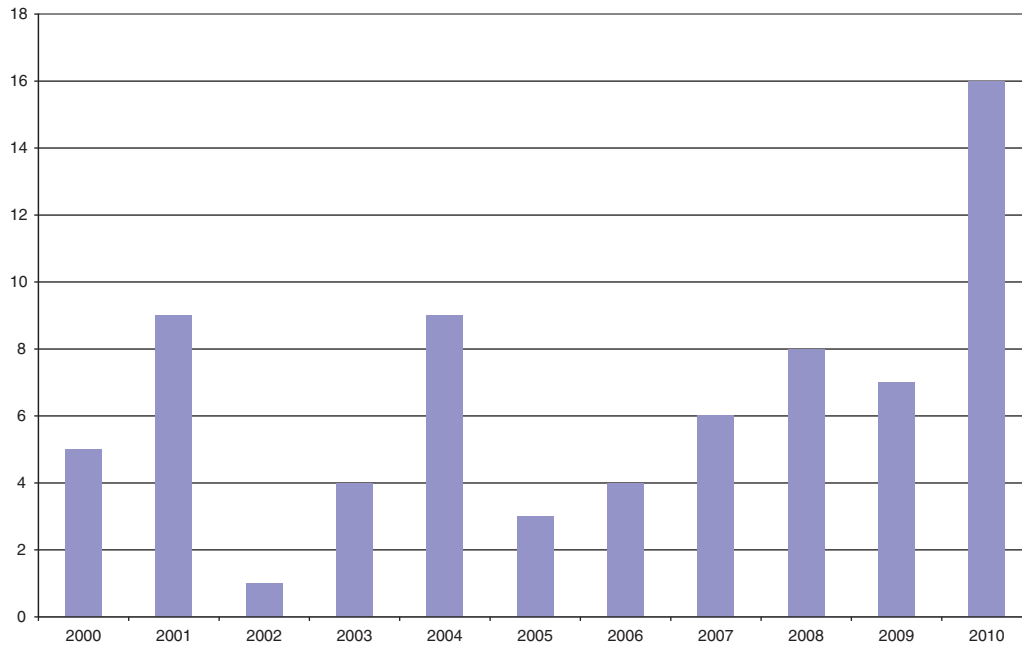


Fig. 3. Distribution of publications by year (2000 to 2010) $n = 72$.

discussed that, among other things, conversations that once occurred between generations about matters related to reproduction are no longer taking place (30). This knowledge gap about sexual health for Inuit youth was referred to elsewhere as well (31).

Factors associated with otitis media among Inuit children included: number of persons per bedroom; number of siblings with a history of the disease; age at first, second, and third visit to a nursing station for ear problems; use of formula versus non-formula in bottle-fed children (32); neonatal vitamin A deficiency (33); and organochlorines (34). The impact of these infections is significant. One in 5 youth experienced hearing loss with a demonstrable impact on school performance (35). Hearing screening and retesting was recommended for surveillance (36). Bronchiolitis was shown to be a serious health problem for Inuit children (37,38). In addition they reported that all infants studied lived in crowded homes and were exposed to maternal smoking prenatally as well as environmental tobacco smoke at home (38). More recently, factors that have been associated with LRTIs among Inuit children are place of residence, lack of breast-feeding (39), reduced ventilation (40,41), neonatal vitamin A deficiency (33) and above average levels of organochlorines (42), and PCBs (25).

Environment/environmental exposures

Of the 15 publications on environment or environmental exposure, 13 had a focus on maternal health and represented 22% of the maternal health literature (Fig. 2). Ten papers were relevant to child health topics, which represented 17% of the child health literature. The

majority of papers that included an environmental exposure were by way of prenatal nutrition, such as through the consumption of fish or marine mammal fat to a health outcome in offspring. Outcomes of interest were children's neuromotor or behavioural development after adverse effects of prenatal mercury (Hg) (43), monomethylmercury (MeHg) (44), lead (Pb) (43,45,46) and polychlorinated biphenyls (PCBs) (43,44,46). A few papers associated contaminants, such as organochlorines (34,42) and PCBs (25) with childhood acute infections. Others found high levels of exposure to lead (47,48), Hg (48) and PCBs (49). The negative association of tobacco smoking (49) and the positive influence of breast-fed children mitigated the effects of these contaminants (44). One study demonstrated that despite widespread knowledge about the contaminants associated with country foods, consumption of these foods increased during pregnancy because of their known beneficial qualities (50). Two studies demonstrated an advantageous association of increased consumption of omega-3 fatty acids from fish, higher levels of on levels of HDL ("good") cholesterol triacylglycerols, and better visual, cognitive, and motor development (51,52).

Nutrition

Fourteen papers were connected to nutrition (Fig. 1). Overall, these publications were related to food availability and nutrient supplementation. The literature on nutrient supplementation was, for the most part, exploratory. For instance, the potential benefit of grain fortification with folic acid for decreasing the rate of congenital heart defects was the focus of 1 paper (53).

The nutritional adequacy of Inuit women's diets during pregnancy and while lactating was assessed along with access to traditional foods. Deficiencies were present in magnesium, zinc, calcium, folate, and vitamins E, A, C (54,55), and D (56). One study demonstrated that traditional food contributed more to the diets of older Inuit women (aged 40–74) compared to younger Inuit women (18–39), where market food provided more to women's energy intake (57). Daily intake of fish for the Inuit in Inuvik was high (131 grams) and was positively associated with beneficial levels of HDL cholesterol and triacylglycerols (51). Through 24-hour dietary interviews, it was determined that Inuit adults generate 6–40% of their daily energy from traditional food, whereas these foods contributed to only 0.4–15% of Inuit children's daily energy intake (58). Despite knowing about the presence of contaminants in traditional foods, a large proportion of Inuit pregnant women reported consuming high amounts of fish, beluga muktuk, seal meat, and seal fat because of the beliefs that these foods are beneficial during pregnancy (50). Egeand and colleague's work concerning food security among Inuit preschoolers demonstrated an urgent need for attention to this issue (59). They reported that approximately 70% of Inuit children lived in households rated as food insecure. Their primary care-givers reported experiencing times in the past year when their children skipped meals (76%), went hungry (90%), or did not eat for a whole day (60%). One work highlighted the complex interaction of many factors resulting in food insecurity. Beyond food affordability, factors such as budgeting, food quality and availability, absence of a full-time hunter in the household, poverty and addiction are all important considerations (60). Another study assessed what factors were important to community members concerning the development of chronic disease programming. The key cultural themes that emerged were perceived healthiness of country foods, food sharing, and importance of family (61).

Birth outcomes

Ten papers examined birth outcomes (Fig. 1). Genetic predisposition was proposed as an explanation for high rates of certain heart defects (62). A periconceptual diet higher in folate and vitamin A was recommended to reduce birth defects. Culturally appropriate public health efforts to encourage the periconceptual use of multi-vitamin supplements were suggested (53). Three papers showed that Inuit have unique risk profiles for adverse pregnancy outcomes (5,63,64). Preventing preterm births, sudden infant death syndrome (SIDS) and infection-related infant mortality were suggested as target areas for Inuit populations (64). Furthermore, the degree of isolation in Inuit-inhabited areas on these outcomes was considered (5,63). Sustaining midwifery care in the

North is consistent with Inuit beliefs about pregnancy and childbirth (65,66), and literature on midwifery-led births demonstrated comparable birth outcomes to physician-led deliveries (67,68).

Health care, policy, and human resources

Six publications related to this broad thematic area (Fig. 1). None of the papers presented specific policy recommendations. Of all the thematic areas included in this review, these findings varied the most. The impact of 2 infectious disease outbreaks in an arctic community highlighted the drain on health care resources caused by these events (69). A paper by Douglas brought attention to the need for accommodating Inuit beliefs about pregnancy in biomedical practices (65). A paper by Houd and colleagues based on 5 years of retrospective data advocated local birthing rather than evacuation to a larger community (70). Hanrahan's work documented the dissatisfaction Inuit and Innu individuals experience when using urban health centres to which they had been referred (71). This work, based on a large sample of interviews (n = 143), summarized key areas for health care delivery improvements. A paper by Wilkins and colleagues (2008) did not address any health care challenges directly; however, they asserted that the 12-year gap in life expectancy between Inuit-inhabited areas and other Canadian regions demonstrates a dramatic disparity in health status. It was the opinion of these authors that rectifying this significant gap in life expectancy would require significant policy improvements (72).

Interventions and programming

Six publications had an intervention or programming component. Two papers related to birthing practices. One paper retrospectively assessed the need for community evacuation to a larger community or health centre from the small community of Inukjuak in 1998–2002 (70). Of 182 births, 4.5% of women or their newborns required to be evacuated for various reasons. In a larger study from 14 Inuit communities in Nunavut between 1989 and 2000, birth outcomes were not significantly different when comparing Inuit midwives to Western physicians after adjustment for maternal age, marital status, parity, education, infant sex and plurality, community size, and community-level random effects (67).

A pilot study was successful in demonstrating an improvement in speech intelligibility scores by using sound field amplifications in a classroom setting. With a 26% prevalence of hearing loss among Inuit children in Nunavik, this tool has potential to advantage these students (73). With only a 9% Inuit sample, an investigation explored the experiences of receiving HIV testing services. Overall, these youth felt they were treated with care, although there were some concerns of discrimination and hostility (74).

Using randomized trial approaches, the acceptability and safety of using microencapsulated-iron sprinkles for prevention of iron deficiency anaemia was assessed (75), and the usability of home heat recovery ventilators to reduce childhood respiratory illnesses was tested (40). In both analyses, the study design was effective in evaluating a chronic disease issue. Gittelsohn and colleagues did not evaluate or assess a program but discussed including the perceived healthiness of country foods, food sharing, and the importance of family (61). The paper is included in this section because of the applicability of the findings to developing Inuit-specific programming for community-based chronic disease prevention programs.

Social determinants of health

There were 6 papers that related to the social determinants of health (Fig. 1). In studies examining food security (59), suicidal ideation and behaviour with depression (76,77), discussions about the social determinants of health such as family responsibilities or language led to culturally appropriate explanations. Richmond's work elaborated on the importance of social support to positive health outcomes (78). In a comparison of Cree, Inuit and non-Aboriginal women of Quebec, it was the Aboriginal women who, as well as experiencing a higher burden from tobacco smoking and alcohol drinking for instance, also have heavier family responsibilities (79). Heavier family responsibilities can cause stress, and negate personal care and wellbeing.

Tobacco

Of the 72 papers reviewed, 6 focussed primarily on tobacco (Fig. 1). Of these, none had a focus on youth health despite high rates of smoking in this population. Much of the tobacco-related literature focused on the relationship between tobacco (often maternal smoking during pregnancy and second-hand smoke) and lower respiratory tract infections among children (38,39,41). Mehaffey et al. demonstrated that when Inuit women did not smoke or reported smoking less than 5 cigarettes a day early in their pregnancies, the birth outcomes of their infants were equal or superior compared to other Canadian infants (8).

Chronic disease

Five papers demonstrated the high chronic disease burden affecting Inuit peoples in Canada (Fig. 1). The number of overweight children reported in the target period was higher than previously reported (80). Rates of respiratory conditions were found to be high, but varied by geographical location, socioeconomic status, demographic characteristics (81), and tobacco use. The distribution of several health conditions for Inuit populations was worse than for other Canadians and other Aboriginal populations. These health disparities contri-

bute to the increasing gap in life expectancy between the Inuit and other Canadians (82).

Mental health and wellbeing

Mental health and wellbeing were the foci of 3 publications (Fig. 1). After compiling data from several cross-sectional surveys in Quebec, smoking, drug use, and mental disorders were more prevalent among Inuit women than other women in the province (79). Two papers with a youth focus dealt with suicide. With high rates of completed suicides among Inuit populations, 1 study sought to examine the characteristics of Inuit people who died by suicide in Nunavik between 1982 and 1996 using a case-control approach (77). Completed suicides were more likely to be male and have had a lifetime psychiatric diagnosis than controls and had more contact with health care services in the year before their death and over their lifetime. The other study used a cross-sectional methodology to assess suicidal ideation and behaviour (76), and found associations between higher suicidal tendencies and increased anxiety and alcohol use, but not with depression or gender. Suicidal ideation occurred more frequently among younger persons, whereas those using local native language were less likely to report a wish to die.

Genetics

Two papers were concerned with genetics (Fig. 1). The first found that while Inuit children had a low intake of calcium per day, calcium absorption appeared to be more efficient in children with a *bb* vitamin D receptor genotype. This may represent a genetic adaptation to dietary constraints in the North (83). The other paper with a genetic focus described the occurrence of a condition known as glycogen storage disease type III (GSD III), and had a sample size of 4 Inuit children (84).

Dental health

The only paper that had a dental health theme utilized data from the Nunavut Inuit Child Health Survey 2007–2008 (85). The paper found a high incidence of poor oral health among children. Parental rating of their child's oral and dental health was also low. Factors associated with reported caries were milk, which had a protective association, and sugar, which had a negative association.

Injury

One paper focussed on youth health and examined prevention of injury mortality (86). Using population-based data from the Northwest Territories, this work showed an increased risk of death from injuries among individuals with being male, having an age greater than 14, living in more remote communities, living above 66 degrees latitude, and self-identifying as Dene or Inuit.

Discussion

The agenda for the past decade of Canadian Inuit health research has not mapped well to the realities of the population's demographic, or to the prevailing health statuses, of these population groups. Overall, the peer-reviewed literature was concentrated in the areas of infectious diseases and environmental contaminants, particularly among children. These findings do not correspond with the issues and areas of concern from the perspective of Canadian Inuit organizations that are in place to represent Inuit communities across the country. These organizations emphasize the importance of understanding the social determinants of health, prevention and cessation of tobacco use, principally among expecting women, and encourage efforts towards the improvement of mental health and wellbeing, particularly of youth (87–89).

This review documents high incidences of illness and significant public health problems, but demonstrates that there are opportunities to work on research in areas that may enhance health outcomes. We suggest that a thorough, inclusive review of non-peer reviewed literature, for instance reports by organizations and programs with a focus on Inuit health should be performed. The peer-reviewed literature does not adequately capture the social determinants of health such as socioeconomic status, educational attainment, spirituality, and community infrastructure. These are more likely captured in the non-peer reviewed literature and would be helpful in conceptualizing and developing culturally fluent programs and interventions. More regionally-led and community-driven studies could be developed based on the Inuit-specific content in the national census data and the Inuit Health Survey. Finally, advocacy organizations such as Inuit Tapiriit Kanatami (ITK), and research organizations such as the Institute of Circumpolar Health are now well positioned to work towards protecting and enhancing the health of Canada's Inuit populations in collaboration with researchers, communities, and governments.

Conflict of interest and funding

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***Amanda J. Sheppard**

AboutKidsHealth
The Hospital for Sick Children
555 University Avenue
Toronto
Ontario
M5G 1X8
Canada
Tel: (416) 854-3809
Fax: (416) 813-6011
Email: amanda.sheppard@utoronto.ca