CHAPTER 4: RESEARCH METHODOLOGY
The study was an integral part of the Second National Oral Health Survey of Vietnam 1999. This survey served as the first major attempt to study broad aspects of oral diseases and their possible links with other socio-economic and behavioural factors among the Vietnamese population.

4.1 THE NATIONAL ORAL HEALTH SURVEY OF VIETNAM 1999

The health care system, as well as dental care services in particular, are undergoing dramatic changes in Vietnam. The economic improvement and changes in people’s perception of health and disease are stimulating the use of dental health care services. Dental professionals and oral health policy planners need more up-to-date and accurate information of the patterns of the disease among the population in order to predict possible disease trends and establish plans for future goal achievement. The National Oral Health Survey in Vietnam 1999 was conducted to pursue a strategic approach to improving the population’s oral health and access to dental care.

The dental knowledge base is very limited in Vietnam, especially knowledge of prevention and community dental measures. Existing data on the population’s experience of oral health and disease are limited in number and in quality. The first National Oral Health Survey of Vietnam in 1989 gathered data mainly on children and showed a high prevalence of dental disease with a high proportion of untreated cases. Several other ad hoc studies on the adult population documented a high prevalence and severity of periodontal disease and poor oral hygiene status of the population. However, these studies were mostly conducted using recently challenged CPITN criteria for periodontal disease and their study samples may not have represented the Vietnamese population. This situation had created a need for a well-designed and conducted population-based national survey.
In 1996 a Memorandum was signed between the Hanoi Institute of Odonto-Stomatology Vietnam (HIOS) and the Dental Statistics and Research Unit (DSRU) of the Australian Institute of Health and Welfare (AIHW), Adelaide University, Australia about collaboration in conducting the survey. From the beginning of 1998, preparation of documents (proposal, questionnaire and examination forms) was done at the DSRU with contribution of two Vietnamese postgraduate students (including the author) studying in Social and Preventive Dentistry, Adelaide University. During the visit of the Vietnamese Vice-Minister of Health and Director of HIOS in Adelaide early in 1999, the project received official approval and it was decided to commence the survey in the second half 1999.

The present nested study was designed to be consistent with the aims and scope of the survey. In combination with earlier studies, it helped document the current disease burden and disease trends over time. Also, considerable effort was put into the collection of a broad variety of information on subjects, including socioeconomic status and risk status for dental diseases, so that the disease distribution among different population groups could be explored and analysed to uncover those groups at greatest risk. Further, the survey provided a good environment to a more extended and accurate study on periodontal disease in the adult population, which was recognised as a problem in earlier studies.

The survey was conducted under the supervision of the Ministry of Health of Vietnam. The DSRU provided assistance and advice in planning, sampling design, methodology, examiner calibration, data capture and preparation and analysis.
4.1.1 Sampling design

The sampling strategy for the survey was a multi-stage stratified random sample of community-dwelling civilian adults (the child sample is not considered here because the present smoking study was conducted only among the adult population).

Vietnam is administratively divided into seven areas based on location and geographic features with a total of 61 provinces and cities. It was decided to select two provinces from within each administrative area even though there are different numbers of provinces in each area and different population sizes of provinces. The rationale for this selection was that each area could have its specific geographic location, lifestyles and life habits, level of economic development and even level of access to health care. In addition, the data on the area level as well as on the country and province levels can be relevant in policy planning for a health care system.

Hanoi and HoChiMinh City (the two largest metropolitan economic and political centres) were purposively selected because of their important features. The other 12 provinces were randomly selected from the lists of provinces in each area with probability of selection proportional to population size of provinces. Similar steps were made to select districts, wards and blocks in each of the 14 provinces. Population sizes of provinces and districts were obtained from the Vietnam Statistical Yearbook 1998.

All adult inhabitants in the cluster were stratified by age into three groups: 18–34; 35–44 and 45+ years old and then listed by group. In 12 provinces, excepted for Hanoi and Quangngai, there was the intention to obtain 12 subjects in each age group for the general adult study. The selection process was carefully planned beforehand and the instructions were explained to local medical personnel who were in charge in subjects’ selection at their locality (see Appendix 4). Also, these personnel were in charge of informing selected subjects about the survey, their responsibility, time and place of proposed interview and dental examinations and in preparation of the necessary place
and examination conditions for the team. All these procedures were completed before the dental examination team’s arrival at the selected area.

4.1.2 Preparation procedures

The sampling selection procedures were done in the DSRU by its staff, with the HIOS supplying lists of all necessary areas and population sizes. The list of selected wards for the whole country was sent to Vietnam for further preparation.

The specially prepared fieldwork plans, questionnaire and examination forms had been completed and pre-tested through skirmish in the DSRU and then sent to Vietnam in both Vietnamese and English versions before the commencement of training and calibration sections.

Professor AJ Spencer and Dr K Robert-Thomson from Social and Preventive Dentistry, Adelaide University, ran two one-week training and calibration sessions in HoChiMinh City and Hanoi. Two dental teams of 16 persons in each gathered in the sessions to take part in the training and calibration courses, after which six examiners had been selected as well as six recorders in each team. Also, local medical personnel who were in charge in a selected locality were gathered to learn the method of subject selection and other necessary procedures for the survey. During the training sessions, the teams became acquainted with examination criteria and practiced examining patients following the instructions and criteria. Those examiners who were consistent with the instruction and with each other were selected as examiners.

4.1.3 Equipment

Equipment had been organised to ensure that all examiners used the same equipment and had the same working conditions. The DSRU provided intra-oral fibre-optic lights, ‘Denlite’, with disposable mirror and CPI probes for general study as well as NIDR
probes for the nested research study. The HIOS and the HoChiMinh City Institute of Odonto-Stomatology (HCMIOS) provided transport, sterilising solutions and boxes, protective measures and other necessary equipment.

Colgate Vietnam provided toothpaste and toothbrushes as an incentive for subjects taking part in the survey. This aimed to increase the response rate in the survey.

### 4.1.4 Fieldwork procedures

Prior to the commencement of the survey, the Ministry of Health of Vietnam had sent an informing letter to all administrative and medical organisations in selected provinces, districts and wards requiring collaboration in the project. It had been organised that the dental team was joined by a person in charge from local administrative and/or medical organisations during fieldwork in every area.

When the time of examination was decided for a site, the local authorities sent letters authorised by the local administration to every selected subject to invite them to an examination. This procedure was employed to get high attendance of subjects, because local authorities often have more influence on their local residents than any other groups.
4.2 THE NESTED STUDY ‘SMOKING AND PERIODONTAL DISEASE AMONG VIETNAMESE MIDDLE-AGED ADULTS’

The present nested ‘Smoking and periodontal disease’ study, being a part of the National Oral Health Survey of Vietnam, had exactly the same steps and procedures of the survey excepted for number of sites, number of subjects at a site and interview, questionnaire, examination forms and equipment.

4.2.1 Study population

The study population was defined as the 35–44-year-old civilian population living in the two selected provinces, Hanoi and Quangngai. The institutionalised population and members of armed services who live in army camps were not included. Nevertheless, this population fraction is small in those two provinces.

Sample size calculation was based on the WHO practical manual *Sample size determination in health studies* by Lwanga and Lemeshow (1991). Given the level of significance $\alpha$ being 5%, power of the test 90%, and the prevalence of periodontal disease among general population 15%, and among smokers 30%, the minimum sample of each group was 131 subjects. Allowing for 10% variation, the sample size was increased up to 150 in each group. The prevalence of smoking in Vietnam was assumed to be 30% (Jenkins et al., 1997) so that the total sample size must be at least 535 subjects in order to get at least 150 smokers. This number was rounded up to 600 subjects in total. Given an expected response rate of approximate 80%, it was decided to select 680 subjects for the present nested study.

4.2.2 Sampling strategy

The present nested study was to comply with all requirements and strategies of the National Oral Health Survey of Vietnam and was confined within its sampling frame.
However, the target population was only 35–44-year-old community-dwelling non-institutionalised adults. Loss of attachment measurement requires high technical preparation, equipment and demands high examiner reliability. Therefore, as few examiners as possible were used in the fieldwork, which was conducted in fewer locations to ease the organisational difficulties. Thus, the decision was made to select two provinces from the list of 14 selected provinces for the survey but to increase the number of clusters involved in each province. Hanoi was randomly chosen from the two previously purposively selected major cities. The second province, Quangngai, was randomly selected from the list of 12 others. Quangngai is a typical rural province in the South Central Coastal area (Figure 4.1: Vietnam Map).

Four districts had been selected in Hanoi and two in Quangngai. Later, one ward in each Hanoi district and two wards in each Quangngai district were selected randomly in the sample selection process of the survey to make the number of wards selected total eight. The number of clusters in each ward was different to that for the survey in each ward five clusters were randomly selected with probability proportional to size resulting in 40 clusters for the study.

In each cluster a total of 17 subjects were targeted for the study. The subjects’ selection process and all contacting and informing procedures were designed and planned in advance (Figure 4.2)
Figure 4.1: Vietnam map. Selected provinces in circles.
4.2.3 Invitation to participate

Ethical approval was received from the Committee on Human Experimentation, Adelaide University. The present study was a part of the survey and was under the same conditions as the whole survey. It was decided to send a letter to selected subjects inviting them to participate in the study. Local medical personnel were in charge of informing subjects about the aims and scope of the survey, explaining social and dental surveys and requesting them to participate. A consent form was designed and approved in the DSRU before being sent to Vietnam. However, owing to the specific characteristics of an Asian developing country, signing a written consent form was thought as unnecessary by the leadership in Vietnam.
Figure 4.2: Schematic diagram of multistage stratified random selection used in the study.

<table>
<thead>
<tr>
<th>STUDY: PERIODONTAL DISEASES IN ADULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Administrative Areas</td>
</tr>
<tr>
<td>Hanoi &amp; HCM city</td>
</tr>
<tr>
<td>Hanoi</td>
</tr>
<tr>
<td>Four districts</td>
</tr>
<tr>
<td>1 ward in each district</td>
</tr>
<tr>
<td>5 clusters in each ward</td>
</tr>
<tr>
<td>2 wards in each district</td>
</tr>
<tr>
<td>Vector of Stratification and random selection of subjects 35-44 yo</td>
</tr>
<tr>
<td>No contact</td>
</tr>
<tr>
<td>Yes contact</td>
</tr>
<tr>
<td>Re contact</td>
</tr>
<tr>
<td>Successful</td>
</tr>
<tr>
<td>Substitution of 5 subjects per cluster, contacted if needed</td>
</tr>
<tr>
<td>No response</td>
</tr>
<tr>
<td>Failed to attend</td>
</tr>
<tr>
<td>Failed</td>
</tr>
<tr>
<td>Study subjects</td>
</tr>
<tr>
<td>Attended</td>
</tr>
<tr>
<td>Interview</td>
</tr>
<tr>
<td>Examination</td>
</tr>
<tr>
<td>Estimate: 680 subjects</td>
</tr>
</tbody>
</table>

- Total 6 districts
- Total 8 wards
- Cluster is defined as a block
- 20 clusters in each province
- Total 40 clusters
- List of households available in administrative point of each cluster
- Selection by random drawing.
- 17 subjects per cluster.
4.2.4 Social survey

A special questionnaire and examination form prepared in English in the DSRU were discussed and tested carefully. The Vietnamese translation was made from the English version. Both versions had been tested with Vietnamese overseas students, including several postgraduate students in linguistics and local Vietnamese Australians with different backgrounds. All comments were recorded and used if applicable and changes were made until a satisfactory version was completed. Where necessary, different dialects with the same meaning were used to make sure people from different dialectical locations could understand clearly (the questionnaire form is in the appendix for reference).

Upon attending the examination point, every subject was given a questionnaire and requested to complete it. Subjects who could not read or/write were interviewed by persons from either the dental team or local medical station.

Recorders were instructed to check the completed questionnaire when the subject was about to be examined. This instruction helped to discover and correct unanswered and misunderstood questions. Examiners did not have access to the questionnaire before or during the dental examination.

4.2.5 Clinical assessment

4.2.5.1 Indices and criteria

A special document of indices and their criteria for clinical assessment had been prepared based on recognised protocols, with some modification to satisfy specific requirements of the study. A full document is presented in the appendix. The following is a brief description of indices and criteria used in the study.
a. **Oral mucosa (WHO 1998)**

Every subject was assessed for mucosal lesions following the WHO instruction of mucosal assessment for eight different mucosal lesions. Each observed lesion was recorded to its location. There might be several lesions in one location or/and one lesion in several locations.

b. **Edentulism**

Edentulism was marked separately for upper and lower jaws when one or other jaws had no natural teeth present, or present teeth in the jaw were all indicated for extraction.

c. **Denture**

Denture status was marked as full, partial and fixed dentures separately for upper and lower jaws when the subject wore a denture(s) on a daily basis.

d. **Salivary flow**

The assessment of salivary flow was a subjective assessment based on clinical signs and consequential questioning of the subject by the examiner. For the purposes of the present study, salivary flow was characterised as ‘normal’ or ‘low’.

e. **Plaque Score (Löe & Silness, 1963)**

Plaque was assessed on the buccal surface of the most anterior molar in each lateral quadrant and labial surface of tooth 11 and 31. When the index tooth was not available the sextant was excluded.

f. **Decayed, Missing and Filled Teeth Index (DMFT) (WHO, 1998)**

A modification of the WHO DMFT Index was employed to assess the tooth crown caries status of examined subjects. In addition to the original index, unsatisfactory fillings were scored and missing teeth were recorded without defining reasons of extraction.
D-component included all teeth with crown decay and filled teeth with decay and teeth with lost fillings.

M-component comprised missing teeth due to any reason.

F-component included teeth with sound fillings and unsatisfactory fillings but without decay.

g. **Loss of periodontal attachment (NIDR, 1987)**

Before clinical assessment, the examiner ensured subjects’ medical fitness for periodontal probing. Subjects who had a heart disorder, including a history of rheumatic fever, implants or transplants, or bleeding disorders were excluded from the periodontal examination.

Loss of attachment (LOA) was assessed in two sites per tooth: mesial and buccal of each fully erupted tooth. Third molars were excluded. The US NIDR probes were used with yellow band in 2–4, 6–8 and 10–12 mm.

- **Gingival Recession (GR):** Defined as the distance (in millimetres) from the cemento-enamel junction (CEJ) to the free gingival margins (FGM). The distance was rounded down to the nearest whole millimetre.

  GR for a site was excluded when the recession at this site could not be estimated. This occurred most commonly when the position of the CEJ could not be estimated at that site due to gross calculus or a large restoration.

  Negative recession was marked when the CEJ was apical to the FGM by 1+mm. If the CEJ was apical less than 1 mm, the distance was rounded down to zero.

- **Probing depth:** was defined as the distance from the FGM to the bottom of the periodontal pocket. This was recorded even if the recession at that site was excluded for any reason. Distance was rounded down to the nearest whole millimetre.
Excluded pocket depth was marked when the probing depth could not be assessed, for example because of calculus or difficulty aligning the probe correctly.

- Loss of periodontal attachment was defined as the sum of gingival recession and pocket depth in a site. It was calculated after examination, during analysis.

- Calculus was marked as ‘Yes’ or ‘No’ for a site indicating a presence or absence of supra- or sub-gingival calculus detected at that site. Calculus was observed visually or was detected with the aid of the NIDR probe. No quantification of calculus was made.

- Bleeding was marked as ‘Yes’ or ‘No’ for a site indicating whether, after probing to the base of the pocket at any of the two sites per tooth, bleeding was observed immediately after probing. Bleeding which did not appear within ten seconds of probing was not included.

The mesial site was approached from the buccal aspect, keeping the probe in the direction of the long axis of the tooth and as close to the contact point as possible, even if the adjacent tooth was missing. The buccal site was assessed at the midpoint of the buccal surface and, in the case of upper and lower molars, at the midpoint of the mesial root. The probing pressure was light and not to exceed 25 grams. It was tested by putting the tip of the probe under the nail of the big finger until bleaching occurred. The tip of the probe was pointed toward the apex of the tooth during measurement.

The location of the CEJ often must be estimated. If a crown was in place the margin of the crown was used as the CEJ. If root caries or a root restoration was present, location of the original CEJ was estimated depending on adjacent teeth and anatomical configuration. If CEJ could not be estimated in any way, the site was excluded.
4.2.5.2 Examiner calibration

During the training course in Hanoi, the method of the periodontal examination was carefully explained to a group of four dentists including the author who was the first examiner. One dentist from the HIOS had been selected as the second examiner because of her good performance in the general training sessions, while two others were recorders. The training was run until the two examiners were in considerable agreement in measurement. During the fieldwork, the examiners performed replicate exams on about 5% of subjects to test inter- and intra-examiner reliability.

A group of 30 subjects was asked to be re-examined in the same day after original examination by either the same or the other examiner to test the intra- and inter-examiner reliability. Both examiners performed examinations on 12 subjects; the first examiner (GLD) re-examined eight of his own subjects and the second examiner (HDH), ten of her own subjects. These data were used to calculate a reliability score using the SPSS software package Version 10.07. The method used was similar to that reported by Beck et al. (1990). The agreement in measurement of GR and PD were calculated as a percentage of sites within 1-mm variation. Intra-class Correlation Coefficients (ICC) were calculated using Reliability test in SPSS with Two-way Mixed Model. Kappa scores were calculated for detection of calculus and bleeding after probing. Separate calculations were made for inter-examiner and intra-examiner reliability of each examiner and shown in tables 4.1 through 4.3.
**Table 4.1**: Site specific agreement in GR and PD allowing for 1mm variation.

<table>
<thead>
<tr>
<th>Site-specific GR %</th>
<th>Site-specific PD %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-examiner reliability</td>
<td>90.6</td>
</tr>
<tr>
<td>Intra-examiner reliability</td>
<td></td>
</tr>
<tr>
<td>Examiner 1</td>
<td>89.1</td>
</tr>
<tr>
<td>Examiner 2</td>
<td>90.1</td>
</tr>
</tbody>
</table>

**Table 4.2**: Intra-class Correlation Coefficients (ICC) for GR and PD

<table>
<thead>
<tr>
<th></th>
<th>ICC for GR (95% CI)</th>
<th>ICC for PD (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-examiner reliability</td>
<td>0.81 (0.78–0.84)</td>
<td>0.85 (0.82–0.87)</td>
</tr>
<tr>
<td>Intra-examiner reliability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examiner 1</td>
<td>0.89 (0.86–0.91)</td>
<td>0.87 (0.82–0.91)</td>
</tr>
<tr>
<td>Examiner 2</td>
<td>0.74 (0.57–0.70)</td>
<td>0.77 (0.72–0.80)</td>
</tr>
</tbody>
</table>

**Table 4.3**: Kappa scores for calculus and BOP detection

<table>
<thead>
<tr>
<th></th>
<th>Calculus</th>
<th>BOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-examiner reliability</td>
<td>0.78</td>
<td>0.62</td>
</tr>
<tr>
<td>Intra-examiner reliability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examiner 1</td>
<td>0.70</td>
<td>0.62</td>
</tr>
<tr>
<td>Examiner 2</td>
<td>0.79</td>
<td>0.52</td>
</tr>
</tbody>
</table>
4.2.6 Fieldwork procedures

Samples of 17 subjects within the 35–44 age group had been selected and informed about the study before the dental examination in each selected cluster. Every subject received a confirmation letter from the local authorities a few days before examination informing them about the time and place of the dental examination. This procedure was aimed at producing an acceptable attendance by subjects, especially in rural areas.

Subjects were examined sitting in a chair with a headrest, with the examiner in the eight or nine o’clock position using a portable fibre-optic light attached with disposable mirror and NIDR probe. The horizontal position of subjects would have been more convenient for examiners, but it was avoided owing to the possible lack of an appropriate examination room in some places, as many women would not lie down in front of other people. The two examiners always worked closely to each other and held discussions over difficult cases in order to improve consistency.

NIDR probes were scrubbed with a brush and cleaning detergent and consequently left in disinfecting solution for at least 30 minutes. Further, clean probes were dried with clean absorbing paper. At the end of each examination day, all probes were cleaned and left in sterilising solution over night. Examiners used protective glasses, mask and disposable examination gloves.

Completed examination forms and questionnaires were stapled together and stored in a specially prepared box marked by province and district. All documents were transported to and kept in the HIOS and sent to the DSRU for data set preparation and analysis.

4.2.7 Data set preparation

A data entry screen was designed in Microsoft Access Version 97. Data were entered by one person who was also responsible for checking errors. The entered data set was
checked for accuracy, cleaned and exported to Dbase IV and subsequently read by SPSS Version 10.07 (SPSS Inc).

4.2.8 Data analysis

4.2.8.1 Study variables

Dependent variables

A number of oral health outcomes variables recorded during clinical examination were used as dependent variables. These variables must reflect the prevalence, extent and severity of periodontal disease observed in an individual. Since clinical outcome measures were recorded at the site level as gingival recession and pocket depth, the dependent variables were re-calculated as variables in the individual level.

- **Bleeding on probing (BOP)**
  Clinically examined. Recorded as presence or absence at every probed site. Pooled as mean percentage of sites with BOP and the prevalence of subjects with at least one site with BOP.

- **The prevalence of periodontal destruction**
  Calculated from clinically examined GR, PD and calculated LOA. A number of discrete thresholds in millimetres were used.

  - Cases with moderate-to-severe periodontitis were defined as having 2+sites with LOA≥4 mm and 1+site with PD≥3 mm.
  - Cases with severe periodontitis were defined as having 2+sites with LOA≥5 mm and 1+site with PD≥4 mm.

- **The extent of periodontal destruction**
  Calculated as the percentage of sites with GR, PD and LOA more than or equal to a number of discrete thresholds for every individual.

- **The severity of LOA**
  Calculated as the mean LOA at sites with LOA≥2 mm for every individual.
The worst score of periodontal destruction

Independent factors

Sets of variables were assigned to be used in the descriptive and inferential analysis for hypothesis testing. Number of variables collected in the social survey questionnaire and clinical examination were used as independent variables. Factors were grouped into several main groups of factors: socio-demographic, medical, behavioural and oral groups.

- Smoking history: Self-reported as smoker or non-smoker. Information on time, amount and type of tobacco consumption was collected from current smokers (CS). Non-smoker (NS) was asked for possible past smoking history, former smoker (FS) was asked for type of tobacco, time since stopped and time smoked.

Three variables were used as independent factors in the subsequent analysis:

- Smoking history: CS, FS and NS
- Pack-years calculation: continuous variable; NS and FS were assigned value of 0*. Calculated by multiplying number of packs per day by number of years smoked.
- Categorical pack-year: subjects were assigned into groups by mean of pack-years.
  - Light smoker (LS) had mean pack-years 0 < and ≤ 5.0
Heavy smoker (HS) had mean pack-years >5.0
Former smoker (FS): past smoker
Non smoker (NS): never smoker

*: FS were assigned a value of 0 because no information on the amount of tobacco consumption was collected among FS.

**Other contributing factors**

- Socio-demographic factors
  - Sex: Self-reported
  - Age: Self-reported in years
  - Income: Self-reported as monthly household income. Additional information on owning certain material items was collected.
  - Education: Self-reported as the highest level of complete or incomplete education attainment.
  - Occupation: Self-reported as daily job.
  - Residency: Urban or rural. Dependent on subject’s living place, which was administratively classified.

- Medical factors
  - General: Self-reported as presence or absence of a number of diseases or conditions. These diseases or conditions included those that had been diagnosed by medical personnel.
  - Use of medications: Self-reported whether the subject used any of a list of indicated medications for a period of at least two weeks during the last six months.
### Behavioural factors

- **Tooth brushing**: Self-reported whether subject brushed teeth on the previous day. Frequency of tooth brushing and subject’s opinion about tooth brushing. Use of toothpaste was also reported.

- **Other means of personal hygiene**: Self-reported. Asked for mouth rinsing, use of tooth floss and toothpicks.

### Oral factors

- **Plaque accumulation**: Clinically examined. Plaque Index by Löe and Silness (1963).

- **Presence of calculus**: Clinically examined. Recorded as present or absent at every site. No quantified assessment of location relative to gingival margins.

- **Salivary function**: Clinically examined. Recorded as normal or reduced. Modified FDI criteria.

- **Dental visiting pattern**: Self-reported. Asked for the last dental visit, time, reasons for visit and dental care provider.

- **Treatment received**: Self-reported. Asked for treatment received at the last dental visit, type and self-reported outcome.

#### 4.2.8.2 Analytical approach to the study objectives

Several analytical approaches were employed to achieve the main objectives of the study. Some information gathered through the questionnaire might not be readily suitable for analysis owing to the attempt to get as precise information as possible. Variables containing too few numbers of subjects in their categorical sub-groups were
re-grouped into smaller numbers of groups with higher subjects to increase the power of statistical tests.

Demographic factors were designed as categorical variables to enable the comparison between groups. Except for sex, these factors were assigned as ordinal variables.

The Plaque Index (Löe & Silness, 1963) provides qualitative data on plaque accumulation in a maximum of six sextants per subject, which can be used in a number of ways. Mean plaque score and the worst plaque score were calculated for comparison at the individual level.

Although outcome variables of periodontal status were recorded at the site level, most of inferential statistics were performed at the subject level. This was decided owing to the fact that explanatory variables were measured at the individual level. For instance, the main explanatory factor, smoking, was assessed at the individual level based on the subject’s smoking status. No site-based explanatory variables were collected during the study. Outcome variables of periodontal status were calculated as subject-based values. However, this can lead to a loss of some information compared to site-based variables given that up to 56 site measurements (28 teeth × 2 sites) might be made in a subject.

Descriptive statistics were used to describe the sample and its characteristics. Continuous variables were analysed by parametric methods including mean, standard deviation, skewness, and standard error. Categorical variables were described as frequencies and their distribution.

Several statistical tests were used dependent on the type of variables of interest. Chi-square was used to test the statistical association between categorical variables. Analysis of variance (ANOVA) was used to test differences in means values between groups. For grouping variables with more than two categories, the Scheffe post hoc test was used to identify the direction of the differences.
Binary logistic regression analysis was used in multivariate models for dichotomous variables reflecting the presence of moderate-to-severe or severe periodontitis. Method Enter was used in variable selection in the models. It means that all named variables were entered in a single step without checking any of the entry criteria except tolerance. The cut-off point was 0.5 in the model for moderate-to-severe periodontitis and 0.2 for severe disease. The Odds Ratios as well as the level of significance of the association were reported.

Linear regression models were used for continuous variables such as the extent of sites with PD≥4mm and LOA≥3mm. These variables were used because they were components in case definitions. Also, these levels of destruction can be of clinical importance. The level of significance and the direction of the association were reported.

4.2.8.3 Data re-weighting

Collected data were re-weighted by sex and residency in order to correct possible selection bias and to allow for a stratified sampling scheme. Rationale for data re-weighting was that the main study variable, smoking, might be confounded by sex and residency. The re-weighting process was made to increase the representativeness of the findings for the 35–44-year-old general population of the selected provinces. There was a slight underestimation of the male population in the responded sample. Also, the sample was stratified by residency with the aim to select a higher proportion of the more heterogenous urban population. These effects were corrected through the re-weighting process.

The re-weighting was achieved using the re-weighting scheme used by Slade and Spencer (1995) and Slade, Gansky and Spencer (1997). Weight of each stratum by sex and residency was calculated by dividing the stratum-specific population size (obtained from Census Data of Vietnam) by the stratum-specific sample size. The results were further divided by the quotient of the complete population size of the two provinces by
the complete sample size. This step was made to avoid inflating the total number of cases used for analysis. Except for the report on the responded sample, all data were re-weighted by this calculated weight in analyses.

4.2.8.4 Case definition of established periodontitis

In order to define cases with established periodontitis to use in the multivariate models, a specific case definition was worked out. As discussed earlier in chapter 1, there is an absence of a uniform case definition of established periodontitis that would enable comparison between studies. Researchers often use case definition of the disease, which would be more relevant to the objectives of their studies.

A number of factors were taken into account in defining the cases in the present study. First, the age span of the sample would indicate low prevalence of the disease. Second, the main objective of the study was to examine the association between smoking and periodontitis, which needed enough subjects in each tested group to enhance the statistical power of the test. Thus, a case definition must be chosen to get a considerable number of subjects with the disease among the low prevalent sample. Finally, the case definition must be methodologically and clinically appropriate.

Periodontal research has revealed a close relation between clinical recorded pocket depth and attachment loss. These two measurements are the most reliable signs of the disease. Thus, it is wise to use a combination of these clinically detectable measurements in defining established periodontitis.

In the study of the elderly, Beck et al. (1990) defined cases with advanced periodontitis as having 4+ sites with LOA≥5 mm and 1+ of those sites with PD≥4 mm. This definition itself covers both gingival margin dependent PD and attachment loss, which is based on fixed landmarks. However, this definition would not be appropriate for the present
study due to the younger ages of the sample. The prevalence of established periodontitis in the present study can be expected to be lower compared to the Beck et al. study.

The decision had been made to adopt the Beck et al. (1990) case definition with some modification. Cases with $2^+$ sites with \( \text{LOA} \geq 4 \text{ mm} \) and $1^+$ site with \( \text{PD} \geq 3 \text{ mm} \) were defined as having moderate-to-severe periodontitis. Further, cases with $2^+$ sites with \( \text{LOA} \geq 5 \text{ mm} \) and $1^+$ site with \( \text{PD} \geq 4 \text{ mm} \) were considered as having severe disease. The sites with PD were not necessarily included in sites with LOA that were defining the cases.

### 4.2.8.5 Missing data

A number of respondents failed to answer some questions, resulting in a proportion of missing data. Almost all variables such as smoking, income and education had few missing cases (less than 5 subjects or 1%) and consequently were left unchanged. The question on the last dental visit was not responded by 84 individuals and was treated with care. The three groups of respondents and non-respondents to this question were compared for age, sex distribution, income and smoking status. There was no statistically significant difference between them. Therefore, this variable was left unchanged. The numbers of missing cases were reported for each variable but were not included in analyses.