

UNCHANGED ASTHMA PREVALENCE DURING 1990-1999 IN RURAL ALASKA NATIVES

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ABSTRACT

Objectives. The prevalence of asthma has been increasing throughout the world, but the reasons for the increase are unclear. Some have hypothesized that the increase is due to industrial and agricultural pollutants in urban and rural areas, respectively. The objective of this research was to determine if the prevalence of asthma has increased in a remote area of Alaska where the population lives a subsistence lifestyle and is not exposed to such pollution.

Study Design. Retrospective review of medical records to determine the prevalence of asthma.

Methods. We reviewed medical records of 1200 children, aged 0-10 years, who lived in the Yukon-Kuskokwum Delta (YKD) region of western Alaska between 1990 and 1999. The entire YKD population receives health care from a single medical system, so records provide a complete picture of each patient's health care. Data collected from the medical records included demographics, and the presence or absence of a diagnosis of asthma or reactive airway disease (RAD).

Results. Over the 10-year period from 1990-1999, there was no significant change in the percentage of children who had a diagnosis of asthma (2.0% in 1990 and 3% in 1999), or RAD (9.6% in 1990 and 9.6% in 1999).

Conclusions. In a population of children not exposed to urban industrial, or rural agricultural pollutants, there was no change in the prevalence of wheezing or asthma between 1990 and 1999. (*Int J Circumpolar Health* 2006; 65(4): 341-346).

Keywords: asthma, environmental health, pollution

INTRODUCTION

The overall prevalence of asthma has been rising in the United States (1) and, currently, many patients with asthma experience the onset of symptoms during the first years of life (2,3). Similar increases in the incidence and prevalence of asthma have been reported worldwide, with some reports indicating a doubling of asthma hospitalization rates (4-8).

The reasons why asthma prevalence has increased are not completely understood. Commonly cited explanations include exposure to industrial air pollutants in urban areas and to agricultural chemicals in rural areas (9-12).

There is limited information available about whether the prevalence of asthma has increased in populations with no exposure to urban pollutants or agricultural chemicals. We studied such a population - American Alaska Natives living a subsistence lifestyle in a sub-Arctic climate - to determine if asthma prevalence had changed in this population over an extended time period.

Our specific objective was to determine if, during the 10-year period from 1990 to 1999, there was a change in the prevalence of asthma and related wheezing illnesses among Alaskan Native children living in rural areas without exposure to the aforementioned environmental pollutants. If the prevalence of asthma has not increased in the population we studied, it would support the notion that the increase in asthma prevalence elsewhere is indeed related to environmental pollution. While the prevalence of asthma has been studied in some Alaskan and Canadian native populations (13-17), little information is available about changes in asthma in these groups over time.

MATERIAL AND METHODS

The methods used for this study were approved by the Yukon Kuskokwim Health Corporation (YKHC) and by the Institutional Review Board of the University of Washington.

Setting

This study was conducted in the Yukon-Kuskokwim Delta (YKD) region of western Alaska, which encompasses 75 000 square miles of coastal wetlands, tundra, and mountains that are inaccessible by road from the remainder North America and Alaska. The YKD region has a population of about 28 000, of which the majority (78%) is composed of Alaskan Natives (18). The Native population consists of 58 tribes living in 52 Yup'ik Eskimo and Indian villages along the Yukon and Kuskokwim rivers and their tributaries.

The YKD population is young, with infants and children (birth to 10 years) comprising 27% of the total population. About half of the total population is under 20 years of age, while less than 5% of the population is 65 years of age or older. At the time of this study, 78.1 percent of the population was represented by Alaskan Natives. The mean unemployment rate was 19.7%, the percentage living below the federal poverty level was 37.2%, and the median household income was \$18 802 (19).

The majority of families in this region live a subsistence lifestyle, with native foods, such as salmon, moose and caribou, comprising a large part of their diet. There are no major industrial plants or agricultural operations in the area and negligible air pollution. In fact, no air quality monitoring was performed by public or private agencies during the period

of this study, and there is still no routine monitoring for any air pollutants (20).

Monitoring for dust – i.e. particular matter of less than 10 microns in size (PM-10) - was conducted in two Bethel-area sites on a temporary basis during 2002-2005 by the Alaska Department of Environmental Quality. The national standard for dust is that PM-10 should not exceed $150 \mu\text{g}\cdot\text{m}^{-3}$ averaged over a 24-hour period. Results of the temporary monitoring program found that PM-10 in the Bethel area exceeded the $150 \mu\text{g}\cdot\text{m}^{-3}$ level in one of the two monitored sites on only three days over the three-year monitoring period; on most other days the level was low: between 6-30 percent of the limit (21).

Although the population of the YKD region is generally of lower socio-economic status, the population has access to an integrated health care delivery system that is supported by federal and native corporation funding. Insurance coverage, therefore, is not a barrier to health care services. Medical care is provided by a system of community health workers in rural areas and a small regional hospital in Bethel, population 6000, which is the YKD region's largest population center.

Subjects

This study involved reviewing the medical records of children in the YKD region. A child's records were included if the child (a) was Yup'ik Eskimo aged 10 years or younger and (b) had medical records available through the Yukon-Kuskokwim Health Corporation (virtually all residents of the area have such medical records). Children aged 2-10 years old were excluded if there was a gap of more than 2 years in their medical record documentation (such a gap indicates the possibility of a prolonged absence from

the area), and children of less than 2 years old were excluded if there was a gap of more than 4 months.

The YKD region is divided into 10 geographic sub-regions according to a classification scheme that has been used for previous research. We chose one community from each sub-region, selected to represent different population sizes and geographic areas within the YKD region. These communities were Bethel, Emmonak, Hooper Bay, Kipnuk, Kwethluk, Mountain Village, Nunapichuk, Russian Mission, Toksook Bay, and Quinhagak.

Lists of children between the ages of 0 and 10 years old who resided in the aforementioned communities were obtained from the Yukon-Kuskokwim Health Corporation database. Names were then selected from these lists using computer-generated random numbers for the list of children from Bethel, and manual random sampling for lists from the other, smaller, communities. Sample size calculations indicated the need for 1200 subjects.

Data collection

One member of the study team traveled to each of the 10 communities and reviewed the medical records of all 1200 identified subjects. Data collected from the medical records included (a) age, sex and community of residence, and (b) the presence or absence of a diagnosis of asthma or reactive airway disease (RAD) that was documented in the medical records by a licensed health care provider (ie, physician, advanced-practice nurse, community health aid, or physician assistant).

Statistical analyses

We calculated the prevalence (with 95% confidence limits) of diagnosed asthma or RAD

during each of the 10 years of the study, using 5-year rolling averages to represent each year's prevalence rate. Chi-square statistics were used to determine if the percentage of children with asthma or RAD differed during the time period studies. We performed all data analysis with the Statistical Package for the Social Sciences (SPSS).

Table I. Percentage of population sampled.

Community	Number of children 0-10 years old residing in the community	Number (%) of village children represented in chart review
Bethel	1152	588 (51.0)
Emmonak	199	90 (45.2)
Hooper Bay	319	108 (33.9)
Kipnuk	126	60 (47.6)
Kwethluk	175	72 (41.1)
Mountain Village	190	96 (50.3)
Nunapichuk	107	48 (44.9)
Quinhagak	137	60 (43.5)
Russian Mission	94	24 (25.5)
Toksook Bay	104	54 (51.9)
Total	2603	1200 (46.1)

RESULTS

The records of 1200 children were reviewed. These children represented 46.1% of the total number of children, aged 0-10 years, who resided within the study communities (Table I). Of the 1220 children, 961 (47.9%) were between ages 2-10, and the remainder were less than 2 years old. Male children represented 51.6% the study population.

Change in asthma prevalence over time

The prevalence of diagnosed asthma or RAD remained constant throughout the 10-year time interval of this study (Figure 1). In 1990-1994, 9.6% of children had a diagnosis of RAD; the percentage was identical in 1995-1999. The prevalence of diagnosed asthma was 2.0% in 1990 and 3.0% in 1990-1994 and in 1995-1999; this difference was not significant ($p = 0.11$).

DISCUSSION

The most important finding of our study is that in a population of Alaska Natives living in remote areas unaffected by urban or agri-

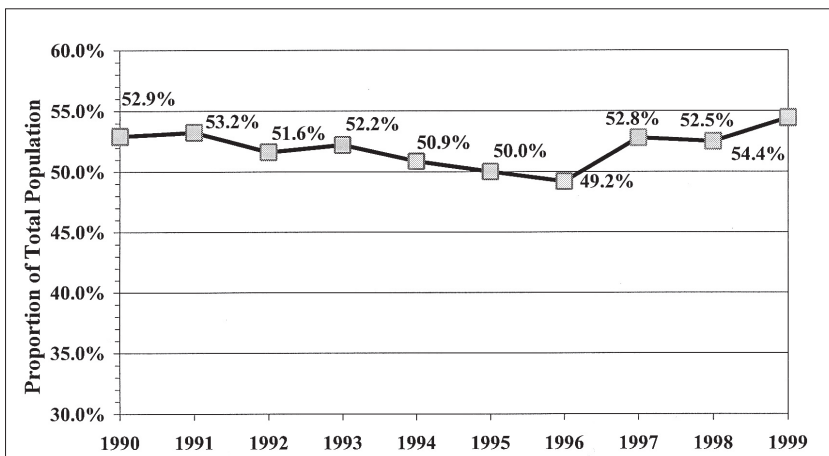


Figure 1. Percentage of Alaskan Native children in the Yukon-Kuskokwim Delta Region with diagnosed reactive airway disease and asthma. Each data point represents a five-year rolling average.

cultural pollutants, the prevalence of diagnosed RAD and asthma remained unchanged over a 10-year period. The children whose records were reviewed in our study live in some of the most remote villages in the US. They maintain a subsistence lifestyle and have little, or no exposure to the environmental pollutants that exist in urban areas, nor to agricultural chemicals that are used in developed agricultural areas.

In the absence of exposure to these environmental pollutants, based on our data it appears that the rate of asthma and wheezing illness has not changed over time. This finding is important, because it supports the hypothesis that the increase in asthma prevalence reported in many countries of the world is due to environmental pollution rather than other factors.

Our data are, however, subject to several limitations that should be considered when interpreting the results. First, we did not use standard epidemiological definitions for the diagnosis of RAD and asthma. Instead, we relied on diagnoses that clinicians entered into the medical records when providing care for the patients. It is therefore possible that some children received incorrect diagnoses, or that asthma and reactive airways disease may have been miscategorized. The magnitude or effect of such incorrect diagnoses is not known.

Second, we did not measure, nor could we identify data on, other factors that might have changed over the period of this study and influenced the rate of asthma. Such factors might include smoking rates, genetics and family histories of asthma, air pollution rates, pets, or psychosocial stressors. Our result should, therefore, be considered preliminary.

Third, there is at least one other report of a stable, or declining incidence of asthma during the late 1990s, and the population studied in

that report included a subgroup of First Nations people in rural Canada (21). The reason for the lack of increase in the Canadian study, as in ours, cannot be stated with certainty, but it is noteworthy that asthma rates in the Canadian study were lowest among Native populations in rural areas.

Finally, the prevalence of diagnosed asthma in our study (approximately 2%) was lower than the prevalence reported in some other native populations (approximately 7%) during a similar time period (22). The lower rate in our study could be attributed to several factors. One is that the YKD population, living in a remote area of Alaska, might truly have a lower rate of asthma – perhaps, as hypothesized, because of the lower rates of pollution in the area. A second possibility is that the difference might be due to the lack of standardized terminology in our study, rather than due to a true difference in the asthma rate. Specifically, in our study, the total percentage of subjects with asthma and those with reactive airway disease was about 11%, and this rate is similar to, or higher than, the asthma rates reported in other studies. A third possibility is that the lower rate could be attributed to selection bias, whereby children living in the most remote villages of the YKD region might have more sporadic and limited access to medical practitioners, and thus their asthma and wheezing illnesses are less likely to be diagnosed. While this possibility exists, the village clinics are the only source of health care services for people in the village who require medical attention, and the medical information system of the Yukon-Kuskokwim Health Corporation contains a virtually complete record of all encounters that children have with the health care system. This makes sampling bias, if it occurred, relatively unlikely to influence the overall study results.

Conclusions

Based on our data, which were collected in a remote area of Alaska that is relatively untouched by urban or agricultural pollution, there was no change in the rates of childhood wheezing, diagnosed asthma, or diagnosed RAD during the 1990s. The stable rate of these conditions contrasts with the increased rates of asthma in other areas of the US and in other countries - areas that are more affected by various forms of pollution. Our results thus support the notion that environmental pollution contributes to the rising rates of asthma seen in many parts of the world, but for the various reasons outlined earlier, the results must be considered preliminary.

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