Hearing screening outcomes in Inuit children in Nunavik, Quebec, Canada

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ABSTRACT

Objectives. Hearing loss is highly prevalent among Inuit children in Canada. Hearing screening at kindergarten age has been carried out in Nunavik by trained Inuit technicians since 1986. In this study, we determined what percentage of children fail their initial hearing screening at age 5-6 years and compared this initial result with the last hearing test. We also report the type of hearing loss observed at the last test.

Methods. Results compiled in a clinical database were analysed. At age 5-6 years, 524 children (born 1990-1994, 84% coverage) were tested and 515 children were retested at a later date. Screening failure was defined as >22 dB pure tone average (.5k, 1k, 2kHz) in either ear. Observations on ear condition at the last test were used to determine type of hearing loss.

Results. Nineteen percent (101 children) failed the hearing screening at age 5-6 years and 12% failed on the later test. When those who failed the first test were retested, 58 had improved and 43 remained with a hearing loss. Twenty-one children who had initially passed the hearing screening were found to have a hearing loss at retest. The majority of the hearing losses were due to otitis media.

Conclusion. Hearing screening and retesting remains necessary due to the high prevalence of hearing loss found in this population and the fluctuating nature of this problem.

Key words: hearing screening, Inuit, otitis media

INTRODUCTION

Hearing loss is highly prevalent among Inuit children in Canada. This is primarily due to middle ear disease. In many Inuit children otitis media occurs early in life and quickly leads to a chronic perforation with intermittent drainage from the middle ear. In 1984, 23% of Inuit school children in Kuujjuarapik were reported to have hearing loss (1)). Since that time, kindergarten hearing screenings have been implemented in Nunavik. Children who fail the initial screening are followed annually until their ear condition is no longer active.

The screening is performed by trained Inuit technicians supervised directly or indirectly by an audiologist. It includes: visual inspection of the ear canal and tympanic membrane, air conduction testing (usually threshold search) in a quiet room and tympanometry, when available.

In 1995, a decision was made to perform a wider screening of the school population because of the nature of hearing loss caused by otitis media. Hearing loss may be temporary, fluctuating, or it may develop, according to the severity of the disease. It was hypothesised that there could be significant numbers of children who developed the disease after passing the kindergarten screening and had not been referred to us by other sources. Because of the numbers of students, children who passed a screening were seen every two to three years, instead of every year.
Screening studies typically compare screening results with a more complete assessment performed within a short time period. They report sensitivity and specificity, numbers of false positives and false negatives. This is not possible with our results because follow-up hearing tests were done at least six months later, and a similar type of exam was performed at that time.

The present study reports on the comparison of the initial screening test with the child’s last test results. We attempted to answer the following questions:

1. What percentage of children fail an initial screening at age 5-6?
2. How do the results at the later test compare with the initial screening?
3. What is the nature of the hearing loss observed?

MATERIALS AND METHODS
Since 1995, the pure tone average (PTA .5k, 1k, 2kHz) hearing test results for each ear for each child have been recorded in a database (ACCESS 97). We analysed a 5-year birth cohort (1990-1994), which included 524 children (of 616 live births) in seven Ungava Bay communities. Hearing screening failure for this analysis was defined as >22dB PTA in either ear. Screening results at age 5-6 were compared with their last hearing test (age 6-12), available for 515 children. When more than one later test was available, the last test was used for comparison. Ear condition recorded in the database was used to determine the nature of the hearing loss observed at the time of the last test.

RESULTS
Five hundred and twenty-four out of 616 children born between 1990-1994 (84% coverage) had a hearing test at age 5-6 years. Nineteen percent (101 children) failed their first hearing test performed at age 5-6 years. Ninety-eight percent (515 children) of those screened at age 5-6 had also a later hearing test. The age at the last test varied between 6-12 years. Eighty percent of the children were aged 7-10 at the time of their last test. Fewer children (12%) failed at the time of their last hearing test compared to the initial screening test. Table I presents percentages of passes and failures obtained on the first and last hearing tests.

Comparison of the first and last tests for each child found that 79 children had differing results on the two tests (Table II). Of the 101 children who failed their initial screening, 43 had hearing loss on their last test and 58 children had no hearing loss on their last test. We also assessed how many children who initially passed the screening had hearing loss later on. Five percent (21 of 414) who passed the initial screening were later found to have hearing loss.

We analysed the results of the 64 children who had hearing loss on their last test. Of this group, 66% had failed the initial screening and 33% had passed the initial screening. Using the ear condition recorded in the database, we found that the majority of the hearing losses (55 of 64) were due to otitis media. In the group who failed both tests, there were 34 with chronic otitis media, 4 with otitis media with effusion, 4 with sensorineural hearing loss, and one with congenital atresia. In the group who initially passed and then failed later, we found 9 children with chronic otitis media, 8 with otitis media with effusion, 2 with probable sensorineural hearing loss, one with cerumen, and one possible functional hearing loss.

| Table I. Results of screenings: first and last test. PASS: pure tone average (.5k, 1k, 2kHz) < 22 dB. FIRST TEST: age 5-6 years; LAST TEST: age 6-12 years. |
|----------|--------|--------|
| Year of birth 1990-1994 | PASS | FAIL |
| FIRST TEST (n= 524) | 423 (81%) | 101 (19%) |
| LAST TEST (n = 515) | 451 (87%) | 64 (12%) |

| Table II. Comparison of first and last test results. PASS: pure tone average (.5k, 1k, 2kHz) < 22 dB. FIRST TEST: age 5-6 years; LAST TEST: age 6-12 years. |
|----------|--------|--------|
| PASS (n = 414) | 393 | 21 |
| FAIL (n = 101) | 58 | 43 |
DISCUSSION:
Failure rate at the time of initial test at age 5-6 years was observed to be 19% for the 1990-1994 birth cohort. However, 16% of the birth cohort were not tested. Possible reasons for children not to be evaluated at age 5-6 years could include: lack of time for testing (rare), unable to test because of uncooperation (rare), missing school because of illness, or missing school due to immaturity or other reasons. Considering these factors, failure rate may be underestimated.

Seventy-nine children had differing results on the first and last tests. Overall, fewer children failed the later test. Some of these differences found may have been because of immaturity of the child at the first test, tester inaccuracy; difference in the ambient noise level at the time of testing; or temporary threshold shift related to recent noise exposure. Many of the differences in test results may be due to a fluctuating middle ear condition, as 55 children were found to have otitis media (chronic or serous) at the time of the later test.

CONCLUSIONS:
As the data analysed were clinical in origin rather than research data, the interpretation must be made with caution. Nineteen percent of 5-6-year olds were found to have failed their initial hearing screening. More than half of these children had normal hearing when retested at a later date. Five percent of those who passed initially were later found to have hearing loss. There is therefore a need to identify the children who may develop hearing loss after the first test. This can be done by re-screening or by using other methods.

Given the high prevalence of hearing loss in this population and the negative effect of hearing loss on speech and language development, early detection of hearing loss is undoubtedly worthwhile. Currently, with new technology, such as otoacoustic emission screening, initial testing can be done at an earlier age and with better reliability. Re-screening of passes can be carried out rapidly. Children with fluctuating hearing loss can benefit from classroom amplification systems (2) and/or individual hearing aids.

Acknowledgements
We thank: Nora Kakkinerk, Johnny Makiuk, Charlotte Airo, Jeannie Simiunie, Louisa Etok, Maggie Annanack, Pasha Berthe, Eva Nuvuuka, Nukaya Qisiiq, Pasha Kiatainaq, Isabelle Billard, Sylvain Daoust.

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