A Survey of Hearing Loss in Vancouver School Children:

Part I. Methodology and Prevalence

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DESPITE the fact that chemotherapy has enabled control of purulent otitis media and its sequelae,[1] except perhaps in the lower social classes,[2] hearing loss remains an important contemporary problem in child health. The National Health Survey[3] revealed that 15% of impairments in children under 15 years were due to hearing loss. From 3 to 5% of school children are found on screening to have hearing impairment sufficient to warrant further study or treatment,[4] and 1.5 to 3% of school children may have a hearing defect requiring special medical and educational help.[5]

During recent years, serous or secretory otitis media (sterile fluid in the middle ear) has been recognized to an increasing degree as a cause of mild conductive hearing loss.[6] Although the etiology, pathogenesis and natural history of this disorder require clarification, there is evidence that non-function or poor function of the Eustachian tube is associated with an accumulation of fluid in the middle ear.[7] Carter[8] found fluid in the middle ear in 92 out of 100 consecutive children with conductive hearing loss of 20 decibels (db) or more. Armstrong[9] reported that secretory otitis media is the most common cause of hearing loss in children, and that four-fifths of these patients are under 8 years of age. Even slight degrees of residual deafness of about 15 db are likely to lead to backwardness in such basic subjects as English and arithmetic.[10] Accordingly, the early identification of children with school failure and the clarification of the causal factors are a major concern of the school health service.

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This survey was designed to collect data which would answer these questions:

1. What is the prevalence of hearing loss in grades 1 to 6 in Vancouver schools?
2. What proportion of cases of hearing loss in these children is due to secretory otitis media, and which tests are most useful to detect secretory otitis media in these children?
3. What is the relationship between atopy in a child, particularly nasal allergy, and secretory otitis media?

This paper describes the methodology of the survey, the results of the prevalence study and the frequency of secretory otitis media.

METHODS AND MATERIALS

1. *Planning the Study*

This study of the prevalence of hearing loss in the Vancouver school system was planned and executed by the Departments of Pediatrics and Preventive Medicine of the University of British Columbia and the Vancouver Health Department. After preliminary planning, the study was described to the medical and nursing staffs of the Vancouver Health Department, to the Vancouver School Board (who granted permission to proceed with the research), to the school principals involved, and to the medical profession by a letter in the *British Columbia Medical Journal.*

2. *The Study Population and Selection of the Sample Schools*

The children enrolled in the first to the sixth grades and in special classes in public elementary schools in Vancouver were eligible for inclusion in the study. In order to draw a 20% sample of the children, a cluster sample of 15 schools was selected, using a system of random numbers from 76 elementary schools in Vancouver as listed in the spring of 1965. There were 81 schools at the time the study was planned, but owing to a clerical oversight five schools, all annexes, were omitted from the study.

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3. *Study Procedure*

(a) *Selection of cases and controls in sample schools.*—Audiometric examination of all children in appropriate grades in the 15 study schools was done by the school audiometrist between September 13 and November 19, 1965, January 3 and February 9, 1966, and April 18 and 25, 1966. The three screening periods were chosen to ensure that the time interval between initial screening and subsequent examination by the research team did not exceed six weeks. The third period was also chosen, so that a group of children could be screened during the pollen season. Two trial runs to develop procedure were conducted in September 1965, and the study began on October 20, 1965.

The criterion for admission to the study was a hearing loss of 15 db or greater in one or both ears in an average of the five frequencies—250, 500, 1000, 2000 and 4000 cycles per second (c.p.s.). This initial screening test was done by the school audiometrist in a quiet room at the school, using a portable audiometer.* In the group of 6035 children screened, 212 children were discovered to have hearing loss.

The teacher and the school nurse selected a control child to match each child with a hearing loss. The children were matched for age within six months, sex, same classroom and grade, and the same number of siblings within one. Race was matched for Oriental but not American Indian children. In some instances, patients or controls changed schools between the screening and the examination by the research team, but they were followed up and included in the study. It was occasionally impossible to find a suitable control when a child was repeating a grade, and in such instances a control was found in another classroom.

A letter was sent to the parent of each child in the hard-of-hearing and control groups, explaining the study and requesting their permission to examine the child.

(b) *The school visit.*—The study team made once-weekly visits to the sample schools. The team included a pediatric allergist, an otologist, an audiometrist, a public health nurse and an interviewer. Prior communication between the public health nurse employed for the study and the school nurse facilitated the operation.

The pediatric allergist, the otologist and the audiometrist independently examined each child without access to the history and recorded their observations on precoded forms. The interviewer gave an allergy questionnaire to the mother (or to the homemaker if there was no mother) at the school, unless the mother was unable to attend, in which case a home visit was made during the same week. The audiometrist used a portable audiometer* and performed a pure-tone audiogram measuring five frequencies—250, 500, 1000, 2000 and 4000 c.p.s. Bone conduction was measured when air conduction was abnormal. The test was performed in the same room as the initial screening audiogram. The examinations by the pediatric allergist, together with the allergy questionnaire, will be described in a subsequent publication.

The study team examined hard-of-hearing children and controls on the same day and did not know which group a given child came from. In about half the children the examinations and questionnaires were completed on the same day. The maximum time period between examinations by various members of the team on any one patient was two weeks. At the end of the visit the school nurse provided a form with the names, division number and school of the patients and controls.

4. *Definitions*

Hearing loss.—A hearing loss was recorded if there was a loss of 15 db or more by air conduction, in an average of five frequencies (250, 500, 1000, 2000 and 4000 c.p.s.) in one or both ears. Bone conduction was tested when a hearing loss was found and the presence of an "air-bone gap" was recorded from a comparison of the results of air and bone conduction.

Secretory otitis media.—A diagnosis of secretory otitis media was made if the drum was abnormal on inspection (chalky or narrow malleus, pars tensa abnormally coloured or transparent), and if there was lack of movement or sluggish movement of the drum on pneumatic otoscopy. The Rinne test was performed after it was recorded whether or not secretory otitis media was present. The test was performed with the 512 c.p.s. tuning fork.

Socioeconomic index[11].—This was obtained for each census tract and was based on three characteristics: (a) Income—per cent of male labour force with wage and salary income of $6000 or more. (b) Occupation—per cent of male labour force in managerial or professional occupations. (c) Education—per cent of total population not attending school, 5 years of age and over, who have attended university.

*Maico MA 2.

*Phillips.

The ranks for the three characteristics were averaged and then this average was ranked in descending order.

Social areas[11].—This index is an attempt to relate social status to commitment to the family and child-rearing functions. Social status is based on: (a) Occupation—per cent of male labour force in managerial and professional occupations. (b) Education—per cent of total population not attending school, 5 years of age and over, who have attended university.

Family index is based on: (a) Fertility—number of children 0 to 4 years of age per 1000 females, 20 to 44 years of age. (b) Households —per cent of one-person households (rank inverted). The average rank for social status and family was calculated for 120 census tracts in Metropolitan Vancouver and then the average was ranked. The two series were then divided in two, the highest 60 ranks indicating a high order of social status or family, and the lowest 60 census tracts, a low order.

5. *Statistical Calculations*

Fifteen heterogeneous clusters out of 76 were chosen by a random sampling procedure; these comprised a varying number of grades and divisions within grades. The standard errors of the rates were therefore calculated by standard methods assuming that there was a constant number of elements in each cluster.

Certain factors, notably a measure of social class,[12] the ratio of people to rooms in each house, a history of earache in the past 12 months, a history of tonsillectomy and adenoidectomy and enuresis (if the child had wet his bed five times during the past month), were examined by a chi square test to see if the study group were significantly dissimilar from the control group selected mainly from classmates.

Sensitivity and specificity of the various audiometric tests were measured in relationship to secretory otitis media as found by the otologist. Sensitivity is defined as the proportion (in percentage) of cases of secretory otitis media in which the test in question was positive; specificity is the proportion of children found to be free of secretory otitis media in which the test in question was negative. False negatives, therefore, reduce sensitivity while false positives reduce specificity. Because the tests were done on the same child, the sensitivities and specificities are directly comparable.

TABLE I.—REPRESENTATIVENESS OF SAMPLE BY GRADE*

	Total enrolment	*Sample*	
		Enrolment	*% of total enrolment*
Grade 1	5605	1086	19.4
Grade 2	5129	984	19.2
Grade 3	4980	1016	20.4
Grade 4	5154	878	17.0
Grade 5	5063	983	19.4
Grade 6	5058	955	18.9
Special classes†	624	133	21.3
Total	31,613	6035	19.1

*Sampling frame—15 out of 76 schools.
†Comprising special classes for slow learners and special remedial classes.

RESULTS

1. *Representativeness of the Sample*

Five schools, all primary annexes, were omitted in error. Since the sample was drawn, the 1965-66 school term began and four additional schools were opened. As a result of the first oversight and the opening of the other schools, 1631 pupils are not included in the population which was sampled.

Despite these errors the sampling procedure is considered adequate according to the following information: (a) 15 of the 76 schools were actually selected for study, comprising 19.7% of those elementary schools in the Vancouver school system from which the sample was drawn; and (b) 6035 children were sampled in these 15 schools out of a total of 31,613 who were at risk of being sampled and thus 19.1% of the children were included in the sample (Table I). The representativeness of the sample by grade revealed some undersampling in the grade 4 population and slight oversampling of the special classes (Table I).

There were 212 children with hearing loss detected in the screening survey in the sample schools, but permission to further examine 10 was not granted. Accordingly, 202 cases and controls were included in the study. The comparison of the matching of cases and controls is shown in Table II, and there is no significant difference between cases and controls for the five parameters recorded. Although no effort was made to match for occupational class, there was no significant difference between the two groups (Table III).

2. *Response Rate of School Children*

Ten (4.7%) of 212 children with hearing loss did not co-operate in the survey; the grade and school of these 10 children are shown in Table IV. These children have been included in

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TABLE II.—COMPARISON OF MATCHING OF CASES WITH HEARING LOSS AS DEFINED AND CONTROLS*

	Cases		Controls	
	No.	*%*	*No.*	*%*
Total	202	100.0†	202	100.0†
Sex				
Male	114	56.4	114	56.4
Female	88	43.6	88	43.6
Grade				
1	44	21.8	42	20.8
2	33	16.3	32	15.8
3	31	15.3	30	14.9
4	38	18.8	37	18.3
5	26	12.9	25	12.4
6	23	11.4	26	12.9
7	0	0.0	3	1.5
Special	7	3.5	7	3.5
Number of preschool siblings				
0	122	60.4	113	55.9
1	47	23.3	59	29.2
2	29	14.4	27	13.4
3	3	1.6	3	1.5
4	1	0.5	0	0.0
Number of school-age siblings				
0	30	14.9	26	12.9
1	74	36.6	85	42.1
2	60	29.7	51	25.3
3	20	9.9	27	13.4
4	10	5.0	9	4.5
5	3	1.5	3	1.5
6	5	2.5	1	0.5
Race				
White	179	88.6	189	93.6
American Indian	4	2.0	0	0.0
Oriental	13	6.4	10	5.0
Other	5	2.5	1	0.5
Unknown	1	0.5	2	1.0

*Excluding 10 children who did not co-operate in the survey (see Table IV).

†Percentages do not always add exactly to 100% because of rounding errors.

the measurement of the prevalence of hearing loss, but they were not seen by any member of the study team and hence were excluded from other parts of the study. The tympanic membranes of 38 children were not visualized by the otologist and, while these children were included in the prevalence study, they were excluded from the secretory otitis media study. Most of these children had severely impacted cerumen that could not be removed easily with a curette.

TABLE III.—COMPARISON OF MATCHING OF CASES WITH HEARING LOSS AS DEFINED AND CONTROLS

	Cases		Controls		Total	
	No.	*%*	*No.*	*%*	*No.*	*%*
Occupational class[12]						
Unknown	—		1	.5	1	.2
Upper 1	10	5.0	7	3.5	17	4.2
2	28	13.9	45	22.3	73	18.1
Middle 3	15	7.4	11	5.4	26	6.4
4	17	8.4	22	10.9	39	9.7
5	54	26.7	57	28.2	111	27.5
Lower 6	33	16.3	26	12.9	59	14.6
7	45	22.3	33	16.3	78	19.3
Total	202	100.0	202	100.0	404	100.0

χ^2 (6) = 8.50. Not significant.

TABLE IV.—NON-COOPERATION IN SURVEY

School	*Grade*	*No.*
A	2	1
B	3	1
C	2	1
H	6	1
I	5	1
K	3	1
	4	1
M	1	1
	4	1
N	Sp.*	1

*Special class.

No attempt was made to remove this as it was felt to be beyond the permission granted by the parents.

3. *Prevalence of Hearing Loss*

The rates of hearing loss as defined in an average of five frequencies when tested by the school audiometrist are given with their standard errors by class in Table V. The highest rate of hearing loss is found for special classes. High rates are also found for grades 1 and 4 children.

TABLE V.—PREVALENCE OF HEARING LOSS IN GRADES 1 TO 6 IN VANCOUVER SCHOOLS

	*Rate of hearing loss** % ± *S.E.*
Total hearing loss on 1 test	3.51 ± 0.35
Grade 1	4.14 ± 0.51
Grade 2	3.56 ± 0.81
Grade 3	3.25 ± 0.82
Grade 4	4.56 ± 0.69
Grade 5	2.75 ± 0.64
Grade 6	2.51 ± 0.68
Special classes	6.02 ± 1.61
Total hearing loss on 2 tests†	2.18 ± 0.27

*15-decibels hearing loss in the average of five frequencies, tested by the school audiometrist.

†Second test administered by the study audiometrist. Adjustments made for the 10 non-cooperating children in the same proportions.

The prevalence of hearing loss in the sample schools tends to fall as the children proceed through their schooling (Table VI). The rate of hearing loss varies by grade, and hence it is necessary to take account of the different distributions by grade in order to make direct comparisons between one school and another. Schools which have a value greater than 100% have a grade standardized prevalence of hearing loss greater than that of the average for the 15 schools, and the schools with a value less than 100% have a lower prevalence of hearing loss than average. The geographic variation in the prevalence of hearing loss in different schools can be seen by comparing Table VI and Fig. 1.

TABLE VI.—PREVALENCE OF HEARING LOSS IN THE SAMPLE SCHOOLS ARRANGED IN ORDER OF DESCENDING STANDARDIZED RATIO

School	Enrolment	Hearing loss*			
		Cases†	Non-cooperative	Crude rate‡	Grade standardized ratio§
A	379	23	1	6.33	182
B	409	22	1	4.56	165
C	719	33	1	4.73	135
D	264	11		4.17	114
E	388	14		3.61	100
F	682	23		3.37	94
G	492	15		3.05	91
H	560	16	1	3.04	85
I	572	15	1	2.80	82
J	390	11		2.82	80
K	289	5	2	2.42	70
L	119	3		2.52	64
M	413	7	2	2.18	63
N	290	4	1	1.72	48
O	69	0		0.00	—
Totals	6035	202	10	3.51	100

*15-decibels hearing loss in the average of five frequencies, tested by the school audiometrist.
†Co-operative cases; an equal number of controls was selected for the study of secretory otitis media.
‡All children with hearing loss (cases and non-cooperative children) included.
§Standardized by the indirect method of the grade-specific rate of hearing loss for the total 15 schools. Ratio is expressed in percentage. No ratio can be determined for school O as no children with hearing loss were detected.

There is a trend for the high rates to be concentrated in the northeast part of Vancouver.

The socioeconomic and social area indices for the census tracts in Vancouver and the distribution of the study schools are related in Figs. 1 and 2. With one exception, the schools with the higher prevalence of hearing loss are located in areas with below-average socioeconomic indices. The indices of social areas again emphasize the relationship of prevalence and social status, and show that schools with high prevalence rates are concentrated in tracts with low family indices.

Comparison was made of other variables in the case and control groups, and these are shown in Table VII. There was a highly significant difference in the occurrence of earache in the past 12 months in the cases compared with controls. There was no difference in the frequency of tonsillectomy and adenoidectomy or enuresis in the two groups of children, and the household resident density of the two groups did not vary when arranged in quartiles.

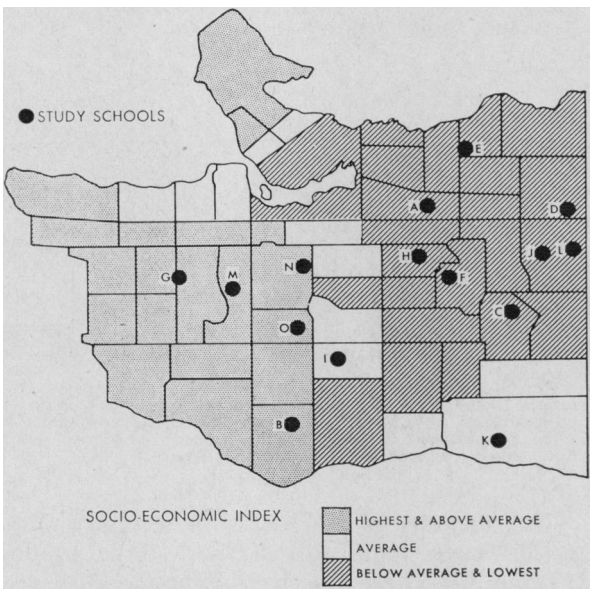

Fig. 1.—Map of Vancouver showing distribution of study schools and socioeconomic characteristics of census tracts. (Adapted from Bell.[11])

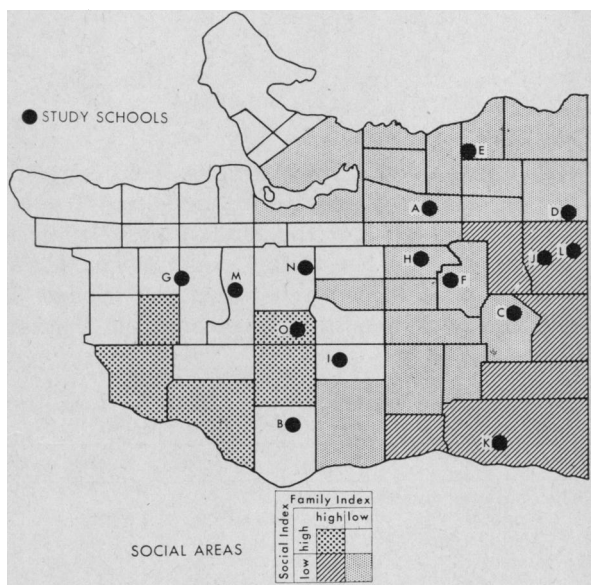

Fig. 2.—Map of Vancouver showing study schools and social areas. (Adapted from Bell.[11])

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TABLE VII.—COMPARISON OF FOUR VARIABLES IN CASES OF HEARING LOSS AS DEFINED AND CONTROLS

	Cases		*Controls*		*Total*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Total	202	100.0	202	100.0	404	100.0
1. Earache in past 12 months						
Yes	106	52.5	67	33.1	173	42.8
No	90	44.6	127	62.9	217	53.7
Unkown	6	2.9	8	4.0	14	3.5
$\chi^2_{(1)} = 15$ $p < .001$						
2. Tonsillectomy with adenoidectomy						
Yes	93	46.0	87	43.1	180	44.6
No	105	52.0	111	54.9	216	53.4
Unknown	4	2.0	4	2.0	8	2.0
$\chi^2_{(1)} = .36$. Not significant.						
3. Enuresis						
Yes	18	8.9	11	5.4	29	7.2
No	159	78.7	164	81.2	323	79.9
Unknown	25	12.4	27	13.4	52	12.9
$\chi^2_{(1)} = 1.85$. Not significant.						
4. No. of people						
No. of rooms						
.38 - .88	51	25.6	52	26.3	103	25.9
.89 - 1.14	46	23.1	51	25.8	97	24.4
1.17 - 1.33	51	25.6	49	24.7	100	25.2
1.40 - 2.67	51	25.6	46	23.2	97	24.4
Total	199*	99.9	198*	100.0	397*	99.9

*7—information not recorded.
$\chi^2_{(3)} = .58$. Not significant.

4. *Consistency of Hearing Loss*

The prevalence of hearing loss at two consecutive audiometric examinations—initial screening and subsequently at the school visit of the research team—is noted in Table V. Adjustments have been made in this table for the 10 non-cooperating children. The consistency of hearing loss by grade for the 202 children tested twice is shown in Table VIII. No striking trend is noted, but the least consistent results are seen in Grades 1 and 4, which had the highest prevalence of hearing loss on the initial examination. There was no sex difference between the groups of children with consistent or inconsistent hearing loss. Consistent hearing loss was least common in occupational class 1 and most common in class 3 (Table IX).

TABLE VIII.—CONSISTENCY OF HEARING LOSS IN TWO CONSECUTIVE AUDIOMETRIC EXAMINATIONS IN STUDY CASES

	Consistent	*Total*	*% consistent*
Grade 1	23	44	52.2
" 2	23	33	65.1
" 3	19	31	61.2
" 4	18	38	47.3
" 5	23	26	88.4
" 6	14	23	62.1
Special class	6	7	85.7
Total	126	202	

TABLE IX.—CONSISTENCY OF HEARING LOSS AND OCCUPATIONAL CLASS IN STUDY CASES

	Consistent	*Total*	*% consistent*
Occupational class[12]			
Upper*	18	38	47.3
Middle	53	86	61.6
Lower	55	78	70.5
Total	126	202	

*See Table III.

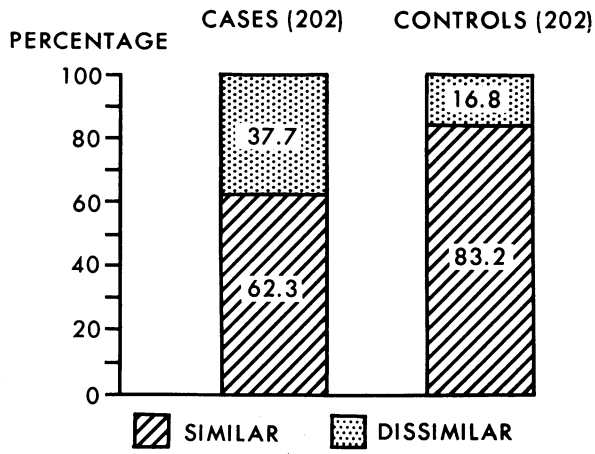

Fig. 3.—The frequency of similarity of results of two audiograms in cases with hearing loss and in controls.

The similarity of two consecutive audiograms in the cases and control groups is seen in Fig. 3. There is not only a decrease of about one-third of the number of cases with hearing loss at the second audiometric examination, but also the appearance of hearing loss in about one-sixth of the controls.

5. *Frequency of Secretory Otitis Media in Cases and Controls*

The frequency of secretory otitis media in the two subgroups of cases and controls is seen in Fig. 4. It is about equal in frequency in the two subgroups of cases and twice as frequent in the control subgroup in which hearing loss was detected at the second examination.

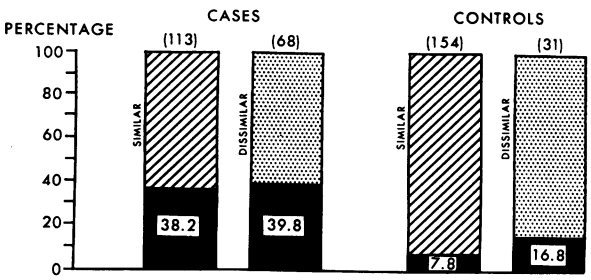

Fig. 4.—The frequency of occurrence of secretory otitis media (solid shading) in cases of hearing loss and controls with similar and dissimilar results on repeat audiograms. (The 38 children in whom the tympanic membrane was not seen have been excluded in this figure.)

The majority of children with secretory otitis media were found in the first three grades (Table X). There was no significant difference for sex, race or occupational class in the cases and control groups.

TABLE X.—COMPARISON OF SIMILARITY OF TWO AUDIOMETRIC EXAMINATIONS IN CASES AND CONTROLS AND FREQUENCY OF SECRETORY OTITIS MEDIA

	Cases						*Controls*					
	Similar			*Dissimilar*			*Similar*			*Dissimilar*		
	S.O.M.†	*No S.O.M.*	*Unknown**	*S.O.M.*	*No S.O.M.*	*Unknown**	*S.O.M.*	*No S.O.M.*	*Unknown**	*S.O.M.*	*No S.O.M.*	*Unknown**
Grade 1	13	6	4	9	9	3	2	27	4	3	5	1
2	11	8	4	3	6	1	4	19	5		3	1
3	9	9	1	5	6	1	1	22	1	1	5	
4	3	13	2	4	14	2	1	26	1	1	8	
5	4	19		2		1	1	18	2	1	2	1
6	4	9	1	2	7		2	23			1	
7								2			1	
Special‡	1	4	1	1			1	5	1			
Total	45	68	13	26	42	8	12	142	14	6	25	3

*There were 38 children in whom it was impossible to visualize the tympanic membrane.
†S.O.M. = secretory otitis media.
‡Comprising special classes for slow learners and special remedial classes.

6. *The Value of Various Tests in Diagnosis of Secretory Otitis Media*

The sensitivity and specificity of four tests administered by the study team in the diagnosis of secretory otitis media are shown in Table XI. The results indicate that the sensitivities of all of the tests are very low, and the Rinne test and 15-db hearing loss by air conduction in two consecutive frequencies are the most sensitive tests. The air-bone gap has a very low sensitivity rating. The most specific tests are the Rinne test and the air-bone gap.

The relationship between these tests and visible otological abnormality, including both secretory otitis media and other abnormalities of external or middle ear, is such that the sensitivity is reduced while the specificity is increased. Thus the inclusion of all visible otological abnormalities reduced the number of false positive results.

The audiometric testing for 15-db hearing loss by air conduction in two consecutive frequencies proved to be the most sensitive audiometric indicator of secretory otitis media and visible otological abnormality. The high specificity of the air-bone gap and Rinne test demonstrates the value of including one or both tests in the study of these children.

DISCUSSION

The present study in a probability sample has shown that the prevalence rate of hearing loss in Vancouver schools is similar to other reported figures,[4, 13] and that the rate decreases as the children move through primary school, with the exception of grade 4. Repeat audiometric testing four to six weeks after the screening test showed that the hearing loss was consistent in over 60% of the children, and the number of children with consistent losses increased by grade, again with the exception of grade 4. The reliability of the response of young children to audiometric screening is hard to judge. The location where the audiometric testing was done often left much to be desired and influenced the reliability of responses. In particular, bone conduction tests are of little value if not done in a low-sound-level room. The highly signifi-

TABLE XI.—THE SENSITIVITY AND SPECIFICITY OF CERTAIN HEARING TESTS FOR SECRETORY OTITIS MEDIA AND OTHER CONDITIONS. BASED UPON 366 CHILDREN*

	Secretory otitis media†		*Visible otologic abnormalities*‡	
	Sensitivity (%)	*Specificity* (%)	*Sensitivity* (%)	*Specificity* (%)
1. 15-db hearing loss by air conduction in an average of five frequencies§	57.3	66.4	55.2	74.2
2. 15-db hearing loss by air conduction in two consecutive frequencies	66.3	50.2	65.1	54.4
3. "Air-bone gap" in all frequencies	32.6	93.5	23.4	96.2
4. Rinne's test	67.4	97.5	62.4	100.0

*As noted in at least one ear.
†As defined.
‡"Yes" recorded by the otologist to either of two questions:
"Is there a secretory otitis media?" and "Are other abnormalities noted in the ears?"
§250, 500, 1000, 2000 and 4000.

cant finding of earache in the children with hearing loss compared with the control group is an important indicator of ear pathology, but factors other than hearing loss may be involved in the recorded audiometric response. The higher prevalence rate in the lower grades and the trend to increasingly consistent responses in older children suggest that the results may be influenced by the child's comprehension. However, a relationship between consistent hearing loss and social class has been noted, with higher consistency in the lower social classes. The meaning of this is obscure.

There is geographic variation in rate of hearing loss throughout Vancouver, and a relationship between prevalence of hearing loss and socioeconomic characteristics is seen. Further study of social areas indicates that high prevalence rates are correlated with low child-rearing family functioning. This supports the finding that the household resident density (number of people/number of rooms) is similar in cases and control groups, and argues that infection is not a major factor in the cause of hearing loss in the study children.

It appears that secretory otitis media is an important single cause of hearing loss in the primary school child, and our finding of 89 cases in 366 children at risk is certainly a minimal estimate. In the Pittsburgh elementary public school study,[14] 3% of the study population had otoscopic findings of acute and chronic ear disease, and chronic serous otitis media was the commonest single entity.

The finding of secretory otitis media in children without hearing loss in the case study group at the second examination can be interpreted as a sign of improvement. Other cases of resolving secretory otitis media were observed by the otologist in this group, but the diagnosis was not recorded unless three signs were present. The finding of secretory otitis media in the control group, in some children without hearing loss and more often in others with hearing loss, was unexpected but may also be related to early or resolving secretory otitis media.

The present study indicates that secretory otitis media is commonest in the younger school child in grades 1 to 3 and that it may be the most important cause of hearing loss in primary grades. The relationship between consistent hearing loss and social class and the lack of such relationship for social class and secretory otitis media suggest that other otological lesions contribute to hearing loss. Other diseases of the middle ear—particularly chronic purulent otitis media—are likely causes.

A useful screening test is one in which there are as few false negatives as possible—high sensitivity is more important than specificity. Thus a 15-db hearing loss by air conduction in two consecutive frequencies proved to be the most sensitive indicator of secretory otitis media, and of any otological abnormality. This test also proved to be the least specific, and hence reexamination should include a test of high specificity, either the air-bone gap or the Rinne test in this situation.

In the Pittsburg elementary public school study[15] it was concluded that in addition to failing an audiometric screening procedure, some other means is needed to identify children needing special otological and audiological attention. It was suggested that a history of earache and ear discharge, together with otoscopic signs of prior infection, was of value in detecting the children who required special attention. The findings in the present study support this conclusion. It is clear that physicians, and particularly school physicians, must become expert at recognizing the appearance of the tympanic membrane in secretory otitis media and in the performance of pneumatic otoscopy. The Rinne test is simple to perform and requires no expensive equipment or special setting, and also would be a valuable tool for the school physician.

The change in the morbidity pattern of children has necessitated revision of school health procedures. Benson and Beattie[16] reviewed new approaches to school health programs and concluded that "The more fruitful procedures of vision and hearing screening, health counselling, the teacher-nurse conference and home visiting, if used to replace anachronistic routines will serve to utilize nursing time effectively." The results of this survey strongly support this emphasis upon the importance of hearing screening of school children.

Summary The prevalence rate of hearing loss (15 decibels or more by air conduction in one or both ears in an average of five frequencies) was studied in a probability sample in grades 1 to 6 in Vancouver schools, and was found to be 3.5% ± 0.35. Details of the method of the study are described; the representativeness of the sample and the response rate were good. The prevalence rate was highest in the lower grades and varied with the location of the school in the city. Further relationship was shown between high prevalence rates and socioeconomic characteristics and low child-rearing family functioning. Compared with a control group, there was a highly significant difference in the occurrence of earache in the preceding 12 months in children with hearing loss.

Secretory otitis media was an important cause of hearing loss and may have replaced purulent otitis media as the most important cause of hearing loss in the primary grades in urban schools. The value of tests to detect serous otitis media is discussed. Air conduction in two consecutive frequencies proved to be the most useful screening test for secretory otitis media and the Rinne test was shown to have high specificity for this diagnosis.

Résumé Le taux d'apparition de la perte de l'ouïe (15 décibels ou plus par conduction d'air dans une oreille ou les deux, à cinq fréquences différentes en moyenne) a été évalué sur un échantillon d'écoliers de Vancouver, de la 1ère à la 6ème année. On a trouvé un pourcentage de 3.5% ± 0.35. L'article expose en détail la méthode de travail: le caractère représentatif de l'échantillon choisi et les réactions des sujets ont été considérés comme bons. Le taux de fréquence de la déficience a été maximum chez les élèves des classes inférieures et variait selon la localisation de l'école dans la ville. On a également trouvé une relation de cause à effet entre les pourcentages d'apparition et les conditions socio-économiques et les conditions prévalant dans les familles qui élevaient mal leurs enfants. Par rapport à un groupe témoin, on a noté une différence très importante au point de vue de l'apparition de maux d'oreilles durant les 12 mois précédents chez les enfants en train de perdre l'ouïe.

L'otite moyenne sécrétoire a été une cause primordiale de la perte de l'ouïe et peut même avoir pris le pas sur la forme purulente comme cause capitale de la perte de l'ouïe chez les plus jeunes écoliers des écoles urbaines. Les auteurs étudient la valeur des épreuves diagnostiques de l'otite moyenne séreuse. La conduction d'air, à deux fréquences consécutives, s'est révélée comme le test le plus utile pour dépister l'otite moyenne sécrétoire, et le test de Rinne a été considéré comme ayant la meilleure spécificité pour ce diagnostic.

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