SUBJECTIVE ORAL HEALTH INDICATORS FOR ORAL HEALTH SURVEYS OF ADULTS

David Locker and Yasmin Miller

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SUMMARY

This report describes the development and evaluation of a battery of subjective oral health status indicators for use in adult oral health surveys. These measure the functional, social and psychological consequences of oral disorders and the extent to which oral conditions compromise the quality of life. As such, they are intended to facilitate the comprehensive assessment of oral health, to contribute to the identification of target populations with high levels of need and to promote the rational allocation of oral health care resources.

The measures were developed over a series of studies of older adults undertaken by the Department of Community Dentistry at the University of Toronto between 1985 and 1993. They are based on a model of disease and its outcomes derived from the International Classification of Impairments, Disabilities and Handicaps. This model identifies impairments, functional limitations, pain and discomfort, disabilities and handicaps as distinct dimensions of health.

An initial set of measures reflecting these concepts were tested and refined during a longitudinal oral health survey of older adults beginning in 1989. These addressed chewing capacity, ability to speak, pain and other oral symptoms and the social and psychological impact of oral disorders. This impact was assessed by means of four scales concerning eating, communication/social relations, activities of daily living and worry and concern.

Subsequently, the **Subjective Oral Health Status Indicators Study** was undertaken to assess the performance of the measures when used on a population of

adults aged 18 years and over. Generalizability, efficiency, test-retest and internal consistency reliability, and concurrent and construct validity were evaluated using data collected by means of a mail survey of 552 subjects. The measures proved to be sensitive to the oral health concerns of younger and older adults and reliability and validity statistics were good.

Generally low correlations with a proxy clinical indicator, self-reported number of teeth, suggested that these measures address distinct dimensions of oral health and should be used routinely alongside, and perhaps instead of, traditional clinical indicators of oral health.

INTRODUCTION

Although dentistry was initially slow in responding to changing concepts of health and methodological advances in the measurement of health status, systematic effort is now being invested in developing indicators which go beyond conventional disease-based measures of oral health to address the functional, social and psychological consequences of oral disorders (1). The unidimensional approach implied by the traditional medical model is giving way to a multidimensional perspective in which an individual's functional, social and psychological well-being is considered along with pathological processes and their biological consequences in terms of damage to body tissues or disturbances in physiological functions. Since they are concerned with an individual's experience and behaviour with respect to oral disorders and the way in which oral conditions compromise an individual's quality of life, these new measures are referred to as subjective oral health status indicators.

Two types of subjective indicator are to be found in the literature. The first measures oral health outcomes at the societal level and the second measures these outcomes at the individual level. An example of the former is to be found in the work of Reisine and colleagues (2,3) who assessed the impact of oral disorders in terms of changes in role functioning and loss of time from work. While such loss is small at the level of the individual, the accumulated burden of work loss days due to oral conditions and their treatment is considerable at the level of the population and has significant economic ramifications.

Examples of the second type are to be found in the work of Cushing et al (4),

Rosenberg et al (5), Strauss and Hunt (6), Atchison and Dolan (7) and Slade and Spencer (8). Atchison and Dolan developed the Geriatric Oral Health Assessment Index (GOHAI) and Slade and Spencer the Oral Health Impact Profile (OHIP). These measures are more comprehensive and attempt to assess how oral disorders impact on the quality of life of an individual. Preliminary work on these indicators has demonstrated that they are reliable and valid and likely to prove useful in the particular contexts for which they were designed. The GOHAI is intended to be a screening instrument which will identify older adults who need to be referred for a comprehensive oral examination, while the OHIP is appropriate for use in clinical trials.

This report describes a set of subjective oral health indicators developed for use in large scale oral health surveys of adult populations. Also described are the results of a study designed to evaluate the performance of these indicators. This work is part of a broader program of research which aims to produce a set of measures which will facilitate the comprehensive assessment of the oral health status of adult populations, identify target groups with high levels of need, promote the rational allocation of oral health care resources and contribute to the evaluation of oral health care services.

DEVELOPMENT OF SUBJECTIVE ORAL HEALTH INDICATORS

The subjective oral health indicators described in this report were developed in a series of studies of the oral health of older adult populations carried out by the Department of Community Dentistry, University of Toronto between 1985 and 1993.

They were based on a generic model of disease and its consequences derived from the World Health Organization's International Classification of Impairments, Disabilities and Handicaps (ICIDH)(9). The application of this model to oral health has been described previously by Locker (10). This model consists of the following key concepts: impairment, functional limitation, pain and discomfort, disability and handicap.

IMPAIRMENT

Impairment refers to the immediate biophysical outcomes of disease in the form of loss of body parts, structural abnormalities or disturbances in physiological processes. It is represented by conventional disease-based indicators of oral health such as the DMFT Index, which attempts to measure caries experience, and the Extent and Severity Index (11), which measures loss of periodontal attachment.

The measures we developed were designed to reflect the remaining functional and behavioural concepts comprising the model. They were intended to be simple and easy to complete to facilitate their use in mail and other self-complete surveys of disadvantaged and minority populations.

FUNCTIONAL LIMITATIONS

Functional limitations refer to limitations in the functions performed by body parts or systems. In the case of the oral cavity this means the ability to chew and the ability to produce intelligible speech. These are measured by means of a six-item index of chewing capacity and a three-item index of problems speaking. The former

was derived from earlier work by Leake (12) and is based on an individual's reported ability to chew or bite six indicator foods varying in texture and consistency. Subjects are classified as having a limitation in chewing capacity if they are unable to chew or bite at least one of these foods. The items comprising the measure of speech assessed difficulties pronouncing words, speaking clearly or being understood by others. The items involved in these measures are given in Table 1.

PAIN AND DISCOMFORT

Pain and discomfort are assessed by means of a nine-item oral and facial pain inventory, with items chosen to reflect disorders affecting the teeth and other oral structures, and a ten-item oral symptoms inventory. Subjects are asked to indicate whether or not they had experienced these pain or other oral symptoms in the previous four weeks. The items comprising the pain and oral symptoms inventories are given in Table 2.

DISABILITY AND HANDICAP

Disability refers to any difficulty performing activities of daily living and handicap to the broader social disadvantage and deprivation that occurs as a result of impairment, functional limitation or disability. They were assessed by means of four unweighted scales describing the social and psychological impact of oral disorders. These consist of a three-item scale of problems with eating, a four-item scale concerned with problems in communication/social relations, a six-item measure

of other limitations in activities of daily living and two items addressing the degree of worry and concern associated with the health or appearance of the oral cavity. All items refer to the past year and are tied to conditions of the teeth, mouth or dentures by a preceding statement. They are scored on a Likert-type response format with the following categories and arbitrarily assigned values: never (5), sometimes (4), fairly often (3), very often (2), all the time (1).

These scales can be analyzed qualitatively or quantitatively. In qualitative analysis, the proportion of subjects responding sometimes, fairly often, very often or all the time to one or more items within an impact scale is calculated. This identifies those individuals who experienced disability or handicap as a result of oral disorders at some point during the reference year. In quantitative analysis, the Likert response values are summed across scales to produce scale scores. In the case of the three-item eating scale, scores range from 3 to 15 with lower scores indicating higher levels of impact. An overall impact score can also be obtained by adding the scores from the four scales to allow the relative well-being of groups and individuals to be compared. The items used in the four impact scales are listed in Table 3.

These measures constitute a battery of indices which cannot be summarised in terms of an overall oral health status score. This is in contrast to measures such as the GOHAI (7) and the OHIP (8) in which an overall or summary score of an individual's oral health status can be obtained and used to compare across groups or time.

EVALUATING MEASURES OF HEALTH STATUS

Health status measures are usually assessed in terms of their reliability and validity. There are, however, other technical requirements of these measures which are no less important even though they are given less attention (13,14). Responsiveness, effect size, generalizability and efficiency are some of the other dimensions along which particular measures can be judged.

The relative significance of these technical requirements will vary according to the context in which a given measure is used and the objectives of the study in question. An instrument for use in clinical trials needs to be sensitive to clinically meaningful change, while an instrument to be used to screen populations for clinical needs assessment should have good predictive validity. For this reason, investigators need to be clear on what purpose a measure is intended to fulfil.

The measures described above were intended for descriptive surveys of adult populations. As such, generalizability and efficiency are concerns along with validity and reliability. The measures we developed need to be applicable to all age groups and sensitive to the effects of oral conditions as varied as tooth loss and chronic facial pain. The efficiency of the indicators is a concern since data collection costs, respondent burden and item non-response increase as the number of items in multi-item scales increases. Item non-response can be a particular problem when using self-complete questionnaires and can give rise to bias if subjects with incomplete data are dropped from the analysis. The imputation of missing values provides an alternative means of managing item non-response but can increase rather than reduce bias (15).

Assessing the reliability of health status measures is relatively straightforward. Test-retest and internal consistency reliability are easily evaluated and involve few theoretical issues. The only concern with respect to the first is whether poor reliability reflects inadequacy in a measure or the possibility of real change between the two applications of the scale. Assessing validity is always more difficult since concurrent and construct validity involve theoretical as well as methodological problems.

One problematic issue within dentistry is whether subjective oral health status indicators can be validated in terms of their relationships with conventional clinical indicators. Consistent with the findings of other studies (4,7), we have found that the relationships between these subjective indicators and conventional clinical indicators of oral health status are significant but weak, the highest correlation coefficient observed being between the number of missing teeth and scores on the index of chewing ability ($r=0.45$; $p<0.001$) (16). The correlations between the number of missing teeth and a score obtained by summing the Likert response codes to the seven eating and communication-social relations items was much weaker at 0.28 ($p<0.001$). In a previous paper we argued that there are good reasons why this should be so. Disease and health represent dimensions of human experience which are conceptually and often empirically distinct. For example, an individual may have a number of decayed teeth which do not impact on functioning or other aspects of well-being and someone may complain of dry mouth in the absence of clinically detectable reductions in salivary flow. Moreover, the links between clinical conditions and their

social and psychological consequences are not direct but mediated by functional concerns and variables such as socioeconomic status (16).

The validity of subjective oral health indicators is best established in the following ways. First, by demonstrating that there are significant associations with overall oral health perceptions and satisfaction with oral health status, and second, by assessing how well the measures discriminate between groups of individuals known to differ in terms of function and well-being.

THE SUBJECTIVE ORAL HEALTH INDICATORS STUDY

The subjective oral health indicators described above were initially tested as part of the baseline phase of the Ontario Study of the Oral Health of Older Adults. Data collection for this phase was undertaken during 1989 and 1990. Following refinements, they were included in the three-year follow-up phase conducted during 1992 and 1993 and re-evaluated. Because of the design of these studies only a limited assessment of their reliability and validity was possible. Moreover, this study was confined to individuals aged 50 years and over and did not allow the performance of the indicators to be assessed when used in surveys of adults below the age of 50 years. Consequently, during 1992-1993 we undertook the Subjective Oral Health Indicators Study to test the generalizability, efficiency, test-retest and internal consistency reliability, and concurrent and construct validity of the measures when completed by adults aged 18 years and over.

METHODS

The target population for the study was all persons aged 18 years and over living independently in the City of North York, one of the five communities which make up Metropolitan Toronto. North York is a multicultural community of approximately 560,000 persons with an aging population and a decline in the number of children affected by dental caries.

Because of the weak relationships between clinical and subjective indicators of oral health status (4,7,16), the clinical examination of subjects was deemed not to be necessary to establish the generalizability, efficiency, reliability and validity of the measures outlined above. Consequently, data were collected by means of a mail survey using the list of voters as the sampling frame. This list has been estimated to include more than 95% of those individuals eligible to vote. Excluded from the list are residents who are not Canadian citizens.

Subjects were selected from the register by means of a two-stage random-start systematic sampling procedure. Primary sampling units were polling sub-divisions and secondary units were named persons. The sampling fractions were adjusted to give a sample size of approximately 1000 subjects.

The study consisted of a three-wave mail survey. All subjects were sent a questionnaire, a covering letter and a stamped addressed envelope. Two weeks later non-responders were sent a postcard reminder and after a further two weeks an additional questionnaire, covering letter and return envelope were mailed to those who still had not responded. In order to facilitate test-retest reliability analysis, the

first 200 subjects who responded to the initial mailing were asked to complete a second copy of the questionnaire which was mailed to them immediately following receipt of the first.

In addition to the subjective oral health indicators described above, the questionnaire contained questions on dental status, use of dental services and socio-demographic characteristics. Data on dental status were used to divide subjects into three categories: edentulous, dentate with one or more dentures and dentate with no dentures. Subjects were also asked to use a finger and a mirror to count the number of natural teeth remaining and to record this on the questionnaire. Additional measures included a three-item index of dissatisfaction with oral health and two single-item measures of overall oral health perceptions; namely, self-rating of oral health and self-perceived need for dental treatment or advice. These measures are important in that they reflect not only an individual's overall personal experience of health but also their values, expectations and preferences (17).

The generalizability of the subjective indicators was assessed by comparing the questionnaire responses of four age groups; 18 to 29 years, 30 to 49 years, 50 to 64 years and 65 years and over. Efficiency was assessed in a very limited way, by determining the extent of item non-response for each of the measures. The assumption here was that respondent burden leads to non-response and is one indication that a measure has too many items.

The test-retest reliability of all subjective indicators was assessed using Pearson correlation coefficients and paired t-tests for continuous data and paired Chi-

square tests, percent agreement and the Kappa statistic for categorical data. The internal consistency reliability of the four social and psychological impact scales was assessed for all subjects using Cronbach's alpha.

Concurrent validity was evaluated by examining the associations between the subjective indicators, global assessments of oral health and satisfaction with oral health status. It was hypothesised that those reporting functional problems, pain and discomfort or social and psychological impacts would be more likely to report their oral health as only fair or poor, more likely to report a self-perceived need for dental care and more likely to be dissatisfied with their oral health.

Construct validity was assessed by comparing the responses of subjects according to dental status. It was hypothesised that the measures would discriminate between dentate and edentulous subjects such that edentulous subjects and dentate subjects wearing dentures would report more functional problems and more social and psychological impacts than dentate subjects not wearing dentures. Construct validity was also established by exploring correlations between the subjective indicators and a proxy clinical indicator, the self-reported number of remaining teeth.

These assessments of reliability and validity were undertaken for subjects as a whole and for two age groups, 49 years and under and 50 years and over. The aim was to ensure that the measures performed equally as well on younger and older subjects.

RESULTS

Of 1181 questionnaires mailed, 122 were returned by the post office as address unknown. Of the remainder, 553 or 52% returned completed questionnaires. This response was low but consistent with other studies of this target population. The Ontario Health Survey 1990, for example, achieved a response rate of 57% for the self-complete component in North York. Second copies of the questionnaire were completed by 156 or 78% of subjects mailed a second copy.

Table 4 compares the characteristics of the 553 subjects completing questionnaires with those of the target population. While distributions according to gender and place of birth were quite similar, some differences in age were observed. Subjects aged 25 to 44 years were under-represented while subjects aged 45 years and over were over-represented. However, the proportions of subjects aged 18 to 24 years and 65 years and over were virtually the same in both groups.

Overall, only 5.8% of respondents were edentulous. This varied from 0% among those aged 44 years and under to 15.6% of those aged 65 years and over. Among the dentate, 28.8% wore a partial denture and 10.2% reported losing one or more teeth in the previous year. The mean numbers of teeth reported by each age group were as follows: 18-29 years - 28.0 (sd=2.8); 30-49 years - 27.3 (sd=3.8); 50-64 years - 20.1 (sd=9.6); 65 years and over - 14.2 (sd=10.2) ($p<0.0001$).

Table 5 shows the associations between age and the indicators of oral function and oral symptoms. Relatively few subjects under the age of 49 years reported difficulty chewing or biting one or more of the six indicator foods. However, younger

subjects were as likely as older subjects to report problems speaking and more likely to report oral pain and other oral symptoms. For example, one-in-seven of those aged 18 to 29 years responded positively to one or more of the items regarding speech.

Table 6 shows the percentage within each age group who responded sometimes, fairly often, very often or all the time to one or more items from the four social and psychological impact scales. Also shown are mean scale scores. Older subjects were more likely to report impacts with respect to the eating scale but even here almost one third of those aged 18 to 29 experienced problems. Younger subjects were as likely to report problems in communication-social relations and other activities of daily living and more likely to report worry and concern about oral health. These differences are also reflected in the mean scale scores which show the same broad pattern of associations with age. That is, a significant difference was observed for eating scale scores but not for the other three scales.

Because relatively few subjects responded very often or all the time to one or more scale items, the four scales were combined when using this more stringent response cut-off. The percentage in each age group responding in this manner to one or more of the fifteen impact statements was, from youngest to oldest, 16.4%, 13.3%, 13.9% and 13.2%. These differences were not significant, indicating that subjects from each age group were equally likely to experience some social or psychological impact on a constant or regular basis.

Item non-response was low. The proportion of subjects with one or more missing items was 5% or less for six of the eight subjective indicators and just over

7% for the pain and oral symptoms inventories. The number of subjects with missing data was too small for a meaningful comparison of the characteristics of those with and without item non-response.

Table 7 provides data on the reliability of the eight subjective indicators. Test-retest reliability was assessed using the correlations between the number of items endorsed at each administration of the questionnaire. For example, the correlation between the number of foods subjects reported being unable to chew or bite at the first and second completion was 0.90. It was 0.77 for the number of pain symptoms reported at each administration and 0.75 for the number of other symptoms. For the impact scales, the correlations refer to the number of items at each completion with responses of 'sometimes' or more frequently. These ranged from 0.61 to 0.84. Correlations between scale scores were of the same magnitude and varied between 0.57 and 0.80. Cronbach's alphas ranged from 0.70 to 0.87. When all 15 impact items were combined into one scale the correlation for the number of items endorsed was 0.83 while the correlation between scores was 0.78. All correlations were significant at the 0.001 level.

Paired t-tests showed no significant differences between the number of items endorsed at each administration of the questionnaire for seven of the eight indicators. There were however, significant differences in the mean number of oral symptoms reported. However, the magnitude of the difference was very small; a mean of 1.3 (sd=1.7) at the first administration and 1.1 (sd=1.6) ($p<0.01$) at the second. Paired t-tests on the four impact scale scores showed a difference in means for the eating scale

only. Again, the magnitude of the difference was small; a mean of 13.9 (sd=2.1) at the first completion and a mean of 14.1 (sd=1.8) ($p<0.05$) at the second.

Test-retest reliability was also assessed by reducing the responses to the eight indicators to a dichotomy. This indicated the proportion of subjects who did and did not report problems related to oral disorders. These proportions were compared for the first and second completion of the questionnaires using the paired Chi-square test (McNemar's test), percent agreement and the Kappa statistic. The results are summarised in Table 8.

Differences in the proportion of subjects reporting problems at each administration of the questionnaire were small and none of the differences were significant. The percent agreement varied from 79 to 96 and seven of the eight Kappa values, indicating agreement corrected for chance, were 0.5 or greater.

Tables 9 and 10 provide data on the validity of the subjective indicators. In order to assess concurrent validity the associations between the eight indicators and three other self-report indicators were examined; self-rating of oral health, self-perceived need for dental treatment and dissatisfaction with oral health status. In all analyses significant associations were observed in the expected direction. For example, subjects reporting a need for dental treatment were more likely to be limited in their ability to chew, have problems speaking, experience pain or other oral symptoms and to have had one or more social and psychological impacts than those not perceiving a need for treatment.

Tables 9 and 10 also show the associations between dental status and the eight

indicators. It was hypothesised that there would be differences on all measures except for pain and other oral symptoms; given the content of the pain and oral symptom inventories there was no reason to expect variations according to dental status. Significant associations were observed for five of the remaining six indicators. The measure of worry and concern about oral health was the only exception.

The correlations between the eight subjective indicators and the self-reported number of teeth are given in Table 11. With the exception of chewing ability (-0.55) and the eating scale score (0.38), these correlations were weak at 0.15 or less. Correlations between the subjective indicators were on the whole systematic and stronger.

The test-retest reliability analysis was repeated separately for subjects aged 49 years and under and 50 years and over. Correlation coefficients ranged from 0.57 to 0.96 ($p<0.001$) in all analyses except for the activities of daily living impact scale for subjects aged 49 years and under. Here the correlation between scores was 0.11 and the correlation between items was 0.09 (NS). However, paired t-tests showed no significant differences in mean scores or the mean number of items endorsed and the paired chi-square test showed no significant differences in the proportions reporting activity of daily living impacts.

Cronbach's alphas for the four impact scales ranged from 0.56 to 0.81 for those aged 49 years and under and from 0.76 to 0.82 for those aged 50 years and over.

The concurrent and construct validity analyses were also repeated separately for the two age groups and confirmed the validity of the indicators for both younger and older adults.

DISCUSSION

This study provides further evidence concerning the performance of a battery of subjective oral health indicators developed for use in large scale surveys of adult populations. The analyses presented above suggest that the indicators are acceptable in terms of four technical requirements; namely, generalizability, efficiency, reliability and validity. The measures seem to be applicable across age groups, subject to low levels of item non-response even when used in a self-complete survey of a multi-cultural population, show generally good levels of test-retest and internal consistency reliability and confirm most hypotheses concerning concurrent and construct validity. With the exception of one or two statistics the measures performed equally well with subjects aged 49 years and under and those aged 50 years and over.

These results confirm an earlier and more limited evaluation of these indicators using data from a survey of the oral health of adults aged 50 years and over. While the measures appear to perform well in the context of descriptive oral health surveys this does not mean that they are suitable for use in other contexts. Their suitability in clinical trials and the assessment of the needs of patients has yet to be tested and should not be inferred from the results presented here.

Perhaps the most contentious aspect of the study is our view that health is a subjectively perceived state and the validity of measures of oral health should not be based on their association or lack of association with clinical indicators. This view is derived from contemporary sociological concepts of health and illness and the distinction between subjective and objective realities (18). It is supported empirically

by many studies which have shown that the correlations between subjective and clinical indicators are significant but generally weak. This is why we decided not to include a clinical examination component in the study: this would have increased costs considerably without providing data useful in terms of our aims and objectives. We did, however, use a quasi-clinical indicator in the form of a classification of dental status to validate the subjective indicators since this identified groups expected to differ in terms of oral health.

This does not mean that there is little merit in including clinical indicators in oral health surveys or exploring the relationships between clinical and subjective indicators. First, clinical indicators continue to be a valuable, if not essential, component of surveys of the oral health and treatment needs of populations. However, it should be recognized that measures of disease and measures of health are qualitatively different and have different implications for treatment need. We should also recognize that it is now quite rare for large scale surveys of the general health of populations to include clinical examinations and to consider whether or not surveys of oral health invariably need to include a clinical component. This is worthy of consideration in an era of scarce resources since clinical examinations are labour intensive and expensive. It may be possible to identify populations that need to be targeted in terms of treatment and prevention services using subjective indicators only.

Second, exploring the links between clinical and subjective indicators in general and specific populations can identify which conditions are responsible for the greatest

reduction in their quality of life. This is also important when resources are scarce since oral conditions as well as populations may be targeted and increase the cost-effectiveness of oral health care provision. That is, resources can be allocated to services likely to produce the most health gain in groups disadvantaged with respect to oral health.

Further work to evaluate these subjective indicators is underway. Data from the three-year follow-up of older adults aged 50 years and over at baseline is being analyzed to assess the sensitivity of the indicators to change. Data were also collected using the Oral Health Impact Profile (7) so that the performance of the eight indicators described here can be compared with that of a technically more sophisticated and empirically-based measure. The measures will also be used in studies of chronic facial pain and implant patients to assess their utility in clinical contexts. In this way we intend to contribute in a systematic way to the growing body of research concerning the functional, social and psychological consequences of oral disorders.

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TABLE 1

CHEWING CAPACITY

Are you usually able to:

chew a piece of fresh carrot?	Yes/No
chew boiled vegetables?	Yes/No
chew fresh lettuce salad?	Yes/No
chew firm meat such as steaks or chops?	Yes/No
bite off and chew a piece of whole fresh apple?	Yes/No
chew hamburger?	Yes/No

ABILITY TO SPEAK

Thinking about problems with your teeth or mouth....

do you ever have difficulty pronouncing any words?	Yes/No
do you ever have difficulty speaking clearly?	Yes/No
do you ever have difficulty making yourself understood?	Yes/No

TABLE 2

ORAL AND FACIAL PAIN

In the last four weeks, have you had the following problems?

toothache	Yes/No
pain in teeth with hot/cold foods or fluids	Yes/No
pain in teeth with sweet foods	Yes/No
pain in jaw joint while chewing	Yes/No
pain in jaw joint when opening mouth wide	Yes/No
pain in face in front of ear	Yes/No
burning sensation in tongue or other parts of mouth	Yes/No
shooting pains in face or cheeks	Yes/No
pain or discomfort from denture	Yes/No

OTHER ORAL SYMPTOMS

In the last four weeks have you had the following problems?

mouth ulcers	Yes/No
cold sores	Yes/No
sore gums	Yes/No
bleeding gums	Yes/No
bad breath	Yes/No
dryness of mouth	Yes/No
unpleasant taste	Yes/No
changes in ability to taste	Yes/No
clicking/grating noise in jaw joint	Yes/No
difficulty opening mouth wide	Yes/No

TABLE 3

EATING IMPACT SCALE

Thinking about your dental health over the last year, how often:

have you been prevented from eating foods you would like to eat?

have you found your enjoyment of food is less than it used to be?

did it take you longer to finish a meal than other people?

Response format: all the time, very often, fairly often, sometimes, never

COMMUNICATION/SOCIAL RELATIONS IMPACT SCALE

Thinking about your dental health over the last year, how often:

did you avoid eating with other people because of problems with chewing?

were you embarrassed by the appearance or health of your teeth or mouth?

did you avoid laughing or smiling?

did you avoid conversation with others?

Response format: all the time, very often, fairly often, sometimes, never

TABLE 3 cont'd

ACTIVITIES OF DAILY LIVING IMPACT SCALE

During the past year how often have pain, discomfort or other problems with your teeth, mouth or dentures caused you to:

have difficulty sleeping?

stay home more than usual?

stay in bed more than usual?

take time off work?

be unable to do household chores?

avoid your usual leisure activities?

Response format: all the time, very often, fairly often, sometimes, never

WORRY/CONCERN IMPACT SCALE

During the past year how often have you worried about:

the appearance of your teeth or mouth?

the health of your teeth or mouth?

Response format: all the time, very often, fairly often, sometimes, never

TABLE 4

CHARACTERISTICS OF TARGET POPULATION AND STUDY SUBJECTS

	Target population* (%)	**Study subjects** (%)
Gender:		
Male	47.1	44.9
Female	52.3	55.1
Age:		
18-24 yrs	11.0	11.9
25-44 yrs	42.3	34.3
45-64 yrs	28.7	32.8
65 yrs and over	18.0	21.0
Place of birth:		
Canada	52.3	56.0
Elsewhere	47.7	44.0

* Data from 1986 census

TABLE 5

PERCENT REPORTING LIMITATIONS IN ABILITY TO CHEW, PROBLEMS SPEAKING, ONE OR MORE ORAL PAIN SYMPTOMS AND ONE OR MORE OTHER SYMPTOMS BY AGE GROUP

Age group:	**Limitation in chewing**	**Problem speaking**	**Pain**	**Other symptoms**
18-29 years	0.9	14.8	43.5	69.6
30-49 years	4.8	6.0	36.7	51.8
50-64 years	16.0	9.7	28.5	50.7
65 years and over	33.3	9.6	28.1	45.6
p	***	ns	*	**

* - $p<0.05$; ** - $p<0.01$; *** - $p<0.0001$: Chi square test

TABLE 6

PERCENT RESPONDING POSITIVELY| TO ONE OR MORE
IMPACT SCALE ITEMS AND MEAN SCALE SCORES BY AGE GROUP

Impact scale:	**Eating**		**Communication/ social relations**		**ADL‖**		**Worry/ concern**	
	%	x	%	x	%	x	%	x
Age group:								
18-29 yrs	29.6	14.2	23.5	19.4	13.9	29.6	65.2	8.4
30-49 yrs	30.1	14.2	26.5	19.4	18.7	29.5	60.2	8.7
50-64 yrs	38.9	13.7	23.6	19.3	20.1	29.4	54.9	8.8
65 yrs and over	43.9	13.6	23.7	19.4	21.1	29.5	48.2	8.9
p	*	**	ns	ns	ns	ns	*	ns

| - Responding sometimes, fairly often, very often or all the time.

‖ - Activities of daily living

* - $p<0.05$; ** - $p<0.01$: Chi square test for differences in proportions and one-way analysis of variance for differences in mean scale scores.

TABLE 7

TEST-RETEST AND INTERNAL CONSISTENCY RELIABILITY: CORRELATION COEFFICIENTS OF ITEMS AND SCORES, PAIRED T-TESTS AND CRONBACH'S ALPHAS

	Test-retest reliability				**Internal consistency**
	Items		Scores		
	r	t	r	t	
Limitation in chewing	.90	ns			
Problem speaking	.76	ns			
Oral pain	.77	ns			
Other oral symptoms	.75	**			
Eating	.78	ns	.79	*	.70
Communication/ social relations	.84	ns	.80	ns	.79
Activities of daily living	.61	ns	.57	ns	.87
Worry/concern	.67	ns	.64	ns	.82

All correlation coefficients significant at the 0.001 level.

* - $p<0.05$; ** - $p<0.01$: T-test.

TABLE 8

TEST-RETEST RELIABILITY: PERCENT REPORTING PROBLEMS AT FIRST AND SECOND COMPLETION, PERCENT AGREEMENT AND KAPPA

	First	**Second**	**p**	**Percent agreement**	**Kappa**
	%	%			
Limitation in chewing	12.2	12.8	ns	96	0.77
Problem speaking	8.3	7.1	ns	95	0.79
One or more pain symptoms	30.8	27.6	ns	80	0.51
One or more other symptoms	52.6	48.1	ns	81	0.62
Eating	34.0	30.1	ns	87	0.70
Communication/ social relations	23.1	23.1	ns	89	0.69
Activities of daily living	14.7	10.3	ns	87	0.41
Worry/concern	55.8	53.8	ns	79	0.76

p: All differences between proportions at first and second administration not significant: Paired chi-square (McNemar's) test.

TABLE 9

CONCURRENT AND CONSTRUCT VALIDITY: ASSOCIATION BETWEEN SUBJECTIVE INDICATORS, GLOBAL ASSESSMENTS OF ORAL HEALTH AND DENTAL STATUS

	Limitation in chewing %	**Problem speaking** %	**Pain** %	**Other symptoms** %
Self-rating of oral health:				
Excellent	6.7	4.0	20.0	37.3
Very good	6.1	7.9	25.5	46.1
Good	10.9	8.2	34.2	57.1
Fair	21.6	15.5	52.6	70.1
Poor	59.1	36.4	68.2	68.2
p	***	***	***	***
Self-perceived need for care:				
Yes	17.9	17.3	55.4	73.2
No	10.6	7.2	24.7	44.8
p	*	**	***	***
Dissatisfied with oral health:				
Yes	30.9	20.9	58.2	75.5
No	8.8	7.4	28.4	48.4
p	***	***	***	***
Dental status:				
Edentulous	61.3	12.9	35.5	45.2
Dentate with denture(s)	26.3	14.6	39.4	48.2
Dentate no denture(s)	2.9	6.6	32.2	55.5
p	***	*	ns	ns

* - $p<0.05$; ** - $p<0.001$; *** - $p<0.0001$: Chi square test.

TABLE 10

CONCURRENT AND CONSTRUCT VALIDITY: ASSOCIATION BETWEEN SUBJECTIVE INDICATORS, GLOBAL ASSESSMENTS OF ORAL HEALTH AND DENTAL STATUS

Impact scale:	**Eating**	**Communication/ social relations**	**ADL‖**	**Worry/ concern**
	%	%	%	%
Self-rating of oral health:				
Excellent	13.3	9.3	10.7	36.0
Very good	23.6	12.7	12.7	49.7
Good	39.7	25.5	14.1	57.1
Fair	48.5	46.4	33.0	82.5
Poor	90.9	63.6	63.6	81.8
p	***	***	***	***
Self-perceived need for care:				
Yes	50.6	41.1	32.7	78.6
No	27.9	17.5	13.3	47.2
p	***	***	***	***
Dissatisfied with oral health:				
Yes	61.8	62.7	41.8	80.9
No	28.6	15.5	13.3	51.1
p	***	***	***	***
Dental status:				
Edentulous	61.3	38.7	32.3	35.5
Dentate with denture(s)	45.3	31.4	23.4	59.1
Dentate no denture(s)	27.0	19.8	14.7	56.9
p	***	**	**	ns

Percentages refer to percent of subjects responding sometimes, fairly often, very often or all the time to one or more impact scale items.
** - $p<0.001$; *** - $p<0.0001$: Chi square test.

TABLE 11

PEARSON'S CORRELATION COEFFICIENTS BETWEEN THE NUMBER OF REMAINING TEETH AND THE SUBJECTIVE INDICATORS

	1.	2.	3.	4.	5.	6.	7.	8.
1. Number of teeth								
2. Limitation in chewing	-.55							
3. Problem speaking	.15	.21						
4. Number of pain symptoms	-.05	.24	.16					
5. Number of other symptoms	.01	.15	.17	.50				
6. Eating scale score	.38	-.62	-.28	-.34	-.29			
7. Communication scale score	.10	-.31	-.18	-.31	-.29	.47		
8. Activities of daily living scale score	.12	-.35	-.22	-.42	-.22	.50	.58	
9. Worry and concern	.01	-.19	-.12	-.32	-.35	.35	.45	.24

Correlations of 0.12 or greater significant at $p<0.01$.