AN EPIDEMIOLOGICAL STUDY OF DENTAL DISEASE AND DENTAL HEALTH BEHAVIOUR OF SCHOOL CHILDREN 6-7 AND 13-14 YEARS OF AGE IN RURAL NEWFOUNDLAND, CANADA

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BY

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A thesis submitted to the School of Graduate Studies

in partial fulfillment of the requirements

for the degree of

Master of Science

Faculty of Medicine

Memorial University of Newfoundland

April 1990

St. John's , Newfoundland Canada

ISBN 0-315-61802-7

ABSTRACT

KEY WORDS: epidemiology, oral, behaviour, prevalence, dental caries, DMF index, rural Canada, ethnicity, socioeconomic factors, utilization of services, periodontal disease

A cross-sectional epidemiological study was carried out in 1985 to investigate the prevalence of and risk factors associated with dental disease in school children aged 6 - 7 and 13 - 14 years living in Coastal Labrador and remote parts of the Island of Newfoundland.

The participants were selected by means of a stratified two-stage probability cluster sampling design. Strata consisted of seven geographic areas. Schools within each area were the primary sampling units. Within the schools selected for the study, a sample of school children within each of the relevant grades was selected.

Information about the relevant clinical, sociodemographic and behavioural data was gathered through an oral examination of the children and a questionnaire administered either to the children or their parents. Data concerning the dependent variable, oral health status, included measurement of decayed, missing and filled tooth surfaces (DMFS), orthodontic status and prevalence and severity of periodontal disease (Russell's PI).

Response to request for participation in the study was 285 (82.9%) in the 6 - 7 year olds and 294 (86.7%) in the 13 - 14 year olds. The number and (%) of the consented that were examined, recorded and subsequently analysed was 244 (85.6%) in the younger age group and 229 (77.9%) in the older students.

The analyses of data from 473, 6 - 7 and 13 - 14 year old school children residing in remote districts of the Province of Newfoundland, Canada, resulted in the following conclusions:

1. In both 6 - 7 and 13 - 14 year age groups, increased parental education level was associated with a significant decrease in DMFS index, largely due to decrease in decayed and missing surfaces. In addition, in 13 - 14 year olds, increased parental education level also indicated a significant increase in level of treatment.
2. Compared with students having little or no exposure to fluoridated water, the 13 - 14 year old students with histories of one or more years of residence in fluoridated communities had significantly less caries experience and significantly lower levels of treatment manifested by restorations; the 6 - 7 year olds with similar histories of residence in fluoridated communities had significantly less filled surfaces.
3. Compared with similar aged school children living in other areas of the province, remote children had a greater average number of teeth decayed and missing due to caries, and a lower average number of teeth filled; remote children had a greater need for treatment as measured by the mean number of teeth per student needing various types of treatment; and remote children had a greater proportion of students requiring various dental services.
4. Russell's periodontal index (PI) was higher in remote children in both 6 - 7 and 13 - 14 year age groups than similar aged children residing in less remote parts of the province.
5. Compared with 6 - 7 and 13 - 14 year old Native Indian children, settler (predominantly Caucasian) children in remote areas in both age groups had significantly greater caries experience and significantly more missing surfaces.
6. No significant difference in caries experience was found between Inuit and settler (predominantly Caucasian) children in remote areas in the 13 - 14 year old age group.

In remote areas of the Province of Newfoundland, the risk of developing dental caries (tooth decay), the most prevalent of the chronic oral diseases, appears to be low for those children having a history of exposure to fluoridated water and for those children indicating a high parental education level. The data from this study support the notion that water fluoridation is the principal choice among the alternatives available for the prevention and control of this main dental disease. In future studies, the

effectiveness and efficacy of diet, education, tooth-brushing, water fluoridation and other preventive programs in reducing the incidence and prevalence of dental caries, and in erasing the differences in dental caries rates between the different social classes, should be examined.

ACKNOWLEDGEMENTS

This Newfoundland and Labrador Children's Oral Health Study was patterned after the Atlantic Canada Children's Oral Health Survey and A Study of Dental Manpower Systems in Relation to Oral Health Status (Ontario) thanks to great co-operation by Dr. David W. Banting, Academic Dean, Faculty of Dentistry, University of Western Ontario; Dr. A. Murray Hunt, Faculty of Dentistry, University of Toronto; Dr. Donald W. Lewis, Professor, Faculty of Dentistry, University of Toronto.

I am grateful to Dr. Bill Bavington, Dr. J. George Fodor, Associate Dean for Community Medicine and Behavioural Sciences, Memorial University of Newfoundland, and Dr. Robert J. Williams, Associate Deputy Minister of Health, Government of Newfoundland, for their considerable help in the successful initiation of this study and consistent help throughout. I thank Dr. Jorge Segovia, Professor of Social Medicine, Memorial University of Newfoundland, and the Community Health Staff of the Department of Health. Under the guidance of Dr. David Banting, Drs. Dennis Jackman, Jim Messer and Robert Kavanagh together with recorders undertook a training program to serve as dental examiner teams for future surveys and to act as reserve teams, although this need did not arise.

I wish to thank the more than five hundred parents and children who agreed to be examined and answer questions. This was made possible with the support of the Department of Education, the school principals and teachers.

The public health nurses in the communities provided us with invaluable assistance in making contact with school officials and parents, in providing transportation in remote areas and in arranging space for the clinic examinations and collection of information through questionnaires. Beatrice Watts and Mary Jane Nut, North West River, helped with translations into Inuktituk and Innu language.

I acknowledge gratefully the help given by Dr. Jon Baskerville, Manager, Stat Lab,

University of Western Ontario, and that of consultants at the Memorial University of Newfoundland Computer Services and at Newfoundland and Labrador Computer Services. I thank Karen Monck at Benchmark Publishing and Design, Windsor, for the final typesetting of this thesis.

My special thanks also go to Dr. Gary Rozier, School of Dental Public Health, North Carolina, U.S.A., for his willingness to help with summarizing and presentation of results in the early stages. I acknowledge gratefully the help given by Dr. Ted Colton, Boston University, School of Public Health, for his constructive critique, and thank Dr. David Johnston, University of Western Ontario, for reviewing the first draft of this thesis.

Finally, I express my thanks to my wife, Kumud, and children, Sheema and Shamir, for the moral support they have shown me during the course of my graduate study.

SCIENTIFIC PAPERS PRESENTED BASED ON THIS THESIS:

Doshi, S.: Dental Caries Prevalence in Rural School Children in Newfoundland. 49th Annual Meeting American Association of Public Health Dentistry. Miami, Florida. October, 1986

Doshi, S.: Dental Status and Preventive Behaviours Among Rural School Children. 11th Congress International Association of Dentistry for Children. Toronto, Ontario. June, 1987

PUBLICATION BASED ON THIS THESIS:

Doshi, S.: Dental Caries Prevalence in Rural School Children in Newfoundland. J Public Health Dent 1987; 47:37 Abstract.

INFORMATION PRESENTED TO FOLLOWING COMMUNITY ORGANIZATIONS:

Doshi, S.: Dental Health Status and Preventive Strategies in Newfoundland and Labrador. Annual Meeting Newfoundland Branch Canadian Public Works Association. Gander, Newfoundland. November, 1987

Op Cit: Annual Meeting Newfoundland Dental Assistants Association. St. John's, Newfoundland. November, 1987

Op Cit: School Principals Meeting Avalon Consolidated School Board. St. John's, Newfoundland. December, 1987

Op Cit: Elementary Teachers Executive Council, Newfoundland Teachers Association. St. John's, Newfoundland. December, 1987

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PREFACE

This is the Final Report for Grant 84-97 from the Hospital For Sick Children Foundation, Toronto, Canada. The research was entitled "Newfoundland and Labrador Children's Oral Health Study."

The roots for this study go back to September 1978 to the convening of a meeting in Winnipeg, Manitoba concerning Canadian Provinces Dental Surveys. This meeting was arranged by the Community Dentistry Departments of the Universities of Toronto, McGill and Western Ontario, and by Health and Welfare Canada. At that time four provinces - Manitoba, Ontario, Alberta and Quebec - had completed or were about to embark on children's dental health studies all of which, with the exception of Manitoba, were patterned after the original World Health Organization International Collaborative Studies of Dental Manpower in Relation to Oral Health Status. Following the completion of these four provincial studies Dr. David Banting was able to interest Dr. Hunt in planning for an Eastern Canada Dental Survey. Their efforts resulted in 1982 in a dental survey of the four provinces of Atlantic Canada combined, that is, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. Although the Atlantic Canada Children's Oral Health Survey included Newfoundland, for reasons of design, budget and timing, Labrador and remote areas of Newfoundland were excluded. The primary purpose of the present study was to survey these excluded areas of Labrador and the remote parts of Newfoundland in order to provide a more complete provincial data set.

Preparations for the Atlantic Canada Children's Oral Health Survey, resulted in the Ontario and Quebec study epidemiologists, Dr. A. Murray Hunt and Dr. John Stamm, to standardize a team of dental examiners, including the author, during a three-day training course in Halifax, Nova Scotia.

One other event that led to the development of a successful grant application was

the holding of a Dental Health Care Evaluation Seminar in February, 1984 at the Faculty of Dentistry, University of Toronto. The Seminar provided an opportunity for consultation with experts such as Drs. Dennis Leverett, David Banting, Don Lewis, Brian Burt, John Stamm, and Geoffrey Norman. The grant was approved in October, 1984 and the project was undertaken from January 1, 1985 to December, 1986.

Additional funding support from the Newfoundland Department of Health has been approved and this will permit combining the data from this remote area study with the Newfoundland portion of the data from the Atlantic Canada Study for a preparation of a report on the Oral Health Status of Children in Newfoundland and Labrador (1982 to 1985) as a whole.

CHAPTER 1

INTRODUCTION

1.1 Purpose of the research

This report presents results from a study of oral health care consumers in two target age groups - 6 to 7 year olds and 13 to 14 year olds residing in Coastal Labrador and Remote Areas of the Island of Newfoundland in the Province of Newfoundland and Labrador, Canada. The study attempted to detect the effect that selected oral health care practices and utilization of dental care services has on the oral health status of the children. In order to achieve such results, the research design and analysis strategy were adapted from the experience of the Atlantic Canada Children's Oral Health Survey (Banting, Hunt and Baskerville, 1984 and 1985) and the study of Dental Manpower Systems in Relation to Oral Health Status (Ontario) (Hunt, Lewis and Banting, 1978). It was envisaged that once such data were collected and analysed, the information would be used to improve the oral health practices and delivery of the type of oral health services that can result in better oral health levels in the children.

1.1.1 Objectives

The general goal of the study can be defined as: to provide descriptive and analytical data concerning the oral health disease and oral health behaviour of children in selected region in Newfoundland and Labrador. Specifically, the objectives of this study were:

1. To obtain information about the dental health status of the children in Coastal Labrador and the Remote Areas of the Island of Newfoundland, including unmet dental needs, dental treatment levels and personal oral health behaviour and snacking behaviour.
2. To provide a baseline for monitoring the effect of direct interventions to prevent dental diseases and effect of diverse systems of delivery of dental services in Labrador

and remote areas of Newfoundland.

3. To combine these data with the Newfoundland portion of the data from the Atlantic Canada Children's Oral Health Survey to construct a profile of the dental health of children in the Province of Newfoundland, and a profile of different groups of children in the five Public Health Regional Units in the Province.

4. To assist the province in developing expertise in the Health Units with respect to administration and liaison aspects of Oral Health Surveys.

5. To generate dental awareness in health professionals generally, and at Memorial University of Newfoundland in particular, through their involvement in the study.

1.1.2 Hypothesis

Key factors that influence dental health practices are the availability and accessibility of the preventive educational-curative services, and, the socio-demographic characteristics of the individuals which enable them or predispose them to practise the accepted dental health behaviours (Wan and Yates, 1975; Gift, 1984; Arnljot, Barmes, Cohen, Hunter and Ship, 1985). It is generally assumed that children and adults possess quite accurate information about the most commonly accepted dental health practices, the regular and consistent use of which should result in optimum oral health (Swinehart, 1974). It is also sometimes assumed that those living in urban communities have an oral health status that is different from those living in remote and rural environments (Stamm, 1984; Enwonwu, 1981).

With these assumptions in mind it may be postulated, if oral health status were the dependent variable, that by determining the amount and regularity of these practices and place of residence one would also be revealing some of the influences on the oral health status. Thus, an individual whose environmental, social and demographic characteristics predispose him or her to practise accepted dental health behaviours would practise these behaviours at optimum level regardless of the availability and accessibility of service or the type of environment. Consequently, this study was used to test the following research hypothesis:

1. There is no difference in the prevalence of dental caries, periodontal disease, and orofacial anomalies between children in Labrador and remote areas of Newfoundland compared to those living in the rest of the Province of Newfoundland as determined by the Atlantic Canada Children's Oral Health Survey.
2. There is no difference in the need for treatment among children in Labrador and remote areas of Newfoundland compared to those living in the rest of the Province.
3. In Labrador and remote areas of Newfoundland, there is no difference in caries rate and treatment levels among children of different categories of socioeconomic status.
4. In Labrador and remote areas of Newfoundland, there is no difference in the prevalence of dental caries or periodontal disease between native (Innu/Inuit) and non-native (settler) children.
5. In Labrador and remote areas of Newfoundland, there is no difference in caries rate and treatment levels among children of different ethnic origins (Innu, Inuit, settler).
6. The more regular the daily toothbrushing/flossing behaviour, the better the oral health status.
7. In Labrador and remote areas of Newfoundland, there is no difference in caries rate and treatment levels among children having different frequency of snacking behaviours.

1.2 Study design

In order to test the hypothesis, the following features were identified as being important in selection of the study population:

1. Population served: The target area may or may not have a resident dentist.
2. Payment mechanism: The payment mechanism may be government fee-for-service or government salaried.
3. Socio-cultural influence: By this was meant areas where population was predominantly native (Innu, Inuit or Micmac) or non-native (settler).

With the existence of differences in these features in mind, the study area was stratified into seven districts or strata: Northern Peninsula, Northern Labrador, Southern Labrador, Fogo-Burgeo, St. Anthony, North West River and Forteau.

The survey design can be described as a two-stage cluster sample with stratification of the primary sampling units or clusters of students (schools).

The reasoning behind this procedure was that if the population to be sampled was stratified so that the units in each group were more homogeneous than those of the population as a whole, the accuracy of an estimate for a given sample size may be improved by taking separate simple random samples from each of the strata (Osborn, 1974). Table 1 illustrates each of the seven original strata in the study area in terms of these three characteristics.

From the strata, designated samples of the population for selected age groups were to be drawn. The study design provided for collection of data on a cross-sectional basis. Over the course of approximately three months, it was planned to collect data from 380 children attending 56 schools. Due to inclement weather, it was not possible to visit three of the schools in Northern Labrador and two schools in Forteau. A Grade VIII class from Mary's Harbour All Grade School in Southern Labrador was later placed as a "substitute" for Forteau.

During fieldwork, about 10% of the study population was re-examined in order to test for examiner reliability.

1.2.1 Target groups

The age groups selected were 6 to 7 year olds (Grade I) and 13 to 14 year olds (Grade VIII). The 6 to 7 year olds were selected in order to provide a group of children that are at an age that is generally considered to be the age of first contact with the dentist, especially in jurisdictions where governments operate a children's dental plan such as the one in Newfoundland and Labrador. Children are eligible for care under the Newfoundland and Labrador Children's Dental Plan up to the age of 12 years (that is, thirteenth birthday). The selection of children aged 13 to 14 years would also provide an indication of the effectiveness of the dental plan.

Ethical considerations necessitated all sampled children to have a signed consent from parent or guardian in order to participate in the study (Cons, 1980; Barmes, 1980;

TABLE 1

Structural characteristics of the study strata (districts)

Stratum	Type of service	Payment mechanism	Socio-cultural influence
Northern Peninsula	Predominantly resident dentist	Predominantly government fee-for-service Some salaried	Non-native (settler)
Northern Labrador	Predominantly non-resident visiting dentist	Salaried	Predominantly Innu, Inuit or Micmac
Southern Labrador	Predominantly non-resident visiting dentist	Salaried	Predominantly non-native (settler)
Fogo/Burgeo	Predominantly non-resident visiting dentist	Government fee-for-service	Non-native (settler)
St. Anthony	Resident dentist	Salaried	Non-native (settler)
North West River	Non-resident dentist	Salaried	Non-native (settler)
Forteau	Predominantly resident dentist	Salaried	Non-native (settler)

Stamm, 1980). In addition, all parents of 6 to 7 year old children would be asked to complete a questionnaire for collection of sociological, demographic and children's dental health practices information.

Similarly, for the 13 to 14 year old group, consents and sociological and demographic information would be collected through questionnaires to parents. The students' dental health practices information, however, would be provided by the 13 to 14 year old students themselves. This questionnaire for 13 to 14 year old students would be administered individually following the clinical examination in the school with the respondents filling out the questionnaires themselves.

A minor deviation from the Atlantic Canada Children's Oral Health Study was this collection of additional information about the children's dental health behaviour. Second modification was that, in consideration with schools in predominantly native communities, all the parents of children in the two identified age groups were to be notified that the children be permitted to participate in the study. In this way, as many of the native children as possible would be included in the study. This route was necessitated because of lack of documented information on ethnicity in the Province. The strategy employed to categorize ethnic ties was based on two assessments - the language spoken at home and classification of native and non-native children based on information provided by a knowledgeable person in the community, such as public health nurse or teacher. As well, liaison would be established with the three known Band Councils - The Naskaupi-Montagnaise Innu Association, Labrador Inuit Association and the council of the Conne River Micmacs. The questionnaire, consent forms and other forms/letters to parents would be made available in three languages - Inuktituk, Innu and English, and an interpreter would be hired where required.

Other factors of interest were defined as follows:

Socioeconomic Status: Highest category attained by either parent based on a modification of the Blishen Socioeconomic Index (Blishen, 1958; Blishen and McRoberts, 1976; Blishen and Carroll, 1978), whereby categories of original scale are combined as follows: 1 and 2, 3 and 4, 5 and 6, 7 and 8, 9 and 10, 11 and 12, and 13,

14 and 15. Categories 1 and 2 represent low socioeconomic status (SES) and categories 13, 14 and 15 high SES. Parents/guardians who were full-time students, housewives, unemployed or retired were not assigned a category. Based on this information, categorization was achieved using the technique of "stratification after selection" (Stamm, Dixter and Langlais, 1980(a)).

Fluoride Status: A child was considered to have been exposed to fluoridated drinking water for a sufficient time if he/she had lived in a fluoridated area for at least twelve months or longer (Burt, Eklund and Loesche, 1986).

1.3 Sampling

The sample for the Newfoundland and Labrador study was selected using a stratified sampling design of children 6 to 7 and 13 to 14 years of age attending elementary or junior high schools in the remote areas of the Province. In order to ensure a representative regional sample, the study design, as described earlier, necessitated stratification of the study area into seven districts or strata.

If the primary purpose of this study was to compare outcome measures among the seven strata, the greatest precision would be gained if equal number of school children were selected from each stratum (Cochran, 1977). However, the predominant interest was in obtaining estimates for the remote area as a whole that can be compared with those of Atlantic Canada, other Canadian and Nation Studies. Therefore, subsample was allocated proportional to the size of the stratum population to produce a more precise estimator by minimizing variance. For example, the number of children selected from Fogo/Burgeo stratum was proportional to that stratum's contribution to the total population in that age group. The calculations and resulting allocation of the Grade I sample are shown in Table 2 and of the Grade VIII sample in Table 3.

TABLE 2

Allocation of sample to strata

Grade I

Stratum	Number of Schools	Number of Children	% of Children per Stratum	Number of Children to be Sampled	Number of Schools to be Sampled	Actual Number of Schools Sampled
Northern Penninsula	29	339	50.2%	95	14	14
Northern Labrador	10	130	19.3%	37	5	7
Southern Labrador	9	45	6.7%	13	2	2
Fogo/Burgeo	4	76	11.3%	21	3	3
St. Anthony	1	50	7.4%	14	2	1
North West River	1	10	1.5%	3	1	1
Forteau	5	25	3.7%	7	1	1
Total	59	675	100.0%	190	28	29

NOTE: Please see Pages 7 and 10 for a discussion of the rationale for sampling of schools and for children within schools.

TABLE 3

Allocation of sample to strata

Grade VIII

Stratum	Number of Schools	Number of Children	% of Children per Stratum	Number of Children to be Sampled	Number of Schools to be Sampled	Actual Number of Schools Sampled
Northern Penninsula	17	439	45.1%	86	12	12
Northern Labrador	11	129	13.2%	25	4	7
Southern Labrador	9	53	5.4%	10	1.4	1
Fogo/Burgeo	4	205	21.0%	40	6	4
St. Anthony	1	82	8.4%	16	2	1
North West River	1	14	1.4%	3	1	1
Forteau	3	52	5.3%	10	1.4	1
Total	46	974	99.8% *	190	27	27

NOTE: Please see Pages 7 and 10 for a discussion of the rationale for sampling of schools and for children within schools.

* Rounding error

1.3.1 Exclusions

The number of schools included in the sampling frame was the result of a decision to sample at least seven students from each school in the Grade I and Grade VIII samples. There were a number of considerations relevant to this decision. A first consideration related to the precision of the sample estimates. More schools chosen with fewer students from each would result in greater precision. A second consideration was that there were a number of schools in rural areas with small enrollments. A requirement that all the schools be included would have resulted in considerable increase of the cost and time of travel between schools. The result of the exclusion of schools with enrollment less than seven was that a very small number of schools in remotest areas were not included in the sampling frame. Tables 4 and 5 show the percentage of Grade I and Grade VIII population excluded from the frame due to consideration of school size. Overall the exclusion rate was 9% for Grade I and 3% for Grade VIII students. However, with the clustering of schools in seven strata, the primary sampling stage ensured adequate representation from the different characteristics of the widely dispersed population and resulted in the geographical concentration of fieldwork without affecting precision too adversely. The schools selected are listed by strata in Appendix A.

Bias can only occur if the students in excluded schools possess oral health characteristics that are markedly and systematically different from those of students included in the frame. The likelihood and magnitude of such bias is discussed in the study results.

1.3.2 Sample size

When data are to be collected on a number of variables including orthodontic status, periodontal disease, decayed, missing, filled teeth and surfaces, and when these are to be subclassified in a number of ways, then the determination of a scientifically acceptable, yet economically feasible, sample size involves compromises (Stamm et al., 1980(a)).

TABLE 4

Number of students and schools excluded
from sampling frame due to size of school

District	Grade I		
	Number of Students Excluded	(%)	Number of Schools Excluded
Northern Peninsula	23	(6.7%)	7
Northern Labrador	11	(9.7%)	2
Southern Labrador	16	(35.6%)	5
Fogo/Burgeo	0	(0.0%)	0
St. Anthony	0	(0.0%)	0
North West River	0	(0.0%)	0
Forteau	10	(40.0%)	3
Overall	60	(9.1%)	17

TABLE 5

Number of students and schools excluded from sampling frame due to size of school

District	Grade VIII	
	Number of Students Excluded (%)	Number of Schools Excluded
Northern Peninsula	6 (1.4%)	1
Northern Labrador	13 (13.7%)	4
Southern Labrador	12 (22.6%)	4
Fogo/Burgeo	0 (0.0%)	0
St. Anthony	0 (0.0%)	0
North West River	0 (0.0%)	0
Forteau	0 (0.0%)	0
Overall	31 (3.3%)	9

The primary purpose of this survey was to obtain an estimate of the mean Decayed, Missing, Filled Surface (DMFS) count per student for Labrador and remote areas of Newfoundland as a whole. In the Atlantic Canada Children's Oral Health Survey of 13 to 14 year olds for Newfoundland sample, the mean Decayed, Missing, Filled Surface count was 11.42 with a standard deviation of 13.7.

For the design of this study an estimate of the number of Grade I or Grade VIII students required to estimate the mean Decayed, Missing, Filled Surface count to within 1.7 surfaces with 95% confidence was obtained from (Freese, 1962; Cochran, 1977):

$$n = \frac{1}{\frac{A^2}{t^2_{.05}\,SD^2} + \frac{1}{N}}$$

$$= 188$$

Where $A = 1.7$

$t_{.05} = 1.96$

$SD = 13.7$

N = Total number of students in Grade I (Or Grade VIII) in study area as a whole.

n = sample size

Both the age groups were over-sampled to allow for inclusion of all the children in Grades I and VIII in schools in predominantly native communities, and for absenteeism, refusals and failure to respond. Thus it was determined that an overall sample size of 260 Grade I students and 260 Grade VIII students would yield adequate precision.

1.3.3 Sample selection

The survey design called for two stages of sampling.

The first stage or primary sampling units (PSU's) were schools. Within each chosen school Grade I or Grade VIII students were sampled as the second-stage units (Moser and Kalton, 1971).

Since the protocol required an independent assessment of the oral health of Grade I and Grade VIII students with equal emphasis, two independent samples of PSU's were taken. This was necessitated by the fact that many schools did not have both Grade I and Grade VIII classes.

1.3.4 Selection of schools

With the exceptions mentioned below, the schools in the Grade I sample were selected with probabilities proportional to the number of Grade I students per school within each stratum. Thus, schools with greater Grade I enrollments had a greater chance of being selected. Schools in the Grade VIII sample were selected similarly, with probability proportional to the number of Grade VIII students in each school. This was accomplished by employing the method proposed by Lahiri (1951). The sampling frame for each stratum was prepared from lists of schools from each School Board, with enrollment by grade for the 1984-85 school year. Schools were chosen in each stratum in numbers indicated in Table 2 and Table 3.

However, in the stratum identified as St. Anthony, there was only one Grade I school - thus this school was purposefully selected. In the stratum identified as Northern Labrador, the schools with sample size less than seven were excluded but all the remaining schools in this group were purposefully selected since all the native children were known to be enrolled in all the schools listed in this stratum (Bavington, 1983).

This resulted in the selection of 29 schools for the Grade I sample and an independent selection of 27 schools for the Grade VIII sample.

1.3.5 Selection of students

A simple random sample of students was selected from the enrollment lists obtained from the chosen schools. However, due to ethnic considerations and the fact that in some schools with small class size random sampling would result in leaving out from the class perhaps one or two students, it was decided, for these schools, based on local situation, to include all of the students in the sample. The school sample therefore varied from 5 to 25 in Grade I and 7 to 26 in Grade VIII. This resulted in an unequal selection probability for some Grade I and Grade VIII students within a stratum. The resulting imbalance was taken into account in the analysis.

1.4 Summary

The purpose of this regional study was to examine the relationship between selected dental health practices and the type of environment, and the oral health status of the children.

The central hypothesis proposed that the more optimally a population practised certain dental health behaviours irrespective of the availability and accessibility of service the more positive would be the effect on that population's oral health.

In order to yield information from the persons involved, 190 children in each of the two distinct age groups were identified for study. The sampling design provided for the selection of a population to allow for differences in methods of delivery, payment mechanism and cultural influences. While the 6 to 7 year old sample was to be clinically examined in its schools with parents completing a questionnaire distributed through the schools, the 13 to 14 year old sample was to be examined and asked to complete a dental health behaviour questionnaire, and their parents to complete sociological and demographic information through the schools.

The next chapter deals with the demographic, socioeconomic and dental systems features in Newfoundland and Labrador.

CHAPTER 2

DEMOGRAPHIC, SOCIOECONOMIC AND DENTAL SYSTEMS FEATURES

2.1 Introduction

This chapter provides an overview of the demographic, socioeconomic and dental system features of the Province of Newfoundland.

2.2 Demographic and socioeconomic features

Politically, Canada is made up of ten provinces and the Yukon and Northwest Territories. The Province of Newfoundland is the most easterly and geographically the seventh largest province of Canada, consisting of the island of Newfoundland and Labrador, which is part of the Province that lies on the mainland of Canada. The Province of Newfoundland stretches more than 1,500 km from St. John's, in the south, to the tip of Labrador near Hudson's Bay, in the north. It covers 404,517 sq km (156,185 sq mi) of which 34,032 sq km or 8.4% (13,140 sq mi) is water area.

The total population of the Province was recorded as 567,681 in the 1981 Canada Census Survey (Statistics Canada, 1983), of which just over 3,200 was native. The population density is about 4 persons per sq mi (2 per sq km). The bulk of the population is concentrated on the island part of the Province and mostly along the coast in several hundred small communities. In 1981, the population was classified as being 59% urban and 41% rural. 91.5% of the population had British origin, 2.7% French and 0.6% Native Peoples. Native population includes both Inuit and Innu (Naskapi-Montagnaise) and the Micmac settlement at Conne River. Other ethnic groups that make up the population are Asian, Italian, Chinese, German, Dutch and Scandinavian.

The population of Coastal Labrador and Remote Areas of Newfoundland, where the study was conducted, was 43,644 and included most of the Native Peoples.

Newfoundland has a relatively young population with a high proportion of children and adolescents. The largest five-year group is 15-19 years of age. In 1984, 9,011

births were recorded compared to 9,581 births in 1983. The Total Fertility Rate for Newfoundland women has declined to approach that of Canada, that is, below the replacement level (Newfoundland Statistics Agency (NSA), 1987).

In 1985, of the 224,000 persons 15 years of age and over in the labour force, 60.1% were males and 39.9% were females. For males, 63.8% of the population 15 and over were in the labour force, and for females 42.0%. 21.3% of the population was unemployed - 17.0% in urban areas and 26.5% in rural areas. The unemployment rate has traditionally been the highest rate in Canada and that problem continues. In 1985, the employed labour force was distributed as follows: 31.8% in Business and Personal Service, 18.2% in Trade, 12.6% in Fishing Industry, 10.2% in Public Administration, 8.5% in Transport and Utilities, 5.7% in Construction and 4.3% in Forestry and Mining (Newfoundland Statistics Agency, 1987).

The per capita income in Newfoundland in 1985 was $10,600, compared to the Canadian per capita income of $15,851 for the same year.

Schools in the Province are organized on the basis of the province's religious denominations. Thirty-five School Boards throughout the province administer the daily operations of the schools. Provincial law requires children to attend school from age 6 years through 16 years, Kindergarten to Grade VI in elementary school and Grade VII to Grade XII in Junior and High School. The Provincial Government pays almost all educational costs. The total amount budgeted for elementary and secondary education in the 1986-87 fiscal year was $4[illegible].6 million or 16.0% of the total expenditure for the Province. The cost of education for each pupil in the province has increased from $460 in 1971-72 to about $3,273 in 1986-87. Part of this is probably reflected in the number of students that has been declining since 1971-72 when enrollment in grades K-XI totalled 162,818 students. In 1986-87 there were 139,378 students in grades K-XII, a drop of 14.4% from 1971-72 (Newfoundland Department of Education, 1987), 28% of the population over age 15, in 1981, had acquired some form of post-secondary education either at university or in community colleges and technical institutes, with 32% having Grade VIII education or less (Statistics Canada, 1983).

As far as the characteristics of the Province relevant to oral health are concerned, in 1985, 7.4% of the population resided in municipalities with fluoridated water supplies. This is approximately 11.4% of the population on treated water supply and this puts the Province at the very bottom of the Canadian Provinces Fluoridation List (Clark and Trahan, 1983). The three communities that are fluoridated are Gander, Goose Bay and Corner Brook. None of the communities selected for this study were fluoridated.

The Province has neither a Fluoridation Act nor an active fluoridation program. Except for the capital city of St. John's, it is left entirely up to the local municipality council membership to initiate any action in this regard. In St. John's, which has never been a fluoridated city, unlike Toronto, Ottawa, Halifax, Charlottetown and other cities in Canada (Health and Welfare Canada, 1978), the situation has a little twist to it. According to the City of St. John's Act (1970), before fluoridating the city water supply it is necessary for the council to hold a plebiscite of the electorates. Should the result of such a plebiscite be negative, a further plebiscite cannot be held until three years later. A fluoridation plebiscite has never been held in St. John's. This situation is further complicated by the fact that four other communities, Mount Pearl, Conception Bay South, Goulds and Paradise, are also served from the same water supply as St. John's. Although these four communities are independent, governed by their own municipalities, it would appear that the determination of whether these communities have access to this particular dental health feature rests with the St. John's Municipal Council and not with them.

Sugar consumption rate for the Province is not available, but for Canada in 1985 was 42 kg/person/year (Canadian Sugar Institute, 1987). The climate of the Province, influenced by the Labrador current, results in a short growing season that does not encourage agriculture. Thus grains, grain products and most of the vegetables and fruits have been imported (Fodor and Rusted, 1980). Family food expenditure (money spent on food) in Newfoundland and Labrador for 1982 shows that Newfoundlanders spent more than the national average on sweet foods and sugar ($6.33 vs $4.77)

(Statistics Canada, 1982).

This study for Coastal Labrador and Remote Areas of Newfoundland was completed in 1985.

2.3 Oral health status

Although data available on the dental health status of the children in Newfoundland and Labrador are somewhat flawed, there is sufficient evidence of caries experience and periodontal disease of schoolchildren and adolescents in the Province (Doshi, 1980). Data from some of the studies are given in Tables 6 to 9. Unfortunately, findings from these various studies cannot be compared directly because of the differences in age grouping of the sample, the experimental design and the criteria and standards used by the examiner(s).

Data from the Nutrition Canada Survey (1970-72) indicate that the average 7 year old in Newfoundland had a mean Decayed, Missing and Filled Teeth (DMFT) score (primary plus permanent teeth) of 5.6 and the average 12 to 14 year old a DMFT score of 8.5, made up of 5.2 decayed, 2.6 missing and 0.7 filled permanent teeth (Nutrition Canada, 1977).

2.3.1 Fluoride studies

Two surveys to document the effects of fluoride in drinking water on the dental health of schoolchildren were undertaken in the naturally fluoridated community of St. Lawrence (approximate concentration of 2.2 parts per million (ppm) of fluoride at time of study) (Brett-Williams, 1956; Chaytor, 1966). The community water supply has since been changed and there is only a negligible amount (less than 0.4 ppm of fluoride) in the drinking water today (Gibbons, Dawe and Wagenbauer, 1985). Comparable data were collected from non-fluoridated "control" sites of Burin and St. John's. Results from St. Lawrence are summarized in Table 9 and those from "control" sites are shown on Tables 7 and 8 (Studies 1 and 2). What is noteworthy is the percentage of population surveyed that was caries-free in 1954 and 1966 in fluoridated compared to non-

TABLE 6

Periodontal disease indices of children and adolescents in Newfoundland and Labrador

Study Serial Number	Year of Study	Author	Area	No. of Children	Age	Percent Students with soft Debris on Teeth	Percent Students with Gingivitis	Mean Periodontal Index per Child
3.	1968-70	Lewis (1973)	Nfld	298	15 years	60.0%	36.0%	-
4.	1970-72	Nutrition Canada (1977)	Nfld	73	12-14 years	-	59.6%	-
5.	1977	Doshi and Marshall (1977)	St. Thomas	209	5-15 years	82.3%	-	-
6.	1982	Banting, Hunt, Baskerville (1984)	Nfld	317	13-14 years	-	-	0.38
7.	1984	Grenfell Report (1985)	Grenfell Region	630	15 years	-	11.6%	-
8.	1985 (Present Report)	Doshi	Remote Nfld Labrador	229	13-14 years	-	-	0.50

TABLE 7

Caries experience of school children in Newfoundland and Labrador 1954-1985

Study Serial Number	Year of Study	Author	Area	No. of Children	Age	Mean DMFT *	Caries-free ** percent	Fluoridated Yes/No
1.	1954	Brett-Williams (1956)	St. John's	?	7 years	10.3	-	No
2.	1966	Chaytor (1966)	Burin	26	6-8 years	9.2	4.0%	No
3.	1968-70	Lewis (1973)	Nfld	331	7 years	-	8.5%	No
4.	1970-72	Nutrition Canada (1977)	Nfld	19	7 years	5.6	7.8%	No
5.	1977	Doshi and Marshall (1977)	St. Thomas	209	5-15 years	6.8	3.3%	No
6.	1982	Banting, Hunt, Baskerville (1984)	Nfld	360	6-7 years	5.7	-	-
7.	1984	Grenfell Report (1985)	Grenfell	572	7 years	5.2	-	-
8.	1985 (Present Report)	Doshi	Remote Nfld Labrador	244	6-7 years	7.4	9.4%	No

* DMFT = DECAYED, MISSING, FILLED TEETH PER CHILD, INCLUDES PRIMARY AND PERMANENT TEETH.
** CARIES-FREE = DMFT OF ZERO

TABLE 8

Caries experience of adolescents in Newfoundland and Labrador 1954-1985

Study Serial Number	Year of Study	Author	Area	No. of Children	Age	Mean DMFT *	Caries-free ** percent	Fluoridated Yes/No
1.	1954	Brett-Williams (1956)	St. John's	?	13 years	11.3	-	No
2.	1966	Chaytor (1966)	Burin	36	12-14 years	8.3	0.0%	No
3.	1968-70	Lewis (1973)	Nfld	295	13 years	-	5.8%	No
4.	1970-72	Nutrition Canada (1977)	Nfld	73	12-14 years	8.5	12.5%	No
5.	1977	Doshi and Marshall (1977)	St. Thomas	209	5-15 years	6.8	3.3%	No
6.	1982	Banting, Hunt, Baskerville (1984)	Nfld	334	13-14 years	5.9	-	-
7.	1984	Grenfell Report (1985)	Grenfell	630	15 years	5.8	-	-
8.	1985 (Present Report)	Doshi	Remote Nfld Labrador	229	13-14 years	5.6	6.7%	-

* DMFT = DECAYED, MISSING, FILLED TEETH PER CHILD, INCLUDES PRIMARY AND PERMANENT TEETH.
** CARIES-FREE = DMFT OF ZERO

TABLE 9

Caries experience of school children and adolescents in fluoridated community ***

Study Serial Number	Year of Study	Author	Area	No. of Children	Age	Mean DMFT *	Caries-free ** percent
1.	1954	Brett-Williams (1956)	St. Lawrence	?	7 years	3.7	-
2.	1966	Chaytor (1966)	St. Lawrence	35	6-8 years	2.4	31.4%
1.	1954	Brett-Williams (1956)	St. Lawrence	?	13 years	3.2	-
2.	1966	Chaytor (1966)	St. Lawrence	27	12-14 years	2.2	25.9%

* DMFT = DECAYED, MISSING, FILLED TEETH PER CHILD, INCLUDES PRIMARY AND PERMANENT TEETH.

** CARIES-FREE = DMFT OF ZERO

*** SEE TABLES 16 AND 17 FOR "CONTROL" SITES (STUDIES SERIAL NO. 1 AND 2)

In 1949, upon joining the Confederation, Newfoundland's delivery of health care services changed as a result of the Federal Hospital Insurance and Diagnostic Services Act (1957), and, the Medical Care Act (1967). In 1950 the Department of Health opened a dental clinic in St. John's. One other event of significance was the opening of the Medical School at Memorial University in St. John's in 1969. The first medical graduates emerged in 1973.

2.5 Provincial system

The Provincial Government of Newfoundland, as with all other Provinces, is responsible for the regulations of health care and operations of Hospital and Medical-Care programs. In addition, the Government has established a Children's Dental Plan and a Provincial Drug Program.

2.5.1 Physician services

The main method for delivery of medical care is the private practice, fee-for-service system. Almost all (98.0%) physicians are registered with the Newfoundland Medicare Plan that administers the joint Federal-Provincial funds for this program.

Patients are free to chose a physician of their own liking and the physician is not obliged to accept a particular patient. Payment is made by billing the Medi-Care Plan directly, in which case the physician is paid a percentage of the Newfoundland fee guide.

The ratio of physician to the population for Newfoundland and Labrador was 1:1,751 in 1971 and 1:1,273 in 1981. 65.4% of physicians are in private practice as general practitioners or specialists (Osborn, Patey and Pynn, 1984).

2.5.2 Hospital services

Care in hospitals, excluding mental hospitals, is covered by the Hospital Insurance Plan (1958) and the costs are shared by the Provincial and Federal Governments. Most hospitals are board operated and financed through the Department of Health.

There are a total of 44 hospitals including cottage hospitals, nursing stations, one

fluoridated areas (Study 2). Caries-free children in this definition were those children that did not have any decayed teeth nor had ever any fillings placed, or teeth extracted because of decay.

The next section will review the Newfoundland and Labrador health care delivery system from historical perspective.

2.4 A brief history of health care development

Newfoundland's health care development began to take shape from as early as 1814 when Newfoundland was formally recognized to be a British Colony (Perlin, 1970). The first civic hospital was established in St. John's in 1813 (Miller, 1959). From this time on there were four brief periods of political development that had an influence on development of health care in Newfoundland. The first was the establishment of representative government in 1832 until 1854; from 1855 to 1934 Newfoundland was granted responsible government. In 1934 Newfoundland's constitution providing responsible government was suspended and a Commission government was established. In 1949 Newfoundland entered Confederation and became the tenth province of Canada.

During the period of representative government a Board of Health (1832) was established to deal with the main problem of the day - epidemic diseases. One event of note was the passing of the Public Health Act (18[illegible]) It was during the period of responsible government that significant developments in health care took place. In 1892, Dr. Wilfred Grenfell, a British doctor began his medical missionary work in Northern Newfoundland. His work led to the establishment of the Grenfell Regional Health Services, a part of the International Grenfell Association. The organization set up a private hospital program in St. Anthony. Similar hospital programs were later set up by United Church of Canada and such agencies in other parts of Newfoundland.

In 1936, with establishment of the Commission government, five of the eventual seventeen cottage hospitals were opened and operated by the Government. In general, this was the extent of the health care program until 1949.

mental hospital, a children's hospital in St. John's and a children's rehabilitation centre.

2.5.3 Pharmacist services

The Newfoundland Pharmacy Board was established in 1910 (Newfoundland Department of Health 1987). The regulation and licensing of pharmacists is set out in the Pharmacists Act (1910). The Food and Drug Act and the Narcotics and Control Drug Regulations control advertising and dispensing of drugs. The Newfoundland Interchangeable Drug Products Formulary guides the pharmacist on the base cost of product selection.

The Newfoundland Department of Health operates three drug programs: Senior Citizens Drug Subsidy Program, Social Services Drug Program and Newfoundland and Labrador Prescription Drug Program.

In 1986-87 the cost of the Senior Citizens Drug Subsidy Program and Social Service Drug Programs was estimated at $18.2 million (Newfoundland Department of Health, 1987).

The number of licensed pharmacists in 1987 was 407, giving a pharmacist to population ratio of 1:1,400. (Newfoundland Pharmaceutical Society, 1987).

2.5.4 Dentist services

The first Dental Act was passed in 1893. This Act also led to the setting up of a Dental Board which consisted of three dentists and four medical men, and others appointed by the Government (Kavanagh, 1952).

2.5.4.1 Children's dental plan

In 1950 a clinic was established by the Provincial Government for dental care of children in St. John's. Free treatment was offered to 5 and 6 year old children who were in regular school attendance (Kavanagh, 1952; Gullett, 1971). It was at this time that the dental program was formalized. Newfoundland is recognized as the first province to

have a universal children's dental care program (Health and Welfare Canada, 1986). The program was introduced in 1950-51 through an Order-in-Council.

The service availability and population coverage has continued to expand such that since 1978 the program provides for dental care of children up to their thirteenth birthday. In 1984-85 there were approximately 140,000 children under the age of 13 in the province. The number of children treated in that year was 78,674 and the cost of the Children's Dental Program was estimated to be $6.46 million, giving a per user cost of $82.07 for 1984-85. All basic dental care services are covered, including preventive care. There is a user service charge of $5.00 payable for each curative dental service. Funding of the program is raised through general taxation, and the method of payment to the dentists is fee-for-service.

Patients are free to choose a dentist of their own liking. Payment for the children's dental services is made by billing the dental section of the Medi-Care Plan (MCP). A fee structure is negotiated between the MCP and representatives of the dental association usually on an annual basis (Newfoundland Department of Health, 1985).

2.5.4.2 Surgical-dental services

Another plan through which residents can obtain dental services is the Hospital Surgical Dental Services. Where an individual requires hospitalization and dental care is medically necessary, payment for this is covered by the Medi-Care Plan under surgical-dental procedures. The expenditure for this service in 1981-82 was $476,900 (Health and Welfare Canada, 1986).

2.5.4.3 Social-services care

Limited dental care is available for adults who are social service beneficiaries. Coverage is also extended for the dependent children of social service recipients to the eighteenth birthday, and for orphans and wards of the Director of Child Welfare, to the twenty-first birthday (Health and Welfare Canada, 1986).

2.5.4.4 Third-party dental plan

Data from the Canadian Association of Accident and Sickness Insurances, largest group among the private third-party payment sponsors, indicate that in the nine years from 1970 to 1979, the number of Newfoundlanders covered by third party dental payment grew from 768 to 10,343 (Canadian Dental Association, 1980).

2.5.5 Dentists

In 1985 there were 134 dentists in the Province, including specialists in dental public health (two), orthodontics (five) and oral surgery (two), serving a population of about 570,000 giving a dentist to population ratio of 1:4,300. Some of the dentists have been encouraged to settle in to rural areas through the provision of grants and subsidies. Practically all the dentists are in private practice (Newfoundland Dental Board, 1985).

In the areas of study, that is, remote Newfoundland and Labrador, in 1985, there were an equivalent of approximately nine full-time dentists serving a population of 43,644, giving a dentist population ratio of 1:4,849.

2.5.6 Targeted preventive services

The Dental Division of the Department of Health was established in 1952 and continued to administer children's dental plan and provide preventive-educational services until 1982.

In 1982 Government's Minute-of-Council (833-'82), authorized the Department of Health to separate the administrative aspects of the children's dental program from the preventive and public health aspects. This led to the merging of the children's dental plan with the Medi-Care Plan (MCP) and to the establishment of a division of community dentistry. The community dentistry division was set up in 1982-83 within the province's public health structure, and a director of community dentistry was appointed.

2.5.7 Dental auxiliaries

Four types of auxiliaries are engaged in the delivery of dental services all of whom, except dental assistants, receive their training outside the province. Since 1985, a dental assistant training program has been available at a privately operated institute in St. John's. The certified dental assistants are trained in one year. It should be noted here that assistants may also receive training in a dentist's office.

In 1985 there were 21 dental hygienists registered with the Newfoundland Dental Board. The other auxiliaries are dental technicians and denturists. The denturists function under their own act, The Denturists Act, that was established in 1980.

2.6 Costs

It has been estimated that in Newfoundland in 1983 the cost per person for dentist service was $25.60. The total bill for dental services was $14.7 million (Health and Welfare Canada, 1987), or 2.1% of the total Newfoundland health expenditure which amounted to $683.8 million. Health care represented a little over 13.9% of the Newfoundland Gross Domestic Product and dental services were 0.3% of the G.D.P. (Newfoundland Statistics Agency, 1987).A breakdown of expenditure per person on health care in Newfoundland is given in Table 10. Per capita expenditure for dentist's services rose 522.9% from 1970 to 1983. For every $4.80 spent on all physician services combined, $1.00 was spent on dentist services. In 1970 this ratio had been closer to 7:1.

Since less than 50% of the population in Newfoundland visits a dentist in any given year (Canada Health Survey, 1981), the true cost of oral diseases and their treatment is underestimated. In addition, there is the added burden of time lost from work, lost schooling, emotional, psychological and sociological aspects of the impact of oral diseases at both the individual and societal level. Oral diseases, especially dental caries, present a vast public health problem (Federation Dentaire Internationale (FDI), 1981).

TABLE 10

Health expenditure
1970-1983
Newfoundland, dollars per capita

	Hospital Care	Physician Services	Dentist's Services	Prescribed Drugs	Total Expenditure
1970	93.72	29.38	4.11	12.07	187.83
1983	565.85	122.04	25.60	84.97	1187.19
Percent Increase 1970-1983	503.8	315.4	522.9	604.0	532.1

Source: Health and Welfare Canada (1987)

2.7 Oral health attitudes

An important perspective on the dental health delivery system is the attitude of the consumers toward the system and the patterns of consumer utilization.

In a telephone survey on all adults over 20 years of age in a sample of households in metropolitan St. John's, just over 97% of the 2,612 adults with teeth reported brushing their teeth daily (Segovia, Bartlett, Veitch and Edwards, 1986). 60% of the sample reported visiting a dentist in the past year.

In the same study (Segovia et al., 1986) 20.7% of the 3,300 adults surveyed reported being completely edentulous. Under the children's dental plan, in 1984-85, 34.9 extractions were performed for every 100 teeth filled (Newfoundland Department of Health, 1986).

In another survey of 282 new mothers in two maternity hospitals in St. John's, 91% of the mothers reported brushing their teeth two or more times a day and 52.8% reported visiting a dentist in the past twelve months (Doshi 1985). It was interesting to note that although most of the mothers surveyed were unaware of administration and use of fluorides, and the majority unaware of the dentist's recommendations on this preventive measure, yet just about 90% agreed to have their children participate in a fluoride program if one were available.

2.8 Summary

In summary, the Newfoundland dental care system revolves around the private practice, fee-for-service system, where most of the care to the children is delivered by private practitioners through the government operated children's dental plan. At the end of 1978, about 28% of Newfoundland residents were covered by government and/or private dental plans (Canadian Dental Association, 1980). Dental hygienists and denturists also provide care, but this is minimal.

The adults seem to be well aware of the importance of self-care through tooth-brushing and there is a desire for citizens to want effective preventive programs. This, coupled with the results from the earlier studies of dental benefits of fluorides, seems to

indicate a need for the province to shift future investment from personal curative to community preventive programs.

CHAPTER 3

MATERIALS AND METHODS

3.1 Oral health status in perspective

The first consideration with respect to health is that it is easier to define and measure disease than to produce a definition of health (Lewis, 1979; World Health Organization (WHO), 1984). Secondly, it is important to recognize that although the "International Classification of Diseases - Application to Dentistry and Stomatology" lists more than 1,000 diseases or conditions which the dentist should be able to diagnose and treat, or appropriately refer, there are only two overwhelmingly prevalent oral problems - dental caries and periodontal disease, at least in the industrialized countries. A third set of oral conditions - malocclusion, a part of dentofacial anomalies - reaches the moderately prevalent state (Barmes, 1979).

3.1.1 Theoretical orientation

"Oral Health Status" in this report is defined in several ways based on clinical findings of oral structures.

The theoretical focus of the study is on oral health status and how it is affected by the type of oral health care service and behaviour. Variations in the prevalence (experience) of oral disease and the utilization of services and children's reported dental health behaviours are also described and discussed.

Further consideration is that the two more commonly occurring oral diseases, dental caries and periodontal disease, fall predominantly into the category of chronic illnesses. Their aetiologies, in similarity with other chronic diseases, are multifactorial in nature, and therefore encompass multiple risk factors and their interactions (Konig, 1970; Newbrun, 1983; Loe, Theilade and Jensen, 1965; McHugh, Matsson and Socransky, 1986; Theilade and Theilade, 1976; von der Fehr, Loe and Theilade, 1970; Bowen and Birkhed, 1986; Gustafsson, Quensel, Lanke, Lundquist, Grahnen, Bonow

and Krasse, 1954). A further limitation of prevalence data, as collected in cross-sectional study such as this one, is that the presence of an attribute and disease status are measured at the same time and thus, strictly speaking, do not permit aetiological inferences (Mausner and Kramer, 1985). These and other methodological problems are discussed further in the section on questionnaires and in the section on estimates of association.

It is important to recognize, however, that full knowledge of aetiological mechanisms is not necessary to mount effective control measures against dental caries and periodontal disease (Granath and McHugh, 1986; Lewis, 1988). The reported results, when appropriately analysed and interpreted, may provide additional information to identify the extent to which selected components of the oral health care delivery system are associated with differences in oral health status.

This study is primarily interested in demonstrating if the oral health status of the population in remote areas is different from that of similar age group children reported in the Atlantic Canada Children's Oral Health Survey and other Canadian studies (Hunt, Lewis, Banting and Foster, 1980; Stamm, Lizaire, Fedori, Finnigan, Taylor and Willey, 1980(b); Banting et al., 1985; Health Unit Association of Alberta, 1986) and whether there is any relationship between selected dental health practices and the oral health status of the population.

3.2 Instrumentation

As the Newfoundland and Labrador Remote Areas study was based on the Atlantic Canada Children's Oral Health Survey (ACCOHS), this study used the instruments designed for the ACCOHS. These included an oral examination for the collection of clinical data and a questionnaire for the sociological information. However, certain changes were made in the questionnaire in order to collect additional personal oral care and snacking behaviour data, as well as information on utilization of dental services.

3.2.1 Oral examination

The examination form (Appendix A) was revised from that used in the Ontario (Hunt et al., 1980), Alberta (Stamm et al., 1980(b)) and Quebec (Stamm et al., 1980(a)) studies. The major additions to the form were the observations of tooth surfaces (Radike, 1972; FDI, 1975 and 1982; WHO, 1977) and the use of orthodontic template (FDI, 1974). The procedure manuals prepared for the Atlantic Canada Children's Oral Health Survey (Banting et al., 1984) and Ontario Study (Hunt, et al., 1978) were used for retraining session and throughout the survey (Appendix A).

Periodontal conditions were recorded for all fully erupted teeth using a modified Russell Periodontal Index (PI) (Russell, 1956; Davies, 1968). Each tooth was scored according to the clinical condition of its supporting tissues. A score from 0 to 8 was assigned to each tooth: score 0 = normal, 1 = mild gingivitis, 2 = gingivitis, 6 = gingivitis with pockets, 8 = advanced periodontitis. The patient's Periodontal Index was calculated by adding the scores for each tooth and dividing by the number of teeth scored. Partly erupted teeth were not scored and so did not contribute to the Periodontal Index. The modification from the Russell Periodontal Index included the assignment of score 6 for recoding of pockets between 3 mm and 6 mm in depth, and a score of 8 for recoding of pockets over 6 mm in depth. Instructions were included on the use of periodontal probe in regard to scores 6 and 8 which had been included specifically for Atlantic Canada Children's Oral Health Survey and this study.

Periodontal treatment requirements were assessed as those requiring plaque removal and individual instructions, and scaling. Scaling was scored as being necessary when there were gross deposits of calculus necessitating meticulous removal of subgingival and/or supragingival deposits. Plaque removal and individual instruction was scored as a required treatment when there was adherent plaque and minor deposits of supragingival calculus in any part of the mouth.

Dental caries was recorded for each surface of each tooth, four or five surfaces according to tooth, in terms of decayed (D), missing (M) and filled (F) primary and/or permanent surface. The total number of decayed (D), missing due to caries (M), and

filled (F) surfaces formed the DMFS index. In case of teeth assessed as missing due to caries the index was interpreted literally and the missing tooth was given a score of four or five surfaces, according to the tooth type (FDI, 1975; James and Beal, 1974). Since surface counts can be converted to a per-tooth basis, DMF tooth counts (DMFT) were also calculated for comparison with the results of other surveys. In either case the basic unit of analysis was the student (or mouth) and results are given in terms of surfaces or teeth per child. The average DMF score thus expresses the mean caries prevalence in a group of individuals.

Dentofacial anomalies were measured for the 13 to 14 year old group only. The method used was a modification of the FDI Measures of Occlusal Traits (FDI, 1974), indicating presence or absence of anomalies of the dentition, of spacing, of occlusion, and, skeletal deformity and molar relationship. Treatment requirements as well as treatment status were recorded.

Space was provided for scoring if a child had oral pathology or condition needing immediate attention. Note was also made for orthodontic and other requirements, such as, prosthetic.

3.2.2 Questionnaires

Identical questionnaires were used for both the 6 to 7 and 13 to 14 year old groups with minor word changes for the 13 to 14 year old version where the students themselves were to complete the questionnaire (Appendix A).

For both age groups socioeconomic and demographic background information was obtained from the parents/guardians through the school. For the younger children the parent/guardian also provided information on the child's personal oral care, eating of snacks between meals and utilization of dental services. This latter information, for the 13 to 14 year old students, was obtained from the students themselves at the time of the examination in the school.

One measurement was to estimate the number of sweet drinks and sweet snacks taken by the students in the previous 24 hours. The advantages of the 24-hour recall

questionnaire used in this study are its simplicity, the short time that is required to collect the information and its reasonable validity for a group of individuals (Burt and Eklund, 1981; Block, 1982; Ismail, 1986).

Variables

Socioeconomic

1. Age
2. Gender
3. Place of residence(s) since birth and time spent at each location
4. Socioeconomic status
   (parent/guardian relationship to child, education, occupation)
5. Income - Total family income
6. Siblings - Number and gender
7. Language and Ethnic Group

Past dental health actions

Personal oral health behaviour

1. Personal oral care
   toothbrushing, flossing
2. Number and type of snacks between meals
   sweet snacks, sweet drinks, other snacks
3. Use of fluoride toothpaste
4. Toothbrushing behaviour
   when and how many times teeth were brushed
5. Flossing behaviour
   how many times flossed

Tendency to use practitioners

Utilization

1. Time of last visit
2. Type of services received at last visit
   diagnostic, curative, preventive
3. Number of visits in past twelve months
4. Estimated cost of dental care in past twelve months

The questionnaires were prepared in English and were then translated by consultants into Inuktituk and Innu languages. Samples of these will be found in Appendix A.

3.3 Fieldwork

The fieldwork stage began on March 25, 1985 in Sheshatshit, Labrador and the last school visited was in Conne River on the southern coast of the Island of Newfoundland on June 3, 1985. It had been planned to take place at a period when school holidays and climate would not hinder contact with the study population. Work schedules were developed daily to co-ordinate the administration and collection of questionnaires, contact with school principals, caretakers, public health nurses in the community, parents and providers of transportation and accommodation.

3.3.1 Staff

The principal investigator for this study who served as the examiner and the recorder who also served as the co-ordinator, had the overall responsibility for carrying out the study according to the protocol. The team conducted all the examinations. The recorder noted the clinical measurements called out aloud by the examiner. A number of steps were taken to ensure that uniform measurement criteria and examination procedures were used and maintained in performing examinations. Firstly, the team of examiner and recorder had participated with World Health Organization epidemiologists in a three-day training and calibration session held in Halifax, Nova Scotia, as part of the 1982 Atlantic Canada Children's Oral Health Survey (ACCOHS) (Banting et al., 1984). The team subsequently examined 269 of the 2,381 children in the two selected age groups for that study.

Secondly, prior to the fieldwork for the present study, a two-day re-training session was held for the team under the guidance of Dr. David Banting, the chief investigator for the ACCOHS. The session was held from February 25 to 27, 1985 at St. Patrick's Hall School, St. John's. The children were randomly selected from the Grade I and Grade VIII class lists. At this session three additional examiners were also trained in case of illness or emergency replacement and to assist with such future investigations in the Province. Eleven children in the two age groups were examined during the two-day period. In all 44 examinations were performed by the four examiners. Each dentist

examined a child and the results were compared.

Dr. Banting checked to see that the examining techniques and the judgements of the examiners met with the criteria established during the ACCOHS.

Thirdly, during the fieldwork a measure of intra-examiner reliability (consistency) was obtained by having a second examination performed by the study examining team for about 10% of the sample.

3.3.2 Pretest

In order that the examining team become familiar with the equipment, instruments and the examination procedure under field condition a pretest was held at Robert Leckie School in Goose Bay, Labrador, on March 3 and 4, 1985. Twenty-six students were randomly selected from the Grade I and Grade VIII class lists.

From the pretest it was learned (Table 11) that in Coastal Labrador for any number of reasons (extreme weather, over age/under age, small classes, family moving in or out permanently from the community) the final response rate (the number of children examined, recorded and subsequently analysed) would probably be somewhat lower than normally expected in other communities in such studies. In Coastal Labrador, therefore, special efforts were made to maintain a high response rate.

3.4 Field Procedures

3.4.1 On site arrangement

It was essential to investigate and arrange accommodation and transportation well in advance. In Coastal Labrador the only means of transportation between communities was airplanes, and, within communities a skimobile and kimatik. In other areas of the study, Fogo/Burgeo district, the ferry schedule had to be checked in advance to avoid unnecessary waiting.

Accommodation was found through the public health nurses or the school staff in the community. It was generally of the private boarding type.

TABLE 11

Status of respondents selected for pretest
Goose Bay, Labrador, March 1985

	Grade I No.	Grade VIII No
Total Sampled	13	13
No Response	3	3
Moved	1	0
Refused to Participate	1	0
Consented to Participate	8	10
Absent or Moved (following consent)	0	1
Over/Under Age	0	1
Examined and Recorded	8	8

3.4.2 Contacting respondents

Approval to conduct the study was obtained initially from the Department of Education. The Superintendents of Boards were then contacted through the Director of School Services. Once the schools were chosen, the individual principals and the Public Health Nurse assigned to the school were advised of the study, by letter and then phone call, and their assistance sought to make final arrangements for the visit.

As noted earlier, the students were chosen at random from the class lists provided by the school. Each selected student was provided with a sealed envelope containing a combined consent form/questionnaire and a letter addressed to the parents explaining the purpose of the study. An envelope was also enclosed for return of consent/ questionnaire.

The sealed envelopes with appropriate instructions were mailed to the school some weeks in advance for distribution and collection. The envelopes were distributed and collected by the class teacher and held in the school until the examining team arrived.

Each student consent/questionnaire was assigned a case number. This case number formed a permanent record for future referral. It also provided an ongoing record of the number of consents/questionnaire distributed and the number of children examined. At the end of each examination the student was provided with a short oral health status report. (See Appendix A for all relevant forms).

On arrival at the school the team met with the principal and teachers involved. The co-ordinator/recorder collected the consent/questionnaire forms while the examiner set up the equipment of portable dental chair and fibre-optic light in an unused classroom or nurses' room. Sufficient supply of sterile disposable gloves and instruments were carried for use at each examination. The younger children were generally seen in the morning and the 13 to 14 year olds were scheduled for the afternoon. After examination, each 13 to 14 year old completed a questionnaire regarding his/her past dental health practices.

3.4.3 Persuasion

All take-home material was translated into native languages and in Sheshatshit, a predominantly native Innu community, an interpreter was hired to assist with distribution and collection of consents and questionnaires. In Nain, with largely Inuit population, the public health nurse arranged distribution and collection of consents/ questionnaires. Also, on the day of the examinations, which were conducted in the late afternoon and evening because of logistics of flight times, the nursing assistants and caretaker for the nursing station, played an important role in ensuring that all these students were examined. The nursing staff contacted the families by phone or by home visits. They also provided transportation for the children and parents to and from the examination centre.

3.5 Data processing and analysis

For the ACCOHS, the survey data were recorded on mark-sense forms and the forms were processed and data written on a tape at the American Dental Association headquarters in Chicago. For this tudy, after consultation with computer agencies, it was decided to transfer coded data to computer files at Newfoundland and Labrador Computing Services (NLCS) in St. John's. A data entry program was designed by NLCS especially for this study using a fourth generation computing product called PC/ FOCUS. Data were entered directly from the examination recording forms and the questionnaire. This was done to save time of transcribing of data from examination form on to a coding form before data entry, and it also probably reduced the compounding of errors. An IBM/AT micro computer (640K) was used for data entry.

A record/file layout as well as a procedural guide for data entry were prepared by NLCS. The record/file layout was organized to match exactly all the elements of the raw data files generated from the ACCOHS. This was an important consideration since the raw data files from both the studies were to be merged for re-analysis of combined data for a further report at a later date.

Most of the important fields were validated in the program. Editing rules and ranges for the approximately 400 variables were defined and the program tested before data entry. For example, the number of primary and permanent teeth entered was checked against the total number of primary and permanent teeth calculated. Further, hard copy of all data entered were printed and proofread for verification. Notes of any errors noted were kept and a program prepared for correction. Finally, for other inconsistencies a series of "select if" statements were prepared using Statistical Package for the Social Sciences (SPSS^x, 1986). An example of this is where a tooth is missing on the caries index but was given a score on the periodontal index.

Cleanliness of the data were thus ensured through: following an established protocol and checking the entries during clinical examinations, validation through data entry, verification after data entry and examination of frequency tabulations of each variable to identify missing or out of range values.

Raw data on the diskette were formatted by NLCS for uploading into the mainframe computer system. The analysis of the study results was carried out on the VAX system at the Faculty of Medicine, Memorial University of Newfoundland, and also at the University of Western Ontario on the CDC385 computer.

The Statistical Package for the Social Sciences (SPSS^x, 1986 Version 2.0) was used for the computation of frequency distributions, basic indices of oral health (e.g., DMFS, DMFT, PI) and to construct data files for further analysis. The computation of survey estimates and tests of significance was performed using the Cluster Analysis and Regression Program (SUPER CARP) (Hidiroglou, Fuller, and Hickman, 1980). This program was designed for the analysis of survey data and implements methods of estimation appropriate for data from complex survey designs such as the one employed in this study.

3.5.1 Statistical analysis

Common aims of epidemiological research on, for example, dental caries are:

(i) To determine the prevalence of dental caries within different age, sex, ethnic,

geographic, national, or social groups of people; this type of epidemiological survey is called a descriptive survey.

(ii) To search for possible reasons or causes of any differences manifested among and within these groups, such as diet, tooth-brushing habits, presence of elements such as fluoride; this type of epidemiological survey is called an explanatory or analytical survey (FDI, 1975).

Results from a descriptive epidemiological study inform of the amount and distribution of disease within a population; whereas results from analytical studies inform of the reasons for the relatively high or low frequency in specific population (Mausner and Kramer, 1985).

Although the primary aim of this study was to provide precise estimates of the prevalence of oral disease and of selected dental health behaviours, the development of a priori hypothesis may come helpful in providing an additional level of explanation about the effect of some of the behavioural and other factors on oral health status.

For example, one of the objectives of statistical analysis is to reveal the underlying differences in the DMFS index, from the effects of other measured variables, such as two-times-a-day toothbrushing (Norman and Streiner, 1986).

3.5.2 Estimates of association

In observational studies, when the researcher cannot institute an experiment in which some people get one or more of an independent variable, for example, regular or occasional consumption of fluoridated water, and some do not get it at all, the researcher must deal with natural variations in the real world, in which people may, of their own volition, acquire varying degrees of something (systemic fluoride) and then have more or less of the dependent variable (DMFT index or oral health status) and so the problem of identifying the reasons for differences in health or disease levels is much more difficult.

A number of criteria are widely used to evaluate the likelihood that an association is causal. Cause can be defined by saying that A causes B, if and only if, (i) A is prior

to B, (2) change in A is correlated with change in B, and (3) this correlation is not itself the consequence of both A and B being correlated with some prior C (Mausner et al., 1985).

The first step in determining causal relations is to study association. One question to ask is if there is a statistical association between groups (those with and without optimal use of fluoride) in frequency of disease (dental caries). Another question is whether the subgroup with high dental caries rate has any factor(s) other than the one being studied (they might also have high or low frequency of between-meal sweet snacks) that might influence the disease rate (dental caries rate). Analytical procedures can be employed to determine the effect of such factors (as many as are known to be of importance) and to neutralize them. One such analytical procedure or statistical model is regression analysis (Dunn and Clark, 1974; Banting et al., 1984).

3.5.3 Computation of estimates

Estimates related to the major objectives of the study were computed using SUPER CARP (Hidiroglou et al., 1980). The basic estimates computed by SUPER CARP were of three types: Stratum (district) means and standard errors, overall means and standard errors, and subpopulation means and standard errors. In addition multiple regression models were fitted to the survey data using SUPER CARP to test for the effects of certain factors with others controlled.

3.5.3.1 Computation of overall means and stratum means

Estimates of oral health were first calculated within each stratum or district. The stratum estimates were then combined to form overall estimates.

3.5.3.2 Computation of stratum means

The stratum estimates were means of individual school means weighted to reflect the selection probability for each school as determined by the sampling plan. The

weights used in SUPER CARP were the reciprocals of the selection probabilites and are given in Tables 12 and 13.

These weights assume that each school was selected with probability proportional to the size of Grade I or Grade VIII enrollment. And, since, due to study design, each student in a given stratum did not have the same probability of being selected, the weights for selection of students assume that each student was selected with probability proportional to the actual number of students sampled from each school.

The estimates of oral health were calculated separately for each age group, 6 to 7 and 13 to 14 years, for each of the six strata: Northern Peninsula, Northern Labrador, Southern Labrador, Fogo/Burgeo, St. Anthony and North West River, for the following variables: Decayed, Missing, Filled Surfaces and Decayed, Missing, Filled Teeth as well as individual components of each, Decayed Surfaces, Missing Surfaces, Filled Surfaces and Decayed Teeth, Missing Teeth and Filled Teeth, separately for primary and permanent teeth and a total.

3.5.3.3 Computation of overall means

The computation of overall means as estimates for the study population as a whole involved taking a weighted combination of stratum means. This was done so that each stratum contributed to the overall estimate in proportion to the actual number of students in that stratum.

Overall means and standard errors for each of the two age groups were calculated for a number of variables including the following: DMFT, DMFS as well as their components and for primary teeth as well as permanent teeth and total, and, Russell's Periodontal Index.

3.5.4 Computation of subpopulation means

Subpopulation are groups within the population that cut across stratum boundaries (e.g. males and females or socioeconomic status - there were students of each sex or a particular socioeconomic group in every stratum since the sample was not

TABLE 12

Weights and sampling fractions for Super Carp
Ages 6-7

Stratum	School	Weight	Sampling Fraction
1	22	318/7	14/22
	21	318/15	
	23	318/8	
	16	318/16	
	24	318/13	
	25	318/11	
	19	318/12	
	18	318/11	
	13	318/14	
	11	318/15	
	12	318/13	
	15	318/13	
	14	318/10	
	17	318/9	
2	4	102/8	4/7
	3	102/18	
	29	102/12	
	1	102/26	
3	9	29/8	2/3
	8	29/12	
4	26	76/13	3/4
	28	76/7	
	27	76/13	
5	20	50/13	1
6	2	10/10	1

NOTE: Please see Pages 4 and 56 for an explanation of schools not included in this table.

TABLE 13

Weights and sampling fractions for Super Carp
Ages 13-14

Stratum	School	Weight	Sampling Fraction
1	22	433/9	12/16
	21	433/9	
	16	433/13	
	19	433/13	
	23	433/13	
	18	433/13	
	13	433/13	
	12	433/13	
	11	433/14	
	15	433/13	
	14	433/12	
	17	433/13	
2	4	82/5	4/7
	3	82/11	
	27	82/25	
	1	82/9	
3	9	41/15	2/4
	8	41/11	
4	24	205/13	1
	26	205/7	
	25	205/13	
	28	205/25	
5	20	82/13	1
6	2	14/10	1

NOTE: Please see Pages 4 and 56 for an explanation of schools not included in this table.

stratified by sex or socioeconomic status). The computations of subpopulation estimates in SUPER CARP was accomplished in a fashion similar to that for stratum estimates (i.e. the program treats the subpopulations as new strata). Subpopulations means and standard errors were calculated for DMFT, DMFS and PI for the following variables in each of the two age groups: gender (sex), parental education, socioeconomic status, income, utilization of dental services, snacking, tooth-brushing and flossing behaviour, language, ethnic group and influence of water fluoridation.

3.5.5 Regression analysis

Regression analysis examines relationship (association) between a dependent variable (dental caries) and one or a set of independent variables. The measures of association in this model are the correlation and regression coefficients. The correlation coefficient measures the degree of association between two factors (dental caries and frequency of use of fluoridated tooth-paste, for example). A regression coefficient measures the change in the response variable (number of decayed tooth) associated with per unit change in the given factor (fluoride tooth-paste) when all other known factors are controlled (number of sugar snacks, for example).

Regression analysis was used to test the significance of the effects of certain factors (e.g. brushing habits) on oral health status (DMFS and its components). The use of multiple independent variables in the same model (multiple regression) provided a test of each independent variable controlling for the effects of the other independent variables. Multiple regression models were fitted to the survey data using SUPER CARP. The program implements methods of estimating the standard errors of regression coefficients from complex survey data. Thus the tests of significance of the regression coefficients took into account the fact that the data came from a two-stage cluster sample. These tests of significance were based on student's t-tests, and a p-value of .05 or less meant that the coefficient was significantly different from zero at the 0.05 level of significance. This can be interpreted as meaning that the given factor had a statistically significant effect on the given aspect of oral health (dependent variable), when the other

factors in the model were controlled (Dunn and Clark, 1974).

3.5.5.1 Analysis of covariance (ANCOVA)

Comparisons of oral health status were made among categories of a survey factor (e.g. native vs non-native). Such comparisons may be influenced by other factors that were not controlled in the study design (e.g. native and non-native students may be from different socioeconomic backgrounds). The means can be adjusted for the estimated effects of these possible confounding factors by analysis of covariance (ANCOVA). Such an adjustment was made for the comparison of DMFS for the six strata (Dunn and Clark, 1974).

Tests of significance of regression coefficients for factors with unordered categories (e.g. sex) are tests of significance of the difference of adjusted means for those categories (e.g. male vs females).

3.5.6 "Raw" means and standard errors

"Raw" means and standard errors were also computed by treating the data involved in its computation as a simple random sample. Since the only simple random samples in this study were the samples of students from each school, raw means and standard errors are not appropriate estimates of population or subpopulation quantities above the level of the single school. For this reason SUPER CARP was used to compute estimates related to the major objectives of the study. However, because of the large number of questions involved in the study questionnaire it was too costly and time consuming to estimate means for all subdivisions of the population determined by the response to each question. Therefore raw means and standard errors computed in SPSS[x] are given for the categories of response to the individual questionnaire items (see Appendix B). Because districts and schools were represented in the sample approximately in proportion to their size the raw means are adequate estimates for the purpose of suggesting or explaining effects of factors examined in more detail by the SUPER CARP analysis.

3.5.7 Possible sources of bias

3.5.7.1 Sample and target population

Schools with less than seven students were omitted from the sampling frame. Tables 14 and 15 show the number of schools and students excluded in each district due to this restriction. A fairly sizeable proportion of the Southern Labrador student population was omitted. This may have biased the Labrador estimates and to a smaller extent the overall estimates if the oral health status of students in the excluded schools was systematically different from those in the sampled population.

To examine the possibility and extent of any bias due to this non-coverage, it was hypothesized that the oral health status of students would decrease with the size of the school. This hypothesis was tested by regressing DMFS on Grade I and Grade VIII enrollment for the 6 schools visited in Labrador.

These results were shown on scatter plots. The negative slopes of the regression lines would support the hypothesis. The slopes were not significantly different from zero for Grade I or Grade VIII school size (P= 0.38 for Grade I and p= 0.26 for Grade VIII).

The results showed no significant trends in DMFS with decreasing enrollment. Therefore unless there were factors other than school size that resulted in systematic differences between sampled and excluded schools, the bias resulting from their exclusion was likely rather small.

3.5.7.2 Non-response

The examination of students in this survey required parental consent. Students who were selected into the sample but did not return the consent form with parental/ guardian approval for participation were not examined. A total of 285 consent forms with parental approval were returned for the 6 to 7 year old group and 294 for the 13 to 14 year old group. Thus response to request for participation in the study was 82.94% in the younger group and 86.70% among the older students (Tables 16 and 17). If the non-respondents had systematically poorer (or better) oral health than those who responded, the results from this study would overestimate (or underestimate) oral

TABLE 14

Exclusions from sampling frame
Ages 6-7

District	No. of Schools in District	No. of Schools Excluded	No. of Students in District	No. of Students Excluded	% of Students Excluded
1. Northern Peninsula	29	7	341	23	6.7
2. Northern Labrador	9	2	113	11	9.7
3. Southern Labrador	8	5	45	16	35.6
4. Fogo/Burgeo	4	0	76	0	0.0
5. St. Anthony	1	0	50	0	0.0
6. North West River	1	0	10	0	0.0
7. Forteau	5	3	25	10	40.0
	57	17	660	60	9.1

TABLE 15

Exclusions from sampling frame
Ages 13-14

District	No. of Schools in District	No. of Schools Excluded	No. of Students in District	No. of Students Excluded	% of Students Excluded
1. Northern Peninsula	17	1	439	6	1.4
2. Northern Labrador	11	4	95	13	13.7
3. Southern Labrador	8	4	53	12	22.6
4. Fogo/Burgeo	4	0	205	0	0.0
5. St. Anthony	1	0	82	0	0.0
6. North West River	1	0	14	0	0.0
7. Forteau	3	0	52	0	0.0
	45	9	940	31	3.2

TABLE 16

Response rates and examinations for Grade I

District	Consents Distributed	No response/ Refused Number (%)	Consented Number (%)	Number (%) of consented that were . . . Absent/ Moved	Over/ Under Age	Not Recorded	Examined, Recorded and Analysed
Northern Peninsula	167	16 (9.6)	151 (90.4)	13 (8.6)	0 (0.0)	3 (2.0)	135 (89.4)
Northern Labrador	96	35 (36.5)	61 (63.5)	3 (4.9)	0 (0.0)	12 (19.7)	46 (75.4)
Southern Labrador	20	1 (5.0)	19 (95.0)	2 (10.5)	0 (0.0)	0 (0.0)	17 (89.5)
Fogo/Burgeo	33	3 (9.1)	30 (90.9)	0 (0.0)	0 (0.0)	0 (0.0)	30 (100.0)
St. Anthony	13	4 (30.8)	9 (69.2)	1 (11.1)	0 (0.0)	0 (0.0)	8 (88.9)
North West River	10	2 (20.0)	8 (80.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (100.0)
Forteau	7	0 (0.0)	7 (100.0)	0 (0.0)	0 (0.0)	7 (100.0)	0 (0.0)
Total	346	61 (17.6)	285 (82.4)	19 (6.7)	0 (0.0)	22 (7.7)	244 (85.6)

TABLE 17

Response rates and examinations for Grade VIII

District	Consents Distributed	No response/ Refused Number (%)	Consented Number (%)	Number (%) of consented that were . . . Absent/ Moved	Over/ Under Age	Not Recorded	Examined, Recorded and Analysed
Northern Peninsula	148	20 (13.5)	128 (86.5)	12 (9.4)	6 (4.7)	0 (0.0)	110 (85.9)
Northern Labrador	72	10 (13.9)	62 (86.1)	3 (4.8)	0 (0.0)	16 (25.8)	43 (69.4)
Southern Labrador	26	1 (3.8)	25 (96.2)	6 (24.0)	0 (0.0)	0 (0.0)	19 (76.0)
Fogo/Burgeo	58	6 (10.3)	52 (89.7)	1 (1.9)	1 (1.9)	9 (17.3)	41 (78.8)
St. Anthony	13	5 (38.5)	8 (61.5)	1 (12.5)	0 (0.0)	0 (0.0)	7 (87.5)
North West River	10	1 (10.0)	9 (90.0)	0 (0.0)	0 (0.0)	0 (0.0)	9 (100.0)
Forteau	12	2 (16.7)	10 (83.3)	0 (0.0)	0 (0.0)	10 (100.0)	0 (0.0)
Total	339	45 (13.3)	294 (86.7)	23 (7.8)	7 (2.4)	35 (11.9)	229 (77.9)

health in remote areas of Newfoundland and Labrador for this group. These differences between participants and non-participants cannot be determined from the data.

Additional sources of "non-response" were due to students being absent on the examination day, students in Grade I or Grade VIII but not in the target age groups, and schools not visited because of inclement weather. The latter source accounts for the low examination rates in Northern Labrador and Forteau where a total of four schools could not be visited. With these four schools eliminated from consideration, the examination rates were 80% for ages 6-7 and 75% for ages 13-14. The sources of non-response other than non-consent seem to be rather non-systematic and not likely to produce serious bias in the results. However, since no data were obtained from Forteau the overall study estimates do not take into account possible systematic differences between oral health in Forteau and the other districts (i.e. the study population to which the actual results apply does not include Forteau).

3.5.7.3 Examiner effects

The two common sources of error due to examiner effects are examiner bias and examiner precision (FDI, 1982). As mentioned earlier (Section 3.3.1), care was taken to reduce examiner bias by having the examiner re-calibrated through participation in a re-training session that was held just prior to the field survey.

Examiner consistency or examiner precision was assessed by re-examining 25 of the 6 to 7 year old children and 18 of the older students over two examination cycles several days apart. Diagnosis were identical on 31 children (72.1%), and the mean DMFS score from the re-examinations was 99.2% of that from the initial examinations. The computation of reliability coefficients from the scores of the duplicate examinations was above 0.95, indicating that the error variance due to examiner inconsistency was less than 5% of the total variance and, therefore, contributed a negligible amount (Rugg-Gunn and Holloway, 1974; Zar, 1974).

3.6 Response rate

Tables 18 and 19 show the distribution of enrollment in the target population (including schools excluded from sample because of size), the distribution of the sample, and the distribution of the actual examinations. Each of the districts except for St. Anthony (Forteau could not be visited due to extreme winter conditions) exceeded the target number displayed in Tables 2 and 3. Also the distribution of the examination was approximately proportional to that of enrollment in the stratum.

3.7 Summary

This concludes the section of the report on the materials and methods selected for the Coastal Labrador and Remote Areas of Newfoundland Children's Oral Health Study.

3.8 Expected relationship between system features and system performance

The primary interest of the study is in demonstrating if the oral health status of the school population in remote areas is different from that of similar age-group population reported in other Canadian and nation studies, and, whether there is any relationship between selected dental health practices and the oral health status of the population within the remote areas.

On the basis of the information presented so far it is possible to make some assumptions on the outcome that could be expected in the study area. The following hypothesis can be commented upon:

(i) The greater the availability of manpower the greater the beneficial effect to the consumer.

(ii) The more regular the personal oral health behaviour, the greater the beneficial effect to the consumer.

(iii) The greater the influence of fluoridated water, the greater the beneficial effect to the consumer.

As far as the availability of operating dental manpower is concerned the strata with relatively stable dentist services are Northern Peninsula and St. Anthony, and on the

TABLE 18

Population and sample distributions for students at Ages 6-7

District	Enrollment	% of Total Enrollment	Sampled	% of Total Sampled	Examined	% of Total Examined	% of Sample Examined
1. Northern Peninsula	341	51.7	167	48.3	135	55.3	80.8
2. Northern Labrador	113	17.1	96	27.7	46	18.8	47.9
3. Southern Labrador	45	6.8	20	5.8	17	7.0	85.0
4. Fogo/Burgeo	76	11.5	33	9.5	30	12.3	90.9
5. St. Anthony	50	7.6	13	3.8	8	3.3	61.5
6. North West River	10	1.5	10	2.9	8	3.3	80.0
7. Forteau	25	3.8	7	2.0	0	0.0	0.0
	660	100.0	346	100.0	244	100.0	70.5

TABLE 19

Population and sample distributions for students at Ages 13-14

District	Enrollment	% of Total Enrollment	Sampled	% of Total Sampled	Examined	% of Total Examined	% of Sample Examined
1. Northern Peninsula	439	46.7	148	43.7	110	48.0	74.3
2. Northern Labrador	95	10.1	72	21.2	43	18.8	59.7
3. Southern Labrador	53	5.6	26	7.7	19	8.3	73.1
4. Fogo/Burgeo	205	21.8	58	17.1	41	17.9	70.6
5. St. Anthony	82	8.7	13	3.8	7	3.1	53.8
6. North West River	14	1.5	10	2.9	9	3.9	90.0
7. Forteau	52	5.5	12	3.5	0	0.0	0.0
	940	99.9*	339	99.9*	229	100.0	67.6

* Rounding error

basis of the first hypothesis these areas can be expected to have better oral health status.

Areas with low dentist to population ratio (more than 1:4,000) include all of Newfoundland and Labrador. The study area had a dentist population ratio of approximately 1:4,800.

The other two features worthy of mention are sugar consumption and amount of fluoride exposure in the study area. Sugar consumption data were only available for Canada as a whole. Annual per capita sugar consumption was 42 kg for the country.

The amount of fluoridation in the study area was nil. However, children's residence histories will permit judging the influence of water fluoridation on oral health.

Overall the study area as a whole would be expected to have poorer oral health status than rest of the province. Within the study area subjects who could be expected to have good oral health status are students and children in Northern Peninsula and St. Anthony; those subjects who report spending some time of their lives in fluoridated communities in the Province or other parts of Canada; those who indicate consuming less sugar as measured from the data collected on quantity of between-meal sweet snacks and sweet drinks; and those with optimal level of tooth-brushing and flossing behaviour. The results in the following chapters will determine whether these assumptions are correct.

The next chapter deals with a description of the dental status among children and this is followed by a parallel discussion of oral health experience among adolescents.

CHAPTER 4

THE ORAL HEALTH STATUS OF REMOTE NEWFOUNDLAND AND LABRADOR SAMPLE 6 TO 7 YEAR OLD CHILDREN

As mentioned in the section of the report dealing with study design, a sampling frame was developed using the seven strata/districts: Northern Peninsula, Northern Labrador, Southern Labrador, Fogo/Burgeo, St. Anthony, North West River and Forteau, such that a target sample of 190 children 6 to 7 years old would be examined. In practice, the actual sample was 244 (Table 16). In addition, Table 18 indicates the proportion of the sample chosen from each of the sample areas, and Table 20 indicates the number of schools visited in each area.

One dental examiner conducted all the examinations. Dr. David Banting was consultant epidemiologist; and was thus able to ensure re-training of the examiner. Three additional examiners participated in the re-training sessions so that assistance could be at hand for future studies and an examiner would be available in the event of illness.

In terms of general characteristics of the children's sample, 116 (47.5%) were males and 128 (52.5%) were females. As for exposure to a fluoridated water supply, 8 (3.3%) had one or more years of exposure to fluoridated water, 216 (88.5%) did not and remaining 20 (8.2%) could not provide the required information. Of the 8 that spent some time in fluoridated communities, the mean length of stay was 3.4 years.

The next section will review the results of the oral examinations in general and then comparisons will be made among the subgroups of the sample. The more interesting multivariate an .lyses are discussed in Section 4.3.

4.1 Oral morbidity in the total sample

In terms of tooth development, the 6 and 7 year olds have a mixed dentition; that is, some primary teeth and some fully and partially erupted permanent teeth are present. Because both type of teeth are relevant for evaluating the oral health status of

TABLE 20

Distribution by number and percent
of Grade I schools visited by
sampling stratum
Remote Newfoundland and Labrador Study
1985

Districts/Strata	N	%
Northern Peninsula	14	56.0
Northern Labrador	4	16.0
Southern Labrador	2	8.0
Fogo/Burgeo	3	12.0
St. Anthony	1	4.0
North West River	1	4.0
Forteau	0	0.0
Total	25	100.0

the children's sample, the findings will be presented for both primary and permanent teeth.

4.1.1 Overall estimates of DMFS and DMFT

The estimated means and standard errors for the study population are given in Tables 21 and 22. Table 21 contains DMFS and components by tooth and surface type. Table 22 gives DMFT and components by type of tooth.

4.1.1.1 Primary teeth

Tables 21, 22 and 23 give the major findings for primary teeth. The children had a mean of 14.52 primary teeth still present in the mouth. As for the dental index of primary DMFT (and DMFS), 4.1 teeth (8.8 surfaces) were decayed (D), 1.0 tooth (2.0 surfaces) was filled (F) and 1.2 teeth (6.0 surfaces) missing due to caries (M) for an average DMFT of 6.4 teeth (16.8 surfaces) per child or mouth.

As for the intra-oral distribution of caries, an average per child of 12.2 surfaces were decayed, missing or filled on proximal and smooth surfaces and 4.6 surfaces were decayed, missing, or filled on the occlusal aspect of the tooth.

The following yardstick suggested by the WHO can be useful in gauging the severity of caries experience in this group of children. The WHO defines placement of child sample into low, moderate and high DMFT (primary teeth) groups according to score 0 to 3, 4 to 6 and over 6 (Arnljot et al., 1986). The children in remote areas have a high prevalence of dental caries in primary teeth.

4.1.1.2 Permanent teeth

Tables 21, 22, and 23 also present findings related to oral health status of the permanent dentition in the children's sample. At 6 to 7 years of age, the children had an average of 6.71 permanent teeth present. As for the permanent DMF teeth (DMFT) and DMF surface index (DMFS), an average of 0.9 teeth (1.2 surfaces) were decayed, 0.08 teeth (0.09 surfaces) were filled and 0.0 teeth (0.00 surfaces) were missing due to

TABLE 21

Overall mean DMFS and components with standard errors by tooth and surface type

6-7 year age group

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	3.5	.09	3.6	2.5	0	2.5	.7	0	.7	6.6	.09	6.7
	.3	.05	.3	.3	0	.3	.1	0	.1	.4	.06	.4
Smooth	2.7	.4	3.1	2.5	0	2.5	.4	.03	.4	5.6	.4	6.0
	.2	.06	.3	.3	0	.3	.05	.01	.06	.4	.06	.4
Occlusal	2.6	.7	3.3	1.1	0	1.1	.9	.05	1.0	4.6	.7	5.4
	.2	.05	.2	.1	0	.1	.1	.02	.1	.1	.05	.2
	8.8	1.2	10.0	6.0	0	6.0	2.0	.09	2.1	16.8	1.3	18.1
	.7	.1	.8	.7	0	.7	.3	.02	.3	.9	.1	.9

TABLE 22

Overall mean DMFT and components with standard errors by tooth type

6-7 year age group

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
4.1	.9	5.0	1.2	0	1.2	1.0	.08	1.1	6.4	1.0	7.4
.2	.06	.3	.1	0	.1	.1	.02	.1	.2	.05	.3

PRIM = PRIMARY
PERM = PERMANENT
TOT = TOTAL

D = DECAYED
M = MISSING
F = FILLED

DMFT = DECAYED, MISSING, FILLED TEETH
DMFS = DECAYED, MISSING, FILLED SURFACES

TABLE 23

Additional oral health characteristics
for 6-7 year age group in remote
Newfoundland and Labrador (1985)

Number children examined	244	
Mean number and standard deviation ( ) primary teeth present	14.52	(3.63)
Mean number and standard deviation ( ) permanent teeth present	6.71	(3.01)
Total	21.23	
Percentage children needing plaque removal		
Northern Peninsula	75.56	
Northern Labrador	65.22	
Southern Labrador	88.24	
Fogo/Burgeo	76.67	
St. Anthony	62.50	
North West River	75.00	
Percentage children visiting a dentist in the last twelve months	50.82	
Percentage children requiring:		
relief from pain	20.90	
plaque removal	74.18	
scaling	2.05	
referral to an orthodontist	0	
other treatment services	10.66	
Percentage children with one or more caries-affected teeth	82.79	
Percentage children with one or more teeth missing due to caries	37.30	
Percentage children with one or more filled teeth	30.33	

caries, for an average DMFT of 1.0 or DMFS of 1.3.

Of the permanent decayed, missing and filled surfaces, an average of 0.5 was on smooth and proximal surfaces, and 0.7 on occlusal surface.

The mean number of decayed, missing and filled permanent teeth (DMFT) was considerably lower than the mean count of primary teeth. This is because of fewer number in the mouth and the shorter time that the permanent dentition has been exposed to attack by caries.

4.1.2 Gingival health

As one of the important factors that affects dental health is the presence of bacterial plaque on the tooth surface at the gingival margin and the resulting inflammation in the free gingival, called gingivitis, a measure of the variable, gingivitis, was included in the study. The index used to measure both prevalence and severity was the Periodontal Index of Russell (1956). The average score of the periodontal index was 0.47 ± 0.02.

4.1.3 Treatment needs

4.1.3.1 Restorations, extractions and sealants

Another aspect of oral health status which is relevant for evaluating the system and delivery of dental care is the treatment needs. These needs are important in determining the requirements of dentist services for the population. In terms of the treatment requirements for the 6 to 7 year olds Table 24 describes the needs for both primary and permanent teeth. An average of 5.09 teeth per child needed some treatment of which 4.14 required restorations, 0.55 extractions and 0.01 pit and fissure sealant.

4.1.3.2 Percent of children needing treatment

Another way to examine the treatment needs is to look at the percentage of decayed, missing and filled teeth for primary and permanent dentition. Table 23 shows

TABLE 24

Mean number and standard deviations ( )
of teeth needing treatment per student
in various categories for 6-7 year age group
in remote Newfoundland and Labrador (1985)

Treatment Category	Number of Teeth	Standard Deviations
1 surface restoration	2.18	(2.03)
2 surface restoration	1.45	(1.64)
3 surface restoration	0.48	(1.02)
More than 3 surface restoration	0.03	(0.25)
Extraction of primary tooth	0.52	(1.19)
Extraction of permanent tooth	0.03	(0.27)
Stainless steel crown	0.39	(0.99)
Tooth replacement	0.00	(0.00)
Pit and fissure sealant	0.01	(0.09)
Total	5.09	

that when investigating the treatment needs of permanent and primary teeth together, 20.9% of children required relief from pain as a result of pulpal involvement of the teeth.

Frequency distribution of DMFS and DMFT counts for the 6 to 7 year old age group are given in Figures 1 and 2. It can be seen that 9.4% of this group had no DMF surfaces. They were caries-free. In Atlantic Canada, 20.7% of the 6 to 7 year olds were identified as caries-free (Banting et al., 1984).

4.1.3.3 Periodontal treatment requirements

The categories of periodontal treatment requirements are presented in Table 23. Each of the two categories was based on subjective clinical judgement on the part of the examiner.

The first category, plaque removal, was scored only when there was a positive need based on a clear diagnosis of persistent and adherent plaque in any part of the mouth. The category, scaling, was scored where there were deposits of calculus necessitating meticulous removal of sub-gingival and/or supragingival deposits. 74.18% of the 6 to 7 year age group required plaque removal and 2.05% required scaling.

4.1.3.4 Other treatment requirements

10.66% of the children were assessed as requiring other treatment including removal of roots (8.61%), treatment for abscess (1.22%) or artificial tooth replacement for function and aesthetics (0.82%).

4.1.4 Visit to the dentist

50.82% of the children were reported by the parents to have visited a dentist in the past twelve months.

It would be helpful to the Province if, in the future, survey data such as visits to the dentist could be correlated to the actual utilization of dental services as determined through the Newfoundland Children's Dental Program statistics. Such correlation can be efficiently carried out through co-operation with the Medi-Care Plan (MCP) that

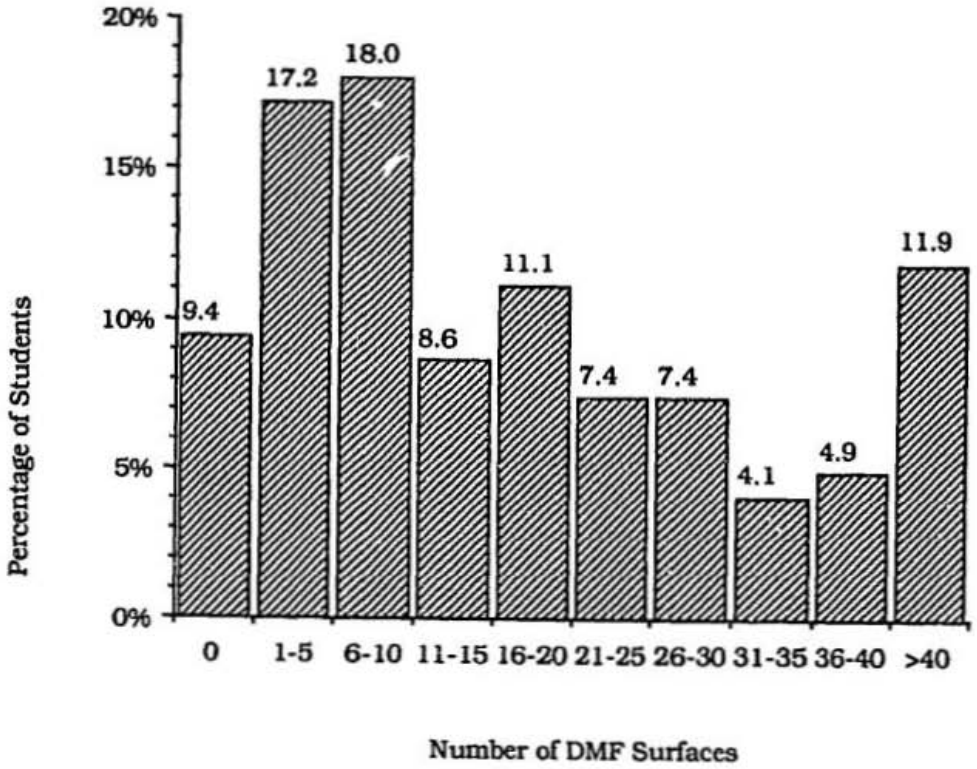

FIGURE 1: Distribution of DMF surfaces among 6-7 year age group in Newfoundland and Labrador

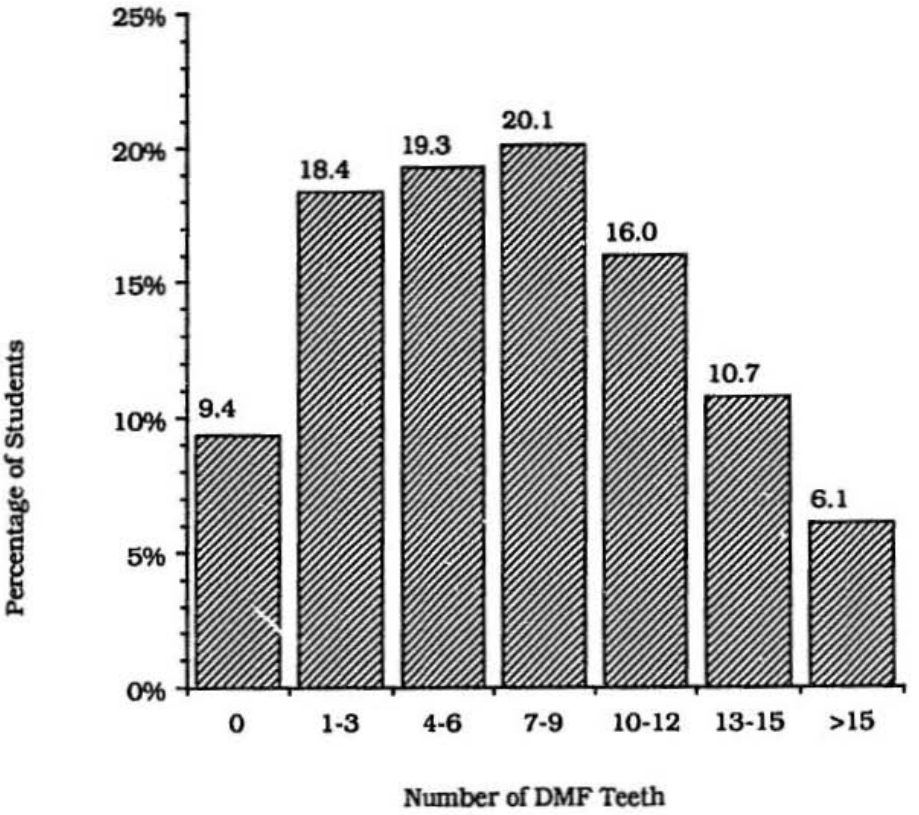

FIGURE 2: Distribution of DMF teeth among 6-7 year age group in Newfoundland and Labrador

administers the Children's Dental Program, by using and matching the unique MCP identification number for each child surveyed. This process would also allow determination of the reliability of the survey data collected (Chatwin, Delaquis and Walker, 1968).

4.2 Differences in oral morbidity by selected characteristics

There are a number of factors which could be identified as having an impact on the oral health status of the 6-7 year old sample. Some of the more relevant ones include gender, socioeconomic status, past dental health actions and influence of water fluoridation. The oral morbidity measures will be discussed in terms of these characteristics in the following sections. As mentioned previously, because this age group had a mixed dentition, the measures presented are for both primary and permanent teeth combined, except where indicated otherwise.

Table 25 contains mean DMFS, DMFT, and periodontal index (PI) for different subpopulation groups defined by demographic, socioeconomic, or behavioural characteristics of the students examined. The significance of the difference between two group means (a and b) was judged by computing $1.96\ \sqrt{(\text{SE of a})^2 + (\text{SE of b})^2}$ (Dunn and Clark, 1974). If the two means differed by at least this amount they were declared to be different at the .05 significance level. Care must be taken in concluding that the factor on which the groups were formed (e.g. gender) is responsible for any significant difference since such an analysis ignores other factors that might contribute to the observed difference and were not controlled in the design or analysis. The multiple regression analysis discussed in Section 4.3 indicates which factors have significant effects when others were controlled.

4.2.1 Gender

There were minimal differences among sexes in the DMF teeth and DMF surface count. DMFT was 7.4 in females and 7.3 in males. (DMFS 18.1 females vs 18.0 males).

Table 25 presents findings related to periodontal score according to gender and

TABLE 25

Subpopulation means and standard errors of DMFS, DMFT and PI by selected variables Ages 6 and 7

	N	DMFS, SE	DMFT, SE	PI, SE
Sex:				
Male	116	18.0, 1.2	7.3, .3	.52, .03
Female	128	18.1, .9	7.4, .3	.44, .02
Parental Education:				
Neither Sec	68	23.0, .9	8.9, .3	.56, .04
One Sec	53	21.1, 2.2	8.3, .5	.54, .02
Both Sec	27	14.1, 1.3	6.2, .5	.51, .03
One Post Sec	42	11.2, 1.2	5.4, .4	.32, .03
Both Post Sec	19	4.4, .9	2.7, .5	.22, .03
Missing	35	24.3, 2.5	9.0, .7	.52, .05
SES:				
1.	66	21.1, 1.3	8.2, .3	.58, .03
2.	49	17.6, 2.3	7.3, .6	.51, .04
3.	38	17.9, 1.3	7.0, .3	.43, .03
4.	15	19.4, 1.3	8.9, .6	.48, .08
5.	11	16.6, 5.0	6.6, 1.3	.24, .07
6.	31	7.9, 1.1	4.4, .5	.27, .03
7.	4	2.9, 1.4	1.9, .9	.22, .04
Missing	30	26.2, 3.9	1.0, 1.0	.54, .1
Income:				
Under $5,000	25	19.0, 3.6	7.8, 1.0	.57, .07
$5,000-$9,999	38	20.1, 2.1	8.1, .5	.52, .03
$10,000-$14,999	39	21.0, 1.5	8.4, .4	.58, .04
$15,000-$19,999	35	18.5, 2.3	7.3, .7	.46, .05
$20,000-$24,999	20	17.0, 1.6	6.6, .5	.47, .06
$25,000-$29,999	22	21.0, 2.5	8.4, .6	.57, .07
$30,000 and over	32	7.6, 1.2	4.2, .6	.21, .03
Unemployed	8	25.8, 4.9	8.6, 1.6	.40, .06
Missing	25	18.3, 3.5	7.4, 1.0	.45, .05
Prevention:				
No reg. preventive checkup in last 12 months	144	22.1, 1.2	8.5, .3	.57, .03
Reg. preventive checkup or work identified in last 12 months	83	11.7, .8	5.6, .3	.34, .02
Missing	17	16.2, 2.4	6.1, .8	.39, .02

. . . continued

TABLE 25 (Continued)

Subpopulation means and standard errors of
DMFS, DMFT and PI by selected variables
Ages 6 and 7

	N	DMFS, SE		DMFT, SE		PI, SE	
Sweet snacks:							
Less than two	72	15.2,	1.4	6.3,	.4	.42,	.04
Two or more	82	18.9,	1.3	7.8,	.4	.47,	.03
Missing	90	19.5,	1.3	7.7,	.4	.53,	.02
Sweet drinks:							
Less than two	68	12.7,	.8	5.8,	.3	.36,	.02
Two or more	86	22.7,	1.6	8.6,	.4	.54,	.03
Missing	90	17.6,	1.4	7.3,	.5	.51,	.02
How often brush teeth:							
Less than two times per day	119	19.1,	1.0	7.9,	.3	.51,	.02
Two or more times per day	118	16.7,	1.4	6.7,	.4	.46,	.03
Missing	7	22.5,	5.2	9.3,	1.5	.31,	.05
Uses dental floss:							
Yes	24	13.2,	3.5	5.1,	1.0	.42,	.09
No	207	18.4,	.8	7.5,	.2	.49,	.02
Missing	13	26.3,	4.7	10.8,	1.1	.35,	.08
Ethnic group:							
Settler	201	18.0,	.9	7.4,	.3	.50,	.02
Indian	22	11.1,	1.5	5.5,	.1	.19,	.01
Inuit	21	26.9,	3.2	8.5,	.6	.10,	.01
Health Unit:							
Central Health	7	8.3,	0	5.3,	0	.22,	0
Western Health	80	16.1,	1.8	7.0,	.5	.41,	.04
Northern Health	157	19.4,	1.0	7.6,	.3	.52,	.02
Language 1:							
Inuktituk	18	27.1,	3.4	8.6,	.7	.09,	.01
Montagnais	15	13.9,	0	5.8,	0	.17,	0
English	211	17.8,	.9	7.3,	.3	.50,	.02
Dental visit in last 12 months:							
Yes	124	15.9,	1.0	6.6,	.3	.40,	.02
No	112	20.4,	1.3	8.2,	.4	.57,	.03
Missing	8	27.6,	.9	9.0,	.5	.30,	.09

. . . continued

TABLE 25 (Continued)

Subpopulation means and standard errors of
DMFS, DMFT and PI by selected variables
Ages 6 and 7

	N	DMFS, SE	DMFT, SE	PI, SE
Years spent in fluoridated area:				
Under one year	216	17.9, 1.0	7.3, .3	.49, .02
One year or more	8	13.0, 4.8	5.6, 1.3	.15, .04
Missing	20	26.3, 3.0	9.2, .7	.54, .07
Sweet snacks and drinks:				
0.	8	11.8, 3.6	5.2, 1.3	.05, .03
1.	21	11.2, 1.9	5.1, .8	.37, .05
2.	25	12.5, 1.4	5.7, .5	.41, .02
3.	20	17.0, 2.3	7.0, .8	.46, .05
4.	20	23.1, 3.7	8.9, 1.0	.57, .01
5.	15	19.2, 2.6	9.3, .6	.55, .06
6.	13	25.0, 3.3	8.9, .6	.25, .03
7.	12	19.0, 3.5	7.1, .8	.43, .09
8.	7	17.8, 4.0	6.9, 1.4	.42, .07
9.	1	22.5, 8.1	8.0, 1.8	.54, .02
10.	4	18.6, 6.0	6.4, 1.5	.63, .09
Missing	98	19.1, 1.2	7.7, .4	.52, .02
Brushed teeth yesterday:				
Zero or one	127	18.8, .7	7.9, .2	.50, .02
Two or more	102	17.0 1.7	6.7, .5	.46, .04
Missing	15	20.9, 3.1	8.2, 1.0	.44, .07
Asymptomatic visit in last 12 months:				
No	172	20.9, 1.1	8.3, .3	.52, .03
Yes	55	9.9, .9	4.6, .4	.38, .03
Missing	17	16.2, 2.4	6.1, .8	.39, .02

other variables. Females had a significantly lower periodontal index than males (0.44 vs 0.52).

4.2.2 Strata

Tables 26 and 27 give detailed breakdowns of mean DMFS and DMFT and their components for each of the six districts included in the survey. The standard errors for St. Anthony and North West River could not be estimated since there was only a single school sampled in each of these strata. The significance of this is that there is reduced sensitivity in the outcome measures for those two strata.

Southern Labrador, Northern Labrador and Fogo/Burgeo, it will be recalled, had predominantly visiting dentists. Northern Peninsula and St. Anthony had, for the most part, dentists residing in the community. Northern Labrador, which included Conne River, had predominantly Native Peoples' influence. In Fogo/Burgeo stratum the payment mechanism was fee-for-service and elsewhere mainly salaried, except Northern Peninsula where there was some fee-for-service payment.

In terms of primary teeth, St. Anthony had the lowest DMFT (4.3) and Fogo/Burgeo had the highest DMFT index (8.3). In terms of individual components of DMFT index, Fogo/Burgeo had the highest primary decayed teeth (5.9). Northern Labrador had the most primary teeth missing due to caries (2.0). The filled component is low in all districts.

In terms of permanent teeth, Fogo/Burgeo at 1.3 had the highest DMFT, as well as the highest decayed teeth (D) component (1.1).

Within each of the six strata, proximal surfaces of primary teeth contributed the most towards the mean DMFS score. For example, in Northern Peninsula for primary teeth the number of proximal surfaces involved per child is 6.5 vs 5.4 smooth surface and 4.6 occlusal surface. And in terms of permanent teeth, occlusal surfaces contributed the most towards the mean DMFS score. Again, in Northern Peninsula, for example, mean DMFS for permanent teeth was made up of 0.7 occlusal surface vs 0.5 smooth surface and 0.1 proximal surface.

TABLE 26

Mean DMFS and components with standard errors by stratum, tooth, and surface type for 6-7 year age group

Northern Peninsula

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	3.4	.1	3.5	2.4	0	2.4	.7	0	.7	6.5	.1	6.6
	.4	.06	.4	.3	0	.3	.1	0	.1	.4	.06	.4
Smooth	2.8	.4	3.1	2.4	0	2.4	.4	.02	.4	5.4	.5	5.9
	.3	.07	.3	.3	0	.3	.06	.01	.07	.4	.07	.4
Occlusal	2.6	.7	3.3	1.1	0	1.1	.9	.05	1.0	4.6	.7	5.3
	.2	.06	.2	.1	0	.1	.1	.02	.1	.2	.05	.2
	8.7	1.2	10.0	5.8	0	5.8	2.0	.07	2.1	16.5	1.3	17.8
	.7	.2	.9	.7	0	.7	.3	.03	.3	1.0	.2	1.0

Northern Labrador

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	3.4	.03	3.4	4.0	0	4.0	.6	0	.6	7.9	.03	7.9
	.5	.02	.5	1.2	0	1.2	.2	0	.2	1.7	.02	1.7
Smooth	2.3	.2	2.5	4.0	0	4.0	.3	.09	.4	6.5	.3	6.8
	.3	.06	.3	1.2	0	1.2	.09	.06	.1	1.4	.1	1.4
Occlusal	2.3	.5	2.8	1.5	0	1.5	.8	.02	.8	4.6	.5	5.1
	.3	.09	.3	.5	0	.5	.2	.01	.2	.3	.09	.3
	8.0	.7	8.6	9.4	0	9.4	1.6	.1	1.7	19.0	.8	19.8
	.7	.1	.6	3.0	0	3.0	.4	.05	.5	3.4	.2	3.3

Southern Labrador

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	4.8	0	4.8	2.9	0	2.9	.2	0	.2	7.9	0	7.9
	.4	0	.4	.1	0	.1	.03	0	.03	.3	0	.3
Smooth	4.1	.5	4.6	2.9	0	2.9	.05	.05	.1	7.1	.5	7.6
	.9	.06	.8	.1	0	.1	.03	.03	.05	.7	.09	.7
Occlusal	3.0	.6	3.6	1.3	0	1.3	.3	0	.3	4.6	.6	5.2
	.3	.03	.3	.08	0	.08	.08	0	.08	.1	.03	.1
	11.9	1.1	13.0	7.1	0	7.1	.6	.05	.7	19.6	1.1	20.7
	1.6	.03	1.6	.3	0	.3	.1	.03	.2	1.1	.05	1.1

. . . continued

TABLE 26 (Continued)

Fogo/Burgeo

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	4.6	0	4.6	2.5	0	2.5	.7	0	.7	7.8	0	7.8
	.2	0	.2	.1	0	.1	.1	0	.1	.2	0	.2
Smooth	3.6	.4	4.0	2.5	0	2.5	.7	.1	.9	6.8	.6	7.4
	.3	.08	.3	.1	0	.1	.1	.07	.2	.3	.1	.2
Occlusal	3.5	.8	4.3	1.2	0	1.2	1.0	.2	1.2	5.7	1.0	6.7
	.2	.08	.3	.05	0	.05	.1	.1	.2	.1	.09	.08
	11.7	1.3	13.0	6.2	0	6.2	2,4	.3	2.8	20.3	1.6	21.9
	.7	.1	.7	.3	0	.3	.3	.2	.5	.6	.2	.4

St. Anthony

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	1.6	0	1.6	.8	0	.8	0	0	0	2.4	0	2.4
Smooth	.4	0	.4	.8	0	.8	.3	0	.3	1.4	0	1.4
Occlusal	2.5	.8	3.3	.4	0	.4	.5	0	.5	3.4	.8	4.1
	4.5	.8	5.3	1.9	0	1.9	.8	0	.8	7.1	.8	7.9

North West River

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	1.6	0	1.6	3.5	0	3.5	.1	0	.1	5.3	0	5.3
Smooth	1.6	0	1.6	3.5	0	3.5	0	0	0	5.1	0	5.1
Occlusal	1.9	0	1.9	1.6	0	1.6	.1	0	.1	3.6	0	3.6
	5.1	0	5.1	8.6	0	8.6	.3	0	.3	14.0	0	14.0

TABLE 27

Mean DMFT and components with standard errors by stratum and tooth type for 6-7 year age group

Northern Peninsula

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
4.1	.9	5.0	1.2	0	1.2	1.0	.07	1.1	6.3	1.0	7.3
.3	.07	.3	.1	0	.1	.1	.02	.1	.3	.06	.3

Northern Labrador

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
3.9	.6	4.4	2.0	0	2.0	.8	.1	.9	6.6	.7	7.3
.3	.1	.1	.6	0	.6	.2	.05	.2	.7	.1	.6

Southern Labrador

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
4.8	1.0	5.8	1.5	0	1.5	.3	.05	.4	6.5	1.1	7.6
.5	.07	.5	.06	0	.06	.08	.03	.1	.3	.05	.4

Fogo/Burgeo

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
5.9	1.1	7.0	1.2	0	1.2	1.1	.2	1.3	8.3	1.3	9.6
.3	.1	.4	.05	0	.05	.2	.1	.3	.2	.1	.1

St. Anthony

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
3.4	.8	4.1	.4	0	.4	.5	0	.5	4.3	.8	5.0

North West River

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
3.4	0	3.4	1.8	0	1.8	.1	0	.1	5.3	0	5.3

Appendix B presents findings related to periodontal disease - Fogo/Burgeo stratum has the highest periodontal score (PI=0.55).

4.2.3 Influence of fluoride

While none of the communities involved in the study had optimally fluoridated water residence histories permitted separation of those children who had lived for some time previously in a fluoridated community (Burt, Eklund and Loesch, 1986; Rugg-Gunn, Nicholas, Potts, Cranage, Carmichael and French, 1981). Table 25 has data comparing those children who had lived in a fluoridated community one year or longer with those children who had not, on three measures DMFS, DMFT and PI (Periodontal Index of Russell). 3.3% of the children had spent an average of 3.4 years in a fluoridated community (high of 5.0 years and a low of 1.0 year) while 88.5% did not have this exposure to fluoride. For the rest of the sample, this information was not available.

The fluoride group appears to have a lower DMFS, lower DMFT index and a lower periodontal score. A significant difference exists only for the periodontal index.

4.2.4 Socioeconomic factors

Table 25 includes means for three oral morbidity measures (DMFT, DMFS, PI) by selected socioeconomic factors. It can be noted that the higher the parental education level, the lower are the DMF indices. The same pattern of differences holds true for periodontal index. When both parents of a child have post-secondary education all three indices, DMFT, DMFS and PI, are significantly lower from the means for groups of children in other categories for this socioeconomic measure.

Another direct measure of social class is the Blishen Occupation Index (Blishen, 1958) defined here as SES. The pattern of differences is not as well defined by SES as by parental education level. For example, on DMF indices, scores for SES class 4 increases, as does the periodontal index for SES 4 and SES 6. Another measure of social class might be the total family income. Table 25 indicates relation of family income to the DMF indices. The DMF indices for those children living in families with income

$30,000 and over are significantly lower (DMFT 4.2) from the scores of the children in the other lower income categories. Children with unemployment in the family appear to have the highest indices (DMFT 8.6).

For the oral hygiene indicator there is no clear trend, although a significant difference exists between those children in the highest income category, $30,000 and over, and each of the other lower income groups.

To summarize the relationship of oral health status and social class, it would appear that in general the higher one's social class the better one's overall oral health status.

4.2.5 Ethnic groups

There were 116 (47.5%) males and 128 (52.5%) females in the sample. Just over 55% of the sample resided in Northern Peninsula. Of the total sample 82.4% were settler children, 9.0% were Native Indian and 8.6% were Inuit children.

Table 25 indicates that there were differences among the three ethnic sub-groups in the DMFT and DMFS indices (these include both primary and permanent teeth). The Native Indian sub-group had significantly fewer DMF teeth (5.5) than the Inuit sub-group (8.5) or the settler group (7.4).

This finding, where the oral health of the Native Indian sub-group is somewhat better than that of its Caucasian counterpart in rural areas is in contrast to the findings reported in other studies. Titley and Bedard (1986) reported that the 5 year old Indian child in the community of Sandy Lake, Ontario, had a DEF (decayed, extracted, filled index for deciduous teeth) index of 12.4.

A regression model (not shown here) indicated that the Native Indian sub-group had significantly less decayed, missing and filled surfaces compared to the settler sub-group. The Inuit sub-group had significantly more decayed and missing surfaces, and less filled surfaces than the settler sub-group.

Table 25 presents the findings related to oral hygiene measures according to ethnic sub-groups. The settler sub-group had a significantly higher periodontal index than the

native Indian or Inuit sub-groups.

4.2.6 Past dental health actions

In addition to clinical and sociological data, information was gathered about dental habits and utilization pattern. In this way the analytical possibilities were broadened in that it would be possible to determine the relationship of differences in habits to dental health status.

There are a number of activities an individual can engage in to reduce his/her rate of dental disease and to increase his/her chances of having healthy gums and dentition. The first is diet and this includes the frequency and quality of sugar in daily food intake. Other actions which are classified as preventive actions include tooth-brushing frequency (Fosdick, 1950), use of fluoridated tooth-paste (Murray, 1976) and use of dental floss (Wright, Banting and Feasby, 1977).

4.2.6.1 Tooth-brushing

Appendix B provides information regarding tooth-brushing as reported by the parents. 92.2% reported owning a tooth-brush and the same percentage of children reported brushing their teeth. 4.1% indicated that they did not own a tooth-brush. 73.4% reported brushing at least once a day. 20.1% reported brushing between one and six times per week.

18% reported not brushing their teeth yesterday with the mean being 1.36 times per day for the 6 to 7 year old group.

When related to oral morbidity measures, brushing two or more times a day appears to be negatively related to DMFT, DMFS and PI scores (Table 25). A significant difference exists for DMFT index.

Brushing immediately withing ten minutes of eating has been shown to control one's tooth-decay rate (Fosdick, 1950), or an intensive and frequent regimen of mouth cleansing can also result in a better oral health status (Axellson and Lindhe, 1977). However, in general, in population studies, tooth-brushing per se has been shown to

contribute little toward reducing the dental caries rate (Burt, 1983).

The greatest percentage of the parents reported that their children brushed their teeth after breakfast (51.6%) and before bedtime (44.3%).

4.2.6.2 Between-meal sweet snacks

The average number of between-meal sweet snacks and sweet drinks was 3.27. In terms of the relationship of snacks to oral morbidity measures, those who had less than two sweet snacks yesterday or less than two sweet drinks yesterday had significantly lower DMFT and DMFS indices compared to those who had two or more sweet snacks or drinks (Table 25). The PI was also significantly lower in those children who had less than two sweet drinks compared to those who had two or more.

When sweet snacks and sweet drinks were combined, it was found that, up to a maximum of four, increased frequency of snacking was positively correlated with the DMFT, DMFS and PI.

These results are as expected, knowing that caries is the result of an interaction between bacteria and sugar in a suitable environment and that frequency of sugar intake has long been considered a major determinant of caries (Burt and Ismail, 1986).

Observational epidemiological studies have also demonstrated an association between caries experience and both the amount and frequency of between-meal consumption of sugary foods (Weiss and Trithart, 1960; Ismail, 1986). However, it should be interesting to further analyse the data and determine if these data demonstrate that individuals who had high DMFT scores (DMFT 10 or more) were also frequent between-meal consumers of sugary snacks; and that individuals who had low DMFT scores (DMFT 3 or less) had different between-meal snacking and other behaviours that explained their oral health status.

As well, it would be useful to determine if the observations from this study can contribute toward the "threshold" hypothesis of sugar consumption (Newbrun, 1979), which postulates that the caries experience is proportional to sugar consumption up to a threshold, but that above this threshold, extra sugar consumption makes little

difference (Ismail, 1986).

4.2.6.3 Flossing

9.8% of the children reported using dental floss.

Wright et al. (1977) have demonstrated a 50% reduction in proximal caries in 5 to 6 year olds whose proximal surfaces were flossed regularly at school by dental assistants. However, this age is considered too young to be able to use this particular preventive dental health practice (Burt, 1983). A further discussion on this subject will be found in Sections 4.3 and 5.2.6.3.

4.2.6.4 Fluoridated tooth-paste

Another dental habit which may affect oral health status is use of fluoridated tooth-paste. According to Appendix B, a majority of the parents (76.2%) reported using two of the leading brands of fluoride tooth-paste approved by the Canadian Dental Association. Since most other brands that were reported to be in use also have fluoride, it was not possible to reach any conclusion on this measure.

4.2.7 Dental services

Just about half (50.82%) of the children were reported to have visited the dentist in the past twelve months (Table 23). In 1960, the Canadian Sickness Survey stated that about one in seven persons (14%) visited the dentist during 1950-51 (McFarlane, 1965). Since then, there has been a steady increase in the utilization rates such that at present approximately 40% to 60% of the population is seeking the services of the dentist (Lewis and Sanders, 1979). Hann (1977) suggests that a reasonable level of utilization is possible even when dental services are provided in other than a school environment.

In the ACCOHS (Banting et al., 1984) 74.3% of the children were reported to have visited the dentist in the past twelve months.

Two of the issues in the utilization of dental services include preventive versus non-preventive utilization of dental services and structural features of the dental services

themselves that influence utilization (e.g. availability and accessibility of dentists).

The pattern of utilization of oral health services was believed to influence the oral morbidity measures in such a way that children visiting a dentist during the past twelve months should have lower dental indices than non visitors, and children visiting for asymptomatic reasons (check-up, cleaning etc.) should have the lowest indices. A consistent pattern of this kind was found in 6 to 7 year old children.

Children with dental visits during the past 12 months had significantly lower DMFT, DMFS and PI scores than children who had not visited a dentist (DMFS 15.9 vs 20.4; DMFT 6.6 vs 8.2; PI 0.40 vs 0.57) (Table 25).

23% of the sample reported visiting the dentist in the past twelve months for regular dental check-up, and 13% because of a specific dental problem (tooth-ache, pain, etc.).

4.3 Regression analysis

Table 28 presents the results of the effects of various factors on DMFS and its components. The number of cases in the analysis for the group was somewhat reduced because of missing values in the independent variables. Only cases with non-missing values on all of the variables were included in the analysis.

The regression coefficients represent the change in the response index per unit change in the factor (independent variable). Coefficients with positive signs indicate that the response index increases as the factor increases while those with negative signs indicate that the response decreases as the factor increases (or with its presence or absence in the case of factors with two categories). Each of the factors in the analysis had two levels, with the exception of parental education, which had five levels as defined in Table 25. Thus, DMFS decreases as parental education increases and the number of filled surfaces tends to increase with parental education.

The levels of brushing were less than twice per day and two or more times per day. Brushing less than twice per day and two or more times per day did not show any significant effects on decayed, missing or filled surfaces. The flossing factor was defined

TABLE 28

Regression coefficients and p-values ( )
for the effects of certain factors on DMFS and its components

Ages 6 and 7 (n=182)

	Response							
Factor	Decayed surfaces		Missing Surfaces		Filled Surfaces		DMFS	
Parental Education	-2.5	(<.001)	-1.7	(<.001)	.2	(.41)	-4.0	(<.001)
Brushing	-.1	(.94)	1.9	(.11)	.2	(.73)	1.9	(.21)
Flossing	1.4	(.66)	-2.8	(<.001)	.4	(.67)	-1.0	(.72)
Asymp Visit	-5.2	(<.001)	-2.7	(.003)	1.1	(<.001)	-6.8	(<.001)
Fluoride	-.4	(.63)	7.1	(.13)	-2.4	(<.001)	4.3	(.37)

as not flossing (or not knowing what dental floss is) or flossing. The significant effects of flossing were to decrease missing surfaces among 6 and 7 year olds.

Having an asymptomatic dental visit in the last 12 months was significantly associated with reductions in DMFS, decayed surfaces, missing surfaces, and increases in filled surfaces in the 6-7 year age group. Residing in a fluoridated area for one or more years was associated with a decrease in filled surfaces in the children.

A second regression model (not shown here) was fit by adding degree of consumption of sweet snacks (less than two, or two or more per day) and sweet drinks to the factors in the model discussed above. Because of the large number of missing values for these factors, there were only 116 cases for the younger group. Of the two factors, sweet drinks generally showed the greater effects among the younger students and was associated with more decay (p=.004), more missing surfaces (p=.001), fewer filled surfaces (p=.01), and greater DMFS (p=.002).

Table 29 shows adjusted mean DMFS and components by district.

4.4 Need for treatment and other characteristics

Table 24 gives the mean number of teeth per student requiring different types of treatment. Table 23 also contains results pertaining to other oral health characteristics and treatment needs for 6-7 year age group. Figures 1 and 2 show the distribution of DMFS and DMFT for the age group in graphical form. The results for the questionnaire items and related factors are contained in Appendix B. The statistics contained in Tables 23 and 24, and in Appendix B are "raw" estimates computed in SPSS^x as discussed in Section 3.5.6.

TABLE 29

Adjusted [1] mean DMFS and components for strata

Ages 6 and 7

Stratum	Decayed	Missing	Filled	DMFS
Northern Peninsula	8.9	6.0	2.1	16.9
Northern Labrador	7.2	5.0	6.5	18.6
Southern Labrador	8.5	4.6	1.3	14.4
Fogo/Burgeo	11.2	5.4	2.3	18.9
St. Anthony	8.8	4.7	0.0	13.3
North West River	5.3	3.1	0.6	9.0

[1] The adjusted means are the means that would be expected if each district had the same fluoride exposure, sex distribution, ethnic makeup, level of parental education, amount of brushing and flossing, and number of asymptomatic visits as the overall average for remote areas of Newfoundland and Labrador.

4.5 Summary of main findings

To summarize the findings from the study, some of the important findings are listed below:

1. Six and seven year olds have mixed dentition. The average DMF for the remote areas of Newfoundland and Labrador for primary teeth was 6.4, while for permanent teeth it was 1.0.
2. Of the primary plus permanent DMFT score (7.4), the components were as follows: 5.0 decayed, 1.1 filled and 1.2 missing due to caries.
3. 33% of the sample had 10 DMFT or more and 9.4% of the group was caries-free (DMFT of zero).
4. Females had slightly higher DMFT count than males (7.4 vs 7.3).
5. Males had significantly higher periodontal score than females.
6. Social class is strongly related to oral health status. The higher the parental education level, social status and income level, the more likely are DMF and other caries measures for the child to be low.
7. Those with exposure to water fluoridation had lower periodontal scores and decreased number of filled surfaces.
8. The Native Indian sub-group had significantly fewer DMF and other caries measures as compared to the settler population. The Inuit sub-group had significantly higher DMFT(S) scores than the settler sub-group, mainly due to more missing surfaces.
9. Of all the districts Fogo/Burgeo had the highest primary plus permanent DMFT score (9.6).
10. For a regression analysis of DMFS for between-meal snacks, the variable, sweet drinks, was associated with more decayed, more missing and fewer filled surfaces, and, greater DMFS. Those children with two or more between-meal sweet drinks had 22.7 DMFS and those with one or none had DMFS of 12.7.
11. Those children brushing two or more times a day had significantly lower DMFT score as compared to the group brushing once a day or less. However, when controlled for other factors in the analysis this difference was erased.

12. About 51% of the sample had visited a dentist in the past twelve months. 23% of the sample visited for a regular dental check up and 13% because of a specific dental problem.

13. A regression analysis of DMFS and its individual components with parental education, brushing and flossing habits, asymptomatic dental visit and time spent in an area with fluc .dated water supply as independent variables, the factors asymptomatic dental visit in the last twelve months and parental education showed the most frequent associations with decayed, missing, and filled surface counts and the overall DMFS index.

14. About 21% of the sample were assessed to require emergency care for relief of pain due to pulpal involvement of the teeth.

15. And, 74% were assessed to have sufficiently high levels of plaque to require minor scaling and individual oral care instructions.

4.6 Interprovincial comparison of children

4.6.1 Background

One of the features of the recent Canadian studies is that calibration techniques and standards were closely instituted through the efforts of WHO trained epidemiologists Drs. A. Murray Hunt and John Stamm. Thus one can fairly confidently undertake comparisons of oral health status for these provinces.

4.6.2 Findings

Table 30 presents DMFT scores for primary plus permanent teeth and Table 31 presents periodontal scores from these studies.

For DMFT, remote Newfoundland and Labrador has the highest rate (7.4). It should be noted that the Provinces of Newfoundland, Prince Edward Island and Nova Scotia have almost similar children's dental plans (Health and Welfare Canada, 1986). Also, Prince Edward Island has the most favourable and Newfoundland the least favourable dentist to population ratio (Hann, 1982). The figures for individual

TABLE 30

Mean number of decayed, missing and filled teeth
(primary plus permanent teeth)

Child sample 6 to 7 years

Study Area	Year of Study	D	M	F	DMFT
Remote Newfoundland & Labrador	1985	5.00	1.20	1.10	7.40
Newfoundland,[1] not including remote areas	1982	2.90	0.79	2.04	5.65
Prince Edward[1] Island	1982	1.00	0.10	4.17	5.24
Nova Scotia[1]	1982	1.66	0.45	3.07	5.09
New Brunswick[1]	1982	2.12	0.38	1.56	4.04

[1] Banting et al. (1984)

TABLE 31

Mean periodontal index (Russell's PI)

Child sample 6 to 7 years

Study Area	Year of Study	Mean Periodontal Index
Remote Newfoundland & Labrador	1985	0.47
Newfoundland,[1] not including remote areas	1982	0.31
Prince Edward[1] Island	1982	0.14
Nova Scotia[1]	1982	0.40
New Brunswick[1]	1982	0.18

[1] Banting et al. (1984)

components of DMF indicate remote Newfoundland and Labrador to have the least filled (1.1) and the highest decayed (5.0) and missing due to caries (1.2).

Turning to periodontal disease, at 0.47 remote areas of Newfoundland has the highest score of any other jurisdiction shown here.

When comparing the results of this remote areas of Newfoundland study with the less remote parts of the province previously reported in Atlantic Canada Children's Oral Health Study (Banting et al., 1985), the following can be observed:

(i) Among this group of remote children the DMFT (7.4) and DMFS (18.1) was higher than in the parts of Newfoundland surveyed previously, 5.7 DMFT, 13.6 DMFS.

(ii) Russell's periodontal index was higher in this study (0.47 ± 0.02) than that reported for similar age group children in less remote areas of Newfoundland (0.31 ± 0.06).

(iii) Need for treatment as measured by the mean number of teeth per student needing various type of treatment was generally greater for 6 to 7 year old group in these remote areas of Newfoundland (5.09 for remote areas vs 3.10 for all Newfoundland and Labrador) (Department of Health, 1988).

(iv) The proportion of children requiring various types of dental services was also generally greater in remote areas of Newfoundland and Labrador.

4.7 Summary

The findings from this dental study seem to indicate that in remote Newfoundland and Labrador, 6 to 7 year old children have a high disease rate compared to similar age group children in other areas in Canada studied previously. There are several factors which contribute to this.

Despite acceptable dental service utilization rates in remote areas of Newfoundland and Labrador, it should be noted that with the present characteristics of the delivery system and pattern of dental care being available, increased utilization of dentists services alone will not necessarily lead to improvements in oral health.

In this study less than 4% of the child sample had any exposure to fluoridated water, nevertheless, there was a strong indication that the effect of water fluoridation

was to reduce significantly the number of filled surfaces. Community and school water fluoridation is known to result in a better oral health status (Miller and Barmes, 1980).

The other factor contributing to the difference in oral health status of the children in remote areas of Newfoundland and Labrador might be the oral hygiene habits of the children themselves. Just under 50% of the parents reported that the children brush teeth two or more times a day. This group of children has relatively good oral health status.

Finally, those children reporting consuming one or no between-meal sweet drinks or sweet snacks yesterday had significantly lower DMFT and DMFS indices compared to those who had two or more between-meal sweet drinks or sweet snacks yesterday.

CHAPTER 5

THE ORAL HEALTH STATUS OF REMOTE NEWFOUNDLAND AND LABRADOR SAMPLE 13 TO 14 YEAR OLD STUDENTS

There was a target number of 190 for the 13 to 14 year old students. This number was proportioned among the seven strata in the same manner as the children's sample. Table 19 illustrates the distribution of the 229 students examined and questioned in the various strata. Table 32 lists the number of schools visited in each stratum.

There were 107 (46.7%) males and 122 (53.3%) females in the sample. As for exposure to fluoridated water supply, 17 (7.4%) had one or more years of exposure to fluoridated water, 195 (85.2%) did not and the remaining 17 (7.4%) could not provide the required information. Of the 17 who spent some time in fluoridated communities, the mean length of stay was 5.4 years (high of 10 years and low of 2 years).

The next section of the chapter will review some of the findings on selected oral morbidity measures for the entire sample. Subsequent sections will look at oral health morbidity for sub-groups of population and for selected dental health behaviours.

5.1 Oral morbidity in the total sample

Usually by age 13-14 the primary teeth have been shed and have been replaced by the permanent teeth. The students had a mean of 26.48 permanent teeth present in the mouth (Table 36).

5.1.1 Overall estimates of DMFS and DMFT

The estimated means and standard errors for the study population are given in Tables 33 and 34. Table 33 contains DMFS and components by tooth and surface type. Table 34 gives DMFT and components for the age group.

The mean DMFT score per student was 5.6 teeth or 10.6 surfaces (DMFS). The younger, 6 to 7 year age group, had a mean of 1.0 teeth or 1.3 surfaces in permanent teeth.

TABLE 32

Distribution by number and percent
of Grade VIII schools visited by
sampling stratum
Remote Newfoundland and Labrador Study
1985

Districts/Strata	N	%
Northern Peninsula	12	50.0
Northern Labrador	4	16.7
Southern Labrador	2	8.3
Fogo/Burgeo	4	16.7
St. Anthony	1	4.2
North West River	1	4.2
Forteau	0	0.0
Total	24	100.1*

* Rounding error

TABLE 33

Overall mean DMFS and components with standard errors by tooth and surface type

13-14 year age group

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	.01	.9	.9	0	1.2	1.2	.007	.5	.5	.02	2.6	2.6
	.007	.1	.1	0	.07	.07	.003	.06	.06	.007	.1	.1
Smooth	.009	1.2	1.2	0	1.2	1.2	.0003	.9	.9	.009	3.2	3.3
	.004	.1	.1	0	.07	.07	0	.07	.07	.004	.09	.09
Occlusal	.03	2.1	2.1	0	.6	.6	.007	2.0	2.0	.03	4.7	4.7
	.008	.1	.1	0	.04	.04	.003	.1	.1	.01	.07	.07
	.05	4.1	4.2	0	3.0	3.0	.02	3.4	3.4	.06	10.5	10.6
	.02	.3	.3	0	.2	.2	.005	.2	.2	.02	.2	.2

TABLE 34

Overall mean DMFT and components with standard errors by tooth type

13-14 year age group

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
.03	2.7	2.8	0	.6	.6	.01	2.2	2.3	.04	5.6	5.6
.008	.2	.2	0	.04	.04	.005	.1	.1	.01	.08	.07

PRIM = PRIMARY
PERM = PERMANENT
TOT = TOTAL

D = DECAYED
M = MISSING
F=FILLED

DMFT= DECAYED, MISSING, FILLED TEETH
DMFS=DECAYED, MISSING, FILLED SURFACES

As for different components of the DMFT(S) for the 13 to 14 year age group, an average of 2.8 teeth (4.2 surfaces) were decayed, 2.3 teeth (3.4 surfaces) were filled, and 0.6 teeth (3.0 surfaces) were missing due to caries. This provides an indication of the care provided to students in the study area. 50.0% of the DMFT score was made up of D teeth.

For the intra-oral distribution of caries, an average of 5.9 was decayed, missing or filled on proximal and smooth surfaces and 4.7 was decayed, missing or filled on the occlusal aspect.

The intra-oral distribution of caries in this group of students seems to be of the variety that was all too common in children in North America prior to the general introduction of community water fluoridation and of other fluoride use programs (Bohannan, 1983; Bohannan, Disney, Graves, Bader, Klein and Bell, 1984). That is to say that the bulk of the caries in rural children is in the proximal surfaces. Whereas in North America today, occlusal and bucco/lingual pits make up a high proportion of tooth surfaces affected by caries (Stamm, 1984).

In order for rural Newfoundland children to arrive at the status that is noted today in their counterparts in other areas of North America, there would seem to be a need to devise and implement programs that deal effectively with the type of disease that is predominant in rural children - proximal surface decay. Kwant, Houwink, Backer Dirks, Groeneveld and Pot (1973) have shown that community water fluoridation plays a significant role in the reduction of proximal caries. Perhaps this may be considered an important factor in the future prevention of tooth decay in Newfoundland children.

To facilitate comparison of caries level throughout the world, 5 categories have been defined by WHO covering the range from very low to very high as follows (Miller and Barmes, 1980):

Caries severity index

Sum of decayed, missing and filled teeth (DMFT)

Very low .....0.0 - 1.1
Low .....1.2 - 2.6
Moderate .....2.7 - 4.4
High .....4.5 - 6.5
Very high.....6.6 and over

With a mean DMFT of 5.6, students in remote areas of Newfoundland and Labrador have a high level of dental caries.

5.1.2 Gingival health

The measure of gingival health was Russell's periodontal index (PI). PI for the group was 0.50 ± 0.02.

5.1.3 Orthodontic assessment

Orthodontic needs in terms of dentofacial anomalies were recorded using the method of measuring occlusal traits developed by the FDI (1974). Table 35 presents findings from this assessment.

Helm, Kreiborg, Barlebo, Casperson, Eriksen, Hansen, Hanusardottir, Munck, Perregaard, Prydso, Reumert and Spedtsberg (1975) state that in epidemiological surveys the current methods of registering malocclusion traits, namely using subjective estimates of treatment needs, is a preferred method of assigning orthodontic treatment priority to that of interpreting malocclusion severity objectively by employing malocclusion indices where the presence of certain selected morphological traits (or deviations) is expressed numerically by means of a scoring system. This is based on the observation that there is at present little evidence available on the sociopsychological

TABLE 35

Additional oral health characteristics
for 13-14 year age goup in remote
Newfoundland and Labrador (1985)

Number children examined	229	
Mean number and standard deviation ( ) primary teeth present	0.15	(0.73)
Mean number and standard deviation ( ) permanent teeth present	26.48	(2.13)
Total	26.63	
Percentage children needing plaque removal		
Northern Peninsula	37.27	
Northern Labrador	23.26	
Southern Labrador	57.89	
Fogo/Burgeo	24.39	
St. Anthony	42.86	
North West River	44.44	
Percentage children visiting a dentist in the last twelve months	47.16	
Percentage children with:		
Class 1 molar relationship	32.32	
Class 2 molar relationship	12.23	
Class 3 molar relationship	4.80	
Class 4 molar relationship	50.66	
Percentage children with:		
posterior crossbite	18.78	
posterior open bite	8.30	
anterior crossbite	9.61	
anterior open bite	3.49	
overjet	10.48	
overbite	3.93	
midline deviation	36.68	
impingement	1.31	
crowding	23.14	
spacing	7.86	
anterior irregularity	11.79	

. . . continued

TABLE 35 (Continued)

Percentage children with:	
straight facial form	56.33
retrognathic facial form	34.06
prognathic facial form	9.17
Skeletal deformity:	
None	66.80
Class 2 div. 1	14.00
Class 2 div. 2	12.20
Class 3	7.00
Percentage children with:	
space maintainer	-
active appliance	0.44
completed treatment	-
Percentage children with:	
fractured teeth	1.75
malformed teeth	0.87
Percentage children requiring:	
relief from pain	6.99
plaque removal	34.50
scaling	37.99
referral to an orthodontist	21.40
other treatment services	4.80
Percentage children with one or more caries-affected teeth	70.31
Percentage children with one or more teeth missing due to caries	31.44
Percentage children with one or more filled teeth	57.64

and physiological effects of malocclusion.

Eighteen separate assessments of dentofacial anomalies were made. The most common anomaly was where the anterio-posterior relationship was different on one side of the arch compared to the other (50.66%) followed by midline deviations (36.68%), crowding (23.14%) and posterior crossbite (18.78%).

The prevalence of Angle's Class II and Class III malocclusion in the sample of 13-14 year olds was 26% and 7%, respectively. Emrich, Brodie and Blayney (1965) reported prevalence of 14% Class II and 1% Class III malocclusion in a population of 12 to 14 year olds in an urban community. In ACCOHS, the Angle's Class II deformities were recorded in 9.0% of the 13 to 14 year olds and Angle's Class III in 3.2% of the sample (Banting et al., 1984).

5.1.4 Treatment needs

5.1.4.1 Restorations, extractions and sealants

Table 36 describes the treatment needs for teeth for the 13 to 14 year olds. The treatments prescribed were not solely for caries but included repair of trauma and replacement of unsatisfactory restorations. An average of 2.74 teeth per student needed some treatment of which 2.56 required restorations, 0.18 extraction and 0.0 pit and fissure sealant.

In the ACCOHS (Banting et al., 1984) an average of 2.55 teeth per student needed some treatment, of which 1.60 needed restorations, 0.12 extraction and 0.49 pit and fissure sealant.

5.1.4.2 Percent of students needing treatment

Table 35 shows that 70.31% of the students had one or more caries affected teeth. 7.0% of the sample needed relief from pain as a result of pulpal involvement of teeth. In ACCOHS (Banting et al., 1984) those figures were 47.2% and 5.2%, respectively.

Frequency distribution of DMFS and DMFT (Figures 3 and 4) indicate that 6.7% of the sample was caries-free (DMFT of zero). Just over 31 percent of the sample had

TABLE 36

Mean number and standard deviations ( )
of teeth needing treatment per student
in various categories for 13-14 year age group
in remote Newfoundland and Labrador (1985)

Treatment Category	Number of Teeth	Standard Deviations
1 surface restoration	1.94	(2.12)
2 surface restoration	0.41	(0.98)
3 surface restoration	0.14	(0.45)
More than 3 surface restoration	0.07	(0.28)
Extraction of primary tooth	0.00	(0.00)
Extraction of permanent tooth	0.18	(0.62)
Stainless steel crown	0.00	(0.00)
Tooth replacement	0.00	(0.00)
Pit and fissure sealant	0.00	(0.00)
Total	2.74	

DMFT of 7 or more, a very high caries index (see WHO index scale in Section 5.1.1).

5.1.4.3 Periodontal treatment requirements

Two categories of periodontal treatment requirements are presented in Table 35. 34.5% of the students had a need for plaque removal and 37.99% had a need for meticulous scaling, for the removal of supra and subgingival calculus.

5.1.4.4 Orthodontic treatment needs

A decision concerning need for orthodontic treatment depends largely on clinical judgement and is probably the most subjective dental assessment reported here (Arnljot et al., 1986). The need for orthodontic care was recorded when it was judged that a simple orthodontic appliance would not correct the existing problem. 21.4% of the students were assessed as needing orthodontic referral.

0.44% of the students in this study were either receiving treatment or had successfully completed treatment compared to 7.6% in Atlantic Canada who were receiving treatment at the time of the study or had already been successfully treated.

5.1.4.5 Other treatment needs

4.8% of the sample required other treatment services, including, artificial tooth replacement for function and/or aesthetics, compared to 3.3% for similar aged children in other areas of Atlantic Canada (Banting et al., 1984).

5.1.5 Visit to the dentist

41.76% of the sample reported visiting the dentist in the past twelve months.

In the ACCOHS (Banting et al., 1984) 71.3% of the 13-14 year olds reported visiting the dentist in the past twelve months. For Alberta, the utilization rate was 73.7% (Stamm et al., 1980(b)) and for Ontario it was 70.9% (Hunt et al., 1980). Dental care delivery in rural parts of the province takes place in a difficult environment and the sparse and unevenly distributed population may be factors that contribute to the poor

utilization pattern (Stamm, 1977).

5.2 Differences in oral morbidity by selected characteristics

There are a number of characteristics which can be assumed to affect oral health status. As with the children's sample, the ones identified for analysis included gender, location, influence of water fluoridation, socioeconomic status, past dental health actions and use of dentists' services.

Table 37 contains mean DMFS, DMFT and periodontal index including standard errors for different groups defined by demographic, socioeconomic or behavioural characteristics of the students examined. As stated previously (Section 4.2), the significance of the difference between the two group means (a and b) was judged by computing $1.96 \sqrt{(\text{SE of a})^2 + (\text{SE of b})^2}$.

If the two means differed by at least this amount, they were declared to be different at 0.05 significance level. The multiple regression analysis discussed in section 5.3 indicates which factors have significant effects when others are controlled.

5.2.1 Gender

Table 37 indicates that there were insignificant differences among the sexes in the DMFT and DMFS counts. As with the younger children, the females in the 13 to 14 year age group had slightly higher DMFT (DMFS) scores. Females had DMFT of 5.7 (10.9) and males 5.5 (10.1).

Table 37 also presents findings related to periodontal index (PI). Females had significantly lower PI than males (0.42 vs 0.61).

5.2.2 Strata

Tables 38 and 39 give detailed breakdowns of mean DMFT and DMFS and components for each of the six strata included in the survey - Northern Peninsula, Northern Labrador, Southern Labrador, Fogo/Burgeo, St. Anthony and North West River. The standard errors for St. Anthony and North West River could not be estimated

TABLE 37

Subpopulation means and standard errors of DMFS, DMFT and PI by selected variables Ages 13 and 14

	N	DMFS, SE		DMFT, SE		PI, SE	
Sex:							
Male	107	10.1,	.5	5.5,	.2	.61,	.02
Female	122	10.9,	.2	5.7,	.1	.42,	.01
Parental Education:							
Neither Sec	108	10.7,	.3	5.7,	.1	.54,	.02
One Sec	44	11.7,	.9	6.0,	.4	.52,	.04
Both Sec	19	9.3,	.6	5.2,	.2	.46,	.03
One Post Sec	28	9.8,	.5	5.3,	.3	.38,	.02
Both Post Sec	9	7.3,	1.2	4.3,	.6	.44,	.06
Missing	21	11.6,	1.3	6.3,	.8	.44,	.09
SES:							
1.	63	9.0,	.5	5.0,	.2	.55,	.02
2.	57	12.6,	.6	6.3,	.2	.48,	.02
3.	26	8.7,	.6	4.7,	.4	.48,	.04
4.	22	11.2,	.7	6.6,	.2	.35,	.02
5.	11	9.9,	1.1	5.5,	.6	.60,	.06
6.	17	10.2,	.4	5.5,	.2	.40,	.03
7.	2	6.0,	0	4.5,	0	.18,	0
Missing	31	14.6,	1.2	7.1,	.6	.57,	.06
Income:							
Under $5,000	12	11.1,	1.8	5.9,	.7	.54,	.07
$5,000-$9,999	40	10.5,	.9	5.1,	.3	.52,	.02
$10,000-$14,999	50	8.2,	.5	4.5,	.2	.42,	.03
$15,000-$19,999	30	13.6,	1.1	7.1,	.3	.53,	.04
$20,000-$24,999	26	12.8,	.5	7.0,	.3	.48,	.04
$25,000-$29,999	18	8.8,	.7	5.0,	.3	.50,	.05
$30,000 and over	28	8.1,	.3	4.8,	.1	.39,	.04
Unemployed	10	13.5,	1.9	7.3,	1.0	.75,	.08
Missing	15	15.0,	2.0	6.9,	.6	.71,	.1
Prevention:							
No reg. preventive checkup in last 12 months	156	9.4,	.2	5.2,	.09	.50,	.01
Reg. preventive checkup or work identified in last 12 months	58	13.0,	.6	6.5,	.2	.44,	.03
Missing	15	10.9,	.3	5.6,	.1	.57,	.02

. . . continued

TABLE 37 (Continued)

Subpopulation means and standard errors of
DMFS, DMFT and PI by selected variables
Ages 13 and 14

	N	DMFS, SE	DMFT, SE	PI, SE
Sweet snacks				
Less than two	60	8.0, .5	4.4, .2	.42, .02
Two or more	146	11.2, .3	6.0, .1	.52, .02
Missing	23	13.0, 1.3	6.2, .5	.54, .03
Sweet drinks:				
Less than two	72	9.1, .6	5.1, .2	.43, .02
Two or more	137	11.1, .4	5.9, .2	.52, .01
Missing	20	12.9, 1.2	6.2, .5	.60, .07
How often brush teeth:				
Less than two times per day	74	9.2, .7	4.7, .3	.58, .04
Two or more times per day	146	10.5, .3	5.7, .1	.46, .01
Missing	9	17.1, 1.0	8.0, .5	.75, .03
Uses dental floss:				
Yes	42	10.3, .7	5.6, .2	.41, .03
No	185	10.7, .3	5.6, .1	.52, .02
Missing	2	10.0, 0	4.5, 0	.67, 0
Ethnic group:				
Settler	185	10.7, .2	5.7, .08	.50, .02
Indian	28	7.0, .3	4.1, .4	.55, .009
Inuit	16	9.0, .8	4.7, .2	.37, .07
Health Unit:				
Central Health	38	9.8, .7	5.4, .1	.64, .02
Western Health	72	11.8, .2	6.1, .1	.54, .03
Northern Health	119	9.8, .7	5.3, .09	.46, .01
Language 1:				
Inuktituk	13	9.6, .7	4.9, .2	.38, .08
Montagnais	6	7.5, 0	3.3, 0	.57, 0
English	210	10.6, .2	5.7, .08	.50, .02
Dental visit in last 12 months:				
Yes	108	12.6, .4	6.5, .1	.46, .02
No	120	9.0, .3	5.0, .1	.53, .02
Missing	1	0, 0	0, 0	.57, 0

. . . continued

TABLE 37 (Continued)

Subpopulation means and standard errors of
DMFS, DMFT and PI by selected variables
Ages 13 and 14

	N	DMFS, SE		DMFT, SE		PI, SE	
Years spent in fluoridated area:							
Under one year	195	10.6,	.3	5.7,	.08	.50,	.02
One year or more	17	8.5,	.6	4.1,	.4	.31,	.02
Missing	17	13.1,	1.1	7.2,	.6	.81,	.04
Sweet snacks and drinks:							
0.	3	4.8,	.1	4.5,	.3	.86,	.07
1.	14	8.1,	1.3	4.5,	.5	.46,	.05
2.	27	8.6,	.6	4.8,	.3	.38,	.03
3.	34	9.7,	1.0	5.4,	.5	.50,	.04
4.	35	14.5,	.6	7.2,	.3	.39,	.02
5.	30	11.6,	.8	5.4,	.4	.55,	.03
6.	24	6.9,	.3	5.0,	.2	.58,	.03
7.	16	11.9,	.8	6.2,	.5	.57,	.06
8.	8	3.3,	.7	2.9,	.6	.64,	.06
9.	7	9.9,	1.4	6.1,	.8	.33,	.04
10.	2	1.3,	.2	1.3,	.2	1.41,	.07
Missing	29	13.7,	1.2	6.4,	.4	.57,	.05
Brushed teeth yesterday:							
Zero or one	96	8.8,	.7	5.0,	.3	.61,	.03
Two or more	130	11.1,	.3	5.9,	.1	.43,	.02
Missing	3	10.8,	.7	5.4,	.3	.63,	.04
Asymptomatic visit in last 12 months:							
No	181	10.0,	.3	5.5,	.1	.51,	.02
Yes	33	12.6,	.9	6.0,	.3	.40,	.02
Missing	15	10.6,	.3	5.6,	.1	.54,	.02

TABLE 38

Mean DMFS and components with standard errors by stratum, tooth, and surface type for 13-14 year age group

Northern Peninsula

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	.02	.9	.9	0	1.1	1.1	.01	.5	.5	.03	2.5	2.5
	.009	.1	.1	0	.09	.09	.004	.07	.07	.009	.1	.1
Smooth	.01	1.1	1.1	0	1.1	1.1	0	1.0	1.0	.009	3.2	3.2
	.004	.1	.1	0	.09	.09	0	.09	.09	.004	.1	.1
Occlusal	.03	1.9	2.0	0	.5	.5	.01	2.2	2.2	.03	4.7	4.7
	.009	.1	.1	0	.05	.05	.004	.2	.2	.01	.09	.08
	.05	3.9	3.9	0	2.7	2.7	.02	3.7	3.8	.07	10.4	10.4
	02	.4	.4	0	.2	.2	.006	.3	.3	.02	.3	.3

Northern Labrador

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	.01	.5	.5	0	1.2	1.2	0	.2	.2	.01	2.0	2.0
	.008	.08	.07	0	.3	.3	0	.09	.09	.008	.3	.3
Smooth	.03	.6	.7	0	1.2	1.2	0	.7	.7	.03	2.5	2.6
	.02	.1	.1	0	.3	.3	0	.2	.2	.02	.3	.3
Occlusal	.08	1.7	1.8	0	.6	.6	0	1.7	1.7	.08	4.0	4.1
	.05	.3	.3	0	.1	.1	0	.3	.3	.05	.2	.2
	.1	2.8	2.9	0	3.1	3.1	0	2.6	2.6	.1	8.5	8.6
	.07	.2	.2	0	.7	.7	0	.6	.6	.07	.6	.6

Southern Labrador

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	0	1.1	1.1	0	1.3	1.3	0	.3	.3	0	2.7	2.7
	0	.5	.5	0	.05	.05	0	.2	.2	0	.7	.7
Smooth	0	1.2	1.2	0	1.3	1.3	0	.6	.6	0	3.0	3.0
	0	.4	.4	0	.05	.05	0	.06	.06	0	.5	.5
Occlusal	0	1.3	1.3	0	.6	.6	0	1.1	1.1	0	3.0	3.0
	0	.3	.3	0	.02	.02	0	.08	.08	0	.4	.4
	0	3.6	3.6	0	3.1	3.1	0	2.0	2.0	0	8.6	8.6
	0	1.2	1.2	0	.08	.08	0	.3	.3	0	1.6	1.6

. . . continued

TABLE 38 (Continued)

Fogo/Burgeo

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	0	1.3	1.3	0	1.9	1.9	0	.3	.3	0	3.5	3.5
	0	.5	.5	0	.5	.5	0	.2	.2	0	.4	.4
Smooth	0	2.1	2.1	0	1.9	1.9	0	.2	.2	0	4.2	4.2
	0	.5	.5	0	.5	.5	0	.1	.1	0	.3	.3
Occlusal	0	3.2	3.2	0	.8	.8	0	.9	.9	0	4.9	4.9
	0	.4	.4	0	.2	.2	0	.5	.5	0	.6	.6
	0	6.6	6.6	0	4.6	4.6	0	1.4	1.4	0	12.6	12.6
	0	1.3	1.3	0	1.1	1.1	0	.8	.8	0	1.1	1.1

St. Anthony

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	0	.2	.3	0	1.1	1.1	0	.9	.9	0	2.3	2.3
Smooth	0	.3	.3	0	1.1	1.1	0	.9	.9	0	2.3	2.3
Occlusal	0	1.9	1.9	0	.6	.6	0	2.7	2.7	0	5.1	5.1
	0	2.4	2.4	0	2.9	2.9	0	4.4	4.4	0	9.7	9.7

North West River

	D			M			F			DMFS		
	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
Proximal	0	.3	.3	0	0	0	.2	0.0	.2	.2	.3	.6
Smooth	0	.7	.7	0	0	0	.1	.9	1.0	.1	1.6	1.7
Occlusal	0	.4	.4	0	0	0	.2	2.1	2.3	.2	2.6	2.8
	0	1.4	1.4	0	0	0	.6	3.0	3.6	.6	4.4	5.0

TABLE 39

Mean DMFT and components with standard errors by stratum and tooth type for 13-14 year age group

Northern Peninsula

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
.03	2.5	2.6	0	.5	.5	.02	2.5	2.5	.04	5.6	5.6
.009	.2	.2	0	.05	.05	.006	.2	.2	.01	.09	.09

Northern Labrador

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
.08	2.0	2.1	0	.6	.6	0	1.9	1.9	.08	4.6	4.6
.05	.3	.3	0	.1	.1	0	.4	.4	.05	.3	.2

Southern Labrador

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
0	1.9	1.9	0	.6	.6	0	1.4	1.4	0	3.9	3.9
0	.3	.3	0	.02	.02	0	.2	.2	0	.6	.6

Fogo/Burgeo

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
0	4.3	4.3	0	1.0	1.0	0	1.1	1.1	0	6.4	6.4
0	.6	.6	0	.2	.2	0	.6	.6	0	.7	.7

St. Anthony

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
0	2.0	2.0	0	.6	.6	0	3.0	3.0	0	5.6	5.6

North West River

D			M			F			DMFT		
PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT	PRIM	PERM	TOT
0	.8	.8	0	0	0	.2	2.6	2.8	.2	3.3	3.6

since there was only a single school sampled in each of these strata.

One of the characteristics upon which stratification was based was the availability of dentist's services in the district. Fogo/Burgeo district, generally, did not have a resident dentist. At 6.4 it had the highest DMFT index. A closer look at the DMF components shows that there were over 4 decayed (D) teeth per student in the stratum. Thus in Fogo/Burgeo stratum more than 65% of the DMF score was made up of D teeth.

Table 38 gives detailed breakdown of DMFS, its components, and surface types for each of the six stratum, and Table 40 presents adjusted means.

With reference to periodontal index Fogo/Burgeo district (Appendix B) has the highest score (0.65).

5.2.3 Influence of fluoride

As with younger children, residence histories, provided by parents, permitted separation of students who had lived some time previously in fluoridated communities. Table 37 provides findings on three oral morbidity measures by water fluoridation influence. 7.4% of the 13 to 14 year old students had spent an average of 5.4 years in fluoridated communities (high of 10 years and low of 2 years). 85% either did not have any exposure to fluoridated water or the exposure was for less than twelve months of their lives. Fluoride group that had spent an average of 5.4 years in fluoridated communities had significantly lower DMFT, DMFS and PI scores. The results of regression analysis are presented in section 5.4. In terms of percentage difference, the fluoride group had 28.07% less DMFT than the non-fluoride group (4.1 vs 5.7).

Other recent surveys of similar age school children in Atlantic Canada (Banting et al., 1984), the province of Quebec (Stamm et al., 1980 (a)), Alberta (Stamm et al., 1980(b)), Ontario (Hunt et al., 1980) and Manitoba (Cageorge, Ryding and Leake, 1980) have also reported clinically and statistically significant lower caries experience for those students with histories of residence in fluoridated communities.

TABLE 40

Adjusted [1] mean DMFS and components for strata

Ages 13 and 14

Stratum	Decayed	Missing	Filled	DMFS
Northern Peninsula	3.8	2.7	3.6	10.1
Northern Labrador	4.1	6.5	5.8	16.4
Southern Labrador	2.1	3.0	3.2	8.3
Fogo/Burgeo	4.3	4.2	1.3	10.2
St. Anthony	4.6	2.4	2.6	9.6
North West River	0.0	1.2	4.5	5.4

[1] The adjusted means are the means that would be expected if each district had the same fluoride exposure, sex distribution, ethnic makeup, level of parental education, amount of brushing and flossing, and number of asymptomatic visits as the overall average for remote areas of Newfoundland and Labrador.

5.2.4 Socioeconomic factors

Socioeconomic status for students can be assessed from three measurements: parental education level, parental occupation or family income. For each student, data on all three dimensions were collected through a questionnaire that was completed by parent or guardian.

Table 37 shows the means for oral morbidity measures by the three socioeconomic indicators.

In terms of parental education level, the differences among the categories are not well defined for the three indices DMFT, DMFS and PI, although there is a trend of lower disease level with increased education level. Similar inconsistencies were also apparent in the other measures of social class, Blishen occupation index and family income.

5.2.5 Ethnic groups

80.8% of the student sample was settler group, 12.2% Native Indian and 7.0% Inuit.

Data in Table 37 indicate that the Native Indian sub-group had significantly lower DMFS (7.0) and DMFT (4.1) than the settler or Inuit sub-group. On the other hand, periodontal score for the group was the highest among the three sub-groups.

To adjust for the effects of other measures, regression analysis (not shown here) was done on the DMFS score. Settler category was chosen as "reference category". After adjusting for other factors in the model (fluoride exposure, sex, education level, brushing and flossing, asymptomatic visit, district) both the Inuit and Native Indian sub-groups had markedly less of all the components, that is, less decayed, less missing and less filled surfaces.

In contrast to observations reported in other studies (Kristoffersen and Bang, 1973; Titley, 1977; Myers and Lee, 1974; Curzon and Curzon, 1970) the oral health of both the Native Indian and the Inuit in rural Newfoundland is less severely affected than their counterparts in other areas of Canada. In 1983, the caries rate for 12-13 year old

Native Indians in Northern Ontario (Titley and Bedard, 1986) was reported as 9.41 DMFT.

5.2.6 Past dental health actions

Data on certain well-accepted preventive dental health behaviours were collected for the purpose of baseline documentation and also to reveal any underlying systematic variations in oral health status from the effects of the behavioural variables.

Indicators selected for inclusion were:

(i) whether or not the students brushed their teeth two or more times a day

(ii) whether or not students used a fluoride tooth-paste

(iii) whether or not students used dental floss

(iv) the number of sweet snacks the students had between regular meals.

It can be argued that behaviours related to oral health are part of a total cultural pattern. It was believed that if it could be established that certain preventive dental health behaviours were not being practised by students with high caries rate or, conversely those students with little or no caries had a history of specific health behaviours, then this could help to identify those who are presently without high caries rate, but who are most likely to develop it in the future (Fodor, 1985).

5.2.6.1 Tooth-brushing

Appendix B gives information regarding tooth-brushing behaviour as reported by the students themselves. 96.5% reported owning a tooth-brush and 79.0% indicated brushing at least once a day.

21.4% reported not brushing their teeth yesterday, with the mean for the 13-14 year olds being 1.7 times per day. When related to oral morbidity measures, brushing two or more times a day was negatively related to periodontal scores (Table 37). When fitted to the multiple regression model, shown in Table 41, brushing two or more times a day was significantly associated with less decayed surfaces.

The greatest percentage of students reported brushing their teeth after breakfast

TABLE 41

Regression coefficients and p-values ( )
for the effects of certain factors on DMFS and its components

Ages 13 and 14 years (n=174)

	Response							
Factor	Decayed surfaces		Missing Surfaces		Filled Surfaces		DMFS	
Parental Education	-.9	(<.001)	-.4	(<.001)	.7	(<.001)	-.7	(.002)
Brushing	-1.8	(.004)	1.4	(.02)	1.1	(<.001)	.7	(.51)
Flossing	-.4	(.41)	-.7	(.17)	.7	(.19)	-.3	(.72)
Asymp Visit	-1.5	(<.001)	2.2	(.002)	3.8	(<.001)	4.5	(.001)
Fluoride	-1.4	(.007)	.4	(.002)	-2.2	(<.001)	-3.2	(<.001)

(60.3%) and after evening meal (44.1%).

5.2.6.2 Between-meal sweet snacks

The average number of between meal sweet snacks and sweet drinks per day was 3.81. For the younger children, the average was 2.27 snacks per day (see Section 4.2.6.2). Those students (13-14 years old) consuming two or more between-meal sweet snacks or drinks had higher DMFS index compared to students consuming one or no sweet drinks or snacks between meals.

A regression model (not shown here) was fit by adding degree of consumption of sweet snacks (less than two, or two or more per day) and sweet drinks to the factors in the model. Because of the large number of missing values for these factors there were only 155 cases for the group. Of the two factors, more sweet drinks significantly correlated with more missing surfaces (p=.001) and greater DMFS (p=.01). More sweet snacks were associated with more decayed surfaces (p=.01), filled surfaces (p=.001) and greater DMFS (p<.001) in the 13-14 year age group.

5.2.6.3 Flossing

Another dental habit reported was use of dental floss. 18.3% of the students reported using dental floss. The significant effect of flossing was to decrease the periodontal score among the 13 to 14 year olds.

It is gratifying to note that this finding is consistent with expected results in that when it comes to prevention of periodontal disease, it is recommended that adolescents use dental floss for cleaning the interdental area at least once a week. Dental flossing has been shown to be effective in removing proximal plaque and in improving the condition of the gingivae (Granath and McHugh, 1986).

5.2.6.4 Fluoridated tooth-paste

Use of fluoride toothpaste may affect oral health status. According to Appendix B, 66.8% of the students reported using two of the leading brands of fluoride toothpaste

approved by the Canadian Dental Association.

42.4% of the students reported not knowing if the tooth-paste they used contained fluoride. It would appear from the brand names reported that nearly all, if not all the brands contain fluoride in some form. From the data available, it was not possible to determine if the use of fluoride tooth-paste had any effect on oral health measures.

On an epidemiological level, increasing and regular use of fluoridated tooth-paste has been reported to be an important factor in reducing caries in school children (Renson, 1986).

5.2.7 Dental services

As can be seen in Table 35, Page 99-100, just under one-half of the students (47.16%) visited a dentist in the twelve months prior to the study. In Atlantic region, 71.30% of the 13 to 14 year old students reported visiting a dentist in the past twelve months (Banting et al., 1984), and 56.37% for the province of Newfoundland as a whole (Newfoundland Department of Health, 1988). Reasons for utilization of dental services are an interesting aspect of the utilization pattern. The students indicated the reasons for their last dental visit, and the percentage indicating asymptomatic reasons (regular preventive checkup) was 14.4%. Percentage visiting because of a specific dental problem was 16.2%.

Students with visits to a dentist in the past twelve months had significantly higher DMFT and DMFS scores but lower periodontal index scores (Table 37). The DMFT (DMFS) score for those visiting a dentist was 6.5 (12.6) and for those with no visits it was 5.0 (9.0). The result is in accord with experiences that a regular visiting pattern as such does not reduce the overall DMF score (Jackson, Murray, Fairpo, 1973; Arnljot et al., 1986). Those expressing asymptomatic reasons for dental visits also had high DMF scores.

5.3 Regression analysis:

Table 41 presents the results of a regression analysis of the effects of various factors on DMFS and its components. The number of cases in the analysis with all independent variables present was 174.

The regression coefficients represent the change in the response index per unit change in the factor (independent variable). Coefficients with positive signs indicate that the response index increases as the factor increases (or with its presence in the case of factors with two categories). Coefficients with negative signs indicate that the response decreases as the factor increases. Thus, for example, the number of decayed surfaces tends to decrease with increasing parental education while the number of filled surfaces tends to increase. Only coefficients with p-values less than or equal to .05 were considered to provide strong evidence for the association suggested by the regression coefficient.

Parental education as a factor in the analysis had five levels while each of the other factors had two levels. The DMFS decreased as parental education level increased and the number of filled surfaces tended to increase with parental education.

The levels of brushing were less than twice per day and two or more times per day. In this age group of students, more brushing was associated with less decay but more missing and filled surfaces. The flossing factor was defined as not flossing (or not knowing what dental floss is) or flossing. There were no significant effects among the students of ages 13 and 14.

Having an asymptomatic dental visit in the last twelve months was significantly associated with decreased decay and increases in the other components of DMFS. Residing in a fluoridated area for one or more years was associated with a decrease in filled surfaces and with reductions in decay and DMFS in the students.

5.4 Need for treatment and other characteristics

Table 36 gives the mean number of teeth per student requiring different types of treatment. Table 35 contains results pertaining to other oral health characteristics and

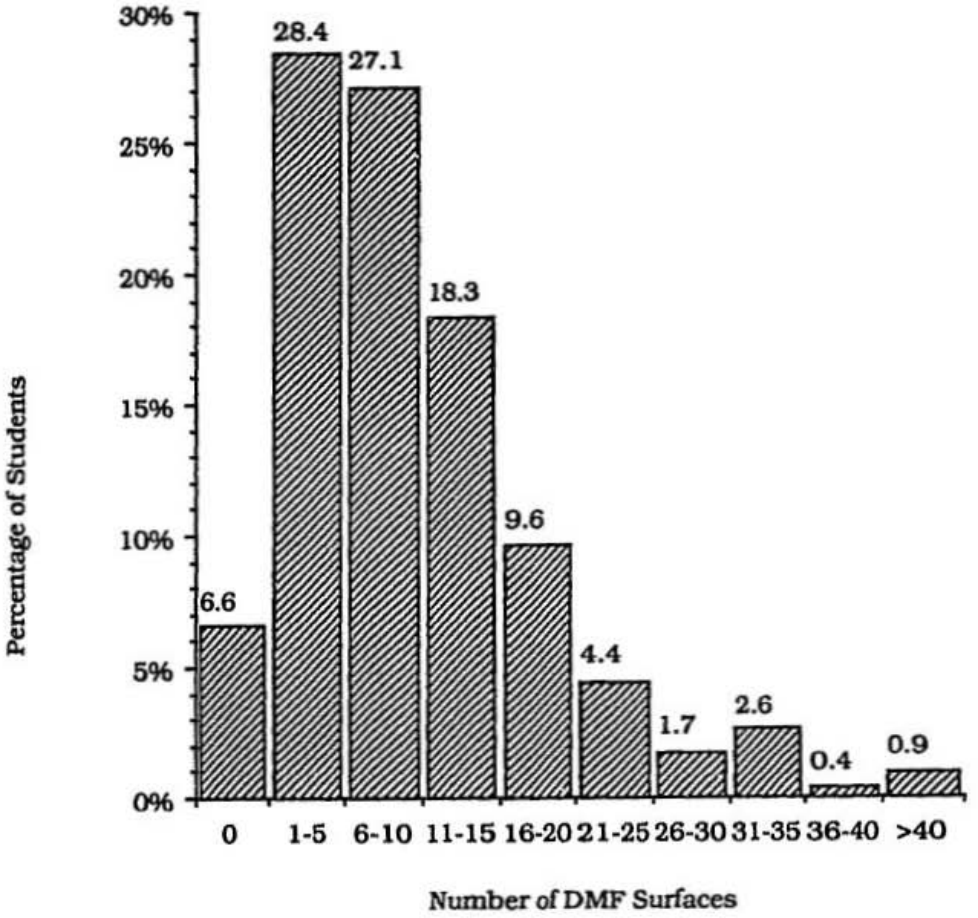

FIGURE 3: Distribution of DMF surfaces among 13-14 year age group in Newfoundland and Labrador

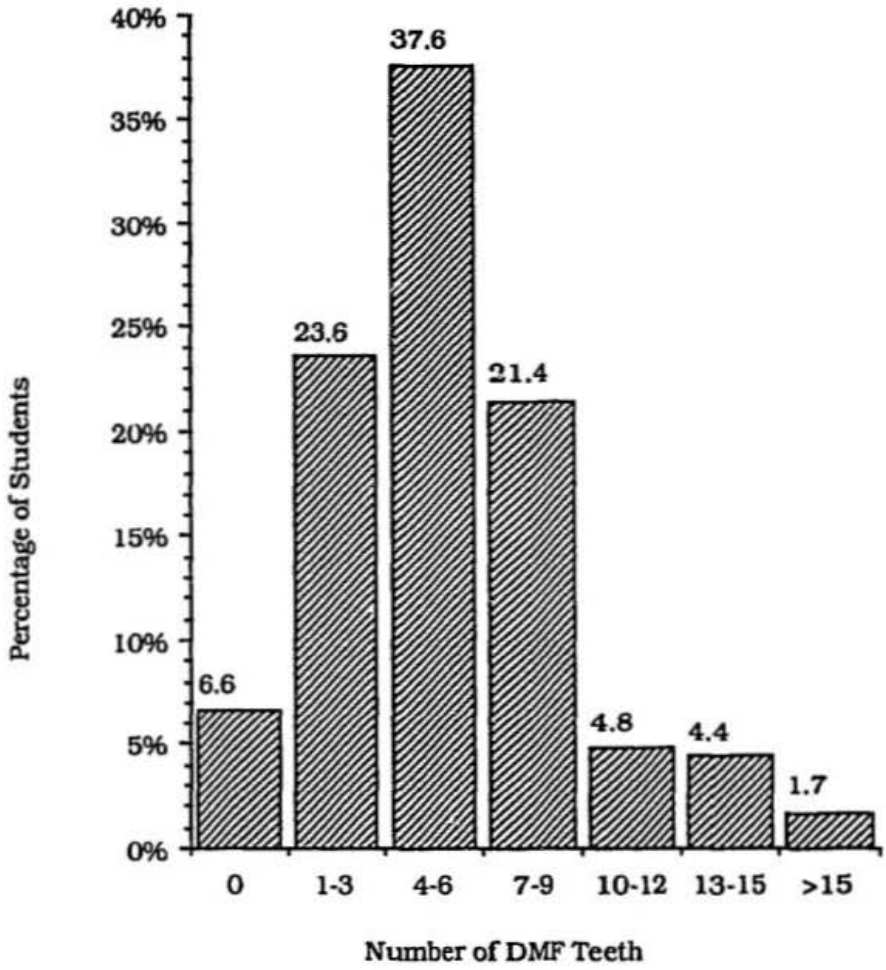

FIGURE 4: Distribution of DMF teeth among 13-14 year age group in Newfoundland and Labrador

treatment needs for the group. Figures 3 and 4 show the distribution of DMFS and DMFT in graphical form. The results for the questionnaire items and related factors are contained in Appendix B. The statistics contained in Tables 35 and 36, and Appendix B are "raw" estimates computed in SPSS* as discussed in Section 3.5.6.

5.5 Summary of main findings

Some of the noteworthy findings from the study for 13 to 14 year old students are listed below:

1. The students had a mean number of 26.48 permanent teeth present. The average DMFT score for the remote areas of Newfoundland and Labrador was 5.6 (10.6 DMF surfaces).

2. The components of DMFT score were as follows: 2.8 Decayed, 2.3 Filled and 0.6 Missing due to caries. 56% of the DMFS score was due to proximal and smooth surface lesions, and 44% due to occlusal involvement.

3. 31% of the sample had DMFT of seven or more. 7% of the sample had no DMFT (DMFT of zero).

4. Females had slightly higher DMFT than males (5.7 vs 5.5).

5. The average periodontal score (PI) was 0.50. Females had significantly lower periodontal index than males.

6. Parental education level was negatively related to DMF levels and to decayed and missing surfaces. The filled surfaces increased with increase in parental education level.

7. Fluoride group with exposure to water fluoridation for a mean of 5.4 years, had a significantly improved oral health status. Specifically, fluoride group had 4.1 DMF teeth and non-fluoride group 5.7 DMF teeth.

8. The Native Indian and Inuit sub-group had marginally lower DMFT(S) scores than settler group. These differences were significant when controlled for certain factors.

9. The Fogo/Burgeo district had the highest DMFT (6.4) score compared to other districts. 67.2% of this DMFT score was due to D teeth.

10. The mean number of between-meal sweet snacks was 3.81. More sweet snacks were significantly related to increase in DMFS. Students having two or more sweet snacks had DMFS of 11.2 and those having one or no sweet snacks had DMFS of 8.0.
11. Those brushing two or more times a day had significantly lower periodontal scores and lower decayed surfaces.
12. 47.16% of the sample had visited a dentist in the past twelve months. 16% of the sample visited because of a specific dental problem, and 14% for a regular checkup.
13. Students visiting a dentist in the past twelve months had significantly higher DMFT scores (6.5 vs 5.0).
14. 21.4% of the students needed orthodontic referrals.
15. 38% of the sample were assessed as requiring meticulous scaling for removal of supra and subgingival calculus.

5.6 Interprovincial and intercountry comparison of students

5.6.1 Background

Thanks largely due to similarities of population groups, study purposes and methodologies originally put forward by the World Health Organization International Collaborative Studies on Dental Manpower in Relation to Oral Health Status (Arnljot et al., 1986; Banting et al., 1984) that comparisons among original country studies and recent Canadian studies may be undertaken with some confidence.

5.6.2 Findings

Tables 42 and 43 present DMFT and PI scores from some of the recent Canadian and other country studies (Arnljot et al., 1986; Stamm et al., 1980(b); Hunt et al., 1980; Banting et al., 1984).

When comparing the results of this remote areas of Newfoundland and Labrador study with results from less remote parts of Newfoundland previously reported in the Atlantic Canada Children's Oral Health Survey (Banting, et al. 1984), the following can be observed:

TABLE 42

Mean number of decayed, missing and filled teeth

Student sample 13 to 14 years

Study Area	Year of Study	D	M	F	DMFT
Remote Newfoundland & Labrador	1985	2.8	0.6	2.3	5.6
Newfoundland,[1] not including remote areas	1982	2.12	0.45	3.41	5.86
Prince Edward[1] Island	1982	0.20	0.18	5.53	5.87
Nova Scotia[1]	1982	1.32	0.41	4.13	5.72
New Brunswick[1]	1982	1.37	0.55	3.18	5.04
Alberta[2] (rural 13 year olds)	1985	0.91	0.05	2.41	3.37
Ontario[3]	1977	1.17	0.15	2.99	4.32
Dublin (Metro)[4]	1980	1.5	0.5	2.1	4.2
Baltimore[4] (Metro) (U.S.A.)	1976	0.8	0.1	1.8	2.7

(1) Banting et al. (1984)
(2) Health Unit Association of Alberta (1986)
(3) Hunt et al. (1980)
(4) Arnljot et al. (1985)

TABLE 43

Mean periodontal index (Russell's PI)

Student sample 13 to 14 years

Study Area	Year of Study	Mean Periodontal Index
Remote Newfoundland & Labrador	1985	0.50
Newfoundland,[1] not including remote areas	1982	0.38
Prince Edward[1] Island	1982	0.21
Nova Scotia[1]	1982	0.52
New Brunswick[1]	1982	0.31
Alberta[2]	1978	0.65
Ontario[3]	1977	0.26
Dublin (Metro)[4]	1980	0.55
Baltimore (Metro)[4] (U.S.A.)	1976	0.47

(1) Banting et al. (1984)
(2) Stamm et al. (1980(b))
(3) Hunt et al. (1980)
(4) Arnljot et al. (1985)

1. Among the 13 to 14 year olds there was little difference in the DMFT scores between the two study areas.
2. Need for treatment as measured by the mean number of teeth per student needing various types of treatment was generally greater in the remote areas of Newfoundland and Labrador.
3. Russell's Periodontal Index was higher in this group in remote areas than for other areas of Newfoundland reported in the Atlantic Canada survey (0.50 vs 0.38).
4. Prevalence of other dental anomalies was also greater in remote areas of Newfoundland and Labrador as was the proportion of students requiring various dental services.

As noted in an earlier section, although Newfoundland, Prince Edward Island and Nova Scotia have almost similar Children's Dental Plans (Health and Welfare Canada, 1986), Prince Edward Island has the most favourable dentist to population ratio (Hann, 1982). Thus an examination of the separate DMFT components demonstrates some contrast in the care provided as a result of the better manpower ratio. Newfoundland has the highest D component of these three provinces.

With regard to other country comparisons, high DMFT scores, ranging from 5.8 to 5.0 were observed in Atlantic Canada, while moderate to low scores were seen in Alberta, Ontario, Dublin and Baltimore. All these latter four jurisdictions have a substantial proportion of students consuming fluoridated water (Arnljot et al., 1986). The area with targeted school dental service scored the highest DMFT (Prince Edward Island, 5.87) together with the highest score for filled teeth (5.53). Less than 10% of the DMFT scores in Prince Edward Island consisted of decayed teeth, in contrast to remote Newfoundland, where the rate was 50%.

The D (decayed) component for remote Newfoundland is highest of all areas shown, as is the M (missing) component. The periodontal disease finding is difficult to interpret because of the considerable variation among the different areas shown.

5.7 Summary

The findings from this study seem to indicate that in remote areas of Newfoundland and Labrador 13 to 14 year old students have a high dental disease rate as measured on the WHO DMFT index scale (see Section 5.1.1).

50% of the DMFT consist of D teeth, underlining the shortcomings in the delivery of dental services. One factor observed to contribute to improved oral health status was influence of water fluoridation.

The other factor affecting oral health status was assessed via respondents' evaluation of their own dental health. This evaluation included the subjects' dental habits. Students that reported brushing two or more times a day had significantly fewer decayed surfaces.

CHAPTER 6

CONCLUSION

This study provides data collected from a regional descriptive epidemiological survey.

The purpose of this study was to gather the most current information on the oral health status of the child and adolescent population of the remote areas of Newfoundland and Labrador. These data can be used to guide planning and provision of dental health services, and the development of research strategies for the future. A second important purpose was to establish a baseline for the dental health, disease and behaviour in the remotest areas that will permit comparisons with the less remote areas studied previously, and with future provincial surveys. In this way, it will be possible to monitor trends in the dental health and behaviour of the child and adolescent population in Newfoundland and Labrador.

Historical data indicate a downward trend in dental caries prevalence in the adolescent population, in the province and elsewhere (Brunelle and Carlos, 1982; O'Mullane, 1982; Barmes, 1978). In spite of this seemingly downward trend, children and adolescents in remote areas of Newfoundland and Labrador, indeed in the province as a whole, have a higher average number of decayed, missing and filled teeth (DMFT) than the average of similar age population of over a decade ago of provinces such as Ontario (Johnston, Grainger and Ryan, 1986).

With respect to dental caries, the data from this study support the notion that exposure to fluoridated water in childhood is of potential importance in the control of the disease.

The other factor of importance was parental education level. Parental education level was found to be inversely related to both the DMFT index and periodontal index in the 6-7 year old school children.

Both these areas may be worth investigating in future studies.

This study also provided evidence that the increase in frequency of between-meal sweet snacks and sweet drinks plays a role in increasing the amount of dental caries. In both the age groups studied, those students who reported consuming two or more sweet snacks or sweet drinks per day had considerably higher decayed surfaces compared to students reporting consuming none or just one sweet snack or sweet drink per day.

Perhaps it would be reasonable to suggest that further research be conducted to learn more about the type of between-meal snacks and drinks that are available to and consumed by the "high" and "low" caries students in these rural areas of the province.

One other finding reported in this study that appears to be contrary to that reported in other similar studies in Canada's northern population is the insignificant difference in caries experience between the Inuit and the settler (mainly Caucasian) adolescents in coastal Labrador. While further investigation will be needed to explain this finding, one is tempted to speculate whether or not the oral structures of the children of the two ethnic groups are not facing similar challenges in terms of diet, exposure or non-exposure to optimal amount of systemic and/or topical fluorides and professional dental care service.

This study also provided evidence that there was no significant relationship between tooth-brushing per se and DMFT index.

The results thus give an insight into the amount and distribution of dental disease within a selected population in remote areas of the province of Newfoundland and Labrador. In addition, the development of a priori hypothesis became helpful in elucidating some of the factors that have an influence on the distribution of dental disease in groups of children and adolescents studied.

The knowledge of the distribution and the factors influencing this distribution may help in laying groundwork for establishing more effective programs of prevention and control for the most predominant types of dental disease.

CHAPTER 7

RECOMMENDATIONS

The following recommendations may be made as a result of this study:

1. In view of the high prevalence of dental disease in rural Newfoundland and Labrador, it is recommended that plans be made to review the existing preventive-educational and treatment services in these parts of the province.
2. It is recommended that the results of this study be communicated to leaders and decision-makers in the communities surveyed to create an awareness of the amount and distribution of dental disease in the population; and that the Department of Health, Government of Newfoundland, assist the communities in selecting, from among the many strategies available, the most effective and efficient dental disease preventive method to deal with dental caries, the predominant type of dental disease.
3. It is recommended that school teachers, students and their parents be informed of the complex role that sweet foods, especially between-meal snacks, play in the development of dental caries.
4. It is recommended that in 1994-95 a repeat oral health epidemiological survey be conducted, using already established criteria and standards, in order to evaluate the worth of preventive-educational programs implemented, as well as to monitor the disease trend in school children.

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APPENDIX A

"Manual - Newfoundland and Labrador Children's Oral Health Study (1985)".

Please consult Memorial University of Newfoundland Library

APPENDIX B
"RAW" MEANS AND STANDARD ERRORS FOR QUESTIONNAIRE ITEMS

Means and standard errors of DMFS, DMFT and PI by selected variables

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
SEX:				
Age 6 and 7				
Female	128	18.06, 1.44	7.34, .43	.37, .03
Male	116	17.89, 1.46	7.29, .46	.46, .03
Age 13 and 14				
Female	122	10.16, .75	5.31, .35	.40, .03
Male	107	9.74, .87	5.43, .34	.62, .04
INCOME:				
Age 6 and 7				
Under $5,000	25	16.44, 3.16	7.24, .99	.47, .07
$5,000-$9,999	38	20.84, 2.55	8.42, .71	.52, .05
$10,000-$14,999	39	22.23, 2.70	8.36, .74	.47, .06
$15,000-$19,999	35	19.57, 2.88	7.86, .94	.42, .05
$20,000-$24,999	20	16.95, 2.88	7.20, .83	.45, .07
$25,000-$29,999	22	18.00, 3.27	7.27, 1.06	.49, .07
$30,000 and over	32	8.09, 1.92	4.47, .85	.22, .04
Unemployed	8	21.75, 7.65	7.13, 2.29	.23, .10
Missing	25	18.56, 3.45	7.20, 1.00	.29, .06
Age 13 and 14				
Under $5,000	12	10.00, 2.88	4.92, 1.10	.48, .15
$5,000-$9,999	40	9.48, 1.22	4.95, .50	.57, .06
$10,000-$14,999	50	8.94, 1.03	4.78, .44	.52, .05
$15,000-$19,999	30	11.07, 1.46	6.40, .65	.51, .06
$20,000-$24,999	26	11.54, 1.98	5.96, .88	.46, .07
$25,000-$29,999	18	10.50, 1.83	5.83, .99	.49, .08
$30,000 and over	28	7.29, 1.07	4.46, .53	.36, .06
Unemployed	10	10.70, 3.53	6.10, 1.77	.58, .17
Missing	15	13.60, 3.67	6.33, 1.27	.57, .15
LAST DENTAL VISIT:				
Age 6 and 7				
Yes	124	16.79, 1.40	6.78, .44	.35, .03
No	112	18.73, 1.52	7.83, .47	.50, .03
Missing	8	25.88, 7.28	8.50, 2.07	.29, .09
Age 13 and 14				
Yes	108	11.19, .82	5.93, .37	.48, .04
No	120	8.95, .78	4.91, .32	.53, .04
Missing	1	0.00, 0.00	0.00, 0.00	.57, 0.00

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
REGULAR PREVENTIVE CHECKUP:				
Age 6 and 7				
Yes	69	11.30, 1.72	5.01, .57	.31, .03
No	15	21.33, 2.76	8.67, .94	.39, .10
Missing	160	20.54, 1.29	8.19, .38	.46, .03
Age 13 and 14				
Yes	50	10.72, 1.20	5.80, .58	.43, .04
No	17	10.12, 1.63	5.12, .72	.41, .10
Missing	162	9.72, .69	5.26, .29	.54, .03
REGULAR CHECKUP				
Age 6 and 7				
Yes	34	17.44, 2.36	7.68, .81	.28, .04
No	13	18.62, 4.50	6.54, 1.45	.33, .11
Missing	197	18.03, 1.17	7.31, .35	.44, .02
Age 13 and 14				
Yes	27	12.81, 1.76	7.11, .93	.43, .07
No	31	9.39, 1.03	5.06, .47	.52, .07
Missing	171	9.62, .68	5.15, .28	.51, .03
DENTAL PROBLEM:				
Age 6 and 7				
Yes	32	27.53, 2.69	9.53, .73	.43, .06
No	16	12.00, 3.71	4.88, 1.24	.19, .06
Missing	196	16.91, 1.12	7.16, .35	.43, .02
Age 13 and 14				
Yes	37	11.00, 1.30	5.70, .57	.51, .07
No	32	10.78, 1.33	5.72, .68	.45, .06
Missing	160	9.56, .71	5.22, .30	.51, .03
NUMBER OF VISITS:				
Age 6 and 7				
1	45	16.78, 2.31	6.56, .68	.32, .05
2	42	13.55, 2.11	5.93, .78	.33, .04
3 or more	20	21.50, 3.26	8.65, 1.00	.38, .06
Missing	137	19.22, 1.44	7.80, .43	.47, .03
Age 13 and 14				
1	41	9.22, .86	5.00, .45	.50, .05
2	26	12.00, 1.60	6.38, .71	.41, .08
3 or more	17	11.47, 2.35	6.29, 1.23	.33, .07
Missing	145	9.63, .77	5.18, .31	.54, .03

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
DENTAL EXPENSE:				
Age 6 and 7				
Zero	63	12.57, 1.99	5.38, .62	.29, .03
0 - - 10	27	19.11, 2.46	7.70, .78	.39, .06
11 - - 20	16	19.81, 3.98	7.38, 1.04	.34, .08
21 - - 50	11	26.36, 4.45	9.82, 1.49	.40, .08
>50	2	25.00, 13.00	12.00, 5.00	.51, .31
Missing	125	19.38, 1.46	7.91, .44	.49, .03
Age 13 and 14				
Zero	146	8.18, .58	4.77, .27	.52, .03
0 - - 10	13	8.69, 1.25	4.54, .55	.35, .05
11 - - 20	16	9.31, 1.72	5.00, .91	.49, .05
21 - - 50	28	16.89, 1.95	7.79, .80	.46, .08
>50	19	12.11, 1.93	6.47, .87	.43, .07
Missing	7	17.43, 7.35	7.43, 2.64	.80, .28
NUMBER OF CHILDREN:				
Age 6 and 7				
1	39	17.56, 2.47	7.64, .74	.43, .05
2	85	15.81, 1.73	6.67, .56	.41, .03
3	65	20.48, 2.08	8.02, .59	.43, .04
4	23	12.87, 2.47	5.74, .89	.44, .06
5 or 6	15	28.27, 4.32	9.73, 1.22	.35, .08
7, 8 or 9	7	18.86, 5.54	7.43, 2.21	.47, .18
10 or more	1	4.00, 0.00	4.00, 0.00	.41, 0.00
Missing	9	19.00, 5.70	7.33, 2.01	.32, .08
Age 13 and 14				
1	7	10.43, 2.29	5.71, 1.02	.45, .08
2	40	8.05, 1.02	4.40, .50	.42, .06
3	59	10.31, 1.21	5.59, .51	.46, .04
4	33	12.61, 1.80	6.88, .82	.73, .08
5 or 6	44	10.25, 1.25	5.27, .51	.47, .06
7, 8 or 9	26	10.00, 1.94	5.04, .73	.43, .08
10 or more	19	8.00, 1.36	4.89, .61	.64, .10
Missing	1	0.00, 0.00	0.00, 0.00	.08, 0.00

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
NUMBER OF OLDER BROTHERS:				
Age 6 and 7				
0	138	17.26, 1.37	7.28, .42	.43, .03
1	57	18.28, 2.27	7.21, .67	.48, .04
2	17	20.06, 3.10	8.24, 1.09	.42, .08
3 or more	11	17.18, 4.49	6.45, 1.49	.28, .09
Missing	21	20.62, 3.61	7.62, 1.07	.22, .05
Age 13 and 14				
0	101	9.11, .74	5.16, .36	.46, .04
1	54	9.76, 1.07	5.19, .45	.56, .05
2	28	10.89, 1.76	5.64, .75	.48, .07
3 or more	44	10.82, 1.37	5.66, .53	.56, .07
Missing	2	27.00, 27.00	10.50, 10.50	.54, .46
NUMBER OF YOUNGER BROTHERS:				
Age 6 and 7				
0	172	17.70, 1.19	7.40, .37	.44, .02
1	47	19.66, 2.70	7.51, .78	.42, .05
2	6	12.33, 5.79	3.67, 1.61	.24, .05
Missing	19	18.11, 2.15	7.26, 1.04	.24, .05
Age 13 and 14				
0	129	10.36, .72	5.47, .30	.52, .03
1	74	9.09, .94	5.01, .43	.45, .04
2	19	9.21, 2.15	5.31, 1.03	.57, .12
3 or more	5	8.80, 1.93	6.00, 1.38	.55, .21
Missing	2	27.00, 27.00	10.50, 10.50	.54, .46
NUMBER OF OLDER SISTERS:				
Age 6 and 7				
0	137	16.78, 1.39	6.98, .43	.40, .02
1	62	19.40, 2.00	7.82, .60	.46, .05
2	19	18.79, 3.90	7.05, 1.20	.41, .06
3 or more	8	24.75, 4.00	10.00, 1.34	.55, .15
Missing	18	18.33, 3.79	7.28, 1.18	.26, .05
Age 13 and 14				
0	100	9.69, .82	5.46, .39	.48, .04
1	65	11.09, 1.15	5.48, .45	.51, .05
2	30	7.93, .90	4.77, .49	.59, .07
3 or more	32	9.38, 1.32	5.09, .58	.48, .07
Missing	2	27.00, 27.00	10.50, 10.50	.54, .46

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
NUMBER OF YOUNGER SISTERS:				
Age 6 and 7				
0	159	18.31, 1.22	7.58, .38	.47, .03
1	55	15.93, 2.37	6.44, .70	.35, .04
2	7	16.00, 7.01	6.71, 2.31	.27 .13
3 or more	2	47.00, 9.00	12.00, 0.00	.37, .37
Missing	21	18.76, 3.18	7.43, 1.03	.23, .05
Age 13 and 14				
0	120	9.63, .67	5.34, .32	.51, .03
1	81	10.21, 1.00	5.23, .41	.49, .05
2	22	10.14, 1.98	5.68, .79	.52, .08
3 or more	4	5.75, 1.55	4.50, 1.32	.37, .20
Missing	2	27.00, 27.00	10.50, 10.50	.54, .46
RELATIONSHIP TO CHILD:				
Age 6 and 7				
Father	43	16.84, 2.36	7.07, .74	.43, .05
Mother	188	17.70, 1.15	7.21, .36	.40, .02
Foster parent	6	31.83, 9.32	11.33, 2.01	.53, .15
Missing	7	20.71, 7.27	8.29, 2.34	.48, .22
Age 13 and 14				
Father	55	8.67, .89	4.60, .37	.57, .05
Mother	166	9.91, .65	5.44, .29	.47, .03
Foster parent	7	15.14, 4.26	7.43, 1.56	.79, .22
Missing	1	54.00 0.00	21.00, 0.00	1.00, 0.00
SWEET SNACKS BREAK-LUNCH:				
Age 6 and 7				
Yes	89	20.37, 1.73	7.89, .50	.48, .03
No	110	15.96, 1.42	6.87, .46	.37, .03
Missing	45	18.18, 2.65	7.29, .83	.39, .04
Age 13 and 14				
Yes	68	9.91, 1.19	5.29, .50	.51, .05
No	149	10.03, .66	5.43, .29	.51, .03
Missing	12	9.42, 2.44	5.00, 1.26	.41, .10
SWEET SNACKS LUNCH-EVE:				
Age 6 and 7				
Yes	119	18.23, 1.56	7.40, .47	.41, .03
No	82	17.52, 1.72	7.07, .51	.43, .04
Missing	43	18.16, 2.20	7.56, .75	.41, .05
Age 13 and 14				
Yes	127	10.49, .77	5.65 .33	.50, .04
No	91	8.77, .73	4.84, .34	.51, .04
Missing	11	13.82, 4.82	6.45, 2.00	.56, .11

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
SWEET SNACKS AFTER-EVE:				
Age 6 and 7				
Yes	97	18.56, 1.67	7.33, .46	.43, .03
No	94	16.28, 1.58	6.97, .53	.39, .03
Missing	53	19.94, 2.26	7.92, .72	.43, .04
Age 13 and 14				
Yes	135	9.76, .72	5.34, .31	.52, .03
No	88	10.14, .83	5.41, .38	.48, .04
Missing	6	12.17, 8.48	5.33, 3.23	.41, .14
SWEET SNACKS BEFORE-BED:				
Age 6 and 7				
Yes	54	20.33, 2.37	8.11, .64	.45, .05
No	125	17.16, 1.37	7.04, .45	.38, .03
Missing	65	17.60, 2.01	7.20, .62	.44, .04
Age 13 and 14				
Yes	55	8.38, 1.04	4.80, .42	.51, .05
No	158	10.50, .67	5.61, .30	.50, .03
Missing	16	10.13, 3.18	4.94, 1.27	.51, .09
SWEET SNACKS OTHER-TIMES:				
Age 6 and 7				
Yes	62	23.47, 2.35	8.92, .62	.42, .04
No	105	14.54, 1.38	6.38, .47	.38, .03
Missing	77	18.25, 1.74	7.31, .56	.45, .03
Age 13 and 14				
Yes	100	9.95, .77	5.67, .38	.55, .04
No	113	9.67, .77	5.02, .31	.47, .04
Missing	16	12.13, 3.70	5.94, 1.50	.44, .08
SWEET DRINKS BREAK-LUNCH:				
Age 6 and 7				
Yes	71	19.87, 2.14	7.73, .60	.44, .04
No	122	16.60, 1.32	6.96, .43	.40, .03
Missing	51	18.65, 2.28	7.61, .73	.41, .04
Age 13 and 14				
Yes	73	10.12, .85	5.48, .40	.54, .04
No	148	10.14, .77	5.43, .32	.50, .03
Missing	8	5.25, 1.39	3.25, .73	.30, .13

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
SWEET DRINKS LUNCH-EVE:				
Age 6 and 7				
Yes	118	19.75, 1.57	7.66, .45	.44, .03
No	83	13.89, 1.56	6.13, .51	.36, .03
Missing	43	21.02, 2.33	8.67, .78	.45, .05
Age 13 and 14				
Yes	127	10.75, .72	5.68, .31	.52, .04
No	96	8.15, .78	4.70, .37	.46, .03
Missing	6	22.50, 7.54	9.50, 2.72	.93, .25
SWEET DRINKS AFTER-EVE:				
Age 6 and 7				
Yes	107	21.19, 1.57	8.24, .44	.46, .03
No	85	14.32, 1.71	6.16, .56	.34, .03
Missing	52	17.37, 2.07	7.31, .70	.43, .04
Age 13 and 14				
Yes	127	9.97, .80	5.48, .34	.51, .03
No	95	9.83, .71	5.23, .33	.50, .04
Missing	7	11.71, 7.12	5.14, 2.70	.37, .13
SWEET DRINKS BEFORE-BED:				
Age 6 and 7				
Yes	75	20.44, 2.03	7.85, .55	.47, .04
No	106	15.38, 1.44	6.54, .48	.33, .03
Missing	63	19.43, 1.95	8.00, .63	.48, .04
Age 13 and 14				
Yes	70	9.64, 1.06	5.26, .48	.49, .05
No	148	9.85, .65	5.32, .28	.51, .03
Missing	11	13.55, 4.34	6.64, 1.63	.50, .12
SWEET DRINKS OTHER-TIMES:				
Age 6 and 7				
Yes	61	23.84, 2.27	8.85, .62	.46, .04
No	106	15.25, 1.48	6.61, .48	.38, .03
Missing	77	17.09, 1.66	7.08, .54	.43, .03
Age 13 and 14				
Yes	88	9.65, .84	5.32, .38	.52, .04
No	128	10.01, .75	5.36, .32	.50, .03
Missing	13	11.69, 3.86	5.77, 1.51	.40, .10

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
OTHER SNACKS BREAK-LUNCH:				
Age 6 and 7				
Yes	71	16.38, 1.85	6.87, .58	.41, .04
No	120	18.83, 1.52	7.48, .45	.42, .03
Missing	53	18.19, 2.07	7.54, .70	.40, .04
Age 13 and 14				
Yes	62	10.10, 1.24	5.53, .55	.48, .05
No	157	10.02, .66	5.37, .28	.52, 03
Missing	10	8.30, 1.67	4.30, .79	.42, .11
OTHER SNACKS LUNCH-EVE:				
Age 6 and 7				
Yes	75	17.60, 1.84	7.17, .58	.41, .04
No	107	17.11, 1.49	6.99, .46	.42, .03
Missing	62	19.94, 2.18	8.06, .65	.41, .04
Age 13 and 14				
Yes	93	10.24, .86	5.39, .39	.48, .04
No	127	9.54, .72	5.28, .31	.52, .04
Missing	9	13.22, 5.40	6.44, 2.00	.53, .13
OTHER SNACKS AFTER-EVE:				
Age 6 and 7				
Yes	82	20.01, 1.76	8.37, .52	.48, .04
No	102	17.10, 1.65	6.68, .51	.39, .03
Missing	60	16.70, 1.93	6.98, .60	.37, .03
Age 13 and 14				
Yes	97	9.76, .84	5.49, .37	.50, .04
No	120	9.86, .73	5.16, .32	.51, .03
Missing	12	12.67, 4.39	6.42, 1.76	.45, .10
OTHER SNACKS BEFORE-BED:				
Age 6 and 7				
Yes	63	19.14, 2.10	7.63, .57	.45, .04
No	120	17.99, 1.51	7.19, .47	.40, .03
Missing	61	16.75 1.85	7.25, .63	.41, .04
Age 13 and 14				
Yes	67	10.48, 1.00	5.63, .48	.52, .05
No	150	9.53, .66	5.17, .28	.50, .03
Missing	12	12.58, 4.35	6.42, 1.72	.43, .09

VARIABLE	N	DMFS, SE		DMFT, SE		PI, SE	
OTHER SNACKS OTHER-TIMES:							
Age 6 and 7							
Yes	46	20.48,	2.60	8.20,	.75	.47,	.06
No	118	16.41,	1.45	6.75,	.45	.38,	.03
Missing	80	18.86,	1.73	7.66,	.54	.42,	.04
Age 13 and 14							
Yes	80	9.38,	.80	5.29,	.40	.55,	.04
No	135	10.25,	.77	5.38,	.32	.49,	.03
Missing	14	10.57	3.44	5.71,	1.27	.43,	.09
OWNS TOOTHBRUSH:							
Age 6 and 7							
Yes	225	17.33,	1.03	7.22,	.32	.43,	.02
No	10	26.20,	6.40	8.40,	1.59	.21,	.08
Missing	9	25.11,	7.60	8.56	2.21	.28,	.08
Age 13 and 14							
Yes	221	10.00,	.58	5.39,	.25	.50,	.03
No	8	9.13,	2.77	4.63,	.84	.56,	.17
BRUSHES TEETH:							
Age 6 and 7							
Yes	225	17.24,	1.02	7.24,	.32	.43,	.02
No	10	28.10,	6.62	8.10,	1.59	.13,	.06
Missing	9	25.11,	7.60	8.56,	2.21	.28,	.08
Age 13 and 14							
Yes	218	9.72,	.55	5.30,	.24	.50,	.03
No	11	14.91,	4.53	6.73,	1.68	.67,	.12
NUMBER OF TIMES BRUSHES TEETH:							
Age 6 and 7							
3 or more times	44	15.14,	2.62	6.30,	.89	.38,	.05
Twice a day	65	17.35,	1.98	7.03,	.57	.40,	.04
Once a day	70	17.04,	1.61	7.13,	.51	.46,	.04
3-6 Times a week	27	16.93,	2.68	8.22,	.91	.53,	.06
1-2 Times a week	16	21.38,	4.34	8.25,	1.3[illegible]	.40,	.07
< Once a week	6	38.00,	4.55	11.00,	.58	.21,	.12
Missing	16	23.31,	5.29	8.31,	1.56	.24,	.06
Age 13 and 14							
3 or more times	58	10.88,	.97	5.95,	.50	.44,	.04
Twice a day	88	9.55,	.89	5.26,	.39	.43,	.03
Once a day	35	7.86,	1.47	4.31,	.53	.54,	.08
3-6 Times a week	17	9.06,	1.74	4.88,	.84	.48,	.08
1-2 Times a week	15	10.27,	2.43	5.60,	.97	.83,	.14
< Once a week	7	11.86,	2.41	5.43,	.78	.90,	.12
Missing	9	16.11,	5.49	7.22,	2.00	.70,	.15

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
BRUSHED TEETH YESTERDAY:				
Age 6 and 7				
Yes	187	17.08, 1.14	7.06, .36	.42, .02
No	44	20.84, 2.43	8.32, .67	.42, .05
Missing	13	21.23, 5.79	7.62, 1.72	.28, .08
Age 13 and 14				
Yes	178	9.54, .61	5.24, .28	.44, .03
No	49	11.04, 1.38	5.69, .55	.72, .06
Missing	2	21.50, 12.50	8.50, 3.50	1.10, .90
NUMBER OF TIMES BRUSHED YESTERDAY:				
Age 6 and 7				
One	83	18.02, 1.60	7.48, .50	.45, .03
Two	63	17.86, 2.17	7.19, .62	.41, .04
Three	34	13.09, 2.68	5.47, .96	.37, .05
Four	5	16.20, 6.06	7.80, 2.65	.41 .15
Missing	59	21.02, 2.19	8.25, .63	.39, .04
Age 13 and 14				
One	47	6.87, 1.08	4.00, .42	.50, .05
Two	71	10.15, 1.03	5.56, .48	.41, .04
Three	48	11.00, 1.06	5.90, .51	.42, .04
Four	9	8.56, 2.12	4.78, 1.09	.39, .11
Five	2	22.50, 10.50	10.00, 4.00	.71, .45
Missing	52	11.31, 1.38	5.77, .53	.73, .06
BRUSHED YESTERDAY BEFORE BREAKFAST:				
Age 6 and 7				
No	229	17.90, 1.06	7.28, .33	.42, .02
Yes	15	19.27, 4.37	8.00, 1.36	.37, .08
Age 13 and 14				
No	206	10.02, .60	5.40, .26	.52, .03
Yes	23	9.43, 1.74	5.09, .79	.32, .07
BRUSHED YESTERDAY AFTER BREAKFAST:				
Age 6 and 7				
No	118	20.31, 1.49	8.18, .44	.41, .03
Yes	126	15.80, 1.39	6.52, .44	.41, .03
Age 13 and 14				
No	91	9.71, .94	5.19, .38	.60, .04
Yes	138	10.13, .71	5.49, .32	.44, .03

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
BRUSHED YESTERDAY BEFORE EVE:				
Age 6 and 7				
No	220	18.54, 1.07	7.56, .33	.42, .02
Yes	24	12.88, 3.38	5.08, .90	.33, .06
Age 13 and 14				
No	214	9.84, .59	5.29, .25	.52, .03
Yes	15	11.73, 2.31	6.53, 1.04	.40, .09
BRUSHED YESTERDAY AFTER EVE:				
Age 6 and 7				
No	189	18.10, 1.15	7.31, .34	.40, .02
Yes	55	17.58, 2.27	7.35, .78	.47, .05
Age 13 and 14				
No	128	9.11, .76	4.88, .31	.56, .04
Yes	101	11.05, .85	5.98, .39	.43, .03
BRUSHED YESTERDAY BEFORE BED:				
Age 6 and 7				
No	136	19.35, 1.44	7.72, .42	.44, .03
Yes	108	16.26, 1.44	6.81, .47	.38, .03
Age 13 and 14				
No	131	10.10, .82	5.51, .34	.58, .04
Yes	98	9.79, .76	5.17, .36	.40, .03
KNOW BRAND OF TOOTHPASTE:				
Age 6 and 7				
Yes	221	17.34, 1.05	7.15, .33	.42, .02
No	10	26.90, 6.23	9.60, 1.62	.37, .10
Missing	13	21.92, 4.90	8.38, 1.72	.32, .09
Age 13 and 14				
Yes	188	9.96, .61	5.40, .27	.47, .03
No	39	10.44, 1.56	5.41, .63	.67, .07
Missing	2	1.50, 1.50	1.00, 1.00	.41, .05
BRAND:				
Age 6 and 7				
Brand 1	36	13.86, 1.98	5.50, .67	.30, .05
Brand 2	150	19.51, 1.38	7.91, .41	.46, .03
Other brands	23	8.35, 1.76	4.52, .75	.37, .06
Missing	35	21.97, 2.85	8.49, .87	.35, .05
Age 13 and 14				
Brand 1	29	8.62, 1.47	4.55, .69	.32, .05
Brand 2	124	10.67, .60	5.81, .34	.53, .03
Other brands	28	7.14, 1.16	4.00, .49	.26, .03
Missing	48	10.60, 1.41	5.52, .57	.69, .06

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
TOOTHPASTE CONTAINS FLUORIDE:				
Age 6 and 7				
Yes	206	17.55, 1.10	7.21, .34	.41, .02
Don't know	7	11.00, 4.90	4.57, 1.81	.33, .15
Missing	31	22.39, 3.09	8.68, .96	.43, .07
Age 13 and 14				
Yes	88	9.97, .86	5.45, .41	.49, .04
No	2	2.00, 2.00	2.00, 2.00	.42, .34
Don't know	97	9.75, .83	5.29, .35	.44, .04
Missing	42	10.83, 1.64	5.52, .62	.67, .06
KNOW OTHER BRANDS:				
Age 6 and 7				
Yes	177	16.38, 1.12	6.76, .36	.39, .02
No	43	21.40, 2.67	8.77, .74	.49, .05
Missing	24	23.63, 4.03	8.88, 1.12	.45, .08
Age 13 and 14				
Yes	150	10.24, .64	5.53, .29	.44, .03
No	74	9.69, 1.17	5.12, .47	.63, .05
Missing	5	5.80, 2.27	4.20, 1.66	.54, .16
CREST:				
Age 6 and 7				
No	130	19.29, 1.47	7.67, .45	.42, .03
Yes	114	16.48, 1.41	6.92, .44	.41, .03
Age 13 and 14				
No	168	10.13, .70	5.39, .30	.52, .03
Yes	61	9.52, .90	5.30, .39	.47, .04
COLGATE:				
Age 6 and 7				
No	187	19.46, 1.23	7.86, .37	.44, .02
Yes	57	13.12, 1.54	5.56, .54	.33, .04
Age 13 and 14				
No	169	10.25, .68	5.59, .29	.53, .03
Yes	60	9.17, 1.00	4.73, .44	.44, .05
CLOSE-UP:				
Age 6 and 7				
No	172	18.84, 1.29	7.55, .38	.41, .03
Yes	72	15.92, 1.61	6.76, .55	.42, .03
Age 13 and 14				
No	174	9.84, .68	5.22, .29	.55, .03
Yes	55	10.36, .99	5.82, .46	.36, .03

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
AIM:				
Age 6 and 7				
No	230	17.90, 1.05	7.33, .32	.42, .02
Yes	14	19.21, 5.02	7.07, 1.43	.37, .08
Age 13 and 14				
No	224	9.96, .58	5.34, .25	.51, .03
Yes	5	10.40, 2.23	6.40, 1.17	.27, .08
ULTRABRITE:				
Age 6 and 7				
No	198	18.31, 1.14	7.40, .35	.42, .02
Yes	46	16.57, 2.38	6.98, .76	.40, .05
Age 13 and 14				
No	222	10.12, .58	5.45, .25	.51, .03
Yes	7	5.00, 2.25	2.86, .99	.43, .11
AQUAFRESH:				
Age 6 and 7				
No	188	18.58, 1.19	7.48, .35	.41, .02
Yes	56	15.96, 1.98	6.77, .69	.42, .04
Age 13 and 14				
No	159	9.94, .70	5.30, .29	.54, .03
Yes	70	10.03, .96	5.53, .46	.42, .03
PEPSODENT:				
Age 6 and 7				
No	231	18.06, 1.04	7.36, .32	.42, .02
Yes	13	16.54, 5.58	6.62, 1.70	.31, .08
Age 13 and 14				
No	227	9.97, .57	5.36, .24	.50, .03
Yes	2	9.00, 9.00	6.00, 6.00	.44, .35
TWICE-BRIGHT:				
Age 6 and 7				
No	239	17.86, 1.02	7.32, .32	.42, .02
Yes	5	23.60, 12.02	7.20, 2.71	.15, .06
Age 13 and 14				
No	228	9.92, .57	5.35, .25	.50, .03
Yes	1	20.00, 0.00	7.00, 0.00	.70, 0.00

VARIABLE	N	DMFS, SE		DMFT, SE		PI, SE	
MACLEANS:							
Age 6 and 7							
No	240	18.21,	1.03	7.40,	.32	.42,	.02
Yes	4	4.00,	4.00	2.25,	2.25	.06,	.04
Age 13 to 14							
No	229	9.97,	.57	5.37,	.25	.50,	.03
USES DENTAL FLOSS:							
Age 6 and 7							
Yes	24	11.33,	2.85	4.92,	1.00	.33,	.08
No	193	17.29,	1.07	7.25,	.34	.44,	.02
Don't know what floss	14	35.86,	5.54	11.14,	1.35	.29,	.09
Missing	13	21.23,	4.89	8.62,	1.51	.29,	.07
Age 13 and 14							
Yes	42	8.98,	.95	5.19,	.52	.39,	.04
No	180	10.10,	.67	5.37,	.28	.53,	.03
Don't know what floss	5	13.40,	4.49	7.20,	2.13	.60,	.15
Missing	2	10.00,	9.00	4.50,	3.50	.67,	.04
NUMBER OF TIMES USE FLOSS:							
Age 6 and 7							
Daily	2	3.50,	2.50	2.00,	1.00	.05,	.05
Few times a week	8	15.00,	7.45	5.63,	2.30	.60,	.20
Once a week	3	17.33,	3.84	7.00,	2.08	.11,	.01
<Once a week	218	18.04,	1.08	7.36,	.33	.42,	.02
Missing	13	21.23,	4.89	8.62,	1.51	.29,	.07
Age 13 and 14							
Daily	15	9.07,	1.57	5.13,	.82	.39,	.05
Few times a week	22	7.95,	1.33	4.59,	.67	.38,	.07
Once a week	2	9.50,	2.50	4.00,	0.00	.38,	.06
< Once a week	188	10.28,	.66	5.50,	.28	.53,	.03
Missing	2	10.00,	.93	4.50,	3.50	.67,	.04
ETHNIC GROUP:							
Age 6 and 7							
Settler	201	17.51,	1.09	7.34,	.35	.47,	.02
Indian	22	12.09,	2.49	5.64,	.73	.18,	.03
Inuit	21	28.62,	4.49	8.86,	1.26	.10,	.03
Age 13 and 14							
Settler	185	10.64,	.65	5.61,	.28	.51,	.03
Indian	28	6.75,	.96	4.39,	.54	.54,	.08
Inuit	16	7.81,	2.17	4.25,	1.03	.32,	.10

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
HEALTH UNIT:				
Age 6 and 7				
Central Health	7	8.29, 2.66	5.29, 1.54	.22, .05
Western Health	80	16.99, 1.69	7.46, .58	.43, .04
Northern Health	157	18.92, 1.33	7.34, .39	.41, .03
Age 13 and 14				
Central Health	38	8.74, 1.61	5.24, .68	.61, .07
Western Health	72	12.13, .97	6.26, .45	.55, .04
Northern Health	119	9.05, .75	4.87, .31	.45, .03
DISTRICT 1:				
Age 6 and 7				
N. Peninsula	135	16.96, 1.36	7.08, .42	.49, .03
N. Labrador	46	20.13, 2.78	7.30, .73	.14, .02
S. Labrador	17	20.35, 4.09	7.47, 1.35	.45, .07
Fogo/Burgeo	30	21.67, 2.33	9.50, .88	.55, .06
St. Anthony	8	7.88, 3.51	5.00, 1.56	.32, .07
North West River	8	14.00, 4.32	5.25, 1.29	.14, .05
Age 13 and 14				
N. Peninsula	110	10.35, .79	5.59, .34	.48, .03
N. Labrador	43	7.88, 1.02	4.70, .52	.48, .07
S. Labrador	19	9.00, 2.30	4.00, .73	.49, .10
Fogo/Burgeo	41	12.71, 1.65	6.46, .70	.65, .06
St. Anthony	7	9.71, 2.77	5.57, 1.46	.40, .10
North West River	9	5.00, 1.42	3.56, .80	.35, .13
LANGUAGE 1:				
Age 6 and 7				
Inuktituk	18	29.56, 4.92	9.11, 1.36	.08, .03
Montagnais	15	13.87, 3.40	5.80, .83	.17, .04
English	211	17.28, 1.06	7.27, .34	.46, .02
Age 13 and 14				
Inuktituk	13	9.15, 2.53	4.77, 1.21	.33, .11
Montagnais	6	7.50, 2.55	3.33, .84	.57, .22
English	210	10.09, .60	5.46, .26	.51, .03

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
PARENTAL EDUCATION:				
Age 6 and 7				
Neither Sec	68	23.25, 2.04	9.19, .63	.48, .04
One Sec	53	20.09, 2.29	7.91, 1.08	.49, .04
Both Sec	27	12.93, 1.81	6.19, .83	.46, .05
One Post Sec	42	11.00, 1.67	5.17, .34	.30, .04
Both Post Sec	19	5.89, 2.14	3.32, .54	.25, .06
Missing	35	23.37, 3.13	8.43, .51	.37, .06
Age 13 and 14				
Neither Sec	108	10.05, .82	5.42, .34	.55, .04
One Sec	44	10.11, 1.33	5.20, .54	.51, .06
Both Sec	19	9.05, 1.02	5.16, .51	.54, .08
One Post Sec	28	9.86, 1.42	5.46, .76	.40, .05
Both Post Sec	9	6.56, 1.60	4.33, .93	.42, .11
Missing	21	11.67, 2.90	5.95, 1.21	.37, .09
SES:				
Age 6 and7				
1.	66	21.10, 1.82	8.30, .56	.53, .04
2.	49	19.53, 2.41	7.96, .74	.49, .04
3.	38	16.97, 2.36	7.08, .70	.38, .05
4.	15	18.80, 2.97	7.80, 1.20	.39, .09
5.	11	17.09, 6.36	6.45, 1.71	.24, .09
6.	31	7.52, 1.79	4.00, .75	.24, .04
7.	4	3.00, 2.68	2.00, 1.68	.22, .08
Missing	30	22.57, 3.64	8.63, .97	.35, .07
Age 13 and 14				
1.	63	8.54, .98	4.76, .40	.56, .05
2.	57	10.89, 1.07	5.89, .48	.53, .05
3.	26	8.69, 1.29	4.58, .70	.43, .06
4.	22	10.86, 2.32	5.77, .92	.43, .07
5.	11	9.00, 1.34	5.18, .66	.52, .16
6.	17	10.65, 1.99	5.71, .98	.36, .06
7.	2	6.00, 4.00	4.50, 2.50	.18, 0.00
Missing	31	11.81, 2.11	5.94, .86	.56, .08

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
PREVENTION:				
Age 6 and 7				
No reg. prev. checkup in last 12 months	144	20.69, 1.36	8.21, .40	.48, .03
Regular prev. or work identified in last 12 months	83	12.59, 1.53	5.78, .53	.31, .03
Missing	17	21.35, 4.21	7.29, 1.15	.32, .05
Age 13 and 14				
No reg. prev. checkup in last 12 months	156	9.48, .67	5.12, .28	.52, .03
Regular prev. or work identified in last 12 months	58	11.33, 1.16	6.16, .56	.44, .05
Missing	15	9.73, 2.51	4.93, .78	.53, .10
SWEET SNACKS:				
Age 6 and 7				
Less than 2	72	14.88, 1.73	6.35, .57	.36, .04
2 or more	82	19.39, 1.87	7.78, .54	.41, .03
Missing	90	19.18, 1.68	7.68, .52	.45, .03
Age 13 and 14				
Less than 2	60	8.10, .80	4.42, .35	.45, .04
2 or more	146	10.51, .71	5.69, .31	.53, .03
Missing	23	11.39, 2.64	5.78, 1.09	.46, .07
SWEET DRINKS:				
Age 6 and 7				
Less than 2	68	12.69, 1.68	5.76, .59	.32, .03
2 or more	86	21.85, 1.90	8.38, .52	.45, .04
Missing	90	18.28, 1.58	7.48, .51	.45, .03
Age 13 and 14				
Less than 2	72	8.79, .87	4.78, .40	.47, .05
2 or more	137	10.31, .72	5.63, .31	.52, .03
Missing	20	11.85, 2.90	5.70, 1.14	.50, .11
NUMBER OF TIMES BRUSH TEETH:				
Age 6 and 7				
2 times a day	119	18.66, 1.35	7.72, .41	.45, .03
or more times	109	16.46, 1.58	6.73, .49	.39, .03
Missing	16	23.31, 5.29	8.31, 1.56	.24, .06
Age 13 and 14				
2 times a day	74	9.00, .96	4.81, .38	.62, .05
or more times	146	10.07, .66	5.53, .31	.43, .03
Missing	9	16.11, 5.49	7.22, 2.00	.70, .15

VARIABLE	N	DMFS, SE	DMFT, SE	PI, SE
NAME OTHER BRANDS:				
Age 6 and 7				
1	36	13.86, 1.98	5.50, .67	.30, .05
2	150	19.51, 1.38	7.91, .41	.46, .03
More than 2	23	8.35, 1.76	4.52, .75	.37, .06
Missing	35	21.97, 2.85	8.49, .87	.35, .05
Age 13 and 14				
1	29	8.62, 1.47	4.55, .69	.32, .05
2	124	10.67, .78	5.81, .34	.53, .03
More than 2	28	7.14, 1.16	4.00, .49	.26, .03
Missing	48	10.60, 1.41	5.52, .57	.69, .06
NUMBER TIMES BRUSHED YESTERDAY:				
Age 6 and 7				
1	83	18.02, 1.60	7.48, .50	.45, .03
2	63	17.86, 2.17	7.19, .62	.41, .04
3 or more	39	13.49, 2.44	5.77, .90	.37, .05
Missing	59	21.02, 2.19	8.25, .63	.39, .04
Age 13 and 14				
1	47	6.87, 1.08	4.00, .42	.50, .05
2	71	10.15, 1.03	5.56, .48	.41, .04
3 or more	59	11.02, 1.00	5.86, .47	.42, .04
Missing	52	11.31, 1.38	5.77, .53	.73, .06
YEARS SPENT IN FLUORIDATED AREA:				
Ages 6 and 7				
Under 1 year	216	17.63, 1.07	7.23, .33	.42, .02
1 year or more	8	13.63, 5.79	5.75, 1.50	.20, .08
Missing	20	23.45, 4.13	8.90, 1.20	.41, .07
Age 13 and 14				
Under a year	195	9.80, .63	5.31, .27	.50, .03
1 year or more	17	8.35, 1.33	4.18, .52	.31, .06
Missing	17	13.47, 2.04	7.24, .95	.75, .10