

PEDIATRIC ASTHMA

Severe Early Lower Respiratory Tract Infection is Associated with Subsequent Respiratory Morbidity in Preschool Inuit Children in Nunavut, Canada

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Background. Inuit children in Nunavut, Canada, have high rates of lower respiratory tract infection (LRTI) early in life. Whether this commonly results in chronic respiratory symptoms later in life is unknown. **Methods.** A cross-sectional survey of 3- to 5-years-old Inuit children was conducted in all three regions of Nunavut, as part of the "Qanuippitali, what about us, how are we?" survey. **Results.** Reported chronic cough and wheezing were common in preschool Inuit children, although reported asthma diagnosed by a healthcare professional was uncommon. The presence of smokers in the home tended to be associated with severe LRTI in the first 2 years of life. Reported wheezing as well as reported bronchitis or pneumonia in the previous 12 months was significantly associated with severe LRTI in the first 2 years of life. Reported wheezing was also strongly associated with reported bronchitis or pneumonia in the past 12 months. The prevalence of chronic moist cough could not be clearly assessed, due to limitations in the questionnaire. **Interpretation.** Severe LRTI in the first 2 years of life was associated with ongoing respiratory morbidity in preschool Inuit children, although symptoms appeared to lessen in severity over time.

Keywords asthma, child (preschool), cough, Inuit, Nunavut, pneumonia, respiratory sounds/wheezing

INTRODUCTION

The reported hospitalization rate for bronchiolitis caused by respiratory syncytial virus is markedly elevated in Inuit infants living in the world's polar regions. Rates in Baffin (Qikiqtani) Region, Nunavut, are as high as 306 per 1000 infants during the first year of life (1). High rates of bronchiolitis have also been reported in Alaska Native infants (2) and Inuit infants in Greenland (3). These are the highest recorded rates in the world (4); in contrast, corresponding hospitalization rates in the continental United States are approximately 10 per 1000 infants, and 53 per 1000 infants in developing countries (5). The cause(s) of the high rates of respiratory infection in aboriginal populations in the Arctic remains incompletely understood. Lower respiratory tract infection (LRTI) can be defined as infection of the intrathoracic airways and/or lung parenchyma, and as respiratory syncytial virus infection involves contiguous infection from the bronchioles to the alveoli, bronchiolitis and pneumonia can be considered together as LRTI (6). Diseases that could predispose children to severe LRTI, such as cystic fibrosis and primary ciliary dyskinesia, appear to be very rare in these populations (7). Immune deficits also appear to be rare, with no abnormalities reported in serum immunoglobulins, mannose-binding lectin, and

T-cell numbers or function (7–10). Potential causal factors likely include high rates of environmental tobacco smoke (ETS) exposure, overcrowded homes (3, 11), and reduced home ventilation rates in tightly sealed northern housing (11). The relative immunological naïveté in populations that had little contact with other peoples for centuries may also play a role (12). Other potential factors include nutritional deficiencies (13, 14) and idiopathic oral aspiration (15, 16).

Not only do Aboriginal infants in the Arctic have high rates of acute, severe LRTI, but they also appear to have an increased frequency of chronic respiratory disease following these infections. The prevalence of chronic lung diseases, such as bronchiectasis, is reported to be increased in Alaska Native (7) and aboriginal Australian populations (17); and bronchiectasis, pulmonary fibrosis, and *bronchiolitis obliterans* have also been reported in aboriginal children in northern Canada following bronchiolitis caused by adenovirus (18). Bronchiectasis has been shown to follow severe LRTI in these populations (10). Unexpectedly, studies from Nunavik (Arctic Quebec) have suggested that the prevalence of asthma is decreased in Inuit children living there (19), and pulmonary function in Inuit children in Greenland is higher than in Danish children (20). Rates of atopy are low in Inuit children in Nunavik (19), although rates have been reported to be increasing in Greenland (21).

The prevalence of chronic respiratory symptoms in Inuit children, who suffered from high rates of severe LRTI early in life, has been incompletely characterized.

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In a predominantly Alaska Native population of middle school children, the prevalence of wheezing without a diagnosis of asthma by a physician was 7.4%, and the prevalence of chronic productive cough was 21.5%. These symptoms were strongly associated with ETS and active smoking (22). It has been suggested that chronic wet cough, possibly due to protracted bacterial bronchitis, may precede bronchiectasis (22, 23).

The objective of this study was to determine the prevalence of chronic respiratory symptoms in preschool Inuit children, using the Inuit Health Survey, a population-based survey of preschool Inuit children in Nunavut, Canada. We hypothesized that these children would be reported to have an increased frequency of LRTI early in life, and high rates of chronic wet cough, wheezing, and reported asthma in the preschool years.

METHODS

A cross-sectional survey was conducted in the late summer and fall of 2007 and 2008 in 16 of the 25 communities of Nunavut, representing all three regions of the territory. Details of the survey have been published elsewhere (24). The survey timing was coincident with the school year so that families with children would be in the communities rather than hunting or camping; only one community was surveyed immediately before the start of the school year. Inuit children aged 3–5 years were eligible to participate and were recruited from community health centers' lists of age-appropriate children and from randomly selected households that had at least one participant in the International Polar Year Adult Inuit Health Survey for Nunavut: "*Qanuippitali*, what about us, how are we?" The overall desired minimum target sample size was 300 children. About 644 households were initially approached and 107 could not be reached and/or the families were out of town. Of the 537 households with 3–5 year olds that were successfully contacted, 75 refused on initial contact and 74 canceled or failed to show up for their clinic visit, providing a total participation rate of 60.2% (72.3% of contacted households) and 388 participants. The 388 children represent 26% of all Inuit 3–5 year olds in the 16 communities, based on the health centers' records of children in the appropriate age group.

All staff members were trained in interviewing skills, including dietary assessments. Face-to-face interviews with the parent or primary caregiver included a home-based questionnaire, a household composition chart, a medication and supplement use form, and a health questionnaire. Questions about respiratory symptoms and illnesses were based on the standard ATS-DLD 78c questionnaire (25). The questions pertaining to wheezing and respiratory illnesses had been validated in previous research in Nunavut (26). LRTI was defined as reported bronchiolitis, pneumonia, or asthma, because viral bronchiolitis and pneumonia have overlapping pathology (6, 27), and asthma in this age group is typically triggered by viral infection (28). Chronic cough symptoms were

defined as symptoms between colds, of cough, cough with exercise, cough at night, or sputum production. Results were analyzed using SAS version 9.2. Relations between dichotomous variables were examined using the chi-square tests. Generalized linear models were used for multiple linear regression, using stepwise forward entry of variables with a probability (p) value of $<.10$. p -Values less than .05 were considered statistically significant.

A Scientific Research License was obtained from the Nunavummi Qaujisagtulirijikkut (Nunavut Research Institute). The McGill Faculty of Medicine Institutional Review Board issued a certificate of Ethical Acceptability.

RESULTS

The characteristics of the 388 study children are presented in Table 1. The majority of the children were cared for at home (Table 1). Houses, on average, were overcrowded. The great majority had been exposed to cigarette smoke *in utero*, and smokers were present in most of the homes.

Approximately one-third of the children had a severe LRTI before 2 years of age (Table 2), most commonly for pneumonia or bronchiolitis; only 8% had been hospitalized with a reported diagnosis of asthma. The children had been hospitalized, for any reason, a mean of 1.2 (SD 3.1) times. The presence of smokers in the home tended to be associated with LRTI in the first 2 years of life ($p = .08$).

TABLE 1.—Demographic characteristics: Nunavut Inuit Child Health Survey, 2007–2008.

Characteristic	Total ^a	Number (%)	Mean	SD
Age (years)	388		4.4	0.85
Household				
Number of bedrooms	367		3.0	1.0
Occupancy	378		5.9	2.2
Number of smokers per home	374		2.1	1.4
Smoker(s) present in the house	374	347 (92.8)		
Male gender	388	184 (47.4)		
Breastfed	371	252 (67.9)		
Prenatal cigarette exposure	377	316 (83.8)		
Cared for in daycare	384	129 (33.6)		

Note: ^aTotal number of children with non-missing data for each variable.

TABLE 2.—Lower respiratory tract infection (LRTI) during the first 2 years of life^a prevalence: Nunavut Inuit Child Health Survey, 2007–2008.

Characteristic	Total ^b	Number (%)
LRTI ^a in the first 2 years of life	345	112 (32.5)
Among those with LRTI ($n = 112$)		
Disease prevalence		
Bronchiolitis	112	44 (39.3)
Pneumonia	112	49 (43.8)
Asthma	112	9 (8.0)
Other diagnosis/not specified	112	10 (9.0)
Hospitalization		
Hospitalized in Nunavut	112	30 (26.8)
Hospitalized outside of Nunavut	112	61 (54.5)

Note: ^aAs reported by parent or caregiver.

^bTotal number of children with non-missing data for each variable.

TABLE 3.—Proportion of children with reported respiratory events or conditions in the past 12 months: Nunavut Inuit Child Health Survey, 2007–2008.

Condition ^a	Total ^b	Number with condition (%)
Visiting health center for cough, wheezing, or a breathing problem	378	160 (42.3)
Hospitalization for a respiratory problem	378	18 (4.8)
Need for medication(s) for a respiratory problem, such as an inhaled medication	368	107 (29.1)
Diagnosis by a health professional		
Pneumonia	380	21 (5.5)
Bronchitis	379	17 (4.5)
Asthma	380	13 (3.4)
Allergies	380	19 (5.0)
Tuberculosis	379	7 (1.9)

Note: ^aAs reported by parent or caregiver.^bTotal number of children with non-missing data for each variable.

LRTI in the first 2 years of life was associated with the presence of more persons per room in the home (1.24 (SD 0.38) vs. 1.13 (SD 0.37) persons per room, $p = .02$).

In the previous 12 months, nearly half of the subjects were reported to have visited the community health center for cough, wheezing, or a breathing problem (Table 3). Children visiting the health center visited a mean of 2.5 (SD 2.6) times. About one-third of the children were reported to have needed medication(s) for a respiratory problem, and those who needed them required them an average of 1.8 (SD 2.5) times. Reported hospitalization in the preceding 12 months was much less frequent than it had been during the first 2 years of life. In the past 12 months, families had been told that their child had bronchitis or pneumonia more frequently than asthma. Reported hospitalization in the past 12 months, and/or diagnosis by a healthcare professional of asthma, bronchitis, or pneumonia, were all highly associated with severe LRTI in the first 2 years of life (Table 4).

Twenty-three percent (82/353) of the children were reported to have ever wheezed. When wheezing occurred, it was generally during colds (19.2% (68/354) children) rather than between colds (7.4% (26/350) children).

Wheezing with exercise was also uncommon (6.9% (24/350) children). Reported wheezing (ever) became less common with age (29.4% (42/143) of 3 year olds, 21.7% (25/115) of 4 year olds, 15.8% (15/95) of 5 year olds, $p = .047$). Wheezing with colds, between colds, and with exercise were all highly associated with a reported history of chest infection in the first 2 years of life (Table 5), as well as with visiting the hospital for a breathing problem in the past 12 months (Table 6). Maternal smoking during pregnancy was associated with wheezing ever, and wheezing with exercise (Table 7). Wheezing ever was not associated with occupancy or indoor cigarette smoke exposure (data not presented). Wheezing ever, wheezing with or between colds, and wheezing with exercise were all strongly associated with a diagnosis of bronchitis, pneumonia, or asthma in the past 12 months (except for the association between bronchitis and wheezing with colds, which was not significant). Recent use of a respiratory medication was associated with wheezing, with visiting the hospital recently, and with a recent diagnosis of asthma, bronchitis, or pneumonia (data not presented).

Symptoms of chronic cough were reported to be present in the majority of children, with 62.9% (224/356) reported to cough between colds. Chronic wet cough was also commonly reported, with 34.0% (118/347) reportedly having this symptom. Cough between colds, with exercise, or at night were also common, being reported by 41.3% (140/339) and 40.1% (141/352) of the subjects, respectively. Neither cough between colds nor chronic wet cough was associated with a recent diagnosis of asthma, bronchitis, or allergies. In addition, no cough symptom was associated with chest infection in the first 2 years of life (data not presented). Cough between colds was associated with smoking during pregnancy (Table 7). Chronic nighttime cough was associated with a recent diagnosis of bronchitis (Table 6). Cough with exercise was more common in males than in females (47.8% (76/159) vs. 35.6% (64/180), $p = .02$). Cough between colds, at night, or with exercise were associated with breastfeeding, for any length of time (Table 6). The presence of fewer bedrooms in the house (2.80 (SD 0.91) vs. 3.11 (SD 1.06) bedrooms, $p = .0068$) was also associated with chronic nighttime cough.

TABLE 4.—Relative risk (RR) and 95% confidence intervals (CI) of respiratory conditions during the past 12 months, by history of lower respiratory tract infection (LRTI) during the first 2 years of life: Nunavut Inuit Child Health Survey, 2007–2008.

Condition ^a	With condition in past 12 months (%)		RR (95% CI)
	Among those with history of LRTI [% (n/N)] ^b	Among those without history of LRTI [% (n/N)] ^b	
Hospitalized in past 12 months	11.6 (13/112)	1.3 (3/230)	8.9 (2.6–30.6)***
Visiting hospital in past 12 months for a breathing problem	51.8 (58/112)	38.3 (88/230)	1.4 (1.1–1.7)**
Asthma diagnosis in past 12 months ^c	10.7 (12/112)	0 (0/231)	—
Bronchitis diagnosis in past 12 months	9.9 (11/111)	1.7 (4/231)	5.7 (1.9–17.6)***
Pneumonia diagnosis in past 12 months	16.1 (18/112)	1.3 (3/231)	12.4 (3.7–41.1)***
Recent use of a respiratory medication	9.8 (11/112)	1.7 (4/233)	0.9 (0.9–1.0)***

Note: ^aAs reported by parent or caregiver.^bSubjects with missing data on the survey for a given variable are excluded.^cRR and 95% CI cannot be calculated due to 0 value in denominator.** $p \leq .01$; *** $p \leq .001$; chi-square and Fischer's exact tests.

TABLE 5.—Relative risk (RR) and 95% confidence intervals (CI) of respiratory symptoms during the past 12 months, by history of lower respiratory tract infection (LRTI) during the first 2 years of life: Nunavut Inuit Child Health Survey, 2007–2008.

Condition ^a	With condition in past 12 months (%)		RR (95% CI)
	Among those with history of LRTI [% (n/N)] ^b	Among those without history of LRTI [% (n/N)] ^b	
Wheezing with colds	32.1 (36/112)	13.9 (32/231)	2.3 (1.5–3.5)***
Wheezing (ever)	36.9 (41/111)	17.3 (40/231)	2.1 (1.5–3.1)***
Wheezing between colds	12.8 (14/109)	5.2 (12/230)	2.5 (1.2–5.1)*
Wheezing with exercise	14.6 (16/110)	3.5 (8/229)	4.2 (1.8–9.4)***
Cough with exercise	44.9 (48/107)	38.9 (86/221)	1.2 (0.9–1.5)
Chronic night-time cough	43.2 (48/111)	39.6 (91/230)	1.1 (0.8–1.4)

Note: ^aAs reported by parent or caregiver.^bSubjects with missing data on the survey for a given variable are excluded.^cRR and 95% CI cannot be calculated due to zero value in denominator.* $p \leq .05$; *** $p \leq .001$; chi-square and Fischer's exact tests.

TABLE 6.—Associations between respiratory symptoms, and respiratory conditions reported to have occurred in the past 12 months: Nunavut Inuit Child Health Survey, 2007–2008.

Symptom		Subjects visiting hospital for breathing problem ^a (%) (n/N) ^b	Subjects recently using a respiratory medication (%) (n/N) ^b	Subjects diagnosed with asthma ^a (%) (n/N) ^b	Subjects diagnosed with bronchitis ^a (%) (n/N) ^b	Subjects diagnosed with pneumonia ^a (%) (n/N) ^b
Wheezing with colds	Yes	64.7 (44/68)	8.8 (6/68)	11.9 (8/67)	13.6 (9/66)	17.9 (12/67)
	No	38.1 (107/281)***	3.15 (9/286)*	1.4 (4/285)***	2.1 (6/285)***	3.2 (9/285)***
Wheezing (ever)	Yes	65.4 (53/81)	9.8 (8/82)	11.3 (9/80)	13.9 (11/79)	17.5 (14/80)
	No	36.3 (97/267)***	2.6 (7/271)**	1.1 (3/271)***	1.5 (4/271)***	2.6 (7/271)***
Wheezing between colds	Yes	76.9 (20/26)	19.2 (5/26)	24.0 (6/25)	12.5 (3/24)	24.0 (6/25)
	No	40.4 (129/319)***	3.1 (10/324)**	1.6 (5/323)***	3.4 (11/323)	4.3 (14/323)**
Wheezing with exercise	Yes	87.5 (21/24)	8.3 (2/24)	16.7 (4/24)	16.7 (4/24)	29.2 (7/24)
	No	39.6 (127/321)***	4.0 (13/326)	2.5 (8/324)**	3.4 (11/323)*	4.3 (14/324)***
Chronic night-time cough	Yes	47.5 (67/141)	5.7 (8/141)	5.7 (8/140)	7.2 (10/139)	7.9 (11/140)
	No	40.1 (83/207)	3.3 (7/211)	1.9 (4/209)	2.4 (5/209)*	4.8 (10/209)

Note: ^aIn past 12 months as reported by parent or caregiver.^bSubjects with missing data on the survey for a given variable are excluded.* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$; chi-square and Fischer's exact tests.

TABLE 7.—Relative risk (RR) and 95% confidence intervals (CI) of respiratory symptoms during the past 12 months, by history of smoking during the pregnancy, or any breast feeding: Nunavut Inuit Child Health Survey, 2007–2008.

Condition ^a	Subjects with symptoms among those who were exposed to prenatal smoking (%)			Subjects with symptoms among those who were ever breastfed (%)		
	Yes (n/N) ^b	No (n/N) ^b	RR (95% CI)	Yes (n/N) ^b	No (n/N) ^b	RR (95% CI)
Wheezing ever	25.6 (74/289)	11.9 (7/59)	2.2* (1.0–4.4)	22.5 (52/231)	22.7 (25/110)	1.0 (0.7–1.5)
Wheezing with exercise ^c in past 12 months	8.0 (23/286)	0 (0/59)	–	6.1 (14/229)	7.3 (8/109)	0.8 (0.4–1.9)
Cough between colds in past 12 months	65.0 (189/291)	50.9 (30/59)	1.3* (1.0–1.7)	65.8 (154/234)	57.8 (63/109)	1.1 (0.9–1.4)
Chronic night-time cough during past 12 months	42.5 (122/287)	28.8 (17/59)	1.5 (1.0–2.3)	44.4 (102/230)	32.1 (35/109)	1.4* (1.0–1.9)
Cough with exercise during past 12 months	44.0 (121/275)	30.5 (18/59)	1.4 (1.0–2.2)	45.8 (104/227)	34.0 (34/100)	1.3* (1.0–1.8)

Note: ^aAs reported by parent or caregiver.^bSubjects with missing data on the survey for a given variable are excluded.^cRR and 95% CI cannot be calculated due to zero value in denominator.* $p \leq .05$; chi-square and Fischer's exact tests.

DISCUSSION

In logistic regression analysis, bringing the child to the health center, bronchitis, and pneumonia in the past 12 months was associated with LRTI before 2 years of age. Bringing the child to the health center or a diagnosis of bronchitis in the past 12 months was inversely associated with age; bronchitis was also associated with male gender (Table 8).

This large, population-based health survey confirmed previous reports that young Inuit children suffer from high rates of LRTI (1, 4, 29), and that known risk factors for LRTI, including overcrowding (11) and prenatal and postnatal tobacco smoke exposure (30), are prevalent. Moreover, following LRTI early in life, respiratory

TABLE 8.—Odds ratios (OR) and 95% CI for respiratory events, based on history of lower respiratory tract infections (LRTI)^a during the first 2 years of life, using multivariable logistic regression analysis^b: Nunavut Inuit Health Survey, 2007–2008.

Events	LRTI before 2 years of age [OR (95% CI)]	Age [OR (95% CI)]	Gender [OR (95% CI)]
Bringing child to the health center in past 12 months	1.75 (1.1, 2.79)*	0.68 (0.53, 0.89)**	0.89 (0.57, 1.38)
Bronchitis in past 12 months	6.18 (1.88, 20.32)**	0.48 (0.23, 1.00)*	0.24 (0.066, 0.89)*
Pneumonia in past 12 months	14.6 (4.19, 50.89)***	0.85 (0.48, 1.48)	0.98 (0.39, 2.48)

Note: ^aFor highly prevalent outcomes such as LRTI, odds ratios tend to over-estimate the true relative risks.

^bAdjusted for age (years) and sex (female vs. male).

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

sequelae persist through the preschool period, although morbidity tends to drop over time. Children in the preschool age group participating in the Inuit Health Survey had frequent visits to the community health center, and reported wheezing was frequent. Nearly one-third needed medication(s) for a respiratory problem in the preceding 12 months. Although chronic cough was commonly reported, more specific questioning is needed to define the true prevalence of chronic wet cough in this population.

We found that reported LRTI in the first 2 years of life was associated with considerable subsequent morbidity, including further hospitalizations or stays at the health center, diagnoses of bronchitis, pneumonia, and asthma, and reported wheezing. Consistent with previous studies of children living in the Arctic, rates of respiratory illness fell with increasing age (26, 31). However, severe respiratory infections early in life appeared to be associated with impaired airway function throughout the preschool period. An increased incidence of asthma in children following bronchiolitis has been widely reported elsewhere (32), and is most likely due to a genetic predisposition to wheezing illness and other atopic conditions (32), airway alteration due to early, severe infection (33), or a combination of both factors. The strong association between reported wheezing and reported bronchitis or pneumonia in the past 12 months suggests that at least some of the reported LRTIs in preschool Inuit children were actually asthma exacerbations. Asthma exacerbations can be confused with LRTI in young children particularly easily, as mucous plugging due to bronchial hypersecretion from asthma can cause crackles, atelectasis, and other clinical findings typical of LRTI (34). It is also possible that parents and healthcare professionals were more cognizant of subsequent respiratory conditions after a prior history of severe respiratory illness. Although wheezing both during and between colds was commonly reported, the frequency of this symptom may have been overestimated. The term “wheezing” may be confused for noisy breathing in Inuktitut (35), and this explanation would be consistent with the relatively infrequent use of inhaled medication for asthma.

To date, it has generally been felt that asthma is uncommon in Inuit children. Previous studies reported that 5% (36) to 7.9% (19) of Inuit children had been diagnosed with asthma. We also found that asthma was diagnosed infrequently, both during the first 2 years of life, and also

in 3- to 5-year-old children. However, the frequency of conditions that may mimic asthma, such as bronchitis and pneumonia (34), suggests that asthma may be underdiagnosed in this population. The low prevalence of asthma in children living in the Arctic might be due to the “hygiene hypothesis,” which proposes that frequent infections early in life reduce the risk of subsequent atopic disease (37). Consistent with the “hygiene hypothesis,” rates of atopy in the Arctic appear to be rising, concurrent with the adoption of relatively less rural living conditions (21).

Given the potential diagnostic confusion arising from the similar symptoms of respiratory tract infections and asthma in young children, it may not be surprising that either the diagnosis of asthma by healthcare professionals possibly lacked precision, or was not communicated to families adequately clearly. Of the children diagnosed with asthma, only 11.3% were reported to have wheezed ever, 11.9% to have wheezed with colds during the past year, and 5.7% to have chronic nighttime cough. A total of 9.8% of subjects reporting recent use of a respiratory medication were reported to have wheezed with colds during the past year, although 19.2% reported wheezing between colds. Families may not have understood what the medications their children had received were for, or did not recall why their children received the medication(s). Families in Nunavut may require more education regarding lower respiratory tract diseases and the use of respiratory medications.

Severe LRTI early in life appeared to be associated with an increased risk of hospitalization in preschoolers. A total of 4.8% of surveyed preschool children had been hospitalized in the preceding 12 months, which is similar to findings in Nunavik (Arctic Quebec), where a hospitalization rate of 31 per 1000 child-years for children 2–4 years of age has been reported (Arctic Quebec) (31). It is possible that hospitalization in preschool children was an overestimate in our population. Most communities in Nunavut do not have hospitals and their health centers do not normally admit children overnight, so the question “In the 12 months, did your child ever have to stay in the hospital for a respiratory problem?” could possibly have been misinterpreted to include occasional overnight stays at the community health center, and daytime visits to the health center, as well as hospitalization at a regional center.

Severe LRTI early in life has been reported to be an important risk factor for long-term lung injury such as bronchiectasis, in aboriginal populations (10). Early

manifestations of this type of lung injury in indigenous populations in Australia and Alaska may include chronic moist cough or protracted bacterial bronchitis (23). We therefore wished to examine chronic moist cough in young children in Nunavut. Although our subjects were frequently reported to have had chronic cough, it was generally not associated with the diagnosis of a respiratory condition. Chronic cough was not associated with severe LRTI in the first 2 years of life. This would further suggest that protracted bacterial bronchitis in toddlers (22, 23) was not prevalent in our population. However, it is likely that the questionnaire's items on chronic cough were not specific enough to make a possible diagnosis of chronic moist cough, as the proportion of the year with cough symptoms was not specified, and the validity of these questions for determining the presence of chronic moist cough in Inuit children in Nunavut has not been formally evaluated. Respondents may have confused cough during recent acute respiratory tract infections with chronic cough symptoms. The significant association between night cough and recent reported bronchitis supports this possibility. The lack of association of cough symptoms with health provider encounters, medication use, asthma, or pneumonia suggests that reported chronic cough was not due to chronic respiratory illness. The prevalence of chronic cough in preschool children elsewhere in the Arctic is incompletely understood. In an older pediatric population, Lewis and coworkers found that 40% of Alaska native students in grades 6–9 had chronic respiratory symptoms, and 30% had productive cough, although approximately one-third of these children were active smokers (22). Determining whether common moist cough is common in older Inuit children in Nunavut will require research involving an older pediatric population than was examined in our study.

Our population had several important risk factors for respiratory disease, and at least one potentially protective influence. Cigarette smoke exposure, both before and after birth, was extremely common, and, consistent with other reports (30), prenatal smoke exposure was associated with subsequent wheezing and cough. The borderline-significant association between presence of smokers in the home and LRTI in the first 2 years of life is novel for community-based studies of children in the Canadian far north, as the “unexposed” group in most surveys has been too small to permit reasonably adequate evaluation (11, 38).

Occupancy rates in our population's houses were high. A previous report based on the Nunavut Inuit Child Health Survey observed that 54% of preschoolers lived in crowded housing (using Statistics Canada's definition of more than one person per room, where rooms included bedrooms, kitchen, and living room). In contrast, 3% of Canadians as a whole lived in crowded housing (39). We observed a link between reported cough and smaller houses. This may have been due to an increased risk of respiratory infection in more crowded houses, which has been previously observed in Nunavut (11, 40).

The majority of children in this study had been breastfed. Research in Alaska has demonstrated that

breastfeeding reduces the risk of LRTI in Alaska Native children (38). At present, research evaluating whether breastfeeding reduces or increases the risk of future LRTI has been contradictory (41). Our finding of a positive association between cough and breastfeeding could be due to a possible positive association between breastfeeding and subsequent asthma (41), or could have been a chance finding. The possible relationship between respiratory symptoms and conditions, and nutritional status and income levels will be explored in future analyses using the survey data (24, 39, 42, 43).

Limitations of this study included inadequate validation of the questions on cough in the respiratory questionnaire, lack of specific information on respiratory medications administered at the health centers or in the home, and lack of confirmation of health facility encounters using health records. However, previous work using a similar questionnaire has found an adequate correlation between reported health facility encounters and medical records (26). The paucity of children never exposed to cigarette smoke passively or prenatally limited analysis of the effects of tobacco smoke exposure.

In conclusion, severe LRTI early in life, in Inuit children appeared to be followed by an increased prevalence of wheezing and respiratory illnesses during the preschool years. Determining whether chronic moist cough is common in this population will require more specific and culturally appropriate questioning. Measures to reduce the frequency of early childhood LRTI, including reduction of ETS, enhanced immunization strategies, improved ventilation in houses (11, 26), and construction of additional housing to reduce overcrowding (26) may also reduce respiratory morbidity later in childhood, and potentially later in life as well.

DECLARATION OF INTEREST

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