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Development and Design of the Ontario Tobacco Survey

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Abstract

General population health surveys often include small samples of smokers. Few longitudinal studies specific to smoking have been carried out. We discuss development of the Ontario Tobacco Survey (OTS) which combines a rolling longitudinal, and repeated cross-sectional components. The OTS began in July 2005 using random selection and data-collection by telephones. Every 6 months, new samples of smokers and non-smokers provide data on smoking behaviours and attitudes. Smokers enter a panel study and are followed for changes in smoking influences and behaviour. The design is proving to be cost effective in meeting sample requirements for multiple research objectives.

KEY WORDS: Survey methods; Cohort; Repeated measures; Tobacco Control; Smoking behaviour.

1. Introduction

Canada has used a range of surveys to track smoking prevalence since the mid-1960s. In recent years, national smoking data on adults have been provided through the following key initiatives: a) Canadian Tobacco Use Monitoring Survey (CTUMS), an annual cross-sectional survey developed to monitor tobacco use and related issues in Canada (Statistics Canada, 2006a); b) the National Population Health Survey (NPHS), a longitudinal health survey of the Canadian population with a cross-sectional component prior to 2000 (Statistics Canada, 2006b); and c) the Canadian Community Health Survey (CCHS), a cross-sectional survey that collects information on the determinants of health, including tobacco use, in the Canadian population (Statistics Canada, 2006c). The Centre for Addiction and Mental Health Monitor (CAMH Monitor) has monitored adult smoking prevalence, attitudes and behaviour within Ontario since 1977 (Ialomiteanu & Adlaf, 2006). The Rapid Risk Factor Surveillance System (RRFSS) also collects tobacco-related exposures, in 21 out of 36 public health units in Ontario (RRFSS Evaluation Group, 2006). In addition to monitoring trends in tobacco use, these data sources have also afforded opportunities to examine correlates of smoking behaviour as well as exposures to second-hand-smoke (Ontario Tobacco Research Unit, 2006; Zhang, 2006; Hammond, 2005).

Cross-sectional surveys (e.g., CTUMS, CCHS, and CAMH Monitor) have a somewhat limited capacity to test hypotheses of cause and effect, or to link individual changes in behaviour with individual or community-level exposures to tobacco control interventions. Furthermore, secondary analyses are often hampered by sample size considerations, and/or lack richness in terms of questionnaire content. For example, the CTUMS survey captures considerable information on an individual's smoking history, current behaviour and exposures and attitudes, but includes no repeated measures, whereas the NPHS which includes within-person follow-up for as many as 6 years, includes limited details regarding history of smoking and prior exposure to external influences on smoking behaviour. Longitudinal studies have been effectively applied in tobacco use research in Canada (Fong, 2006; Karp, 2005; Mills, 2000; Abernathy, 1992). All of these studies, while rich in content, provide small sample sizes of smokers within Ontario.

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Within this context, much of the literature we rely upon to evaluate public health initiatives in tobacco control comes from cross-sectional and ecological studies, as opposed to cohort studies which are a stronger design for establishing causal relationships. Therefore, a study design was sought that would over-sample smokers, providing valid and reportable results on smoking-related behaviours over time in Ontario, while allowing for regular snapshots of smoker and non-smoker attitudes and beliefs. This paper describes the design and development of the Ontario Tobacco Survey.

1.1 Objectives for the Ontario Tobacco Survey

The Ontario Tobacco Survey (OTS) is an initiative of the Ontario Tobacco Research Unit, which receives funding from the Government of Ontario. The study objectives for the Ontario Tobacco Survey are:

- 1) To evaluate existing projects or policies of the Smoke-Free Ontario strategy;
- 2) To serve as baseline for evaluating new or likely projects or policies within the Smoke-Free Ontario strategy; and
- 3) To serve as a basis for planning projects rated as likely or a high priority.

2. Design of the Ontario Tobacco Survey

2.1 Study Design and Recruitment Strategy: a Cross-sectional / Longitudinal Hybrid

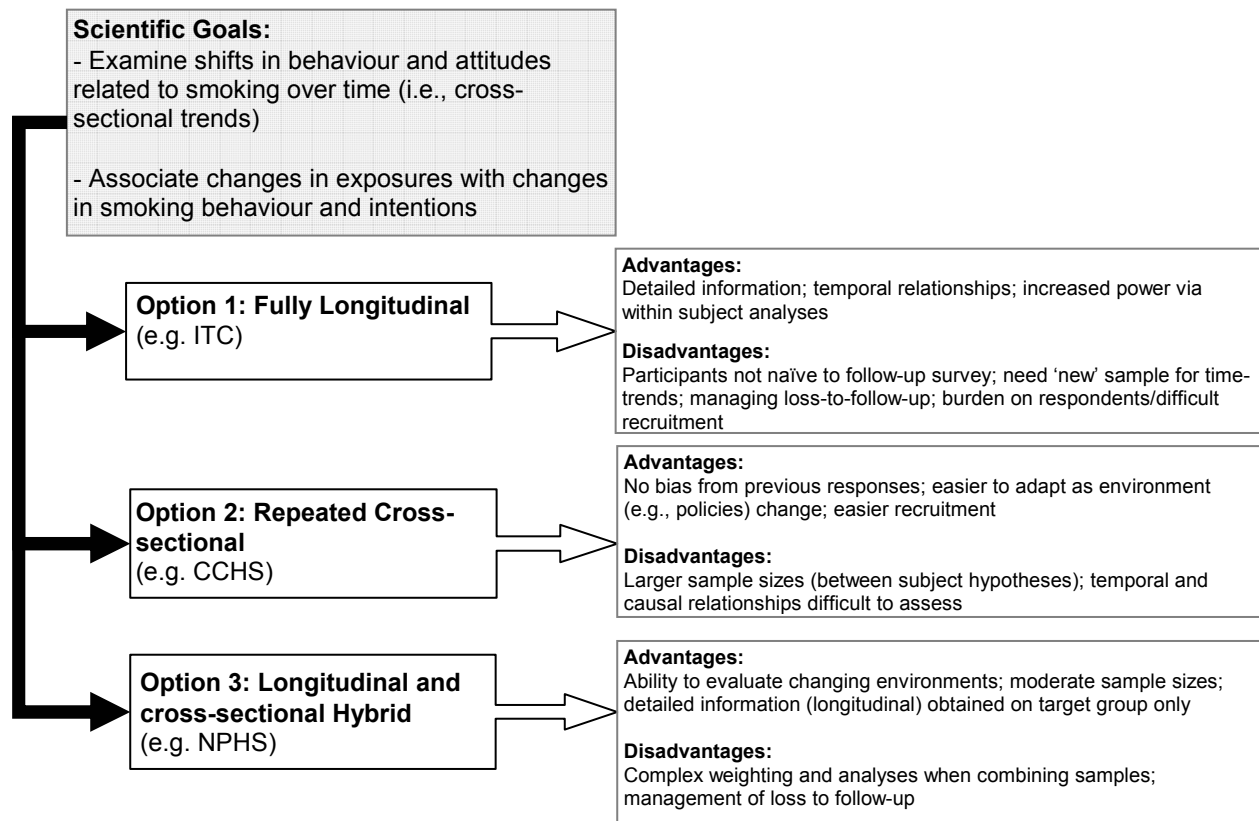
The objectives of the survey imply using the data for specific analyses that are either descriptive or analytic (hypothesis-testing) in their nature, or combinations of the two. For example, in order to evaluate the impact of the new Smoke-Free Ontario strategy, descriptive snapshots of the prevalence of smoking behaviours, and of exposure to the kinds of influences on smoking behaviour that are being manipulated by the strategy would be required. These descriptive data must be collected in a consistent manner as any new initiative or component rolls out (i.e., repeated cross-sectional data collection).

There is much stronger evidence of impact of a given initiative if one can relate actual changes in behaviour over time with coinciding changes in tobacco control initiatives and influences. Quite often the only data available to link the two together are ecological; however, such correlational designs are not the strongest for evaluating the impact of an initiative and conclusions can be erroneous. Much stronger evidence of impact can be achieved when one is able to link changes in behaviour for specific respondents before and after a change in exposure to initiatives intended to change behaviour.

In order to develop a cost-effective design that allows for the examination of changes over time in behaviours, exposures and attitudes, it was necessary to fully consider both longitudinal and repeated cross-sectional survey designs. Figure 1 outlines the design options for the Ontario Tobacco Survey (OTS), along with the advantages and disadvantages for each of the following: a fully longitudinal design, a repeated cross-sectional design, and a longitudinal and cross-sectional hybrid design.

The typical repeated cross-sectional design (Figure 1, Option 2), does not allow for identifying causal inferences; and unless the sample of smokers is enriched, it often lacks power for questions particular to smokers. The fully longitudinal design (Figure 1, Option 1) based on a representative sample of the population without over-sampling of smokers, allows for obtaining both scientific objectives, but comes at an increased cost as this design requires a very large sample of smokers and non-smokers in each round of baseline data collection. Any large cohort will be subject to loss to follow-up and will not guarantee population-descriptive data over subsequent waves of data collection. Therefore, the OTS was a hybrid of the two models (Figure 1, Option 3), and includes an over-sampling of smokers. The final design is a regionally-stratified random telephone survey of adult recent smokers, with new representative samples of smokers being recruited over time. This is paired with cross-sectional samples of non-smokers.

Figure 1: Design Options for the Ontario Tobacco Survey



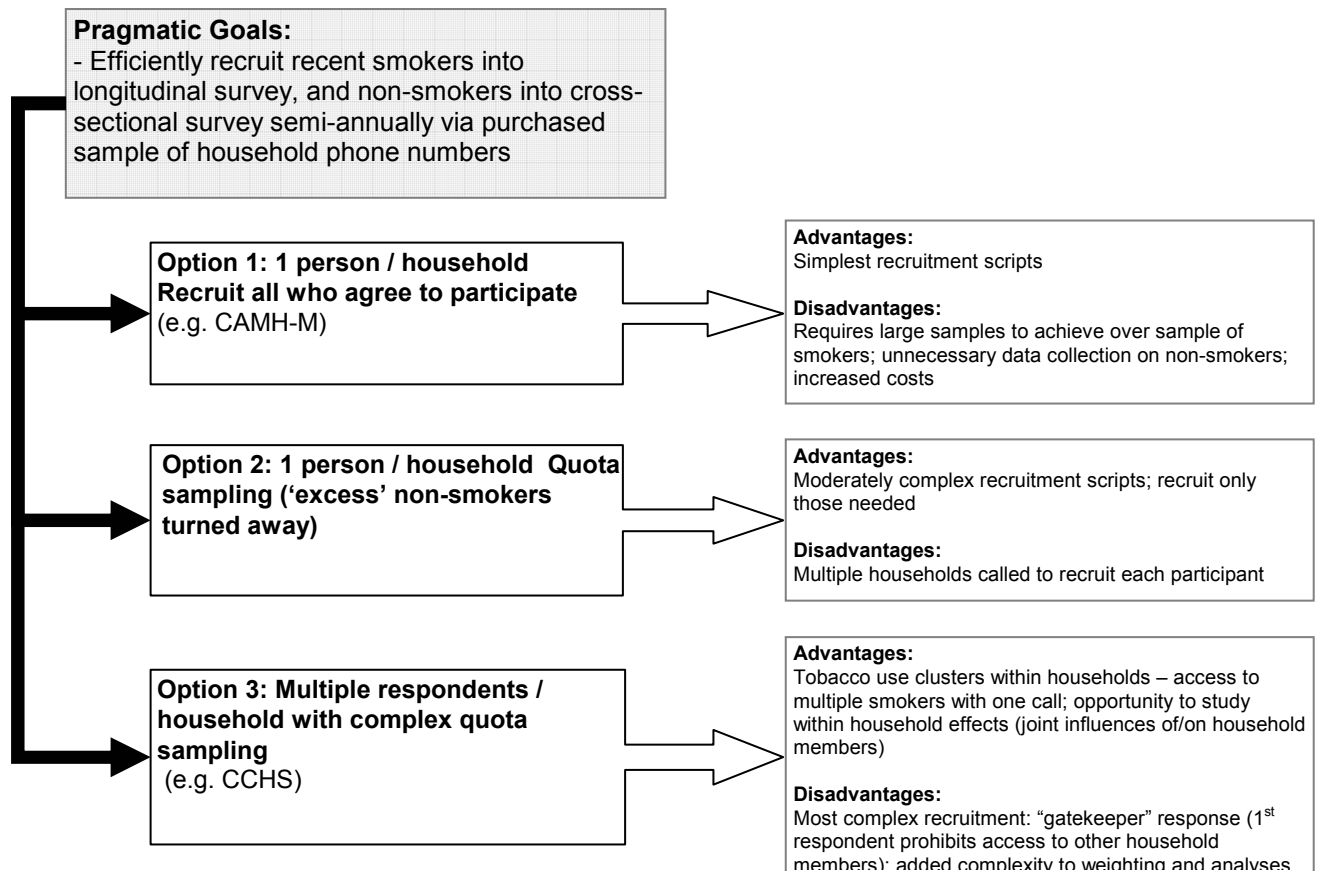
Most cross-sectional health surveys take a random sample of individuals, without attention to smoking status, and therefore the proportion of smokers in the sample is roughly the same as the prevalence in the population. However, the OTS required selection of smokers with a higher probability in order to have sufficient smokers for hypothesis testing regarding quit attempts and cessation (either through a quota system or some nature of random selection with differential probability of selection). The over-sampling posed a methodologic challenge. The differential probability rules are further complicated by the fact that sampling must be carried out at the earliest stages of contact with a potentially eligible respondent, while satisfying the ethical requirements for informed consent and minimizing the amount of personal information obtained during the consent process.

Figure 2 illustrates the three recruitment options discussed for this study. All options started with regionally-stratified random selection of private households using a telephone number bank of residential phone numbers (approximating the effect of random digit dialling). For each Option in Figure 2 where multiple eligible household members are identified, the 'next birthday' method would be used within each sampling stratum.

Option 1 (Figure 2) was to ignore smoking status and take all eligible adults in the household, a very cost-effective means of obtaining a population-representative sample. This option was immediately rejected for the OTS recruitment protocol given the large sample size required to recruit the needed numbers of smokers, and the cost of excess interviews of non-smokers.

Option 2 (Figure 2) is another fairly simple design where one adult respondent per household is selected at random, where excess non-smokers are thanked but turned away once the non-smoker monthly quota has been reached. This design includes some inefficiency in the form of selecting and contacting households where no data will be collected, and possible awkwardness for both interviewers and potential respondents.

Figure 2: Recruitment Options for the Ontario Tobacco Survey



Option 3 (Figure 2) was extremely appealing and included a complex sampling design in which the field staff first identified the mix of smokers and non-smokers in the household and would recruit a stratified sample of up to two smokers per household. In theory, this would maximize the number of interviews obtained for each contacted household. A pilot study was implemented to test the viability of this option, showing that recruiting two smokers per household resulted in a low rate of cooperation and other complications. Ultimately, Option 2 (Figure 2) – one person per household with quota sampling – was selected as our recruitment protocol. This method has proven to be cost-effective and allows for explicit definition of the desired sample size for both recent smokers and non-smokers.

2.2 Target Population and Sampling Design

For the purposes of this study, recent smokers are asked to consent to the baseline (cross-sectional) plus longitudinal survey; and non-smokers are asked to consent to the cross-sectional survey. Eligible participants include all residents of Ontario, 18 years of age and older, residing in a dwelling that has a telephone.

Survey data for the OTS is collected by the Survey Research Centre at the University of Waterloo using computer-assisted telephone interview (CATI) technology. The sample is stratified into four strata defined by telephone area code (807/705, 613, 519, 416/647/905/289). This study collects data in six month waves, maintaining recent smoker and non-smoker quotas on a monthly basis. For each of six planned waves of the survey, 1250 new study participants are recruited, comprising:

- 750 recent smokers who are invited to participate one baseline (cross-sectional interview) and three follow-up surveys occurring in 6-month intervals; and
- 500 non-smokers who are invited to participate in a single baseline (cross-sectional only) survey.

Sample size determinations were complex and based on adequacy of the sample to address a series of research questions. The technique triangulated *a priori* sample size against power to do anticipated analyses. Different members of the investigator team were responsible for *a priori* hypotheses under specific theme domains pertaining to the goals of the Smoke-Free Ontario Strategy and the major initiatives that take place under the strategy. Estimates of dropout were taken from ongoing research at the University of Waterloo: the International Tobacco Survey, a longitudinal survey of smokers in four countries (Thompson, 2006).

2.3 Recruitment, Consent and Compensation Procedures

When a dialed number reaches a private household, the person who answers is asked to provide minimal information on the number of adult residents, and one is selected at random using the 'next birthday' method. When the chosen individual is reached, they are asked for basic eligibility information including smoking status -- approximated by a single question that determines if the participant has smoked one or more cigarettes in the past six months. This measure of smoking status is not as detailed as standard definitions, but provides an easy approximation for recruitment while minimizing personal information requested from participants before they have an opportunity to provide full informed consent. These procedures were specifically reviewed and approved by Universities of Toronto and Waterloo ethical review boards.

Once interviewers verify respondent eligibility, quota sampling determines if eligible non-smokers are notified that they are ineligible for participation in the survey because only recent smokers are being sought at that time. All respondents meeting eligibility criteria and chosen for inclusion into the study are informed of the expected survey length, confidentiality issues, and future data collection if applicable. Interviewers then ask respondents to provide verbal consent to participate in the survey.

At the time of recruitment, participants are informed that they will be compensated for their participation. After being recruited to the survey, each participant is mailed a thank-you letter along with a \$15 honourarium. Every six months, longitudinal participants are mailed a reminder letter regarding their participation in the upcoming phase of the study, along with a \$15 honourarium, two weeks prior to re-contact. Once contacted, participants are consented to participate in the current follow-up survey. Respondents not reached are sent a second reminder letter that indicates our inability to contact them for the next phase of the study, requesting they contact our toll-free number to provide us with updated contact information and/or preferred times to reach them. All participants completing the interview are sent a thank-you letter, along with details regarding the next phase of the study.

3. Content of Survey Instruments

Baseline (cross-sectional) survey scripts are programmed to include significantly more information from smokers than non-smokers. Both recent smokers and non-smokers are asked questions their attitudes and beliefs regarding smoking, environmental tobacco smoke, exposure to tobacco industry marketing, mass media tobacco control campaigns aired in Ontario, and demographic information. For smokers (longitudinal participants), the baseline script also includes detailed questions about their personal smoking characteristics, including past quit attempts and quit intentions, as well as their lifetime exposure to smoking cessation aids and resources. Table 1 outlines the major content areas of the OTS instruments for recent smokers and non-smokers.

Follow-up instruments, administered only to recent smokers, are structured to reflect the content on the baseline questionnaire for recent smokers (Table 1). However, questions on the follow-up surveys are modified to specifically ask respondents about their personal smoking behaviours in the past six months, as well as more detailed information on the factors that may have initiated these changes.

Table 1: Major Content Areas for the Ontario Tobacco Survey

Content Area	Recent Smokers	Non-Smokers
General Smoking Behaviour		
- Current / past tobacco use	•	•
Detailed Smoking Behaviour		
- Frequency / Quantity	•	•
Addiction		
- Perceived addiction / Fagerstrom	•	
Quitting Behaviour		
- Previous attempts and motivation		
- Intentions / Stages of Change	•	
- Perceived ability to quit		
Quit Aids		
- Usage / Opinions of quit aids	•	
Health Professionals		
- Previous advice	•	
- Likelihood of seeking advice		
Purchasing Profile		
- Specific brand / Discount purchasing	•	
Point of Sale		
- Awareness of signage	•	•
Second-Hand Smoke		
- Exposure at home, work, public places	•	•
- Workplace and household policies		
Typology		
- Attitudes and behaviours regarding smoking	•	•
Tobacco Industry		
- Exposure to tobacco sponsored events	•	•
Mass Media		
- Aided recall of mass media campaigns	•	•
Demographics	•	•

Some of the OTS content areas are subject to change depending on the tobacco control environment in Ontario. For example, the survey mass media questions are modified depending on the current and future media buys and messaging aired in Ontario. Other content changes for the OTS is subject to review by Principal Investigators and consensus is obtained before major revisions are implemented.

4. Description of Sample to Date

Wave 1 – July to December 2005 – created the first baseline survey data (Response Rate (RR²)=57%; Cooperation Rate³=89%); Wave 2 - January to June 2006, created the second baseline data (RR=58%; Cooperation Rate=90%) as well as the first follow-up data (RR=92%; Cooperation Rate=98%; Retention Rate⁴=87%). At the time of writing, Wave 3 data collection is near completion and Wave 4 began in early 2007. Table 2 includes sample characteristics from the first two waves of the OTS.

² RR = AAPOR #4 (estimates number of ineligible from non-contact)

³ Cooperation Rate = no. of completes / (no. of refusals + no. of completes)

⁴ Retention Rate = no. of follow-up interviews at Wave2 / no. of recent smokers interviewed at Wave 1

Table 2: OTS Sample Characteristics* from Wave 1 and Wave 2

Variable	WAVE 1		WAVE 2		FOLLOW-UP 1
	Recent Smokers	Non-smokers	Recent Smokers	Non-smokers	Recent Smokers
Average Age (yrs) (SD)	41.9 (14.9)	50.8 (17.0)	42.8 (15.0)	50.7 (16.9)	-
Sex (%)					
- F	54.4	61.1	53.5	59.4	-
- M	45.6	38.9	46.5	40.6	
Education (%)					
- Some secondary or less	18.4	10.1	18.0	11.1	-
- Completed secondary	30.2	26.9	29.9	26.8	
- Some post-secondary	10.8	11.6	10.6	8.4	
- Completed post-secondary	40.6	51.4	41.5	53.7	
Self-Report Smoking Status (%)					
- Daily / Almost daily	78.1	-	78.5	-	72.6
- Occasional	14.0	-	13.8	-	15.1
- Recent Quitter (1-6mth)	7.9	-	7.7	-	7.0
- Former (6mth +)	-	41.1	-	39.6	5.3
- Never	-	58.9	-	60.4	-
One or more quit attempts** (%):					
- Ever	83.0	-	83.1	-	-
- In the past 6 months	-	-	-	-	24.8
Use of any pharmaceutical quit aid** (%):					
- Ever	51.2	-	53.6	-	-
- In the past 6 months	-	-	-	-	17.7
Use of any non-pharmaceutical quit aid** (%):					
- Ever	25.5	-	28.9	-	-
- In the past 6 months	-	-	-	-	7.0

* Unweighted sample data

** Baseline data collects EVER use of quit aids and quit attempts; incident use and attempts (past 6 months) is collected in the follow-up surveys

5. Discussion

The OTS study design is a cross-sectional / longitudinal hybrid, restricting longitudinal membership to a subgroup of interest – in this case, recent smokers. This design allows detailed analysis of the subgroup, while permitting contextual analyses of the entire population and allows the examination of behavioural relationships that may vary in space and time. In addition, the rolling design of the OTS, recruiting new samples at each wave, permits the monitoring of trends in attitudes and exposures for smokers and non-smokers as policies and programs change. The survey data to date indicate that the OTS is successful at obtaining a wealth of data on tobacco related behaviours and exposures of both recent smokers and non-smokers.

There are additional opportunities to build on the current study, depending on future research plans and additional funding. For example, future research may include over-sampling within specific socio-geographic subgroups and experimental smoking cessation interventions with study participants. The Ontario Tobacco Research Unit is committed to making OTS data sets available to tobacco control researchers who are interested in conducting

additional secondary analyses. Individuals interested in making an application for data access should contact the Ontario Tobacco Research Unit.

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