

OTITIS MEDIA: HEALTH AND SOCIAL CONSEQUENCES FOR ABORIGINAL YOUTH IN CANADA'S NORTH

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ABSTRACT

Objectives. Otitis media is endemic among Inuit, First Nations and Métis children in northern Canada, with prevalence rates in some communities as high as 40 times that found in the urban south. Hearing impairment, much of it attributable to chronic otitis media, is the most common health problem in parts of the arctic, and conductive hearing loss among children may affect as many as two-thirds.

Study Design and Methods. There is a need for systematic data based on consistent disease definitions and measures, and taking account of cross-cultural methodological issues and sampling.

Results. Otitis media is most likely to develop in infancy. Susceptibility has been linked to immune defects and to a variety of environmental factors. Among the most significant are diet, the decline in initiation and maintenance of breastfeeding, and exposure to cigarette smoke. Hearing loss has been related to difficulties in language acquisition, and to subsequent issues with literacy and school achievement, including learning disabilities and attention deficits. The economic and social costs of otitis media are substantial.

Conclusion. Approaches to treatment and prevention have enjoyed limited success. Public health and medical practice need to be informed by the traditional knowledge and practices of indigenous peoples. (*Int J Circumpolar Health* 2005;64(1):5-15.)

Key words: hearing, infant health, indigenous health, prevention

INTRODUCTION

The literature concerning the effects of early middle ear disease (otitis media) and concomitant conductive hearing loss on auditory skills, language development, social development and other aspects of children's behav-

our is extensive. However, the research evidence regarding many aspects of these issues remains controversial (1) and evidence relating to aboriginal Canadians is often sketchy and incomplete (2). Otitis media is a complex generic term (3, 4) that includes, for the purposes of this review, the acute condition

(AOM, middle ear inflammation characterized by rapid onset with associated pain and fever), chronic otitis media (COM, a chronic inflammatory process that may result in damage to the mucous membranes and bone), and otitis media with effusion (OME, involving fluid in the middle ear).

The high incidence of otitis media among Inuit, First Nations and Métis children has been noted in the literature for several decades. However, comprehensive, systematic data regarding prevalence is needed, since most available data arise from studies employing limited samples (5-7). However, the World Health Organization reported high prevalence rates among Canadian aboriginal peoples (8). The social and economic consequences of OM are extensive. In northern Canada alone, where the incidence of OM is endemic (9), the economic costs were estimated at \$611 million for 1994, with over \$400 million of that applying to children aged below 14 (10).

Several methodological difficulties arise in this field. For example, different studies have reported incidence rates for limited samples, have used varying definitions and diagnostic/assessment tools, and much of the work has been correlational. Research in this area is complicated further because it deals with cross-cultural issues and draws on theories and methods from medicine, public health, psychology and anthropology.

PREVALENCE

Prevalence data for otitis media are limited and sometimes ambiguous, particularly concerning sub-populations (such as indigenous

peoples) within Canada. Often, the data represent estimates based on limited and not necessarily representative studies that employ different definitions of otitis media and include children of varying age ranges.

Inuit, Métis and First Nations

Bluestone (3) compiled data from approximately 50 reports published between 1968 and 1998. Prevalence ranges were similar to those listed by the World Health Organization (8), indicating wide variations across communities. Population estimates for COM were: Inuit of Alaska (30%-46%), Canadian Inuit (7%-31%), Greenland Inuit (7%-12%) and Native Americans (Navajo, Apache 4%-8%). Among First Nations Canadians (Cree and Ojibway), signs of present OM within communities ranged from 8% to 30%, and, when signs of past OM were added, the figure for the total sample rose to 41% (6).

A study comparing Inuit and Cree children in northern Quebec found evidence of ear disease in 78% of Inuit children and 12% of Cree children (11). Surveys of school children in three Nunavut communities found rates of COM ranging from 3.1% to 15.4%, depending upon community (12). There is also evidence that rates of COM increased during the 1990s. Ayukawa, Bruneau & Proulx (13) reported a rate of 16.9% for 12- to 16-year-olds in a northern Quebec community, compared with 9.4% in 1987. Historically, no reference was made to deafness and chronic ear disease by surgeons working in the Arctic before 1850, implying that OM was uncommon among the Inuit at that time (14).

Otitis media rates of aboriginal children in Saskatchewan have been reported at 6.7% for

boys and 5.6% for girls, varying significantly between communities. For non-aboriginal children, the rate was less than 1% (2). Data interpretation is complicated by sampling, definitional and other methodological issues. Prevalence has been found to vary widely across communities in the Northwest Territories, ranging from 8% to 45% (15). Wide community variations are consistent with the literature for Greenland Inuit and native Alaskans (16-18). As noted, available data depend upon variations in sampling by age, screening methods, disease definitions and other methodological issues.

Hearing loss attributable to Chronic Otitis Media

Hearing loss as a consequence of OM may range from fluctuating levels associated with mild acute attacks, to damage to the ear drum and bones of the middle ear, or sensori-neural loss in severe and chronic cases. Among Inuit in northern Quebec, COM is the chief cause of hearing loss, with 28% of children so affected showing slight loss, 46% mild loss, 21% moderate loss and 5% severe hearing loss. The rate of significant hearing loss for adult Inuit in Canada has been put at 44%, while for First Nations adults on reserves and in settlements, 39% of disabilities have been related to hearing (19). Hearing loss, much of it due to OM, constitutes the most common health problem of the 7000 Inuit living in Nunavik (northern Quebec), (20). Moore (21) found regional differences for hearing loss among western Arctic children, including Inuit, Dene, Métis and others. In the high Arctic, conductive hearing loss among children was 67%, while in the other 3 regions it was 17%, or less.

Moore (22) analysed audiological data collected for over 3,000 Inuit, First Nations and non-aboriginal children in the Northwest Territories for interactions between age, gender, ethnicity and history of OM. She found that gender was not a significant variable to explain conductive hearing loss. However, conductive hearing loss increased with age. Ethnic comparisons were made for individuals with a history of OM and those without. In this sample, Inuit appeared to be at much greater risk than the other ethnic groups for conductive hearing loss resulting from OM, perhaps due to wind, diet, activity during the winter months and/or smoking. The possibility of genetic differences was also raised.

ETIOLOGY AND RISK FACTORS

The etiology and pathogenesis of OM are complex and multifactorial. It seems probable that the most important factors that relate to the onset of OM in infancy are developmental. When infants are exposed to upper respiratory tract infection, OM is a frequent consequence (3). Much of the research examining risk factors for OM and subsequent hearing loss is correlational and the usual cautions regarding causal interpretation of such data apply.

Heredity and constitutional factors

Children are most likely to develop OM in infancy and early childhood (4), peaking between 6 and 18 months (23), and OM aggregates in families (24). However, infants experiencing initial episodes at an early age are at 2 to 8 times greater risk for COM, in part because of immune system and eustachian tube

immaturity, which increase susceptibility to upper respiratory pathogens (25).

Susceptibility to AOM has been linked to immune defects (26, 27). Other respiratory diseases (e.g. sinusitis and tonsillitis) are closely related to the development of OME (4, 28). Numerous studies indicate that males are at higher risk of OM than females, as is true of most infectious diseases in childhood (24, 29). However, differences are small, and Daly (4) placed the ratio at less than 2:1. Prevalence data for indigenous Canadians and other groups demonstrate an association between ethnicity and COM. Several researchers have discussed the difficulty in determining its meaning within the context of correlated socio-economic and other environmental variables (11, 21, 30).

Environmental risk factors

Several broad aspects of the environment (such as socio-economic status, SES) have been identified as risk factors, along with many specific variables (e.g., the use of pacifiers). These are not independent, and may often be associated with genetic and constitutional elements.

Evidence of a relationship between poverty and OM is ambiguous. Daly (4) noted that some studies have failed to demonstrate a relationship with SES, arguing that interpretation of the evidence is confounded by methodological issues. Definition, measurement and sampling matters are relevant and examination of specific risk factors subsumed within SES is a more useful approach.

In the past, Inuit communities in which traditional hunting was maintained and breastfeeding widely practised had lower preva-

lence of COM. Children from larger communities lived in crowded conditions and ate a high carbohydrate diet, while those in smaller settlements ate a traditional diet and most were breastfed (31). The change from a traditional high protein, high fat diet to a high carbohydrate one has been associated with increasing prevalence of OM in the decades leading up to 1990 (32), while initiation and duration of breastfeeding among indigenous Canadian women has declined over the past three decades (33).

Many studies have reported that the risks of OM are significantly reduced by breastfeeding, and that the greatest degree of protection is conferred on infants breastfed for at least 4 months, with or without supplementation (2, 24, 34, 35). The majority of Canadian aboriginal mothers do not breastfeed beyond early infancy. According to Health and Welfare Canada's Medical Services Branch, 61% of Aboriginal children were breastfed at birth, 42% at 3 months and only 31% at 6 months (2). Bottle-feeding as a risk factor for OM has been widely studied. Thomson (2) reviewed 8 studies in this field, most reporting a substantially elevated risk for OM and upper respiratory tract infection for infants bottle-fed compared with those who were breastfed. There is some evidence also suggesting an association between the use of pacifiers, sleeping prone, and OM. (24, 36).

Exposure to tobacco smoke has been frequently cited as an important risk factor for OM (4, 24) and for some northern aboriginal communities it is relevant to consider the additional possible risk factor of wood burning for cooking and heating. However, no research was located examining wood smoke

exposure in the north as a risk factor for OM. Passive exposure to parental smoking has been linked to increased risk of COM and OME and its duration (37-40). These results are particularly troubling given the high level of cigarette smoke exposure among infants in Canada's north (39, 40).

Remoteness, Access to Medical Care, and Long-term Effects

Recurrent AOM and OME are more likely to be prevalent in communities where risk factors are present, but access to appropriate medical care is not readily available. However, the precise relationship between geographical remoteness, medical access and the reported incidence of OM and hearing loss requires further investigation. For example, higher prevalence rates may be reported because of access to medical care, while going largely unreported among children living in remote communities (41). A decline in the prevalence of COM during the 1990s and an increase in AOM in Canada's arctic have been tentatively attributed to better access to diagnostic and treatment facilities (14).

Most studies dealing with risk factors for OM have employed univariate, correlational designs and failed to control for possible confounding variables in determining the significance of particular risk factors. To illustrate, Daly (4) pointed out that women who choose to breastfeed are more likely to be Caucasian, not employed outside the home (their children are consequently less likely to be in day care), non-smokers and of higher SES than women who do not breastfeed. Caution must be exercised, therefore, in examining the apparent relationship between breastfeeding and OM, be-

cause of the uncontrolled effects of contaminating variables. However, Daly's example raises another issue when placed in cross-cultural context. It is true that breastfeeding mothers in urban North America are more likely to be of higher SES and non-smokers, but such relationships may not be replicated in different cultural environments, such as those found in the Canadian north.

Design limitations imply caution in interpreting long-term effects of OM. Most published research has been conducted retrospectively, in non-northern, urban environments, often employing small and unmatched samples. Early research examining language, vocabulary, reading and I.Q. associations with a history of OM were frequently characterized by these limitations (42-44). The Government of Nunavut has recently recognized the educational implications of minimal and significant hearing loss, and has adopted the practice of installing sound enhancement equipment (e.g. FM systems) in all new classrooms (45).

The relationship between language development and OME remains unclear, the literature yielding a variety of different, often conflicting results. Some studies indicated that all children with histories of COM have general language deficits, while others implied more specific deficits and some have found no differences from children without this history. Research suggests OM may relate to speech and language deficits in production, but not in perception or comprehension, and implies that a history of OM in early childhood may be one of many variables that can have an impact on children's language development, linkages that merit further scrutiny (46, 47).

Relationships between OM and behavioural and attention deficits, as well as language-related difficulties, have been reported; however, these results should be interpreted with caution (48). It is not uncommon for children with learning disabilities, or language problems, to react to consequent frustration with aggression, acting out, withdrawal and inattention in the school environment (49, 50). A history of OM has been related to hyperactivity (51), behavioural problems (52), attention deficits (53) and verbal IQ (54). None of these relationships have been replicated with indigenous Canadian groups; the definitions of learning and behavioural difficulties employed have limited cross-cultural validity, and culturally biased measures have been employed in the identification process. Therefore, conclusions and implications for indigenous Canadian children and adolescents remain tentative.

TREATMENT

Policy guidelines for the treatment of COM and OME include an initial diagnosis to be accompanied by risk factor reduction and antimicrobial therapy. This is routine in northern Canada, although treatment programs with aboriginal children have not proven successful in most cases, because of failure to comply with directions (2). Compliance problems in northern Quebec often result from communication difficulties; both mothers and Inuit interpreters perceived no cultural conflict regarding antibiotic treatment, because no traditional treatment exists (55).

As elsewhere, the problem of resistance is increasing markedly in northern communities

(56), and the magnitude of benefit in antibiotic treatment has been judged to be small (57, 58). Successful implementation of supplementary and alternative strategies depends upon accommodation with the social and linguistic environment of the North, recognizing that an ideal intervention for OM does not exist (59).

The development of a new pneumococcal conjugate heptavalent vaccine may hold promise for prevention of AOM and other invasive bacterial infections in young children (60). Canada's National Advisory Committee on Immunization has recently recommended the use of the heptavalent pneumococcal conjugate vaccine in children, beginning at the age of 2 months (60). However, the vaccine does not include serotype 1, which is common in the aboriginal population. Nevertheless, because of the high morbidity of this infection among First Nations and Inuit children, immunization has been noted as a high priority (61, 62).

Cultural Value Differences and Biomedicine

Two broad value differences have direct implications for the treatment and management of disease. First, public health education programs usually stress future consequences of risky behaviour, rather than focussing upon the immediate social consequences of risk factors. Canadian aboriginal peoples, however, are more likely to be present-oriented and to lack the preoccupation with future-time that is characteristic of non-aboriginals. Second, aboriginal cultures tend to share belief systems stressing harmony, rather than conquest over nature, and cooperation with others, rather than competition. This is why it is essential to enlist community support in

health services delivery and education, and to present disease prevention in a manner that does not employ, or infer, metaphors like "battle" and "struggle". The development of effective services will differ between one cultural group and another and will be constructed at the community level (63, 64).

The medical disease model separates the individual and the environment: physical, social and cultural data are not accessed by the clinician; and, even when illness is related to environmental conditions (as for OM), treatment is often limited to symptoms. The traditional knowledge and practices of indigenous peoples (which provide a more holistic view of health, linking individual, family, community and the environment), should inform public health and medical practice in the treatment of OM and other diseases (65-67).

For the Inuit, disease is a consequence of transgression against the social, or spiritual orders. Inuit culture places emphasis on social behaviour and its relationships with disease. At the same time, "common sense empiricism" coexists within the Inuit belief system: snow blindness, for example, is a common sense pathology and does not require a metaphysical explanation. While biomedicine is better informed about the workings of the body, traditional Inuit understanding of the relations between person, family, social group, community and the environment represents a global view of health that is not shared by biomedicine (67).

Prevention and Intervention Approaches

Risk factor amelioration, along with medical advances such as the development of safe and effective vaccines for infants and young chil-

dren, have been cited as strategies of fundamental importance in the prevention of OM (4). These, along with community-based delivery of culturally sensitive public health programs, are key to the prevention of middle ear disease and hearing loss in northern communities. However, research regarding the effectiveness of risk factor modification programs remains limited (4).

General health promotion should include the targeting of breastfeeding, immunization, adequate nutrition, personal hygiene, improved housing, reduced overcrowding and access to clean water. In addition, primary health care workers should be given appropriate training and equipment, and the prevention and care of OM should be integrated into the existing primary health care system (8). Substantial national and provincial programs need to be developed for Canada's north to meet these goals, in addition to interventions at the regional and community levels, in the home and school. Such programs should be based on an assurance that all services are available, accessible and specifically culturally appropriate to the local aboriginal communities. They should feature early intervention, educational support programs addressing hearing loss, community awareness and prevention, appropriate personnel training and ongoing evaluation (68).

CONCLUSION

Methodological difficulties limit the exploration of implications for this field. Different studies have reported data for "otitis media", without specifying the type being reviewed,

and employed different methods of diagnosis, ranging from hospitalization and physician visits, to complete audiological examinations. Prevalence is associated with age, and different studies report data for varying age ranges. Much of the research, particularly on etiology, was conducted within southern and urban environments, where the incidence of chronic otitis media is typically less than 1%. The limited documentation of extremely high prevalence rates in aboriginal communities, particularly among the Inuit, needs to be validated by a comprehensive investigation and prevention program for aboriginal children in the north. In the shorter term, systematically collected prevalence data from a regionally and culturally representative sample of communities would enable more accurate estimates of prevalence than is evident at present.

The examination of specifically defined risk factors has shed light on the causes of OM. Further study within aboriginal communities is needed, particularly where risks identified in non-aboriginal settings (e.g. sleeping position and the use of pacifiers) have been generalized to Inuit, First Nations and Métis

communities. There may well be risk factors that apply in aboriginal communities, but have been excluded in studies of non-aboriginals (for example specific allergies and food intolerances). The role of prenatal alcohol ingestion does not appear to have been explored and may merit consideration.

There is a need for further research documenting the extent of treatment failure, examining the cultural and linguistic factors that contribute to it, and evaluating implied modifications to practice. The implications of differences between the traditional medical disease model and aboriginal value and belief systems are substantial and require further study.

Few family-centred, community-based, culturally sensitive, preventive public health and education programs are in place within aboriginal communities and schools. Appropriate programs targeting breastfeeding, immunization, nutrition, hygiene and smoking should be set up, trialled and evaluated. The needs for this kind of research, along with a coordinated study of prevalence rates, were considered to be the most salient deficiencies noted in the literature.

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