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# Survey of tobacco use and oral health among male factory workers in Hoshiarpur, India

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A thesis submitted in partial fulfillment  
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## Dedication

*This thesis is dedicated to my husband Dr. Desh Deepak Aggarwal and my daughter Sanna Aggarwal, for encouraging me in my pursuit of higher education, and for giving me all their support*

\*\*\*\*\*

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\*\*\*\*\*

# Summary

Tobacco use has been a cause for concern for oral health problems. In particular, caries experiences, oral lesions and, symptoms have been reported in relation to different tobacco habits. However, detailed epidemiological studies of oral problems in relation to use of different tobacco products are scarce.

## **Purpose of the study**

The purpose of the study was to determine the prevalence of use of various tobacco products as chewed or smoked by factory workers, and to determine any association between tobacco use and oral health.

## **The sample**

The study sample was comprised of a total of 300 factory workers aged between 14-50 years who were working in six factories in Hoshiarpur, Punjab, India.

## **Questionnaire interviews**

Questionnaire interviews were conducted to obtain information on tobacco habits and the amount and type used each day. Interviews were conducted in Punjabi by the author. Each subject was asked whether he experienced the symptoms of mouth dryness, burning sensation and difficulty in mouth opening.

## **The oral examination**

The status of the respondent's teeth and oral mucosa was checked and recorded. The clinical examination was performed on the subjects while seated on a chair in front of a window. Oral illumination was by the natural daylight, and wooden spatulas were used to reflect lips and cheeks to aid the examination of the status of teeth and the oral mucosa. The teeth and oral mucosa (cheeks, lips, and tongue) were examined by visual inspection. The status of each tooth was recorded as sound, decayed (obvious cavitation) or missing. No subjects had any restorations or dentures. Tooth mobility was also recorded. Soft tissue lesions that were identified were classified as brown pigmentation, white lesion or ulcerated lesions (erosions).

## **The main points arising from this study**

The main points to emerge from this study are:

1. One hundred percent of laborers were tobacco users.
2. Many laborers had more than two tobacco habits.
3. Tobacco use among laborers begins early in life.
4. The prevalence of tobacco-related oral signs and symptoms was high:
  - about 60% had white lesions and mouth dryness
  - about 20 to 30% had ulcerated lesions, burning sensation, and difficulty in mouth opening, and
  - about 10% had brown pigmentation
5. No laborers had restorations or dentures.
6. The main dental problem was unmet treatment need for caries.
7. The mean number of teeth per person in need of restoration and extraction were 1.45 and 0.24, respectively.
8. The prevalence of oral signs and symptoms increased with increasing age.
9. The odds of both mouth dryness and oral burning sensation were, related to use of loose tobacco and betel quid.
10. The odds of both difficulty in mouth opening and ulcerated lesions were, related to only betel quid.
11. The odds of brown pigmentation was, related only to the smoking cigarettes or bidis.

## **Conclusions**

1. The prevalence of use of tobacco products was 100% among factory laborers in selected factories in Hoshiarpur, and that many laborers had more than two tobacco habits.
2. Tobacco use was related to detrimental changes to oral status that compromise oral health. The problem of difficulty in mouth opening associated with chewing betel quid.

3. The prevalence of white lesions, known to be risk factors for the development of precancerous condition, was 66%.

### **Recommendation**

It is recommended that health authorities should raise awareness of dangers of tobacco use (loose tobacco, packet tobacco, cigarettes, bidi, pan and betel quid) through oral health through health promotion programs aimed at factory workers in particular, and the population as a whole in general.

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## **PART 1**

# **REVIEW OF LITERATURE**

# Chapter 1

## 1.1 Tobacco use in India

**George A, Varghese C, Sankaranarayanan R, Nair MK (1994). Use of tobacco and alcoholic beverages by children and teenagers in a low-income coastal community in South India. *Journal of Cancer Education*.9:111-113.**

George et al., (1994) surveyed 146 children and teenagers aged 5-20 years, in Kerala, India. The purpose was to study the tobacco and alcohol habits among children and teenagers in a low income coastal community in order to plan for establishing a program to control oral cancer. Children and teenagers were selected randomly and interviewed to obtain information about age, education level, and number of children in family, pan-tobacco chewing, smoking and drinking habits.

The results showed that the average education was six years of schooling and the average number of children per family was five. It was reported that 28% of males and 2% of females were regular pan-tobacco chewers whereas 14% males and 11% females chewed occasionally. Only 1% males reported regular bidi or cigarette smoking. Alcoholic beverages were reported to be used occasionally by 5% of males. Furthermore, it was reported that 35% of males and 14% of females under the age of ten had at least one habit (chewing pan-tobacco, smoking bidi or cigarettes, or drinking alcoholic beverages).

**Gupta PC (1996). Survey of socio demographic characteristics of tobacco use among 99, 598 individuals in Bombay, India using hand held computers. *Tobacco control* 5:114-120.**

Gupta (1992-94) interviewed 99,598 permanent residents, aged 35 years and over, in Bombay, India. The purpose was to study the diversity and socio-demographic characteristics of tobacco use. Information from the interviews was directly input into the hand-held computers.

The results were that 57.5% of females were current tobacco users, 57.5% used smokeless tobacco, and 0.4% were smokers. Among women who used smokeless tobacco, 44.5% used mishri, and mishri with betel quid plus tobacco.

In addition, it was reported that 69.3% of males were current tobacco users and 27.1% chewed betel quid with tobacco. Furthermore, it was reported that for males, the prevalence of bidi smoking (13.3%) was slightly higher than cigarette smoking (11.3%).

**Venkat Narayan KM, Chadha SL, Hanson RL, Tandon R, Shekhawat S, Fernandes RJ, Gopinath N (1996). Prevalence and patterns of smoking in Delhi: cross sectional study. *British Medical Journal* 312:1576-1579.**

Narayan et al., (1985-86) surveyed 13,558 men and women aged 25-64 years, in Delhi, India. The aim was to determine the prevalence and predictors of smoking. The survey subjects were randomly selected and were interviewed by trained social scientists. Information regarding smoking, socioeconomic status, and medical histories was obtained by using a structured questionnaire. It was reported that men with no education were 1.8 times (95% CI= 1.52-2.02) more likely to smoke than those with a college education whereas women with no education were 3.7 times (95% CI= 2.86-4.82) more likely to smoke. As compared to Hindu women, Muslim women were more likely to be smokers (OR=3.47, 95% CI = 2.81-4.28), but Hindu and Muslim men were equally likely to be smokers. It was reported that other than education and religion, alcohol drinking was also strong predictor of smoking in all age groups. Furthermore, results showed that compared with college educated people, subjects with no education were more likely to smoke bidi or chutta (OR=2.88, 95% CI = 2.37, 3.49) and were more likely belong to a lower socio economic group.

**Nichter M, Nichter M, Sickle van D (2004). Popular perception of tobacco products and patterns of use among male college students in India. *Social Science and Medicine* 59:415-431.**

Nichter et al., (2004) investigated the popular perception of tobacco products and patterns of use among 15,887 male college students aged 16-23 years in Karnataka, India. Data was gathered by interviewing college students and shopkeepers.

The results were that 45.1% of males were tobacco users, 36.1% smoked cigarettes and 18.3% chewed gutkha. Among smokers, cigarette smoking was popular (assumed to mean, commonly used). In addition, it was reported that

49.3% of students attending professional colleges were cigarette smokers whereas 25.3% of students attending government colleges were gutkha users.

The popular perceptions of tobacco use (assumed to mean, common belief) among youth were that tobacco helps in relieving tension, helps in socialization, combats bad breath, and helps in gaining confidence.

**Subramanian SV, Nandy S, Kelly M, Gordon D, Davey Smith G (2004). Patterns and distribution of tobacco consumption in India: cross sectional multilevel evidence from the 1998-9 national family health survey. *British Medical Journal* 328:801-806.**

Subramanian et al., (1998-99) investigated the patterns and distribution of tobacco consumption in the Indian National Family Health Survey of 301,984 adults aged 18 and over. The data was obtained through interviews with adult household members. Information regarding demographic, socioeconomic markers, smoking and chewing habits of all household members were gathered.

The results showed that compared to females, males were 8.53 times (95% CI =8.37-8.70) more likely to smoke and chew tobacco. Compared to those with postgraduate education, the individuals with no education were 2.69 times (95%CI =2.51-2.87) more likely to smoke and chew tobacco. Compared to 'other' caste groups (those that have higher social status), the individuals who belonged to scheduled tribes and scheduled castes (both groups considered as disadvantaged) were more likely to consume tobacco (OR=1.23 and 1.19, respectively).

Furthermore, the socioeconomic trends regarding chewing were more directly obvious with regard to smoking. Finally, there was a marked variation across states; Punjab was ranked as the lowest state regarding both smoking and chewing, and Mizoram was ranked as the highest. Compared to the national average, Punjabis and Mizoramis were 65% less likely and 18 times more likely, respectively, to chew and smoke.

**Sinha DN, Gupta PC, Pednekar MS (2004). Use of tobacco products as dentifrice among adolescents in India: questionnaire study. *British Medical Journal* 328:323-324.**

Gupta et al., (2004) surveyed school students aged 13 to 15 years independently in 14 Indian states. The purpose was to report on the prevalence of the use of

tobacco products as a dentifrice. Participants were asked via a self administered close ended questionnaire to report the brand of the dentifrice they used.

The response rate was 80%. The use of toothpaste and tooth powder containing tobacco were common in all states. Gul (a pyrolysed tobacco product) was common in 8 states. The other products containing tobacco were mishri (roasted and powdered tobacco), dry snuff (smokeless tobacco inhaled through the nose). Gadakhu, is a paste of tobacco and molasses, which is used as dentifrice. Tobacco water, which is manufactured by passing tobacco smoke through water, is used for gargling. Furthermore, the results reported that the prevalence among the boys were higher than among girls in Orissa and Uttaranchal but statistics were not presented to support this claim.

It was noted that in India the misconception is widespread that tobacco is good for teeth, reported in a study from Ernakulam district in Kerala that 92% (3013) of 3261 female tobacco users and 28% (2159) of 7575 male tobacco users specified tooth related problems as the reason for starting to use tobacco. Many companies take the advantage of this misconception by packaging and positioning their products as dental care products. The 1992 amendments to India's Drug and Cosmetics Act 1940 barred manufacturers from using tobacco as an ingredient in any toothpaste or tooth powder.

**Anwar S, Williams SA, Scott-Smith J, Sage H, Baweja S, Singal M, Sharma NK (2005). A comparison of attitudes and practices of gutka users and non-users in Chitrakoot, India. A Pilot. *Primary Dental Care* 12:5-10.**

Anwar et al., (2005) conducted a pilot study in Chitrakoot, India of 103 males and 21 females. The subjects were interviewed using a semi-structured questionnaire. The purpose of the study was to investigate attitudes and practices concerning gutkha use.

The prevalence of gutkha use was higher among males (58%) aged 21-40 years as compared to female users of the same age (23%). Both education attainment and age were not found to be significantly different among users and non-users. It was noted that 53% of the users claimed that they had taken up the habit due to peer pressure. Compared to non-users (2/57), significantly large number of users (6/57) found gutkha was 'helpful' in relieving tension and bad

breath. Furthermore, results showed that as compared to non-users, all users belonged to families in which one or more family members had also used gutkha.

**Mohan S, Sarma PS, Thankappan KR (2005). Access to pocket money and low educational performance predict tobacco use among adolescent boys in Kerala, India. *Preventive Medicine* 41:685-692.**

Mohan et al., (2003) surveyed 1323 randomly selected boys aged 12-19 years from 14 schools in Kerala, India. The purpose was to find the prevalence and correlates of tobacco use among the adolescent boys. Information regarding tobacco use, academic performance, and pocket money was obtained by using a self-administered questionnaire.

The results showed that the prevalence of ever tobacco use among boys was 34.6% and 11.3% reported current tobacco use. The prevalence of tobacco use was higher among those boys whose friends were tobacco users (OR=2.9, 95%CI = 1.6, 5.1).

Compared with boys aged 13 years, the boys above the age of 16 years were more likely to smoke (OR=2.9, 95%CI = 1.6-5.3). It was reported that compared with boys of graduate mothers, boys of mothers with less than primary education were more likely to smoke (OR=1.8, 95%CI = 0.8-4.0). The results showed that tobacco use was higher among those students whose academic marks were less than 40%.

Furthermore, it was reported that tobacco use was 4 times higher among those boys who got pocket money above 50 rupees (OR=4.0, 95%CI =2.2-7.4).

**Sushma C, Sharang C (2005). Pan masala advertisements are surrogate for tobacco products. *Indian Journal of Cancer* 42:94-98.**

Sushma and Sharang (2005) investigated the pan masala advertisements which were suspected to be surrogates for tobacco products in India. The purpose was to assess whether these advertisements were aimed to promote the product, as advertised, or whether (and more importantly) to promote the sale of a tobacco containing product of almost identical brand manufactured by the same company. Advertisements of plain pan masala and other products were observed for 24 hours on one Hindi news channel and one English news channel. The frequency and duration of all advertisements were noted.

Results showed that three types of advertisements observed were either direct advertisements, sponsorships of programmes or advertisements for sponsored programmes. The five types of direct advertisements that were observed during the 24 hours period had names very similar to the tobacco containing products. The results showed that the total duration of the advertisements was 1215 hours. Half of this time (615 hours) was related to only one product, plain Pan Parag. "In 2001, it was reported that the prevalence of use of plain pan masala, the advertised product, among males, in urban area of Uttar Pradesh was only 0.4%, whereas 10.2% used the tobacco containing product of almost identical brand, that is, 25 times more people used the tobacco containing product." (Chaudhry et al., 2003)

It was stated that the annual cost of advertisements of plain Pan Parag on two television channels alone was 3.8 times its annual sale value. This is showing that the plain Pan Parag masala branded as "Pan Parag pan masala" was a surrogate for the tobacco containing pan masala branded as "Pan Parag gutkha." It was concluded that "the advertisements of plain pan masala seen on Indian television are a surrogate for tobacco products bearing the same name."

## 1.2 The oral effects of tobacco use

"A causal association between tobacco and betel quid chewing habits and oral mucosal diseases such as leukoplakia, oral sub mucous fibrosis and oral cancer has been established and heavy users have a significantly increased mortality rate." (Nair et al., 2004)

The information obtained from the web stated that "the amount of nicotine absorbed from the smokeless tobacco use is 3-4 times higher than those delivered by cigarettes. The nicotine is absorbed more slowly from the smokeless tobacco, but the amount of nicotine per dose is much higher than that of a cigarette" (<http://www.cancer.gov>) dated 30-5-03.

**Walsh PM, Epstein JB (2000). The oral effects of smokeless tobacco. *Journal of Canadian Dental Association* 66:22-5.**

Walsh and Epstein (2000) reviewed the oral effects of smokeless tobacco, a recognized as a cause of cancer. The oral lesions associated with smokeless

tobacco are seen on the mucosal surface at sites where the product is placed as well as on the adjacent periodontium. "They observed that the affected site can be white or yellow brown in color and it may develop a thickened and wrinkled appearance with increased use of tobacco product." The clinical diagnosis of these white lesions is tobacco-associated-leukoplakia. The two most common forms of cancer, found in association with smokeless tobacco use, are verrucous carcinoma and squamous cell carcinoma. Other oral effects of smokeless tobacco include leukoplakia, periodontal diseases, delayed wound healing and dental caries, gingivitis, staining of composite restorations, halitosis, reduction of smell and taste acuity, and loss of attachment adjacent to the area of placement of smokeless tobacco. Nicotine dependence, transient increase in blood pressure and cardio-vascular diseases are the systematic effects that are associated with smokeless tobacco use.

**Schepman KP, Bezemer PD, Meij van der EH, Smeele LE, Waal van der I (2001). Tobacco usage in relation to the anatomical site of oral leukoplakia. *Oral Diseases* 7:25-27**

Schepman et al., (2001) investigated the relation of tobacco usage to the anatomical site of oral leukoplakia in 166 patients (73 men and 88 women) with oral leukoplakia aged 23-91 years, in Amsterdam, The Netherlands. Data regarding tobacco use was gathered from the hospital records. The results showed that compared with non-smokers, the risk of leukoplakias of cheek mucosa, including commissures, was higher in male smokers (OR=7.54, 95%CI = 1.41, 39.93). Furthermore, results reported that as compared with other sites leukoplakias of the floor of the mouth was higher in smokers (OR=8.47, 95% CI 1.41-50.97 and OR=18.13, 95% CI 3.58-91.95) for men and women, respectively, than in non-smokers.

## **1.2.1 Consequences of tobacco use**

### **1.2.1.1 White lesions**

#### **Leukoplakia**

"Leukoplakia" as a rather loose clinical term having no histological

connotation. Accordingly the term leukoplakia as used here will imply only the clinical feature of a white plaque on the mucosa.

It is same definition that has been described by World Health Organization (WHO) Collaborating Centre for Oral Precancerous Lesions "to characterize and define those lesions that should be considered in a study of oral precancers and to determine, if possible, their relative risk of becoming malignant." (Shafer et al., 1997)

Factors that are responsible for leukoplakia are tobacco, alcohol, oral sepsis, local irritation, vitamin deficiency, syphilis, endocrine disturbances, and galvanism.

Few studies have shown that tobacco is associated with the development of leukoplakia (Banoczy et al., 2001). It was reported that 80% of leukoplakia patients were smokers and found that smokers are much likely to have leukoplakia than non-smokers (23% vs. 4%) (Bouquot et al., 1992). The chemical released from the tobacco and its combustion end products like tars, and resins, are cytotoxic substances which are capable of producing leukoplakic alteration of the oral mucosa (Shafer et al., 1997). The reported prevalence of leukoplakia among smokers was 3.73% and among non smokers was 0.26% (Banoczy et al., 2001). In another study by Dombi et al the reported percentages were 6.03 and 0.22, respectively.

For smokeless tobacco, the nitrosamines, which form during fermentation and curing, rest against the oral mucosa and are also cause alterations of the mucosa (Shafer et al., 1997).

### **Smokeless tobacco keratosis**

Smokeless tobacco keratosis is a pre-malignant condition. It is a white keratotic plaque which is characterized as having a semi-translucent appearance. This is also known as "snuff pouch" or smokeless tobacco keratosis. It is not true a leukoplakia. It is commonly found in areas where snuff or chewing tobacco is placed. The condition is reversible after quitting of the habit with which it is associated. Today, the only smokeless tobacco keratosis feature known to have an increased risk of cancer transformation is continued presence after tobacco cessation. Its malignant potential is less than true leukoplakia by magnitude of ten (4% vs. 0.4% estimated lifetime risk for leukoplakia and smokeless tobacco

keratoses, respectively) (Bouquot et al., 1992). Those lesions remaining after two months following cessation of smokeless tobacco use should be considered as something other than true leukoplakia, possibly developed from, or hidden by, the previous smokeless tobacco keratosis (Bouquot et al., 1992)

### **1.2.1.2 Brown pigmentation**

#### **Smokers' melanosis**

Smoker's melanosis is a brown pigmentation of the buccal mucosa or gingival, commonly found in smokers. Smoking stimulates oral mucosal melanocytes, to produce excessive melanin (Bouquot et al., 1992). In vitro testing, it was found that nicotine activates one of the steps in melanin production (Bouquot et al., 1992). The prevalence of pigmentation in heavy cigarette smokers was reported at about 30% (Johnson et al., 2000).

It is reversible condition which reverses after cessation of smoking. This condition is dose dependent. No case has been reported in which smoker's melanosis has transformed into carcinoma or melanoma. (Bouquot et al., 1992)

### **1.2.1.3 Ulcerated lesions**

Areca nut/ betel nut use has a significant effect on the hard and soft tissues of the oral cavity (IARC Monographs). Ulcerated lesions and erosions (superficial loss of tissue that involves only epithelium) that are found among tobacco and betel nut users are believed to be associated with the chemicals and carcinogens released from tobacco and betel nut (Nikitakis et al., 2005). The erosions or ulcers which were present were centered in the white lesions. These erosions are associated with chewing the hard betel nut, or hard pieces of crushed betel nut. After years of betel nut use, the ulcers may transform to pre-malignant conditions.

### **1.2.1.4 Difficulty in mouth opening (Trismus)**

#### **Oral submucous fibrosis**

Oral submucous fibrosis is a pre-malignant condition which is characterized by progressive stiffening of the oral mucosa (Bouquot et al., 1992), and is due to the development of fibrous bands. The loss of elasticity of the mucosa results in

progressive restriction of mouth opening (Nair et al., 2004). This problem is commonly found in areca nut users, who chew areca nut with tobacco, betel leaf, and slaked lime. The main etiological factor is considered to be some component of the areca nut (Bouquot et al., 1992). Slaked lime increases the absorption of nicotine through the oral mucosa (Anwar et al., 2005). The  $\text{Ca}(\text{OH})_2$  which is present in the slaked lime leads to alkaline conditions in the oral cavity. Oral submucous fibrosis frequently has superimposed leukoplakia on it. It commonly occurs between the age of 20- 40 years but can occur at any decade of life. The disease is characterized by a burning sensation of the mouth, particularly when eating spicy foods (Shafer et al., 1997). Vesicle formation, ulceration of the oral mucosa and xerostomia may occur. (Shafer et al., 1997). This problem can become extremely debilitating.

#### **1.2.1.5 Mouth dryness**

It has been shown that the intense use of smokeless tobacco results in degenerative changes of the minor salivary glands (more than 40%) located at the site of tobacco placement, resulting in dryness of the oral mucosa. (Bouquot et al., 1992).

#### **1.2.1.6 Burning sensation**

Burning sensation of oral mucosa is associated with betel nut chewing (see oral submucous fibrosis).

**Note:** It was reported by several factory workers in the Part 2 of this treatise that they experience burning sensations particularly when chewing tobacco with slaked lime.

### **1.3 Tobacco Control**

Shimkhada R, Peabody JW (2003). Tobacco control in India. *Bulletin of the World Health Organization* 81:48-51.

Shimkhada and Peabody (2003) have recently described tobacco control in India. They reported on a dramatic rise in tobacco consumption in India. They noted,

however, that the policies to control tobacco demand have lagged behind. It was estimated that about 65% of all men and 33% of all women use some form of tobacco. The annual rise in tobacco consumption in India is 2-3% per annum and by 2020 it is predicted that it will account for 13% of all deaths in India. Bidi (hand rolled filterless tobacco cigarette) accounts for 40% (largest proportion) of tobacco use, and is the alternative to cigarettes. "Tobacco is also used in hookah (a traditional water pipe), pan masala or gutkha (a chewing tobacco containing the areca nut), chutta (a clump of tobacco smoked with the lighted end inside the mouth), and mishri (a powdered tobacco rubbed on the gums as toothpaste)." In the last decade, state legislation has been used to control tobacco use but not very successfully. Long term strategies of different types will be necessary to control demand. "These strategies include the following: raising taxes, publishing and disseminating the information about the adverse health effects of tobacco, including prominent health warnings labels to products; imposing comprehensive bans on advertising and promotion; restricting smoking in work places and public places; and extending access to nicotine replacement alternatives and other cessation therapies." The authors claimed that priority should be given to educate the people to control the epidemic in India.

## **1.4 Summary of 6 studies on the oral effects of tobacco use in India since 1985.**

**Phukan RK, Ali MS, Chetia CK, Mahanta J (2001). Betel nut and tobacco chewing; potential risk factors of cancer of oesophagus in Assam, India. *British Journal of Cancer* 85:661-667.**

Phulkan et al., (2001) interviewed 358 newly diagnosed male patients and 144 female (total 502) together with 994 control subjects in Assam, India. In Assam, raw (green), ripe (red), and fermented (underground processed) betel nuts are chewed with and without tobacco. The purpose was to study the patterns of risk associated with different ways of preparing and chewing the betel nuts and to estimate the effect independently of tobacco and alcohol consumption. Methods included microscopic investigation to determine case and interviewing of suspected cases of cancer of oesophagus to determine risk factors before referral to a medical consultant. Information from attendants was collected at the same

time. Only cases confirmed by microscopy and for whom the oesophagus was the primary site of cancer were included in the study. Data analysis by multiple regression and estimation of proportion of cases of a disease attributable to exposure to a particular factor was carried out by calculating the aetiological fractions for each variable.

The results demonstrated that compared with non-chewers, male and female chewers were at greater risk of cancer (OR =2.3 and 1.9, respectively). Compared with non-chewers, both male and female chewers, who had been chewing for more than 20 times a day, were at greater risk of cancer (OR= 13.3 and 5.7, respectively). Furthermore, results showed that both male and female chewers, who had chewed for more than 20 years, were at even greater risk of cancer than non-chewers (OR=10.6 and 7.2, respectively). Finally, compared with non-users, males and females, who commenced tobacco chewing before the age of 20 years, were at a greater risk of cancer (OR=10.3 and 5.3 respectively).

**Gupta PC, Sreevidya S (2004). Smokeless tobacco use, birth weight, and gestational age: population based, prospective cohort study of 1217 women in Mumbai, India. *British Medical Journal* 328:1538-1547**

Gupta and Sreevidya (2002) surveyed 1217 women in Mumbai, India, who were 3 to 7 months pregnant and 1167 (96%) were followed up in this population cohort study. The purpose was to study the effect of using smokeless tobacco during pregnancy on babies' birth weight and gestational age at birth. Methods included an interview and use of available medical reports and women were monitored by the community health volunteers routinely. All women who had used a smokeless tobacco product at least once a day for past six months were included. The tobacco products included were: betel quid with tobacco, gutkha, pan masala, and the most commonly used mishri (80%) (pyrolysed and powdered tobacco). Out of 1217 recruited women, 974 women were included in the birth weight analysis.

Results demonstrated that compared with non users, the birth weights of the users' babies were reduced by an average of 105gm, and their gestational age was 6.2 days shorter. Compared to non users, chewers were at 60% greater risk of low birth weight babies (OR=1.6, adjusted for maternal age, education, socio-economic status, weight, anemia, antenatal care and gestational age). The

adjusted odds ratios for preterm delivery before 37 weeks were 1.4, and before 32 weeks and 28 weeks it was 4.9 and 7.2, respectively.

**Chitra S, Ashok L, Anand L, Srinivasan V, Jayanthi V (2004). Risk factors for esophageal cancer in Coimbatore, southern India: a hospital-based case-control study. *Indian Journal of Gastroenterology* 23:19-21.**

Jayanti et al., (2004) conducted a hospital-based case control study in Coimbatore in southern India to determine the role of smoking and alcohol, and their combination, in the etiology of cancer of the esophagus. Ninety patients with cancer of the esophagus were compared with those in age- and sex-matched control groups. Information was obtained using a structured questionnaire. Questions on tobacco habits, demographic data, occupation, religion, literacy, and socio-economic status were asked.

The results demonstrated that compared to controls, the risk of cancer of esophagus among cases was higher among alcohol consumers (OR=3.5; 95%CI = 1.7-7.0), tobacco chewers (OR=2.5; 95%CI = 1.2-5.4), betel nut chewers (OR=2.8; 95%CI = 1.3-5.9) and smokers (OR=2.84; 95%CI = 1.5-5.4).

It was concluded that alcohol use, smoking and chewing of tobacco are factors predisposing to esophageal cancer in southern India.

**Jacob BJ, Straif Kurt, Thomas G, Ramadas K, Mathew B, Zhang Z, Sankaranarayanan R, Hashibe M (2004). Betel quid without tobacco as a risk factor for oral precancers. *Oral Oncology* 40:697-704.**

Jacob et al., (2003) conducted a case control study in Kerala, India that included 927 oral leukoplakia cases, 170 oral sub mucous fibrosis cases, 100 erythroplakia cases, 115 multiple oral precancerous cases, and 47,773 controls. The purpose of the study was to assess the independent effect of betel quid without tobacco on oral precancers. Subjects who chewed betel quid with and without tobacco and non-chewing controls were selected. Cases were identified by known disease status and by oral visual inspection. Subjects were interviewed and data was gathered using a structured questionnaire on betel quid chewing, alcohol consumption, and demographic information.

The results were that compared with non-betel quid chewers, the risk of oral precancers was higher among chewers of betel quid without tobacco. The odds ratios were: for oral leukoplakia OR=22.2 (95%CI = 11.3, 43.7); oral submucous

fibrosis OR=56.2 (95%CI = 21.8, 144.8); erythroplakia OR=29.0 (95%CI = 5.63, 149.5); and for multiple oral precancers OR=28.3 (95%CI = 6.88, 116.7).

Furthermore, results showed that compared with non-chewers who smoke and drink, the risk of oral precancers was higher among chewers of betel quid without tobacco. The odds ratios were: for oral leukoplakia OR=4.02 (95%CI = 2.65, 6.08); oral submucous fibrosis OR=47.2 (95%CI = 3.70, 42.4); erythroplakia OR=12.5 (95%CI = 3.70, 42.4); and for multiple oral precancers OR=17.0 (95%CI = 4.72, 61.6). It was also shown that the odds ratios were even higher for chewers of betel quid that contained tobacco. It was concluded that chewing betel quid without tobacco increases the risk of oral precancers.

**Znaor A, Brennan P, Gajalakshmi V, Mathew A, Shanta V, Varghese C, Boffetta P (2003). Independent and combined effects of tobacco smoking, chewing and alcohol drinking on the risk of oral, pharyngeal and esophageal cancers in Indian men. *International Journal of Cancer* 105:681-686.**

Zanor et al., (1993-99) conducted a case control study at The Cancer Institute in Chennai, Tamilnadu and Trivandrum, among 1,563 oral, 636 pharyngeal and 566 esophageal male cancer patients and 1,711 male diseased controls and 1,927 male healthy hospital visitors. The purpose was to assess the independent and combined effects of tobacco smoking, tobacco chewing, and alcohol drinking on the risk of oral, pharyngeal and esophageal cancers in Indian men. Male cancer patients with non-tobacco related cancers and the healthy male hospital visitors were selected as controls. All cases and diseased controls were confirmed histological. Trained social investigators interviewed all subjects and asked questions about their demographic and socio economic parameters, clinical history, tobacco and alcohol habits, diet and occupational exposures.

The results showed that compared with non-smokers, current smokers were at higher risk for oral cancer (OR=1.91, 95%CI = 1.61, 2.26); pharyngeal cancer (OR=4.00, 95%CI = 3.07, 5.22); and for esophageal cancer (OR=2.83, 95%CI = 2.18, 3.66). Compared with non-chewers, the tobacco chewers were at higher risk for oral cancer, pharyngeal cancer, and esophageal cancer. The odds ratios were: for oral cancer (OR=5.05, 95%CI = 4.26, 5.97); pharyngeal cancer (OR=1.83, 95%CI = 1.43, 2.33); and for esophageal cancer (OR=2.06, 95%CI = 1.62, 2.63).

Furthermore results were reported that compared with never drinkers, the ever drinkers were at higher risk for oral cancer (OR=1.98 95% CI = 1.68, 2.33);

pharyngeal cancer (OR=2.07 95% CI = 1.67, 2.56); and for esophageal cancer (OR=1.70, 95%CI = 1.36, 2.13).

**lype EM, Pandey M, Mathew A, Thomas G, Sebastian P, Nair MK (2001). Oral cancer among patients under the age of 35 years. *Journal of Postgraduate Medicine* 47:171-176.**

lype et al (2001) conducted a retrospective descriptive study of 264 oral cancer patients under the age of 35 years. The purpose was to assess the etiological factors, patient characteristics, treatment and the outcome in young patients with oral cancer. Data was gathered from the electronic database of The Regional Cancer Centre regarding age, sex, tobacco history, alcohol habits, and family history of cancer, and presence of pre-malignant lesions, histology, clinical extent and lymph node involvement.

The results showed that 149 (56%) patients had a habit of either tobacco use or alcohol consumption. Among these patients, 45% had tongue cancer and 37% had cancer of the buccal mucosa. Sixty three percent of patients with tongue cancer were at an advanced stage of disease. Family history of oral cancer was present in 3% patients. It was reported that 44% of cases of tongue carcinoma were below 30 years of age compared with 28% of cases with carcinoma of the buccal mucosa. Radio therapy, surgery, and combined treatment modalities were employed for majority of the patients. It was reported that 5 year survival was 57.3%.

It was concluded that there is a need to investigate the etiology of intra oral cancers in younger patients. Since significant proportions (almost 40%) of these patients were reported as not being exposed to risk factors for cancer, there is an urgent need to investigate this matter.

## **1.5 Discussion and review**

Tobacco use has been recognized as a potential factor for causing cancer. However, socio-economic groups and rural populations are more likely to use tobacco. Marked variations of tobacco consumption across the states have been reported. The risk of oral cancer was reported to be more in males than females,

but in pregnant female tobacco users, there is an increased risks associated of having pregnancy like low birth weight babies and preterm deliveries.

Some studies reported that education is the strongest predictor of smoking. But one study has reported that there were no differences among users and non-users for educational attainments and age. Thus, for health promotion reasons all age groups and educated people need to be targeted.

Cigarette smoking is more prevalent among educated and higher income people whereas bidi smoking is prevalent among low socio-economic people. In addition to smoking, people who drink alcohol are at further increased risk of cancer.

In India, users adopt the tobacco habit at a very young age - as young as 10 years (Mohan et al., 2005). Youths adopt the habit due to peer pressure and due to widespread misconceptions about tobacco use. It is commonly believed by youths and higher income people that, more expensive cigarettes are less harmful and more westernized. Other factors indicating increased tobacco use have been reported and include family use of tobacco and peer pressure.

Smokeless tobacco which is associated with oral cancer is also common among students and females. Available evidence suggests that chewing betel quid without tobacco is also a risk factor for oral precancers. The smokeless tobacco is considered to be more harmful than cigarettes because of long periods of nicotine release when the tobacco is in contact with mucosa over prolonged periods. Due to economic reasons, low socio-economic population use bidi, which has more potential risks due to the unfiltered nature of bidi.

The low socioeconomic population, who are at greater risk of consuming tobacco, may need risk reduction strategies aimed specifically to reach members of this sub-culture. Misconceptions about tobacco use need to be cleared. Due to widespread misconceptions indicating that tobacco use is healthy, the tobacco companies manufacture products containing tobacco such as tooth pastes and tooth powders. Despite the ban on tobacco in certain states, products containing tobacco are still available. Strategies to control tobacco demand are required and tough laws need to be put forward to control the tobacco companies.

## **PART 2**

### **Survey of tobacco use and oral health among male factory workers in Hoshiarpur, Punjab**

# Chapter 2

## Introduction

India is the world's third largest tobacco-growing country. The Portuguese introduced tobacco to India 400 years ago and established a tobacco trade in their colony of Goa (Shimkhada et al.,2003).Two hundred years later the British introduced commercially produced cigarettes to India and also established cigarette production in the country (Shimkhada et al.,2003). It is estimated that of the 1.1 billion people who smoke worldwide, 182 million live in India (Shimkhada et al., 2003) and 17 million tobacco users are under the age of 25 years. In India, oral cancer accounts for 30-40% of all diagnosed cancer cases (Nichter et al.,2004) Tobacco use in India is more varied than in most countries (Shimkhada et al.,2003).

### 2.1 Common forms of tobacco used in India

#### 2.1.1 Tobacco smoking

Smoking is a wide-spread habit. Tobacco is smoked either as cigarettes, bidis, cigars or in a pipe.

**Cigarettes:** Cigarettes are filtered, commercially produced, used for smoking.

**Bidi:** Bidi is a traditional, hand rolled filterless tobacco cigarette. It consist a small quantity of shredded, sun dried tobacco of about 0.2-0.3 grams and is hand rolled in tendu leaf (*Diospyrus meburnoxylon* or *Diospyrus ebenum*) (Mahbubur et al., 2003)

**Chutta:** Chutta is a clump of tobacco smoked with the lighted end inside the mouth.

#### 2.1.2 Smokeless tobacco:

##### 2.1.2.1 Chewing

**Loose tobacco:** Loose tobacco is available in tins and also available loosely from the pan shop.

***Gutkha and pan masala:*** These mixes containing areca nut, tobacco and flavored additives, are sold in colorful small sachets. Due to aggressive marketing, these mixes have become popular among children, teenagers and women.

***Khaini:*** Khaini is a powdered tobacco mixed with slaked lime paste and sometimes used with areca nut.

***Gadakhu:*** Gadakhu is a paste of tobacco and molasses.

***Mishri:*** Mishri is roasted and powdered tobacco rubbed on the gums as tooth powder.

***Zarda:*** Finely cut scented tobacco. (Phulkan et al., 2001)

***Chadha:*** It is dried tobacco which is chewed alone, in Assam state.

***Mawa:*** is a mixture of areca nut, tobacco and slaked lime.

***Pan:*** Betel leaf treated with lime and packed with mixture of tobacco, slaked lime, condiments and spices.

***Betel nut:*** Crushed betel nuts, also called areca nuts (nut of the areca catechu palm) are chewed with or without tobacco.

***Betel quid:*** Betel leaf, leaf of betle piper vine treated with slaked lime and packed with areca nut, catechu, finely cut scented tobacco, condiments and aromatic spices.

### **2.1.2.2 Inhaling**

***Snuff:*** Dry snuff is the other form of smokeless tobacco which is inhaled through the nose.

### **2.1.2.3 Gargling**

***Tobacco water:*** Tobacco water, which is manufactured by passing tobacco smoke through water, is used for gargling.

## **2.2 Purpose of the study**

The purpose of the study was to determine the prevalence of use of various tobacco products as chewed or smoked by factory workers, and to determine any

association between tobacco use and oral health, and the development of oral mucosal lesions and symptoms.

1. White lesions
2. Ulcerated lesions/ erosions
3. Brown pigmentation
4. Mouth dryness
5. Difficulty in mouth opening
6. Oral burning sensation

## **2.3 Ethics clearance**

Permission for the survey was obtained from the Human Research Ethics Committees of The University of Sydney and from managers of factories in Hoshiarpur, India.

(Ethics approval – Appendix B)

# Chapter 3

## Materials and methods

### 3.1 Study population

The study population comprised factory laborers working in Hoshiarpur, Punjab, India.

### 3.2 Study sample

The study sample was comprised of a total of 300 factory workers aged between 14-50 years who were working in six factories, two of which were associated with the paint industry, three were timber mills, and one was a rubber factory. All workers were males.

### 3.3 Recruitment of the sample

The Managers of nine factories, conveniently located, were approached for permission to meet with all laborer employees in order to outline the purpose of the survey and to invite them all to participate. Managers of three factories refused permission. After permission had been obtained, a separate room was provided by the each factory manager and a coordinator was selected to organize the availability of the workers. The managers of three factories gave permission to conduct survey only during lunch times. A participant information statement was distributed and those who gave informed consent to participate were invited to complete the questionnaire and were given oral examination (*see Appendices for the letter to management, participant information statement and participant consent form*).

### 3.4 The interviews

Questionnaire interviews were conducted to obtain information on tobacco habits and the amount and type used each day (*see Appendix F for questionnaire*). The

tobacco products, except cigarettes and bidis that were the subject of this study are classified as smokeless tobacco. A short description of each product was obtained. The products used were loose tobacco, packet tobacco (Gutkha), pan, cigarettes or bidis, and betel quid (Crushed betel nut mixed with tobacco and lime). Each subject was asked whether he experienced the symptoms of mouth dryness, burning sensation and difficulty in mouth opening. Interviews were conducted in Punjabi by the author

### **3.5 The oral examination**

The purpose of the oral examination was to determine caries status, tooth mobility, tooth restoration status, tooth extractions, and oral mucosal lesions. The status of the respondent's teeth and oral mucosa was checked and recorded on an examination sheet (*see Appendix G for oral examination sheet*). The clinical examination was performed on the subjects while seated on a chair in front of a window. Oral illumination was by means of the natural daylight, and wooden spatulas were used to reflect lips and cheeks to aid the examination of the status of teeth and the oral mucosa. It was not possible for the author to take the subjects to dental clinic for an oral examination. Although the situation for conducting an oral examination in natural day light is not ideal, it is sufficient to see clearly any lesions of about 5 mm in diameter and also to obtain a focus on the lesion to observe any related ulceration or erosions. The teeth and oral mucosa (cheeks, lips, and tongue) were examined by visual inspection.

The status of each tooth was recorded as sound, decayed (obvious cavitation) or missing. No subjects had any restorations or dentures. Tooth mobility was also recorded. Soft tissue lesions that were identified were classified as brown pigmentation, white lesion or ulcerated lesion (erosions).

### **3.6 Data preparation**

The response distribution was categorized post-survey. In general, the sub-groups included the zero exposure, and the other exposures were sub-grouped into two or

three equally sized groups. Age grouping followed the World Health Organization system.

### **3.7 Statistical analysis**

Association between signs and symptoms were investigated firstly using chi-square analysis. Factors showing association of the  $p < 0.05$  level were considered further in logistic regression modeling.

## **Chapter 4**

### **Results**

#### **4.1 Response**

The response rate was 100%.

#### **4.2 The prevalence of use of different tobacco products and tobacco-related oral lesions and symptoms.**

##### **4.2.1 Use of different tobacco products**

The prevalence of use by the factory workers of different tobacco products was that 86.3% used loose tobacco, 46.3% used packet tobacco, 31.3% used pan, 28.3% used betel quid, and 33.7% smoked cigarettes or bidis (Table 1a). Various combinations of tobacco habits were used by the workers which are not reported in this table. All workers used tobacco.

##### **4.2.2 Tobacco-related oral lesions and symptoms**

Exposure to tobacco was shown to be associated with oral lesions and symptoms (Table 1b), including brown pigmentation, white lesions, ulcerated lesions, mouth opening difficulty, burning sensation and, mouth dryness. There is a clear trend that the prevalence of oral lesions and symptoms increased with increasing age except for white lesions that varied between 10 and 65% in all age group.

#### **4.3 Caries experience, tooth mobility and dental treatment needs**

##### **4.3.1 Caries experience and tooth mobility by age group**

No subjects had restorations and therefore the DMFT values refer to untreated decay and missing teeth (Table 2a). The mean number of DMFT among workers increased with age. For the age group 35 and over, the mean DMFT was 4.9. The maximum DMFT reported was 10 teeth.

The numbers of mobile teeth were few in all age groups except for 1 person aged 35 and over. It is assumed that tooth looseness was associated with loss of periodontal attachment due to advancing periodontal disease. The maximum

Table 1a. The prevalance of use of different tobacco products.

| Tobacco products  | Response | Frequency | Percent |
|-------------------|----------|-----------|---------|
| Loose tobacco     | 0=No     | 41        | 13.7    |
|                   | 1 = Yes  | 259       | 86.3    |
| Packet tobacco    | 0=No     | 161       | 53.7    |
|                   | 1 = Yes  | 139       | 46.3    |
| Cigarette or bidi | 0=No     | 191       | 66.3    |
|                   | 1 = Yes  | 101       | 33.7    |
| Pan               | 0=No     | 206       | 68.7    |
|                   | 1 = Yes  | 94        | 31.3    |
| Betel quid        | 0=No     | 210       | 70.0    |
|                   | 1 = Yes  | 90        | 30.0    |

Table 1b. The prevalence of tobacco-related oral lesions and symptoms by age group.

| Age group | Number | Brown pigmentation |      | White lesions |      | Ulcererated lesions |      | Mouth opening difficulty |      | Burning sensation |      | Mouth dryness |      |
|-----------|--------|--------------------|------|---------------|------|---------------------|------|--------------------------|------|-------------------|------|---------------|------|
|           |        | Number             | %    | Number        | %    | Number              | %    | Number                   | %    | Number            | %    | Number        | %    |
| 14-19     | 14     | 0                  | 0.0  | 7             | 50.0 | 1                   | 7.1  | 2                        | 14.3 | 1                 | 7.1  | 4             | 28.6 |
| 20-24     | 113    | 4                  | 3.5  | 82            | 72.6 | 15                  | 13.3 | 27                       | 23.9 | 6                 | 5.3  | 45            | 39.8 |
| 25-29     | 117    | 9                  | 7.7  | 64            | 54.7 | 25                  | 21.4 | 33                       | 28.2 | 26                | 22.2 | 76            | 65.0 |
| 30-34     | 37     | 11                 | 29.7 | 27            | 73.0 | 16                  | 43.2 | 16                       | 43.2 | 17                | 45.9 | 30            | 81.1 |
| 35+       | 19     | 7                  | 36.8 | 10            | 52.6 | 9                   | 47.4 | 14                       | 73.7 | 13                | 68.4 | 18            | 94.7 |
| Total     | 300    | 31                 | 10.3 | 190           | 63.3 | 66                  | 22   | 92                       | 30.7 | 63                | 21   | 173           | 57.7 |

Table 2a. Caries experience and tooth mobility by age group.

| Age group | Caries experience |           |      |           |          | Tooth mobility (Score 1)* |    |       |
|-----------|-------------------|-----------|------|-----------|----------|---------------------------|----|-------|
|           | Number            | Mean DMFT | SD   | %DMFT = 0 | Max DMFT | Individuals               |    | Max** |
|           |                   |           |      |           |          | Number                    | %  |       |
| 14-19     | 14                | 0.64      | 1.01 | 64.0      | 3        | 0                         | 0  | 0     |
| 20-24     | 113               | 1.16      | 1.21 | 40.0      | 5        | 0                         | 0  | 0     |
| 25-29     | 117               | 2.17      | 1.25 | 10.0      | 6        | 1                         | <1 | 2     |
| 30-34     | 37                | 2.89      | 1.63 | 11.0      | 7        | 0                         | 0  | 0     |
| 35+       | 19                | 4.89      | 2.38 | 5.0       | 10       | 6                         | 32 | 6     |
| Total     | 300               | 1.98      | 1.69 | 24.0      | 10       | 7                         | 2  | 6     |

\*Bucco-Lingual movement of 1 mm

\*\*Maximum number of mobile teeth per person.

number of teeth per person was recorded as six in the age group 35 years and over.

### **4.3.2 Dental treatment needs**

(Table 2b) shows the dental treatment needs. The numbers of teeth in need of extraction and restoration increased sharply with increasing age. In all age groups, a high percentage needed tooth restoration. For example in the age group 35+ years, the mean restoration need was 2.26 teeth and the mean extraction need was 1.37 teeth. The high need for tooth extraction was due to the backlog of unmet restorative care, due to lack of awareness and expenses, and hence the teeth were unrestorable.

## **4.4 Odds of oral lesions by any tobacco habit**

### **4.4.1 Oral brown pigmentation**

Thirty one subjects had oral brown pigmentation. In the logistic regression analysis (unadjusted ORs) of brown pigmentation by any tobacco habit, it was shown that only one of the five tobacco habits was significantly associated with odds of brown pigmentation (Table 3a). Cigarette or bidi smokers were 40 times more likely to develop brown pigmentation compared to non-smokers (OR=39.67; 95% CI = 9.23, 170.49).

### **4.4.2 Oral white lesions**

Although 190 subjects had white lesions, the lesions were not significantly associated with any particular smoking habit. There was a tendency for pan and betel quid chewers to have elevated odds of oral white lesions (Table 3b).

### **4.4.3 Oral ulcerated lesions**

All together 66 subjects had oral ulcerated lesions. In the logistic regression analysis (unadjusted ORs) of oral ulcerated lesions by any tobacco habit, it was shown that one of the five tobacco habits was significantly associated with odds of oral ulcerated lesions (Table 3c). Risk of oral ulcerated lesions was greater among those who had chewed betel quid as compared with non-betel quid chewers

Table 2b. Dental treatment needs by age group

| Age group | Number | Tooth extraction |      |        |      | Tooth restoration |      |        |      |
|-----------|--------|------------------|------|--------|------|-------------------|------|--------|------|
|           |        | Mean need        | SD   | % Need | Max* | Mean              | SD   | % Need | Max* |
|           |        |                  |      |        |      |                   |      |        |      |
| 14-19     | 14     | 0.00             | 0.00 | 0.0    | 0    | 0.64              | 1.00 | 36.0   | 3    |
| 20-24     | 113    | 0.06             | 0.24 | 6.0    | 1    | 0.99              | 1.15 | 52.0   | 4    |
| 25-29     | 117    | 0.21             | 0.45 | 20.0   | 2    | 1.65              | 1.16 | 81.0   | 5    |
| 30-34     | 37     | 0.38             | 0.59 | 33.0   | 2    | 2.10              | 1.28 | 87.0   | 5    |
| 35+       | 19     | 1.37             | 1.57 | 63.0   | 6    | 2.26              | 1.62 | 84.0   | 6    |
| Total     | 300    | 0.24             | 0.62 | 18.0   | 6    | 1.45              | 1.28 | 69.0   | 6    |

\*Maximum need per person.

Table 3a. Odds of oral brown pigmentation\* by any tobacco habit.

| Tobacco habit               | Response | Number | OR    | 95% CI |        | p-value |
|-----------------------------|----------|--------|-------|--------|--------|---------|
| Loose tobacco<br>(LTANY)    | 1 = Yes  | 41     | 1.08  | 0.36   | 3.25   | 0.896   |
| Packet tobacco<br>(PTANY)   | 1 = Yes  | 139    | 0.71  | 0.33   | 1.51   | 0.371   |
| Cigarette or bidi<br>(CANY) | 1 = Yes  | 101    | 39.67 | 9.23   | 170.49 | 0.000   |
| Pan<br>(PANANY)             | 1 = Yes  | 94     | 0.74  | 0.32   | 1.72   | 0.485   |
| Betel quid<br>(BQANY)       | 1 = Yes  | 90     | 1.04  | 0.46   | 2.36   | 0.927   |

\*31 subjects had oral brown pigmentation.

Table 3b. Odds of oral white lesions\* by any tobacco habit.

| Tobacco habit               | Response | Number | OR   | 95% CI |      | p-value |
|-----------------------------|----------|--------|------|--------|------|---------|
| Loose tobacco<br>(LTANY)    | 1 = Yes  | 41     | 0.78 | 0.38   | 1.57 | 0.479   |
| Packet tobacco<br>(PTANY)   | 1 = Yes  | 139    | 1.00 | 0.62   | 1.60 | 0.994   |
| Cigarette or bidi<br>(CANY) | 1 = Yes  | 101    | 1.00 | 0.61   | 1.65 | 0.993   |
| Pan<br>(PANANY)             | 1 = Yes  | 94     | 1.26 | 0.76   | 2.11 | 0.371   |
| Betel quid<br>(BQANY)       | 1 = Yes  | 90     | 1.17 | 0.69   | 1.98 | 0.565   |

\*190 subjects had oral white lesions.

Table 3c. Odds of oral ulcerated lesions\* by any tobacco habit.

| Tobacco habit               | Response | Number | OR   | 95% CI |      | p-value |
|-----------------------------|----------|--------|------|--------|------|---------|
| Loose tobacco<br>(LTANY)    | 1 = Yes  | 41     | 1.76 | 0.71   | 4.38 | 0.225   |
| Packet tobacco<br>(PTANY)   | 1 = Yes  | 139    | 0.88 | 0.51   | 1.53 | 0.659   |
| Cigarette or bidi<br>(CANY) | 1 = Yes  | 101    | 0.75 | 0.41   | 1.36 | 0.343   |
| Pan<br>(PANANY)             | 1 = Yes  | 94     | 1.46 | 0.82   | 2.58 | 0.196   |
| Betel quid<br>(BQANY)       | 1 = Yes  | 90     | 3.50 | 1.97   | 6.21 | 0.000   |

\*66 subjects had oral ulcerated lesions.

(OR=3.50; 95% CI = 1.97, 6.21). Elevated odds of ulcerated lesions were evident among loose tobacco and pan users, but were not significant.

## **4.5 Odds of oral symptoms by any tobacco habit**

### **4.5.1 Mouth dryness**

Altogether 173 subjects had mouth dryness. It was shown that three of the five tobacco habits were significantly associated with increased odds of mouth dryness in the logistic regression analysis (unadjusted ORs) of mouth dryness by any tobacco habit (Table 4a). Mouth dryness may be due to other confounders, such as drugs, acute and chronic infections of salivary glands, x-ray radiations and vitamin deficiency (Shafer et al., 1997). These confounders were not measured in the present study. Odds of mouth dryness by any tobacco habit was greater among those who had chewed loose tobacco (OR=2.14; 95% CI = 1.10, 4.18), those who had chewed pan (OR=1.66; 95% CI = 1.00, 2.75), and greater among those who had chewed betel quid (OR=14.08; 95% CI = 6.21, 31.92).

### **4.5.2 Oral burning sensation**

Sixty three subjects had oral burning sensation. The risk of the oral burning sensation was significantly associated with only betel quid use (Table 4b). Betel quid chewers were nearly four times more likely to experience oral burning sensation as compared with non-betel quid chewers (OR=3.58; 95% CI = 2.01, 6.41).

### **4.5.3 Difficulty in mouth opening**

Ninety two subjects had difficulty in mouth opening. In the logistic regression analysis (unadjusted ORs), exposure to any tobacco habit was shown to be a risk for mouth opening in relation to betel quid chewers (OR=46.85; 95% CI = 26.60, 97.11) whereas the other tobacco habits were shown as not to be associated with mouth opening difficulty (Table 4c).

Table 4a. Odds of mouth dryness\* by any tobacco habit.

| Tobacco habit               | Response | Number | OR    | 95% CI |       | p-value |
|-----------------------------|----------|--------|-------|--------|-------|---------|
| Loose tobacco<br>(LTANY)    | 1 = Yes  | 41     | 2.14  | 1.10   | 4.18  | 0.026   |
| Packet tobacco<br>(PTANY)   | 1 = Yes  | 139    | 1.24  | 0.78   | 1.96  | 0.368   |
| Cigarette or bidi<br>(CANY) | 1 = Yes  | 101    | 1.19  | 0.73   | 1.93  | 0.496   |
| Pan<br>(PANANY)             | 1 = Yes  | 94     | 1.66  | 1.00   | 2.75  | 0.051   |
| Betel quid<br>(BQANY)       | 1 = Yes  | 90     | 14.08 | 6.21   | 31.92 | 0.000   |

\*173 subjects had mouth dryness

Table 4b. Odds of oral burning sensation\* by any tobacco habit.

| Tobacco habit               | Response | Number | OR   | 95% CI |      | p-value |
|-----------------------------|----------|--------|------|--------|------|---------|
| Loose tobacco<br>(LTANY)    | 1 = Yes  | 41     | 2.73 | 0.93   | 7.97 | 0.066   |
| Packet tobacco<br>(PTANY)   | 1 = Yes  | 139    | 0.77 | 0.44   | 1.35 | 0.365   |
| Cigarette or bidi<br>(CANY) | 1 = Yes  | 101    | 0.82 | 0.45   | 1.49 | 0.508   |
| Pan<br>(PANANY)             | 1 = Yes  | 94     | 1.47 | 0.82   | 2.62 | 0.194   |
| Betel quid<br>(BQANY)       | 1 = Yes  | 90     | 3.58 | 2.01   | 6.41 | 0.000   |

\*63 subjects had oral burning sensation.

Table 4c. Odds of difficulty in mouth opening\* by any tobacco habit.

| Tobacco habit               | Response | Number | OR    | 95% CI |       | p-value |
|-----------------------------|----------|--------|-------|--------|-------|---------|
| Loose tobacco<br>(LTANY)    | 1 = Yes  | 41     | 1.08  | 0.52   | 2.23  | 0.835   |
| Packet tobacco<br>(PTANY)   | 1 = Yes  | 139    | 1.32  | 0.81   | 2.15  | 0.273   |
| Cigarette or bidi<br>(CANY) | 1 = Yes  | 101    | 0.87  | 0.52   | 1.47  | 0.601   |
| Pan<br>(PANANY)             | 1 = Yes  | 94     | 1.09  | 0.64   | 1.84  | 0.752   |
| Betel quid<br>(BQANY)       | 1 = Yes  | 90     | 46.85 | 22.60  | 97.11 | 0.000   |

\*92 subjects had difficulty in mouth opening.

## **4.6 Odds of oral lesions by current daily exposure to tobacco products**

Current daily exposure refers to the number of times per day that the tobacco product is used.

### **4.6.1 Oral brown pigmentation**

Thirty one subjects had oral brown pigmentation. In the logistic regression analysis (unadjusted ORs) of brown pigmentation by current daily exposure to tobacco product, it was shown that only one of the five tobacco habits was significantly associated with odds of brown pigmentation (Table 5a).

Odds of oral brown pigmentation by current daily exposure to tobacco products were greater among those who had smoked cigarettes or bidis for more than one to three times a day (OR=16.03; 95% CI = 3.22, 79.87), and those who had smoked cigarettes or bidis for four or more times a day were nearly 75 times more likely to have brown pigmentation (OR=74.72; 95% CI = 16.69, 334.55).

In the multiple logistic regression analysis (age-adjusted ORs), age was a significant predictor for brown pigmentation in relation all tobacco habits. For example, among smokers, odds of brown pigmentation increased four-fold per five years increase in age (OR=4.14; 95% CI = 2.20, 7.50). The interpretation of the odds ratio is that of a multiplicative factor by which odds of risk of brown pigmentation increases per five years of age. Age refers to 5-year age groups, where age group 1 = 14-19 years, and age group 2 = 20-24 years, etc. In comparison with any age group, for example, the age group 2, smokers in the age group 3 were 4.14 times more likely to have oral brown pigmentation, and that compared to smokers in age group 2, age group 4 were 17 ( $4.14^2$ ) times more likely to have oral brown pigmentation. While age was a significant predictor for all smoking habits, current daily exposure to cigarettes or bidis was also significantly associated with brown pigmentation in addition to age. Compared with non-smokers, those who smoked 1-3 and 4+ cigarettes or bidis per day were about 30 times and 120 times more likely to have oral brown pigmentation, respectively (OR= 31.35; 95% CI = 5.33, 184.55, OR=117.28; 95% CI = 21.61, 636.63)

Table 5a. Odds of oral brown pigmentation\* by current daily exposure (number of times per day) to tobacco products.

| Tobacco product              | Daily exposure<br>(Frequency) | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |       |         |
|------------------------------|-------------------------------|--------|-----------------------------|--------|---------|-------------------------------|-------|---------|
|                              |                               |        | OR                          | 95% CI | p-value | OR                            |       | p-value |
| Loose tobacco<br>(LTTIME)    | 0                             | 41     | 1.00                        |        |         | 1.00                          |       |         |
|                              | 1-3                           | 119    | 1.13                        | 0.35   | 3.70    | 0.87                          | 0.24  | 3.12    |
|                              | 5+                            | 140    | 1.03                        | 0.32   | 3.31    | 0.60                          | 0.17  | 2.15    |
|                              |                               |        |                             |        |         | Age                           | 1.96  | 4.43    |
|                              |                               |        |                             |        |         |                               |       | 0.000   |
| Packet tobacco<br>(PTTIME)   | 0                             | 161    | 1.00                        |        |         | 1.00                          |       |         |
|                              | 1                             | 47     | 0.51                        | 0.14   | 1.80    | 0.44                          | 0.12  | 1.66    |
|                              | 2+                            | 92     | 0.81                        | 0.35   | 1.87    | 0.81                          | 0.33  | 1.97    |
|                              |                               |        |                             |        |         | Age                           | 1.93  | 4.34    |
|                              |                               |        |                             |        |         |                               |       | 0.000   |
| Cigarette or bidi<br>(CTIME) | 0                             | 199    | 1.00                        |        |         | 1.00                          |       |         |
|                              | 1-3                           | 50     | 16.03                       | 3.22   | 79.87   | 31.35                         | 5.33  | 184.55  |
|                              | 4+                            | 51     | 74.72                       | 16.69  | 334.55  | 117.28                        | 21.61 | 636.63  |
|                              |                               |        |                             |        |         | Age                           | 2.20  | 7.50    |
|                              |                               |        |                             |        |         |                               |       | 0.000   |
| Pan<br>(PANTIME)             | 0                             | 206    | 1.00                        |        |         | 1.00                          |       |         |
|                              | 1+                            | 94     | 0.74                        | 0.32   | 1.72    | 0.67                          | 0.27  | 1.62    |
|                              |                               |        |                             |        |         | Age                           | 1.92  | 4.29    |
|                              |                               |        |                             |        |         |                               |       | 0.370   |
| Betel quid<br>(BQTIME)       | 0                             | 210    | 1.00                        |        |         | 1.00                          |       |         |
|                              | 1+                            | 90     | 0.95                        | 0.42   | 2.15    | 0.74                          | 0.30  | 1.80    |
|                              |                               |        |                             |        |         | Age                           | 1.94  | 4.41    |
|                              |                               |        |                             |        |         |                               |       | 0.504   |
|                              |                               |        |                             |        |         |                               |       | 0.000   |

\*31 subjects had oral brown pigmentation.

#### **4.6.2 Oral white lesions**

Altogether, 190 subjects had white lesions. The lesions were not significantly associated with any particular tobacco habit (Table 5b). But there were elevated odds for pan and betel quid chewers for oral white lesions. Odds of oral white lesions by current daily exposure were also not significantly age-related.

#### **4.6.3 Oral ulcerated lesions**

A total of 66 subjects had oral ulcerated lesions. In the logistic regression analysis (unadjusted ORs), daily exposure to betel quid was significantly associated with increased odds of oral ulcerated lesions (Table 5c). Compared to those who did not use betel quid, betel quid users were 3 times more likely to have oral ulcerated lesions (OR=3.11, 95% CI = 1.76, 5.48).

In the multiple logistic regression analysis (age-adjusted ORs), among betel quid chewers the odds of oral ulcerated lesions increased two fold per five years increase in age (OR=1.95; 95 % CI = 1.44, 2.65). Betel quid was also associated with age-related increased odds of oral ulcerated lesions (OR=3.10; 95% CI = 26.5).

### **4.7 Odds of oral symptoms by current daily exposure to tobacco products**

Current daily exposure refers to the number of times per day that the tobacco product is used.

#### **4.7.1 Mouth dryness**

Altogether, 173 subjects had mouth dryness. Table 6a shows that three of the five tobacco habits were significantly associated with odds of mouth dryness. Odds of mouth dryness by current daily exposure to tobacco products were greater among those who had chewed loose tobacco (OR=3.18; 95% CI = 1.54, 6.53), who chewed pan (OR=1.66; 95% CI = 1.00, 2.75), and greater among those who chewed betel quid (OR=8.86; 95% CI = 4.46, 17.62).

In the multiple logistic regression analysis (age-adjusted ORs), age was a significant predictor for mouth dryness in relation all tobacco habits. For example,

Table 5b. Odds of oral white lesions\* by current daily exposure (number of times per day) to tobacco product.

| Tobacco product              | Daily exposure<br>(Frequency) | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |       |
|------------------------------|-------------------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|-------|
|                              |                               |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |       |
| Loose tobacco<br>(LTTIME)    | 0                             | 41     | 1.00                        |        |         | 1.00                          |        |         |       |
|                              | 1-3                           | 119    | 0.85                        | 0.40   | 1.82    | 0.677                         | 0.41   | 1.85    | 0.712 |
|                              | 5+                            | 140    | 0.72                        | 0.34   | 1.50    | 0.379                         | 0.36   | 1.59    | 0.453 |
| Packet tobacco<br>(PTTIME)   | 0                             | 161    | 1.00                        |        |         | Age                           | 0.71   | 1.17    | 0.455 |
|                              | 1                             | 47     | 1.02                        | 0.52   | 2.01    | 0.953                         | 0.52   | 2.03    | 0.933 |
|                              | 2+                            | 92     | 0.99                        | 0.58   | 1.68    | 0.961                         | 0.58   | 1.69    | 0.972 |
| Cigarette or bidi<br>(CTIME) | 0                             | 199    | 1.00                        |        |         | Age                           | 0.70   | 1.14    | 0.361 |
|                              | 1-3                           | 50     | 1.23                        | 0.64   | 2.38    | 0.537                         | 0.63   | 2.38    | 0.543 |
|                              | 4+                            | 51     | 0.83                        | 0.44   | 1.55    | 0.555                         | 0.46   | 1.62    | 0.637 |
| Pan<br>(PANTIME)             | 0                             | 206    | 1.00                        |        |         | Age                           | 0.70   | 1.16    | 0.418 |
|                              | 1+                            | 94     | 1.26                        | 0.76   | 2.11    | 0.371                         | 0.77   | 2.16    | 0.336 |
|                              |                               |        |                             |        |         | Age                           | 0.69   | 1.13    | 0.327 |
| Betel quid<br>(BQTIME)       | 0                             | 210    | 1.00                        |        |         |                               |        |         |       |
|                              | 1+                            | 90     | 1.15                        | 0.69   | 1.92    | 0.601                         | 0.69   | 1.96    | 0.562 |
|                              |                               |        |                             |        |         | Age                           | 0.69   | 1.14    | 0.344 |

\*190 subjects had oral white lesions.

Table 5c. Odds of oral ulcerated lesions\* by current daily exposure (number of times per day) to tobacco product.

| Tobacco product              | Daily exposure<br>(Frequency) | Number | OR   | 95% CI | p-value | OR   | 95% CI | p-value |
|------------------------------|-------------------------------|--------|------|--------|---------|------|--------|---------|
| Loose tobacco<br>(LTTIME)    | 0                             | 41     | 1.00 |        |         | 1.00 |        |         |
|                              | 1-3                           | 119    | 1.40 | 0.53   | 0.503   | 1.23 | 0.45   | 0.683   |
|                              | 5+                            | 140    | 2.10 | 0.82   | 0.125   | 1.60 | 0.60   | 0.349   |
| Packet tobacco<br>(PTTIME)   | 0                             | 161    | 1.00 |        |         | 1.91 | 1.42   | 0.000   |
|                              | 1                             | 47     | 0.59 |        |         | 1.00 |        |         |
|                              | 2+                            | 92     | 1.05 | 0.24   | 0.236   | 0.53 | 0.21   | 0.179   |
| Cigarette or bidi<br>(CTIME) | 0                             | 199    | 1.00 |        |         | 1.99 | 1.47   | 0.000   |
|                              | 1-3                           | 50     | 0.53 | 0.58   | 0.866   | 1.05 | 0.56   | 0.889   |
|                              | 4+                            | 51     | 1.00 | 1.42   |         | 1.99 | 1.47   | 0.000   |
| Pan<br>(PANTIME)             | 0                             | 206    | 1.00 |        |         | 1.00 |        |         |
|                              | 1+                            | 94     | 1.46 | 0.22   | 0.145   | 0.54 | 0.22   | 0.497   |
|                              |                               |        |      | 0.48   | 0.989   | 0.77 | 0.36   | 0.169   |
| Betel quid<br>(BQTIME)       | 0                             | 210    | 1.00 |        |         | 1.97 | 1.46   | 0.000   |
|                              | 1+                            | 90     | 3.11 | 0.82   | 0.196   | 1.00 |        |         |
|                              |                               |        |      | 2.58   |         | 1.38 | 0.76   | 0.286   |
|                              |                               |        |      |        |         | 1.95 | 1.45   | 0.000   |
|                              |                               |        |      |        |         | 1.00 |        |         |
|                              |                               |        |      | 1.76   | 0.000   | 3.10 | 1.71   | 0.000   |
|                              |                               |        |      | 5.48   |         | 1.95 | 1.44   | 0.000   |

\*66 subjects had oral ulcerated lesions.

Table 6a. Odds of mouth dryness\* by current daily exposure (number of times per day) to tobacco product.

| Tobacco product              | Daily exposure<br>(Frequency) | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |
|------------------------------|-------------------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|
|                              |                               |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |
| Loose tobacco<br>(LTTIME)    | 0                             | 41     | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3                           | 119    | 1.39                        | 0.68   | 2.86    | 1.23                          | 0.57   | 0.592   |
|                              | 4+                            | 140    | 3.18                        | 1.54   | 6.53    | 2.42                          | 1.13   | 0.023   |
| Packet tobacco<br>(PTTIME)   | 0                             | 161    | 1.00                        |        |         | Age 2.42                      | 2.76   | 0.000   |
|                              | 1                             | 47     | 1.57                        | 0.80   | 3.09    | 1.56                          | 0.75   | 0.233   |
|                              | 2+                            | 92     | 1.10                        | 0.66   | 1.84    | 1.06                          | 0.61   | 0.833   |
| Cigarette or bidi<br>(CTIME) | 0                             | 199    | 1.00                        |        |         | Age 2.58                      | 1.88   | 0.000   |
|                              | 1-3                           | 50     | 0.91                        | 0.49   | 1.70    | 1.00                          |        |         |
|                              | 4+                            | 51     | 1.55                        | 0.81   | 2.96    | 0.90                          | 0.47   | 0.751   |
| Pan<br>(PANTIME)             | 0                             | 206    | 1.00                        |        |         | 1.22                          | 0.60   | 0.582   |
|                              | 1+                            | 94     | 1.66                        | 1.00   | 2.75    | Age 2.56                      | 1.86   | 0.000   |
|                              |                               |        |                             |        | 0.051   | 1.00                          |        |         |
| Betel quid<br>(BQTIME)       | 0                             | 210    | 1.00                        |        |         | 1.52                          | 0.88   | 0.132   |
|                              | 1+                            | 90     | 8.86                        | 4.46   | 17.62   | Age 2.54                      | 1.85   | 0.000   |
|                              |                               |        |                             |        | 0.000   | 1.00                          |        |         |
|                              |                               |        |                             |        |         | 11.74                         | 5.57   | 0.000   |
|                              |                               |        |                             |        |         | Age 3.13                      | 2.15   | 0.000   |
|                              |                               |        |                             |        |         |                               | 4.56   |         |

\*173 subjects had mouth dryness

among betel quid chewers odds of mouth dryness increased 3 fold per five years increase in age (OR=3.13; 95% CI = 2.151, 4.556). Loose tobacco and betel quid was also significantly associated with increased odds of mouth dryness.

Compared to non-loose tobacco chewers, those who chewed loose tobacco were 2.42 times more likely to have mouth dryness (OR=2.42; 95% CI = 1.23, 5.18) and compared to non-betel quid chewers, those who chewed betel quid were about 12 times more likely to have mouth dryness (OR=11.74; 95% CI = 5.56, 24.742).

#### **4.7.2 Oral burning sensation**

Sixty three subjects had oral burning sensation. It is shown in Table 6b that two of the five tobacco habits were significantly associated with increased odds of burning sensation. Current daily exposure to tobacco products was shown to be a risk factor for burning sensation in loose tobacco chewers (OR=1.38; 95% CI = 1.38, 12.22), and in betel quid chewers (OR=3.19; 95% CI = 1.79, 5.67).

In the multiple logistic regression analysis (age-adjusted ORs) odds of burning sensation was significantly associated with betel quid chewing alone among the tobacco habits and with age in relation to all tobacco habits. For example, among the betel quid chewers odds of burning sensation increased by more than three times per five years increase in age (OR 3.28; 95% CI = 2.29, 4.72). In addition, those who chewed betel quid were about 3.5 times more likely to have mouth dryness (OR=3.56; 95% CI = 1.84, 6.90).

#### **4.7.3 Difficulty in mouth opening**

Ninety two subjects had difficulty in mouth opening. In the logistic regression analysis (unadjusted ORs), current daily exposure to tobacco products was shown to be a risk factor for mouth opening in relation to betel quid chewers only (OR=33.63; 95% CI = 17.07, 66.25), in Table 6c.

In the multiple logistic regression analysis (age-adjusted ORs) odds of mouth opening was significantly associated with betel quid chewing alone among the tobacco habits and with age in relation to all tobacco habits except packet tobacco. Among betel quid chewers, odds of mouth opening increased nearly three fold per five years increase in age (OR=2.76; 95% CI = 1.81, 4.20). In

Table 6b. Odds of oral burning sensation\* by current daily exposure (number of times per day) to tobacco product.

| Tobacco product              | Daily exposure<br>(Frequency) | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |
|------------------------------|-------------------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|
|                              |                               |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |
| Loose tobacco<br>(LTTIME)    | 0                             | 41     | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3                           | 119    | 1.44                        | 0.45   | 4.58    | 1.14                          | 0.32   | 0.845   |
|                              | 4+                            | 140    | 1.38                        | 1.38   | 12.22   | 3.01                          | 0.92   | 0.069   |
| Packet tobacco<br>(PTTIME)   | 0                             | 161    | 1.00                        |        |         | Age 3.10                      | 2.18   | 0.000   |
|                              | 1                             | 47     | 0.59                        |        |         | 1.00                          |        |         |
|                              | 2+                            | 92     | 0.87                        | 0.24   | 1.42    | 0.47                          | 0.17   | 0.128   |
| Cigarette or bidi<br>(CTIME) | 0                             | 199    | 1.00                        |        |         | Age 3.26                      | 2.29   | 0.000   |
|                              | 1-3                           | 50     | 0.57                        |        |         | 1.00                          |        |         |
|                              | 4+                            | 51     | 1.08                        | 0.24   | 1.36    | 0.60                          | 0.24   | 0.280   |
| Pan<br>(PANTIME)             | 0                             | 206    | 1.00                        |        |         | Age 3.24                      | 2.27   | 0.000   |
|                              | 1+                            | 94     | 1.47                        | 0.52   | 2.25    | 0.68                          | 0.29   | 0.369   |
|                              |                               |        |                             |        |         | Age 3.18                      | 2.25   | 0.000   |
| Betel quid<br>(BQTIME)       | 0                             | 210    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1+                            | 90     | 3.19                        | 1.79   | 5.67    | 3.56                          | 1.84   | 0.000   |
|                              |                               |        |                             |        |         | Age 3.28                      | 2.29   | 0.000   |

\*63 subjects had oral burning sensations.

Table 6c.Odds of difficulty in mouth opening\* by current daily exposure (number of times per day) to tobacco product.

| Tobacco product              | Daily exposure<br>(Frequency) | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |
|------------------------------|-------------------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|
|                              |                               |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |
| Loose tobacco<br>(LTTIME)    | 0                             | 41     | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3                           | 119    | 0.89                        | 0.41   | 1.95    | 0.78                          | 0.35   | 1.76    |
|                              | 4+                            | 140    | 1.26                        | 0.59   | 2.69    | 0.96                          | 0.44   | 2.12    |
| Packet tobacco<br>(PTTIME)   | 0                             | 161    | 1.00                        |        |         |                               |        |         |
|                              | 1                             | 47     | 1.46                        | 0.74   | 2.91    |                               |        |         |
|                              | 2+                            | 92     | 1.25                        | 0.72   | 2.71    | 1.25                          | 0.70   | 2.21    |
| Cigarette or bidi<br>(CTIME) | 0                             | 199    | 1.00                        |        |         | 1.80                          | 1.37   | 2.36    |
|                              | 1-3                           | 50     | 0.54                        | 0.25   | 1.15    | 0.54                          | 0.25   | 1.17    |
|                              | 4+                            | 51     | 1.28                        | 0.68   | 2.43    | 1.05                          | 0.54   | 2.07    |
| Pan<br>(PANTIME)             | 0                             | 206    | 1.00                        |        |         |                               |        |         |
|                              | 1+                            | 94     | 1.09                        | 0.64   | 1.84    | 1.01                          | 0.59   | 1.74    |
|                              |                               |        |                             |        |         | 1.80                          | 1.37   | 2.37    |
| Betel quid<br>(BQTIME)       | 0                             | 210    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1+                            | 90     | 33.63                       | 17.07  | 66.25   | 54.50                         | 23.86  | 124.51  |
|                              |                               |        |                             |        |         | 2.76                          | 1.81   | 4.20    |

\*92 subjects had difficulty in mouth opening

In addition, those who chewed betel quid were nearly 55 times more likely to have difficulty in mouth opening (OR=54.40; 95% CI = 23.86, 124.51).

## **4.8 Odds of oral lesions by lifetime exposure to tobacco products**

Lifetime exposure, as referred to in this section, was calculated as number of smoking/chewing occasions per day times number of years of use.

### **4.8.1 Oral brown pigmentation**

Thirty-one subjects had oral brown pigmentation. In the univariate logistic regression analysis (unadjusted ORs), it is shown in Table 7a that only one of the five tobacco products was significantly associated with brown pigmentation. Odds of brown pigmentation by lifetime exposure to tobacco products were significantly associated with cigarette or bidi smoking. Compared to non-smokers, those in the two upper quartiles were 19 times and 755 times more likely to have brown pigmentation respectively (OR=18.76; 95% CI = 3.24, 108.62; OR=755.17; 95% CI = 119.86, 1000.0)

In multiple logistic regression analyses (age-adjusted ORs), age was a significant predictor for brown pigmentation in relation to all tobacco habits. Among smokers, odds of brown pigmentation increased three-fold per five year increase in age (OR= 3.01; 95% CI = 1.32, 6.86). While age was a significant predictor for all tobacco habits, lifetime exposure to cigarettes or bidis was also significantly associated with brown pigmentation. Compared to non-smokers, those in the upper exposure quartiles were about 20 times and 832 times more likely to have brown pigmentation, respectively (OR= 20.08; 95% CI = 3.19, 126.31; OR= 832.19; 95% CI = 101.85, 1000.0).

### **4.8.2 Oral white lesions**

Altogether, 190 subjects had oral white lesions. It is shown in Table 7b that the increased odds of oral white lesions were not significantly associated with any tobacco habit.

Table 7a. Odds of oral brown pigmentation\* by lifetime exposure (number per day x number of years of use) to tobacco products.

| Tobacco product              | Lifetime exposure | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |
|------------------------------|-------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|
|                              |                   |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |
| Loose tobacco<br>(LTEXPO)    | 0                 | 41     | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-11              | 77     | 0.782                       | 0.21   | 2.94    | 1.02                          | 0.25   | 4.22    |
|                              | 12-20             | 65     | 0.711                       | 0.19   | 3.06    | 0.83                          | 0.19   | 3.64    |
|                              | 21-36             | 62     | 1.370                       | 0.38   | 4.89    | 0.72                          | 0.18   | 2.91    |
|                              | 40+               | 55     | 1.349                       | 0.37   | 4.96    | 0.41                          | 0.09   | 1.80    |
|                              |                   |        |                             |        |         | Age                           | 2.10   | 5.09    |
| Pan<br>(PANEXPO)             | 0                 | 206    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3               | 26     | 1.04                        | 0.29   | 3.73    | 1.46                          | 0.36   | 5.82    |
|                              | 4-5               | 29     | 0.28                        | 0.04   | 2.19    | 0.25                          | 0.03   | 2.05    |
|                              | 6-7               | 19     | 0.00                        | 0.00   | >999.99 | 0.00                          | 0.00   | >999.99 |
|                              | 8+                | 20     | 1.40                        | 0.38   | 5.16    | 1.46                          | 0.40   | 5.29    |
|                              |                   |        |                             |        |         | Age                           | 1.92   | 4.29    |
| Cigarette or bidi<br>(CEXPO) | 0                 | 199    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-6               | 23     | 0.00                        | 0.00   | >999.99 | 8.99                          | 0.66   | 121.95  |
|                              | 8-15              | 27     | 3.79                        | 0.33   | 43.25   | 8.78                          | 0.62   | 124.00  |
|                              | 16-28             | 25     | 18.76                       | 3.24   | 108.62  | 20.08                         | 3.19   | 126.31  |
|                              | 30+               | 26     | 755.17                      | 119.86 | >999.99 | 832.19                        | 101.85 | >999.99 |
|                              |                   |        |                             |        |         | Age                           | 1.32   | 6.86    |
| Packet tobacco<br>(PTEXPO)   | 0                 | 161    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3               | 21     | 0.00                        | 0.00   | >999.99 | 0.00                          | 0.00   | >999.99 |
|                              | 4-5               | 42     | 0.37                        | 0.08   | 1.67    | 0.57                          | 0.15   | 2.17    |
|                              | 6-9               | 40     | 0.39                        | 0.09   | 1.76    | 0.35                          | 0.08   | 1.65    |
|                              | 10+               | 36     | 1.80                        | 0.70   | 4.68    | 1.36                          | 0.49   | 3.76    |
|                              |                   |        |                             |        |         | Age                           | 1.81   | 4.10    |
| Betel quid<br>(BQEXPO)       | 0                 | 210    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-6               | 24     | 0.78                        | 0.17   | 3.53    | 1.34                          | 0.26   | 6.92    |
|                              | 7-12              | 22     | 0.00                        | 0.00   | >999.99 | 0.00                          | 0.00   | >999.99 |
|                              | 14-20+            | 44     | 1.62                        | 0.64   | 4.06    | 0.87                          | 0.31   | 2.44    |
|                              |                   |        |                             |        |         | Age                           | 1.89   | 4.38    |

\*31 subjects had oral brown pigmentation.

Table 7b. Odds of oral white lesions\* by lifetime exposure (number per day x number of years of use) to tobacco products.

| Tobacco product              | Lifetime exposure | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |
|------------------------------|-------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|
|                              |                   |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |
| Loose tobacco<br>(LTEXPO)    | 0                 | 41     | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-11              | 77     | 1.03                        | 0.45   | 2.32    | 1.01                          | 0.45   | 0.984   |
|                              | 12-20             | 65     | 0.58                        | 0.25   | 1.31    | 0.58                          | 0.25   | 0.187   |
|                              | 21-36             | 62     | 0.69                        | 0.30   | 1.58    | 0.75                          | 0.32   | 0.502   |
|                              | 40+               | 55     | 0.88                        | 0.37   | 2.08    | 1.02                          | 0.41   | 0.973   |
|                              |                   |        |                             |        |         | Age                           | 0.66   | 1.16    |
|                              |                   |        |                             |        |         |                               |        | 0.347   |
| Pan<br>(PANEXPO)             | 0                 | 206    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3               | 26     | 1.18                        | 0.50   | 2.76    | 1.14                          | 0.48   | 0.767   |
|                              | 4-5               | 29     | 1.18                        | 0.52   | 2.67    | 1.20                          | 0.53   | 0.659   |
|                              | 6-7               | 19     | 1.35                        | 0.49   | 3.69    | 1.44                          | 0.52   | 0.485   |
|                              | 8+                | 20     | 1.45                        | 0.54   | 3.39    | 1.53                          | 0.56   | 0.408   |
|                              |                   |        |                             |        |         | Age                           | 0.68   | 1.13    |
|                              |                   |        |                             |        |         |                               |        | 0.297   |
| Cigarette or bidi<br>(CEXPO) | 0                 | 199    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-6               | 23     | 1.64                        | 0.62   | 4.35    | 1.57                          | 0.59   | 0.368   |
|                              | 8-15              | 27     | 0.72                        | 0.32   | 1.63    | 0.68                          | 0.30   | 0.362   |
|                              | 16-28             | 25     | 0.63                        | 0.27   | 1.45    | 0.66                          | 0.29   | 0.337   |
|                              | 30+               | 26     | 1.57                        | 0.63   | 3.92    | 1.83                          | 0.71   | 0.214   |
|                              |                   |        |                             |        |         | Age                           | 0.65   | 1.11    |
|                              |                   |        |                             |        |         |                               |        | 0.244   |
| Packet tobacco<br>(PTEXPO)   | 0                 | 161    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3               | 21     | 0.94                        | 0.37   | 2.40    | 0.88                          | 0.34   | 0.788   |
|                              | 4-5               | 42     | 1.04                        | 0.51   | 2.11    | 1.03                          | 0.51   | 0.930   |
|                              | 6-9               | 40     | 0.87                        | 0.43   | 1.76    | 0.88                          | 0.43   | 0.725   |
|                              | 10+               | 36     | 1.16                        | 0.54   | 2.48    | 1.22                          | 0.57   | 0.608   |
|                              |                   |        |                             |        |         | Age                           | 0.68   | 1.13    |
|                              |                   |        |                             |        |         |                               |        | 0.317   |
| Betel quid<br>(BQEXPO)       | 0                 | 210    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-6               | 24     | 2.29                        | 0.82   | 6.38    | 2.21                          | 0.79   | 0.131   |
|                              | 7-12              | 22     | 1.06                        | 0.42   | 2.63    | 1.05                          | 0.42   | 0.916   |
|                              | 14-20+            | 44     | 0.87                        | 0.45   | 1.69    | 0.91                          | 0.46   | 0.778   |
|                              |                   |        |                             |        |         | Age                           | 0.72   | 1.20    |
|                              |                   |        |                             |        |         |                               |        | 0.556   |

\*190 subjects had oral white lesions.

### **4.8.3 Oral ulcerated lesions**

Altogether, 66 subjects had oral ulcerated lesions. It was shown that three of the five tobacco habits, namely loose tobacco, pan, and betel quid were significantly associated with increased odds of oral ulcerated lesions (Table 7c). The increased odds were observed only in the higher exposure groups where the respective odds ratios ranged from 2.93 to 4.47.

In the multiple logistic regression analysis (age-adjusted ORs), age was a significant predictor for oral ulcerated lesions in relation all tobacco habits. In addition only betel quid chewers had increased odds of oral ulcerated lesions in relation to their lifetime

A dose response is evident in which the two higher exposure group were around 4 times more likely to have oral ulcerated lesions, respectively (OR=4.22; 95% CI = 1.62, 11.00; OR=3.53; 95% CI = 1.69, 7.37).

## **4.9 Odds of oral symptoms by lifetime exposure to tobacco products**

Lifetime exposure, as referred to in this section, was calculated as number of smoking/chewing occasions per day times number of years of use

### **4.9.1 Odds of oral dryness**

Mouth dryness was experienced by 173 subjects. It was shown that four of the five tobacco habits were significantly associated with increased odds of mouth dryness by lifetime exposure to tobacco products (Table 8a). Among loose tobacco chewers, the increased odds of mouth dryness were observed in upper two exposure groups. The respective odds ratios were OR=5.32; 95% CI = 2.23, 12.72; OR=11.53, 95% CI = 4.03, 32.98. Among pan and cigarette or bidi chewers, the increased odds of mouth dryness were observed in the higher exposure group, respectively (OR=16.24; 95% CI = 2.14, 123.45; OR=4.27; 95% CI = 1.42, 12.85). But among betel quid chewers, all three exposure groups had increased odds of mouth dryness illustrating a strong response. The respective odds ratios were

Table 7c. Odds of oral ulcerated lesions\* by lifetime exposure (number per day x number of years use) to tobacco products.

| Tobacco product              | Lifetime exposure | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |
|------------------------------|-------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|
|                              |                   |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |
| Loose tobacco<br>(LTEXPO)    | 0                 | 41     | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-11              | 77     | 0.97                        | 0.33   | 2.85    | 1.04                          | 0.35   | 0.950   |
|                              | 12-20             | 65     | 1.19                        | 0.40   | 3.51    | 1.21                          | 0.40   | 0.731   |
|                              | 21-36             | 62     | 2.03                        | 0.72   | 5.72    | 1.50                          | 0.51   | 0.459   |
|                              | 40+               | 55     | 3.89                        | 1.40   | 10.79   | 2.33                          | 0.79   | 0.124   |
| Pan<br>(PANEXPO)             | 0                 | 206    | 1.00                        |        |         | Age                           | 1.23   | 0.001   |
|                              | 1-3               | 26     | 0.96                        | 0.34   | 2.69    | 1.15                          | 0.39   |         |
|                              | 4-5               | 29     | 1.05                        | 0.40   | 2.75    | 1.00                          | 0.37   | 0.804   |
|                              | 6-7               | 19     | 2.93                        | 1.11   | 7.74    | 2.38                          | 0.88   | 0.997   |
|                              | 8+                | 20     | 1.73                        | 0.63   | 4.76    | 1.39                          | 0.48   | 0.086   |
| Cigarette or bidi<br>(CEXPO) | 0                 | 199    | 1.00                        |        |         | Age                           | 1.42   | 0.541   |
|                              | 1-6               | 23     | 0.00                        | 0.00   | >999.99 | 1.92                          | 1.42   | 0.000   |
|                              | 8-15              | 27     | 0.74                        | 0.26   | 2.05    | 0.00                          | 0.00   |         |
|                              | 16-28             | 25     | 1.02                        | 0.39   | 2.71    | 0.98                          | 0.34   | 0.966   |
|                              | 30+               | 26     | 1.44                        | 0.59   | 3.52    | 0.85                          | 0.31   | 0.968   |
| Packet tobacco<br>(PTEXPO)   | 0                 | 161    | 1.00                        |        |         | Age                           | 2.08   | 0.748   |
|                              | 1-3               | 21     | 0.35                        | 0.08   | 1.59    | 0.78                          | 0.29   | 0.613   |
|                              | 4-5               | 42     | 0.35                        | 0.12   | 1.05    | 1.94                          | 1.41   | 0.000   |
|                              | 6-9               | 40     | 0.97                        | 0.43   | 2.23    | 1.00                          | 0.11   |         |
|                              | 10+               | 36     | 2.13                        | 0.99   | 4.58    | 0.50                          | 0.11   | 0.373   |
| Betel quid<br>(BQEXPO)       | 0                 | 210    | 1.00                        |        |         | Age                           | 2.15   | 0.063   |
|                              | 1-6               | 24     | 1.07                        | 0.34   | 3.34    | 0.91                          | 0.39   | 0.837   |
|                              | 7-12              | 22     | 3.71                        | 1.47   | 9.39    | 1.73                          | 0.78   | 0.176   |
|                              | 14-20+            | 44     | 4.47                        | 2.22   | 9.00    | 1.88                          | 1.38   | 0.000   |
|                              |                   |        |                             |        |         | Age                           | 2.55   |         |
|                              |                   |        |                             |        |         | Age                           | 4.83   | 0.511   |
|                              |                   |        |                             |        |         | 4.22                          | 1.62   | 0.003   |
|                              |                   |        |                             |        |         | 3.53                          | 1.69   | 0.001   |
|                              |                   |        |                             |        |         | 1.88                          | 1.37   | 0.000   |
|                              |                   |        |                             |        |         | Age                           | 2.57   |         |

\* 66 subjects had oral ulcerated lesions.

Table 8a. Odds of mouth dryness\* by lifetime exposure (number of times per day x number of years of use) to tobacco products.

| Tobacco product              | Lifetime exposure | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |
|------------------------------|-------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|
|                              |                   |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |
| Loose tobacco<br>(LTEXPO)    | 0                 | 41     | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-11              | 77     | 0.64                        | 0.29   | 1.40    | 0.67                          | 0.30   | 0.332   |
|                              | 12-20             | 65     | 1.55                        | 0.70   | 3.41    | 1.57                          | 0.70   | 0.272   |
|                              | 21-36             | 62     | 5.32                        | 2.23   | 12.72   | 4.00                          | 1.63   | 0.003   |
|                              | 40+               | 55     | 11.53                       | 4.03   | 32.98   | 6.96                          | 2.33   | 0.001   |
|                              |                   |        | Age                         |        |         | 1.77                          | 1.64   | 0.001   |
| Pan<br>(PANEXPO)             | 0                 | 206    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3               | 26     | 0.86                        | 0.38   | 1.94    | 1.05                          | 0.44   | 0.912   |
|                              | 4-5               | 29     | 1.63                        | 0.72   | 3.67    | 1.50                          | 0.63   | 0.358   |
|                              | 6-7               | 19     | 1.18                        | 0.46   | 3.05    | 0.73                          | 0.27   | 0.530   |
|                              | 8+                | 20     | 16.24                       | 2.14   | 123.45  | 16.35                         | 2.02   | 0.009   |
|                              |                   |        | Age                         |        |         | 2.66                          | 1.90   | 0.000   |
| Cigarette or bidi<br>(CEXPO) | 0                 | 199    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-6               | 23     | 0.85                        | 0.36   | 2.01    | 1.05                          | 0.43   | 0.915   |
|                              | 8-15              | 27     | 0.72                        | 0.32   | 1.61    | 0.93                          | 0.40   | 0.872   |
|                              | 16-28             | 25     | 0.99                        | 0.43   | 2.29    | 0.68                          | 0.28   | 0.390   |
|                              | 30+               | 26     | 4.27                        | 1.42   | 12.85   | 2.34                          | 0.72   | 0.158   |
|                              |                   |        | Age                         |        |         | 2.53                          | 1.82   | 0.000   |
| Packet tobacco<br>(PTEXPO)   | 0                 | 161    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-3               | 21     | 1.08                        | 0.43   | 2.70    | 0.00                          | 0.64   | 0.281   |
|                              | 4-5               | 42     | 1.32                        | 0.66   | 2.64    | 1.48                          | 0.70   | 0.307   |
|                              | 6-9               | 40     | 0.99                        | 0.49   | 1.98    | 0.86                          | 0.40   | 0.686   |
|                              | 10+               | 36     | 1.62                        | 0.76   | 3.46    | 1.10                          | 0.49   | 0.823   |
|                              |                   |        | Age                         |        |         | 2.68                          | 1.93   | 0.000   |
| Betel quid<br>(BQEXPO)       | 0                 | 210    | 1.00                        |        |         | 1.00                          |        |         |
|                              | 1-6               | 24     | 3.00                        | 1.19   | 7.53    | 5.69                          | 2.12   | 0.001   |
|                              | 7-13              | 22     | 7.82                        | 2.24   | 27.22   | 10.81                         | 2.90   | 0.000   |
|                              | 14-20+            | 44     | 53.04                       | 7.17   | 392.18  | 51.77                         | 6.82   | 0.000   |
|                              |                   |        | Age                         |        |         | 3.01                          | 2.06   | 0.000   |

\*173 subjects had mouth dryness.

OR=3.00; 95% CI = 1.19, 7.53; OR=7.82; 95% CI = 2.24, 27.22; OR=53.04; 95% CI = 7.17, 92.18).

In the multiple logistic regression analyses (age-adjusted ORs), age was a significant predictor of mouth dryness in relation to all tobacco habits. In addition to age, the increased odds of mouth dryness were significant for the higher exposure groups of loose tobacco and pan chewers, and for all groups among betel quid chewers.

#### **4.9.2 Oral burning sensation**

Sixty three subjects had oral burning sensations. In the logistic regression analysis (unadjusted ORs), lifetime exposure to loose tobacco, pan and betel quid was associated with the increased odds of oral burning sensations (Table 8b).

Compared to those who were not exposed to loose tobacco, users of loose tobacco in the higher lifetime exposure groups were nearly 13 times more likely to have oral burning sensations. Compared with non-pan chewers, those in the two upper exposure quartiles were nearly 3 times and 3.5 times more likely to have oral burning sensations, respectively (OR= 3.11; 95% CI =1.17, 8.26; OR= 3.50; 95% CI =1.36, 9.04. The increased odds were observed only in the higher betel quid exposure group, respectively (OR=66.32; 95% CI = 3.13, 12.78).

In the multiple logistic regression analyses (age-adjusted ORs), age was a significant predictor for oral burning sensations in relation to all tobacco habits. In addition, lifetime exposure to loose tobacco and betel quid was also significantly associated with increased odds of oral burning sensation. Among loose tobacco and betel quid chewers, the increased odds were significant only in the higher exposure groups. The respective odds ratios were OR=6.78; 95% CI = 1.98.13, 23.20; OR=5.23; 95% CI 2.35, 11.63.

#### **4.9.3 Difficulty in mouth opening**

Ninety two subjects had difficulty in mouth opening. In the logistic regression analysis (unadjusted ORs) of mouth opening by lifetime exposure to tobacco products, it is shown in Table 8c that three of the five tobacco products were significantly associated with the increased odds of difficulty in mouth opening. Among loose tobacco and pan chewers, the increased odds of mouth opening

Table 8b. Odds of oral burning sensation\* by lifetime exposure (number of times per day x number of years of use) to tobacco products.

| Tobacco product           | Lifetime exposure | Number | Unadjusted odds ratios (OR) |            |         | Age adjusted odds ratios (OR) |            |         |
|---------------------------|-------------------|--------|-----------------------------|------------|---------|-------------------------------|------------|---------|
|                           |                   |        | OR                          | 95% CI     | p-value | OR                            | 95% CI     | p-value |
| Loose tobacco (LTEXPO)    | 0                 | 41     | 1.00                        |            |         | 1.00                          |            |         |
|                           | 1-11              | 77     | 0.93                        | 0.25 3.37  | 0.906   | 1.01                          | 0.26 3.90  | 0.990   |
|                           | 12-20             | 65     | 0.77                        | 0.19 3.06  | 0.711   | 0.81                          | 0.19 3.35  | 0.766   |
|                           | 21-36             | 62     | 2.95                        | 0.90 9.65  | 0.073   | 1.93                          | 0.56 6.72  | 0.300   |
|                           | 40+               | 55     | 12.87                       | 4.03 41.15 | 0.000   | 6.78                          | 1.98 23.20 | 0.002   |
| Pan (PANEXPO)             | 0                 | 206    | 1.00                        |            |         | Age 2.39                      | 1.64 3.49  | 0.000   |
|                           | 1-3               | 26     | 0.56                        | 0.16 1.96  | 0.362   | 1.00                          |            |         |
|                           | 4-5               | 29     | 0.69                        | 0.23 2.08  | 0.505   | 0.70                          | 0.18 2.76  | 0.614   |
|                           | 6-7               | 19     | 3.11                        | 1.17 8.26  | 0.022   | 0.60                          | 0.18 1.99  | 0.408   |
|                           | 8+                | 20     | 3.50                        | 1.36 9.04  | 0.010   | 2.54                          | 0.93 6.97  | 0.071   |
| Cigarette or bidi (CEXPO) | 0                 | 199    | 1.00                        |            |         | Age 3.11                      | 0.98 8.73  | 0.054   |
|                           | 1-6               | 23     | 0.16                        | 0.02 1.22  | 0.077   | 2.29                          | 2.18 4.42  | 0.000   |
|                           | 8-15              | 27     | 0.44                        | 0.13 1.53  | 0.197   | 1.00                          |            |         |
|                           | 16-28             | 25     | 0.88                        | 0.31 2.48  | 0.810   | 0.23                          | 0.03 1.79  | 0.159   |
|                           | 30+               | 26     | 2.20                        | 0.93 5.19  | 0.071   | 0.74                          | 0.20 2.70  | 0.650   |
| Packet tobacco (PTEXPO)   | 0                 | 161    | 1.00                        |            |         | 0.66                          | 0.22 1.97  | 0.460   |
|                           | 1-3               | 21     | 0.17                        | 0.02 1.29  | 0.086   | 0.83                          | 0.30 2.32  | 0.726   |
|                           | 4-5               | 42     | 0.45                        | 0.17 1.24  | 0.122   | Age 3.13                      | 2.16 4.53  | 0.000   |
|                           | 6-9               | 40     | 0.71                        | 0.29 1.74  | 0.455   | 1.00                          |            |         |
|                           | 10+               | 36     | 1.89                        | 0.88 4.10  | 0.105   | 0.31                          | 0.04 2.45  | 0.265   |
| Betel quid (BQEXPO)       | 0                 | 210    | 1.00                        |            |         | 0.40                          | 0.13 1.23  | 0.110   |
|                           | 1-6               | 24     | 0.83                        | 0.23 2.93  | 0.766   | 0.60                          | 0.23 1.59  | 0.303   |
|                           | 7-13              | 22     | 2.17                        | 0.79 5.96  | 0.135   | 1.37                          | 0.58 3.21  | 0.475   |
|                           | 14-20+            | 44     | 6.32                        | 3.13 12.78 | 0.000   | Age 3.11                      | 2.17 4.44  | 0.000   |
|                           |                   |        |                             |            |         | 1.00                          |            |         |
|                           |                   |        |                             |            |         | 1.51                          | 0.37 6.13  | 0.564   |
|                           |                   |        |                             |            |         | 2.79                          | 0.94 8.30  | 0.065   |
|                           |                   |        |                             |            |         | 5.23                          | 2.35 11.63 | 0.000   |
|                           |                   |        |                             |            |         | Age 3.07                      | 2.13 4.44  | 0.000   |
|                           |                   |        |                             |            |         |                               |            |         |

\* 63 subjects had oral burning sensation.

Table 8c.Odds of mouth opening\* by lifetime exposure (number of times per day x number of years of use) of tobacco use.

| Tobacco product               | Lifetime exposure | Number | Unadjusted odds ratios (OR) |        |         | Age adjusted odds ratios (OR) |        |         |
|-------------------------------|-------------------|--------|-----------------------------|--------|---------|-------------------------------|--------|---------|
|                               |                   |        | OR                          | 95% CI | p-value | OR                            | 95% CI | p-value |
| Loose tobacco<br>(LTEXPO)     | 0                 | 41     | 1.00                        |        |         | 1.00                          |        |         |
|                               | 1-11              | 77     | 0.63                        | 0.27   | 1.51    | 0.66                          | 0.27   | 1.60    |
|                               | 12-20             | 65     | 0.86                        | 0.36   | 2.05    | 0.86                          | 0.35   | 2.08    |
|                               | 21-36             | 62     | 1.07                        | 0.45   | 2.53    | 0.79                          | 0.32   | 1.94    |
|                               | 40+               | 55     | 2.51                        | 1.07   | 5.90    | 1.56                          | 0.62   | 3.89    |
| Pan<br>(PANEXPO)              | 0                 | 206    | 1.00                        |        |         | 1.62                          | 1.20   | 2.20    |
|                               | 1-3               | 26     | 0.70                        | 0.27   | 1.82    | 1.00                          |        |         |
|                               | 4-5               | 29     | 0.89                        | 0.37   | 2.11    | 0.80                          | 0.30   | 2.14    |
|                               | 6-7               | 19     | 0.83                        | 0.29   | 2.40    | 0.83                          | 0.34   | 2.01    |
|                               | 8+                | 20     | 2.84                        | 1.12   | 7.19    | 0.74                          | 0.26   | 2.06    |
| Cigarettes or bidi<br>(CEXPO) | 0                 | 199    | 1.00                        |        |         | 2.35                          | 0.88   | 6.29    |
|                               | 1-6               | 23     | 0.76                        | 0.29   | 2.03    | 1.80                          | 1.37   | 2.37    |
|                               | 8-15              | 27     | 0.49                        | 0.18   | 1.36    | 1.00                          |        |         |
|                               | 16-28             | 25     | 0.68                        | 0.26   | 1.79    | 0.91                          | 0.34   | 2.47    |
|                               | 30+               | 26     | 1.85                        | 0.81   | 4.23    | 0.61                          | 0.22   | 1.71    |
| Packet tobacco<br>(PTEXPO)    | 0                 | 161    | 1.00                        |        |         | 0.56                          | 0.21   | 1.51    |
|                               | 1-3               | 21     | 1.03                        | 0.38   | 2.82    | 1.12                          | 0.46   | 2.75    |
|                               | 4-5               | 42     | 1.16                        | 0.55   | 2.42    | 1.77                          | 1.33   | 2.36    |
|                               | 6-9               | 40     | 1.39                        | 0.67   | 2.90    | 1.00                          |        |         |
|                               | 10+               | 36     | 1.64                        | 0.77   | 3.48    | 1.44                          | 0.51   | 4.07    |
| Betel quid<br>(BQEXPO)        | 0                 | 210    | 1.00                        |        |         | 1.32                          | 0.60   | 2.88    |
|                               | 1-6               | 24     | 7.62                        | 3.03   | 19.13   | 1.81                          | 1.37   | 2.39    |
|                               | 7-13              | 22     | 40.50                       | 12.53  | 130.94  | 1.00                          |        |         |
|                               | 14-20+            | 44     | 188.96                      | 42.66  | 837.03  | 15.25                         | 5.24   | 44.44   |
|                               |                   |        |                             |        |         | 64.54                         | 17.92  | 232.46  |
|                               |                   |        |                             |        |         | 221.03                        | 46.93  | >999.99 |
|                               |                   |        |                             |        |         | 2.46                          | 1.59   | 3.81    |

\*92 subjects had difficulty in mouth opening.

were observed in the higher exposure groups. The respective odds ratios were OR=2.51; 95% CI = 1.07, 5.90; OR=2.84; 95% CI = 1.12, 7.19. However, among betel quid chewers, the increased odds were observed in all exposure groups, illustrating a very strong dose response (OR=7.62; 95% CI = 3.03, 19.13; OR=40.50; 95% CI = 12.53, 130.94; OR=188.96; 95% CI = 42.66, 837.03).

In multiple logistic regression analysis (age-adjusted ORs), age was a significant predictor for difficulty in mouth opening in relation to all tobacco products. In addition to age, with respect to betel quid chewers only, the increased odds were observed in all exposure groups, and the dose response continued to be evident (OR=15.25; 95% CI = 5.24, 44.44; OR=64.54; 95% CI = 17.92, 232.46; OR=221.03; 95% CI = 46.93, 1000.00)

#### **4.10 Predictors of oral symptoms and signs experienced by factory workers.**

The best fitting multiple regression models for oral signs and symptoms that were experienced by the factory workers are shown in Table 9. Odds ratios are adjusted for age and all other tobacco habits.

There were 173 workers with mouth dryness. Workers with loose tobacco and betel quid habit had statistically significant odds ratios after adjustment for age and other tobacco habits. Compared to those who were not exposed to loose tobacco, workers who used loose tobacco and who were in the two upper quartiles of lifetime exposure were up to 16 times more likely to have mouth dryness (OR=8.38; OR=16.19). In relation to betel quid workers who were not exposed, those in all exposure quartiles were up to 85 times more likely to have mouth dryness. The adjusted odds ratio in relation to age was 1.67(95% CI =1.04, 2.66). Considering the difficulty with mouth opening in workers with tobacco habits, only age and betel quid had significant effect in all exposure quartiles (OR=50.41, 95% CI = 11.63, 218.51; OR=296.12, 95% CI = 55.90, >999.99; OR=738.87, 95%CI = 116.76, >999.99).

Ninety two workers had oral burning sensation. Compared to those who were not exposed to loose tobacco, workers in the upper quartile exposure groups

Table 9. Best fitting multiple logistic regression models for symptoms and signs experienced by factory workers.

| Sign or symptom             | Predictor variable | Lifetime exposure* | Adjusted odds ratios (OR) |        |          |         |
|-----------------------------|--------------------|--------------------|---------------------------|--------|----------|---------|
|                             |                    |                    | OR                        | 95% CI | P-value  |         |
| Mouth dryness               | Age                |                    | 1.67                      | 1.046  | 2.668    | <0.0001 |
|                             | Loose tobacco      | 0                  | 1.00                      |        |          |         |
|                             |                    | 1-11               | 0.521                     | 0.167  | 1.621    | 0.260   |
|                             |                    | 12-20              | 2.489                     | 0.822  | 7.54     | 0.1068  |
|                             |                    | 21-36              | 8.387                     | 2.554  | 27.539   | 0.0005  |
|                             |                    | 40+                | 16.199                    | 4.049  | 64.814   | <0.0001 |
|                             | Betel quid         | 0                  | 1.00                      |        |          |         |
|                             |                    | 1-6                | 10.105                    | 2.995  | 34.094   | <0.0001 |
|                             |                    | 7-13               | 17.008                    | 4.234  | 68.323   | 0.0317  |
|                             |                    | 14-20+             | 85.522                    | 10.327 | 708.218  | 0.0002  |
| Difficulty in mouth opening | Age                |                    | 1.96                      | 1.11   | 3.46     | 0.0209  |
|                             | Betel quid         | 0                  | 1.00                      |        |          |         |
|                             |                    | 1-6                | 50.41                     | 11.63  | 218.51   | <0.0001 |
|                             |                    | 7-13               | 296.12                    | 55.90  | >999.999 | <0.0001 |
|                             |                    | 14-20+             | 738.87                    | 116.76 | >999.999 | <0.0001 |
| Oral burning sensation      | Age                |                    | 2.154                     | 1.38   | 3.37     | <0.0001 |
|                             | Loose tobacco      | 0                  | 1.00                      |        |          |         |
|                             |                    | 1-11               | 1.616                     | 0.292  | 8.937    | 0.5842  |
|                             |                    | 12-20              | 1.179                     | 0.199  | 6.973    | 0.8556  |
|                             |                    | 21-36              | 2.362                     | 0.48   | 11.616   | 0.2904  |
|                             |                    | 40+                | 13.382                    | 2.65   | 67.49    | 0.0017  |
|                             | Betel quid         | 0                  | 1.00                      |        |          |         |
|                             |                    | 1-6                | 3.138                     | 0.662  | 14.865   | 0.1496  |
|                             |                    | 7-13               | 5.55                      | 1.41   | 21.86    | 0.0143  |
|                             |                    | 14-20+             | 9.678                     | 3.67   | 25.52    | <0.0001 |
| Brown pigmentation          | Age                |                    | 5.922                     | 1.65   | 21.25    | 0.0017  |
|                             | Cigarette or bidi  | 0                  | 1.00                      |        |          |         |
|                             |                    | 1-6                | <0.001                    | <0.001 | >999.999 | 0.9812  |
|                             |                    | 8-15               | 18.584                    | 0.56   | 88.78    | 0.1012  |
|                             |                    | 16-28              | 231.746                   | 7.85   | >999.999 | 0.0016  |
|                             |                    | 30+                | >999.999                  | 339.91 | >999.999 | <0.0001 |
| Ulcerated lesion            | Age                |                    | 1.56                      | 1.06   | 2.30     | 0.0244  |
|                             | Betel quid         | 0                  | 1.00                      |        |          |         |
|                             |                    | 1-6                | 2.335                     | 0.65   | 8.33     | 0.1915  |
|                             |                    | 7-13               | 5.565                     | 1.88   | 16.51    | 0.0020  |
|                             |                    | 14-20+             | 4.279                     | 1.93   | 9.48     | 0.0003  |

\* Lifetime exposure to tobacco product = frequency per day x number of years of use.

were 13 times more likely to have oral burning sensation (OR=13.38, 95%CI = 2.65, 67.49).

Workers in the two upper quartiles of lifetime exposure to betel quid were 9 times more likely to have oral burning sensation compared to those who were not exposed (OR=5.55, 95% CI = 1.41, 21.86; OR=9.67, 95%CI = 3.67, 25.52). The adjusted OR in relation to age was 2.15.

Thirty one workers had brown pigmentation. Compared to those who were not exposed to cigarette or bidi smoking, workers who were exposed were more than 200 times more likely to have brown pigmentation (OR=231.7) and nearly six times more likely to have brown pigmentation per 5-years increase in age (OR=5.92). No other tobacco habit was related to brown pigmentation. Similarly, only one habit, betel quid and age was related to ulcerated lesions. There were 66 workers presenting ulcerated lesion. Compared to those who were not exposed to betel quid, workers in the two upper quartiles of lifetime exposure were up to 5 times more likely (OR=5.56) to have ulcerated lesions.

\*\*\*\*\*

## Chapter 5

### Discussion

In this survey, the prevalence of use of different tobacco products among factory workers aged 14 to 50 was high; 86.3% used loose tobacco, 46.3% used packet tobacco, 31.3% used pan, 28.3% used betel quid, and 33.7% smoked cigarettes or bidis. Venkat Narayan et al., (1996) reported that the prevalence of cigarette or bidi smoking among skilled and unskilled workers else where in India, which was 58.9%, which is much higher than that reported in the current study. In the Indian National Sample Survey of 120,942 households (471,143 persons) aged 10 years and above, conducted in 1995-96, the prevalence estimates of regular smoking of tobacco products was 16.2%. The prevalence of regular use of chewing tobacco was 14.0%. Nichter et al., (2004) reported on the prevalence of different tobacco products among 1587 students in India. He found that 36% used cigarettes, 18% used gutkha, 10% had tried bidi and 6% had tried pan. In another study, among 99,598 people aged 35 and over, reported on by Gupta et al., (1996), the prevalence of tobacco use among men was 69.3%. Of these, 23.6% were smokers and 27.1% were betel quid with tobacco users. The values in both of these studies are much less than that found in the current study of factory workers.

The prevalence of oral lesions and symptoms among factory workers varied between 10 to 65%. A survey of 17,027 United States adolescents conducted in 1986-87 determined that mucosal lesions were found in 27 percent of snuff users compared to 0.4% among those who had never used smokeless tobacco. The prevalence of mucosal lesions for chewing tobacco increased from 3.1 percent in relation to those who had chewed for less than one month to 21% those who used chewing tobacco for more than two years. In the present study, there were only 14 adolescents, and 50% of them had white lesions and one subject only had an ulcerated lesion. The term, ulcerated lesion used in this study, refers to a break in the mucosa epithelium and is perhaps best described as erosion rather than a true ulcer.

Factory workers in the present study belonged to the lower socio-economic status group and, in fact, most of them were illiterate. Subramanian et al., (2004) reported that individuals with no education are 2.69 times more likely to smoke and

chew than people with higher education and households belonging to lowest fifth of a standard of living index were 2.54 times more likely to consume tobacco than those in the highest fifth.

Age was significantly associated with an increased odds of oral signs and symptoms, except white lesions. In particular, age was associated with long odds for brown pigmentation. Similarly, exposure to chewing betel quid was significantly associated with all signs and symptoms except white lesions and brown pigmentation. Loose tobacco exposure was associated with mouth dryness and burning sensations, while cigarette and bidi exposure only were associated with brown pigmentation. In terms of health problems, the most debilitating problem was that of difficulty in opening.

The mean DMFT for the age group 35 and over was 4.9. The DMFT values were referred to untreated decay and missing teeth. Deborah et al., (2001) reported that high levels of fermentable sugars in the chewing tobacco stimulate the growth of cariogenic bacteria, and is a cause of concern for caries, however the low DMFT count in the study sample does not support this statement. The need for tooth extraction was due to the backlog of unmet dental care.

## **5.1 Main points arising from study**

The main points to emerge from this study are:

1. One hundred percent of labourers were tobacco users.
2. Many labourers had more than two tobacco habits.
3. Tobacco use among labourers begins early in life.
4. The prevalence of tobacco-related oral signs and symptoms was high:
  - about 60% had white lesions and mouth dryness
  - about 20 to 30% had ulcerated lesions, burning sensation, and difficulty in mouth opening, and
  - about 10% had brown pigmentation
5. No labourers had restorations or dentures.
6. The main dental problem was unmet treatment need for caries.

7. The mean number of teeth per person in need of restoration and extraction were 1.45 and 0.24, respectively.
8. The prevalence of oral signs and symptoms increased with increasing age.
9. The odds of both mouth dryness and oral burning sensation were, related to use of loose tobacco and betel quid.
10. The odds of both difficulty in mouth opening and ulcerated lesions were, related to only betel quid.
11. The odds of brown pigmentation was related only to the smoking of cigarettes or bidis.

## **5.2 Conclusions**

1. The prevalence of use of tobacco products was 100% among factory laborers in selected factories in Hoshiarpur, and that many laborers had more than two tobacco habits.
2. Tobacco use was related to detrimental changes to oral status that compromise oral health. The problem of difficulty in mouth opening associated with chewing betel quid.
3. The prevalence of white lesions, known to be risk factors for the development of precancerous condition, was 66%.

## **5.3 Recommendation**

It is recommended that health authorities should raise awareness of dangers of tobacco use (loose tobacco, packet tobacco, cigarettes, bidi, pan, and betel quid) through health promotion programs aimed at factory workers in particular. Future research will be needed to monitor carefully the use of other tobacco products by factory and other workers. In order to develop appropriate prevention and cessation interventions for factory workers, data is required on trajectories of tobacco use and non-use. Urgent research is needed to investigate the use of tobacco by children and to find ways and means of curbing this undesirable addictive habit.

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# Appendices

Appendix A: Map of Hoshiarpur, India

Appendix B: Ethics approval

Appendix C: Letter to the management

Appendix D: Participant information statement

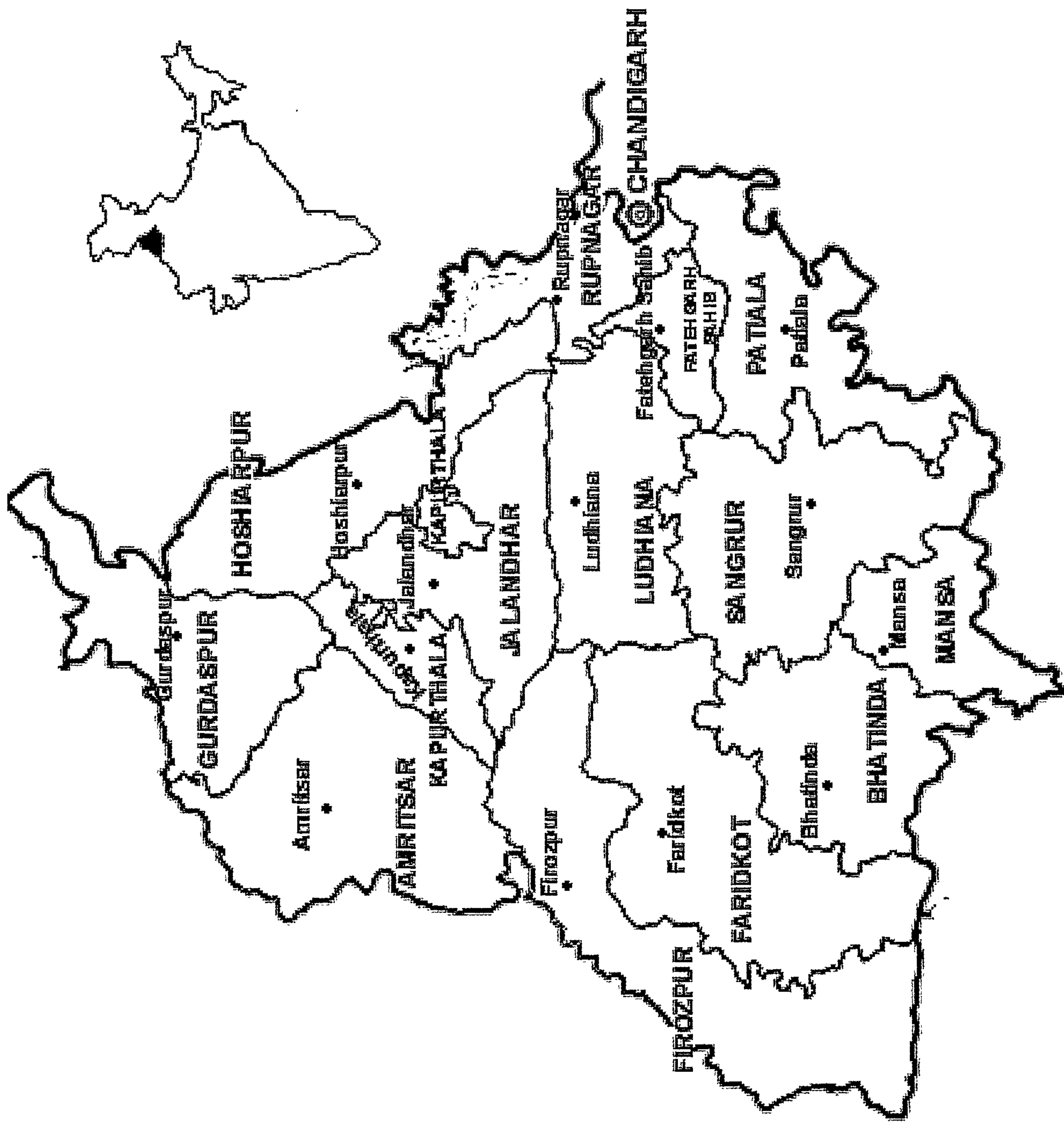
Appendix E: Consent form

Appendix F: Questionnaire

Appendix G: Clinical examination form

Appendix H: List of variables

## **Appendix A: Map of Hoshiarpur, India**



## **Appendix B: Ethics approval**



# The University of Sydney

NSW 2006 Australia

## Human Research Ethics Committee

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25 July 2005

Associate Professor W Evans  
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Dear Professor Evans

Thank you for your correspondence dated 29 June 2005 addressing comments made to you by the Committee. After considering the additional information, the Executive Committee approved your protocol entitled **"Survey of Tobacco use among factory workers in Hoshiarpur, India"**

Details of the approval are as follows:

|                                    |                                                  |
|------------------------------------|--------------------------------------------------|
| <b>Ref No.:</b>                    | <b>07-2005/1/8044</b>                            |
| <b>Approval Period:</b>            | <b>July 2005 to July 2006</b>                    |
| <b>Completion Date of Project:</b> | <b>31 December 2005</b>                          |
| <b>No. of Participants:</b>        | <b>300</b>                                       |
| <b>Authorised Personnel:</b>       | <b>Associate Professor W Evans<br/>Dr R Kaur</b> |

To comply with the *National Statement on Ethical Conduct in Research Involving Humans*, and in line with the Human Research Ethics Committee requirements this approval is for a 12-month period. At the end of the approval period, the HREC will approve extensions for a further 12-month, subject to a satisfactory annual report. The HREC will forward to you an Annual Progress Report form, at the end of each 12-month period. **Your report will be due on 31 July 2006.**

### **Conditions of Approval Applicable to this Project**

- (1) Amendment to the Participant Information Sheet: Please insert the Complaints Clause as the final point and provide a certified translation of this document (see point 5 below regarding the Complaints Clause). Please provide the amended document before the commencement of the study.

#### ***"(7) What if I have a complaint or concerns?"***

*Any person with concerns or complaints about the conduct of a research study can contact the Manager, Ethics Administration, University of Sydney on (+612) 9351 4811.*

*This information sheet is for you to keep."*

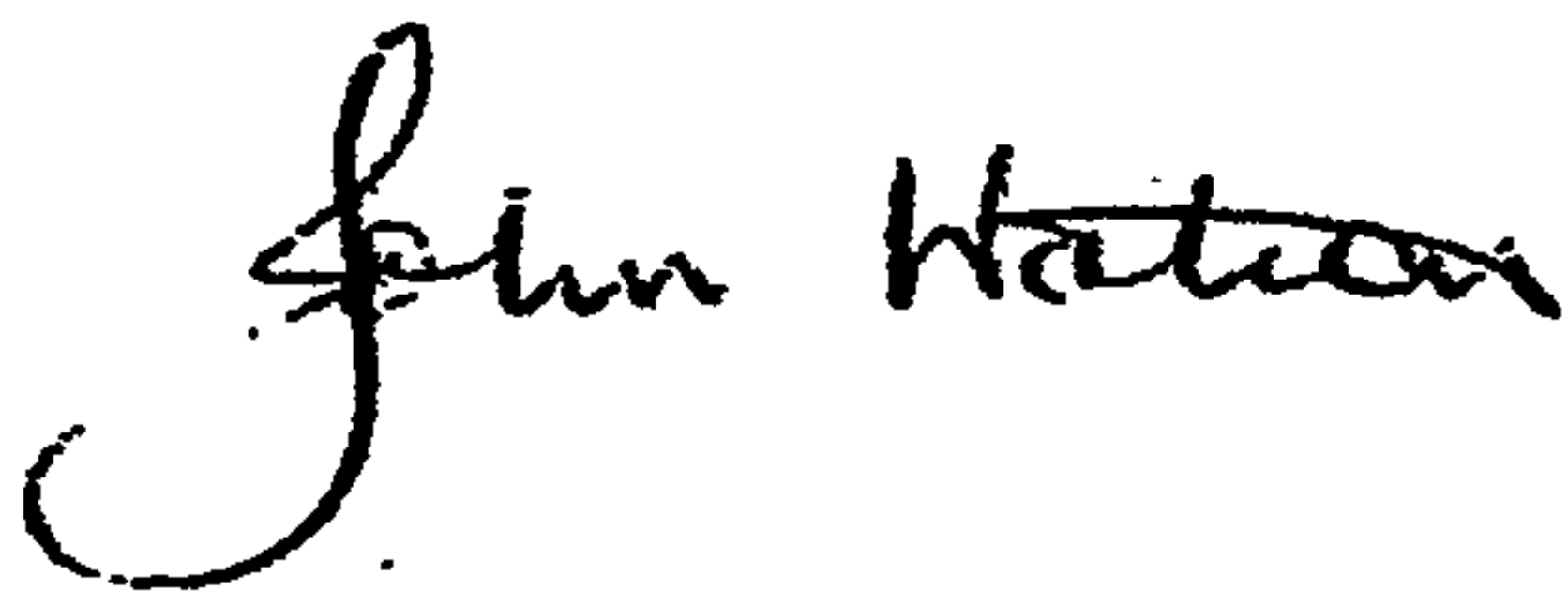
- (2) Please provide a certified translation for the "Letter to Factories".

### **Conditions of Approval Applicable to all Projects**

- (1) Modifications to the protocol cannot proceed until such approval is obtained in writing. (Refer to the website [www.usyd.edu.au/ethics/human](http://www.usyd.edu.au/ethics/human) under 'Forms and Guides' for a Modification Form).
- (2) The confidentiality and anonymity of all research subjects is maintained at all times, except as required by law.
- (3) All research subjects are provided with a Participant Information Sheet and Consent Form, unless otherwise agreed by the Committee.
- (4) The Participant Information Sheet and Consent Form are to be on University of Sydney letterhead and include the full title of the research project and telephone contacts for the researchers, unless otherwise agreed by the Committee.
- (5) The following statement must appear on the bottom of the Participant Information Sheet. ***Any person with concerns or complaints about the conduct of a research study can contact the Manager, Ethics Administration, University of Sydney, on (02) 9351 4811.***
- (6) The standard University policy concerning storage of data and tapes should be followed. While temporary storage of data or tapes at the researcher's home or an off-campus site is acceptable during the active transcription phase of the project, permanent storage should be at a secure, University controlled site for a minimum of seven years.

- (7) A report and a copy of any published material should be provided at the completion of the Project.

Yours sincerely

A handwritten signature in cursive script, appearing to read "John Watson".

**Associate Professor J D Watson  
Chairman  
Human Research Ethics Committee**

Encl. Participant Consent Form  
"Dear Sir/Madam" letter to Factory  
Questionnaire



The University of Sydney

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Survey of tobacco use by factory workers in India  
Participant Information Statement

---

**Participant consent form**

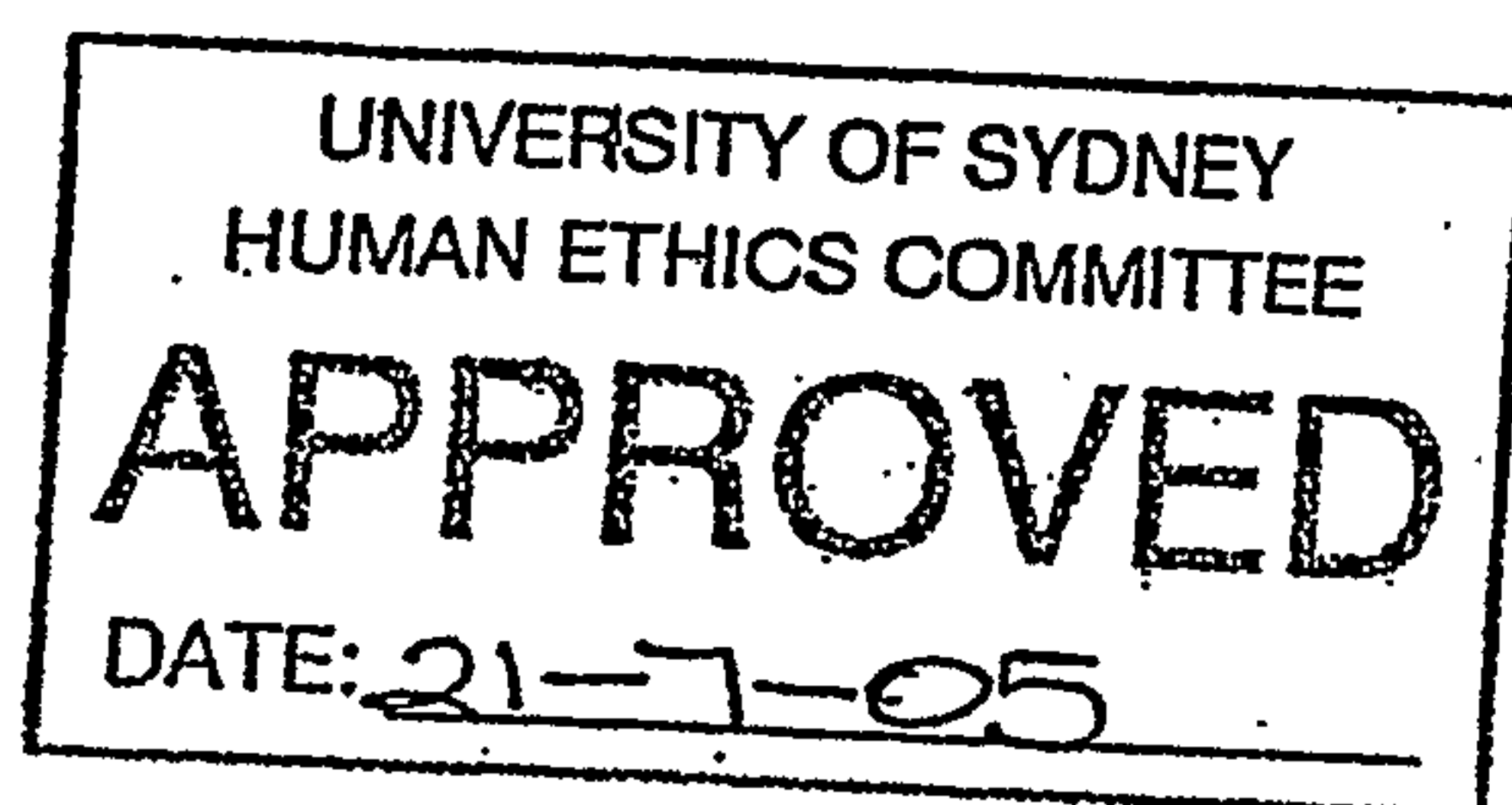
I agree to participate in the survey of tobacco use by factory workers in India.

In giving consent I acknowledge that::

1. I have received the Participant Information Statement and that I have read and understood the information given.
2. Dr. Ravinder Kaur has given me the opportunity to discuss this information and to ask questions about the project and they have been answered to my satisfaction.
3. I understand that I can withdraw from study at any time without penalty now or in future.
4. I understand that if I have any further questions about my participation in this survey I may contact Dr. Kaur who will be happy to answer them

Name ..... Signature of participant.....

Address ..... Date.....



Questionnaire on tobacco use by factory workers in India

Subject name ..... Age ..... ID

1 Show subject the basket of tobacco products and ask:  
Do you use any of the following products ? Then enter product codes.

Loose tobacco

2 How many years have you used loose tobacco ?   
1 2 5 10 15 20 30

3 How many times do you use loose tobacco per day ?   
1 2 3 4 5

4 What quantity do you use each time ?   
Spoonfuls: H = Half 1 = One

5 What else do you use with loose tobacco ?   
0 = nothing 1 = lime 2 = ???

Packet tobacco

6 How many years have you used packet tobacco ?   
1 2 5 10 15 20 30

7 How many times do you use packet tobacco per day ?   
1 2 3 4 5

Cigarettes/Biddies

8 How many years have you used cagaretters/biddies ?   
1 2 5 10 15 20 30

9 How many do you smoke per day ?   
1 2 3 4 5 (cigarettes/biddies - not packets)

Pan

10 How many years have you used pan ?   
1 2 5 10 15 20 30

11 What type of pan do you chew ?   
1 = sweet pan 2 = tobacco pan

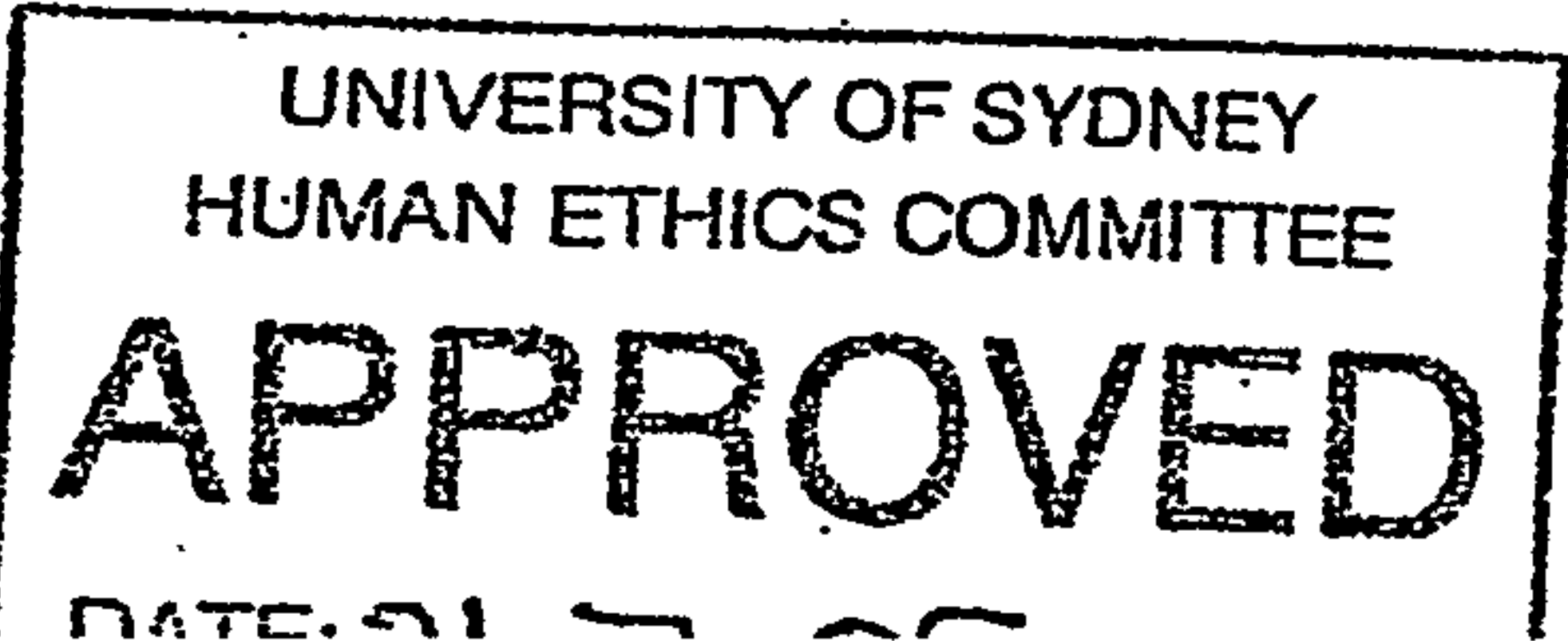
12 How many pan do you chew per day ?   
1 2 3 4 5

Snuff

13 What type of snuff do you sniff ?   
1 = dry (nasal) 2 = moist (oral)

14 How many years have you used snuff ?   
1 2 5 10 15 20 30

15 How many times do you use snuff per day ?   
1 2 3 4 5



**Betel quid**

16

How many years have you used betel quid ?

1 2 5 10 15 20 30

17

How many times do you use betel quid per day ?

1 2 3 4 5

18

How long do you keep it in your mouth ?

1 = 30 minutes 2 = 1 hour 3 = 1.5 hours 4 = 2 hours

19

Where do you keep the quid ?

1 = upper lip 2 = lower lip 3 = cheek 4 = tongue

20

Does your skin feel hard where you keep the quid ?

0 = no 1 = yes

**General**

21

Do you use tobacco at home ?

0 = no 1 = yes

22

If no, then why not at home ?

1 = My family does not approve tobacco use.

2 = Other

23

Do you use tobacco at work ?

0 = no 1 = yes

24

If no, then why not at work ?

1 = My boss does not approve tobacco use.

2 = Other

25

Do you use tobacco when you go to the market or after work when you go out ?

0 = no 1 = yes

26

What kind of paste or powder do you use when toothbrushing ?

(Enter code of product used.)

27

How many times do you brush your teeth daily with this powder/paste ?

1 2 3 4 5

28

How much do you earn daily ?

29

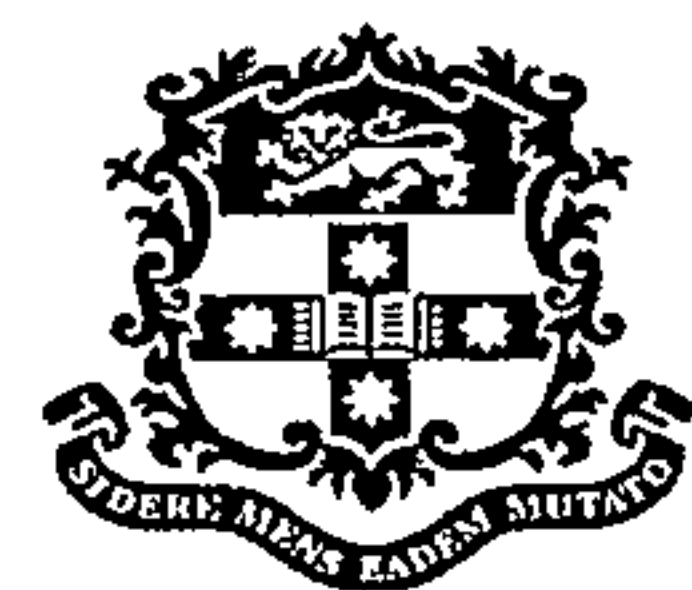
How much do you spend on tobacco daily ?

UNIVERSITY OF SYDNEY  
HUMAN ETHICS COMMITTEE

**APPROVED**

DATE: 21-7-05

## **Appendix C: Letter to the management**



**The University of Sydney**

**Faculty of Dentistry  
College of Health Sciences**

Wendell Evans, MDS DDSc  
Associate Professor  
Community Oral Health and Epidemiology

Westmead Centre for Oral Health  
Westmead Hospital  
Australia NSW 2145

Tel: +61 2 9845 7537 Fax: +61 2 9845 8306  
E-mail: w.evans@dentistry.usyd.edu.au

Date .....

The Manager  
Factory X  
HOSHIARPUR

Dear Sir/Madam,

**Request for approval to conduct a survey of factory workers on tobacco use and oral health**

I would be grateful if you would give me permission to conduct a survey of workers in your factory regarding tobacco use and oral health.

I am a dentist and am specialising in Public Health Dentistry at the University of Sydney, Australia. This survey is related to my research project on tobacco use by factory workers in India.

I would also be grateful if you would assist me to conduct this survey. In particular, it would be helpful if you would identify a staff member who would introduce me to your workers and explain to them that their participation is entirely voluntary.

I have attached an information statement about the survey that will be given to the workers. I will ask them to give written consent.

Thank you very much for your help. I look forward to your support.

Yours faithfully,

Dr Ravinder Kaur  
Master of Dental Science Student  
The University of Sydney

Dr Wendell Evans  
Associate Professor  
The University of Sydney

## **Appendix D: Participant information statement**



**The University of Sydney**

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## **Survey of tobacco use by factory workers in India Participant Information Statement**

1. **What is this study about?**  
This study is about the use of tobacco products by factory workers.
  2. **Who is carrying out the study?**  
Dr Ravinder Kaur, who is an Indian dentist and now training to be dental specialist at the University of Sydney, Australia.
  3. **What does the study involve?**  
Dr Kaur will ask you some questions about your tobacco habits and will count your teeth.
  4. **How much time will the study take?**  
It will take not more than 5 minutes to complete everything
  5. **Can I withdraw from the study?**  
Yes, you can withdraw from study without any penalty.
  6. **What if I require further information?**  
Please contact Dr Ravinder Kaur by telephone (01882-250288) or by mail at House No. 861, Mohalla Tibba Sahib, Hoshiarpur, Punjab.
-



The University of Sydney

## **SURVEY OF TOBACCO USE BY FACTORY WORKERS IN INDIA PARTICIPANT INFORMATION STATEMENT**

ਭਾਰਤ ਵਿੱਚ ਫੈਕਟਰੀ ਵਰਕਰਾਂ/ਕਾਮਿਆਂ ਵਲੋਂ ਕੀਤੀ ਜਾ ਰਹੀ ਤੰਬਾਕੂ ਦੀ ਵਰਤੋਂ ਸੰਬੰਧੀ ਸਰਬੇ ਰਿਪੋਰਟ ਲਈ ਪਾਰਟੀਸੀਪੇਸ਼ਨ ਸੂਚਨਾ ਸਬੰਧੀ ਬਿਆਨ :-

- 1) ਇਹ ਤਕਮੀਨਾਂ ਕਿਸ ਸਬੰਧੀ ਹੈ ?  
ਇਹ ਤਕਮੀਨਾਂ ਫੈਕਟਰੀ ਕਾਮਿਆਂ ਵਲੋਂ ਤੰਬਾਕੂ ਦੀ ਵਰਤੋਂ ਸਬੰਧੀ ਹੈ।
- 2) ਇਹ ਸਟੱਡੀ ਕੌਣ ਕਰ ਰਿਹਾ ਹੈ ।  
ਡਾਕਟਰ ਰਵਿੰਦਰ ਕੌਰ, ਜਿਹੜੀ ਕਿ ਇੱਕ ਭਾਰਤੀ ਡੈਨਟਿਸਟ ਹੈ ਅਤੇ ਹੁਣ ਦੰਦਾਂ ਤੇ ਟਰੇਨਿੰਗ ਕਰ ਰਹੀ ਹੈ ਅਤੇ ਸਪੈਸ਼ਲਿਸਟ ਬਣਨ ਲਈ ਯੂਨੀਵਰਸਿਟੀ ਆਫ ਸਿਡਨੀ/ਅਸਟਰੇਲੀਆ ਤੋਂ ਕਰ ਰਹੀ ਹੈ।
- 3) ਇਸ ਸਟੱਡੀ ਵਿੱਚ ਕਿਵੇਂ ਸ਼ਾਮਲ ਹੋਣਗੇ।  
ਡਾਕਟਰ ਰਵਿੰਦਰ ਕੌਰ ਆਪ ਜੀ ਨੂੰ ਕੁੱਝ ਸਵਾਲ ਪੁੱਛੇਗੀ ਕਿ ਆਪ ਜੀ ਦੀ ਤੰਬਾਕੂ ਕਿਸੇ ਤਰ੍ਹਾਂ ਵਰਤੋਂ ਕਰਦੇ ਹੋ ਜੋ ਆਪਦੇ ਦੰਦਾਂ ਬਾਰੇ ਵੀ ਰਿਕਾਰਡ ਕਰੇਗੀ ।
- 4) ਪੜ੍ਹਾਈ ਨੂੰ ਕਿੰਨਾਂ ਸਮਾਂ ਲੱਗੇਗਾ ।  
ਇਸ ਸਬੰਧੀ ਸਾਰਾ ਵੱਧ ਤੋਂ ਵੱਧ 5 ਮਿੰਟ ਦਾ ਸਮਾਂ ਲੱਗੇਗਾ ਜਿਸ ਵਿੱਚ ਹਰ ਚੀਜ਼ ਪੂਰੀ ਹੋ ਜਾਵੇਗੀ ।
- 5) ਕੀ ਮੈਂ ਪੜ੍ਹਾਈ ਤੋਂ ਹੱਟ ਸਕਦੀ ਹਾਂ ।  
ਹਾਂ ਤੁਸੀਂ ਬਿਨਾਂ ਕਿਸੀ ਪਨੈਲਟੀ ਤੋਂ ਹੱਟ ਸਕਦੇ ਹੋ ।
- 6) ਜੇਕਰ ਆਪ ਕੋਈ ਹੋਰ ਜਾਣਕਾਰੀ ਲੈਣਾ ਚਾਹੁੰਦੇ ਹੋ ਤਾਂ  
ਆਪ ਡਾਕਟਰ ਰਵਿੰਦਰ ਕੌਰ ਨੂੰ ਟੈਲੀਫੋਨ (01882-250288) ਅਤੇ ਬਾਈ ਮੇਲ ਐਟ ਹਾਊਸ ਨੰ: 861, ਮੁਹਲਾ ਟਿੱਬਾ ਸਾਹਿਬ, ਹੁਸ਼ਿਆਰਪੁਰ ਪੰਜਾਬ ਮਿਲ ਸਕਦੇ ਹੋ ।

## **Appendix E: Consent form**



The University of Sydney

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**Survey of tobacco use by factory workers in India**  
**Participant Information Statement**

---

**Participant consent form**

I agree to participate in the survey of tobacco use by factory workers in India.

In giving consent I acknowledge that::

1. I have received the Participant Information Statement and that I have read and understood the information given.
2. Dr. Ravinder Kaur has given me the opportunity to discuss this information and to ask questions about the project and they have been answered to my satisfaction.
3. I understand that I can withdraw from study at any time without penalty now or in future.
4. I understand that if I have any further questions about my participation in this survey I may contact Dr. Kaur who will be happy to answer them

Name .....Signature of participant.....

Address ..... Date.....



The University of Sydney

**SURVEY OF TOBACCO USE BY FACTORY WORKERS  
IN INDIA PARTICIPANT INFORMATION STATEMENT**

**PARTICIPANT CONSENT FORM**

ਮੈਂ ਇਸ ਵਿੱਚ ਸ਼ਾਮਲ ਹੋਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ ਕਿ ਭਾਰਤ ਵਿੱਚ ਫੈਕਟਰੀ ਕਾਮਿਆਂ ਵਲੋਂ ਜੋ ਤੰਬਾਕੂ ਦੀ ਵਰਤੋਂ ਕੀਤੀ ਜਾਂਦੀ ਹੈ । ਇਸ ਬਾਰੇ ਮੈਂ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਦਿੰਦੀ ਹਾਂ :-

- 1) ਇਹ ਕਿ ਮੈਂ ਬਤੌਰ ਪਾਰਟੀਸੀਪੈਂਟ ਇਸ ਦੀ ਜਾਣਕਾਰੀ ਸਬੰਧੀ ਸਟੇਟਮੈਂਟ ਪੜ੍ਹ ਲਈ ਲਈ ਅਤੇ ਸਮਝ ਲਈ ਹੈ। ਜੋ ਜਾਣਕਾਰੀ ਇਸ ਵਿੱਚ ਦਿੱਤੀ ਗਈ ਹੈ।
- 2) ਇਹ ਕਿ ਡਾਕਟਰ ਰਵਿੰਦਰ ਕੌਰ ਨੇ ਮੈਨੂੰ ਇਸ ਜਾਣਕਾਰੀ ਤੇ ਗੱਲਬਾਤ ਕਰਨ ਸਬੰਧੀ ਮੌਕਾ ਦਿੱਤਾ ਹੈ ਅਤੇ ਮੈਂ ਉਹਨਾਂ ਨੂੰ ਇਸ ਸਬੰਧੀ ਸਵਾਲ ਕੀਤੇ ਸਨ ਅਤੇ ਉਹਨਾਂ ਨੇ ਇਸ ਸਬੰਧੀ ਤੱਸਲੀ ਬਖਸ਼ ਜਵਾਬ ਦਿੱਤੇ ਹਨ।
- 3) ਇਹ ਕਿ ਮੈਨੂੰ ਜਾਣਕਾਰੀ ਹੈ ਕਿ ਮੈਂ ਬਿਨਾਂ ਕਿਸੀ ਪੈਨਲਟੀ ਤੇ ਹੁਣ ਜਾਂ ਬਾਅਦ ਵਿੱਚ ਸਟੱਡੀ ਤੋਂ ਹੱਟ ਸਕਦੀ ਹਾਂ ।
- 4) ਇਹ ਕਿ ਜੇਕਰ ਇਸ ਸਬੰਧੀ ਸਰਬੇ ਵਿੱਚ ਮੈਨੂੰ ਕੋਈ ਵੀ ਸਵਾਲ ਹੋਵੇ ਤਾਂ ਡਾਕਟਰ ਕੌਰ ਉਹਨਾਂ ਦਾ ਉਤਰ ਦੇਣ ਵਿੱਚ ਖੁਸ਼ੀ ਮਹਿਸੂਸ ਕਰਨਗੇ।

ਨਾਮ \_\_\_\_\_

ਦਸਤਖਤ \_\_\_\_\_

ਪਤਾ \_\_\_\_\_

ਮਿਤੀ : \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## **Appendix F: Questionnaire**

## Questionnaire on tobacco use by factory workers in India

Subject name ..... Age ..... ID

1 Show subject the basket of tobacco products and ask:

Do you use any of the following products ?

Then enter product codes.

### Loose tobacco

2 How many years have you used loose tobacco ?   
1 2 5 10 15 20 30

3 How many times do you use loose tobacco per day ?   
1 2 3 4 5

4 What quantity do you use each time ?   
Spoonfuls: H = Half 1 = One

5 What else do you use with loose tobacco ?   
0 = nothing 1 = lime 2 = ???

### Packet tobacco

6 How many years have you used packet tobacco ?   
1 2 5 10 15 20 30

7 How many times do you use packet tobacco per day ?   
1 2 3 4 5

### Cigarettes/Biddies

8 How many years have you used cagaretters/biddies ?   
1 2 5 10 15 20 30

9 How many do you smoke per day ?   
1 2 3 4 5 (cigarettes/biddies - not packets)

### Pan

10 How many years have you used pan ?   
1 2 5 10 15 20 30

11 What type of pan do you chew ?   
1 = sweet pan 2 = tobacco pan

12 How many pan do you chew per day ?   
1 2 3 4 5

### Snuff

13 What type of snuff do you sniff ?   
1 = dry (nasal) 2 = moist (oral)

14 How many years have you used snuff ?   
1 2 5 10 15 20 30

15 How many times do you use snuff per day ?

1 2 3 4 5

**Betel quid**

- 16 How many years have you used betel quid ?   
1 2 5 10 15 20 30
- 17 How many times do you use betel quid per day ?   
1 2 3 4 5
- 18 How long do you keep it in your mouth ?   
1 = 30 minutes 2 = 1 hour 3 = 1.5 hours 4 = 2 hours
- 19 Where do you keep the quid ?   
1 = upper lip 2 = lower lip 3 = cheek 4 = tongue
- 20 Does your skin feel hard where you keep the quid ?   
0 = no 1 = yes

**General**

- 21 Do you use tobacco at home ?   
0 = no 1 = yes
- 22 If no, then why not at home ?   
1 = My family does not approve tobacco use.  
2 = Other
- 23 Do you use tobacco at work ?   
0 = no 1 = yes
- 24 If no, then why not at work ?   
1 = My boss does not approve tobacco use.  
2 = Other
- 25 Do you use tobacco when you go to the market or after work when you go out ?   
0 = no 1 = yes
- 26 What kind of paste or powder do you use when toothbrushing ?   
(Enter code of product used.)
- 27 How many times do you brush your teeth daily with this powder/paste ?   
1 2 3 4 5
- 28 How much do you earn daily ?
- 29 How much do you spend on tobacco daily ?

## **Appendix G: Clinical examination form**

# Survey of factory workers in India

## Dental clinical examination form

Name \_\_\_\_\_

|  |
|--|
|  |
|  |

Sex

Duplicate

ID

|  |
|--|
|  |
|--|

|           | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Status    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Treatment |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Mobility  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

|           | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Status    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Treatment |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Mobility  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

### STATUS

0 = Sound

1 = Decayed (Decayed = D3)

F = Filled

M = Missing (Missing = missing due to caries)

T = Trauma (Trauma = a broken tooth due to trauma or a filled tooth due to trauma)

8 = Unerupted

### TREATMENT

0 = None

F = Filling

X = Extraction

### SOFT TISSUE

0 = Health

1 = Firm

2 = Hard

|    |    |    |
|----|----|----|
| UL |    |    |
| UT |    |    |
|    |    |    |
| RC | LL | LC |

## **Appendix H: List of variables**

Appendix H.  
Table : List of variables.

| Code name                        | Variable description                                              | Variable values | Number |
|----------------------------------|-------------------------------------------------------------------|-----------------|--------|
| SEX                              | Gender                                                            | Male            | 300    |
| AGE                              | Age                                                               | Range = 14-50   | 300    |
|                                  | Age distribution                                                  | 14-19           | 14     |
|                                  |                                                                   | 20-24           | 113    |
|                                  |                                                                   | 25-29           | 117    |
|                                  |                                                                   | 30-34           | 37     |
|                                  |                                                                   | 35+             | 19     |
| <b><i>Loose tobacco use</i></b>  |                                                                   |                 |        |
| NLYEAR                           | Number of years of use of loose tobacco                           | 0 = No          | 41     |
|                                  |                                                                   | 1 = Yes         | 259    |
| LTYEAR                           | Distribution of number of years for use of loose tobacco          | 0               | 41     |
|                                  |                                                                   | 1-4             | 114    |
|                                  |                                                                   | 5-8             | 80     |
|                                  |                                                                   | 9+              | 65     |
| NLTIME                           | Number of times per day of use of loose tobacco                   | 0 = No          | 41     |
|                                  |                                                                   | 1 = Yes         | 259    |
| LTIME                            | Distribution of number of times per day for use of loose tobacco  | 0               | 41     |
|                                  |                                                                   | 1-3             | 119    |
|                                  |                                                                   | 4+              | 140    |
| <b><i>Packet tobacco use</i></b> |                                                                   |                 |        |
| NPTYEAR                          | Number of years of use of packet tobacco                          | 0 = No          | 161    |
|                                  |                                                                   | 1 = Yes         | 139    |
| PTYEAR                           | Distribution of number of years for use of packet tobacco         | 0               | 161    |
|                                  |                                                                   | 1-4             | 90     |
|                                  |                                                                   | 5+              | 49     |
| NPTTIME                          | Number of times per day of use of packet tobacco                  | 0 = No          | 161    |
|                                  |                                                                   | 1 = Yes         | 139    |
| PTTIME                           | Distribution of number of times per day for use of packet tobacco | 0               | 161    |
|                                  |                                                                   | 1               | 47     |
|                                  |                                                                   | 2+              | 92     |
| <b><i>Cigarette use</i></b>      |                                                                   |                 |        |
| NCYEAR                           | Number of years of use of cigarettes                              | 0 = No          | 199    |
|                                  |                                                                   | 1 = Yes         | 101    |
| CYEAR                            | Distribution of number of years for use of cigarettes             | 0               | 199    |
|                                  |                                                                   | 1-5             | 59     |
|                                  |                                                                   | 6+              | 42     |
| NCTIME                           | Number of times per day of use of cigarettes                      | 0 = No          | 199    |
|                                  |                                                                   | 1 = Yes         | 101    |
| CTIME                            | Distribution of number of times per day for use of cigarettes     | 0               | 199    |
|                                  |                                                                   | 1-3             | 50     |
|                                  |                                                                   | 4+              | 51     |

(continued)

| Code name                           | Variable description                                           | Variable values                                                                  | Number                    |
|-------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------|
| <b><i>Pan chewing</i></b>           |                                                                |                                                                                  |                           |
| NPANYEAR                            | Number of years of use of pan                                  | 0 = No<br>1 = Yes                                                                | 206<br>94                 |
| PANYEAR                             | Distribution of number of years for use of pan                 | 0<br>1-4<br>5+                                                                   | 206<br>44<br>50           |
| NPANTIME                            | Number of times per day of use of pan                          | 0 = No<br>1 = Yes                                                                | 206<br>94                 |
| PANTIME                             | Distribution of number of times per day for use of pan.        | 0<br>1+                                                                          | 206<br>94                 |
| <b><i>Betel quid chewing</i></b>    |                                                                |                                                                                  |                           |
| NBQYEAR                             | Number of years of use of betel quid                           | 0 = No<br>1 = Yes                                                                | 210<br>90                 |
| BQYEAR                              | Distribution of number of years for use of betel quid          | 0<br>1-6<br>7+                                                                   | 210<br>35<br>55           |
| NBQTIME                             | Number of times per day of use of betel quid                   | 0 = No<br>1 = Yes                                                                | 210<br>90                 |
| BQTIME                              | Distribution of number of times per day for use of betel quid. | 0<br>1+                                                                          | 210<br>90                 |
| <b><i>Tobacco use behaviour</i></b> |                                                                |                                                                                  |                           |
| PLACEMENT                           | Where do you keep the tobacco ?                                | 1 = upper& lower lip<br>2 = right &left cheek<br>3 = upper &lower part of tongue | 27<br>124<br>149          |
| HOME                                | Do you use tobacco at home ?                                   | 0 = No<br>1 = Yes                                                                | 63<br>237                 |
| NOHOME                              | If no, then why not at home?                                   | 1 = Family does not approve<br>2 = Other reason                                  | 15<br>48                  |
| WORK                                | Do you use tobacco at work?                                    | 0 = No<br>1 = Yes                                                                | 7<br>293                  |
| NOWORK                              | If no, then why not at work ?                                  | 1 = Boss does not approve<br>2 = Other reason                                    | 0<br>7                    |
| MARKET                              | Do you use tobacco in market or when you go out after work?    | 0 = No<br>1 = Yes                                                                | 104<br>196                |
| EARN                                | How much do you earn daily?                                    | 60<br>70<br>80<br>90<br>100                                                      | 1<br>47<br>52<br>75<br>90 |

(Continued)

| Code name                           | Variable description                                                 | Variable values          | Number |
|-------------------------------------|----------------------------------------------------------------------|--------------------------|--------|
|                                     |                                                                      | 120                      | 31     |
|                                     |                                                                      | 200                      | 3      |
|                                     |                                                                      | 250                      | 1      |
| SPEND                               | How much do you spend on tobacco daily?                              | 1-5                      | 105    |
|                                     |                                                                      | 6-10                     | 161    |
|                                     |                                                                      | 11-20                    | 34     |
| <b><i>Tooth brushing habits</i></b> |                                                                      |                          |        |
| PASTE                               | What kind of paste or powder do you use when tooth brushing?         | 0 = nothing              | 1      |
|                                     |                                                                      | 1 = Colgate              | 141    |
|                                     |                                                                      | 2 = Pepsodent            | 77     |
|                                     |                                                                      | 3 = Red tooth powder     | 40     |
|                                     |                                                                      | 4 = Close up             | 32     |
|                                     |                                                                      | 5 = Babul                | 4      |
|                                     |                                                                      | 6 = Datun                | 4      |
|                                     |                                                                      | 7 = Colgate tooth powder | 1      |
| PASTETIMES                          | How many times do you brush your teeth daily with this powder/paste? | 0                        | 1      |
|                                     |                                                                      | 1                        | 297    |
|                                     |                                                                      | 2                        | 2      |
| <b><i>Clinical findings</i></b>     |                                                                      |                          |        |
| BROWN                               | Presence of brown lesions                                            | 0 = no                   | 270    |
|                                     |                                                                      | 1 = yes                  | 30     |
| ULCER                               | Presence of ulcerated lesions                                        | 0 = no                   | 234    |
|                                     |                                                                      | 1 = yes                  | 66     |
| WHITE                               | Presence of white lesions                                            | 0 = no                   | 110    |
|                                     |                                                                      | 1 = yes                  | 190    |
| DECAYED                             | Number of decayed teeth                                              | 0                        | 83     |
|                                     |                                                                      | 1-3                      | 185    |
|                                     |                                                                      | 4+                       | 32     |
| MISSING                             | Number of missing teeth                                              | 0                        | 238    |
|                                     |                                                                      | 1+                       | 62     |
| FILLED                              | Number of filled teeth                                               | 0                        | 300    |
|                                     |                                                                      | 1                        | 0      |
| DMFT                                | Number of decayed missed filled teeth                                | 0                        | 71     |
|                                     |                                                                      | 1-3                      | 183    |
|                                     |                                                                      | 4+                       | 46     |
| NEEDS EXTRACTION                    | Number of subjects in need of extraction                             | 0                        | 246    |
|                                     |                                                                      | 1                        | 43     |
|                                     |                                                                      | 2+                       | 11     |
| NEEDS RESTORATION                   | Number of subjects in need of restoration                            | 0                        | 93     |
|                                     |                                                                      | 1-2                      | 149    |
|                                     |                                                                      | 3+                       | 58     |
| MOB1                                | Distribution of subjects that have grade 1 tooth mobility            | 0                        | 293    |
|                                     |                                                                      | 1                        | 7      |

(Continued)

| Code name | Variable description                                                   | Variable values | Number |
|-----------|------------------------------------------------------------------------|-----------------|--------|
| OPENING   | Distibution of subjects<br>experiencing difficulty in<br>mouth opening | 0 = No          | 208    |
|           |                                                                        | 1 = Yes         | 92     |
| FEELING   | Distibution of subjects<br>experiencing burning sensations             | 0 = No          | 237    |
|           |                                                                        | 1 = Yes         | 63     |
| DRYNESS   | Distibution of subjects<br>experiencing mouth<br>dryness               | 0 = No          | 127    |
|           |                                                                        | 1 = Yes         | 173    |