Centre of Excellence for Children & Adolescents with Special Needs

Learning and Communication Task Force: Lakehead University

OTITIS MEDIA: ITS HEALTH, SOCIAL AND EDUCATIONAL CONSEQUENCES PARTICULARLY FOR CANADIAN INUIT, MÉTIS, AND FIRST NATIONS CHILDREN AND ADOLESCENTS

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Centre of Excellence for Children & Adolescents with Special Needs
Centre d'excellence pour les enfants et aolescents ayant des besoins spéciaux
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Learning & Communication

ISSN
ISBN 0-88663-037-1

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Health Canada Santé Canada

The Centre of Excellence for Special Needs is one of five Centres of Excellence for Children's Well-Being funded by Health Canada.

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OTITIS MEDIA:

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Otitis media: its health, social and educational consequences particularly for Canadian Inuit, Metis and First Nations children and adolescents

Alan D. Bowd

Centre of Excellence for Children and Adolescents with Special Needs[1]

The literature concerning the effects of early middle ear disease (otitis media) and concomitant conductive hearing loss (CHL) on auditory skills, language development, social development and other aspects of children's behaviour is extensive. However, the research evidence regarding many aspects of these issues remains controversial (Nienhuys, n.d.) and evidence relating to aboriginal Canadians is often sketchy and incomplete (Thomson, 1994).

Otitis media is a generic term (Daly, 1997) and includes the acute condition (AOM, middle ear inflammation characterized by rapid onset with associated pain and fever) and chronic otitis media (COM, a chronic inflammatory process resulting in damage to the mucous membranes and bone). Otitis media with effusion (OME), sometimes called "glue ear", involves fluid (effusion) in the middle ear which is not typically accompanied by the pain and fever characterizing acute otitis media. OME is also referred to as non-suppurative otitis media (Bluestone, 1998). Chronic suppurative otitis media (CSOM) has been defined as "a stage of ear disease in which there is chronic infection of the middle ear-cleft, a non-intact tympanic membrane and discharge (otorrhea) for at least the preceding two weeks" (WHO/CIBA, 1996, p. 2). It should be emphasized that while acute otitis media and otitis media with effusion typically result in transient conductive hearing loss, chronic suppurative otitis media may cause sensori-neural hearing loss with significant long-term implications for communication and learning.

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This review examines research relating to the health and educational consequences of otitis media for Inuit, Metis and First Nations children of northern Canada. The high incidence of otitis media among aboriginal children has been noted in the literature for several decades (e.g. McShane, 1982; Scaldwell & Frame, 1985; Scaldwell, Frame & Straus, 1985), and much speculation as to the reasons for this is evident. Comprehensive, systematic data regarding prevalence is needed, however most available information arises from studies employing limited samples. The World Health Organization has compiled information for different ethnic groups, estimating a prevalence rate among Inuit for COM of 12%-46% and for Native Americans of 4%-8% (WHO/CIBA, 1996). The WHO noted that the incidence rates for aboriginal peoples in North America and Australia far exceed those for their non-aboriginal fellow citizens and speculated that poverty, limited access to health services and culturally different practices were likely risk factors. The social and economic consequences of OM are extensive. In Canada alone the economic cost of OM were estimated at $611 million for 1994, with over $400 million of that applying to children aged below 14 (Coyte, Asche & Elden, 1999).

There are several methodological difficulties which arise in an examination of research in this field and these are addressed throughout the present review. For example, different studies have reported incidence rates for limited samples and have used varying definitions and diagnostic/assessment tools; much of the work has been correlational, making causal attributions limited. The work in this area is further complicated by the fact that it represents an interdisciplinary field dealing with cross-cultural issues and drawing on theories and methods from medicine, public health, education, psychology and anthropology.

Prevalence

Following the practice of the *Report of a WHO/CIBA Foundation Workshop* (WHO/CIBA, 1996) in the present report the term *chronic otitis media* includes both chronic suppurative otitis media and chronic perforation of the tympanic membrane. The term *chronic otitis media with effusion* refers to a different disease entity, the chronic form of otitis media with effusion or secretory otitis media.

Prevalence data for COM are limited and sometimes ambiguous, particularly concerning sub-populations (such as aboriginal groups) within countries. Often the data represent estimates based on limited and not necessarily representative studies that employ different definitions of otitis media and include children of different age ranges. Table 1 illustrates the estimates of the World Health Organization. The data are organized using three of originally four population groupings and noting that certain economically disadvantaged ethnic groups have the highest prevalence rates.

Table 1

The Global Burden of COM

Group	Population	Prevalence
Highest	Inuit	12-46%
	Australian Aboriginals	12-25%
High	Native Americans	4-8%
	South Pacific Islanders	4-6%
Lowest	USA	<1%
	UK	<1%

Note. Adapted from WHO/CIBA, 1996

Inuit and First Nations

Bluestone (1998) compiled prevalence data derived from an analysis of approximately 50 reports published between 1968 and 1998. The reported prevalence ranges were not dissimilar to those listed by the World Health Organization and indicated wide variations from community to community apparent in each investigation. Populations in which prevalence of CSOM were reported as highest were: Inuit of Alaska (30%-46%), Canadian Inuit (7%-31%), Greenland Inuit (7%-12%), Australian Aborigines (12%-33%) and Native Americans (Navajo, Apache 4%-8%).

Bluestone's report (1998) did not address prevalence rates among Canadian First Nations children and data are limited. A study of prevalence rates among 739 Cree and Ojibway children aged from 3 to 16 years and from six Ontario communities (Scaldwell & Frame, 1985) tested participants for evidence of present or past OM using an electroacoustic tympanometer (impedance bridge). It was determined that signs of present OM existed for 23% of the total sample with communities ranging between 8% and 30%. When signs of past OM were added the figure for the total sample rose to 41%. This is a very high degree of prevalence, however the data are influenced by the definition of OM employed as well as the method used to examine symptoms.

A study comparing Inuit and Cree school children living in the same community in northern Quebec found "evidence of ear disease" in 78% of Inuit children and 12% of Cree children (Julien, Baxter, Crago, Ilecki & Therien, 1987). Surveys of school children in three Nunavut communities by Baxter and his colleagues (Baxter, Stubbing, Goodbody & Terraza, 1992) found rates of COM and CSOM ranging from 3.1% to 15.4%, depending upon community, with an overall average rate of 7% for ears tested.

There is evidence that rates of COM increased during the 1990s. Ayukawa, Bruneaue & Proulx (2001) reported a rate of 16.9% for 12-16 year olds in a northern Quebec community, compared with 9.4% in 1987. However, Baxter (1999) has stated:

> In the 1970s, the pattern of ear disease observed across the Baffin zone was COM, acute otitis media and serous otitis media was seldom seen. Starting in the 1980s the pattern of ear disease observed changed, as the decade progressed acute otitis media and serous otitis media were more frequently seen... (p. S167).

He went on to note concomitant declines in the prevalence of COM between the 1960s and 1990 for schoolchildren in two Nunavut communities. Historically, no reference was made to deafness, otorrhea or chronic ear disease in the writings of surgeons working in the Arctic during the first half of the nineteenth century leading Baxter to conclude that the conditions were not common among the Inuit at that time. This interpretation was supported by examination of skeletal samples for three groups of Greenland Inuit (Baxter, 1998). The frequency of infectious middle ear disease after analysis was determined to be 4.7% in prehistoric crania, 17.9% in historic crania and 23.5% in modern Inuit.

Moore (1990) analysed hearing loss data from four western Arctic health care regions (Hay River, Kitikimeot, Fort Smith and MacKenzie) including Inuit, Dene, Metis and others. She found regional differences in conductive hearing loss and sensorineural loss. In the high Arctic conductive hearing loss among children was 67% while in the other 3 regions it was 17% or less. Sensorineural loss was found among adults, rarely in children, and was attributed in part to noise exposure associated with hunting and mining. This was the only study located referring to OM and hearing loss among Metis children, however data were reported by region rather than by ethnicity.

Thomson (1994) examined hospitalization rates for OM of children in Saskatchewan, reporting 6.7% for aboriginal boys and 5.6% for aboriginal girls. For non-aboriginal children the rate was less than 1%. Once more it becomes difficult to comparatively evaluate the data because of sampling, definitional and other methodological problems. Researchers with the Health Sciences Centre, University of Manitoba examined 307 children aged 11 or younger in 8 Keewatin, NWT communities (Woods, Moffatt, Young, O'Neil, Tate & Gillespie, 1994). They found that 27% of children had "evidence of otitis media, discharge or perforation in one or both ears" (p. 693) and that prevalence varied widely between communities, ranging from 8% to 45%.

The prevalence of otitis media among Greenland Inuit is well documented with COM reported for between 7% and 31% of children (Homøe, Christiansen & Bretlau, 1996; Pedersen & Zachau-Christiansen, 1986). Recent research by Homøe, Christiansen and Bretlau (1999) in two of Greenland's largest communities examined 740 children aged 3, 4, 5 and 8 years. Among Inuit children COM prevalence was 10.5%, for children of mixed Inuit-Caucasion parentage the

rate was 3.7%, while no examples of COM existed among children of Danish parents (although this was a very small group). In related work, Homøe (1999) reported rates of COM for the same communities of 6.8% and 11.7%. Such wide variations in prevalence across communities appears consistently in the literature for Inuit in Alaska, Canada and Greenland.

American Indians

Data indicating prevalence rates for otitis media among American Indians is extremely limited. Like that for Inuits, reported prevalence varies between communities, is dependent upon sampling by age, methods of screening used, definitions of OM employed and other methodological shortcomings. The WHO/CIBA report (1996) estimated a rate between 4% and 8%, considerably lower than prevalence rates in most investigations of Inuit children, but more than 4 to 6 times that observed in the general U.S. population.

Stewart (1986) summarized the work of others examining prevalence of OM among Native American children, citing 24% of 385 6-16 year-old children in a South Dakota Indian school (Gregg, Steele, Clifford & Werthman, 1970) and 30% of children in three Navajo boarding schools (Jaffe, 1969). These figures are not limited to COM but include other forms such as repeated acute OM. Goinz (1984) reported data from screening performed on 3,865 Indian children from reservations in Michigan, Minnesota and Wisconsin during 1981 and 1982. Children were classified as "passing" or "needing referral" based on symptoms of otitis media (several types) and apparent hearing loss. Among children aged 1 to 5 years the referral rate was 25.3%; for children 6 to 17 years it was 13.8% in 1982, a slight increase over figures for the previous year. Goinz observed that "the incidence of otitis media among Indian children in the Bemidji program is quite high" (1984, p. 18) but went on to note that less than 1% had perforated or draining ears and referred to the prevalence data as representing "pre-chronic otitis media" (1984, p.18). He called for mass, regular screening of Indian children before and during the school years, referring to the system at the time as grossly inadequate.

Australian Aborigines

As has been noted, the prevalence rates of COM among Australian Aboriginal and Inuit children are similar and are higher than for any other ethnic or cultural group. The parallels between the Inuit and the Australian Aborigines are remarkable. It has been noted that:

> Both lived traditionally in isolated communities in harsh environments. Both survived traditionally on a nutritious natural diet. Both have a similar history of colonisation by a dominant European culture with introduction of previously unknown diseases, high carbohydrate diet, alcohol and tobacco. Both have been exposed to similar influences of urbanization. The only major environmental difference is the climate. There seems little doubt that the ear disease observed in these two populations is the same (Stuart, n.d., p. 3)

This review is concerned with North American aboriginal peoples, however some discussion of the study of otitis media and its health, educational and social ramifications with Australian Aboriginal peoples is particularly relevant because of the similarities alluded to. Morris (1995) has summarized information concerning prevalence of OM among Australian Aboriginal children. Perhaps the best available data were gathered in the only large scale survey extant, reported in 1979 (Moran, Waterford, Hollows & Jones, 1979). The investigation involved 21, 988 children aged 0-9 as part of the National Trachoma and Eye Health Program. Otitis media was defined as perforation or "glue ear". The prevalence rate among Aboriginal children was 16.6% for OM and 15.4% for perforation. Parallelling the situation among the Inuit, very wide variations were found between communities with a range of OM prevalence from 7.1% to 32.7%. Among non-aboriginal children the rate was 0.7%.

Other studies also report wide variations in prevalence using different samples. A survey of 642 children aged 3-15 in the state of Western Australia (Watson & Clapin, 1992) found perforation in 37% of Aboriginal children, varying from 14% in Kalgoorlie (a city, population 30,000) to 67% in the remote Central Reserve.

Hearing loss attributable to Chronic Otitis Media

Chronic otitis media with persistent middle ear effusion is associated with ongoing negative pressure within the middle ear because of the maintenance of the effusion within that area due to impairment of the system generating mucous and a pumping action of the eustachian tube opening and closing. Chronic perforation of the tympanic membrane may develop as part of the resolution of CSOM, effectively draining the ear. However, if there is a chronic perforation organisms may enter the middle ear through the external ear canal (for example, as a consequence of swimming or bathing), resulting in secondary infection, chronic otorrhea and osteitis

(Bluestone, 1998; WHO/CIBA, 1996). According to the WHO/CIBA report (1996):

> A conductive hearing loss usually accompanies CSOM; it results from blockage of the external auditory canal by pus and perforation of the tympanic membrane. The average hearing loss is usually worse than that caused by otitis media with effusion. A hearing loss greater than 40dB may indicate fixation or discontinuity of the ossicular chain as well. Sensorineural hearing loss may also occur, probably due to infiltration of infectious or inflammatory agents through the round window to produce serous labyrinthitis (p. 10).

Scaldwell and Frame (1985) noted that hearing loss as a consequence of otitis media may range from fluctuating hearing levels associated with mild infrequent acute attacks, to damage to the ear drum and bones of the middle ear or sensori-neural loss in severe and chronic cases. This takes place during the period of language acquisition, for which hearing is vital, and later literacy learning, for which language is vital. The hearing loss may be mild enough to remain within what is widely accepted as the normal range (-20dB), but may consequently interfere with the child's ability to distinguish similar phonemes. When there is a combination of these factors, learning literacy skills by an auditory or phonic instructional system is particularly challenging (Scaldwell, Frame & Straus, 1985).

Hearing assessments in children with OME show that they experience significant loss (Bluestone, 1998). A study of children with OME in Pittsburgh reported an average speech awareness threshold of 24.66dB for those aged 7-24 months, and an average air conduction threshold of 27dB for 540 children aged 2-12 (Fria, Cantekin & Eichler, 1985). Bluestone (1998) noted that there have been few studies of hearing in populations with high rates of CSOM and that the average hearing loss was usually greater than when OME was present.

Tremblay (1990) investigated hearing loss and its etiology among Inuit in northern Quebec. She reported that among individuals using hearing aids CSOM was the chief cause of loss. Where CSOM was determined to be the cause, 28% showed slight hearing loss, 46% mild loss, 21% moderate loss and 5% moderately severe hearing loss. The rate of significant hearing loss for adult Inuits in Canada has been put at 44%, while for aboriginal adults on reserves and in settlements 39% of disabilities have been related to hearing ("Aboriginals Disabled,", 1994). Hearing loss, much of it due to OM, constitutes the most common health problem of the 7000

Inuit living in northern Quebec (Santé Québec, 1992).

Moore (1999) analysed audiological data collected for 3,094 Inuit, First Nations and non-aboriginal children in the NWT, examining the interaction 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. Teenagers were 2.36 times more likely to present with conductive hearing impairment than preschool children. Ethnic comparisons were made for individuals with a history of OM and those without. Among the Inuit the predicted odds of conductive hearing loss were 34 times higher for those with a history of OM compared to those without. For First Nations individuals those with a history of OM were 12.55 times more likely to have conductive hearing loss than those without. Among non-aboriginals the predicted odds of conductive hearing loss were 11.22 times greater for those persons having a history of OM. Although cautioning against generalizing, Moore (1999) noted that the Inuit in this sample appeared to be at much greater risk than the other ethnic groups for conductive hearing loss resulting from OM. She speculated that this might be attributed to a number of factors including wind, diet, activity during the winter months and smoking. The possibility of genetic differences was also raised.

Etiology and Risk Factors

The etiology and pathogenesis of OM are complex and involve a variety of factors. As Bluestone (1998) has noted, risk factors associated with AOM (such as infection and eustachian tube abnormalities) may lead to acute perforation or persistent effusion precipitating chronic OME or CSOM respectively. It seems probable that the most important factors that relate to the onset of OM in infancy are developmental: the anatomical structures of the ear, particularly the eustachian tube and the immune system are immature. When infants are exposed to upper respiratory tract infection, OM is a frequent consequence (Bluestone, 1996; 1998).

Much of the research examining risk factors for OM and subsequent hearing loss is correlational in design and the usual cautions regarding causal interpretation of such data apply. The literature includes work examining heredity/constitutional factors and environmental/cultural factors. The following section of the present review is organized accordingly.

Heredity and constitutional factors

Age. There is abundant research indicating that children are more likely to develop OM in infancy and early childhood compared with later ages (see Daly, 1997). OM incidence appears to peak between 6 and 18 months (Alho, Koivu, Sorri & Rantakallio, 1991), however, infants who experience their initial episode at an early age are at 2 to 8 times greater risk for COM (Harsten, Prellner, Heldrup, Kalm & Kornfält, 1989). This may be attributed in part to the immaturity of the immune system and the eustachian tube which increase susceptibility to upper respiratory pathogens:

> The combination of innate predisposition (e.g. decreased ability to produce antibodies against common OM pathogens, differences in eustachian tube anatomy and function) and early exposure to risk factors (e.g. child-care attendance) probably result in earlier OM onset (Daly, 1997, pp. 17-18).

Not surprisingly, high rates of OM have been found to be associated with high rates of respiratory disease in early infancy (Lowe, Bamforth & Pracy, 1963).

Sex. Numerous studies indicate that males are at higher risk of AOM and OME than females, as is true of most infectious diseases in childhood (Adams & Benson, 1991, Klein, 2001). However, differences tend to be small and Daly (1997), after reviewing the literature, placed the ratio at less than 2:1.

Ethnicity. The prevalence data for Native Americans, Native Canadians and Australian Aborigines clearly demonstrate an association between ethnicity and COM. Several researchers have noted this association and the difficulty in determining its meaning in the context of correlated socioeconomic and environmental variables (e.g. Homøe, Christiansen & Bretlau, 1999; Julien, Baxter, Crago, Ilecki & Therien, 1987; Moore, 1999).

Immune system status and related conditions. The immature immune response of infants and consequent susceptibility to OM pathogens has already been noted. Some researchers have shown a link between susceptibility to AOM and subtle immune defects such as a significantly lower antibody response to rubella vaccine (Prellner, Harsten, Löfgren Christianson & Heldrup, 1990) and other antibodies relating to resistance to upper respiratory infection (Prellner, Kalm, Harsten, Heldrup & Oxelius, 1989).

Other respiratory diseases are closely related to the development of OME. These include nasal congestion, tonsillitis and sinusitis (see Daly, 1997; Higgins, 1997). The role of allergy in OM remains unclear. However, since certain allergies result in congestion of the respiratory mucosa, obstruction of the eustachian tube and the accumulation of fluid in the middle ear, it is "a likely predisposing factor for acute otitis media" (Klein, 2001, p. S4). Asthma has also been listed among identified risk factors for OM (NSW Health Department, 2000), along with anatomical defects (e.g. cleft palate) and AIDS (Klein, 2001)

Familial predisposition. There is a clear trend for OM to aggregate in families. Children born into homes where parents or siblings have a history of OM are themselves at higher risk for infection (Klein, 2001). However, the relative contributions of genetics and environment remain entangled:

> Specific genes or chromosomes have not yet been implicated in the transmission of OM susceptibility. Although an HLA antigen has been associated with recurrent OM, the clustering of specific genotypes in affecting family members has not been explored. The most likely model for genetic influence in OME is multifactorial, in which genes and environmental exposures play a role in predisposing a child to OME, recurrent OM, and chronic OME (Daly, 1997, p. 27).

Environmental risk factors

The multifactorial approach suggested by Daly for genetic influence in OME is used in the discussion of the role of environmental influences which follows. Several broad and complex aspects of the environment (such as socioeconomic status) have been identified as risk factors, along with many quite specific elements (for example, the use of pacifiers). These factors, in turn, are not independent, and are also likely to be associated with possible genetic and constitutional elements.

Socioeconomic status (SES). The evidence regarding a relationship between SES or poverty and OM prevalence is ambiguous. Klein (2001) stated that factors associated with low SES (crowded living conditions, poor sanitation and inadequate access to medical care) are associated with severe and recurrent AOM. However, some studies have found no relationship (e.g. Chalmers, Stewart, Silva & Mulvena, 1989), some have found a positive correlation (e.g.

Kero & Piekkala, 1987) and one study (Shaw, Todd, Goodwin & Feldman, 1981) found an inverse relationship. Shaw et al. (1981) examined the influence of living conditions among four groups of American Indian children. Those who lived near a health care facility had a higher rate of AOM than those living further away. However, this result may be explained by the likelihood that closer access to health care results in more frequent examinations and a greater likelihood that AOM will be identified and treated (Daly, 1997).

The ambiguous evidence regarding SES and OM reflects methodological issues. The study by Chalmers et al. (1989) was conducted in New Zealand and Kero & Piekkala's (1987) research was in Scandinavia. Differences in the definition and measurement of SES become relevant, along with sampling matters. For example, samples that are relatively homogeneous with regard to SES are unlikely to yield significant correlations in comparison with samples where a larger variance is evident. Finally, SES is not a single variable, and studies of the specific risk factors often subsumed within SES are more enlightening.

Prematurity and birth weight. Feagans (1986) listed prematurity as a risk factor, however, Daly (1997), in a more recent and extensive review, observed that "most researchers have concluded that there is no relationship between birth weight or gestational age and AOM, OME, chronic OME and OME duration" (p. 20).

Breastfeeding and nutrition. A paper regarding OM among the Inuit (Manning & Avery, 1974) addressed the matter of risk factors, commenting that communities in which traditional hunting was maintained and breastfeeding widely practised had lower prevalence levels of COM. These observations followed from an earlier survey revealing that approximately two-thirds of 165 Inuit children in one community had drum perforations, compared with one-third in a small, isolated settlement. Children from the larger community lived in crowded conditions and ate a high carbohydrate diet, while those in the smaller settlement ate a traditional diet and most were breastfed. Baxter (1990) related the change from the traditional high protein, high fat diet to a high carbohydrate one to the increased prevalence of OM in the decades leading up to 1990.

Many studies have reported that the risks of OME, AOM and recurrent OM are significantly reduced by breastfeeding (Klein, 2001, Thomson, 1994). Human breast milk includes a variety of components that have antimicrobial, anti-inflammatory and immuno-

modulating properties that help protect against OM and respiratory infection during breastfeeding and even after breastfeeding has been discontinued (Goldman, 1993). There is evidence that the greatest degree of protection is conferred on infants breastfed for at least 4 months, with or without supplementation (Duncan, Ey, Holberg, Wright, Martinez & Taussig, 1993).

Bottle feeding as a risk factor for OM has been widely studied. Thomson (1994) reviewed 8 studies in this field, one of which involved a First Nations community. Seven attempted to determine the risk that bottle feeding presented for significant OM; 6 of these found a substantially elevated risk for OM and upper respiratory tract infection for infants bottle fed compared with those who were breastfed.

Sleeping position and use of pacifiers. There is some evidence suggesting an association between the use of pacifiers and AOM. Niemelä Uhari & Möttönen (1995) examined Finnish children younger than 2 attending a day care centre and found that among those using pacifiers 29.5% had experienced at least three episodes of AOM. Among those not using pacifiers the figure was 20.6%. Klein (2001) noted one study, conducted in the UK, in which more episodes of AOM were identified in children who slept prone.

Exposure to smoke. Exposure to tobacco smoke has been frequently cited as an important risk factor for OM (Daly, 1997; Klein, 2001; Todd, 1986). Many reports have linked passive cigarette smoking to increased risk of OM, but for some northern aboriginal communities it is relevant to consider the additional possible risk factor of wood burning for cooking and heating. (No empirical study was located examining wood smoke exposure as a risk factor for OM).

Daly (1997) pointed out that smoke inhalation may result in inflammation of the mucous membranes of the nasopharynx, middle ear and eustachian tube with consequent increased susceptibility to bacterial and viral infection. Additionally, smoke exposure increases susceptibility to upper respiratory disease which precipitates OM, and adults who smoke are at increased risk for the same infections that may then spread to their children.

Research has related passive exposure to parental smoking to increased risk of recurrent OM (Ey, Holberg, Aldous, Wright, Martinez & Taussig, 1995), OME (Etzel, Pattishall, Haley, Fletcher & Henderson, 1992), chronic OME (Black, 1985) and OME recurrence after surgery for

chronic OME (Maw & Bawden, 1994). There is also evidence that exposure to smoke lengthens the duration of OME (Owen, Baldwin, Swank, Pannu, Johnson & Howie, 1993).

Daycare attendance and presence of siblings. Daycare attendance has been identified as a risk factor for AOM and SOM in a number of studies (Homøe, Christiansen & Bretlau, 1999; Klein, 2001). However, research is also reported in which no relationship has been found. For example, Homøe, Christiansen & Bretlau (1999) reported frequencies of repetitive AOM for Greenland Inuit children, most of whom attended larger daycare centres. They noted that 19.2% of children in daycare had evidence of recurrent AOM compared with 9.4% of those cared for at home. (This difference fell short of statistical significance).

Several variables may be relevant in examining the risk factors associated with daycare attendance, including the type and size of daycare, the age at enrolment, the degree of crowding in the centre, as well as hygiene practices adhered to. Daly (1997) reviewed numerous studies of risk factors for OM and concluded that "the majority of researchers report a 1.5- to 5-fold increase of risk of OME, AOM, and recurrent OM among child care attendees" (pp. 24-25). She also noted that children attending larger centres are at greater risk of AOM and OME and that duration of OME was greater as the number of children increased. The environment of the day care centre facilitates the transmission of the infectious agents and clearly this is associated with the number of children to whom the individual is exposed. Risk of AOM and OME also increases with the number of siblings in the home, presumably for the same reason (Daly, 1997; Klein, 2001; Parliament of Australia, 2000).

Season. The incidence of OM tends to be highest in winter and lowest in summer (Maw & Counsell, 1997). Todd (1986) cited several studies supporting this contention, all of which were conducted in the northern hemisphere. Daly (1997) pointed out that no relationship has been found between OME and weather patterns (such as temperature and humidity) and that respiratory illnesses often associated with OME are more common in winter. It is possible that seasonal variations may occur in different geographic and climatic zones. No studies were located examining the relationship between season and OM in the Arctic or northern and central Australia.

Exposure to organochlorines. One study has linked prenatal exposure to organochlorines with the incidence of AOM (Dewailly, Ayotte, Bruneau, Gingras, Belles-Isles & Roy, 2000). Among breastfed infants those with exposure to higher levels of organochlorines in breast milk were found to be at higher risk of AOM, although bottle fed infants remained at marginally greater risk.

Maternal alcohol consumption during pregnancy. No studies were located that examined a possible association between OM and maternal alcohol consumption during pregnancy. This may be a significant omission since a large literature addresses fetal alcohol syndrome (FAS) and fetal alcohol effect (FAE). Fetal Alcohol Syndrome and FAE are frequently characterized by structural changes to the outer ear (Day, 1992; Little, Graham & Samson, 1982; Streissguth, 1992), however no study linking FAS/FAE with middle ear anomalies or OM was located.

Remoteness and access to medical care. Clearly, 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. Watson and Clapin (1992) reported large differences in prevalence rates of OME among Australian Aboriginal children living in an urban area with access to medical care and those living on a remote reserve. Baxter (1999) commented on trends in the Canadian arctic where he claimed there was a decline in the prevalence of COM during the 1990s and an increase in AOM that could be attributed to better access to diagnostic and treatment facilities. The precise relationship between geographical remoteness and access to medical care requires further investigation.

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 (1997) pointed out that women who choose to breastfeed are more likely to be Caucasian, not employed outside the home (their children 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 because 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 are found in the Canadian north and remote rural Australia.

Long-term effects

In a review of the literature published in the mid-1980s the author stated that it is not clear what the long-term effects of OM might be, despite the importance of such information for the development of appropriate interventions (Feagans, 1986). However, one of the earliest studies indicating a relationship between COM and later behaviour compared small, matched samples of children with and without COM (Holm & Kunze, 1969). Children with a history of COM scored lower on measures of vocabulary and language. A similarly designed investigation by Howie (1979) reported that children with a history of COM scored lower on IQ tests together with reading and language measures.

Zinkus and his colleagues (Zinkus & Gottlieb, 1980; Zinkus, Gottleib & Shapiro, 1978) examined children receiving remedial assistance for academic underachievement. Health records were reviewed and comparisons made between students having a history of COM before age 3 along with myringotomies, and those without a history of COM. Both groups were matched for several demographic factors. Children with a history of COM were found to have significantly more verbal and academic difficulties than those without. Other retrospective comparative studies have found that children identified with a specific learning disability have a higher incidence of COM (Freeman & Parkins, 1979; Masters & Marsh, 1978). The presence of significant academic difficulties as late as grade 9 for Alaskan Eskimo individuals with an early history of middle ear pathology, tympanoplasty and subsequent hearing loss was noted in a study by DiSarno & Barringer (1987).

More recently Schwartz, Mody & Petinou (1997) argued that the relationship between language development and OME "remains unknown" (p.110). They found the literature yielded a variety of different, often conflicting results. Some studies suggested that all children with histories of COM have general language deficits, others implied more specific deficits and some have found no differences from children without this history. Finally, Schwartz, Mody & Petinou

claimed "most puzzling are findings of speech and language deficits in production but not in perception or comprehension" (1997, p. 110). This conclusion is echoed by Roberts & Wallace (1997): "a history of OME in early childhood may be one of many variables that can have an impact on children's language development, yet these linkages merit further scrutiny" (p. 149).

Feagans (1986) reported that several studies have found relationships between OM and behavioural and attention deficits, as well as language-related difficulties. These results should be interpreted with caution. It is not uncommon for children with learning disabilities or language problems to react to the consequent frustration with aggression, acting out, withdrawal and inattention in the school environment (see Roberts & Wallace, 1997). A history of OM has been related to hyperactivity (Hersher, 1978), behavioural problems (McGee, Silva & Stewart, 1982) and attention deficits (Silva, Kirkland, Simpson, Stewart & Williams, 1982). Lindsay and his colleagues examined the history of middle ear infection among 507 children referred to a clinic for developmental anomalies (Lindsay, Tomazic, Whitman & Accardo, 1999). A positive association was found between history of ear disease and verbal IQ using the WISC-R. The presence of articulation disorders related to a history of major ear problems among children of lower social class. For middle class children, hyperactivity correlated with a history of ear disease. Among higher social class children articulation problems related to ear disease. This study was important because it suggested that the longer term consequences of ear disease may vary with other factors such as social class.

Treatment of Otitis Media

Antibiotic treatment of AOM is routine in North America, Europe and Australia. Treatment programs used with First Nations children in Canada have "not proven successful", according to Thomson (1994, p. 1947). She cited a report by Reed & Dunn (1970) in which treatment of Inuit children with long lasting penicillin injections had no effect on OM prevalence, together with an Australian report noting that antimicrobial treatment with Aboriginal children appeared to be unsuccessful (Westwater, Rebgetz, Douglas, Nienhuys, McConnell & Matthews, 1990). Treatment deficiency is most likely a consequence of failure to comply with directions in the use of antibiotics (see Papillon, 1994).

Policy guidelines for treatment of OME are similar in North America and Australia (Maw & Counsell, 1997). In the United States the Agency for Health Care Policy and Research published guidelines for OME for the care of young children aged between 1 and 3, based on the literature and established clinical practice (Stool et al., 1994). Initial diagnosis of OME was to be accompanied by risk factor reduction and antimicrobial therapy. After 3 months duration of OME antimicrobial therapy remained an option, but additionally myringotomy (producing a hole in the eardrum surgically) and tube (grommet) insertion became clinical options. By 4-6 months tube insertion was a moderate recommendation and it was emphasized that the child's hearing status be identified.

Treatment in northern Canada is made more difficult by isolation, lack of medical resources and cultural/linguistic factors. For example, in northern Quebec OM is usually diagnosed by nurses and treatment prescribed according to a protocol prepared by physicians and pharmacists (Papillon, 1994). Since the latter do not see the patient treatment failure becomes a problem, usually represented by inappropriate delays between doses or ceasing treatment before the end of the prescription, hence increasing the probability of resistance. Among the other factors noted that relate to treatment failure were:

1. Communication problems between translator and patients inasmuch as the patient may not understand the message accompanying the treatment.
2. Patients' failure to comply with advice (e.g. not to bottle feed in bed) accompanied by difficulty for nurses in assessing follow-up visits.
3. Reluctance on the part of patients to ask questions and on the part of interpreters to encourage them, particularly if viewed as personal.
4. A tendency to discontinue treatment when symptoms disappear, also a result of communication problems.

Papillon (1994) reported that Inuit mothers and interpreters did not perceive any cultural conflict regarding antibiotic treatment of OM since no traditional treatment existed. Treatment failure was primarily attributed to compliance problems resulting from communication difficulties, "a community health problem requiring a systematic answer" (p. 688).

The problem of resistance is increasing markedly in northern communities as well as elsewhere. Guðmundsson (1994) warned that "the antibiotic era may soon be over unless firm measures are taken to curtail it" (p. 684). He recommended the use of less expensive narrow spectrum antimicrobials with a treatment duration shortened to 5 days and preferred tube insertion in recurrent cases instead of long term antimicrobial prophylaxis. Successful implementation of these strategies depends upon accommodation with the social and linguistic environment of the North.

Baxter and his colleagues conducted a follow-up treatment success study of a large group of Inuit in the eastern Arctic who were the first to have post-secondary education available in their home community (Baxter, Stubbing & Goodbody, 1994). The cohort was originally visited during 1974-1977 and 72 (144 ears) were revisited beginning in 1990. Initially 132 ears (92%) had COM/CSOM. At follow-up 57% of ears had COM/CSOM, 42% had sealed off middle ear clefts and only 1% had normal tympanic membranes. Thirty three percent of individuals had "inadequate hearing", the majority having been fitted with hearing aids but few using them.

Baxter et al. (1994) noted that in 1990 72% of the native population was functionally illiterate; among the participants in their study 90% were functionally illiterate, having left school before completing grade 8. (Having less than grade 9 education was the definition employed for functional illiteracy). The researchers observed an immense generation gap between these young people and their parents: essentially this generation grew up in a world of extraordinarily rapid change. During the period from 1955 to 1965 the Inuit moved into settlements, abandoning the semi-nomadic way of life. This was accompanied by schooling structured entirely along the lines of southern Canada, basic housing, a radically altered diet, cash employment in which traditional skills were unimportant, alcohol, tobacco and drugs. (Comparable social upheaval with subsequent illness has been documented for Alaska Inuit - see Christensen, 1990).

Baxter and his colleagues (1994) stressed that the treatment of AOM is a public health and broad educational matter that has to be implemented within a context of rapid acculturation and drastic social problems. They noted, for example, that in 1990 violent deaths accounted for

35% of all deaths in the NWT. The suicide rate, estimated at .01% in 1970, had reached an alarmingly high rate of 13% by 1990, with alcohol a contributing factor in most of these deaths. Smoking rates in Nunavut and the NWT are the highest in Canada. A 1985-86 survey reported that 77% of Inuit women smoked along with 62% of adolescents aged 15-19 (Godel, Pabst, Hodges, Johnson, Froese & Joffres, 1992). The rate of lung cancer in women is four times the Canadian average. According to Baxter et al. (1994) tobacco use is "one of the major preventable causes of disease, disability and death" (p. 667) in Arctic Canada.

Cultural value differences

Screening, diagnosis, treatment and the prevention of disease as practised in Euro-Canadian culture rest upon a set of values that are usually taken for granted, but which may conflict with aboriginal cultural assumptions, resulting in decreased effectiveness of interventions among indigenous peoples. Several value differences have been cited between American Indian cultures and the majority culture (see for example, Epperley, 1991 and Bryde, 1971). However, they are broadly applicable to First Nations and Inuit peoples, recognizing at the same time that many differences exist between aboriginal societies.

At least two broad value differences have implications for the treatment and management of disease. First, Canadian aboriginal peoples are more likely to be present-oriented and to lack the preoccupation with time so characteristic of non-aboriginals. This is relevant to public health education programs, for example, as many stress future consequences of risky behaviour rather than focussing upon the immediate social consequences of risk factors. Second, aboriginal peoples tend to share belief systems stressing harmony with nature 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.

Cultural differences and biomedicine

> *Siutikuvijuq* is the term used by Inuit, at least in Nunavik, to name and designate an active chronic otitis media. Literally, the term means "his/her ear is running". We are accustomed to speaking about otitis media (OM) from a clinical or from an epidemiological perspective. We are less used to speaking about it from an Inuit point of view (Dufour, 1994).

Dufour (1989, 1990, 1994) has argued that the traditional medical disease model separates the individual from the environment for two reasons: first, physical, social and cultural data are not accessed by the clinician, and second, even when illness is related to environmental conditions (as in the case of OM), treatment is limited to the symptoms. This observation is not restricted to the study of disease among the Inuit, but applies to approaches to prevention and treatment whenever western/aboriginal cultural differences exist. She proposed that 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.

According to Dufour (1994) traditional Inuit views of disease are very different from that of biomedicine, which emphasizes the disease's symptoms. For the Inuit, disease is a consequence of a transgression against the social or spiritual orders. Inuit culture places emphasis on social behaviour and its relationships with disease. At the same time, what Dufour called "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 (Dufour, 1994, p. 671). Within the Inuit belief system aging is not perceived as a disease process, although in western culture's mechanistic and symptom-focussed perspective it is often regarded as such. Dufour argued that 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 which biomedicine is unable to put into practice" (1994, p. 674).

Prevention and Intervention Approaches

Risk factor amelioration along with medical advances, such as the development of safe

and effective vaccines for infants and young children, have been cited as strategies of fundamental importance in the prevention of OM (Daly, 1997). Community-based, culturally sensitive public health and educational programs appear likely to be the keys to prevention middle ear disease and hearing loss in remote, rural and northern communities. It has been pointed out, however, that research regarding the effectiveness of risk factor modification programs is either lacking or at best limited (Daly, 1997).

According to the WHO/CIBA Foundation (1996) general health promotion is the key to prevention. This should include:

> Targeting 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 COM should be integrated into the existing primary health care system WHO/CIBA Foundation workshop, 1996, p. 2).

Provincial/state planning. Substantial national and provincial/state programs are required to meet these goals, in addition to interventions at the regional and community levels, in the home and school. An example is the New South Wales Otitis Media Strategic Plan for Aboriginal Children (NSW Health Department, 2000). The plan featured 7 strategic directions coordinated by the state's department of health. (Australian states and Canadian provinces have similar constitutional responsibilities for health, education and social services). The strategic directions are:

1. Coordinated partnership of service provision at a state, regional and local level to manage and control OM and conductive hearing loss in Australian Aboriginal children.
2. Assurance that all services are available, accessible and specifically culturally appropriate and sensitive to the local Aboriginal community.
3. Early intervention (screening, referral, medical and audiological management) based on standardized protocols.
4. Provision of educational support through a continuation and expansion of Aboriginal education and student support programs addressing hearing loss in children.
5. Encouragement of community awareness and prevention that will assist the process of

community self-determination.

6. Training in cultural awareness for non-Aboriginal service providers and access to resources, accredited training and professional support for Aboriginal service providers.

7. Monitoring of the plan through research including evaluative surveys and measurement of success against agreed indicators.

The Strategic Plan described the implementation of the directions in detail, reviewing outcomes, responsibilities, target dates and performance indicators. For example, research strategies included the following:

1. The role bacteria, viruses and risk factor represent in Aboriginal children, which will enable better treatment and prevention protocols.

2. Effectiveness of various antibiotics and protocols in treating and preventing otitis media.

3. Effectiveness of treatments for chronic otitis media in Aboriginal children.

4. Effectiveness of traditional Aboriginal healing practices.

5. Effectiveness of the Breathing Blowing Coughing (BBC) program in the prevention/management of otitis media (NSW Health Department, 2000, p. 16).

Comparable strategic plans for otitis media and conductive hearing loss prevention and management for aboriginal Canadian children were not located in preparing the present review. However, the Native Hawaiian Hearing and Speech Project (Kamehameha Schools, 1991) represents a broad ranging intervention program aimed at producing improvements in the school achievement of Hawaiian preschool children. Young native Hawaiian children have been shown to score poorly on standardized tests of language skills that correlate with a high incidence of moderate, intermittent hearing loss (Heath, Plett & Tibbetts, 1987). The program was implemented and evaluated over a 2 year period and involved approximately 100 children enrolled in 5 preschools together with a matched comparison group of approximately 100 in another 5 schools.

The experimental program included six components:

1. An enhanced hearing loss and middle-ear disorder screening and speech screening procedure. This included health history information, a 4 part hearing examination (otoscopy, pure tone audiometry, immittance tympanometry and acoustic reflectometry) and complete speech and language assessment. All screening was conducted by relevant health professionals.
2. A follow-up effort to ensure every child who failed the screening received appropriate medical care. Parents were the primary focus of the efforts in assuring timely medical attention for the children. Other family members and care-givers as well as medical care providers, community health personnel, preschool teachers, aides and site managers, project staff and other community agencies were also involved. Speech and language therapy was directed toward improving the children's use of syntactically correct Standard English, improving expressive vocabulary skills and facilitating verbal communication with peers.
3. The reduction of classroom ambient noise levels to an educationally acceptable level as specified by an acoustic engineer. This involved acoustical treatment of exhaust fans and air conditioning ducts and other physical modifications in classrooms.
4. The amplification of instructional speech to an educationally effective signal-to-noise ratio. Free-field amplification was installed in each experimental classroom and used during large group instruction and activities.
5. Special communication-enhancing classroom teaching techniques, a classroom speech centre, and equipment (electronic speech trainers) designed to improve the language competence of children experiencing moderate speech and hearing difficulties.
6. An individualized home and school communication therapy program for those children most at need.

Numerous informational and interactive parent workshops were conducted and parents also received a newsletter keeping them informed of progress in the project.

By the end of the school year 70% of the children had failed at least one of the audiometric measures. Thirty two percent of the preschoolers in the experimental group were judged to need individual speech-language therapy. Communication, language and articulation problems were found to be much more common than fluency problems. When compared with non-identified children, those identified by the hearing and language screenings scored lower on

verbal achievement measures, but not quantitative ones. Fewer entering preschoolers who were identified by the hearing screening had been breastfed, and of those who were, breastfeeding was for a shorter period. Consistent with the main hypothesis of this study, children in the experimental group showed nearly 25% more improvement on verbal and quantitative measures than members of the comparison group.

Hawaiian children are disadvantaged when compared with other ethnic groups in the state on standard verbal measures such as the Peabody Picture Vocabulary Test. In the Native Hawaiian Speech and Hearing Project it was found that children who failed the screening scored lower on verbal tests. The authors observed that:

> This finding, confirmed over several school years, suggested the hypothesis that counteracting the negative educational effects of mild/moderate intermittent hearing loss might result in improved achievement test performance by Hawaiian preschoolers. That is the hypothesis that this project tested and affirmed (Kamehameha Schools, 1991, p. 59).

The Family-Professional Partnerships Model

The Native Hawaiian Speech and Hearing Project was an excellent example of what is often referred to as the Family-Professional Partnership or Family-Centred Model (Winton, Roberts & Zeisel, 1997). In describing this approach Winton and her colleagues noted that the prevention and management of OM requires family-centred care that involved the following elements:

1. Developing treatment plans by working in partnership with families.
2. Providing care that is culturally and linguistically appropriate and recognizes individual differences.
3. Providing families with choice regarding alternative treatments and recognizing that they have the ultimate decision-making role about treatment.
4. Providing clear and concise relevant information about health promotion and management.

Two qualitative, ethnographic studies have examined the ways in which Caucasian and First Nations families might learn to manage OME and its consequences for the infected child, his or her family and the family's interactions with health care professionals (Wuest, 1991;

Wuest & Stern, 1990). It was reported that First Nations peoples attempt to manage by harmonizing or integrating the situation into the family lifestyle and were "less likely to be upset with the health care system and less likely to develop adversarial relationships with professionals" (Wuest, 1991, p. 203). However, generalization from this limited qualitative data should be made with considerable caution.

Winton et al. (1997) noted that a need exists for information that is clearly understood and accepted by families and that meeting this is fundamental to the provision of a family-centred approach to care. The researchers discussed some alternatives to written information (parallelling the problems with simple verbal translation of information described by Papillon (1994) and discussed in the section of the present review dealing with the treatment of OM). Storytelling is traditional among many aboriginal peoples and may well be a preferable vehicle to print alone (Wuest, 1991). Other suggestions included verbal explanations with pictures and diagrams that could be taken home and discussed with family and friends, community meetings, newsletters and the involvement of other agencies, particularly schools. The relevance of such alternatives is likely to vary for different communities.

A shared decision-making role for families regarding care and treatment is difficult to implement. One study indicated that the majority of participating health care professionals believed they should retain final authority concerning treatment, in contrast to parents surveyed who believed the decision rested with them (Giangreco, 1990). Winton et al. (1997) stressed the importance of taking account of the family's values and belief systems – a fundamental consideration when working with First Nations and Inuit families. (Of related interest, a survey of Aboriginal people by the Australian Bureau of Statistics, 1999 confirmed that more than 75% of indigenous people ranked Aboriginal involvement in health services as important).

Family centred prevention to enable breastfeeding. 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 (Thomson, 1994). In a study of 77 new Mohawk mothers (Macaulay, Hanusaik & Beauvais, 1989) two-thirds planned to breastfeed before becoming pregnant and mothers who continued to do so were strongly supported by the infant's fathers and their own

mothers. Macaulay et al. (1989) recommended that education about breastfeeding for adolescents in school. (This could be accomplished by having young parents speak to high school students about the many immediate benefits of breastfeeding, not only its consequences for ear disease). They pointed out that programs should target the whole community and not just pregnant women, helping re-create a supportive community and family environment for breastfeeding mothers.

Strategies to develop and enhance communication and learning in the family

The chief developmental consequences of otitis media stem from its implications for communication. Children who experience intermittent or permanent hearing loss, depending on its extent and the age of the child, are likely to demonstrate difficulties in the acquisition and use of oral and written language. Resources have been developed to assist parents manage the effects of the disease, and for teachers and other educational professionals to better meet the needs of children with OM and conductive hearing loss.

Coping strategies used by parents

Interventions to support parents in dealing with the consequences of OM should build upon communication adaptations they already use. Smith and Haggard (1999) investigated the communication strategies used by parents of 574 British children aged between 3.25 and 6.75 years taking part in a national randomized controlled trial of surgical treatment for OME. Communication tactics were conceptualized as part of the coping process used by parents in helping manage the disease and its consequences. An open-ended questionnaire was employed and responses coded, with parents reporting the use of both task-oriented tactics and palliative tactics. This distinction referred to attempts to deal with the difficulty itself (behavioural), as distinct from tactics designed to comfort or make the child feel better.

Thirty one communication tactics were described and grouped according to frequency. High frequency tactics, reported by more than 50% of participants were: attract attention; encourage the child to watch you talking; repeat/speak slowly/clearly/louder and wait for an answer. Middle frequency tactics, reported by 10%-50% of participants were: remove distractions such as television; comfort or support the child; shouting at the child to ensure he/she hears; move closer to the child/bring the child closer to you; talk to the child about the

situation; distract the child/play games; encourage the child to sit near the teacher. Parents were generally more aware of tactics that directly engage the child and were less aware of tactics requiring the involvement of a third party. The researchers recognized that parental awareness of the communication strategies they employ may differ from actual behaviour, but recommended that literature designed to inform families should incorporate both behavioural and palliative tactics.

Strategies designed to enhance learning for children with conductive hearing loss have been widely used in schools for several decades, but few exist designed for parents of preschool age infants. Very few interventions have been designed to be culturally relevant and fewer still have been field-tested and objectively evaluated.

Strategies designed for parents

The United States Department of Education, along with several sponsoring agencies, has published *Ear infections and language development*, a booklet designed to provide parents with information about otitis media and suggestions concerning the promotion of language and literacy skills in young children with COM or conductive hearing loss (Roberts & Zeisel, 2000). This has been reproduced online by other organizations, such as the National Institutes of Health (NIH, 2001) and the National Parent Information Network (NPIN, 2001). Using a simple question and answer format, the publication provides basic information about otitis media, how it may affect a child's language and what parents can do to help. Specifically, it addresses symptom identification and treatment; the manner in which hearing is affected and signs of hearing loss, the ways in which speech and language learning may be affected and where parents can receive help. The booklet also provides a checklist of milestones in language development that parents can determine whether their child's speech and language is developing normally for his/her age. Finally, the booklet lists several tips for the prevention of ear infection (e.g. clean toys that have been in a child's mouth before another child plays with them) as well as practical suggestions to promote listening, language learning and early literacy learning.

The same kind of information designed for parents has been posted on the Internet by the American Speech-Language-Hearing Association (ASHA, 2001). Similarly the Canadian Pediatric Society has posted information for parents about OM on its website *Caring for Kids*

(CPS, 2001) linked to a Health Canada sponsored site *Canada Health Network* (Health Canada, 2001). The material is organized around three basic questions: How are ear infections treated? Can ear infections cause hearing loss? What can parents do? However, the Internet does not currently represent a significant means of communicating directly with families in northern and isolated communities.

There are likely to be many other materials prepared for parents at a local level and not widely distributed, however none was located directed at aboriginal communities in Canada. No evaluation research was found dealing with the effectiveness of parent education campaigns or materials relating to OM and conductive hearing loss prevention and management.

Strategies to enhance learning and communication in the school

Guidelines have been published for the medical and audiological management of OME in young children. However, there are significant educational management issues as well, including the promotion of healthy practices, promotion of a good listening and language environment and collaboration with families and other professionals in the management of OME. The role of professional specialists (e.g. audiologists and speech language pathologists) will not be reviewed here, but may be found in Roberts & Medley (1995). Similarly, the website of the American Speech-Language-Hearing Association (ASHA, 2001) contains summary information about aural rehabilitation for children. This involves plans tailored to meet the needs of the individual child, including the following elements: training in auditory perception; using visual cues; improving speech; developing language; managing communication; managing hearing aids and assistive listening devices.

Adaptations used by early childhood special educators

Medley, Roberts & Zeisel (1995) conducted a nationwide American survey of early childhood special education teachers to describe their beliefs and practices concerning the management of children with histories of chronic and recurrent OME. The authors pointed out that "no literature exists on what these educators believe and practice with regard to OME and the children on their case-loads" (1995, p. 49). Participants were 189 respondents who returned a questionnaire sent to 500 members of the Council for Exceptional Children working in the early

childhood field. The majority of respondents reported using hygiene practices recommended to reduce the prevalence of OME, with one exception: 94% would allow an infant to drink from a bottle while in bed (a well-documented risk factor). Respondents used a variety of responsive strategies for enhancing children's listening and learning in the classroom, with the exception of reducing background noise. (Background noise reduction is an important consideration for children with hearing loss, whether using amplification or not). The researchers noted that most participants (80%) expressed a need for more information. This is a significant observation since the sample consisted of voluntary members of a professional organization who may well be more professionally committed and better informed than other teachers.

The high turnover rate of teachers in remote communities has two direct implications for working with children who are deaf and hard of hearing. First, many of these teachers have little classroom experience and may not have learned to recognize signs of learning difficulties for aboriginal students with disabilities. Their familiarity with appropriate instructional modifications is likely to be limited as well. This means that in-service training is essential. Second, the high turnover rate implies that "it is essential that this training be offered regularly or included with schools' induction programs" (Parliament of Australia, 2000, p. 150).

Few materials were located designed for use by teachers with aboriginal students. Ruddell (see Higgins, 1997) and her project team at the Dajarra State School in Queensland, Australia developed culturally-friendly materials designed for use by teachers of Australian Aboriginal children with OME and conductive hearing loss. Teachers attended a one-day interactive workshop where they received training in the use of the materials. These consisted of an introductory booklet for teachers in which rudimentary information about the symptoms, risk factors, course and consequences of OM are described.

The booklet was supplemented by five strategies encompassing practical advice for classroom organization, teacher behaviour and approaches to instruction and are accompanied by warnings when cultural differences are salient. Strategy 1 included an overview of appropriate ways to modify teacher behaviour (e.g. clarify instruction by asking children to repeat what is wanted. Importantly though, don't put any children in a "shame" situation). It also included suggestions for ways to change pupils' behaviour through adaptations to teaching style (e.g.

encourage peers to face other children when they are talking, reading). Strategy 2 involved the utilization of identifiers. The term refers to signs teachers need to recognize as pointing to OM. Such identifiers may be physical (e.g. rubbing or pulling at the ear), speech (e.g. speaking in a low or loud voice), behaviour (e.g. watching other children to get clues), learning (e.g. appearing to hear and respond sometimes and not at other times).

Strategy 3 was termed "linking health and learning". It included ideas for classroom posters on ear health, as well as a host of other pictures and print materials. The strategy focussed on the maintenance of healthy ears and a healthy respiratory system. The BBC (blow, breathe, cough) routine for classrooms is considered of fundamental importance in this respect and was described in strategy 4. Strategy 5 dealt with the effects of OM and intermittent conductive hearing loss by recognizing the importance of approaching the issues as a shared responsibility, involving both health care professionals and families.

The workshop and materials developed by Ruddell and her team (see Higgins, 1997) appear to be potentially valuable if adapted to comparable Canadian educational situations with Inuit and First Nations children. No formal evaluation of this newly developed program was located.

Cultural adaptation of classroom activities and materials. Adaptations of instructional approaches and curricula must take account of the traditional classroom practices of aboriginal teachers and their pupils. Eriks-Brophy & Ayukawa (2000) described the discourse and interaction behaviours of Inuit teachers working in Nunavik (northern Quebec), contrasting them with non-aboriginal classrooms. Rather than the typical initiation-response sequence in which the teacher is perceived as an authority and as an orchestrator of interaction, the Inuit classroom is characterized in the following way:

> Inuit teachers tended to engage in interactional sequences that focused on appropriate group participation. Elicitations for information were typically directed to the class as a whole and only rarely were individual students selected to respond to teacher-initiated questions. Evaluation of student responses was also directed toward the group as a whole rather than toward individual students. Overall classroom talk was relatively equally shared between teachers and students, and students were able to interject comments and

questions relatively freely within lessons (p. 325).

Teachers were described as encouraging and promoting both verbal and social interaction between students to a greater extent than that which usually occurs in non-aboriginal classrooms. Inuit teachers were interviewed and described their role as being a facilitator of student interaction whose task was to develop cooperative behaviour and respect for others. Similar considerations in developing culturally appropriate classroom activities and materials have been outlined for teachers of Australian Aboriginal children (see Nienhuys, Westwater, Dillon & McConnel, 1990).

Collaboration with families

The collaborative role of teachers in regard to families has traditionally been conceived as one of information provision (e.g. Medley, Roberts & Zeisel, 1994; Winton, Roberts & Zeisel, 1997). Roberts & Schuele (1990) outlined the main areas they believed could effectively be covered using brochures, workshops and presentations. These included the provision of education about OME and hearing loss (emphasizing the importance of early recognition of symptoms and seeking prompt medical advice), and provision of education about the potential effects of OME on language and learning. Special educators have been assumed to be knowledgeable about the role of hearing in language learning and possible speech and language sequelae of chronic OME, however there is little evidence as to the extent of knowledge and knowledge gaps among both specialist and regular teachers.

Promotion of a positive listening environment

Simple classroom modifications for children with mild hearing loss are also appropriate for those with OME (Medley, Roberts & Zeisel, 1995). These include seating the child close to the speaker, getting the child's attention before speaking to him or her, speaking clearly with normal intonation, repeating important words and frequent checking with the child as to whether directions and new material have been understood. These modifications have appeared in most special education materials used in pre-service and continuing teacher education for the past two decades (e.g. Davis, 1989; Hamilton Board of Education, 1997; Smith, Polloway, Patton, Dowdy & Heath, 2001; Toledo Board of Education, 1982). Reduction of distracting background noise is an important modification in the regular classroom and may include hanging drapes, using

carpets and rugs, closing windows and doors and minimizing sounds from appliances. Noise distraction can also be reduced by using portable barriers such as bookshelves and flannel boards to create smaller work areas facilitating small group and one-to-one interactions (Davis, 1989; Medley, Roberts & Zeisel, 1995).

The benefits of sound field FM amplification in Inuit classrooms was evaluated by Eriks-Brophy & Ayukawa (2000) in 3 Inuit classrooms over a 3 month period. Significant improvements were reported in speech intelligibility scores for students with hearing loss and students with normal hearing. On-task behaviour and attending behaviour improved for observed students and comments regarding the system from both teachers and students were positive:

> Areas of improvement mentioned by all participating teachers included increased attention in large group lessons, more rapid student response times, increased involvement in class discussions, less need for repetition of presented material, improved listening skills, and less teacher fatigue at the end of the day (p. 331).

The authors noted several methodological limitations in the design of this study, however they argued that the system has good potential for improving learning in multicultural settings. The positive consequences of classroom amplification were also reported for Australian Aboriginal children with hearing loss and a history of OM (Parliament of Australia, 2000), however it was noted that expense is often a prohibitive factor, particularly in remote areas.

Most teachers teach listening skills as part of the regular curriculum, however there may be value in using discreet lessons. Ryan (1993) constructed 5 plans for 30 minute lessons that address various listening skills and are suitable for grades 1 to 3. The effectiveness of this approach has not been formally evaluated.

Promotion of a responsive language environment

The same strategies that have been demonstrated to facilitate language growth in all young children are recommended for teachers working with children having OME. These include encouraging conversation, speaking directly to the child's face and asking children to elaborate on their input, reinforcing auditory information with visual information and using games and stories with frequent repetition of words and phrases. Reading activities and activities

requiring careful attention to auditory information may be used to facilitate listening skills (Davis, 1989; Roberts, Bailey & Nychka, 1991).

Wallace & Hooper (1997) have proposed that children with OM may demonstrate stronger visual-perceptual abilities and weaker auditory-verbal abilities, and that teaching strategies should target strengths:

> For example, the liberal use of visual prompts (e.g. pictures) and cues (e.g. written outlines) may serve to increase learning efficiency in children with OM. Furthermore, given the relative weaknesses in the auditory-verbal domain, any instruction tapping this learning modality should routinely be accompanied by materials that tap other modalities. This does not imply that the weaker modality should be ignored or avoided but, rather, that it should not be used as the primary vehicle for learning. Indeed, specific remediation efforts may be in order (Wallace & Hooper, 1997, p. 188).

They noted as well that children with OM have been found to demonstrate phonological deficits (Schwartz, Mody & Petinou, 1997) and advocated early identification and intervention to develop phonological awareness and articulation awareness in children at risk.

Conclusion

Middle ear disease and consequent hearing loss have an impact on Canadian aboriginal children and adolescents that can only be characterized as alarming. In some Inuit communities the prevalence of chronic otitis media has been estimated at more than sixty times the rate for southern Canadians, and among First Nations peoples it is not unusual for the disease to be as much as ten times more prevalent than among non-aboriginal Canadians. The economic, social, health and educational costs are immense, and yet research in this area is fragmented, while the need for culturally appropriate public health and educational interventions continues to expand.

Data regarding prevalence of OM among Inuit, First Nations and Metis children and youth are typically derived from unconnected studies in single communities, a factor that has significantly limited extrapolation of findings to northern and arctic Canada. The absence of systematically collected regional or territorial information is unfortunate because such data are vital for government planning in the delivery of public health and educational services. Research regarding risk factors for OM and hearing loss among aboriginal Canadians is also limited, and for several environmental risk factors implications have been drawn from work completed within other populations. However, it is abundantly clear that several high risk factors are almost universally present in aboriginal communities. These include bottle feeding in the absence of breastfeeding, a diet of low nutritional value, cigarette smoking resulting in passive smoking by infants and limited access to medical care.

Treatment of OM in northern Canada is made more difficult by isolation, lack of medical resources and cultural/linguistic factors impinging on service delivery. Difficulties accompanying treatment such as non-compliance with directions have likely contributed to increased resistance and reduced effectiveness of prophylaxis. When aboriginal cultural values, customs and linguistic differences have been taken into account in the delivery of health and medical services, increased success has been documented. The treatment of OM is a public health and broad educational matter that has to be implemented, not only within a cross-cultural context, but within a milieu of rapid acculturation and acute social problems.

The negative educational consequences of OM and hearing loss are long-term and serious. Family-centred, community-based prevention programs need to be widely implemented

in areas such as encouragement of breastfeeding and the reduction of smoking, particularly in the presence of infants. Schools can play an important role as well, however few data exist either describing such programs or evaluating them. Finally, it is necessary to implement increased and ongoing in-service education of teachers in culturally-appropriate ways of modifying curriculum and instruction to meet the needs of Inuit, Metis and First Nations children and adolescents.

Future work in this area

Prevalence. The literature in this field is complicated by several methodological concerns, making interpretation difficult. Different studies have reported data for "otitis media" without specifying the type being reviewed (acute, chronic, with effusion) and have employed different methods of diagnosis, ranging from hospitalization and physician visits to complete audiological examinations. A further complication is the fact that prevalence is associated with age, and different studies report data for a variety of age groups. Many of the studies cited in this review were conducted within western cultural 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 Nunavut and the NWT. (The Australian National Trachoma and Eye Health Program might serve as a relevant model). Short of this, 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.

Risk factors. Interpretation of the association between ethnicity and middle ear disease is problematic in the context of correlated socioeconomic variables. The examination of specifically defined risk factors has shed considerably more light on the etiology 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 Metis societies. There may well be risk factors which apply in aboriginal communities but have been excluded in studies of non-aboriginals, for example specific allergies and food intolerances. The role of maternal alcohol ingestion, FAS and FAE do not appear to have been explored and may merit consideration.

Treatment failure. 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.

Prevention and interventions. There are few family-centred, community-based, culturally sensitive preventive public health and education programs in place within aboriginal communities. 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.

Formal educational implications. Very little data were available regarding educational management issues in the North, such as the promotion of healthy practices, the creation of good listening and learning environments in schools, and collaboration with families in the management of COM and hearing loss. The need for appropriate and frequent in-service education for teachers is clear, but research is required regarding its content and delivery, and evaluating effectiveness in the field. Little is known about the present knowledge levels and classroom practices regarding OM and hearing loss among teachers in aboriginal communities. Research in this area is necessary before effective in-service programs are established.

Some prevention and management programs developed for aboriginal children in Australia and with native Hawaiians (e.g. Breathing, Blowing Coughing program; Kamehameha Schools project) may be adaptable in whole or part so that they are culturally appropriate in Inuit, First Nations and Metis classrooms. Notably, there is limited evidence regarding the effectiveness of these kinds of interventions and appropriate evaluation research needs to be conducted. Few culturally friendly materials designed to be used by teachers of aboriginal children were located during the preparation of this review, however they may exist at the local level and may have not been distributed to a larger audience. Where materials have been developed (as by Ruddell and her team for Australian Aboriginal children), research will be needed to adapt them for use with different populations when judged relevant.

Positive classroom listening environments may involve simple physical and behavioural modifications, or may range to installation of sound field FM amplification. Research is needed concerning the modifications teachers of aboriginal children are aware of and actually use, as well as evaluative studies of the effects of these and expensive technical adaptations on children's subsequent speech, language and behaviour. In conclusion, it should be reiterated that the investigation of Otitis Media and subsequent hearing loss among aboriginal Canadian children and youth is a complex undertaking. The field draws upon the methods and theoretical constructs of several disciplines, and involves work in cross-cultural settings that are themselves undergoing rapid acculturation and experiencing acute social problems. However, the importance of this research and its beneficial applications for northern, isolated and rural communities is clear.

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