ITC New Zealand

Wave 2

Technical Report

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Method Summary

This report summarises various methods issues that relate to the New Zealand arm of the International Tobacco Control (ITC) Policy Evaluation Survey (the ITC Project). It provides additional depth on the primary sampling frame for this survey (which is the 2006/07 New Zealand Health Survey) and on the subsequent ITC Project telephone survey of smokers. For further information not detailed in this report please contact Dr Nick Wilson (principal investigator) at: nick.wilson@otago.ac.nz.

1 Introduction

This report outlines in more detail the methods of this survey which is part of an international collaboration – the International Tobacco Control (ITC) Policy Evaluation Survey. The overall objective of the ITC Project is to "apply rigorous research methods to evaluate the psychosocial and behavioural effects of national-level tobacco control policies". The ITC Project uses multiple country controls, longitudinal designs, and theory-driven mediational models that allow tests of hypotheses about the anticipated effects of given policies.[1] The ITC Project began in 2002 as a prospective cohort study tracking and comparing the impact of national level tobacco policies among representative samples of adult smokers in four countries: the United States, Canada, the United Kingdom, and Australia. Since then the number of countries involved has expanded to 14.[2] A conceptual framework[3] and methods paper,[1] on the ITC Project have been published along with many published outputs in the scientific literature[4] (see also a list of publications in the "key findings" section of the ITC Project website for a list of these[2]). This output has included a whole supplement of the international journal *Tobacco Control* (in 2006: volume 15, Supplement III).

2 Background to the NZ arm of the ITC Project

Development of this arm was stimulated by a visit to New Zealand of Dr Mike Cummings (PI for the USA arm) in 2005 (a visit funded by New Zealand's National Heart Foundation). An application to the Health Research Council of New Zealand for funding was submitted later in this year – with funding successfully obtained in late 2006. The New Zealand Ministry of Health provided critical support through its willingness to allow the New Zealand Health Survey to be the sampling frame.

3 The Primary sampling frame

In most of the other ITC Project countries which have high telephone penetrations, recruitment involves random digit dialling methods. However for New Zealand the sampling frame was based on a national survey, the 2006/07 New Zealand Health Survey (NZ Health Survey). Respondents were selected by a complex sample design, which included systematic boosted-sampling of the Māori, Pacific and Asian populations. Interviews were conducted face-to-face in respondents' homes by trained interviewers (on contract to the Ministry of Health) and resulted in a total of 11,924 interviews with respondents aged 18 and over. For full details of the methods of this survey see the report on the key results[5] and a very detailed methods report.[6] However, additional key features are as follows:

> "The 2006/07 NZ Health Survey was carried out from October 2006 to November 2007, collecting information on over 17,000 New Zealanders (4921 children aged from birth to 14 years and 12,488 adults aged 15 years and over)…. The adult sample included 3160 Māori, 1033 Pacific, 1513 Asian and 8593 European/Other adults".

> "The NZ Health Survey measures self-reported physical and mental health status (including doctor-diagnosed health conditions), risk and protective behaviours for health outcomes, and the use of health care services, among the usually resident New Zealand population living in private dwellings."

> "Like earlier NZ Health Surveys, the 2006/07 NZ Health Survey used a multi-stage, stratified, probability proportionate to size (PPS) sample design, with increased sampling of some ethnic groups, primarily through a 'screened' sample. The sample design was developed by the Centre for Statistical and Survey Methodology, University of Wollongong, New South Wales, Australia."

> "The survey only included the usually resident population who live in private dwellings, that is, approximately 94% of the usually resident population. People living in institutions (hospitals, intellectually disabled homes, rest homes, prisons, boarding schools), the homeless, short-term visitors and tourists were not included."

> "Small geographic areas (meshblocks) were randomly chosen throughout New Zealand, with larger areas and those with relatively higher population proportions of Māori having a slightly increased chance of selection. These areas were randomly allocated to the four seasons of the year to minimise seasonality bias. Interviewers began at a random point in each area and selected every kth house as the 'core' sample households. In core households, one adult aged 15 years and over, and one child aged from birth to 14 years old, if any, were randomly selected for the survey. Interviewers then selected every jth house in each area as the 'screened' sample households, to boost Māori, Pacific and Asian sample sizes. In screened households, adults and children were only eligible if the participants identified with a Māori, Pacific or Asian ethnicity (determined using the Census ethnicity question and Statistics New Zealand Ethnicity Classification

Level 4). There was no substitution of households or participants if the selected household or participant refused, was not contactable or was unavailable."

"The data collection was carried out by a specialist survey company, National Research Bureau Ltd (NRB), which undertook the interviewing and prepared the data sets."

"Interviews were conducted in participants' homes, at a time to suit participants. Interviewers typed responses directly into a laptop computer, and show cards with predetermined response categories were used to assist the participant, where appropriate. The height, weight and waist measurements were taken following protocols developed specifically for the survey, using professional weighing scales, a portable stadiometer, and a standard anthropometric measuring tape. Adult interviews were approximately 60 minutes long and child interviews (with the primary caregiver) were approximately 40 minutes long."

"The New Zealand Health and Disability Multi-Region Ethics Committee granted approval for the 2006/07 NZ Health Survey (MEC/06/02/004)."

4 Response to the NZ Health Survey

The response rates obtained were similar to previous NZ Health Surveys, but were markedly better than those achieved in some recent telephone surveys in New Zealand study (eg, only 21.4% in a recent New Zealand study[7]).

Table 1: Final adult weighted response rates (percentage), by ethnic group and gender (Table 7 from the NZ Health Survey Methods Report)

Ethnic group (total response)	Response rate (%)				
	Māori	**Pacific**	**Asian**	**European/ Other**	**Total**
Males	62.6	65.6	79.5	66.4	66.1
Females	70.9	74.3	79.6	68.9	69.9
Total	67.5	70.2	79.6	67.8	67.9

The coverage rate is an alternative measure related to survey response. This "rate" is the ratio of the sum of the selection weights for the survey to the known external population size. These coverage rates reflect the discrepancy between the sample weighted by selection weight and the population by age, gender and ethnicity.

Table 2: Sample sizes and coverage rates (Table 11 from the NZ Health Survey Methods Report)

Population	Sample size	Population benchmark	Sum of selection weights	Coverage rate
All adults	12,488	3,120,706	1,844,371	59.1%

| Māori adults | 3,160 | 355,364 | 249,666 | 70.3% |
| Pacific adults | 1,033 | 164,618 | 110,062 | 66.9% |

5 Limitations of the NZ Health Survey

The NZ Health Survey is widely considered to be a very valuable instrument using state-of-the-art survey methods. Nevertheless, as detailed above, the sampling frame of the NZHS was somewhat constrained (eg, no institutionalised populations) and the response rate was less than optimal (though still very good for a national New Zealand survey). Although many quality control and other measures were taken (see Table 1.5, "Summary of actions taken to prevent non-sample error" in the NZHS Report p18[5]) there still remain various limitations with this approach to information collection. These include:

- The assumption that participants can accurately recall previous events (such as if a doctor has ever told them they had angina) and that they have a sufficient level of literacy to understand health-related terms.
- The assumption that self-reported smoking status provided in the NZHS is accurate since there was no biochemical validation of this status (eg, salivary cotinine).
- The unquantifiable effect of social desirability bias with regard to smoking behaviours (given the changes in socially cued smoking with the recent expansion of smokefree laws in New Zealand[8]). The same societal trend towards the denormalisation of smoking may also make it easier for respondents to admit to such behaviours as "calling the Quitline" or utilising other smoking cessation services.

6 Secondary sampling frame

From the NZHS sample we had an additional sampling frame of adult smokers who had all of the following characteristics:
- Aged 18 years or older
- Smoked more than 100 cigarettes in their lifetime
- Smoked at least once a month
- Were willing to participate in further research (85.2% (2441/2866) of adult smokers in the NZ Health Survey agreed "they would be happy to be contacted again about the possibility of answering further health questions of importance to the Ministry of Health" when asked this at the end of the NZHS interview).
- Did not require language assistance for interviewing, did not have any cognitive impairment, and provided some name and address details (these conditions only excluded three potential respondents).

Out of 2,438 potential respondents who met these criteria, a total of 1376 completed the NZ ITC Project Wave 1 questionnaire giving a response rate of 56.4%. If however, the smokers who were unwilling to participate are considered in the denominator then this response rate is 48.0% (1376/2866). Furthermore, if the response rate is considered in terms of the NZ Health Survey overall response rate as well it is reduced to 32.6% (ie, 48.0% x 67.9%). However all three response rate estimates are probably slight

underestimates, since they do not reflect that some people may have moved from in-scope to out-of-scope of ITC between the NZ Health Survey interview and the ITC interview. We suspect however, that these movements are not a substantive issue.

Suboptimal response rates are inherent with surveys in New Zealand – even when respondents are thanked and acknowledged for their time as in this ITC Project survey (though acknowledgement for doing the NZ Health Survey was very modest). The current situation in New Zealand with households regularly approached by survey companies and marketing companies is likely to be impeding response rates to health surveys. Of note is that the suboptimal response rate issue is largely addressed by the use of weighting procedures (see below).

The survey company: The survey company (Roy Morgan Research) was selected for the NZ arm on the basis of this company having been used for multiple survey waves in the four main ITC Project countries (US, UK, Canada and the Australia). Furthermore, this company had an Auckland office and had Auckland-based staff with experience with the ITC Project questionnaire. All calling specifications and the formatting of the final questionnaires (as per the CATI format) were done as a collaborative exercise between the survey company and the ITC Project research team.

Contact and interviewing protocol: Potential respondents were sent an invitation letter (with an information sheet) approximately four to six months after the NZ Health Survey interview, followed by a phone call from Roy Morgan Research. If they agreed to participate they were given the opportunity to participate in the full survey immediately – or else called back at a more convenient time. In the event that a respondent did not keep a main survey appointment, up to 25 attempts to follow-up were made at varying times of day (as per standard ITC Project approaches). In addition, respondents could complete the main survey during two or more calls if requested.

The study protocol was approved by the Multi-Region Ethics Committee in New Zealand (MEC/06/07/071) and by the Office of Research Ethics, University of Waterloo, Waterloo, Canada (ORE #13547)).

Thanking participants: After the interview in Wave 1, a thank you letter was mailed along with a $NZ20 voucher for a popular retail store. This type of response has been shown in randomised experiments on incentives to increase response rates.[9] For the Wave 2 survey, prior respondents were sent a letter with the compensation approximately one week before being re-contacted to do the interview. For the latter, we included as an additional gift a chocolate bar that was high (70%+) in cocoa solids (to maximise the health benefits of the gift). This additional gift was also approved by both the Ethics Committees overseeing this study. The particular choice of chocolate was also dictated by the requirement of the packaging having labelling that indicated no nut products were in the product (to inform those who are allergic to nuts).

Questionnaire development: The New Zealand questionnaire was adapted from the ITC-four country questionnaire used for Wave 4. The latter was developed by the ITC Project's team of experts on tobacco control (whose varied backgrounds covered: psychology, public health, economics, community medicine, marketing, sociology and statistics/biostatistics). This team also conducted a pilot survey just before Wave 1 to test the questionnaire and the study protocol, as well as further refining the survey measures (n=approximately 125 participants in each country completing the survey).

Modifications to wording and question framing were made as a result of this pre-testing. The questionnaire has been revised at each subsequent wave since this time, but the core of the instrument has remained essentially the same to facilitate comparisons and modelling over time.

Adaptations for New Zealand included minor variations in wording to account for national differences in colloquial speech (for example, bar/pub) and the names of local services and smoking cessation products. A number of additional policy-related questions of particular New Zealand relevance were added to the questionnaire with these being pre-tested on a convenience sample of smokers. But to keep the questionnaire length short we also deleted some of the 4-country Wave 4 questions (in lower-priority tobacco control areas for New Zealand).

Timeframe – NZ arm: The interviews were conducted between 19 March 2007 and 8 February 2008 with the median interview date being 7 September 2007. In total, 89% of interviews were conducted in the 2007 calendar year. These telephone interviews were several months after participants had participated in the face-to-face NZHS. The surveying was done in four batches during this period with subsequent weeks spent following up potential respondents who were difficult to contact. Also during 2007 we undertook a range of reviews and background studies to inform subsequent ITC Project work. These publications and presentations are detailed on the New Zealand ITC Project website (http://www.wnmeds.ac.nz/itcproject.html).

Representativeness of the sample: Survey weights have been used to account and adjust for uneven representation of the final sample (due to the sampling process of the NZHS and also to the non-response rates). A separate report on the weighting process has been prepared and is available in an online report.[10] Of note is that if non-contact and non-response occur randomly, no bias is introduced and the validity of the estimates is unaffected (ie, low response rates lead to biased estimates only to the extent that non-respondents differ from respondents on the characteristics of interest). Other studies report that large differences in response rates have tended to show only minor effects on key estimates (as discussed in Thompson et al[1]).

Mediation models: As noted by other ITC Project investigators,[3] it is of importance to test whether the effects of policies on downstream distal variables (*psychosocial mediators*) and behavioural end-points (for example, quit attempts) are *mediated* by the proximal variables (*policy-specific variables*). There are analytic methods for conducting such mediational analyses which are well-described in the psychosocial literature.[11] However, such methods need to be considered in the context of the complex survey design of the NZ ITC Project.

Ethnic group analyses: As detailed in the NZHS "ethnicity is a self-defined concept" and participants in the 2006/07 NZHS were able to report affiliation with multiple ethnicities, using the Statistics New Zealand standard ethnicity question and Level 4 response categories. Only three adult participants (0.02%) refused the ethnicity question in the NZHS. In all our analyses participants' ethnicity was detailed according to the following ethnic groups: European/Other, Māori, Pacific, and Asian. The 'Other' ethnic group (only n=5 individuals) has been combined with 'European' to avoid small number problems. The small number of participants who reported 'New Zealander' as their

ethnicity (0.9% of adults in the NZHS) or refused the ethnicity question (noted above) have also been included in the European/Other group.

In most analyses we prioritised ethnicity in the following way:
- "Māori" was for all those who reported being "Māori" or having multiple affiliations that included "Māori".
- "Pacific" was for all those who reported being "Pacific" or having multiple affiliations that included "Pacific" (unless Māori affiliation was also reported).
- "Asian" was for all those who reported being "Asian" or having multiple affiliations that included "Asian" (unless Māori or Pacific affiliation was also reported).
- "European" was for all those who reported being "European" or "New Zealander" or who reported another (non-Māori, non-Pacific, non-Asian) ethnic affiliation (n=5).

But we have also in our ITC Project studies described the sample in terms of the "total response" (ie, where participants were counted in each of the four output ethnic groups, and so the sum of the ethnic group populations exceeds the total New Zealand population) (Table 3). This approach is referred to as 'total response standard output' by Statistics New Zealand and was used in reporting the NZHS results.[5]

Table 3: Ethnicity of the ITC Project respondents (Wave 1, n=1376) using the "prioritised" and "total response" approaches to ethnicity classification

	Prioritised (%)*	Total response (%)*
European/other**	45.1	65.6
Māori	44.1	44.1
Pacific	6.5	7.8
Asian	4.3	4.4
Total	**100.0**	**121.9**

* See the text for details on these different approaches.
** Other was small (n=5 respondents). This "European" category also included a few respondents who described themselves as "New Zealander".

Socio-economic and financial stress analyses: Data in our analyses has been presented by quintile of the 2006 version of the New Zealand Index of Deprivation (NZDep2006) as one proxy measure of socioeconomic position (SEP). NZDep2006 is an area-based index of deprivation that measures the level of socioeconomic deprivation for each neighbourhood (meshblock) according to a combination of the following 2006 Census variables: income, benefit receipt, transport (access to car), household crowding, home ownership, employment status, qualifications, support (sole-parent families), and access to a telephone.[12] This index has been used in many published articles and reports and the predecessors of NZDep2006 (NZDep91, NZDep96 and NZDep2001) have been extensively validated (see ref[13] for further details). A full Atlas of Socioeconomic Deprivation in New Zealand (3rd edition) that uses this index has recently been published by the Ministry of Health.[13]

We have also used an individual level deprivation score created for the New Zealand setting (NZiDep).[14] This measure is based on eight questions and has been used in major national surveys eg, the NZHS. Although NZDep2006 and NZiDep they are weakly correlated (see Table 4), these are conceptually quite different measures.[14]

We also have used two measures of financial stress which have been described in the literature, which are correlated with each other (and the two deprivation measures, see Table 4) but involve significant conceptual differences.[15 16] Indeed, we have been able to include the two deprivation variables and both financial stress variables in multivariate modelling without destabilising the model with inter-correlation. Of note is that the relationship between financial stress and smoking is generally now well detailed in the tobacco-related literature.[17-21]

Table 4: Relationships (correlation coefficients) between different socio-economic status measures and financial stress measures (using the full dataset for Wave 1, n=1376)

SES measure	Area deprivation	Individual deprivation	"Financial stress" (paying bills)
Area deprivation (NZDep2006 – a small area deprivation measure)			
Individual level deprivation (NZiDep)	0.26[1] (p<0.001)		
Financial stress: Unable to pay any important bills on time[4]	0.07[2] (p=0.011)	0.21[2] (p<0.001)	
Financial stress: Not spending on household essentials[5]	0.13[2] (p<0.001)	0.25[2] (p<0.001)	0.47[3] (p<0.001)

Notes:
[1] Pearson's correlation coefficient.
[2] Point Biserial correlation coefficient.
[3] Tetrachoric correlation coefficient.
[4] The question is: "In the last month, that is since […], because of a shortage of money, were you unable to pay any important bills on time, such as electricity, telephone or rent bills?".
[5] The question is: "In the last six months, have you spent money on cigarettes that you knew would be better spent on household essentials like food?".

Heaviness of Smoking Index (HSI): This index has been developed by others and we used the "alternative version" (HSI-AV) utilised by Borland et al.[22] This is calculated as the square root of the daily cigarette consumption minus the natural logarithm of time to first cigarette of the day. The specific equations are:

For daily smokers:

$$HSI\text{-}AV = SQRT(\text{daily cigarette consumption}) - \ln(\text{time to first cigarette}) +1.$$

(Note: A value of 1 is added to the above computation to adjust the addiction measure to have a score of zero or more based on 10 or more cigarettes smoked per day and smoked within the first hour of waking up. Also, the value of time to first cigarette has to be at least 1 for the log). If the time to first cigarette is less than 1, then it is rounded up to 1 before applying this formula.

For non-daily smokers:

$$HSI\text{-}AV = SQRT(\text{daily cigarette consumption}) - \ln((\text{time to first cigarette} + 900)/2)) +1$$

(Note: The computation of time to first cigarette for non-daily smokers is adjusted by taking the average of the time to first cigarette on days the respondent smoked plus a dummy amount for days they don't smoke. As we did not have data on number of days smoked, we assume these are equal to days not-smoked. The dummy time for non-smoking days is set to 900 minutes (a time lag of 15 hours), which is higher then the longest period reported of 14 hours).

Other indices: The other indices used are detailed in the table below. These indices are only used in our analyses if there are reasonable scores for internal consistency (ie Cronbach's alpha (α) >= 0.5).

Index	Details
Knowledge/beliefs of harm	
Awareness of smoking harm (7-item index) (α=0.69)	Based on 7 questions of knowledge/beliefs around smoking-related harm that covered harm to the smoker (stroke, mouth and throat cancer, blindness, impotence (males), poor circulation to limbs) and harm to other people (lung cancer and asthma in non-smokers) with this being somewhat more extensive than a similar scale used by other ITC Project workers.[22] In early 2008 some of these issues were covered in new graphic warning labels on tobacco packets in New Zealand (ie, warnings on: blindness, gangrene in feet, lung cancer and mouth cancer).
Awareness of Second-hand smoke (SHS) harm (2-item index) (α=0.62)	Based on a 2-question scale of knowledge/beliefs around smoking-related harm that covered harm to just other people (lung cancer and asthma in non-smokers) with this scale being a sub-component of the 7-item scale above. In early 2008 this issue was partly covered in the new graphic warning labels on tobacco packets in New Zealand (ie, one of the warnings addressed the effect of smoking on infant health).
Quitting related beliefs	
Intention of quitting (4-point scale)	This scale has been used by other ITC Project workers.[23] The question was: • Now we would like to ask you some questions on any thoughts

Index	Details
Knowledge/beliefs of harm	
	you might have had about quitting smoking. IF you decided to give up smoking completely in the next 6 months, how sure are you that you would succeed?
	The response options were: "Within the next month"; "Within the next 6 months"; "Sometime in the future, beyond 6 months"; "Or are you not planning to quit"; "Refused"; "Can't Say".
Self-efficacy for quitting (4-point scale)	This scale has been used by other ITC Project workers.[23] The question was:
	• Now we would like to ask you some questions on any thoughts you might have had about quitting smoking. IF you decided to give up smoking completely in the next 6 months, how sure are you that you would succeed?
	The response options were: "Not at all sure"; "Slightly sure"; "Moderately sure"; "Very sure"; 5 "Extremely sure"; "Refused"; "Can't Say".
Beliefs relating to policies and laws	
Attitude to regulation index (2-item index, high score is favourable toward regulation) (α=0.51)	A similar index has been used by other ITC Project workers[23] but we did not include one question ("Tobacco companies should be allowed to advertise and promote cigarettes as they please") as this did not contribute to the internal consistency of the index. The questions used were: • (Please tell me if you strongly agree, agree, neither agree nor disagree, disagree or strongly disagree with...) Tobacco products should be more tightly regulated. (Please tell me if you strongly agree, agree, neither agree nor disagree, disagree or strongly disagree with...) The government should do more to tackle the harm done by smoking.
Smoking restrictions as reasons for quitting (2-item index)	This index includes smoking restrictions at work and smoking restrictions in restaurants/pubs as reasons for quitting (both types of smoking restrictions are in place in New Zealand). A high score is made up of more "2" (somewhat) and "3" (very much) values for each question.
Other beliefs	
Smoking has affected health & quality of life (two-item index) (α=0.68)	This index was based on the following two questions: • To what extent, if at all, has smoking damaged YOUR health? • To what extent, if at all, HAS smoking lowered YOUR quality of life? For both of these questions the response options were: "Not at all"; "Just a little"; "A fair amount"; "A great deal"; "Refused"; "Can't Say".
Concern that	This index was based on the following two questions:

Index	Details
Knowledge/beliefs of harm	
smoking will lower health & quality of life in the future (two-item index) (α=0.78)	• How worried are you, if at all, that smoking WILL damage YOUR health in the future? • How worried are you, if at all, that smoking WILL lower your quality of life in the future? For both of these questions the response options were: "Not at all worried"; "A little worried"; "Moderately worried"; "Very worried"; "Refused"; "Can't Say".
Self-exempting beliefs (3-item index, high score means stronger such beliefs) (α=0.60)	This index has been used by other ITC Project workers[23] (though in our version we did not include a question about genetic makeup as this question was not asked). • (Please tell me if you strongly agree, agree, neither agree nor disagree, disagree or strongly disagree with...) The medical evidence that smoking is harmful is exaggerated. • (Please tell me if you strongly agree, agree, neither agree nor disagree, disagree or strongly disagree with...) You've got to die of something, so why not enjoy yourself and smoke. • (Please tell me if you strongly agree, agree, neither agree nor disagree, disagree or strongly disagree with...) Smoking is no more risky than lots of other things that people do.
Overall attitude to smoking (5-point scale, high score is more positive towards smoking)	This scale has been used by other ITC Project workers.[23] The question was: • What is your overall opinion of smoking? Is it... The response options were: "Very Positive"; "Positive"; "Neither Positive Nor Negative"; "Negative"; "Very Negative"; "Refused"; "Can't Say".
Social denormalisation (3-item index) (α=0.50)	This index has been used by other ITC Project workers.[24] It covers respondent's attitudes to the statements: "society disapproves of smoking"; "there are fewer and fewer places where you feel comfortable about smoking"; and "people who are important to you believe you should not smoke." A high score means that the person strongly believes that that smoking is not socially acceptable for them. The scoring used is: +2 for "strongly agree", 1 for "agree", 0 for "neither agree nor disagree", -1 for "disagree" and -2 for "strongly disagree".
Social concerns index (3-item index)	This index covers social concerns as reasons for trying to quit or having quit. It covers respondent's attitudes to the statements: "Concern about effect of cigarette smoke on non-smokers?"; "that society disapproves of smoking?" and "setting an example for children?". A high score is made up of more "somewhat" and "very much" responses for each question.

Limitations of studies using ITC Project NZ data: As for all such surveys, a limitation is the reliance on smokers' self-reporting and recall for some of the data. We also

suspect that New Zealand smokers might display some social desirability bias in their responses (eg, possibly being more likely to report having made past and recent quit attempts etc). This is because smoking is becoming increasingly denormalised, as shown by reductions in socially-cued smoking with the recent expansion of smokefree environment laws in New Zealand.[8] Nevertheless, some of the data were based on face-to-face interviews in the NZHS where respondents might be inclined to be more truthful than in the subsequent telephone survey. Other objective data were also collected, such as deprivation based on the visited address of the respondents house (ie, a small area deprivation measure).

More subtle biases may sometimes arise from question ordering and wording. For example, in the study on tobacco tax attitudes respondents were first questioned about current tobacco tax and their typical negative response to this may have made it subsequently harder for them to state support for a dedicated tobacco tax increase (which was covered in the following question). Future surveys could ask these questions in variable orders. Another limitation with the tobacco tax study was that only two questions were asked about beliefs in relation to tobacco taxation.

7 The Wave 2 Sample

The Wave 2 questionnaire had some minor changes to ensure compatibility with changes in the 4-country (Wave 5) questionnaire and to make it a little shorter to administer. The surveying was conducted between March 2008 and February 2009. There was subsequent attrition in participation of 32.7% between waves, leaving 926 respondents in Wave 2. Detailed descriptions of the weighting processes are detailed in an online reports for Wave 2 [25].

Acknowledgements

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Summary of Method for Calculating Estimation Weights for Wave 2

1 Introduction

The Wave 1 ITC Project (New Zealand arm) dataset consisted of all eligible respondents from the 06-07 New Zealand Health Survey (NZHS), who also responded to the ITC. Of the 2689 eligible NZHS respondents, 1376 responded to Wave 1 of the ITC Project telephone survey. Weights for this dataset were calculated using the *calibrated weighting method*, which was equivalent for this case to *generalized regression estimation.* The ITC Wave 1 weights were designed to have two properties:

1. The sum of the ITC Wave 1 weights for the ITC Wave 1 responding sample were required to exact equal the sum of the NZHS weights applied to all NZHS respondents meeting the ITC eligibility requirement. These two sums were required to be equal both overall and for a range of selected classifications, called weighting variables. This requirement ensured that the ITC Wave weights captured the main differences between ITC respondents and non-respondents, to the extent that this could be achieved using the weighting variables. For practical reasons, weighting variables could include only those variables which were available for the NZHS sample.

2. The ITC Wave 1 weights were required to be reasonably close to the NZHS weights, for Wave 1 respondents. (To be precise, a distance measure between the two sets of weights was minimized, subject to property 1). This ensured that the ITC Wave 1 weights also reflected the sampling process and non-response adjustments of the NZHS, including the use of census-based benchmarks.

3. Not too many weighting variables, or overly fine weighting classifications, should be used, otherwise weights become unstable, resulting in higher standard errors.

This process is described in greater detail in the report "Summary of Method for Calculating Estimation Weights for Wave 1 of the 2007 International Tobacco Control Policy Evaluation Project (ITC) – New Zealand Arm", which is available from http://www.otago.ac.nz/wsmhs/academic/dph/research/HIRP/Tobacco/itcproject.

This report describes the calculation of estimation weights for Wave 2 of the ITC. Of the 1376 first Wave respondents, 926 went on to respond to the second Wave (67.3%). A new set of weights for the Wave 2 dataset was needed for several reasons:

- Only 67.2% of Wave 1 respondents continued to respond in Wave 2. As a result, the Wave 2 weights need to be roughly one and a half times the Wave 1 weights, in order to sum to the population of interest. (The population for all Waves of ITC is defined to be all people meeting the ITC eligibility requirement at the time of the NZHS. This is a common convention in longitudinal surveys which do not attempt to replenish the sample for new population entrants).

- The 67.2% rate of continuing to Wave 2 was not evenly distributed across the sample. For example, it will be seen in Section 2 that young people were much

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more likely to drop out than older people. As a result, a simple rescaling of the Wave 1 weights would not provide representative estimates.

The Wave 2 weights were designed to meet two requirements, analogous to the two requirements of the Wave 1 weights described above:
1. Weighted estimates from the Wave 2 sample were required to be equally weighted estimates from the Wave 1 sample, for key classifications and variables. Weighting variables can include any variables which were available for the Wave 1 responding sample. This includes variables collected for the NZHS sample, and variables collected in Wave 1.
2. The Wave 2 weights were required to be reasonably close to the Wave 1 weights for Wave 2 respondents. (To be precise, a distance measure between the two sets of weights was minimized, subject to property 1). This ensured that the ITC Wave 2 weights incorporated the NZHS sample design, the census-based benchmarks used to weight the NZHS for non-response and other factors, and the weighting for non-response in Wave 1.
3. Not too many weighting variables, or overly fine classifications, should be used, otherwise weights become unstable, resulting in higher standard errors.

Section 2 briefly tabulates the Wave 2 attrition rate by some key classifications. Section 3 describes the calculation of Wave 2 weights, and the properties of these weights.

2 Brief Analysis of Attrition between Waves 1 and 2

Tables 1 through 6 tabulate attrition by a number of variables. The main features of these tables are:
- Age-group is by far the most important factor influencing attrition. 63% of 18-24 years olds in Wave 1 dropped out in Wave 2, compared to 33% of all adults.
- Male and female attrition rates were very similar. This was also true within each age-group (attrition rates by age and sex not shown).
- Māori and Pacific respondents had higher rates of attrition (39% and 45%) than the overall rate of 33%.
- Tables 4, 5 and 6 show that heavier smokers were more likely to drop out. Lighter smokers, and those who have quit, were much more likely to participate in Wave 2.
- Smoking and quitting status in the NZHS were predictors of attrition (Tables 4 and 5). Smoking status in Wave 1 was also a predictor (Table 5). The effect of all three variables was found to be statistically significant in a logistic regression of attrition (details not included in this report). This means that the Wave 1 status is worth considering as a weighting variable for Wave 2, in addition to the weighting variables used in the calculation of Wave 1 weights.

Table 1: Attrition by Age

Age-group	Number of Respondents		Percentage Lost to Attrition
	Wave 1	Wave 2	
18-24	147	55	62.6
25-34	340	213	37.4
35-44	354	244	31.1
45-54	293	221	24.6
55-64	156	122	21.8
65+	89	71	20.2
Total	1379	926	32.8

Table 2: Attrition by Gender

Gender	Number of Respondents		Percentage Lost to Attrition
	Wave 1	Wave 2	
Male	530	357	32.6
Female	849	569	33.0
Total	1379	926	32.8

Table 3: Attrition by Total Ethnicity

Ethnicity	Number of Respondents		Percentage Lost to Attrition
	Wave 1	Wave 2	
Māori	608	370	39.1
Pacific	108	59	45.4
Total	1379	926	32.8

Table 4: Attrition by NZHS Question "How Often Do You Now Smoke?" (A3_21)

Question "A3_21" responses	Number of Respondents		Percentage Lost to Attrition
	Wave 1	Wave 2	
1: don't smoke now	0*	0*	n/a
2: at least once a day	1280	850	33.6
3: at least once a week	80	58	27.5
4: at least once a month	19	18	5.3
Total	1379	926	32.8

* Respondents making this response not in scope of the ITC.

Table 5: Attrition by NZHS Question on Quitting Intention (Question A3_25)

Question "A3_25" responses	Number of Respondents		Percentage Lost to Attrition
	Wave 1	Wave 2	
1: no intention of quitting	535	361	32.5
2: thinking of quitting	727	477	34.4
3: thinking of quitting within the next 30 days	88	62	29.5
4: have managed to stop smoking for at least a day now	29	26	10.3
Total	1379	926	32.8

Table 6: Attrition by Smoking Status in Wave 1 (Variable "FR309V" - ITC Wave 1 derived variable)

Variable "FR309V"	Number of Respondents		Percentage Lost to Attrition
	Wave 1	Wave 2	
1: daily	1178	801	32.0
2: weekly	42	30	28.6
3: monthly	19	13	31.6
4: quit in the last month	53	28	47.2
5: quit 1-6 months ago	80	50	37.5
6: quit more than 6 months ago	7	4	42.9
Total	1379	926	32.8

3 Calculation of Wave 2 Weights

Weighting Variables

The following weighting variables and classifications were used:

- Region (the same 4 regions were used as for the Wave 1 weights, consisting of the following DHBs:
  - Northern Region: Northland, Auckland, Waitemata, Counties-Manakau;
  - Midland Region: Bay of Plenty, Lakes, Tairawhiti, Taranaki, Waikato;
  - Lower North Island: Hawkes Bay, Midcentral, Wanganui, Wairarapa, Capital & Coast, Hutt Valley;
  - South Island: Nelson-Marlborough, Canterbury, West Coast, South Canterbury, Otago, Southland.

- Region by Māori (total response ethnic group output);

- Gender by Age (6 categories: 18-24, 25-34, 35-44, 45-54, 55-64, 65 and over), with male and female grouped for the youngest category (18-24);

- Age (4 categories: 18-34, 35-44, 45-54, 55 and over) by Māori;

- Gender by Māori;

- Age (4 categories: 18-34, 35-44, 45-54, 55 and over) by Pacific;

- Gender by Pacific;

- 2006 NZ Deprivation index quintile (5 categories);

- How often does the respondent now smoke (item A3_21 from the NZHS: 3 categories; treated as a continuous variable rather than as 3 distinct categories);

- Quitting Intention (item A3_25 from the NZHS: 4 categories);

- Smoking Status in Wave 1 (item FR309V from ITC Wave 1; grouped into two categories: (a) daily, or weekly; and (b) monthly, quit in the last month, quit 1-6 months ago, or quit more than 6 months ago.

These weighting variables are similar to those used in the Wave 1 weighting. The Wave 2 sample size is smaller, so the categories have been grouped to some extent to avoid small cell sizes and unstable weights. In particular: males and females have been grouped together in the age-group by sex benchmarks; 18-24 and 25-34 year olds have been grouped together in the Māori by age and Pacific by age benchmarks; benchmarks now include age by Māori and gender by Māori instead of age by gender by Māori; NZ deprivation index now grouped into quintiles rather than deciles; NZHS variable A3_21 has been treated as a continuous variable for weighting purposes. In addition, smoking status from Wave 1 has been included as a weighting variable.

Other Constraints on Weights

Wave 2 weights were constrained to be no less than the Wave 1 weight, and no more than 4 times the Wave 1 weight, and no more than 3000, for all Wave 2 respondents. The numbers of records affected by these constraints were 93, 6 and 16 respectively. It is common to impose constraints of this kind, to reduce the variability of the weights, and to ensure common sense properties such as the Wave 2 weights being at least as large as the Wave 1 weights. Generally there would be fewer weights on the boundaries than the 115 which occurred here, but the effect of the constraints is still not excessive.

Distribution of Weights

The mean of the Wave 1 weights was 428.2, and the coefficient of variation (CV) of these weights was 89.9%. It would be expected that the Wave 2 weights would have a higher mean, to reflect attrition, and to have greater variation. This was the case: the Wave 2 weights had a mean of 636.3 and a CV of 92.4%.

The "g-weight" is defined as the ratio of the initial weight to the final weight in calibration. It reflects the factor by which each initial weight has been adjusted. In this case, the initial weight was given by the Wave 1 weight, rescaled so that the sums of the initial and

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final weights were equal. (This rescaling is not strictly necessary, and does not affect the final weights, but is useful as it makes the g-weights easier to interpret.) The mean of the g-weights was 1.02, and the CV of the g-weights was 35.1%. Figure 1 shows the distribution of the g-weights.
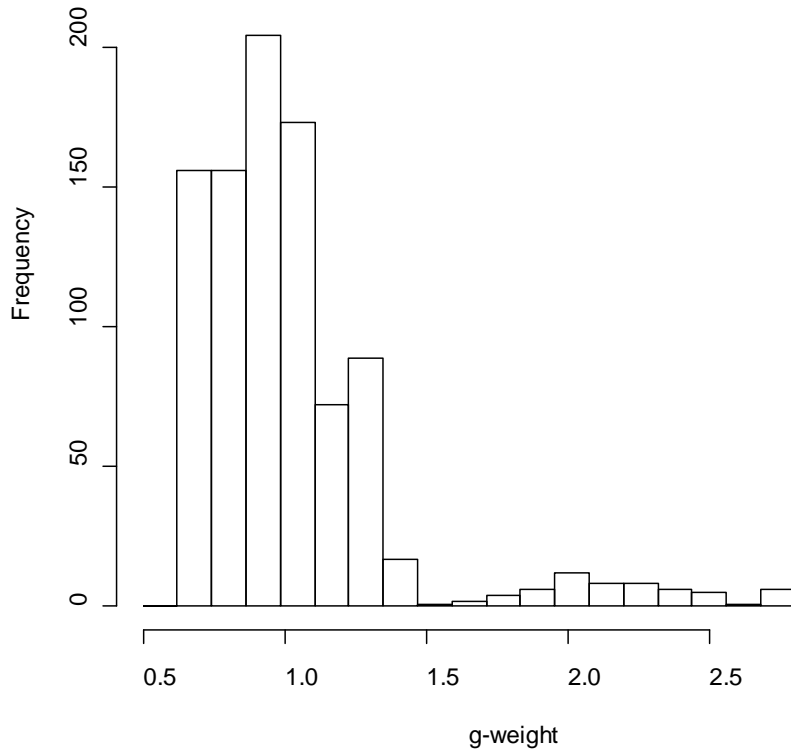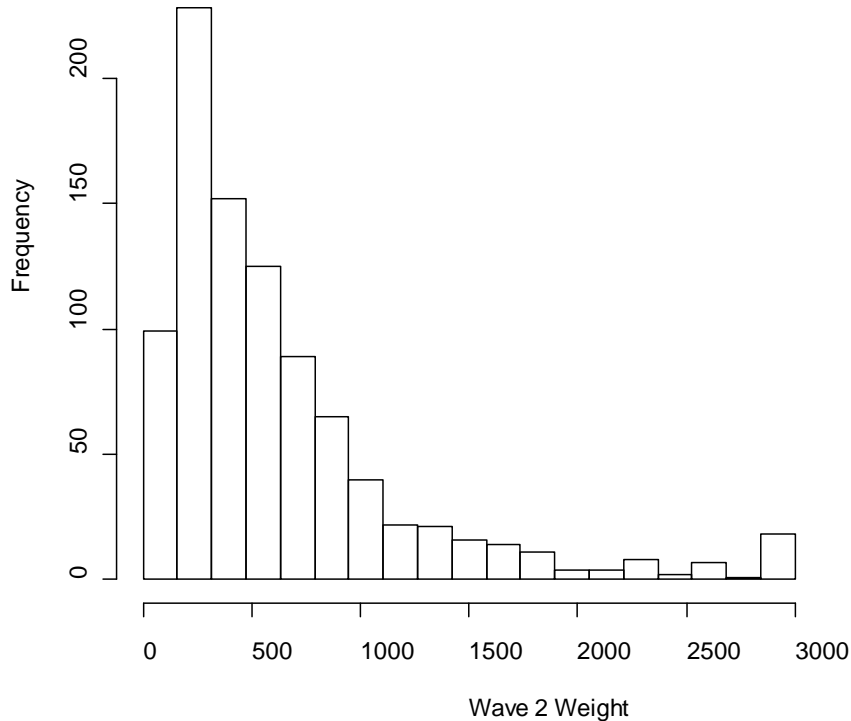
Figure 1: Histogram of g-weights

Figure 2: Histogram of Final Calibrated Wave 2 Weights

Wave 2 Weight

Replicate Weights

A set of 100 replicate weights was calculated for use in estimating standard errors. As described in the Wave 1 report, the Wave 1 replicate weights incorporate the variability both due to the sampling and non-response which occurred in the NZHS, and the non-response which occurred in Wave 1 of the ITC. The Wave 2 replicate weights used the Wave 1 replicate weights as a starting point, and also reflect the attrition between Wave 1 and Wave 2. To be more precise, Wave 2 can be considered the result of three phase sampling, where the first phase was the NZHS, the second phase was ITC Wave 1, and the third phase was ITC Wave 2.

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