# CAUSES AND CORRELATES OF ORAL HEALTH STATUS: PRELIMINARY RESULTS FROM THE INTERNATIONAL COLLABORATIVE STUDY II*

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years, a probability sample is identified through comprehensive lists, such as voter registration or social insurance enrollment, or through household listings.

The provider groups are dentists and dental auxiliaries. The study surveys a random sample of 100 dentists or all dentists in the area (if under 100). Dentists are identified from the list of all registered dentists in the area. In addition to primary data, secondary sources such as published reports from government agencies, the dental profession, industry, school systems, or other institutions provides contextual information on the health care system and the socioenvironmental characteristics of each country and study site.

Participants in ICS II include New Zealand, Poland, Germany (previous German Democratic Republic), the U.S., and the Latvian Republic. Participating communities in the U.S. include San Antonio, Texas, Baltimore, Maryland, and The Indian Health Services. The WHO and CHAS teams have attempted to include developing countries such as Egypt, India, Israel, Uruguay, Saudi Arabia, and Taiwan. However, these countries have not been able to obtain sufficient funds for their data collection due to political or economical reasons. For countries that participated in both ICS I and II -- New Zealand, Poland, Germany, and Baltimore, we will have the opportunity to study the changes in the country's oral health status and its determinants in this 15 year period.

## Conceptual Framework of ICS II

Figure 1 shows the conceptual framework used in ICS II. The model postulates that the socioenvironmental context of the society, the oral health care system, and the personal characteristics of the individual influence oral health status and consumer satisfaction

directly, and also influence it indirectly through individuals' oral health behavior including personal oral hygiene behavior and oral health services utilization.

The oral health status variables include measures of morbidity, disability, social functioning, and satisfaction with own oral health and dental-related symptoms. The three sets of independent variables are: 1) personal characteristics of consumers, including predisposing variables such as sociodemographic characteristics, attitudes and beliefs, and enabling variables such as income, insurance, and regular source of care; 2) oral health delivery system features, such as the organization and resources of personal services and community health programs; and 3) socioenvironmental characteristics, such as the geography, the economy, the culture, and the general health care system.

Figure 1 also shows the major data sources for each set of variables. ICS II has four major sources of data: the consumer survey, the epidemiological survey, the provider survey, and secondary data collection.

Figure 2 shows in more detail the specific components of the conceptual framework which will be used in this paper. The analysis will be linked to data collected from the social survey and the epidemiological examinations. We will explore how personal characteristics and oral health behavior influence oral health outcomes.

The personal characteristics include predisposing, enabling and need variables. The predisposing variables include conditions of people that incline them toward certain behaviors and related health status. These conditions are assumed to exist prior to particular instances where decisions are made whether or not to engage in oral health behavior and to determine rather than be determined by oral health outcomes. These predisposing variables are of two

types: (1) sociodemographic (gender, education, ethnicity and general health); and (2) health beliefs. The latter helps to explain how the sociodemographic variables might influence oral health behavior and outcomes. For example, the kinds of people who believe that oral disease can be serious and place a high value on oral health might be expected to engage more frequently in oral health behavior than others in the population. Conversely, those perceiving many barriers to their receipt of service might engage less often in dental utilization.

Enabling variables represent conditions that allow oral health behavior to take place given that the predisposition to engage in such behavior is present. Examples used in the present analysis include income and insurance providing the means to purchase services, having a regular source of care which promotes ease of access or entry to service, and place of residence (urban or rural) which is associated with the availability of facilities and personnel.

A final type of predisposing factor is the perception of need for care on the part of the individual. In this analysis, we are representing need by the number of symptoms or oral problems the individual experienced in the calendar year preceding the interview date.

We expect the personal characteristics to influence oral health outcomes directly or work through oral health related behaviors. The oral health related behavior considered in this analysis includes personal hygiene (frequency of brushing and flossing) and dental service use -- whether or not a dental visit was made in the last year, whether the visit was in response to a symptom of illness or not, and the number of dentist visits in the year.

Oral health outcomes can either be perceived by the patient or judged or evaluated by a health professional. We have chosen here to consider as perceived health outcomes people's general judgment about how good their oral health is, whether or not they believe a dentist would judge them to have teeth needing pulling, and whether they think they are hindered in social functioning (talking or laughing) because of their teeth. We will also consider as a perceived outcome how satisfied people are with the overall quality of the dental care they have received.

Evaluated outcomes in the study are based on the clinical examinations performed by dentists. Here, we will be considering measures of dentition status (the number of decayed, missing, and filled teeth and simply the number of missing teeth) and periodontal status (a dentist's assessment of how healthy the gums are).

## New Zealand's Participation in the International Collaborative Study

New Zealand is the first country to start and complete the data collection of the consumer survey. In our presentation, we will use New Zealand consumer survey and clinical data to describe the kind of analysis that we will conduct for each ICS II country.

### System Profile

New Zealand's public health service provides treatment through public hospitals under the entitlement established by the Social Security Act of 1964. This encompasses medical and related benefits, applies to all New Zealand residents, and provides for medical, pharmaceutical, hospital, maternity and other benefits. If a patient opts for the private system, part of the costs are met by the public system.

Public spending on dental care includes the school dental service, the training of dental nurses, the education of dentists, special and general dental benefits, and accident compensation. New Zealand's dental health service combines a free school dental service for children, dental benefits for adolescents, and private practice for adults. Public dental treatment is provided by contracting dentists for whom there is a prescribed scale of fees, or in the dental department of a public hospital. The school dental service works to maintain dental health of pre-school and school age children by regular and systematic treatment at six month intervals, starting at two and one-half years of age and continuing through to the highest class at primary or intermediate school. School dental nurses provide examinations, disease prevention measures, fillings in deciduous and permanent teeth, extraction of deciduous teeth, and dental health education. Referrals to dentists for additional care which dental nurses cannot provide is available to the students. This system has been in operation for nearly 70 years. There are 1368 school dental clinics located in New Zealand's schools.

Administratively, the country is divided into 13 dental districts and three area health boards. There are just over 1000 practicing dentists in New Zealand and just over 300 dental technicians. Ninety-two percent of the dentists are trained at the University of Otago (the country's only dental school) with eight percent trained in Great Britain or Australia.

Participation in ICS I

There are two striking findings from the New Zealand ICS I, conducted in 1973. First, New Zealand children of 13 and 14 years old had many filled teeth in their mouths. Table 1 shows the decayed, missing, and filled teeth scores for 13 and 14 year old students for the first seven regions involved in the study. Canterbury and Trondelag, the two areas

with a well-developed school dental service, had similar decayed, missing, and filled teeth scores. The scores were higher than those in the other regions and were characterized by the fact that more than 90% of the DMF teeth score was made up of filled teeth. From this evidence, it appears that the problem of dental caries in young people had been dealt with largely by a curative rather than a preventive approach. Second, there were very high percentages of adults of 35-44 years of age who had lost all of their natural teeth. Table 2 shows the percentage of 35-44 year old adults who had lost all of their natural teeth. In Canterbury, the proportion who had lost all of their natural teeth was three times higher than in Sydney, Australia, the next highest region among ICS I countries.

These results were a major stimulus for the modification of the main community dental program in New Zealand -- the school dental service. As mentioned above, the school dental service employs dental nurses to provide routine dental care for children between two and a half and thirteen years of age.

The first step in this modification of the School Dental Service Program was to introduce a system of national targets for child dental health, coupled with a method to measure any progress toward these targets.

The first target was to reduce the need for fillings by 10%. The national child dental health targets were later changed to specify reductions in decayed, missing, and filled teeth scores. Because of the differences in caries prevalence in different areas, each dental district prepared its own program suited to meet its specified target. This planning by district was an innovation for the school dental service in New Zealand -- previously it had been organized with uniform national policies. While this responsibility had been shifted to the

district level, several suggestions were made on the national level to assist the districts in this planning. The first suggestion was to establish the practice of preventive appointments. While this was being done in many areas, the initiative was intended to give this practice added emphasis.

The second suggestion was that the criteria for diagnosis of caries be reviewed. Up until that time it had been the practice for the school dental service to intervene early in a carious lesion. Following ICS I, active discouragement of early intervention in a carious lesion began. A further change also included the development of a continuing survey program to monitor child oral health.

Since these change in the mid-1970s, modifications to the school dental service have continued. Probably, the most significant recent change has been the devolution of the responsibility for health care from the central government to regional area health boards. While broader health policies are still formulated centrally, area health board are now responsible for policy and planning to meet local needs.

Comparing the results of ICS II with those of the ICS I, we can see a dramatic improvement in the oral health status of the New Zealanders. We include in Table 3 the ICS II result for the number of decayed, missing, and filled teeth for the students 12-13 years old. Although the age group is slightly different, the great contrast of the result of ICS I and ICS II does show a substantial fall in the mean number of decayed, missing, and filled teeth from 1973 to 1988 among New Zealand children. As for adults, ICS II results also indicate a great decrease in the percentage who have lost all of their natural teeth -- from 36% to 14%.

## The New Zealand Sample

One distinctive feature of New Zealand ICS II is that a national sample was used. In the following, we will describe the sampling design for adults and students. Adults in three age groups (20-24, 35-44, and 65-74) were sampled using a two stage, stratified, clustering procedure. Three-thousand and thirty adults were identified as eligible for the study and 1,777 interviews and 1,485 oral exams were obtained, for overall completion rates of 59% for the interviews and 49% for the oral exams. The details of the sampling procedure are as follows:

1. All the census meshblocks (PSUs) in New Zealand were divided into 94 strate according to demographic characteristics.
2. Two PSUs were randomly selected from each urban stratum (yielding 166) and one PSU was randomly selected from each rural stratum (yielding 11).
3. Using the 1986 census listings 56% of the dwelling units (DUs) in the urban PSUs were randomly selected to be screened for the 65-74 age group. In rural PSUs 100% of DUs were selected from screening for the 65-74 age group. Of the DUs screened for the 65-74 age group 57% were randomly selected to be screened for the 35-44 age group and of that group 87.5% were randomly selected for screening for the 20-24 age group.
4. All eligible within the selected DUs were selected to be interviewed.

One thousand and seventy-four students, ages 12-13, were selected through a stratified, multistage random sampling procedure. One thousand and twenty-seven

questionnaires and oral examinations were completed, for a completion rate of 95.6%. As a methodological check, 116 students received duplicate oral examinations. These examinations were not used in the main analysis. The sampling process was as follows:

1. Area units were defined consisting of, on average, 12 census meshblocks in urban areas and single meshblocks in rural areas. Areas were selected if they contained a selected adult meshblock.
2. All schools in the selected areas attended by 12 and 13 year olds composed the universe for the second sampling stage. Fifty schools were selected with a probability weighted by the number of eligible students in attendance.
3. The selected schools contained 324 classes. Within each school one or two classes were selected for a total of 66. Classes were selected with equal probability within school.
4. The selected classes contained 1,480 students. Of these 1,074 students were randomly selected with equal probability within selected classes.

## Describing Oral Health and Its Correlates in New Zealand

Table 3 provides an overview of the oral health status of the New Zealand population according to age group. It provides measures of both perceived and evaluated health status.

The perceptions of health according to the survey respondents include their general description of the state of their teeth and gums, judgment as to whether a dentist would tell them they have teeth that need pulling, avoidance of laughing or conversation because of appearance of teeth or gums, and satisfaction with dental care during the last visit.

The majority of New Zealanders describe their oral health status as excellent or good. There are however a significant minority (18% to 25%) of each age group reporting their oral health as fair, poor or very poor.

Belief that a dentist would recommend an extraction represents a respondent's perception that he or she has a relatively serious dental problem. Among the respondents who have natural teeth, 11.9% of the middle aged group report a need for pulling while fewer of the adolescents (7%) and elderly (8%) do so.

Impaired social functioning may be more of a problem for adolescents than adults. Eighteen percent of all children 12-13 report not laughing because of their teeth or gums. Smaller proportions of adults report the avoidance of laughing.

The last perceived variable in Table 3 shows that most people are satisfied with the quality of dental care received during their last dental visit in the last two years. Ninety five percent or more of all age groups reported being satisfied or very satisfied with their last visit to a dentist or a dental nurse in the case of children.

Clinical oral examinations of the sample provide the respondent's oral health status measured by an expert's (dentist's) opinion. Two major dimensions of oral health status are evaluated in these examinations: periodontal status and dentition status. For the former, Table 3 shows that about three-quarters of the students have healthy gums while 21.3% have calculus in their gums. An accumulation of calculus on teeth for a prolonged period of time without any treatment may lead to deep pockets in the gums and eventual loss of teeth. Few adults are healthy by this measure. A large proportion of them have calculus and an even

greater proportion (about 50% of those 35-44 and 44% of those 65-74) have pockets of 4mm or more.

Dental caries are a universal health problem. The number of decayed, missing, and filled permanent teeth measures the total effect of caries (PDMF's). In most developed countries, dental caries rates among young people have decreased dramatically--primarily due to fluoridation of drinking water. In New Zealand, for example, 28.5% of students aged 12-13 are free of caries and the majority (57%) have only 1-4 decayed, missing, or filled teeth. In contrast, most adults have many decayed, missing, or filled teeth. For example, 56.49% of adults 35-44 years old and 92.02% of those 65-74 years old have more than 20 decayed, missing, or filled teeth. Finally, about 10% of the younger adults and 59.% of the older adults have lost all their natural teeth (32). The distribution of these adults by the number of missing teeth clearly exhibits the impact of aging: the older New Zealanders loose more teeth -- about 96% of the elderly have lost at least 6 teeth, in contrast to 33% of the younger adults. Nearly all New Zealand students (99.6%) have not lost any teeth.

Brushing and flossing teeth are preventive measures against dental diseases, particularly gum disease. As seen in Table 4 many New Zealand children (46.2%) and the majority of adults with natural teeth (69.6% of those 35-44 and 67.4% of those 65-74) have developed the habit of brushing more than once daily. In contrast, flossing has not been widely practiced: only 8.4% of the students, 11.5% of those 35-44 and 9.5% of those 65-74 floss once or more per day and, in fact, 45.4% of the students and more than half the adults do not use dental floss at all.

Many dental professionals recommend a regular dental visit once or twice yearly as another preventive measure. Almost all students had at least one visit to the school dental nurse or dentist last year, demonstrating the successfulness of the school dental program in reaching students. New Zealand does not have the same program for their adults, however. As a result, many of them did not visit the dentist in the last year -- 43.9% of those 35-44 and 70.4% of those 65-74. Many of the elderly did not visit the dentist because they do not have natural teeth. One measure of preventive visits is the number made by people in the absence of pain or other symptoms. The visits of 28.7% of the young adult group and 12.7% of the older adults were asymptomatic.

In the multivariate analyses of the major dependent variables to be discussed in the next section, we use the data for the adult sample aged 35-44. Table 5 shows the individual characteristics of the sample in this age group. About 49% are male. Almost all completed eight years of primary education. About one-third completed secondary education (form 3 to form 7) and 20.3% have college or university education. Maori, the primary indigenous ethnic group in New Zealand, are 6.2% of the sample. Perceived general health is included in this study as a predisposing variable because of the association between general health and oral health. Twenty-six percent of the sample report excellent health while 7 percent report their health as fair, poor or very poor.

Variables to describe the individual's enabling characteristics include income, usual source of care, insurance, and residence. Five percent of the sample of 35-44 years old have an income lower than NZ $10,000 but 25.8% have an income higher than or equal to $50,000. A majority have a usual source of dental care, while a minority have the insurance

that covers dental care cost. 38.9% of the sample live in large urban areas with population over 300,000. Only 8.4% live in rural areas.

People in the sample were asked in a number of ways whether they consider dental disease to be a serious problem. According to Table 5 most (74%) think that dental disease is relatively serious. Most (73%) also think that dental disease is important, compared with other health problems. About 67% perceived one or more barriers to dental visits, including unavailability of dentists, being too busy to visit the dentist, and being afraid of the dental pain. Finally, when asked of symptoms experienced in the last year, 83.6% had at least one dental symptom, such as a broken or chipped tooth, bleeding gums, or an aching tooth and 10% had 5 or more symptoms.

## Multivariate Analysis of Oral Health Status

In this section we will examine the impact of predisposing, enabling, and health behavioral variables on oral health outcomes. In these analyses we have excluded the need variable represented by number of symptoms reported in the last year. The problem here is that need as measured in this study may well be a part of outcome rather than a determinant of outcome. Similarly we have omitted the dental use measure, number of visits. While on the one hand we might hope that more visits would improve oral health status, we cannot exclude the possibility that part of the association we would be observing results from poor health status resulting in more visits.

Table 6 shows the results of our multivariate analysis of perceived oral health outcomes. Ordinary least square models are used for perceived oral health and satisfaction with dental quality. Perceived oral health is treated as a continuous variable with 6 values

ranging from 6 (excellent) to 1 (very poor). Satisfaction with dental quality is treated as a continuous variable with four values ranging from 4 (very satisfied) to 1 (very dissatisfied). Need for pulling and impaired social functioning are dichotomous dependent variables and consequently we use a logit analysis. In, "Need for pulling," 1 = yes and 2 = no. In the case of "impaired social functioning," 1 = respondent reporting avoidance of laughing and/or conversation because of the appearance of teeth and gums and 0 = avoidance of neither of the above.

The results of the analysis of perceived oral health is shown in Table 6 with the standardized regression coefficients for each of the independent variables. The only significant predisposing variable is general health status. Higher general health status is quite highly predictive of higher perceived oral health status. Among the enabling variables, having a regular source of dental care and living in a smaller urban area (as opposed to a large city) is predictive of higher perceived oral health status. Among the behavioral variables, neither brushing nor flossing is predictive of perceived oral health. However, not having a dental visit in the past year was predictive of better reported oral health status. One rather bizarre interpretation here is that staying away from the dentist improves perceived health status. It seems more likely here that perception of good health may reduce the demand for dental visits. We will explore these relationships further.

Respondents' perception that they have teeth in need of pulling is associated with no sociodemographic factor but with some health beliefs. The more people believe that oral disease is serious, the less likely they are to report the need for pulling teeth. Also the greater the number of perceived barriers to care, the more likely they are to perceive the

need for extraction. In terms of health behavior those people seeing the dentist for symptomatic reasons are more likely to perceive the need for extraction. All of these significant factors are in the direction suggested by our initial model.

Impaired social functioning (Table 6) is related to some independent variables in ways quite different from the need for pulling variable. Males are more likely to report avoidance of laughing or conversation. Those who consider dental problems as most serious are more likely to report impaired social functioning. Perception of more barriers to receipt of services reduces the likelihood that people will report impaired social functioning. Finally, people who have a regular source of dental care are more likely to report impaired social functioning than those without a regular source. Impaired social functioning is not significantly related to any of the measures of behavior. Social functioning appears to be primarily a product of a type of person who takes dental care and oral disease seriously but whose behavior and use of services have not eliminated their perception that the appearance of teeth and gums causes social problems.

Satisfaction with the quality of dental service is significantly related to only a few of the independent variables in Table 6. Perception that dental disease is serious predicts a positive assessment of dental quality as does residence in a small urban (suburban type community). None of the sociodemographic or behavior measures are significantly related to quality assessment.

Table 7 shows the results of the multivariate analyses of the evaluated oral health outcome variables. We regress the personal characteristics and oral health behavior variables on three dependent variables, periodontal status, the number of PDMF teeth, and the number

of missing teeth. The multiple regression results for periodontal status indicate that among the personal characteristics, sex and general health status are significant predictors: males and those with poor general health status are more likely to have poor periodontal status. Interestingly, among the oral health behavior variables, only flossing is significantly related with an individual's gum situation: those who floss more frequently tend to have better periodontal status. This result has strong policy implications. Since flossing is a relatively inexpensive preventive measure, dental health education programs aiming at the improvement of individuals' periodontal status should promote flossing among the public. However, it should be noted here that the regression model only accounts for 5% of the variance in the dependent variable, suggesting that the model needs improving and that there are other better predictors.

The number of decayed (D), missing (M), and filled (F) teeth, as mentioned above, is a measure of the total effect of dental caries on dentition. The standardized coefficients ($\beta$s) for PDMF indicate the following significant predictors: sex, having/not having a regular source of dental care, residence, and dental utilization. More specifically, males have significantly fewer decayed, missing or filled teeth. Further, those who have a regular source of dental care tend to have more decayed, missing, and filled teeth. This result may suggest that having a regular source of care is a reflection of an individual's poor dentition status, rather than that having regular source results in poorer dentition status. However, increased contact with the dental care providers may result in some cases in increased numbers of missing and filled teeth. Further causal analysis is necessary to obtain a better understanding of these relationships. In comparison with those who live in large urban areas

with a population of more than 300,000, residents in small urban or rural areas are more likely to have more PDMFs. Residents in large urban areas may have better long term access to dental care and, as a result, a better dentition status. In addition, frequent brushing predicts high PDMFs. Again, this relationship may be a reversed one: higher PDMFs motivates the individual to brush more frequently. For the utilization behavior variable, the significant coefficients indicate that visiting a dentist before dental symptoms appear is predictive of fewer PDMFs.

The number of missing teeth (PMIS) is a dental mortality measure and represents the long term impact of dental caries. Two sociodemographic variables -- education and ethnicity -- are significant predictors of the number of missing teeth (Table 7). People with lower educational levels or who are Maori have more missing teeth. Health beliefs are not significant predictors for any of the evaluated oral health variables. Residents in small urban areas have significantly more missing teeth. Finally, flossing more frequently is a strong predictor of fewer missing teeth.

## Conclusion

Oral health status is probably more simply measured than general health status. Still, in selecting measures of perceived and evaluated oral health status to describe the status of the New Zealand sample, we were struck by the diversity of measures required to cover the dimensions of oral health more or less commonly accepted and described in the literature. Further, many of the measures did not correlate highly with each other adding fuel to the argument of diversity. For the 21 possible correlations among the seven measures of oral

health status, 8 were not significant at the .05 level and only 3 had correlations of .20 or greater.

Further, there may be a general expectation that developing models and measures to explain oral health status is less of a challenge than doing so for general health status. Again, our results belie such an expectation. We found the important explanatory variables from our model to vary considerably in the analysis of various health status measures. Further, our multivariate analysis left much to be explained in many of the runs suggesting that the problems of understanding oral health status are formidable, refinements in our model specifications and measures may be required and alternative study designs and methodologies may also be required for a more complete understanding.

Still these preliminary analyses in ICS II using the New Zealand data do provide some useful insights. Oral health outcomes and oral health behavior vary considerably across the age groups. Children, as expected, generally have better evaluated health status than adults, but do not necessarily have better perceived health status. Further, while they are likely to use dental floss more often than adults with natural teeth, they apparently brush less often. The elderly have worse dentition status than the middle aged and the majority are edentulous. However, the elderly with natural teeth have similar periodontal status and brushing habits to the 35 to 44 year olds. None-the-less they are less likely to floss than their younger counterparts.

The multivariate analysis hints that our model may be more successful in explaining perceived than evaluated health status. Within the evaluated dimension, we have a special problem in understanding periodontal status.

Location of residence is important in explaining a number of health status measures, with people in larger urban areas tending to have better evaluated health status (according to the dentition measures) but perceive their general oral health and quality of care as lower than their less urbanized neighbors. People with a regular source of care report better general health status and less need to have a tooth pulled, but they are more likely to report impaired social functioning and have a higher PDMF score. Beliefs are important for understanding some perceived measures of health but apparently not so for understanding evaluated measures. Those who consider oral disease to be serious are less likely to report need for teeth pulling and to be more satisfied with their dental care. However, they are also more likely to report impaired social functioning because of teeth.

Turning to behavior, we found oral hygiene behavior to be not significantly related to perceived oral health status. Fortunately, more flossing was predictive of better periodontal status and a smaller number of missing teeth. Studying the relationship between the use of dental services and perceived oral health status suffers some from the chicken and egg problem with our data sets. We found people with no visits in the last year to report better perceived health status. However, on the evaluated health status side we did find some relationships in the expected direction (and probably hoped for direction from the standpoint of the dental profession). Persons who went to the dentist for symptomatic reasons and those who did not go at all, had higher PDMF scores than those whose last visit was for preventive asymptomatic reasons.

These preliminary results from New Zealand reinforce our belief that the ICS II project has a unique and useful contribution to make at the descriptive level. At the

explanatory level we may be raising more questions than we are answering. We hope, however, with further analyses and the incorporation of comparative data from other sites that we are at least making a step in the right direction -- to better understand the individual and system determinants of oral health status and inform policy making to improve it.

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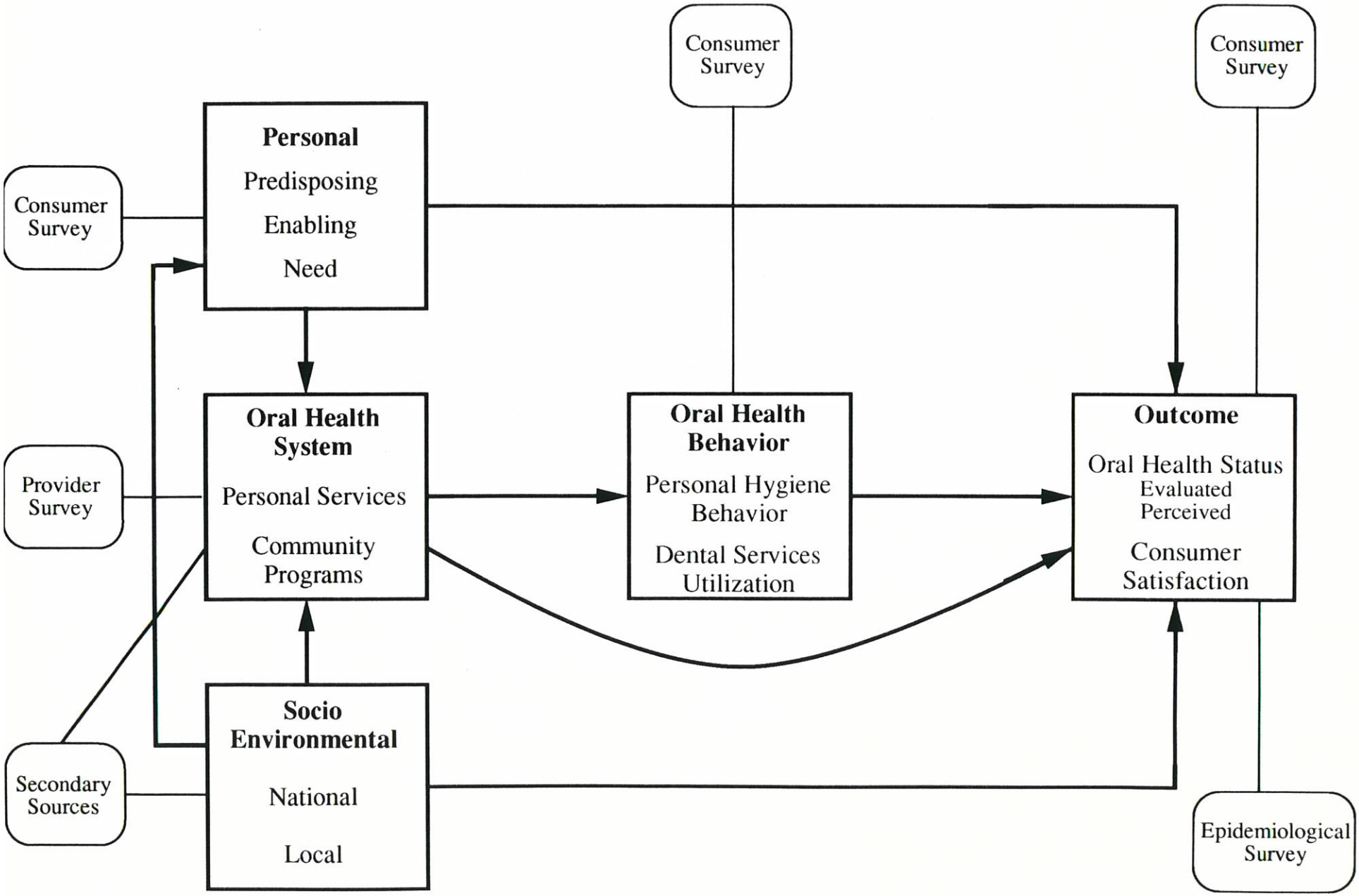
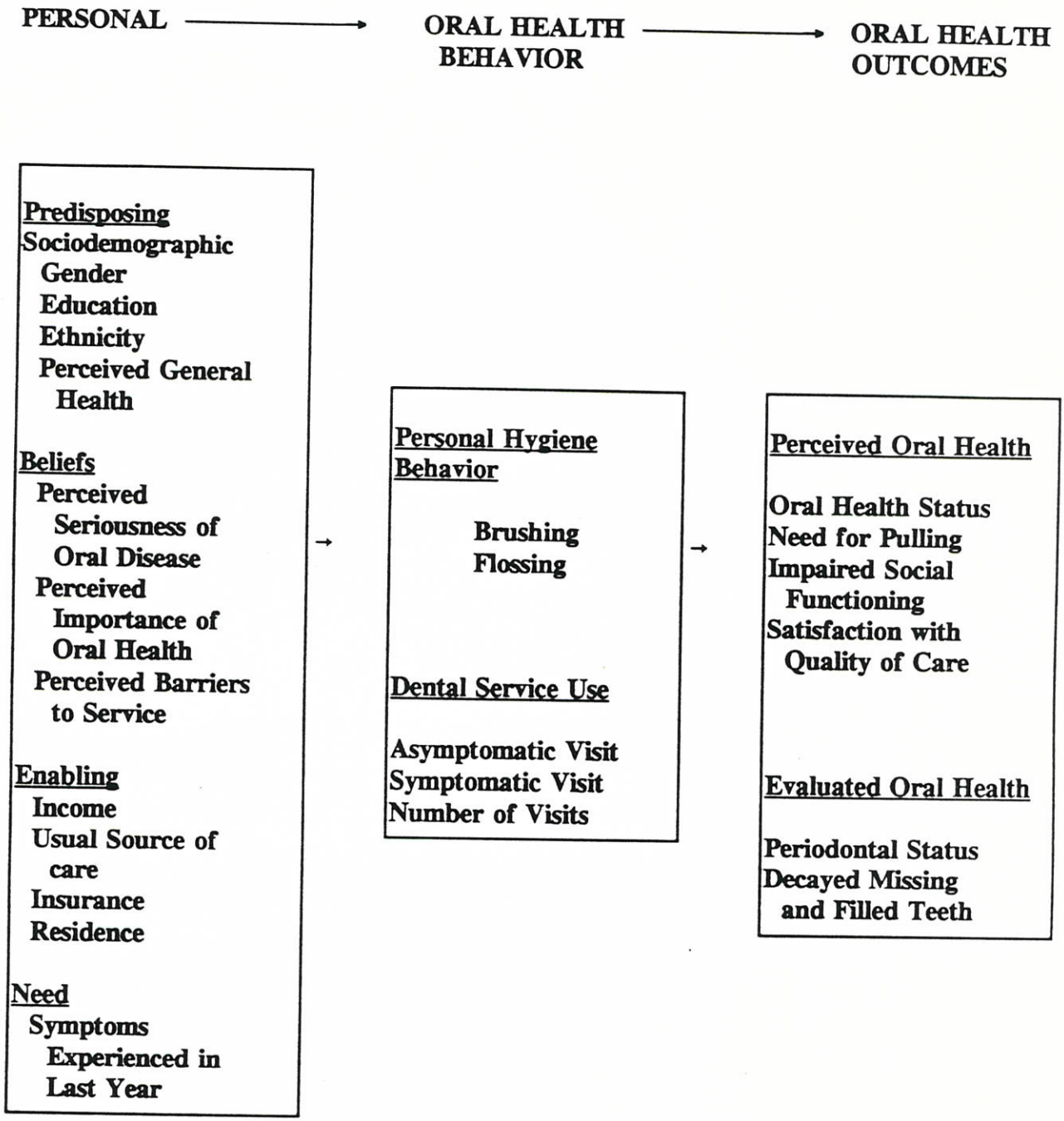
# Figure 1. ICS II Conceptual Framework



## *FIGURE II*

### Social Survey Determinants of Oral Health Outcomes



## TABLE 1

## MEAN NUMBER OF DECAYED MISSING AND FILLED TEETH FOR 13- AND 14-YEAR-OLD STUDENTS BY STUDY AREA (ICS I)

| | DECAYED | MISSING | FILLED | DMF TEETH |
|---|---|---|---|---|
| SYDNEY (Australia) | 2.5 | 0.5 | 3.7 | 6.7 |
| TRONDELAG (Norway) | 1.1 | 0.4 | 11.1 | 12.6 |
| HANNOVER (Fed Republic of Germany) | 4.4 | 0.4 | 4.0 | 8.8 |
| YAMANASHI (Japan) | 4.2 | 0.1 | 3.2 | 7.5 |
| BALTIMORE (USA) | 0.8 | 0.1 | 2.0 | 2.9 |
| ONTARIO (Canada) | 1.2 | 0.2 | 3.0 | 4.3 |
| CANTERBURY - (1973) (New Zealand) | 0.6 | 0.1 | 10.1 | 10.7 (13-14 year olds |
| NEW ZEALAND ICS II (1988) | 0.1 | .01 | 2.3 | 2.4 (12-13 YEAR OLDS) |

## *TABLE 2*

## *PERCENTAGE OF ADULTS 35-44 YEARS OF AGE WHO HAVE LOST ALL OF THEIR NATURAL TEETH BY STUDY AREA (ICS I)*

| | PERCENTAGE |
|---|---|
| SYDNEY (Australia) | 13.2% |
| TRONDELAG (Norway) | 6.4 |
| HANNOVER (Fed Republic of Germany) | 1.6 |
| YAMANASHI (Japan) | 0 |
| ONTARIO (Canada) | 8.7 |
| CANTERBURY (New Zealand) (1973) | 35.8 |
| NEW ZEALAND ICS II (1988) | 14.0 |

## *TABLE 3*
## *Oral Health Status of New Zealanders*

| PERCEIVED | 12-13 | 35-44 | 65-74 |
|---|---|---|---|
| Oral Health Status (Fair to Very Poor) | 18.1% | 24.9% | 18.2% |
| Need for Pulling | 7.1% | 11.9% | 8.0% |
| Avoidance of Laughing | 18.2% | 11.3% | 6.4% |
| Very Satisfied or Satisfied with Quality of Care | 95.7% | 97.2% | 99.1% |
| **EVALUATED** | | | |
| Periodontal Status | | | |
| Healthy | 73.3% | 10.46% | 10.93% |
| Bleeding | 5.5 | 2.86 | 2.04 |
| Calculus | 21.3 | 36.85 | 42.69 |
| Pocket 4.5mm | NA | 45.15 | 37.40 |
| Pocket 6mm or more | NA | 4.68 | 6.93 |
| No. of Decayed, Missing, and Filled Permanent Teeth | | | |
| 0 | 28.5% | | |
| 1-4 | 57.1 | | |
| 5-7 | 11.6 | | |
| 7-8 | 2.8 | | |
| 0 | | 2.99% | 0.16% |
| 1-10 | | 8.47 | 0.71 |
| 11-20 | | 32.06 | 7.10 |
| > = 21 | | 56.49 | 92.02 |

*continued TABLE 3*

## *Oral Health Status of New Zealanders*

| Permanent Missing Teeth | 12-13 | 35-44 | 65-74 |
|---|---|---|---|
| 0 | 99.6% | 26.41% | 0.16% |
| 1-5 | .4 | 40.18 | 4.14 |
| 6-12 | | 16.25 | 16.51 |
| 13-31 | | 7.46 | 20.68 |
| 32 | | 9.69 | 58.50 |

## *TABLE 4*

### *Oral Health Behavior of New Zealanders*

| Personal Oral Hygiene Behavior | 12-13 | 35-44 | 65-74 |
|---|---|---|---|
| Brushing (with natural teeth) | | | |
| Do Not Brush | 0.6% | 2.1% | 4.7% |
| Less than Once-A-Day | 18.3 | 5.6 | 6.2 |
| Once-A-Day | 34.8 | 22.6 | 21.6 |
| More than Once-A-Day | 46.2 | 69.6 | 67.4 |
| Flossing (with natural teeth) | | | |
| Do Not Floss | 45.4% | 50.7% | 63.9% |
| Once/Few Times-A-Month | 27.0 | 18.3 | 13.1 |
| Once/Few Times-A-Week | 19.2 | 19.7 | 13.5 |
| Once or More Per Day | 8.4 | 11.5 | 9.5 |
| Dental Services Use | | | |
| Number of Visits in Last Year | | | |
| 0 | | 43.9 | 70.4 |
| 1-2 | | 47.5 | 25.3 |
| >3 | | 8.0 | 3.1 |
| Asymptomatic Visit | | 28.7 | 12.7 |
| Symptomatic Visit | | 26.4 | 15.8 |
| No visit | | 43.9 | 70.4 |

*continued TABLE 4*

*Oral Health Behavior of New Zealanders*

| Number of Visits in Last Year to School Dental Nurse/Dentist | 12-13 |
|---|---|
| 0 | .5 |
| 1 | 18.0 |
| 2 | 31.4 |
| 3 | 15.3 |
| 4 | 12.1 |
| >4 | 22.7 |

## *TABLE 5*

**Personal Characteristics of 35-44 Sample**

| | | | |
|---|---|---|---|
| **PREDISPOSING** | | **ENABLING** | |
| **Sociodemographic** | | **Income** | |
| **Gender (M)** | **49.2%** | **< $10,000** | **4.6%** |
| **Secondary Education Completed** | | **$10,000 - 19,000** | **11.8** |
| **0** | **1.9%** | **$20,000 - 29,999** | **17.9** |
| **1** | **3.7** | **$30,000 - 39,999** | **22.5** |
| **2** | **14.3** | **$40,000 - 49,999** | **17.3** |
| **3** | **32.2** | **> = $50,000** | **25.8** |
| **4** | **27.3** | **Usual Source of Care** | **76.9** |
| **>4** | **20.3** | **Insurance Covering Dental care** | **11.8** |
| **Ethnicity (Maori)** | **6.2%** | **Residence** | |
| **Perceived General Health** | | **Large Urban** | **38.9%** |
| **Excellent** | **25.6%** | **Small Urban** | **52.7** |
| **Very Good** | **42.4** | **Rural** | **8.4** |
| **Good** | **24.6** | | |
| **Fair/Poor/Very Poor** | **7.4** | | |

*continued* ***TABLE 5***

**Personal Characteristics of 35-44 Sample**

| **Beliefs** | | **NEED** | |
|---|---|---|---|
| **Perceived Seriousness of Oral Disease** | | **Symptoms Experienced in Last Year** | |
| **1 (Low)** | **0.0%** | **0** | **19.2%** |
| **2** | **3.6** | **1** | **25.2** |
| **3** | **74.1** | **2** | **20.6** |
| **4 (High)** | **17.5** | **3** | **13.2** |
| **Perceived Importance of Oral Health** | | **4** | **10.4** |
| **1 (Low)** | **0.0%** | **5-8** | **11.4** |
| **2** | **11.6** | | |
| **3** | **72.8** | | |
| **4 (High)** | **11.6** | | |
| **Perceived Barriers to Service** | | | |
| **0** | **32.3%** | | |
| **1** | **38.6** | | |
| **2** | **18.8** | | |
| **3 (Maximum)** | **3.1** | | |

## *TABLE 6*

### MULTIVARIATE ANALYSIS OF PERCEIVED ORAL HEALTH OUTCOMES

| | PERCEIVED ORAL HEALTH (REGRESSION - $\beta$) | NEED FOR PULLING (LOGIT - t) | IMPAIRED SOCIAL FUNCTIONING (LOGIT - t) | SATISFACTION WITH DENTAL QUALITY (REGRESSION - $\beta$) |
|---|---|---|---|---|
| Sociodemographic | | | | |
| Male | .07 | .52 | 2.62** | .04 |
| Ed. | .00 | -1.19 | .25 | .00 |
| Gen Hlth | .20*** | -.68 | .05 | .02 |
| Maori | -.02 | -1.37 | -.13 | .02 |
| Beliefs | | | | |
| Seriousness | .07 | -3.10*** | 1.92* | .23*** |
| Importance | -.01 | -.35 | -.86 | .06 |
| Barriers | -.07 | 2.29** | -2.42** | -.08 |
| Enabling | | | | |
| Income | .03 | -1.55 | .17 | .06 |
| Source | .11** | -2.53** | 1.67* | .08 |
| Small Urban | .12** | 2.04** | -.44 | .14*** |
| Rural | .04 | -.97 | 1.37 | .06 |
| Oral Hygiene Behavior | | | | |
| Brushing | .01 | -1.23 | -.50 | .06 |
| Flossing | .01 | -.80 | .17 | .01 |
| Dental Utilization | | | | |
| Symptomatic Visit | .00 | 1.69* | .91 | -.08 |
| No Visit | .17** | -.30 | -1.00 | .06 |
| $R^2$ | .14 | | | .14 |

*P <.1 **P <.05 ***P <.01

**TABLE 7**

**MULTIVARIATE ANALYSIS OF EVALUATED ORAL HEALTH OUTCOMES**

| | PERIODONTAL STATUS $\beta$ | PDMF $\beta$ | PMIS $\beta$ |
|---|---|---|---|
| Sociodemographic | | | |
| Male | .14*** | -.12** | -.06 |
| Ed | -.02 | -.02 | -.14*** |
| Gen Hlth | -.10* | -.03 | -.05 |
| Maori | .02 | -.06 | .10** |
| Beliefs | | | |
| Seriousness | -.00 | -.01 | .03 |
| Importance | .03 | .05 | .05 |
| Barriers | .03 | .03 | .03 |
| Enabling | | | |
| Income | .02 | .06 | -.01 |
| Source | .02 | .13** | -.04 |
| Small Urban | .02 | .15*** | .18*** |
| Rural | -.04 | .13** | .08 |
| Oral Hygiene Behavior | | | |
| Brushing | -.03 | .10* | .05 |
| Flossing | -.11** | -.03 | -.14*** |
| Dental Utilization | | | |
| Symptomatic Visit | -.04 | .13* | .00 |
| No Visit | -.02 | .13* | -.04 |
| $R^2$ | .05 | .11 | .12 |

*P <.1 **P <.05 ***P <.01