ORAL HEALTH KNOWLEDGE AND TOOTHBRUSHING AMONG NORTH YORK SCHOOL CHILDREN

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INTRODUCTION

At the beginning of the 1992/93 school year the Community Dental Services Division (CDS) of the North York Public Health Department changed the mode of delivery of its dental health education program from a universal to a targeted approach. That is, education is only provided to the children with the greatest need as identified by their oral health status. In order to establish a baseline for the monitoring of the impact of this change on the oral health knowledge and the dental habits of elementary school children in the City of North York, Community Dental Health Services Research Unit (CDHSRU) conducted a survey in the fall of 1992. This survey concerned the knowledge about risk factors and methods of prevention of dental diseases, as well as the frequency of toothbrushing in this population.

METHODOLOGY

Data collection procedure

The study population was all students from grade 4 to grade 8 in all public, separate and private elementary schools in the City of North York (N~35,000). The survey was conducted between November 2, 1992 and January 2, 1993.

The questionnaire (Appendix A) was designed to collect information on oral health knowledge and frequency of toothbrushing. The nine (9) knowledge items were selected from the existing instrument[1] and modified to meet the program's educational objectives. They concerned the risk factors and methods of prevention of tooth decay and periodontal disease. The items were either questions or statements with multiple choice responses. "I don't know" was one of the response options, included to preclude the guessing of correct responses.

Dental educators employed by CDS were responsible for the data collection within their assigned service delivery regions. In order to standardize the procedure across the regions, the educators attended a calibration workshop shortly before the

administration of the survey.

The questionnaires were distributed in the school classrooms during regular school hours at a time convenient for the school staff. Teachers were asked to identify students for whom English was second language (ESL), in a space provided on a questionnaire. Students were responsible for completing the rest of the questionnaire including the name of the school and their grade. They were encouraged to answer the questions themselves and instructed to choose the answer "I don't know" when they were either undecided or did not understand the question. The educators supervised the completion of the questionnaire.

Returned questionnaires were reviewed, edited and entered into the computer using Epi-Info (V5) software. The data were analyzed using the Statistical Package for the Social Sciences (SPSS/PC+).

Data processing and analysis

This report presents findings in terms of descriptive and bivariate analysis. For the purpose of the analysis, the responses to the nine questions measuring oral health knowledge were collapsed into "correct" and "incorrect" categories (Table 1). The "I don't know" response was considered as being incorrect. The sum of correct answers, ranging from 0 to 9, represented the knowledge score for each participant. This composite measure was collapsed into three categories of "low", "medium" and "high" knowledge scores. The low knowledge score respondents were those with 3 or less correct answers, medium had 4 to 6 correct responses, while the high knowledge group was represented by students who scored 7 or more correct responses. Responses to the question measuring frequency of toothbrushing were classified into two categories, based on current teaching of minimum of once a day as acceptable (Table 2).

Descriptive statistics included: (1) the percentage of correct responses to the individual questionnaire items, and (2) the analysis of the knowledge score in terms

of frequencies and measures of central tendency.

Data were analyzed by ESL status, grade and six planning areas in the City of North York. Students were assigned to the areas by the location of the schools they attended.

Both, the Chi-square and the T-test were used to identify significant differences, according to the measurement characteristics of the data. Significance testing used an *alpha(α)* of 0.01 or less.

Table 1. List of correct responses to questionnaire items concerning the prevention of tooth decay and periodontal disease

Question	Correct Response
What does fluoride do?	It helps protect teeth from decay
Which snack food is best for the teeth?	1. Popcorn or 2. Nuts or 3. Cheese
The best time to eat foods containing sugar is?	At meal times
What is plaque?	A layer of germs on the teeth
What combines with plaque to form an acid which causes cavities?	Sugar
Blood on your toothbrush may be sign of ...	Gum disease
The best way to keep from getting gum disease is to ...	Clean your teeth every day by brushing and flossing
Plaque should be removed ...	At least once a day
When is the best time to brush your teeth?	Before you go to sleep

**Table 2. Classification of frequency of toothbrushing
by responses to questionnaire item**

Frequency of toothbrushing	Response
Low	Not every day but at least once a week
High	1. Once a day 2. Twice a day 3. Three or more times a day

RESULTS

A total of 25,974 completed questionnaires were returned by students. Of these, 332 were not considered for the analysis because the respondents had been classified as 'learning disabled' by their teachers. Of the remaining 25,642 questionnaires, 6.7% (n=1,730) were completed by students who had been identified as ESL, and 93.3% (n=23,912) by those who had not been designated as ESL students. Data were analyzed for the group as a whole, and according to the ESL status.

Knowledge about caries and periodontal prevention
Percent responses

Table 3 presents the percent of ESL and non-ESL students who answered to the questionnaire items correctly.

Table 3. Proportion of the students responding correctly to the questions items for the total group and according to the ESL status

Question	Percent response		
	ESL	Non-ESL	Total
1. What does fluoride do?	49.4	72.6	71.1
2. Which snack food is the best for the teeth?	63.1	73.5	72.3
3. The best time to eat food containing sugar is?	39.4	40.4	40.3
4. What is plaque?	42.5	79.1	76.8
5. What combines with plaque to form an acid which causes cavities?	41.4	57.0	56.0
6. Blood on your toothbrush may be a sign of?	43.1	67.8	66.3
7. The best way to keep from getting gum disease is to?	77.5	90.2	89.4
8. Plaque should be removed...?	32.2	58.2	56.0
9. When is the best time to brush your teeth?	20.8	16.8	17.1

Question 1 - Two thirds (71.1%) of the students knew the role of fluorides in preventing tooth decay. ESL students appeared to have less appreciation of the effect of fluoride since only half (49.7%) of them responded correctly, compared to 72.6% of non-ESL students.

Question 2 - 72.3% of respondents knew that avoidance of sweet snacks would help to prevent dental decay. The difference between ESL and non-ESL students was not substantial: 61.3% and 73.5% respectively responded to this knowledge item correctly.

Question 3 - Only two fifths (40.3%) of the students were aware that the best

time to eat foods containing sugar was at meal times. ESL and non-ESL children were equally likely to give the correct answer.

Question 4 - Three quarters (76.8%) of the respondents knew what plaque was. The proportion of non-ESL students (79.1%) who responded correctly to this knowledge item was almost double than the percentage in the ESL group (42.5%).

Question 5 - Slightly more than one half of the students (56.0%) recognized that the presence of carbohydrates and plaque was necessary for the occurrence of dental decay. Non-ESL students were more likely to give correct answer (57.0%) than their ESL counterparts (41.4%).

Question 6 - Overall two thirds of the students (66.3%) recognized gum disease as the cause of bleeding while brushing their teeth. ESL students were less likely to respond correctly (43.1%) than non-ESL participants (67.8%).

Question 7 - When asked about prevention of gum disease, the majority (89.4%) of the students recognized the importance of every day brushing and flossing. The proportion of ESL respondents who identified this factor (77.5%) was lower than the proportion of non-ESL students (90.2%).

Question 8 - A very low proportion of the students (56.0%) were aware that plaque should be removed at least once a day. Only one third (32.2%) of the ESL group and three fifths (58.2%) of non-ESL students answered this item correctly.

Question 9 - Only 17.1% of the students knew that the best time to brush teeth is before going to sleep. The proportion of the students responding correctly to this question was slightly higher among ESL (20.8%) than non-ESL (16.8%) students.

The relationship between the school grade and the percent
of correct responses

For the majority of questions, the proportion of students responding correctly to the knowledge items was positively related to the school grade. The exception was for the questions :"Which snack food is best for the teeth?" and "When is the best time to brush your teeth?", where the percentage of correct responses appeared to be independent of, and inversely related to the grade, respectively (Figure 1 and Figure 2). The likelihood of giving correct answers increased substantially from grade four to grade six. However, the increments between grades six and seven, and seven and eight were very small, except for the question concerning the role of fluorides and the origin of blood on toothbrush, where the likelihood of giving the correct response continued to increase through the grade eight.

Figure 1
Proportion of the Students Responding Correctly
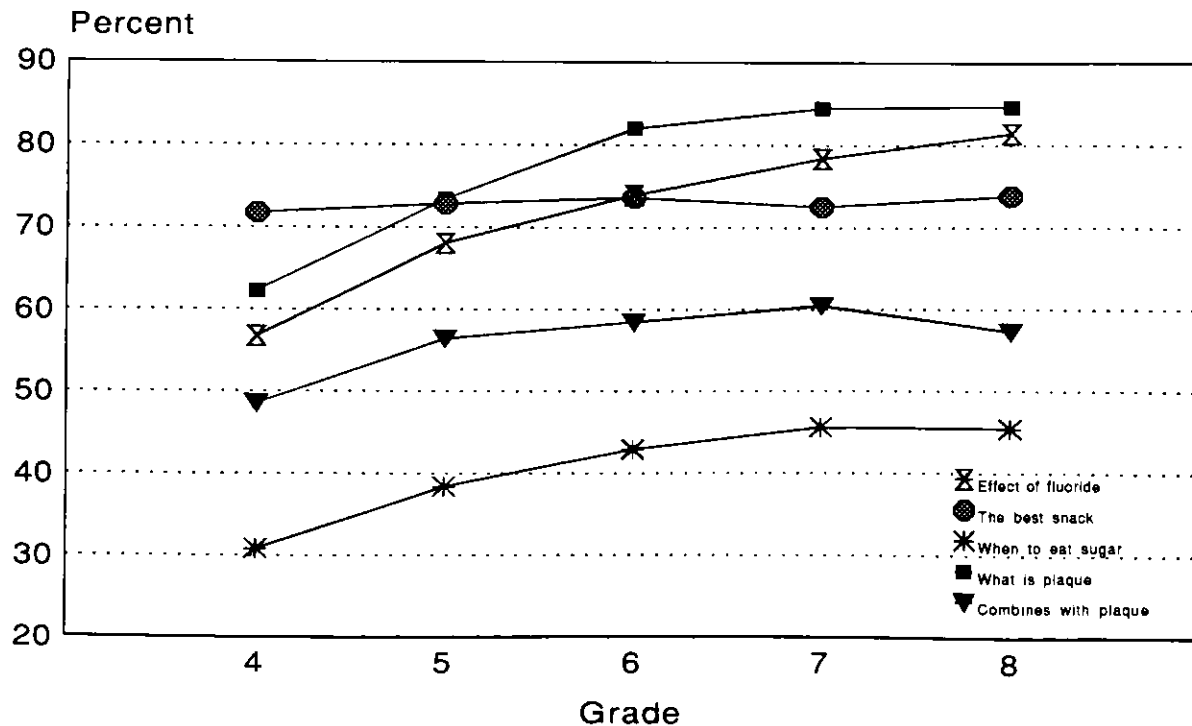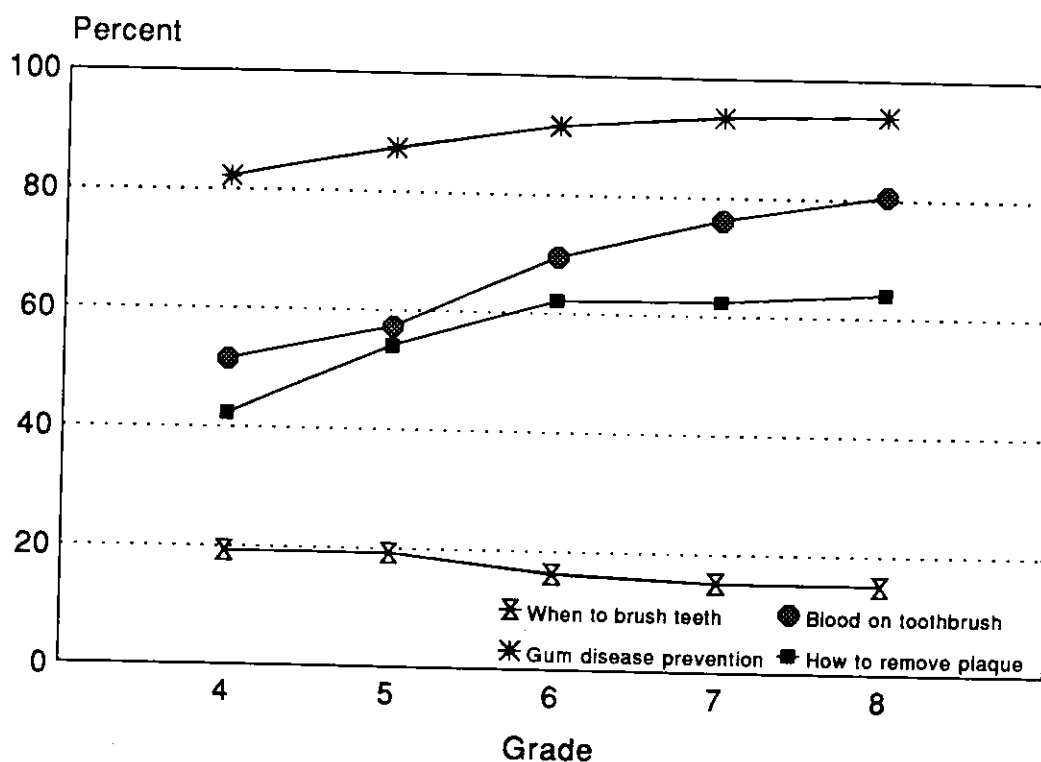## to the Questions No.1,2,3,4,5 by Grade

Figure 2
Proportion of the Students Responding Correctly
to the Questions No.6,7,8,9 by Grade

When we examine the effect of grade on the proportion of correct responses according to ESL status, we find that the responses of ESL students do not fit the pattern described above (Figure 3 and Figure 4). In particular, the percentage of ESL students answering the question: "What does fluoride do?" varied from grade four to grade eight, and a similar variation was observed for the question "What combines with plaque to form acid which causes cavities?".

The proportions of non-ESL students responding correctly to the knowledge questions are presented in Figure 5 and Figure 6.

Figure 3
Proportion of ESL Students Responding Correctly
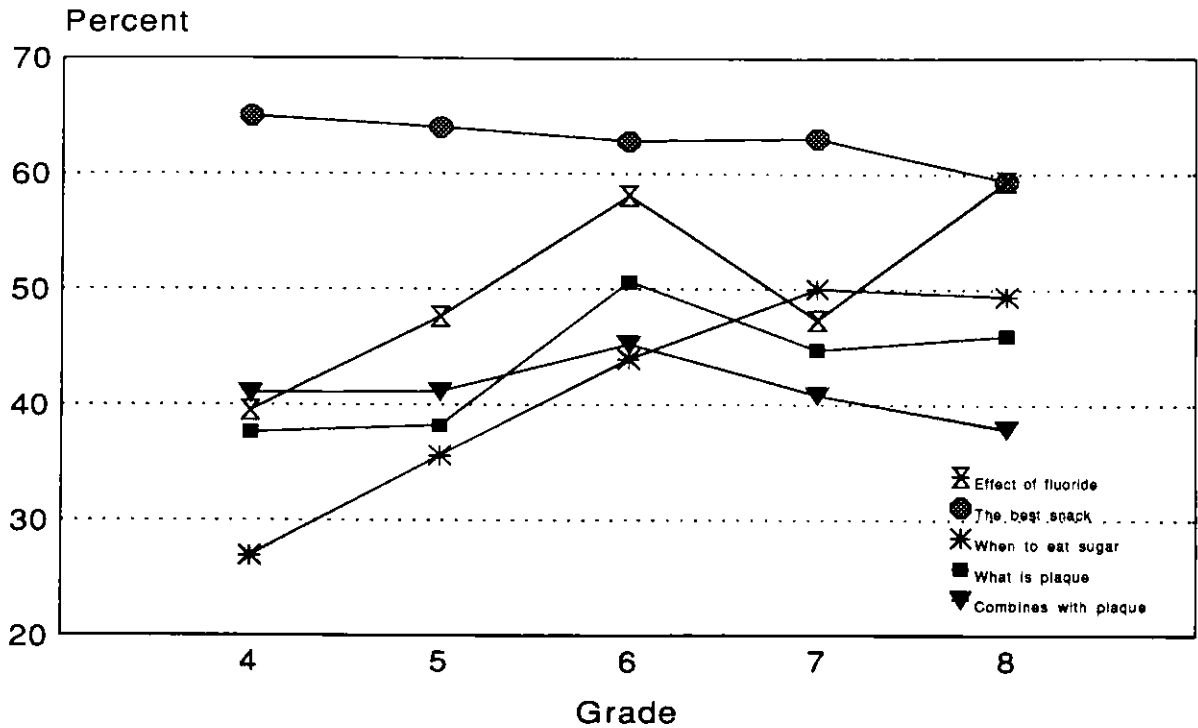## to the Questions No.1,2,3,4,5 by Grade

Figure 4
Proportion of ESL Students Responding Correctly
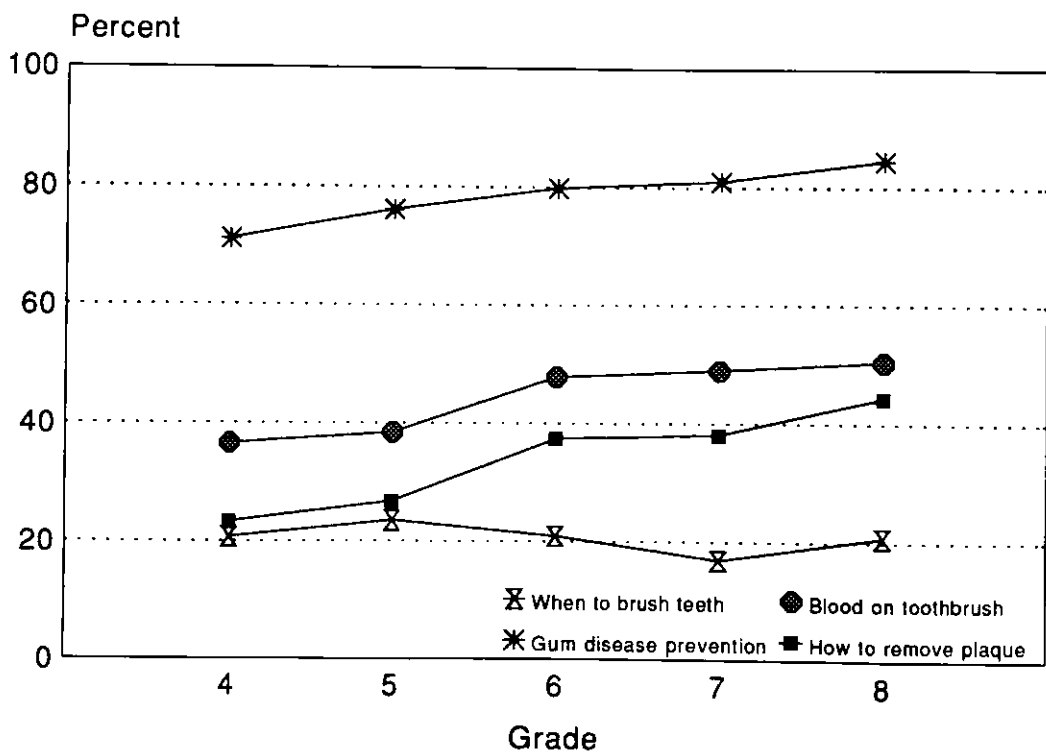## to the Questions No.6,7,8,9 by Grade

Figure 5
Proportion of Non-ESL Students Responding Correctly
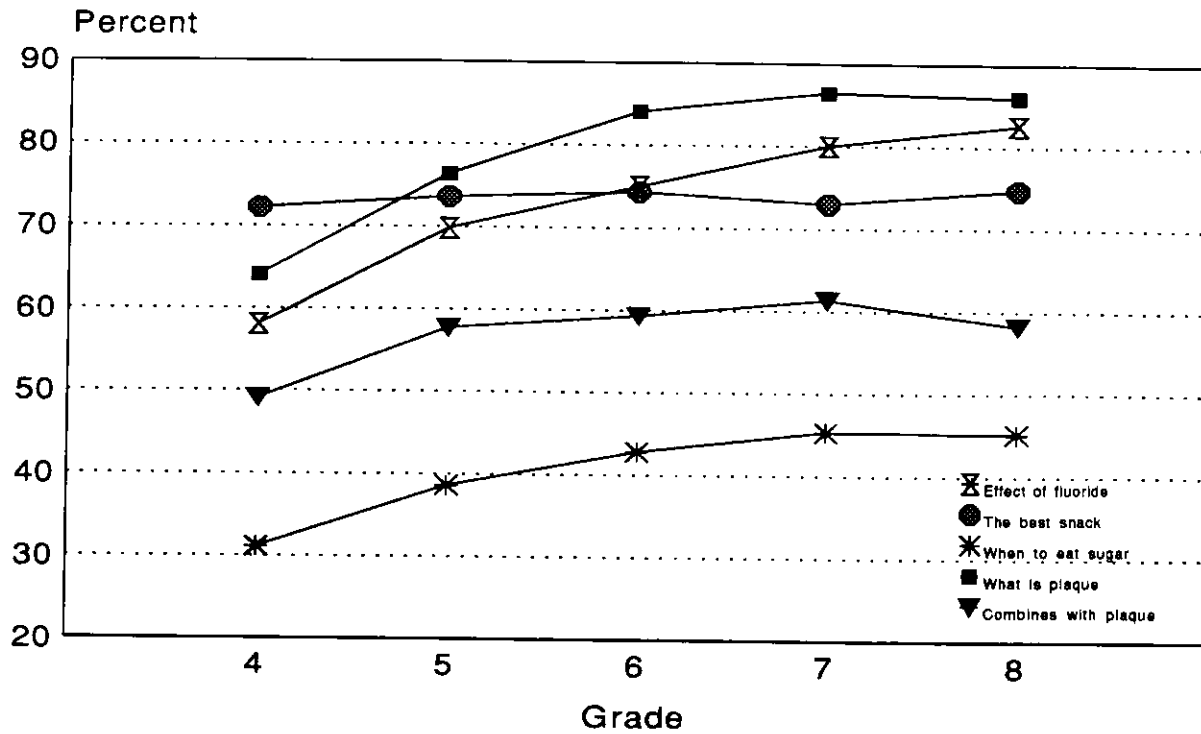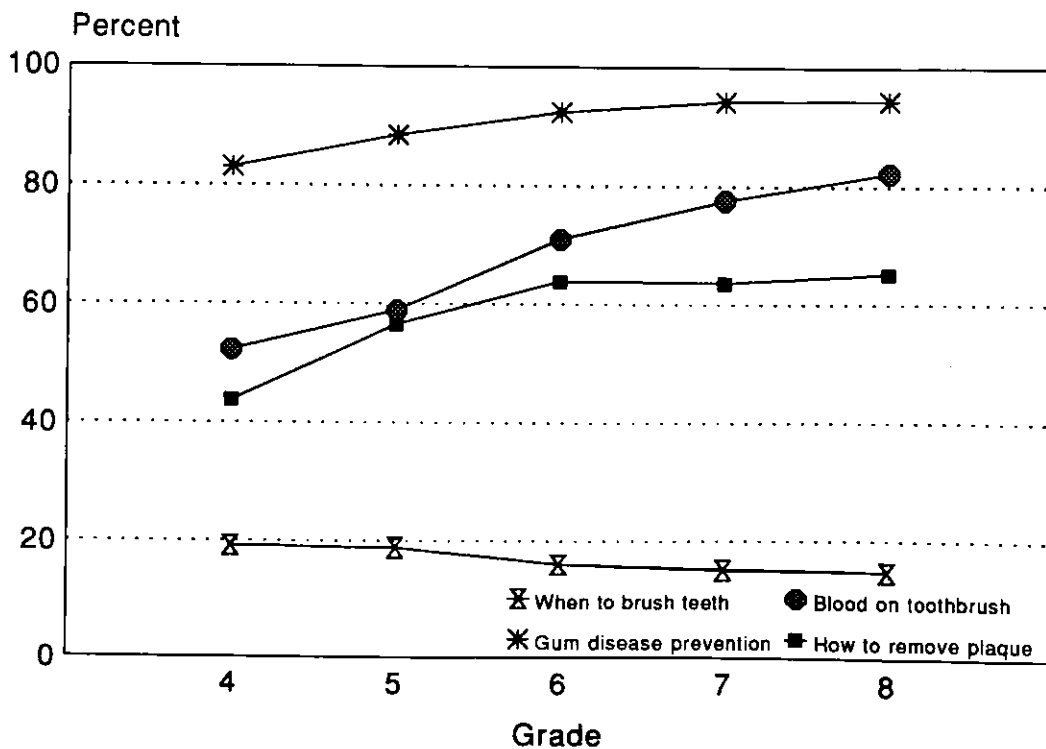## to the Questions No.1,2,3,4,5 by Grade

Figure 6
Proportion of Non-ESL Students Responding Correctly
## to the Questions No.6,7,8,9 by Grade

Knowledge score

Average knowledge score

On average students gave 5.4±1.7 correct answers to the nine knowledge questions. The average knowledge score among ESL students was 3.8±2.0, while non-ESL students scored 6.2±1.7. The difference was statistically significant (t-test, p<0.001).

The mean knowledge score was directly proportional to the school grade, overall and in each study subgroup (Figure 7). Among non-ESL students it increased from 4.7 in grade four to 6.0 in grade eight, while ESL students on average had 3.4 and 4.2 correct responses in these two school grades. The major increment in the knowledge score was observed between grades four and six for both ESL and non-ESL students. The differences between grades six, seven and eight were very small.

The mean knowledge score was significantly lower in the ESL than non-ESL group in each school grade (t-test, p<0.001).

Figure 7
Average Knowledge Score (0-9) by Grade
ESL and non-ESL group

Mean knowledge score
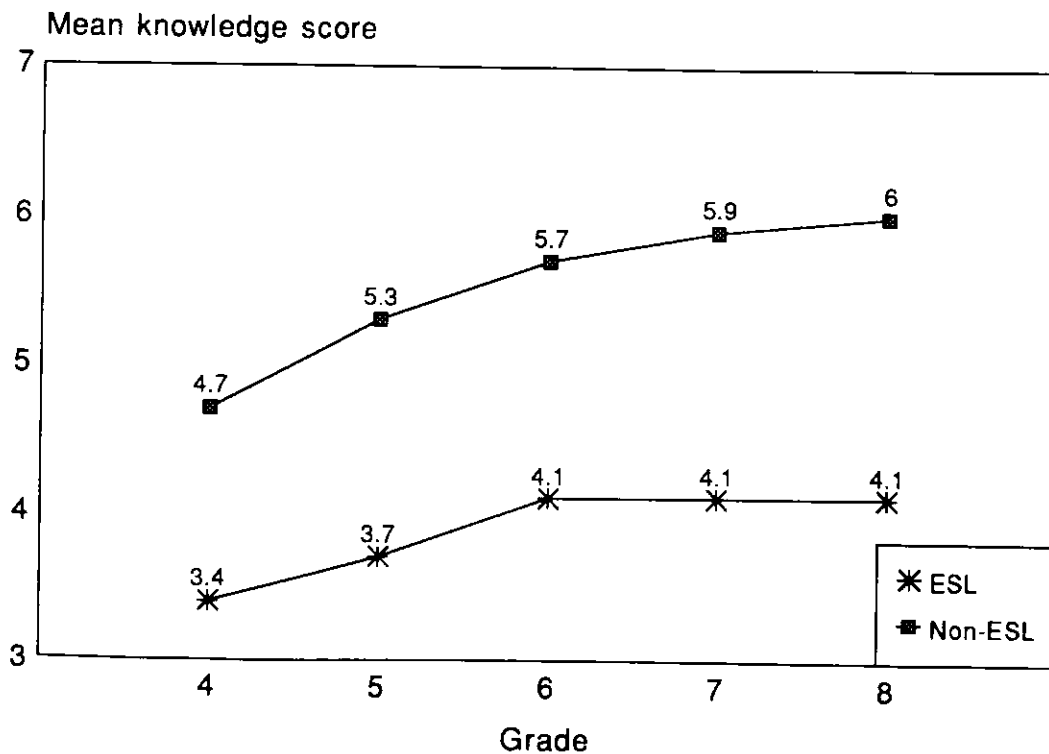
Levels of knowledge score

Almost half of the students (58%, n=14,876) had medium knowledge scores (4-6 correct responses). The proportion of the students with high knowledge scores (7-9 correct responses) was 27.8% (n=7,129), while 14.2% (n=3,637) scored between 0 and 3 correct responses (low knowledge scores). Results are presented in Table 5.

Table 5
Distribution of students by
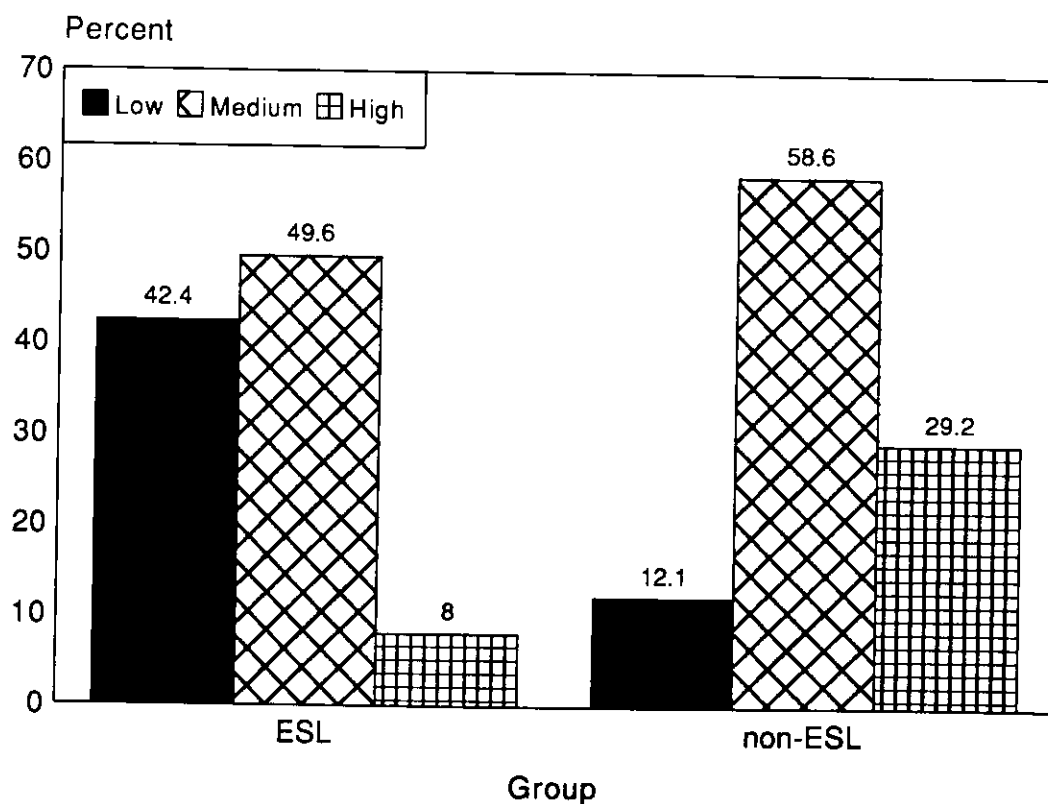### level of knowledge score

Knowledge score	ESL		Non-ESL		Total	
	No	%	No	%	No	%
Low (0-3)	733	42.4	2,904	12.1	3,637	14.2
Medium (4-6)	858	49.6	14,018	58.6	14,876	58.0
High (7-9)	139	8.0	6,990	29.2	7,129	27.8

Relationship between knowledge score
and grade, ESL status and planning area

ESL status - Both ESL and non-ESL students were most likely to have medium knowledge scores: 49.6% and 58.6% respectively. The proportion of the students with low knowledge scores was 3.5 times higher among ESL (42.4%) than non-ESL (12.1%) students (Chi-square, p<0.0001). Also, the percent of non-ESL students with high knowledge scores (29.2%) was 3.5-fold the percent of ESL students

students (8.0%) (Chi-square, p<0.0001). The results are presented in Table 5 and Figure 8. Based on these findings it appears that the ESL status and oral health knowledge are closely related.

Figure 8
Knowledge Score Levels by ESL Status (%)

Grade - The distribution of the levels of knowledge scores was directly related to the school grade. The proportions of the students with low and medium knowledge scores decreased, and the percentage of respondents with high knowledge scores

increased with school grade (Figure 9). Grade eight students were more than three times less likely to be classified as having a low level of oral health knowledge (7.7% against 26.1%), and almost three times more likely to have a high level of knowledge (37.5% against 13%).

Figure 9
Knowledge Score Levels by Grade (%)
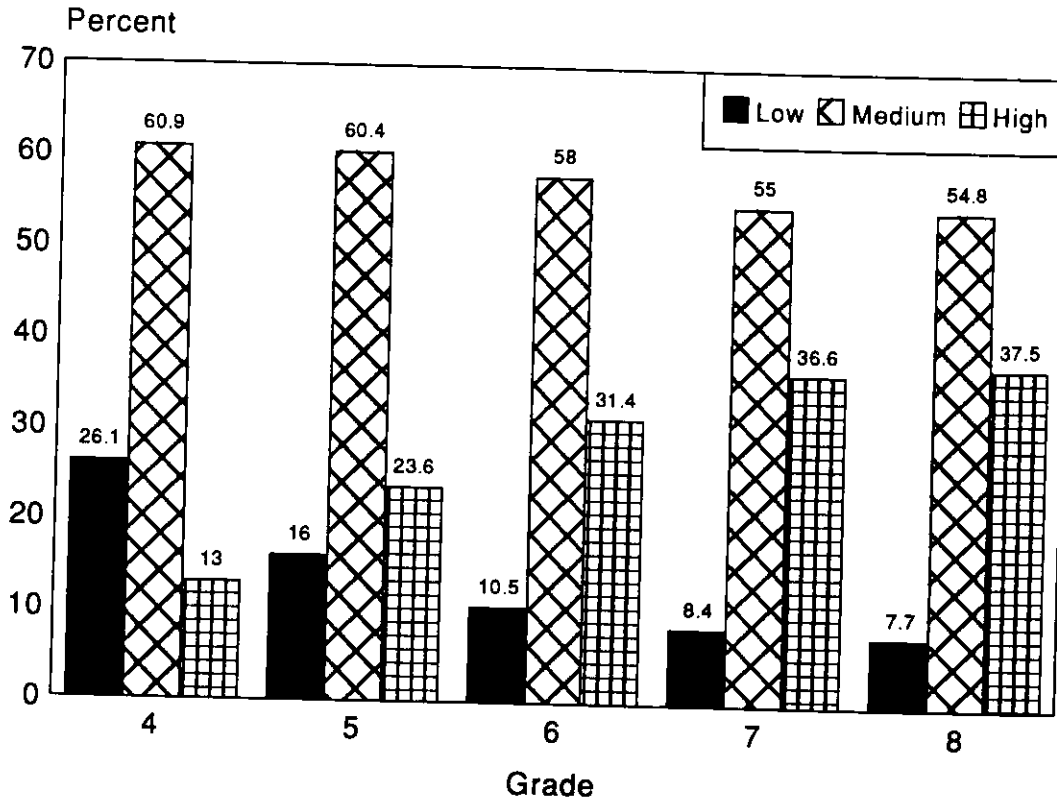
This positive association between school grade and the level of oral health knowledge was observed among both ESL and non-ESL students. The proportion of

students with medium knowledge scores was very similar in all school grades irrespective of ESL status. However, the percent of those who had low knowledge scores decreased with school grade, in the ESL group from 51.1% in grade 4 to 31.6% in grade 8, and among non-ESL students from 24.2% to 6.3% (Figure 10 and Figure 11). Therefore, grade eight ESL students were 1.5 times less likely to have low knowledge scores than those who were in grade four, while among non-ESL students there was almost a four fold difference between these two school grades.

Figure 10
Knowledge Score Levels by Grade (%)
in ESL Group

Percent

Legend: ■ Low ◻ Medium ⊞ High

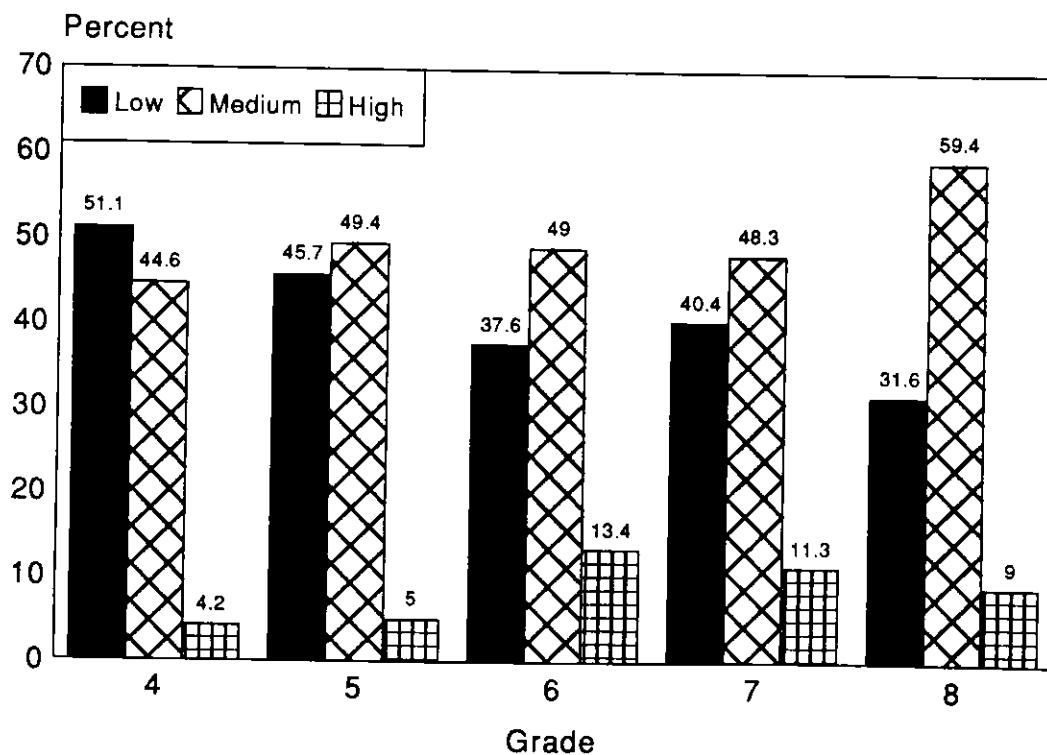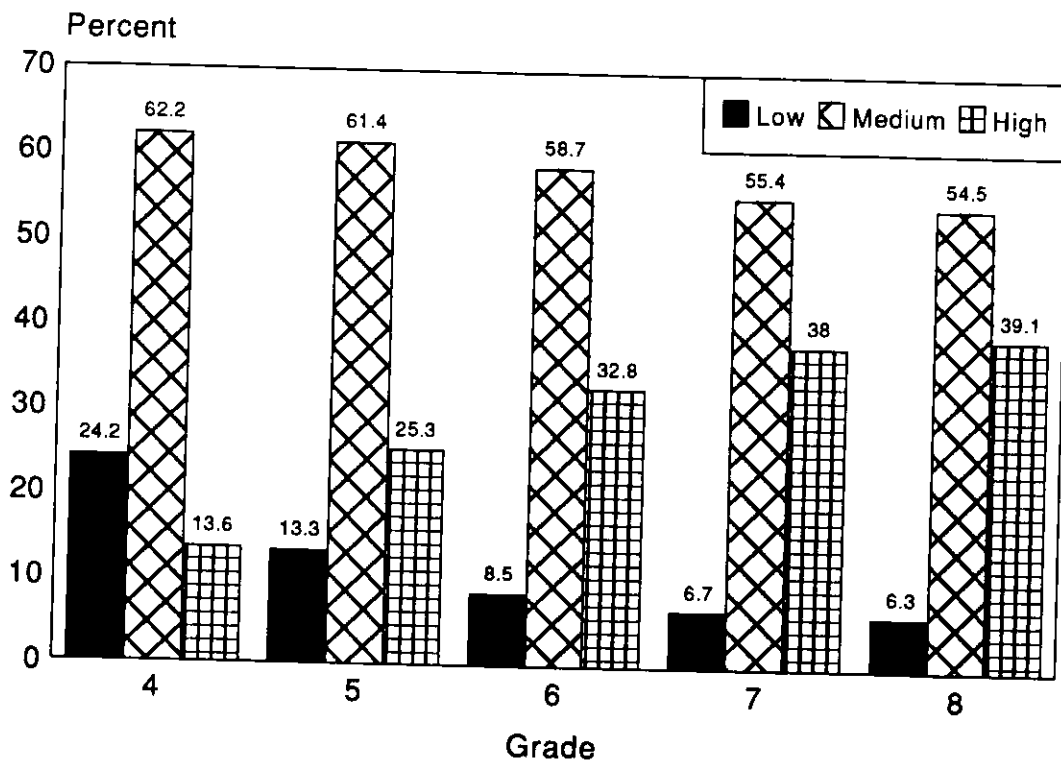| Grade	Low	Medium	High
4	51.1	44.6	4.2
5	45.7	49.4	5
6	37.6	49	13.4
7	40.4	48.3	11.3
8	31.6	59.4	9

Grade

Figure 11
Knowledge Score Levels by Grade
in Non-ESL Group (%)

Planning area - The distribution of knowledge score levels differed across North York planning areas (Figure 12). The proportion of students with medium knowledge scores was similar in all areas, ranging from 55.5% in the North-Central area to 59.2% in the North-West area. However, the ratio between the proportions

of children with high and low knowledge scores varied substantially from area to area. The North-Central area had the highest ratio of 2.9, i.e. 33.0% vs 11.5%. This was followed by the South-Central and the North-East areas, where the ratios were 2.8 and 2.2, respectively. In the South-West area, the ratio was 1.9, while the students from the South-East area were 1.7 times more likely to have high rather than low knowledge scores. In the North-West area, students were almost equally likely to have low and high knowledge scores: 19.2% and 21.6%, respectively.
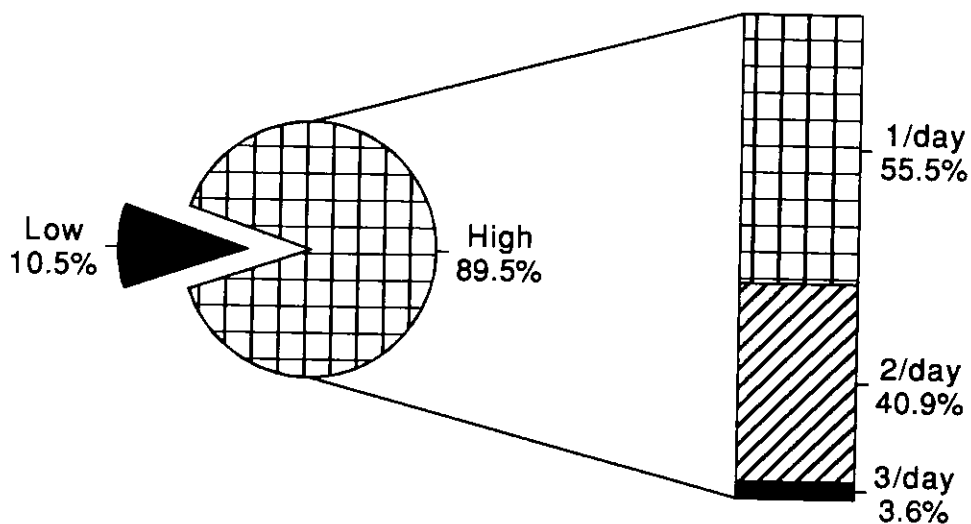
Figure 12
Knowledge Score Levels by Planning Area (%)

Percent
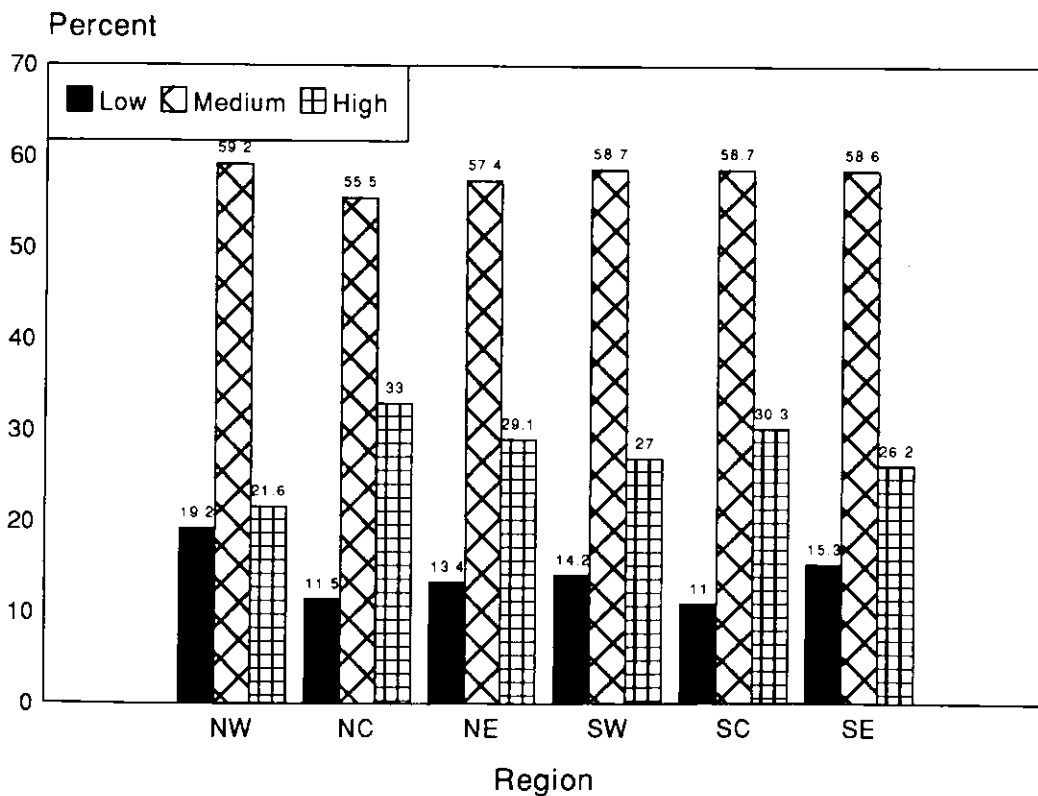
3.3 Frequency of toothbrushing

The majority of the students (89.5%) reported brushing their teeth at least once a day (high toothbrushing score) (Figure 13). More than a half (55.5%) of these students reported brushing their teeth once, 40.9% twice, and 3.6% three times a day.

Figure 13
Frequency of Toothbrushing

The proportions of ESL and non-ESL students with good toothbrushing habits reported were very similar: 87.3% and 89.7% respectively (Figure 14). In the group

of ESL students 48.2% brushed once, 45.9% twice, and 5.9% three times a day, while among non-ESL students these proportions were: 55.9%, 40.6% and 3.4%. These proportions were very similar in all grades.

The proportions of students reporting brushing their teeth at least once a day was not very different in a low, medium and high knowledge group, regardless of their ESL status (Figure 15). This relationship was observed in all grades.

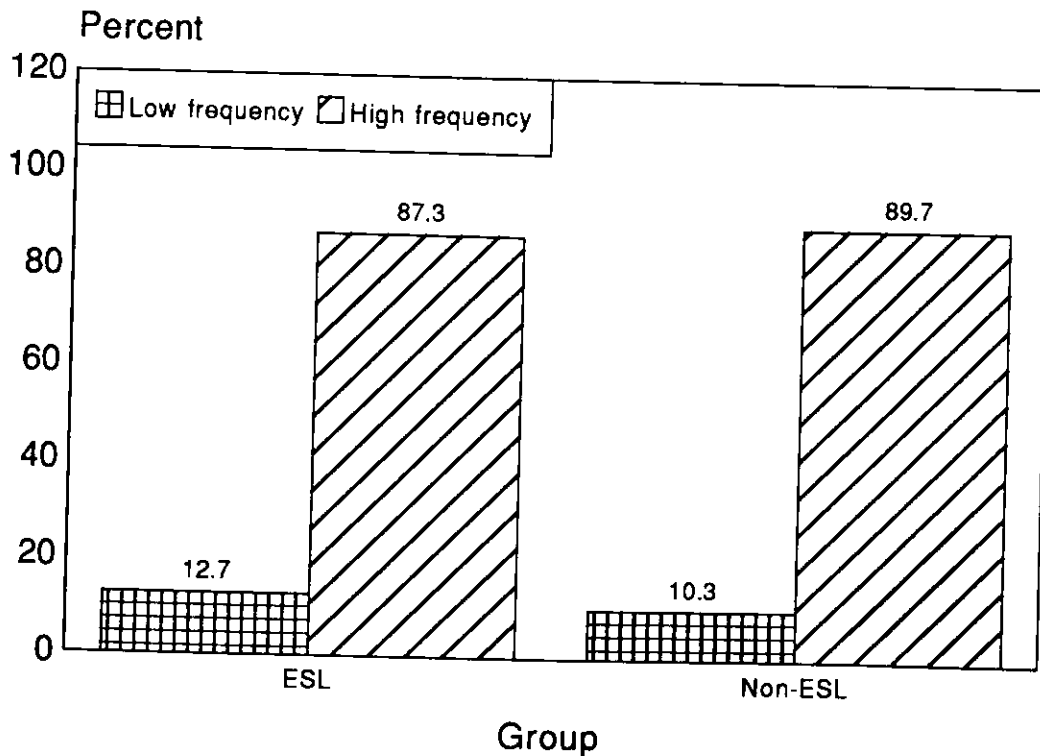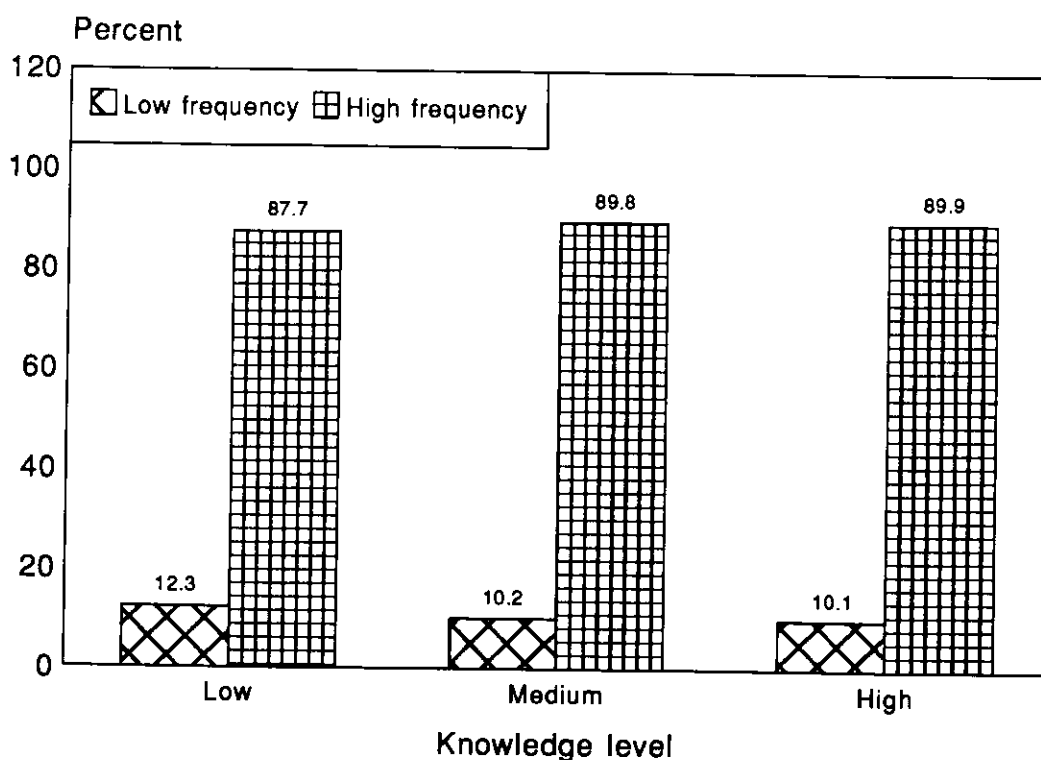Fugure 14
Frequency of Toothbrushing
ESL and Non-ESL Group

Percent

Legend: ⊞ Low frequency ☐ High frequency

ESL: Low frequency 12.7, High frequency 87.3
Non-ESL: Low frequency 10.3, High frequency 89.7

Group

Figure 15
Toothbrushing Practice by Knowledge Level (%)
ESL and Non-ESL Group

4.0 DISCUSSION

The findings of this study confirm the results from similar studies conducted in Michigan, United States and Sudbury, Ontario[1,2]. Our results demonstrate a high variability in students' ability to answer oral health knowledge questions correctly. While a very high proportion of students recognized the importance of brushing and flossing every day in preventing gum disease and which snacks are the best for the

teeth, a substantially lower percentage of students was aware that the best time to eat foods containing sugar was at meal times, and that the best time to brush their teeth was before going to sleep. The low proportion of correct responses to the latter two questions might be partly attributed to the ambiguity of these questions, but it might also be that more emphasis should be placed on the role and importance of diet and the optimum time for toothbrushing in the occurrence and prevention of dental diseases in the dental education program.

The ESL students appeared to know less about the nature of risk factors for, and methods of prevention of dental disease, than non-ESL students. They only scored better than non-ESL students when asked when the best time to brush the teeth is. What cannot be discerned is whether the difference reflects a genuine lack of knowledge among these students or results from the difficulties they have in understanding and/or reading English. If the latter is the case, the type of the questionnaire used in this study may not be the most appropriate method for collecting information from ESL students.

There is some indication that the number of ESL students was underreported, since some schools identified fewer ESL students than was expected by CDS or the schools had in their records. If this is the case, then the study may have underestimated the level of oral health knowledge among students assigned to the non-ESL group, and diminished the difference in the level of knowledge between ESL and non-ESL students, assuming that ESL students had lower level of oral health knowledge.

The study demonstrated a positive association between the knowledge score and the age of children (given that grade was used as proxy for age), regardless of their ESL status, which was expected.

The percentage of students reporting good toothbrushing practices was high. However, this number must be interpreted with caution because of the general tendency to overreport recognized favourable behaviours. The relationship between

dental health knowledge and rational oral health behaviour is complex. Many studies have suggested that knowledge is positively associated with preventive behaviour[3,4,5,6,7,8]. However, there have been also studies reporting no correlation[9,10,11], or inverse relationship between knowledge and preventive practices[12]. In this study a very weak direct relationship between frequency of toothbrushing and level of knowledge was observed.

5.0 CONCLUSION

The most important finding is that ESL students appeared to have a lower level of oral health knowledge than their non-ESL counterparts. Further investigation is necessary to determine whether they genuinely know less about risk factors and prevention of dental diseases or that their lower knowledge scores result from the difficulties these children have in understanding and/or reading English. If it is found that they do have a lower level of oral health knowledge, the ESL status would be a valid selection criterion for the North York targeted dental education program.

Another important finding relates to the variability in children's knowledge about different risk factors and methods of prevention of oral diseases. Based on the findings from the study, more emphasis should be placed on the role of plaque and sugar in causing dental diseases in the dental education program, as well as the best time to brush teeth.

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ESL ☐

TEACHER ☐

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☐☐☐☐   ☐☐☐

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DENTAL HEALTH EDUCATION

NAME:_____   GRADE:_____ CLASS:_____

SCHOOL:_____

CHOOSE THE BEST ANSWER AND CIRCLE IT:

1. **What does fluoride do?**
   a) It makes teeth white
   b) It helps protect teeth from decay
   c) It makes teeth grow
   d) I don't know

2. **Which snack food is best for the teeth?**
   a) Raisins
   b) Candy bars
   c) Popcorn
   d) Ice cream
   e) Nuts
   f) Cheese
   g) I don't know

3. **The best time to eat foods containing sugar is:**
   a) At meal times
   b) Just before bedtime
   c) Never
   d) I don't know

4. **What is plaque?**
   a) A toothpaste
   b) A layer of germs on the teeth
   c) A plastic coating on the teeth
   d) I don't know

5. **What combines with plaque to form an acid which causes cavities?**
   PLAQUE + _____ = ACID
   a) Germs
   b) Sugar
   c) Fluoride
   d) I don't know

6. **Blood on your toothbrush may be a sign of:**
   a) Plaque
   b) Gum disease
   c) Tooth decay or cavities
   d) I don't know

7. **The best way to keep from getting gum disease is to:**
   a) Eat good foods
   b) Clean your teeth every day by brushing and flossing
   c) Take vitamins
   d) I don't know

8. **Plaque should be removed:**
   a) At least once a day
   b) Only by a dentist
   c) Never
   d) I don't know

9. **When is the best time to brush your teeth?**
   a) After eating
   b) Before you visit the dentist
   c) Before you go to sleep
   d) Before you go to school
   e) I don't know

10. **How often do you brush your teeth?**
    a) Once a day
    b) Twice a day
    c) Three or more times a day
    d) Not every day, but at least once a week.
    e) I don't know