

**ASSESSMENT OF EXPOSURES OF  
NEW ZEALAND HOSPITALITY WORKERS TO  
ENVIRONMENTAL TOBACCO SMOKE**

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By

Michael Bates  
Jackie Fawcett  
Stuart Dickson  
Nick Garrett

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Science Project Manager

Michael Bates  
Project Leader

Michael Baker  
Peer Reviewer

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## SUMMARY

The purpose of this project was to obtain an estimate of the exposure of non-smoking bar and restaurant workers in New Zealand to Environmental Tobacco Smoke (ETS) over the course of a typical work-shift. Three samples of non-smoking workers in Wellington city were recruited as participants. These samples were (1) staff who worked in hospitality premises (bars and restaurants) that permitted smoking by customers; (2) staff who worked in hospitality premises that did not permit customers to smoke; and (3) employees of Government departments and ministries. Hospitality worker participants met with a member of the study team before they began their shift, and again after they completed their shift; government employee participants met with a member of the study team shortly after they began work in the morning and again towards the end of their working day. At each of their two meetings with the interviewers, participants answered questions from a standardised questionnaire and supplied a sample of saliva for analysis.

Saliva samples were analysed for the concentration of cotinine they contained. For each participant, the difference between the first and second saliva cotinine sample concentrations could be considered to be an indication of the degree of exposure to ETS over the course of the work shift or work day. Data on changes in cotinine levels were analysed in conjunction with answers to questions in the questionnaire.

Main results from this study suggest that bar and restaurant workers who work in premises that allow smoking by customers are significantly more exposed to environmental tobacco smoke than workers in places with no-smoking policies. Furthermore workers in hospitality premises where there were no restrictions on customer smoking were more highly exposed to environmental tobacco smoke than workers in hospitality premises which permitted smoking by customers in designated smoking areas. Overall, this analysis shows a clear association between ETS exposure and smoking policy.

The study also found that there was a tendency for workers in premises permitting customer smoking to have a higher prevalence of respiratory and irritation symptoms than workers in smoke-free workplaces. Other research has shown that non-smokers who are exposed to environmental tobacco smoke experienced increased risks for a number of smoking-related diseases, including cancer, heart and lung diseases and stroke.

## 1 INTRODUCTION

Exposure to environmental tobacco smoke (ETS)<sup>1</sup> has been associated with increases in risk to exposed non-smokers of a number of diseases, including cancer, heart disease and stroke (Kawachi and Colditz 1999; Lubin 1999).

In New Zealand, to reduce the health risks associated with ETS exposure at work, the Smoke-free Environments Act 1990 requires every employer to have a written policy on smoking in the workplace. These policies are to be based on the principle that employees that do not smoke, or do not wish to smoke in the workplace, should be protected from exposure to tobacco smoke in the workplace. Smoking is not permitted in lifts, in more than half of the cafeteria or lunchroom, or in any place to which members of the public normally have access. The effect of the restrictions is normally to limit smoking to certain designated areas.

Special provisions in the Smoke-free Environments Act apply to licensed premises (section 12) and restaurants (section 13). Smoking is permitted in licensed premises in any room or enclosed area set aside primarily for the consumption of liquor by patrons. However, in areas set aside for the consumption of meals, at least half of the seating should be designated as being for patrons who do not wish to smoke.

The implication of this exemption for areas of licensed premises set aside primarily for the consumption of liquor is that the exposure to environmental tobacco smoke may be considerable, even in non-smoking areas of these premises, due to smoke drift and particularly so for bartenders who may work long hours, day after day, in smoke-filled environments. Studies confirm that ETS in hospitality establishments, particularly bars, can reach substantial levels (Hammond 1999, Lambert 1993). Therefore, unlike most other non-smoking workers, non-smoking bar and restaurant workers are not protected from exposure to ETS. Even in non-smoking areas of these premises, there may be exposure due to smoke drift

### 1.1 Assessment of Exposure to ETS

Various methods have been used to measure or estimate exposure to ETS. These include measurements of levels of ETS components, including particulate matter and nicotine, in the air of rooms or workplaces. Such measurements do not necessarily provide a good basis for estimating actual exposure, since people do not usually remain in the same spot for prolonged periods. Methods of personal exposure monitoring, which take account of the complexities of human movement and behaviour, are considered generally to provide better indications of actual levels of exposure (Maskarinec *et al.* 2000). Personal exposure monitoring of ETS can be measured using three techniques– (1) personal air-space monitors which are attached to the person and move around with them, sampling the air in their breathing zone; (2) questionnaires about perceived levels of exposure and contact with smokers; and (3) biomarkers of ETS. The biomarkers used include nicotine and cotinine (a nicotine metabolite) levels in hair, urine, blood and saliva. All three types of personal ETS

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<sup>1</sup> Also known as “second-hand smoke”, this is the sidestream smoke from burning tobacco that is not directly inhaled by the smoker and the smoke that is exhaled by a smoker.

exposure assessment have been found useful in particular circumstances. (Cummings *et al.* 1990).

## **1.2 Choice of personal ETS exposure measurement method for this study**

The purpose of this study was to obtain data, using personal exposure monitoring, that could be used to estimate the extent to which employees in hospitality premises that permit smoking by customers are exposed to ETS. For this purpose, a biomarker was used, rather than a questionnaire or personal air-space monitor. Reasons for this choice included the objectivity of biomarkers compared with questionnaire-based approaches, and the measurement by biomarkers of actual absorption of the chemicals in tobacco smoke, rather than the external exposure which is measured by personal air-space monitors. It was also necessary to maintain the confidentiality of participants, something that could not easily be done if they wore personal air-space monitors at work. The high level of concern in the hospitality industry about possible law changes to restrict smoking in hospitality premises meant that it was important to avoid any potential for ill feeling between participants in the study and their employers.

Cotinine is a metabolite of nicotine. Nicotine is a distinctive component of tobacco smoke, including ETS, in which it is inhaled by non-smokers. Nicotine, however, is not particularly suitable as a biomarker of ETS exposure because it is rapidly metabolised to cotinine. Cotinine, by comparison, has a longer half-life in the body than nicotine, making it a more convenient biomarker for estimation of ETS exposure. Cotinine (and nicotine) can be detected in urine, blood, hair and saliva. For this study salivary cotinine was measured because saliva can be more readily collected than blood or urine, using a non-invasive method. Measuring hair cotinine levels was not appropriate because hair nicotine levels represent longer term exposures to tobacco smoke, from all sources. It can not be used to assess exposure during a single work shift.

The difference in salivary cotinine levels between the samples collected at the beginning and the end of a work shift provides a measure of the extent of tobacco smoke exposure during that shift. For non-smokers, that difference should be entirely due to ETS exposure.

## 2 METHODS

### 2.1 Recruitment of subjects

For the purposes of this study three separate groups of workers were recruited. All participants were required to be non-smokers.

Initially, two groups of hospitality workers were recruited, one group working in bars and restaurants that permitted smoking by customers, and a second group working in hospitality premises that did not permit customers to smoke (smoke-free premises). The study aimed to recruit 50 hospitality workers in each group, but in the course of the study, it was realised that it would not be possible to recruit sufficient workers in smoke-free hospitality premises, as there are relatively few such premises in the city of Wellington. Therefore, a third group of workers - employees in government ministries and departments - was added to provide additional information from workplaces where smoking is not permitted. Addition of this third group was justified, since the purpose of recruiting a non-exposed group was to take into account normal variation in the salivary cotinine levels of non-smokers who work in non-smoking workplaces. These cotinine levels, and any changes in these levels over the work period, would be a result of exposures received from outside of the workplace. On that basis, for the purposes of this study, workers in non-smoking hospitality premises and workers in non-smoking government departments could be considered to be reasonably comparable.

Three eligibility criteria applied to participants in all three groups.

1. All participants were required to be non-smokers, who had not smoked for at least 6 months. This was to exclude people who were trying to give up smoking and might describe themselves as non-smokers when they had not yet totally quit.
2. All participants were required not to be using any nicotine replacement therapy, such as nicotine patches or chewing gum. Nicotine from nicotine patches or gum would cause elevated cotinine levels in saliva, unrelated to workplace exposures to ETS.
3. On the day of their participation in the study, participants needed to be working a minimum period of four hours, either in hospitality premises or a government department/ministry. Salivary cotinine levels have been shown to plateau about four hours into a period of constant exposure (Curvall et al. 1990).

For practical, logistical reasons, hospitality worker participants were also required to be employed in a bar or restaurant in Wellington city. Two study venues in central Wellington were used for interview of hospitality worker participants and collection of saliva samples. Participants usually came to these venues both just before and at the end of their work shift.

## **2.2 Recruitment methods**

### **2.2.1. Bar and Restaurant Workers**

Methods used to attract potential participants included:

1. A letter inviting participation was sent by the Food and Service Workers Union to members in the Wellington region;
2. Advertisements were placed in local free newspapers;
3. Advertisements were placed in the personal columns of the main Wellington evening and morning newspapers;
4. Fliers and Posters were left at university common areas and hostels in Wellington;
5. Notices were pinned on community notice-boards at inner city supermarkets;
6. In-person canvassing of cafeterias, leaving fliers wherever possible; and
7. Participants were asked to distribute fliers to friends and work colleagues who might also be interested.

All advertisements, letters, posters and fliers asked interested people to either ring a telephone number, especially set up for the study, or to e-mail the study at a designated e-mail address. To prevent calls from being missed, the phone was connected to an answering machine.

On first contact by the study team, potential participants were asked screening questions to confirm their eligibility for the study.

### **2.2.2. Government Office Workers**

Wellington-based government ministries and departments were approached and asked if they would permit staff to participate in the study. Once agreement was reached, study team members visited the designated contact person in the department or ministry and organised recruitment arrangements. Appointments for participants were set up for the beginning and end of their workdays.

### **2.2.3. Participation incentives**

All participants were offered rewards as an incentive to take part. Hospitality workers were given the choice of a book token or a petrol voucher, valued at \$25; Government workers received a lottery ticket, worth \$7. The greater value of the reward for the hospitality workers reflected their greater time commitment and need to travel to the study venue.<sup>2</sup>

## **2.3 Interviews and sample collection**

### **2.3.1. Bar and Restaurant Workers**

All volunteers who met the study criteria were booked to meet with an interviewer 45-60 minutes before the start of their work shift. The interviewer phoned the volunteer a

day or so beforehand and confirmed the appointment, checking that the volunteer had not had a change of shift. If necessary, the appointment was changed.

The interviewer met the volunteer at one of the study venues or at a more convenient prearranged place.

The interviewer first explained the research project and the participant's role in it. Each participant was asked to sign a consent form. The first part (part A) of a two-part questionnaire was completed, and the saliva sample collected according to set procedures. Written permission to use saliva samples for the purposes of the study was also obtained.

The interviewer-administered questionnaire included questions about hours worked in hospitality premises over the course of the previous week, type of work, other sources of recent ETS exposure, and whether the participant had recently experienced specific respiratory symptoms.<sup>3</sup>

A time was then arranged for a second meeting at the end of the participant's shift. A contact number was given to the participant, so that the interviewer could be advised of any change to the participant's finishing time. At the second (post-shift) meeting, part B of the questionnaire was completed and a second saliva sample collected.

All reasonable efforts were made to ensure the safety of interviewers. These measures were considered necessary because many participants finished work, and were then interviewed, late at night. Interviewers were usually alone in the offices used to meet participants. Interviewers all carried cell-phones and personal alarms, and wore identification badges. Participants were identified before they were allowed into the study facility, and other people accompanying the participants were required to remain outside. The local police were informed of the study. Building security staff were notified when the building was being used and checked the offices every night.

### 2.3.2. Government Office Workers

Interviews with government office workers were arranged as close to the beginning and end of the workday as practicable. All interviews took place at the workplace. A similar procedure to that for the hospitality workers, involving a questionnaire interview and saliva sample collection, was followed. The questionnaire was similar to that used for hospitality workers, with some modifications to reflect the different nature of the work<sup>4</sup>.

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<sup>3</sup> A Copy of the questionnaire is included in Appendix 1

<sup>4</sup> A copy of this questionnaire is included in Appendix 2

### **2.3.2.1. Saliva Collection**

Non-stimulated saliva samples were collected by asking the participant to spit into a plastic Salivette<sup>®</sup> tube<sup>5</sup> [Sarstedt, Newton, North Carolina]. A sample of approximately one millilitre of saliva was collected.

## **2.4 Cotinine Analytical Methods**

### **2.4.1. Chemical Analysis**

Analysis of cotinine in saliva was carried out using High-Performance Liquid Chromatography – Tandem Mass Spectrometry (HPLC/MS/MS).

#### **2.4.1.1. Standards and Reagents**

Crystalline native cotinine was obtained from Novartis Ltd. Stock solutions of 1mg/ml of this cotinine in HPLC grade methanol were stored in a refrigerator at 3°C. A 1mg/ml solution in methanol of cotinine D3 (99% purity) was purchased from Radian International. Sodium hydroxide was of Normapur AR grade made by Prolabo (Paris, France). Ethyl Acetate was of Nanograde, manufactured by Mallinckrodt (Paris, Kentucky USA). Glacial acetic acid was of Analar grade, obtained from BPH (Poolle England). Ammonium acetate was of Analar grade, from Hopkin & Williams (Chadwell Heath, England). Methanol was of HPLC grade obtained from Mallinckrodt. All water used was purified using a Barnstead NANOPureII deioniser.

#### **2.4.1.2. Instrumentation**

Analyses were conducted using a Shimadzu 10AVP High Performance Liquid Chromatography (HPLC) system attached to a PE Sciex API 300 Triple-Quadrupole mass spectrometer equipped with a Turboion spray ion source. The HPLC column was a Phenomenex Luna<sup>®</sup> 3<sup>®</sup>m C18(2), 2.0 x 50mm with a 4.0 x 2.0mm C18 Phenomenex SecurityGuard<sup>®</sup> cartridge.

#### **2.4.1.3. Sample extraction**

Depending on the quantity of sample available, between 0.1 and 0.5g (optimum 0.5 mg) of saliva was weighed into a 7mL silanised glass culture tube with a Teflon-lined cap. Each sample was spiked with 50 µL of an aqueous solution of 2ng/mL of cotinine D3. The pH of each sample was then adjusted using 0.5ml of 1.0M sodium hydroxide, then mixed with 3 mL of ethyl acetate on a vortex mixer for 15 minutes. The tubes were then centrifuged and the ethyl acetate layers were transferred to clean culture tubes. Glacial acetic acid (30 µL) was added to each tube, then the ethyl acetate was evaporated just to dryness in a vacuum centrifuge. For analysis, the dry

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<sup>5</sup> The standard Salivette tube contains a swab, which is intended to be chewed to release and absorb saliva. The swab is then replaced in the Salivette tube, which is resealed pending centrifugation to extract the absorbed saliva, followed by chemical analysis of saliva constituents. However, in the course of preliminary investigations for this study, it was found that cotinine was adsorbed onto the swab and not released during centrifugation. Therefore, the saliva collection method was changed to use the Salivette tubes, but without the swabs.

residue in each tube was reconstituted in 100  $\mu$ L in an aqueous 10mM ammonium acetate solution and methanol (50:50).

#### **2.4.1.4. High Performance Liquid Chromatography**

Each sample was injected into the HPLC as a 15 $\mu$ L aliquot. The mobile phase was a gradient of 100% methanol (solution A) and a 10mM aqueous ammonium acetate solution (solution B). The gradient was initially 10% solution A. After 0.5 minutes, the proportion of solution A was increased linearly, reaching 30% in 1.5 minutes and 50% after two minutes. This concentration was maintained for four minutes, after which it was dropped back to 10% over 2 minutes, then the system was re-equilibrated for 4.5 minutes. The flow rate was a uniform 0.2mL/min. Cotinine was eluted at 4.7 minutes.

#### **2.4.1.5. Ion Source and Mass Spectrometry**

The ionisation of the cotinine was achieved in the Turboionspray source in positive ion mode, operating at an ion source voltage of 5200V, at a temperature of 450 $^{\circ}$  C. The mass spectrometer was used in the Multiple Reaction Monitoring mode. Transition ions monitored were at m/z 177? 80 for cotinine and 180? 80 for cotinine D3.

#### **2.4.1.6. Standard Curves**

A nine-point standard curve was created by spiking 0.5mL of deionised water with appropriate amounts of aqueous cotinine standards. The standard curve covered a cotinine concentration range equivalent to 0.1 to 40 ng/g of cotinine in saliva. The calibration curves were obtained by plotting the peak area ratios of the cotinine MRM transition versus the cotinine D3 MRM transition.

Reproducibility was evaluated by analysing aqueous samples spiked at two concentrations (0.4 and 15ng/g) on the same day (six replicates), for within-day reproducibility, and then frequently during the course of the study (six times for the low value, five times for the high value) for the between-day reproducibility.

#### **2.4.1.7. Detection Limit**

Analysis of the validation data showed the detection limit of this method to be 0.2 ng/g of cotinine in 0.5 g of saliva. This level was set as the value when the cotinine peak detected was at least five times higher than an interfering peak caused by the presence of the native cotinine in the deuterated internal standard. As the same vial of deuterated standard was used throughout the study, the effects of this interfering peak were consistent. All samples with cotinine levels of less than 0.2 ng/g were reported as not detected.

#### **2.4.1.8. Linearity and Reproducibility**

The analyses were carried out over seven separate runs on seven different days. As the lower end of the calibration was considered of greater significance, the calibration was weighted using a  $1/n^2$  weighting. The mean correlation coefficient was 0.990.

The within-day reproducibility (six replicates) of the low standard (0.4ng/g) had a coefficient of variation (CV) of 5.0%, the high standard (15ng/g) had a CV of 6.1%.

The between-day CV of the low standard (6 days) was 11.7%, the between-day CV of the high standard was 9.2%.

## **2.5 Statistical Methods**

Participants were categorised according to the customer smoking policy of their workplace. Because of the predominance of cotinine values below the level of detection, non-parametric tests, including the Wilcoxon Rank Sum test, were used to investigate differences between median pre- and post-shift cotinine levels, for the different categories.

## 3 RESULTS

### 3.1 Confirmation of Non-smoking status

Ninety-five subjects provided sufficient saliva samples for chemical analysis, of which 44 worked in restaurants and bars (hospitality workers), and 51 worked in Government Departments and Ministries. All interviews took place in the period June to October 2000. All participants reported themselves to have been non-smokers for at least the six months prior to interview, and not to have been using nicotine replacement therapy. Volunteers were screened by questioning about current smoking status and use of nicotine replacement therapy before interviews took place. However, the pre-shift saliva sample cotinine results were used as a further, more objective, screen. Table 1 shows the levels of cotinine measured in the first (pre-shift) saliva samples taken from all 95 participants who donated samples.

Although it is unlikely there will be one salivary cotinine level that precisely distinguishes smokers from non-smokers, Etter *et al.* (2000) found that a salivary cotinine level of 7 ng/ml distinguished smokers from non-smokers, with a sensitivity of 92% and a specificity of 90%. For this study, a measure of 7.0 ng/g was adopted for the purposes of excluding results for possible smokers and nicotine replacement therapy users from the statistical analysis.<sup>6</sup> Among the bar and restaurant staff there were two males with pre-shift salivary cotinine levels exceeding 7 ng/g (9.7 and 23 ng/g), and among the government employees, one female had a first sample salivary cotinine level of 15 ng/g. All three subjects were excluded from the subsequent statistical analysis. The highest pre-shift salivary cotinine level among those who were included in the statistical analysis was 5.1 ng/g, in a person who worked in a bar where smoking was permitted<sup>7</sup>.

After excluding the three likely smokers, forty-two hospitality workers and 50 government employees remained in the study and were included in the subsequent statistical analyses.

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<sup>6</sup> Because small volumes of saliva were obtained from some participants, cotinine levels are expressed in ug/g. These units could be measured more accurately than the ug/ml used in some other reports in which salivary cotinine levels have been reported. Saliva density will vary from individual to individual, and a 95% range of 1.002-1.012g/ml has been reported (Diem and Lentner,1970, p643)

<sup>7</sup> This person reported having spent 9 hours working in the same room as smokers over the 24 hours prior to the collection of the pre-shift sample. Her post-shift salivary cotinine level was the same as her pre-shift level.

**Table 1. Distribution of cotinine concentrations measured in first saliva samples.<sup>8</sup>**

Cotinine concentration (ng/g)	Number of subjects			
	Hospitality workers		Government employees	All workers in workplaces with No-smoking policies
	Smoking permitted	No-smoking policy		
Below detection limit <sup>§</sup>	12 (35%)	6 (60%)	40 (78%)	46 (75%)
0.2 to < 1	3 (9%)	3 (30%)	9 (18%)	12 (20%)
1 to < 2	10 (29%)	1 (10%)	1 (2%)	2 (3%)
2 to < 5	6 (18%)	0	0	0
≥ 5	3 (9%)	0	1 (2%)	1 (2%)
All subjects	34 (100%)	10 (100%)	51 (100%)	61 (100%)

§ 0.2 ng/g

### 3.2 Demographic Composition and Descriptive variables

The demographic composition of the study groups, including prior smoking history, is shown in Table 2.

Thirty-four of the hospitality worker participants in the study worked in premises permitting smoking by customers; the remaining 10 worked in non-smoking premises. The study participant workplaces where smoking was permitted fell into two categories of customer smoking policy: (1) smoking permitted only in designated area(s); and (2) smoking allowed anywhere in the premises. The numbers of study participants who worked in premises with these policies were 20 and 12, respectively. No-one reported working in premises where a separate room was set aside for smoking customers.

For most premises, the staff smoking policy was consistent with the customer smoking policy. However, there were a few cases where a non-smoking restaurant (for customers) permitted staff to smoke in a designated area or room. All government employees, irrespective of Ministry/Department were combined and treated as one group for the purposes of all analyses.

Although the number of workers in non-smoking bars and restaurants was small (n = 10), the results shown in Table 2 suggest that the characteristics of the two hospitality worker groups are reasonably comparable, although males are more prevalent than females for the premises where smoking is permitted; and the reverse holds for non-smoking premises. The government employee group tended to be older than the hospitality workers. There is a predominance of people of European ethnicity in all groups.

<sup>8</sup> Details of the pre and post shift cotinine levels for all participants are included in Table 7, Appendix three. Table 8 (Appendix three) summarises the means, medians, and minimum and maximum pre and post shift cotinine measurements according to workplace smoking policy

**Table 2. Demographic profiles of the study groups.**

Characteristic	Hospitality workers		Government employees
	Smoking permitted	No-smoking policy	
Total number	32 (100%)	10 (100%)	50 (100%)
Sex:			
♂Males	19 (62%)	3 (30%)	15 (29%)
♀Females	13 (38%)	7 (70%)	35 (71%)
Age (years):			
Range	19.2-48.8	18.1-46.6	21.6-56.7
Median	23.8	24.2	31.9
Ethnicity: <sup>§</sup>			
European/Pakeha	26 (82%)	8 (80%)	47 (94%)
Maori	2 (9%)	1 (10%)	5 (9%)
Pacific People	1 (3%)	0	1 (2%)
Asian	1 (6%)	2 (10%)	0
Not answered	2 (6%)	0	0
Smoking status:			
Never smoked	19 (59%)	8 (80%)	39 (76%)
Ex-smoker	13 (41%)	2 (20%)	11 (24%)

§ May not sum to column totals because participants could report more than one ethnicity.

### 3.3 Change in salivary cotinine levels

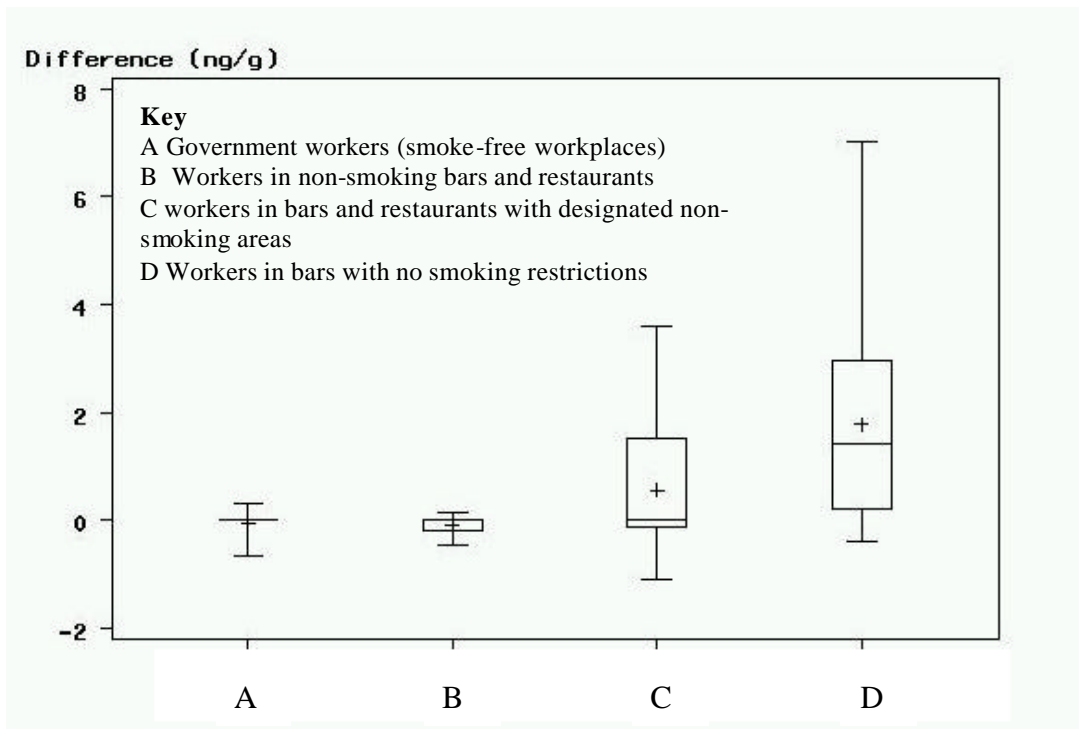
The key subject of investigation in this study was the change in cotinine levels between the two samples. Table 3 summarises the data on changes in cotinine levels between the pre-shift and post-shift samples, for the four groups of study subjects (columns A-D). These groups are based on the customer-smoking policy of each workplace. Figure 1 also shows the distributions of cotinine changes in each of the four groups.

In Table 3, subjects whose pre-shift and post-shift cotinine levels were both below the limit of detection were treated as having no change in concentration. For the purposes of calculating the mean changes in salivary cotinine concentrations for each group, subjects with decreases in cotinine concentration were treated as having zero change. Such people can be presumed to be showing the effects of clearance of cotinine from ETS exposure received before they went on their shift. Inclusion of such negative concentration changes, when calculating group means, could distort comparisons of changes in cotinine concentrations associated with exposures during the work shift itself.

Two key trends are clearly apparent in the data shown in Table 3. The more permissive (less restrictive) the policy on customer smoking (or smoking at work):

1. The higher the proportion of subjects in the group with an increase in salivary cotinine concentration; and
2. The greater the magnitude of the cotinine concentration increases in the subsets of subjects who show increases, as shown by the means, medians and ranges of concentrations in those subsets.

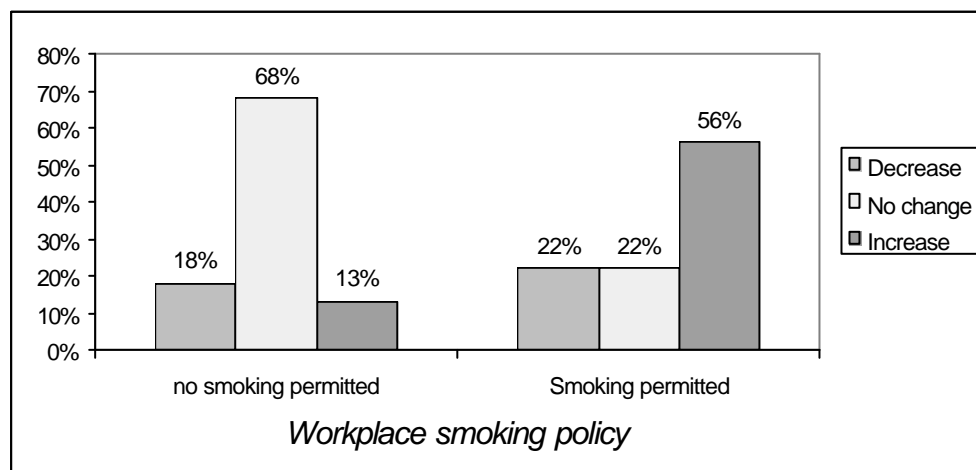
**Figure 1: Changes in salivary cotinine concentration for government and hospitality workers (by category of workplace customer smoking policy) <sup>2</sup>.**



<sup>2</sup>The whiskers show the extreme values. The box shows the 25<sup>th</sup> and 75<sup>th</sup> percentile and median; + indicates the mean value.

Figure 2 shows data from columns E and F of Table 3, in graphical form. It clearly shows differences in employee ETS exposures between no-smoking work premises and premises permitting any customer smoking.

**Figure 2. Proportion of workers experiencing decreases, no change or increases in cotinine by workplace smoking policy**



When the mean cotinine changes are calculated for all subjects in each of the groups (i.e., including those whose cotinine decreased, but was assumed to have remained constant), the effect of the two key trends combined is to enhance the relative

differences between the groups (compared with the relativity between the subsets of subjects with cotinine increases). The two unexposed groups (Table 3: columns A & B) are consistent in having identical very low mean increases in salivary cotinine concentration (0.02 ng/g) by comparison with the two exposed groups (0.7 and 1.8 ng/g) (columns C & D). Put another way, based on the data in Table 3, the estimated average increase in salivary cotinine concentration over the course of a work shift, relative to workers in smoke-free premises, is 35-fold for workers in hospitality premises with some limitations on where customers may smoke, and 90-fold for workers in hospitality premises where there are no restrictions on customer smoking. These ratios should be regarded as indicative, rather than definitive, as they are dependent on the calculation of the average cotinine concentration increase experienced by the unexposed group. This value has some uncertainty because of the number of measurements involved in its calculation that were below the analytical detection limit. Nonetheless, the actual value would be very small and probably little different to that presented in Table 3.

Although plausible trends are apparent in the data summarized in Table 3, to exclude the possibility that the observed differences between groups could be the result of chance (random variation in the data), statistical tests of the changes in cotinine concentrations were carried out. The data were analysed in both categorical and continuous formats.

For the purposes of the categorical analysis of the data presented in Table 3 subjects were combined in the following ways:

1. Subjects in each category who had either a decline or no change in the concentration of cotinine between their two samples were combined. This combination was justified because a decline in cotinine over the period of the shift could be expected to be a result of clearance of cotinine arising from ETS absorbed before the shift began.
2. In view of the small number of study participants working in non-smoking hospitality premises, this group was combined with the government employee group. This combination was justified since both groups were working in non-smoking workplaces and between-sample cotinine variation in both groups should be representative of such variation in non-smoking populations exposed to second hand smoke outside of the workplace.

Table 3. Changes in saliva cotinine concentrations between the first and second samples<sup>9</sup>.

Change in cotinine concentration (second – first sample result) <sup>†</sup>	Government employees	Hospitality workers			All workers in No-smoking workplaces	All workers in workplaces that allow smoking
		No customer smoking	No-smoking in designated areas	No-smoking restrictions		
	A	B	C	D	E (=A+B)	F (=C+D)
Number with decrease	8 (16%)	3 (30%)	6 (30%)	1 (8%)	11 (18%)	7 (22%)
Number with no change	36 (72%)	5 (50%)	6 (30%)	1 (8%)	41 (68%)	7 (22%)
Number with increase	6 (12%)	2 (20%)	8 (40%)	10 (83%)	8 (13%)	18 (56%)
?? Median (ng/g) <sup>§</sup>	0.15	0.1	1.6	1.7	0.14	1.65
?? Mean (ng/g) <sup>§</sup>	0.16	0.1	1.8	2.2	0.15	1.95
?? Range (ng/g) <sup>§</sup>	0.08-0.3	0.05-0.13	0.1-3.6	0.2-7	0.05-0.3	0.1-7.0
Overall mean cotinine increase (ng/g) <sup>‡</sup>	0.02	0.02	0.7	1.8	0.02	1.11
Total number in group	50 (100%)	10 (100%)	20 (100%)	12 (100%)	60(100%)	32(100%)

<sup>†</sup> Setting results less than the limit of detection (0.2 ng/g) at half that value.

<sup>§</sup> Subjects with cotinine increases only.

<sup>‡</sup> Subjects with a decrease in cotinine concentration taken as having no change.

<sup>9</sup> The average times between samples were 7.6 and 8.4 hours for hospitality workers in smoking and non-smoking premises, respectively, and 7.2 hours for government employees.

The resulting distribution of data is shown in Table 4.

**Table 4. Change in cotinine after combining categories**

Cotinine change	Workplace smoking policy (No. of subjects)			Total
	No restriction	Smoking in restricted areas	Not permitted <sup>§</sup>	
Increase	10	8	8	26
No increase <sup>±</sup>	2	12	52	66
<b>Total</b>	12	20	60	92

<sup>±</sup> Includes subjects whose cotinine level decreased and subjects whose cotinine level did not change.

<sup>§</sup> Hospitality and government employees combined.

A test for linear trend of proportions on the data in Table 4 gave a *p*-value of <0.00001 (Chi-square = 25.2). This very highly statistically significant result strongly indicates that the permissiveness of the smoking policy of a workplace is directly associated with the likelihood of an increase in salivary cotinine concentration while at work

To analyse the data while treating them as continuous, a Wilcoxon rank-sum test of equality of medians was used, comparing the pre to post-shift cotinine difference in all hospitality workers working in premises permitting smoking (*n* = 32) with the difference in all workers in hospitality premises not permitting smoking (*n* = 10). Reductions in cotinine were retained as such in the data. This comparison gave a *p*-value of 0.05 for the difference between the two groups. However, after combining all workers in smoke-free workplaces (*n* = 60) and comparing them against the group of those who worked in premises where smoking was permitted, the same statistical test gave a *p*-value of 0.002. This confirms that working in hospitality premises where any smoking is permitted is very significantly associated with higher levels of cotinine in saliva (and hence higher exposures to ETS over the course of a work shift).

Using the Wilcoxon test the changes in cotinine concentrations for workers in hospitality premises with no customer smoking restrictions were compared with workers in premises with designated non-smoking areas. Although the number of subjects was small, reducing the statistical power of the test to discriminate between the two groups, the difference in medians was statistically significant (*p* = 0.03), indicating that the apparent difference in cotinine changes between the two groups of exposed workers (shown in Table 3) is not likely to be due to chance. The clear implication is that workers in hospitality premises where there are no restrictions on customer smoking have higher exposures to ETS than do similar workers in premises where customer smoking is limited to certain areas.

### 3.4 The effect of delay before taking the post-shift saliva sample

Etzel (1990) has suggested that a potential problem in studies such as ours is that the delay between the end of the shift and the taking of the post-shift saliva sample could affect the results. Therefore, the delays between the end of the work-shift and the taking of the saliva samples were examined for the two groups of hospitality workers. The mean delay before saliva sampling for the workers in non-smoking hospitality premises was 8 minutes (median: 8 minutes) and for workers in premises where smoking was permitted the mean delay between end of shift and sampling was 26

minutes (median: 17 minutes). If it is assumed that exposure to second hand smoke ceased at the end of the shift, the extra time delay for those working in premises permitting smoking may have allowed more time for clearance of cotinine from the body. If that were the case, the difference in cotinine changes between the unexposed and the exposed groups in this study would, to some extent, be underestimated. However, the effect on the results would be small, as the half-life of cotinine in saliva is reported to be 17 hours (Etter et al., 2000). Therefore, in the study groups, only a small proportion of the cotinine would be cleared in the time between the end of shift and the second saliva sample collection. It would be unlikely to make any material difference to the results.

### **3.5 Prevalence of Respiratory and Irritation Symptoms**

Study participants were asked a number of questions about respiratory and irritation symptoms experienced in the previous four weeks, as well as questions on asthma (Questions 20 to 29 in the questionnaire contained in Appendix 1). Responses to these questions are summarized in Table 5, along with prevalence ratios and associated confidence intervals. Prevalence ratios were calculated after combining responses from both groups of workers in premises where smoking was not permitted, and using this as the baseline for comparison with the hospitality workers in premises where smoking was permitted.

Although only the prevalence ratio for phlegm production during the past 4 weeks reached statistical significance ( $p \leq 0.05$ ) the prevalence ratios in Table 5 show that there is a tendency for workers in premises permitting customer smoking to have a higher prevalence of respiratory and irritation symptoms than workers in smoke-free workplaces. Asthma diagnosed by a doctor and use of asthma medication were less common in workers in bars and restaurants where smoking was permitted.

**Table 5. Responses to questions about symptoms and asthma – proportion reporting symptom in by category of workplace smoking policy**

Question	Government workers	Hospitality workers			All workers in No-smoking workplaces	All workers in workplaces that allow smoking	Prevalence Ratio <sup>±</sup> F/E	95% Confidence Interval
		No customer smoking	No-smoking In Designated areas	No-smoking restrictions				
	A	B	C	D	E (= A+B)	F (=C+D)		
	N=50	N=10	N=20	N=32	N=60	N=32		
Wheezing in chest	0.24	0.2	0.3	0.25	0.23	0.28	1.21	0.59-2.47
Short of breath	0.14	0	0.25	0.33	0.12	0.28	2.41	0.99-5.87
Cough in morning	0.2	0	0.15	0.33	0.17	0.22	1.31	0.55-3.12
Frequently cough	0.2	0	0.4	0.17	0.17	0.31	1.88	0.87-4.03
Frequent phlegm	0.18	0	0.35	0.42	0.15	0.38	2.53	1.18-5.29
Eye irritation	0.42	0	0.25	0.5	0.35	0.34	0.98	0.54-1.77
Running nose	0.44	0.5	0.6	0.5	0.45	0.56	1.25	0.83-1.89
Sore throat	0.32	0.2	0.3	0.33	0.30	0.31	1.04	0.55-1.98
Asthma diagnosed	0.34	0.2	0.25	0.25	0.32	0.25	0.79	0.39-1.60
Asthma medicine	0.16	0.1	0.15	0.08	0.15	0.12	0.80	0.28-2.50

<sup>§</sup> With the exception of the questions about asthma, all questions asked about symptoms experienced in the preceding four weeks. Responses in columns A to F are recorded as the proportions of respondents who answered “yes” to each question.

<sup>±</sup> Based on hospitality workers in premises permitting smoking [column F] relative to all unexposed workers [column E].

## 4 DISCUSSION

This is the first New Zealand study that has examined exposure to ETS specifically in the hospitality workplace. One other New Zealand study has measured nicotine levels in the hair of hospitality workers and found differences according to smoking policy of the premises (Al Delaimy *et al.*, 2000). However, hair nicotine levels will represent the accumulation of exposures from a variety of workplace and non-workplace sources over a longer period of time, and will be less specific to workplace ETS exposures than the salivary cotinine levels used in this study.

The results of this investigation show convincingly that workers in hospitality premises that permit customer smoking have higher salivary cotinine levels at the end of their shift than at the beginning of their shift.

This result is consistent with the results of studies carried out in other countries using a variety of methods to assess ETS exposure. Studies that have monitored ETS in the work environment using passive air monitoring systems, personal air monitoring systems, and biomarkers, have found high levels of ETS or higher exposures to ETS in hospitality workplaces where smoking is permitted compared with workplaces with non-smoking policies (Jenkins and Counts 1999; Trout *et al.* 1998) Coultas *et al.* 1990, Bergman *et al.* 1996). It has been reported that the levels of ETS in restaurants in the United States were approximately 1.6-2.0 times higher than in office workplaces, while levels in bars were 3.9-6.1 times higher than in offices (Siegel 1993). These findings were based on the measurement of ambient indoor air concentrations of carbon monoxide, nicotine and respirable suspended particles. These authors concluded that restaurant and bar workers were exposed to ETS at a level between 1.5 and 4.4 times greater than that received by someone living with a smoker.

The hospitality workers in this study could be divided into those who worked in premises where there were no restrictions on smoking and those who worked in premises that had some limitations on where customers could smoke. These results confirmed that second hand smoke exposure of staff is greatest in premises where there are no restrictions on where customers may smoke. Workers in these premises appeared to receive about three times the exposure of workers in premises where customers were permitted to smoke, but only in designated areas. However, even in premises where there were some limitations on smoking, increases in cotinine of study participants were still relatively much greater than the increases for workers in premises not permitting smoking at all (Table 3). This result was also consistent with the results of other studies, which have shown the allocation of specific areas for non-smoking customers provides only partial protection from exposure to ETS (Kuusimaki 1999, Lambert, 1993). Studies suggest that ETS exposure can vary considerably with the building layout, size of restaurants and bars, and according to the type of work – waiting, bar work and kitchen staff work – being undertaken (Maskarinec *et al.* 2000, Repace *et al.* 1998, Jenkins and Counts 1999).

A recent study of hair nicotine levels of non-smoking bar and restaurant workers in Wellington and Auckland found that the level of hair nicotine varied strongly with the workplace smoking policy (Al-Delaimy *et al.* 2000). These results were similar to those of a Canadian study showing nicotine levels in hair of hospitality workers

exposed to ETS to increase significantly as the degree of workplace ETS exposure increased (Dimich-Ward *et al.* 1997).

The range of cotinine changes across this study subjects was wide, with some workers in premises permitting smoking showing no increase, or even a slight decrease, in salivary cotinine level. This variation in individual results can be explained by some hospitality workers having spent their work-shifts predominantly in non-smoking parts of their workplaces, while others would have spent most of their time in areas where smoking was permitted.

The results that suggested that workers exposed to smoke during the course of their work have higher prevalences of respiratory and irritative symptoms (Table 5) are suggestive, but not conclusive. There may be other lifestyle factors predisposing to such symptoms that are more prevalent in people willing to work in smoky hospitality premises than in those who work in non-smoking workplaces. These other lifestyle factors could be confounding the associations found. However, a study of workers in California bars, using similar questions, found that the prevalence of these symptoms decreased in workers when the law was changed to make all bars and restaurants in the State smoke-free (Eisner *et al.* 1998). This Californian study also tested respiratory function of participants and found that respiratory parameters (forced expiratory volume and forced vital capacity) improved at follow-up. Results of the Californian study support an interpretation that the higher prevalence of symptoms found in exposed hospitality workers in this study may be a consequence of second-hand smoke exposures at work. The lower rate of diagnosed asthma and use of asthma medication found in exposed hospitality workers (Table 5) may be a manifestation of the so-called “healthy worker effect” (Checkoway *et al.* 1989). To reduce their chances of asthmatic attacks, persons with known asthma are likely to avoid working in smoky premises.

## 5 CONCLUSIONS

This study found convincing evidence, even with a relatively small study sample size, that leads us to the following conclusions:

1. Working in hospitality premises that permit customers to smoke leads to substantially increased exposures to second-hand smoke, compared with smoke-free premises.
2. Policies in hospitality premises that restrict customer smoking to certain areas substantially reduce average exposure of staff to second-hand smoke, but do not eliminate such exposure.
3. It is reasonable to assume that the second-hand smoke exposure of workers in hospitality premises, as measured in this study, carries some risk of disease, including cancer and cardiovascular disease. Many studies have shown that passive smoking is associated with such increased health risks

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**7 APPENDICES**

**7.1 Appendix One - Questionnaire about Exposure to Environmental Tobacco Smoke**

**THE INFORMATION SHEET AND CONSENT FORM MUST BE COMPLETED BEFORE THE QUESTIONNAIRE IS UNDERTAKEN.**

**PART A**

Interviewer	_____	QUEST NO.	_____
Start Time of First interview	____:____ am / pm	Today's date	____/____/2000
Place of Interview	_____		

**A1. What is Your Name?** \_\_\_\_\_  
First Name Last Name

**A2. RECORD THE PARTICIPANT'S SEX – DO NOT ASK!!** Male Female

**A3. Have you smoked tobacco cigarettes, cigars or pipes in the last 6 months?**  
 Yes → TERMINATE INTERVIEW  
 No → A4

**A4. Do you use any nicotine replacement therapy – such as nicotine patches or nicotine chewing gum?**  
 Yes → TERMINATE INTERVIEW  
 No → A5

**TERMINATE INTERVIEW. The nicotine from your smoking (nicotine patch) could affect the saliva samples we need to take. I am sorry but we can not include you in this study. Thank you for offering to take part.**

**A5. What is the Name of Bar / Restaurant where you will be working this evening (today)?** \_\_\_\_\_

**A6. What is your job in this bar/restaurant?**

- Owner or manager
- Bar staff
- Waiting staff
- Kitchen staff

Other (Specify) .....

**A7. How long have you worked at this job?**

RECORD EITHER \_\_\_\_yrs \_\_\_\_ months OR Since \_\_\_\_ (Month) \_\_\_\_ (Year)

**The next two questions ask about the smoking policy at the place where you work.**

HAND THE PARTICIPANT THE SHOW CARD A8

**A8. Which of these options best describes the current policy about smoking by customers in this bar/restaurant?**

- a. No smoking allowed
- b. Smoking allowed in designated part of bar/restaurant only
- c. Smoking allowed only in a separate smokers room
- d. There are no restrictions on where customers can smoke
- e. Other (Specify) \_\_\_\_\_

HAND THE PARTICIPANT THE SHOW CARD A9

**A9. Which of these options best describes the current policy about smoking by staff in this bar/restaurant?**

- a. No smoking allowed .....
- b. Smoking allowed in designated part of bar/restaurant only
- c. Smoking allowed only in a separate smokers room .....
- d. There are no restrictions on where staff can smoke .....
- e. Other (Specify) \_\_\_\_\_

**A10. What time does your shift begin today?** \_\_\_\_\_:\_\_\_\_\_ am / pm

**A11. What time does your shift finish today?** \_\_\_\_\_:\_\_\_\_\_ am / pm

**A12. What shifts have you worked in the last 7 days?**

Yesterday \_\_\_\_\_ → One week ago

Day							
Start time							
Finish time							
Total hrs							

**The next few questions ask about how much time, over the last twenty-four hours, you have spent in the same room as people who are smoking. Please remember we are only concerned here about smoke from tobacco cigarettes, cigars and pipes.**

ON THE BASIS OF THEIR ANSWER TO A12, HAS THE PARTICIPANT WORKED DURING THE LAST TWENTY FOUR HOURS

Yes → Go to A13

No → Go to A14

**A13. Thinking back over the last twenty-four hours. While you were at work, at (name of restaurant/bar), how many hours in total do you estimate you spent in the same room as people who were smoking?** \_\_\_\_\_ Hrs

**A14. Do you have any other paid jobs?** Yes  
No → Go to A16

**A15. During the last twenty-four hours while you were working at your other job, how many hours in total do you estimate you spent in the same room as people who were smoking?** \_\_\_\_\_ Hrs

**A16. Over last twenty-four hours while you were at home,  
how many hours in total do you estimate you spent in the \_\_\_\_\_ Hrs  
same room as people who were smoking?**

**A17. Thinking about all the other time during the last twenty-  
four hours when you have not been at work or at home.  
How many hours in total do you estimate you spent in \_\_\_\_\_ Hrs  
the same room as people who were smoking?**

**The following questions are about your health**

**A18. Have you ever smoked tobacco cigarettes,  
cigars or pipes regularly? By regularly I mean  
on most days.** Yes  
No → **Go to Heading  
box before A20**

**A19. When did you stop smoking?**

RECORD EITHER \_\_\_\_\_ yrs & \_\_\_\_\_ months ago

OR Month \_\_\_\_\_ Year \_\_\_\_\_

**The next few questions ask about breathing symptoms that you might have had during the past 4 weeks.**

**A20. Have you had wheezing or whistling in your chest at  
any time during the last four weeks?** Yes No Unsure

**A21. During the last 4 weeks have you felt short of breath  
at any time apart from after vigorous exercise?** Yes No Unsure

**A22. During the last 4 weeks, did you usually cough first  
thing in the morning?** Yes No Unsure

**A23. During the last 4 weeks, did you frequently cough?** Yes No Unsure

**A24. During the last 4 weeks, did you frequently bring up any phlegm?**      Yes      No      Unsure

**The next few questions ask about eye, nose, or throat irritation during the past 4 weeks**

**A25. In the past 4 weeks, have your eyes been red, teary, or irritated?**      Yes      No      Unsure

**A26. During the last 4 weeks, have you had a runny nose or sneezing?**      Yes      No      Unsure

**A27. During the last 4 weeks, have you had a sore or scratchy throat?**      Yes      No      Unsure

**A28. Has a doctor ever told you that you have asthma?**      Yes      No      Unsure

**A29. Are you currently taking any medicine (including inhaler, aerosols or tablets) for asthma?**      Yes      No      Unsure

**A30. What is your date of birth?**      \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

GIVE THE PARTICIPANT THE SHOW CARD FOR A31

**A31. Please look at this card and tell me which option best describes the ethnic group or groups you identify with? You can choose as many as you wish**

- a. Maori
- b. NZ European- Pakeha
- c. Indian
- d. Chinese
- e. Other European
- f. Pacific peoples
- g. Other  (Specify) \_\_\_\_\_
- h. refused

**A32. As you know we need to collect from you two saliva samples, one before and one after your shift. These will be analysed for levels of cotinine. Would you like to receive a summary of the results of your saliva analysis?** Yes No

**A33. Would you like to receive a copy of the results of this survey?** Yes No

**A34. What is your address?** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TAKE THE FIRST SALIVA SAMPLE ACCORDING TO THE PROTOCOLS.  
ONCE COMPLETED THE INTERVIEWEE MUST SIGN THE STATEMENT  
BELOW TO SAY THEY HAVE PROVIDED THE SAMPLE.

PART A

I have provided a saliva sample for the ESR study on exposure to Environmental Tobacco Smoke. I have given this sample freely and understand that the sample will be used only for the analysis of cotinine levels, for the purposes of this study.

Signed \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Name (Please Print) \_\_\_\_\_

**A35. That is the end of this part of the questionnaire. I need to ask you a few more questions when we meet after your shift tonight (today). When you have provided the second sample you are entitled to either a \$25 book voucher or a \$25 petrol token. Which would you prefer?**

Book token ?  
Petrol Voucher ?

Time \_\_\_\_:\_\_\_\_ am / pm

Place \_\_\_\_\_

**One of the things we would like you to do during your shift today is to take note of approximately how many people are smoking in the room where you work most of the time**

**ARRANGE TO MEET THE PARTICIPANT AFTER THEIR SHIFT. RECORD THE PLACE AND TIME**

**A36. We are concerned that some employers are not very supportive of this study. However if it is not going to cause you any problems, would it possible to ring you about 10 minutes before your shift is due to end to ensure that you are going to be able to make our meeting? I will be careful not to identify myself as being from with the study**

Yes → Go to A37

No → Next page

**A37. What is the best phone number for me to use to contact you?**

\_\_\_\_\_

Continued Next page

?? REMIND THE PARTICIPANT THAT WE WOULD PREFER IT IF THEY DID NOT DRINK OR BRUSH THEIR TEETH FOR AT LEAST 30 MINUTES BEFORE COMING TO THE SECOND INTERVIEW.

?? GIVE THE PARTICIPANT A CARD WITH YOUR PHONE NUMBER AND THE TIME OF THE NEXT INTERVIEW

?? SUGGEST THAT THEY DO NOT SHOW THE CARD OR INFORMATION SHEET TO PEOPLE AT WORK, PARTICULARLY IF THEY ARE CONCERNED ABOUT THAT THEIR COLLEAGUES OR BOSS MAY REACT NEGATIVELY TO THEIR PARTICIPATION IN THE STUDY.

End Time.....:.....

**QUESTIONNAIRE PART B – TO BE COMPLETED BEFORE TAKING SECOND SAMPLE**

Interviewer	_____	QUEST NO.	_____
Start Time of 2 <sup>nd</sup> interview	____:____ am / pm	Today's date	____/____/2000
Place of Interview	_____		

**Before we take the second saliva sample we need to ask you a few questions about your shift today (tonight)**

**B1. What time did your shift finish today (tonight)?** \_\_\_\_\_:\_\_\_\_\_

**B2. How many hours of your shift did you spend in the same room as people who were smoking?** \_\_\_\_\_ hrs

**B3. On average, how many people would have been smoking in the room during that time?** \_\_\_\_\_ people

**B4. Is there anything else that we have not asked you that you think we should know?**

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Continued on next page

TAKE SECOND SALIVA SAMPLE ACCORDING TO THE PROTOCOLS. ONCE COMPLETED INTERVIEWEE MUST SIGN THE STATEMENTS TO SAY THEY HAVE PROVIDED THE SAMPLE.

PART B

I have provided a second saliva sample for the ESR study on exposure to Environmental Tobacco Smoke. I have given this sample freely and understand that the sample will be used only for the analysis of cotinine levels, for the purposes of this study.

Signed \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Name (Please Print) \_\_\_\_\_

Continued on Next Page

GIVE THE BOOK TOKEN TO THE PARTICIPANT AND ASK THEM TO SIGN THE STATEMENT SAYING THAT THEY HAVE RECEIVED THE TOKEN. RECORD THE SERIAL NUMBER OF THE VOUCHER ON THE STATEMENT.

I have received a \$25 PETROL VOUCHER/ BOOK TOKEN (delete what does not apply) as a token of appreciation for participating in the ESR Study on exposure to Environmental Tobacco Smoke

Voucher Number \_\_\_\_\_

Signed \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Name (Please Print) \_\_\_\_\_

**Thank you for taking part in this research. Please remember that if you have any queries about the project you are welcome to ring one of the contact numbers on the information sheet**

End time \_\_\_\_:\_\_\_\_ am / pm



**A5.** Record the participants place of work – \_\_\_\_\_

**A6.** What is your job in this organisation? \_\_\_\_\_

**A7.** How long have you worked at this job?

RECORD EITHER \_\_\_\_yrs \_\_\_\_ months OR Since \_\_\_\_ (Month) \_\_\_\_ (Year)

**A8.** What time did you arrive at work today? \_\_\_\_\_:\_\_\_\_\_ am / pm

**A9.** What time do you expect to finish work today? \_\_\_\_\_:\_\_\_\_\_ am / pm

The next few questions ask about how much time, over the last twenty-four hours, you have spent in the same room as people who are smoking. Please remember we are only concerned here about smoke from tobacco cigarettes, cigars and pipes.

**A10.** Thinking back over the last twenty-four hours. While you were at work at your job here, how many hours in total do you estimate you spent in the same room as people who were smoking? \_\_\_\_\_ Hrs

**A11.** Do you have any other paid jobs? Yes

No → Go to A13

**A12.** During the last twenty-four hours while you were working at your other job, how many hours in total do you estimate you spent in the same room as people who were smoking? \_\_\_\_\_ Hrs

**A13.** Over last twenty-four hours while you were at home, how many hours in total do you estimate you spent in the same room as people who were smoking? \_\_\_\_\_ Hrs

**A14. Thinking about all the other time during the last twenty-four hours when you have not been at work or at home.**

**How many hours in total do you estimate you spent in \_\_\_\_\_ Hrs  
the same room as people who were smoking?**

**The following questions are about your health**

**A15. Have you ever smoked tobacco cigarettes, cigars or pipes regularly? By regularly I mean on most days.**

Yes

No → Go to Heading box before A17

**A16. When did you stop smoking?**

RECORD EITHER \_\_\_\_\_ yrs & \_\_\_\_\_ months ago

OR \_\_\_\_\_ Month \_\_\_\_\_ Year

**The next few questions ask about breathing symptoms that you might have had during the past 4 weeks.**

**A17. Have you had wheezing or whistling in your chest at any time during the last four weeks?** Yes No Unsure

**A18. During the last 4 weeks have you felt short of breath at any time apart from after vigorous exercise?** Yes No Unsure

**A19. During the last 4 weeks, did you usually cough first thing in the morning?** Yes No Unsure

**A20. During the last 4 weeks, did you frequently cough?** Yes No Unsure

**A21. During the last 4 weeks, did you frequently bring up any phlegm?** Yes No Unsure

The next few questions ask about eye, nose, or throat irritation during the past 4 weeks

A22. In the past 4 weeks, have your eyes been red, teary, or irritated? Yes No Unsure

A23. During the last 4 weeks, have you had a runny nose or sneezing? Yes No Unsure

A24. During the last 4 weeks, have you had a sore or scratchy throat? Yes No Unsure

A25. Has a doctor ever told you that you have asthma? Yes No Unsure

A26. Are you currently taking any medicine (including inhaler, aerosols or tablets) for asthma? Yes No Unsure

A27. What is your date of birth? \_\_\_\_/\_\_\_\_/\_\_\_\_

GIVE THE PARTICIPANT THE SHOW CARD FOR A28

A28. Please look at this card and tell me which option best describes the ethnic group or groups you identify with? You can choose as many as you wish

- Maori
- NZ European- Pakeha
- Indian
- Chinese
- Other European
- Pacific peoples
- Other  (Specify) \_\_\_\_\_
- refused



TAKE THE FIRST SALIVA SAMPLE ACCORDING TO THE PROTOCOLS.  
ONCE COMPLETED THE INTERVIEWEE MUST SIGN THE STATEMENT  
BELOW TO SAY THEY HAVE PROVIDED THE SAMPLE.

PART A
I have provided a saliva sample for the ESR study on exposure to Environmental Tobacco Smoke. I have given this sample freely and understand that the sample will be used only for the analysis of cotinine levels, for the purposes of this study.
Signed _____ Date _____ Time _____
Name (Please Print) _____

Continued Next page

?? REMIND THE PARTICIPANT THAT WE WOULD PREFER IT IF THEY DID NOT  
DRINK OR BRUSH THEIR TEETH FOR AT LEAST 30 MINUTES BEFORE  
COMING TO THE SECOND INTERVIEW.

?? GIVE THE PARTICIPANT A CARD WITH YOUR PHONE NUMBER AND THE  
TIME OF THE NEXT INTERVIEW.

End Time.....:.....

**QUESTIONNAIRE PART B – TO BE COMPLETED BEFORE TAKING SECOND SAMPLE**

Interviewer	_____	2.4.1.11. QUES T NO.	_____
Start Time of 2 <sup>nd</sup> interview	____:____ am / pm	2.4.1.12. oday' s date	____/____/2000
Place of Interview	_____		

**Before we take the second saliva sample we need to ask you a few questions about your time at work today**

**B4. Have you spent any time today, since your first interview, in the same room as people who were smoking?** Yes  
No → Go to B4

**B5. How long did you spend in the same room as these people?** \_\_\_\_\_ hrs

**B6. On average, how many people would have been smoking in the room during that time?** \_\_\_\_\_ people

**B5. Is there anything else that we have not asked you that you think we should know?**

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Continued on next page

TAKE SECOND SALIVA SAMPLE ACCORDING TO THE PROTOCOLS. ONCE COMPLETED INTERVIEWEE MUST SIGN THE STATEMENTS TO SAY THEY HAVE PROVIDED THE SAMPLE.

**PART B**

I have provided a second saliva sample for the ESR study on exposure to Environmental Tobacco Smoke. I have given this sample freely and understand that the sample will be used only for the analysis of cotinine levels, for the purposes of this study.

Signed \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Name (Please Print) \_\_\_\_\_

Continued on Next Page

**GIVE THE LOTTO LUCKY STRIKE TICKET TO THE PARTICIPANT AND ASK THEM TO SIGN THE STATEMENT SAYING THAT THEY HAVE RECEIVED THE TICKET.**

I have received a \$7 Lottto Super Lucky Dip ticket as a token of appreciation for participating in the ESR Study on exposure to Environmental Tobacco Smoke

Signed \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Name (Please Print) \_\_\_\_\_

Thank you for taking part in this research. Please remember that if you have any queries about the project you are welcome to ring one of the contact numbers on the information sheet

End time \_\_\_\_:\_\_\_\_ am / pm

### 7.3 Appendix Three

**Table 6: Results of pre and post shift salivary cotinine by age, customer smoking policy and time with smokers during shift for Bar and Restaurant workers**

Participant Number	Gender	Smoking Policy	Time with smokers (Hours)	Pre-shift cotinine (ng/g)	Post-shift Cotinine (ng/g)
1	M	1	0	ND	ND
2	M	3	0	0.6	4.1
3	M	3	7	1.6	8.6
4	F	2	3	ND	1.4
5	F	3	0	ND	3.6
6	F	2	0	ND	ND
7	M	2	0	ND	ND
8	M	3	9	3.4	5
9	F	3	9	5.1	5.1
10	M	2	0	ND	ND
11	M	1	0	0.89	0.44
12	F	1	0	ND	ND
13	F	1	0	ND	0.23
14	F	2	0	ND	ND
15	M	2	0	1.8	1.2
16	F	1	0	0.7	0.27
17	M	2	0	2.3	1.6
18	F	3	6.5	0.45	1.7
19	M	2	7	1.6	1.5
20	F	1	0	0.25	0.3
21	F	2	0.03	1.1	4.2
22	M	1	0	ND	ND
23	F	1	0	ND	ND
24	F	1	0	1.3	1.1
25	F	2	0	4	7.6
26	M	3	7	ND	0.33
27	M	3	7	1.6	1.8
28	M	2	0	1.3	0.63
29	M	3	0	ND	1.9
30	M	3	5	3.3	2.9
31	F	1	0	ND	ND
32	F	2	0	ND	1.8
33	M	2	11	1	2.5
34	F	2	0.1	0.69	0.55
35	M	3	0	ND	0.47
36	M	2	0.02	1.2	ND
37	M	3	0	2.7	5.1
38	F	2	8.5	1	2.5
39	M	2	8.25	1.2	1.3
40	F	2	0	ND	ND
41	F	2	0	ND	ND
42	M	2	7	4.5	6.2

**Table 7: Results of pre and post shift salivary cotinine analysis for government workers.**

<b>Participant number</b>	<b>Gender</b>	<b>Pre-shift Cotinine (ng/g)</b>	<b>Post Shift Cotinine (ng/g)</b>
101	F	ND	ND
102	M	ND	ND
103	F	ND	ND
104	F	ND	ND
105	F	ND	ND
106	F	ND	ND
107	F	ND	ND
108	M	ND	ND
109	F	ND	ND
110	F	ND	ND
111	F	ND	0.27
112	F	ND	ND
113	M	ND	ND
114	M	ND	ND
115	F	0.38	ND
116	F	ND	ND
117	F	ND	ND
118	F	ND	ND
119	M	ND	ND
120	F	ND	ND
121	F	ND	ND
122	F	ND	ND
123	F	ND	0.25
124	F	ND	ND
125	F	0.35	0.47
126	M	ND	ND
127	F	ND	ND
128	M	ND	ND
129	F	ND	ND
130	F	ND	ND
131	F	ND	ND
132	F	0.79	0.73
133	M	ND	0.24
134	M	0.77	ND
135	F	ND	ND
136	F	ND	ND
137	F	ND	0.4
138	F	0.84	0.31
139	F	1	0.43
140	M	ND	ND
141	F	ND	ND
142	F	ND	ND
143	M	0.34	0.42
144	M	0.57	ND
145	M	ND	ND
146	M	ND	ND
147	M	ND	ND
148	F	0.57	0.25
149	F	ND	ND
150	F	0.57	ND

**Table 8. Summary Values for Pre And Post-Shift Cotinine Concentrations in Hospitality Workers And Government Employees**

		<i>Pre Shift Cotinine (ng/g)</i>	<i>Post-Shift cotinne (ng/g)</i>
No smoking policy N=10)	Mean	0.37	0.28
	Median	0.10	0.17
	Minimum	0.10	0.10
	Maximum	1.30	1.10
Restricted smoking policy (N=20)	Mean	1.12	1.68
	Median	1.00	1.25
	Minimum	0.10	0.10
	Maximum	4.50	7.60
No smoking restrictions N=12)	Mean	1.60	3.38
	Median	1.10	3.25
	Minimum	0.10	0.33
	Maximum	5.10	8.60
Government workers (N=50)	Mean	0.12	0.08
	Median	0.10	0.10
	Minimum	0.10	0.00
	Maximum	1.00	0.73

**Table 9. Changes in saliva cotinine concentrations between the first and second samples<sup>10</sup>.**

Change in cotinine concentration (second – first sample result) <sup>†</sup>	Hospitality workers			Government employees
	No smoking restrictions	No Smoking in designated areas	No customer smoking	
Number with decrease	1 (8%)	6 (30%)	3 (30%)	8 (16%)
Number with no change	1 (8%)	6 (30%)	5 (50%)	36 (72%)
Number with increase	10 (83%)	8 (40%)	2 (20%)	6 (12%)
?? Median (ng/g) <sup>§</sup>	1.7	1.6	0.1	0.15
?? Mean (ng/g) <sup>§</sup>	2.2	1.8	0.1	0.16
?? Range (ng/g) <sup>§</sup>	0.2-7	0.1-3.6	0.05-0.13	0.08-0.3
Overall mean cotinine increase (ng/g) <sup>‡</sup>	1.8	0.7	0.02	0.02
Total number in group	12 (100%)	20 (100%)	10 (100%)	50 (100%)

<sup>10</sup> The average times between samples were 7.6 and 8.4 hours for hospitality workers in smoking and non-smoking premises, respectively, and 7.2 hours for government employees.