

Methods of the International Tobacco Control (ITC) China Survey

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ABSTRACT

This paper describes the design features, data collection methods and analytical strategies of the ITC China Survey, a prospective cohort study of 800 adult smokers and 200 adult non-smokers in each of six cities in China. In addition to features and methods which are common to ITC surveys in other countries, the ITC China Survey possesses unique features in frame construction, a large first phase data enumeration and sampling selection; and it uses special techniques and measures in training, field work organisation and quality control. It also faces technical challenges in sample selection and weight calculation when some selected upper level clusters need to be replaced by new ones owing to massive relocation exercises within the cities.

INTRODUCTION

The International Tobacco Control (ITC) Policy Evaluation Project was created in 2002. It was conceived as a research tool to measure the effectiveness of national-level tobacco control policies in selected countries which signed and ratified the Framework Convention on Tobacco Control (FCTC). The ITC project possesses several unique features that set it apart among studies on tobacco control. It was designed based on a conceptual model which assumes that each tobacco control policy ultimately has an influence on behaviour through a specific causal chain of psychological events.¹ While the formulation and inclusion of survey questions (variables) are guided by the assumed conceptual model and the provisions of the FCTC, two other key features of the study are the *longitudinal* and *international* aspects of its design. The longitudinal data structure allows the psychosocial and behavioural changes before and after the implementation of a particular tobacco control policy in a country to be measured and compared; and the use of same model and tools in different countries permits one or more countries to be used as control groups when cross-country comparisons are made, and the impact of culture, geographical and economical differences on the effectiveness of certain tobacco control policies is studied.

The ITC survey first started in four large English speaking countries—namely, Canada, USA, Australia and the UK (the ITC-4 Survey). It is a random digit dialled telephone survey of over 2000 adult smokers in each of the four countries. The first wave of the survey was conducted in 2002. In subsequent waves, the initial group of respondents was followed and

a new cross-sectional replenishment sample was added to make up for the reduced size of the longitudinal sample owing to attrition. The dual design (longitudinal and cross-sectional) is another important feature of the ITC survey, which allows the examination of the effects of attrition and time-in-sample. Thompson *et al*² contains details on the features, data collection methods and statistical methods for the ITC-4 Survey.

The ITC project has been growing steadily, with many countries of geographical and strategic importance being added to the initial ITC-4 Survey. Among the significant expansions was the launch of the ITC China Survey in 2006. The ITC China Survey is a prospective cohort study of 800 adult smokers and 200 adult non-smokers in each of six cities in China: Beijing, Shanghai, Guangzhou, Shenyang, Changsha and Yinchuan.¹ In addition to features and methods which are common to ITC surveys in other countries, the ITC China Survey possesses unique features in frame construction, a large first phase data enumeration and sampling selection. It uses special techniques and measures in training, fieldwork organisation and quality control. It also faces technical challenges in sample selection and weight calculation when some selected upper level clusters need to be replaced by new ones owing to massive relocation exercises within the cities, as occurred with two of the cities at Wave 1 and Wave 2.

This paper describes methods used in the ITC China Survey. Special attention is given to design features, training, fieldwork organisation and quality control measures. Additional details are provided in the ITC China Survey Wave 1 Technical Report, which can be found at <http://www.itcproject.org>.

DESIGN FEATURES

It was clear at the beginning of the planning stage that a national representative sample was not feasible, and that the survey would have to be carried out through face-to-face interviews. First, any attempt to cover the vast rural areas in China would require tremendous resources and staff levels, and the ITC China project is clearly not equipped to achieve that goal. Second, most Chinese people are not used to accepting long interviews by telephone. Given the complexity, the sophistication and the longitudinal nature of the ITC survey, it was decided

¹ There was a seventh city in the first two waves—Zhengzhou—but the quality of the data from that city was not sufficiently high; thus, the data from that city are not included in the overall ITC China Survey dataset.



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that the survey should be conducted in selected cities through face-to-face interviews. Another important consideration was that any tobacco control policy to be implemented by the Chinese government will probably first start in major cities. A prominent example is the introduction of new regulations and restrictions on smoking in public venues in Beijing, put in place prior to the Beijing Olympics in the summer of 2008.

The target population

The six cities in the ITC China survey do not constitute a random sample of the entire population of China. They were judiciously selected based on geographical representations and levels of economic development. Beijing, Shanghai and Guangzhou are the three largest cities in the north, east and south of China, and these three cities are all in the forefront of China's economic development in recent years. Shenyang is the largest city in the north east. Changsha is a mid-sized city in the southern central part of China and is also one of the major bases for the Chinese tobacco industry. Yinchuan is an economically less developed city in the northwest region.

The mobile population in these cities are not eligible for the study owing to the requirement of follow-ups in subsequent years. The well established city registration system for permanent residents makes the exclusion an easy task to execute. The target population of the ITC China Survey consists of smokers and non-smokers who are 18 years or older and are permanent residents and live in residential buildings in each of the six cities. Smokers are defined as those who have smoked at least 100 cigarettes in their lifetime and are currently smoking at least once a week. Ex-smokers are not considered as a separate category at Wave 1 ITC China Survey.

Sample size

The overall sample size of the survey is 4800 for adult smokers and 1200 for adult non-smokers for the baseline Wave 1, with 800 smokers and 200 non-smokers surveyed in each of the six cities. This choice of sample sizes was based not primarily on power calculations but rather on a practical allocation of available resources. However, the sample size for smokers is large enough not only to obtain reliable statistics at the aggregated level but also to have meaningful estimates for each city. The sample of non-smokers with smaller sizes is constrained by the available resources but it nonetheless provides opportunities to examine differences in some of the key psychosocial and behavioural measures between smokers and non-smokers. At subsequent waves replenishment samples of smokers as well as non-smokers are added to compensate for the losses to follow-up owing to attrition in the longitudinal sample.

Frame construction and sample selection

The ITC China Survey employs a stratified multistage cluster sampling design. Each city is treated as a stratum and within each city, there is a natural and well established hierarchical administrative system which provides excellent coverage of the target population:

City → street district (Jie Dao) → residential block (Ju Wei Hui) → household

The Jie Dao and Ju Wei Hui are two levels of administrative units under the city government. More importantly, the ITC China team has strong communication links with the Jie Dao and Ju Wei Hui staff members, who play crucial roles in the first phase data enumeration as well as coordination for the survey interview.

In each of the six cities, 10 Jie Dao were randomly selected, with probability of selection proportional to the population size of the Jie Dao. Within each of the 10 sampled Jie Dao, two Ju

Wei Hui were selected, again with probability proportional to the population size of the Ju Wei Hui. The randomised systematic PPS sampling method was used to select the Jie Dao and Ju Wei Hui. Within each selected Ju Wei Hui, a complete list of addresses of the dwelling units (households) was first compiled from administrative data, and then a sample of 300 households was drawn from the list by simple random sampling without replacement. In this way, the second phase sampling frame of 6000 households was constructed in each city, and the frame itself can be viewed as a first phase sample from the city population. The use of PPS sampling at each of the first two stages (Jie Dao and Ju Wei Hui), and a simple random sample of an equal number (300) of households in each selected Ju Wei Hui, ensured that each eligible household in the city had approximately the same chance of being included in the frame of 6000.

A complete enumeration of the 6000 households was conducted prior to the selection of individuals. In the process, information on age, gender and smoking status for all adults living in these households was collected. The enumerated 300 households within each Ju Wei Hui were randomly ordered, and adult smokers and non-smokers were then approached following the randomised order until 40 adult smokers and 10 adult non-smokers were surveyed. Because of low smoking prevalence among women, one male smoker and one female smoker from each selected household were surveyed whenever possible to increase the sample size for women smokers. At most one non-smoker was interviewed per household. Where there was more than one person in a sampling category to choose from in a household, the next birthday method was used to select the individual to be interviewed, and the selection was done prior to the household visit. Proxy interviews were not allowed in the ITC China Survey.

In order to deal with the potential impact of attrition in this cohort survey, at each subsequent wave, those respondents from the previous wave who are lost to attrition are to be replaced (ie, the cohort is to be replenished) by extending the sampling procedure using the same sampling frame that has been constructed at Wave 1. The way that the initial sampling frame was constructed allows this to be a practical possibility. The Wave 2 replenishment survey, for example, drew its sample from the same list of 300 enumerated households that was constructed in the Wave 1 survey for each Ju Wei Hui; households that were not surveyed in Wave 1 were randomly ordered, and adult smokers and non-smokers were recruited in accordance with the procedures described above for Wave 1. If the list of 300 households was exhausted before the desired quota was reached, available households from an adjacent Ju Wei Hui were used to fill the quota. In Wave 2, this happened four times in Shanghai, three times in Changsha and not at all in the other four cities. In Shenyang, there was a massive loss of Wave 1 respondents within one Jie Dao because they were living in an area where all of the residents were moved under the city's relocation exercise. They could not be contacted at Wave 2. To compensate for this dramatic and unforeseen loss, an entire new Jie Dao was selected in that city, following the procedures that had been used to construct the sampling frame for Wave 1; the 300 enumerated households thus constituted the sampling frame for the Wave 2 replenishment survey in the new Jie Dao, and sampling proceeded as above. In Guangzhou, a similar scenario occurred for one Ju Wei Hui, and a new Ju Wei Hui within the same Jie Dao was added to the Wave 2 replenishment survey. The impact of substituting an upper level cluster on the inclusion probabilities of the resulting sampling design under an

initial multistage PPS sampling scheme is further discussed in the section on statistical methods.

The stratified multistage cluster sampling design used for the ITC China Survey is very attractive in terms of frame construction and coverage properties. This type of design is generally popular and efficient for large-scale population surveys and was well documented by Kish³ and Lohr.⁴ There exist several PPS sampling procedures in the survey literature, and the one used for selecting the first stage clusters Jie Dao and second stage clusters Ju Wei Hui in the ITC China Survey was the randomised systematic PPS sampling method. The procedure was first described in Goodman and Kish⁵ as a controlled selection method, and was later refined by Hartley and Rao.⁶ It is the simplest procedure to implement among alternative PPS sampling methods.

The 10 selected Jie Dao in each city comprise the first stage sample of clusters. The sampling fractions of Jie Dao in the six cities are given in table 1.

The next-birthday method was used to select a respondent where there was more than one person in a sampling category to choose from in a household. Two other existing methods for selecting individuals within a household are the Kish method and the last-birthday method. Binson *et al*⁷ compared the effectiveness of the three methods using data from a national telephone survey and showed that the next-birthday method had a higher rate of retaining respondents in subsequent waves, although the differences between the last-birthday method and the next-birthday method are not statistically significant. Cooperation rates and response rates of Wave 1 ITC China Survey data will be given in the section on sample data.

Survey measures and questionnaire development

The ITC China Survey, as with each ITC Survey being conducted across 20 countries of the ITC Project (at the time of this writing), was designed to measure (1) important smoking and smoking-related behaviours; (2) important psychosocial precursors to smoking and to cessation (eg, intention to quit smoking, self-efficacy for quitting, beliefs about smoking and about quitting, perceived risk, societal and subjective norms, attitudes, denormalisation beliefs); (3) important policy-relevant measures for each of the demand reduction policy domains of the FCTC, including those relevant to health warnings (eg, salience, perceived effectiveness, behaviours relating to reactions to the warnings such as forgoing a cigarette because of the warnings), advertising/promotion (overall salience of pro-tobacco messages and anti-tobacco messages, noticing of tobacco sponsorships), purchasing and price-relevant behaviour, smoke-free laws, cessation, education. The survey also included key psychosocial mediators and (possible) moderators (eg, time perspective, depression) of policy impact.

The development of the ITC China Survey was driven strongly by ITC surveys conducted in other countries, in keeping with the ITC Project's objective of conducting surveys with common measures across the 20 countries. We created the ITC China Survey through a collaborative team effort that involved (1) extensive email exchanges and conference calls between our ITC Project Team centered at the University of Waterloo (and including ITC team members from Roswell Park Cancer Institute), (2) a three-day meeting held at the University

of Waterloo with our China National CDC research team, (3) a three-day meeting held two weeks later in Beijing with five ITC team members attending along with the China National CDC research team and the entire research team of 15 CDC officials and researchers across each of the participating China cities, (4) follow-up conference calls and email exchanges to resolve remaining issues. The result was an ITC China Survey in which most of the measures were either identical or, given linguistic and cultural groups existing in China, as functionally similar as possible, to those included in ITC surveys in other countries, but which also included some questions and question options that were unique to China, in accordance with the China team's expertise and experience in tobacco use in China. The ITC China Survey was constructed originally in English, but then was translated into Chinese through a system of multiple translators and with discussion of differences and resolution of those differences.

Despite the extensive collaborative process that we used to create the ITC China Survey—including both the identification of important China-specific factors by the China CDC team (from the China National CDC and from each of the local CDC offices)—and a multistage collaborative translation process, it may be the case that the ITC China Survey may fall short in failing to measure important constructs. Nonetheless, we believe that the resulting ITC China Survey represents a reasonable attempt, given the time constraints, to measure key constructs that are relevant in describing smoking behaviour and in measuring, predicting, and understanding smoking behaviour and the impact of tobacco control policies among smokers in China.

The main questionnaire for the adult smoker survey includes measures of the demand reduction policies of the FCTC, such as labelling, price/taxation, advertising/promotion, smoke-free, cessation, education, and measures on behaviour and psychosocial characteristics. Most of these measures are common for all ITC surveys but some are specifically designed for the ITC China Survey. For example, the Wave 1 surveys (for both smokers and non-smokers) included a set of questions on the International Quit-and-Win Competition, an ongoing event organised by the Office of Tobacco Control of China CDC. The Wave 2 smoker survey included questions on alcohol consumption, intended to bring statistical evidence to bear on hypothesised psychological and behavioural linkages between drinking and smoking.

The Wave 1 final versions of the smoker and non-smoker surveys were pre-tested in a pilot survey conducted in Wuhan and Shenyang in September and October 2005. The pre-test gave the ITC China team an opportunity of going through the entire process of conducting face-to-face interviews and identifying areas for improvement before the formal launch of the survey in the six cities. One particular aspect of the ITC China Survey is how to effectively use the Ju Wei Hui staff members to play a pivotal role in making the initial contact with the respondents and helping the interviewers to approach and enter the household for the survey. The pre-test also provided valuable feedback on unclear or even confusing wordings of some of the health knowledge and attitude-related questions, which led to further changes and improvement to the surveys.

PROCEDURE

The ITC China Survey was conducted through face-to-face interviews. After the potential respondent was provided with information about the survey and completion of the consent form, the average time to complete a survey was 31.4 minutes for smokers and 10.6 minutes for non-smokers, with respective

Table 1 Sampling fractions ($f=n/N$) of Jie Dao in the six cities

City	Shenyang	Shanghai	Yinchuan	Changsha	Beijing	Guangzhou
$f=n/N$	10/75	10/66	10/19	10/59	10/132	10/110

interquartile ranges (IQR) around 10 minutes and 5 minutes. Interviewers followed a strict protocol in their interview session with each respondent. Up to four visits to a household were made in order to interview the target person(s) within that household.

Survey team

The ITC China team consists of members from the Chinese Center for Disease Control and Prevention (China CDC) and international members from the ITC project. At each city, a project coordinator was appointed at the provincial or city CDC, and the project coordinator subsequently assembled a team consisting of one or two deputy team leaders, one data manager, one quality controller and 20 interviewers. Most of these people were staff members at the local CDC, Jie Dao or Ju Wei Hui, who were associated with the China CDC system. Some of the interviewers in Yinchuan were recruited from students at a local medical school. Team members at the China National CDC as well as international team members were overseeing all major steps in the survey execution.

Training

All survey-related materials, including questionnaires, training and quality control manuals, were fully discussed and finalised at a pre-survey workshop. Participants of the workshop included the international team members, members from the China National CDC and representatives from each of the cities. The workshop provided a platform for key team members to have some commonality on the ITC China Survey project, to work out details for the training and fieldwork organisation, to foresee potential problems and to suggest possible solutions.

There were two training manuals developed, one for the enumeration process and one for the survey interview. The complete enumeration of all adults living in the 300 randomly selected households within each selected Ju Wei Hui for basic demographic information and smoking status is the first crucial step of the survey. The enumeration data not only served as a basis for the final stage sample selection of individuals but also provided a rich source for the estimation of prevalence for different age-gender groups. This task was carried out by local Ju Wei Hui staff members, with training provided by each city. Training of interviewers was also organised at the city level, with support and supervision from the ITC China team members both at the China National CDC and at the ITC Project Data Management Centre at the University of Waterloo.

Quality control

Several quality control procedures were put in place. One was a three-level checking of finished questionnaires. The ITC China team established an efficient reporting and communication system among the interviewers, the data manager and the quality controller of each city, and the central team members at the National CDC. A standard checklist was created for each of the three levels: the interviewer, the city quality controller and the designated central team member. Another major quality control procedure was the practice of making MP3 recordings for each of the 800 smoker interviews in each of the six cities. These recordings were valuable not only in monitoring the quality of each interviewer's work, but also in alerting the research team to ways of improving the interview script for the survey and in identifying and correcting errors occurred during the data entry process.

SAMPLE DATA

Wave 1 of the ITC China Survey was conducted in February to April 2006, and the Wave 2 survey was conducted from October

Table 2 Wave 1 cooperation and response rates

City	Shenyang	Shanghai	Yinchuan	Changsha	Beijing	Guangzhou
Cooperation	81.2	84.2	90.3	95.0	80.0	80.0
Response	50.0	61.3	39.4	50.0	50.0	50.0

to February 2008. The final sample sizes in each of the six cities varied slightly from the target of 800 smokers and 200 non-smokers. There were consistency and validity checks on all respondents, which excluded several cases from the final datasets. One scenario for exclusion was that a respondent in the smoker survey answered "No" to the screening question "Have you smoked 100 cigarettes or more in your lifetime?" Other scenarios included that a respondent had missing values on gender or birth date, or there were mismatches on key identification variables between Wave 1 and Wave 2 data entries for the same respondent.

Cooperation and response rates at Wave 1

The Wave 1 cooperation and response rates (%) for the six cities are summarised in table 2 for the adult smoker survey. The cooperation rate is calculated as the ratio of the number of completed interviews and the total number of successful contacts which include both completed interviews and refusals. The response rate is computed as the ratio of the number of completed interviews and the total number of smokers selected in the initial sample. The cooperation rates and response rates presented in table 2 for Shenyang, Shanghai and Yinchuan are exact. The project coordinators at the other three cities unfortunately did not give clear instructions prior to the field work on collecting these data and the interviewers did not keep records on the number of refusals and the number of unsuccessful contacts. The cooperation rates and response rates for these three cities are estimates only, with the missing numbers recalled by the interviewers and the Ju Wei Hui staff members who accompanied the interviewers through the entire course of field work.

The cooperation rates are comparable to those in the ITC-4 Survey but the response rates are generally higher than the telephone interview response rates in the ITC-4 Survey.

Retention and replenishment at Wave 2

The overall retention rates for the combined six cities were 81.6% for smokers and 83.9% for non-smokers. The number of respondents retained, as well as the corresponding retention rates (in parentheses), for each of the six cities, are given in table 3 for smokers and in table 4 for non-smokers. The retention rates for Shenyang and Guangzhou are much lower than for the other four cities, owing to the replacement of an entire Jie Dao or Ju Wei Hui from the Wave 1 sample. The replenishment sample sizes are also included in tables 3 and 4.

STATISTICAL METHODS

Substitution of units

The ITC China Survey employed a stratified multistage cluster sampling design. The primary sampling units, the Jie Dao, and

Table 3 Wave 2 retention rates and replenishment sample sizes for smokers

City	Shenyang	Shanghai	Yinchuan	Changsha	Beijing	Guangzhou
Wave 1 n	781	784	791	800	785	791
Lost	198	81	132	152	75	231
Retained	583 (74.7)	703 (89.7)	659 (83.3)	648 (81.0)	710 (90.5)	560 (70.8)
Replenished	198	77	101	98	54	236

Table 4 Wave 2 retention rates and replenishment sample sizes for non-smokers

City	Shenyang	Shanghai	Yinchuan	Changsha	Beijing	Guangzhou
Wave 1 n	196	204	214	203	218	224
Lost	24	17	34	45	8	75
Retained	172 (87.8)	187 (91.7)	180 (84.1)	158 (77.8)	210 (96.3)	149 (66.5)
Replenished	22	17	24	25	7	60

the secondary sampling units, the Ju Wei Hui, were selected using the randomised systematic PPS sampling method, with selection probabilities proportional to the unit population size. The list of 300 households enumerated for each selected Ju Wei Hui was initially conceived as large enough to meet the sampling requirement for not only the first wave baseline survey but also the replenishment samples in subsequent waves. The inclusion probabilities, which are required for weight calculation, can be obtained through a simple rescaling of the Jie Dao or Ju Wei Hui population sizes under the initial PPS sampling design.

The original ITC China Survey sampling design was altered in Guangzhou, where one Ju Wei Hui was replaced by a substitute unit, and also in Shenyang, where one Jie Dao (two Ju Wei Hui) was replaced by another one, because of unforeseeable changes in these two cities. When a multistage cluster sampling design is modified by substitution of units, the inclusion probabilities for the modified design can no longer be computed by the same method based on the initial sampling procedure. For the ITC China Survey, the question can be formulated more specifically as follows: when the original sample units were selected by a randomised systematic PPS sampling method, and some units were later replaced by substitute units, selected from units not included in the original sample by the randomised systematic PPS sampling method, how should the inclusion probabilities for the final sample be computed?

The question is not only of practical interest here for the ITC China Survey Project but also of theoretical interest since substitution of units often occurs in other surveys. Unfortunately, this seemingly simple question does not have a simple answer. Motivated by this particular need from the ITC China Survey, Thompson and Wu⁸ proposed a simulation-based approach to assessing the effect of substitution of units for the randomised systematic PPS sampling methods. When all design information is available, which is the case for the ITC China Survey, the inclusion probabilities for the final modified design can be approximated through Monte Carlo simulations. Two important observations are especially relevant to the ITC China Survey: (i) when a PPS sampling procedure is modified owing to substitution of units, the resulting inclusion probabilities are no longer proportional to the size measure, even if the substitute units are selected by the same PPS sampling method; (ii) the impact of substitution of units on the final inclusion probabilities depends on the sizes of the units being replaced. If the units being replaced are of average size, the final inclusion probabilities under the modified sampling design are nearly proportional to the unit size. The replaced Ju Wei Hui in Guangzhou and the substituted Jie Dao in Shenyang were both of average size. It was decided that weight calculations for both cities could

proceed as if the sampling design was still PPS after the replaced unit was removed from the sampling frame.

Weight calculation

For Wave 1 data, the weights were simply calculated as the reciprocal of the inclusion probabilities, and were constructed separately for male adult smokers, female adult smokers, and adult non-smokers. While the inclusion probabilities under a multistage sampling design are usually calculated as a product of the sequence of conditional inclusion probabilities from top to bottom, the weights are most conveniently constructed from bottom to top at the four levels of sample selection: individual, household, Ju Wei Hui and Jie Dao. The final Wave 1 weight for a sampled individual was the number of people in the city population and the sampling category represented by that individual.

For Wave 2 data, two sets of weights were calculated: the Wave 2 longitudinal weights for all successful re-contacts, and the Wave 2 cross-sectional weights for all individuals surveyed at Wave 2, including both the re-contacts and the replenishment sample. The Wave 2 longitudinal weights were based on the Wave 1 weights but were re-scaled at both the household and individual level to adjust for attrition; the Wave 2 cross-sectional weights were constructed by pooling together the re-contacts and the replenishment sample, and computations conducted were guided in accordance with features from the combined sampling design (cohort and cross-sectional) at Wave 2.

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Competing interests None.

Patient consent Obtained.

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国际烟草控制政策评估(ITC)项目中国调查方法

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摘要

ITC中国调查是在中国6个城市开展的前瞻性队列研究, 每个城市调查800名成年吸烟者和200名成年非吸烟者, 本文对此次调查的设计特点、数据收集方法和分析策略进行了介绍。ITC中国调查除了具有其它国家ITC调查常见的特点和方法外, 还有一些独特的特色, 譬如在框架构建当中采用了大规模的第一阶段抽样用人口学信息收集和样本选择, 在培训、现场工作组织和质控方面采用了一些特殊的技术和措施。此外, 由于部分城市的大规模拆迁, ITC中国调查还在样本选择和权重计算当中面临了一些挑战, 包括部分所选上层抽样群在发生大规模迁移时必须使用新的群进行替代。

前言

国际烟草控制政策评估(ITC)项目始于2002年, 最初是测量部分签署了《烟草控制框架公约》(FCTC)并已生效的国家全国性烟草控制政策效果的一个研究工具。ITC项目与其它烟草控制研究相比有几个显著的特色, 其设计基础概念模型是, 假定所有烟草控制政策通过特定心理事件的因果关系, 最终都能对行为产生影响。¹除了调查问卷(变量)依照这一概念模型和FCTC条款进行设计外, ITC调查还有两个重要的特点, 那就是其设计的纵向性和国际性。纵向数据结构使得特定国家特定烟草控制政策实施前后的心理和行为改变可测、可比较; 同时在不同的国家使用同样的模型和工具为跨国比较以及文化、地理和经济差异对特定烟草控制政策有效性的影响比较提供了对照组。

ITC调查最早是在四个主要英语国家开展, 包括加拿大、美国、澳大利亚和英国(ITC-4调查), 其中每个国家以随机电话拨号方式对2000多名成年吸烟者进行电话调查, 第一轮调查是在2002年开展的。在其后的几轮调查中, 对最初的访问人群进行了随访, 同时使用新的横断面补充样本替代失访的纵向样本。这种双向设计(纵向和横向)是ITC调查的又一个重要特点, 这种方式可以考察样本流失和时间-样本关系的影响。Thompson等人²对ITC-4调查的特点、数据收集方法和统计方法进行了具体论述。

ITC项目一直在不断扩大, 很多在地理和策略方面具有重要价值的国家都相继加入了最

初的ITC-4调查当中, 其中一个重要的扩展就是2006年ITC中国调查的开展。ITC中国调查是在中国6个城市(北京、上海、广州、沈阳、长沙和银川)进行的一项前瞻性队列研究, 每个城市调查800名成年吸烟者和200名成年非吸烟者。ⁱ除了具有其他国家ITC调查共同的特点和方法外, ITC中国调查还在抽样框架构建方面具有其独特的特点, 譬如大规模的第一阶段抽样用人口学信息收集和样本选择, 同时在培训、现场组织和质量控制方面也采取了一些特殊的技术和措施。除此之外, 由于部分城市发生大规模的拆迁, ITC中国调查必须使用新的群替代之前所选的部分上层抽样群, 这些对调查样本选择和权重计算都是技术上的挑战, 第一轮和第二轮调查中有2个城市出现了这种情况。

本文介绍了ITC中国调查所使用的方法, 特别是调查的设计特色、培训、现场组织和质控措施。更多信息可参考《ITC中国调查第一轮技术报告》, 网址是:
<http://www.itcproject.org>。

设计特色

在调查规划初期就已经十分明确, 采用全国性代表样本是不可行的, 同时调查只能通过面对面访谈的形式开展。首先, 要覆盖中国十分广大的农村地区需要巨大的物力和人力投入, ITC中国项目很明显达不到这一目标。第二, 绝大多数中国人都不能接受长时间的电话访谈。鉴于ITC调查的复杂性和规模, 并且需要随访, 最终决定选取部分城市, 使用面对面访谈的方式开展。另一个重要的考虑是, 任何由中国政府实施的烟草控制政策一般都会首先从大城市开始, 其中一个最显著的例子就是在北京出台新的公共场所禁止吸烟规定, 其实施时机就是选择在2008年奥运会前夕。

目标人群

参与ITC中国调查的六个城市不能构成代表整个中国人群的随机样本, 选择依据是其地理代表性和经济发展水平。北京、上海和广州分别是中国北部、东部和南部的三个最大城市, 也是中国近年来处于经济发展水平前列的三个城市。沈阳是东北地区最大的城市。长沙是中

ⁱ前两轮实际上还包括了第七个城市, 即郑州, 但是由于该城市的数据质量不够高, 因此其城市数据未纳入ITC中国调查的数据库当中。

6 解锁

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国中南部地区的中等规模城市，同时也是中国的烟草工业基地之一。银川是西北地区经济发展相对比较落后的城市。

由于需要在后面几年继续开展随访工作，因此这些城市的流动人口并未纳入调查。由于这些城市都有针对常住居民的成熟的户籍体系，因此流动人口的排除工作并非难事。ITC中国调查的目标人群为年龄在18岁及以上的吸烟者和非吸烟者，并且是居住在这六个城市居民楼内的常住居民。对吸烟者的定义是指曾吸卷烟超过100支，且目前至少每周吸烟一次的人。曾经吸烟但当前不吸烟者不作为第一轮调查的独立分类考察。

样本量

第一轮调查（基线调查）的总体样本量是4800名成年吸烟者和1200名成年非吸烟者，其中每个城市选择800名吸烟者和200名非吸烟者。这一样本量的确定主要依据不是样本计算结果，而是对现有资源分配的实际考虑。不过，这一吸烟者的样本量已经足够大，不仅可以获得群体水平的可靠统计估计，同时还可以对每个城市进行有意义的估算。非吸烟者的样本规模相对较小，这主要是受到了现有资源的限制，但是这并没有影响对吸烟者和非吸烟者在一些关键社会心理和行为指标方面差异的比较。在后面几轮调查当中，对吸烟者和非吸烟者的样本都进行了补充，弥补了纵向样本在随访过程当中损失。

抽样框架的构建和样本的抽取

中国调查采用的是分层多阶段整群抽样设计。每个城市都被作为一个层，同时每个城市内部自然、成熟的行政层次划分机制又为覆盖目标人群提供了很好的条件：

市→街道→居委会→家庭

街道和居委会是属于市政府的两级行政单位，而ITC中国调查团队与街道和居委会人员之间建立了很好的联系，他们在第一阶段的抽样用人口学信息收集和入户调查协调工作方面都发挥了很重要的作用。

在每个城市当中，分别依据各街道的人口规模，使用按容量比例概率抽样法（PPS）随机抽取了10个街道，在每个抽中的街道中再根据居委会人口规模抽取2个居委会。对街道和居委会的抽取采用了随机化的系统PPS抽样方法。在每个抽中的居委会当中，根据行政数据编制家庭列表，然后采用不放回简单随机抽样的方式从中选择300户家庭做为样本。这样就产生了第二阶段每个城市6000户家庭的抽样框架，而这一框架本身可被视为从各城市人口当中获得的第一阶段样本。前两个阶段（街道和居委会）当中PPS抽样方法的使用，以及对每个抽中居委会当中同样数量（300户）家庭的简单随机抽样确保了城市当中每个满足条件的家庭进入6000户框架中的机会基本相同。

在抽取个人样本之前对6000户家庭进行了全面的信息收集。在这一过程中，采集了所有家庭成年人的年龄、性别和吸烟状况信息。每个居委会当中抽中的300户家庭使用随机排序，然后根据这一随机的排序对其中的成年吸烟者和非吸烟者进行调查，直到完成40名成年吸烟者和10名成年非吸烟者。由于女性当中的吸烟率很低，因此只要条件许可，即从抽中家庭当中选择一名男性吸烟者和一名女性吸烟者进行调查，以增加女性吸烟者的样本量。每个家庭最多调查一名非吸烟者。如果一个家庭当中在某一样本分类下不止一名可选的调查对象，那么则采取“下次生日法”选择调查对象，选择过程在入户调查之前完成。ITC中国调查不使用他人代替回答的方式。

为了解决队列调查当中样本丢失可能带来的影响，在后面的每轮调查中都对前一轮丢失的调查对象进行了替代（即对人群进行补充），具体方法是采用第一轮建立的样本框架去延续抽样过程。初始抽样框架的构建方式使得这一措施具有了可行性。以第二轮的补充调查为例，使用的就是第一轮调查当中每个居委会构建的300户家庭名单，对第一轮当中没有调查的家庭随机排序，然后根据上面描述的第一轮调查程序招募成年吸烟者和非吸烟者。如果在完成需要的配额之前300户家庭的名单就用尽了，那么就使用临近居委会的符合条件家庭填补剩余配额。在第二轮中，这种情况在上海出现了4次，在长沙出现了3次，在其它城市没有出现。在沈阳，第一轮调查中的一个街道由于市里的拆迁出现了大规模的调查对象丢失，这个街道所在地区所有的居民由于拆迁原因都迁离了原址，在第二轮调查时随访不到。为了弥补这一大规模的、未曾预见的丢失情况，又从该市另外抽取了一个街道，具体操作方法与第一轮的样本框架构建程序一样，新街道的300户家庭经抽样用人口学信息收集后形成了第二轮补充调查的样本框架，具体抽样过程同上。广州的一个居委会也发生了类似的情况，同一街道的另一个居委会被加入第二轮的补充调查当中。替换上层抽样群对最初多阶段PPS抽样方案下所得样本设计的纳入概率的影响在统计方法一节当中将做进一步讨论。

从抽样框架构建和覆盖面特点方面来看，ITC中国调查所采用的分层多阶段整群抽样设计很具特色。这种设计总的来说在大规模人群调查领域非常受推崇，效率也非常高，Kish³和Lohr⁴对这些方面有详细的论述。调查文献当中介绍的PPS抽样程序有很多种，而ITC中国调查当中第一阶段街道和第二阶段居委会的抽取方法采用的是随机化的系统PPS抽样方法。这种方法最早是由Goodman和Kish⁵提出，作为一种受控选择方法，而后又得到了Hartley和Rao⁶的进一步改良。该方法是各种PPS抽样方法当中实施起来最简单的一种。

每个城市选择的10个街道构成了第一阶段的群样本。六个城市街道抽样比见表1。

在同一家庭中同一抽样类别下存在不止一名候选对象时，则采用“下次生日法”选择调查对象。另外两种可选的调查对象选择方法还包括Kish法和“上次生日法”。Binson等人⁷通过全国电话调查对三种方法的有效性进行了比较，结果显示下次生日法在后期调查当中的对象保留率比较高，不过下次生日法和上次生日法之间并无显著差异。ITC中国调查第一轮数据的合作率和应答率在抽样数据一节当中有进一步的讨论。

调查指标及问卷设计

同ITC项目中其它20个国家（到文章撰写时为止）的ITC调查一样，ITC中国调查问卷是为了测量：（1）重要的吸烟和吸烟相关行为；（2）与吸烟和戒烟有关的重要心理社会指征（如戒烟意愿、戒烟的自我效能、对吸烟和戒烟的信念、认识到的风险、社会和客观规范、态度和非正常化信念等）；（3）针对FCTC各降低需求政策领域的重要政策相关指标，包括与健康警示有关的信息（如视觉突出度、认知有效性、对警示的反应行为，如因为看到警示拒绝吸烟等）、

表1：6城市街道抽样比(f=n/N)

城市	沈阳	上海	银川	长沙	北京	广州
f=n/N	10/75	10/66	10/19	10/59	10/132	10/110

烟草广告/促销（烟草信息和控烟信息的总体视觉突出度、对烟草赞助的注意程度）、购买及价格相关行为、无烟法律、戒烟和教育。此外，调查问卷还包括了关键性的社会心理中间变量和（可能的）对政策有影响的影响因素（如时效性、抑郁等）。

ITC中国调查问卷的设计很大程度上受到了其它国家ITC调查问卷的影响，保持了ITC项目在20个国家使用共同的测量指标开展调查的目的。我们在设计ITC中国调查问卷时采取了团队合作的形式，其中包括：（1）与我们在滑铁卢大学的ITC项目团队之间进行的大量电子邮件和电话会议（包括来自Roswell Park癌症研究所的ITC团队成员）；（2）在滑铁卢大学召开的一次为期3天的会议，参会的包括中国CDC研究团队成员；（3）两周之后在北京召开的一次为期3天的会议，参会的包括5名ITC团队成员、中国CDC研究团队和由15位各项目城市CDC官员和研究人员组成的研究团队；（4）例行的电话会议和电子邮件来往，解决剩余问题。这些努力最终的结果是形成了ITC中国调查问卷，其中根据中方团队对中国烟草使用领域的专业意见和经验，既包含了与其它国家ITC调查完全相同或者根据中国的语言和文化群体进行了调整但功能上依旧相似的问题或选项，而同时又有具有中国特色的一些问题和选项。ITC中国调查问卷最初是使用英文设计的，而后通过由多名翻译人员组成的系统翻译成了中文，并对其中的差异问题进行了讨论和解决。

虽然在设计ITC中国调查问卷过程中我们采取了如此大规模的合作流程，包括中国团队（由中国CDC和各地CDC人员组成），来确定重要的具有中国特色的因素，并且采取了多阶段式的合作翻译流程，但最终的ITC中国调查问卷依然可能对于某些重要方面的测量仍有一定不足。不过我们相信，在如此有限的时间内，此次设计的ITC中国调查问卷在描述吸烟相关行为，测量、预测和认识吸烟行为以及中国烟草控制政策对吸烟者影响等关键领域都已经具备了相当的水平。

成人吸烟者调查问卷的主要内容包括FCTC中各种降低需求政策措施，包括健康警示标识、价格/税收、广告/促销、无烟化、戒烟、教育和行为与心理社会特征有关的指标。这些指标当中大多数都是所有ITC调查所共有的，也有一部分是ITC中国调查所特有的。譬如在第一轮调查（针对吸烟者和非吸烟者）中有一组问题就是关于“国际戒烟竞赛”的（一项正由中国CDC控烟办公室组织的戒烟比赛）。第二轮吸烟者调查问卷包括了关于饮酒的一些问题，旨在为饮酒和吸烟之间心理和行为联系的假设提供统计学证据。

对第一轮吸烟者和非吸烟者调查问卷的最终版本于2005年9月和10月在武汉和沈阳两市开展的预实验中进行了测试。通过预试验，ITC中国团队得到了一次实际开展面对面访谈全流程的机会，发现了在六城市开始正式调查之前可能需要改善的方面。ITC中国调查当中一个特别重要的部分就是如何有效利用居委会人员，一开始让他们接触调查对象，在协助调查员入户调查的过程中扮演关键作用。此外，预试验还得到了一些十分宝贵的反馈信息，包括部分与健康知识和态度有关的问题的措辞不清甚至意思混淆的情况，并对调查问卷进行了进一步的修改。

调查过程

ITC中国调查采取面对面访谈的形式开展。潜在调查对象首先被告知关于调查的信息，并填写好知情同意书，而后的吸烟者平均调查时间为31.4分钟，非吸烟者为10.6分钟，其

四分位区间分别是大约10分钟和5分钟。调查员在每个调查对象的访谈过程中严格遵循调查程序。为调查到家庭内的目标个人（抽中的调查对象），入户4次都不能完成调查才能放弃。

调查团队

ITC中国团队成员包括中国疾病预防控制中心（中国CDC）人员和ITC项目的国际成员。每个城市在省或市CDC设置一名项目协调人，然后由项目协调人再组建一个工作团队，包括1到2名副组长、1名数据管理员、2名质控员和20名调查员。其中大部分人员都是当地CDC、街道和居委会的人员，都和中国的疾控系统有联系。银川市的部分调查员是从当地的一家医学院招募的。中国CDC和ITC国际团队成员对调查执行中的主要步骤进行了监督。

培训

所有调查相关材料，包括问卷、培训手册和质控手册都在调查前的一次研讨会上进行了全面的讨论并最终定稿。参加研讨会的人员包括ITC国际团队人员、中国CDC人员和各城市代表。研讨会为这些核心团队人员提供了一个平台，讨论ITC中国调查项目内容，确定培训和现场组织细节，预见可能的问题，并提出可能的解决方案。

项目一共准备了两本培训手册，一本是针对抽样用人口信息收集的，另一本是针对入户调查的。对每个抽中的居委会中300户随机抽取家庭进行全面调查，获取家庭内所有成年人的人口学和吸烟状态信息是整个调查过程中的第一步，也是十分重要的一步。获得的数据不仅可以作为最后一阶段个人样本抽取的基础，同时提供了一个丰富的数据资源，用于估算不同年龄性别组的吸烟率情况。这一工作是由当地居委会人员开展，这些人员都是由各市负责培训。对调查员的培训也是在市一级组织，由中国CDC和滑铁卢大学ITC项目数据管理中心的ITC中国团队成员提供支持和监督。

质量控制

ITC中国调查采取了多项质量控制程序。其中一项是对完成的问卷进行三级检查。ITC中国团队在各市调查员、数据管理员和质控员和中国CDC中央团队成员间建立了一套高效的报告和交流机制。针对三级分别制定了相应的标准核对清单——调查员、城市质控员和指定中央团队成员。另一项重要的质控程序是对每个城市的800名吸烟者调查使用MP3进行录音。这些录音材料十分重要，不仅可以用于监督每位调查员的工作质量，还可以用于提示研究团队采取措施改善调查访谈脚本质量，发现并纠正数据录入过程中出现的错误。

样本数据

ITC中国调查第一轮于2006年2月至4月开展，第二轮调查于2007年10月至2008年2月开展。6个城市各自最终的样本量与目标的800名吸烟者和200名非吸烟者略有出入。对所有调查对象都进行了相合性和有效性的检验，并最终从数据库

表2：第一轮调查合作率与应答率

城市	沈阳	上海	银川	长沙	北京	广州
合作率	81.2	84.2	90.3	95.0	80.0	80.0
应答率	50.0	61.3	39.4	50.0	50.0	50.0

中剔除了几条记录。排除程序中的一种情况是调查对象在吸烟者调查中对筛查问题“你到目前为止一共是否抽过超过100支烟”回答“没有”。其它情况还包括调查对象没有填写性别或者生日信息，或者同一对象的第一、二轮数据中关键身份数据不符。

第1轮的合作和应答率

表2中是6个城市第一轮调查成人吸烟者的合作率和应答率数据。合作率的是指完成调查数目与包括完成调查和拒绝调查在内的全部成功接触人数之比。应答率是完成调查数和初始样本当中选择的吸烟者总数之比。表2当中沈阳、上海和银川三个城市的合作率和应答率数据是准确的，而其它三个城市的项目协调人在现场工作之前没有先给出明确说明，要求收集这些数据，结果调查员没有记录下拒绝访谈人数和接触失败数，因此，这三个城市的合作率和回复率数据只是估计值，其中的缺少数据是由调查员和在整个现场工作过程中陪同调查员的居委会人员回忆补充。

ITC中国调查中的合作率与ITC-4调查中的合作率相当，但是与ITC-4调查中的电话访谈应答率相比，ITC中国调查的应答率普遍较高。

第二轮的样本保留和补充

所有6个城市的吸烟者和非吸烟者总体样本保留率分别为81.6%和83.9%。表3、表4分别是吸烟者和非吸烟者中保留下来的调查对象人数和对应的保留率数据（括号里）。沈阳和广州的保留率比其它四个城市低很多，主要原因是由于这两个城市都出现过第一轮样本中的整个街道或者居委会被替换的情况。表3和表4当中同时还包括了补充样本量数据。

统计方法

置换单位

ITC中国调查采用的是分层多阶段整群抽样设计。对一级抽样单位“街道”和二级抽样单位“居委会”使用随机化的系统PPS抽样方法抽取，抽取概率与单位人口规模成比例。

表3：第二轮吸烟者保留率和补充样本规模

城市	沈阳	上海	银川	长沙	北京	广州
第一轮N	781	784	791	800	785	791
丢失	198	81	132	152	75	231
保留	583(74.7)	703(89.7)	659(83.3)	648(81.0)	710(90.5)	560(70.8)
补充	198	77	101	98	54	236

表4：第二轮非吸烟者保留率和补充样本规模

城市	沈阳	上海	银川	长沙	北京	广州
第一轮N	196	204	214	203	218	224
丢失	24	17	34	45	8	75
保留	172(87.8)	187(91.7)	180(84.1)	158(77.8)	210(96.3)	149(66.5)
补充	22	17	24	25	7	60

每个抽中居委会中抽取的300户家庭名单首先就被设计得足够大，不仅能够满足第一轮基线调查的抽样要求，还能满足后面几轮的样本补充需要。相应的入选概率在权重计算当中

会用到，可以通过对街道和居委会人口根据最初的PPS抽样设计进行简单的比例修改获得。

由于不可预见的变故，原始的ITC中国调查抽样设计在广州和沈阳两市不得不进行调整，广州是一个居委会被另外一个居委会替换，沈阳是替换了一个街道（2个居委会）。当多阶段整群抽样设计由于单位置换发生调整时，调整后设计的入选概率就不再能使用最初抽样程序的方法进行计算了。对于ITC中国调查，这个问题可以更加具体化，即：使用随机化的系统PPS抽样方法选择原始样本单位后，其中部分单位被置换单位替换，而置换单位又不属于使用随机化的系统PPS抽样方法选择的原始样本，这种情况下应当如何计算最终样本的入选概率？

这个问题不仅对ITC中国调查项目具有现实意义，同时由于其它调查也经常会发生单位置换的情况，因此还具有相当的理论价值。不过，这个看似简单的问题其答案却并不简单。出于ITC中国调查的特殊需求，Thompson和Wu⁸提出了一个以模拟方式来评估随机化的系统PPS抽样方法中单位置换影响的方法。在具有所有设计信息的情况下——ITC中国调查就具备这个条件，调整后的最终设计入选概率可以通过Monte Carlo模拟进行概算。这里有两个很重要的结果与ITC中国调查关系十分密切：（1）当一项PPS抽样过程由于单位置换发生调整时，得出的入选概率不再与样本规模成比例，即使置换单位是使用同样的PPS抽样方法抽取；（2）置换单位对最终入选概率的影响取决于被取代单位的规模。如果被取代单位为一般规模，那么调整后抽样设计的最终入选概率大致与该单位规模成比例。广州被替代的居委会和沈阳被替代的街道都属于一般规模，因此可判定，在被替代单位从抽样框架中剔除之后仍可视抽样设计为PPS，继续进行两城市的权重计算。

权重计算

对于第一轮数据，权重的计算仅仅是求入选概率的倒数，针对男性成年吸烟者、女性成年吸烟者和成年非吸烟者分别计算。虽然多阶段抽样设计当中的入选概率计算一般是条件入选概率由上至下的排列结果，权重最简单的计算方式是按样本选择的四个层面由下至上得出：个人、家庭、居委会和街道。每个样本个人最终的第一轮权重是该个人所代表的该市此抽样类别中的人数。

对第二轮的数据计算了两组权重：第二轮所有成功随访者的纵向权重，以及第二轮所有调查对象的横断面权重，其中既包括成功随访者也包括补充样本。第二轮纵向权重基于第一轮权重数据，但在家庭和个人层面上进行了调整，以适应样本丢失情况。第二轮横断面权重的计算是将成功随访者和补充样本进行整合，而计算方式则是根据第二轮的综合抽样设计（队列和横断面）特点作为依据。

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