
PUBLIC HEALTH RESEARCH

Methodology of Global Adult Tobacco Survey (GATS), Malaysia, 2011

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ABSTRACT

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Introduction Malaysia participated in the second phase of the Global Adult Tobacco Survey (GATS) in 2011. GATS, a new component of the Global Tobacco Surveillance System, is a nationally representative household survey of adults 15 years old or above. The objectives of GATS Malaysia were to (i) systematically monitor tobacco use among adults and track key indicators of tobacco control and (ii) track the implementation of some of the Framework Convention of Tobacco Control (FCTC)-recommended demand related policies.

Methods GATS Malaysia 2011 was a nationwide cross-sectional survey using multi-stage stratified sampling to select 5112 nationally representative households. One individual aged 15 years or older was randomly chosen from each selected household and interviewed using handheld device. GATS Core Questionnaire with optional questions was pre-tested and uploaded into handheld devices after repeated quality control processes. Data collectors were trained through a centralized training. Manuals and picture book were prepared to aid in the training of data collectors and during data collection. Field-level data were aggregated on a daily basis and analysed twice a week. Quality controls were instituted to ensure collection of high quality data. Sample weighting and analysis were conducted with the assistance of researchers from the Centers for Disease Control and Prevention, Atlanta, USA.

Results GATS Malaysia received a total response rate of 85.3% from 5112 adults surveyed. Majority of the respondents were 25-44 years old and Malays.

Conclusions The robust methodology used in the GATS Malaysia provides national estimates for tobacco used classified by socio-demographic characteristics and reliable data on various dimensions of tobacco control.

Keywords Global Adult Tobacco Survey - Tobacco control - Malaysia.

INTRODUCTION

The Global Adult Tobacco Survey (GATS) was launched in February 2007 as a new component of the on-going Global Tobacco Surveillance System (GTSS)¹. GATS serves as a global standard for systematically monitoring adult tobacco use and tracking key tobacco control indicators. GATS is a nationally representative household survey of adults 15 years of age or older using a standard core questionnaire, sample design, and data collection and management procedures that were reviewed and approved by international experts. GATS is intended to enhance the capacity of countries to design, implement and evaluate tobacco control interventions.

GATS is also intended to generate comparable data within and across countries, and monitor the key indicators of the MPOWER packages. MPOWER is package of technical measures and resources developed by World Health Organization (WHO)², each of which corresponds to at least one demand-reduction provision of the WHO Framework Convention of Tobacco Control (WHO FCTC). MPOWER stands for:

Monitor tobacco use and prevention policies
Protect people from tobacco smoke
Offer help to quit tobacco use
Warn about the dangers of tobacco
Enforce bans on tobacco advertising, promotion and sponsorship
Raise taxes on tobacco

GATS has been implemented in 14 countries in Phase 1 between 2008 and 2010³. Malaysia was invited as one of eight countries to conduct GATS in the second phase implementation. In this paper, we describe the design features, data collection methods, and analytic methods of Malaysian GATS conducted in the year of 2011.

OBJECTIVE

The objectives of GATS Malaysia were:

1. To systematically monitor tobacco use (smoking and smokeless) among adults and track key indicators of tobacco control using a nationally representative sample of adults.
2. To track the implementation of WHO Framework Convention on Tobacco Control (FCTC) recommended demand-reduction provisions.

METHODS

Study Population

The target population for Malaysian GATS survey were non-institutional population of men and

women aged 15 years or older, who considered Malaysia to be their usual place of residence⁴. The sampling did not include those who were visitors (e.g. tourists), institutionalized in hospitals, or residing in an assisted living facility/nursing home, on a military base, or in group quarters or a prison.

Sampling Design

In Malaysia, the sampling for GATS was a multistage stratified cluster sampling that was representative of Malaysia's population (15 years or above) all over the country except very remote areas in Sabah and Sarawak, where the only access to the areas is by boat or air transport. The sampling strategy of the survey was to generate precise cross-sectional estimates at the national level, by gender and by geographical (urban/rural) localities at the national level, and to allow for comparison of the estimates between different countries conducting the survey.

According to the GATS sampling protocol, a sample size of at least 4,000 respondents is required (2,000 males and 2,000 females, and 2,000 from both urban and rural areas)⁴. The GATS sample size was adjusted for potential ineligibility and non-response in determining the number of households to be selected in order to get the required number of respondents. After the adjustment, the final sample size was 5,112 households. Of this number, 2,676 were from urban areas; while 2,436 were from rural areas (the response rate in urban areas was usually lower than rural areas in Malaysia). There was no gender assignment made for the selected households.

The sampling process for GATS was done with the following sample design and technique:

First-Stage Sample

Primary Sampling Unit (PSU): The PSU is made up of enumeration blocks (EBs). Based on the 2010 census in Malaysia, there were 74,756 EBs in Malaysia, of which 48,574 were in urban areas and 26,182 in rural areas. The first stage of selection was selection of EBs from a list of EBs in Malaysia. A total of 426 EBs (223 from urban areas and 203 from rural areas) were selected for the GATS. The selection of EBs was done proportionate to the population size (Table 1). The selection was done by Department of Statistics (DOS), Malaysia.

Second-Stage Sample

Secondary Sampling Unit (SSU): The second stage of selection was selection of living quarters (LQs) from each selected EB. On average, the number of LQs for each EB was about 80 to 120 LQs. Twelve LQs were selected from each selected EB (Table 1). The selection of LQs was also done by Department of Statistics, Malaysia.

Table 1 Number of Primary Sampling Units and Secondary Sampling Units

	Primary Sampling Units		Secondary Sampling Units	
	Urban	Rural	Urban	Rural
Johore	27	22	324	264
Kedah	10	23	120	276
Kelantan	8	21	96	252
Malacca	7	5	84	60
N. Sembilan	7	9	84	108
Pahang	8	17	96	204
Penang	16	6	192	72
Perak	18	19	216	228
Perlis	1	3	12	36
Selangor	55	12	660	144
Terengganu	7	10	84	120
Sabah	21	31	252	372
Sarawak	16	25	192	300
Kuala Lumpur	21	0	252	0
Putrajaya	1	0	12	0
TOTAL (National)	223	203	2676	2436

Final-Stage Sample

Final Sampling Unit (FSU): Eligible household residents: A random selection method from a roster of eligible household members was used to select an individual from within a sampled household as per the GATS protocol.

Questionnaire

GATS Malaysia included a household questionnaire and an individual questionnaire, both based on the GATS Core Questionnaire with Optional Questions, which was designed for use in countries implementing GATS⁵.

The household questionnaire, which solicited information on household members was used to randomly select an eligible household member (aged 15 years or above) to complete the individual questionnaire. The individual questionnaire, which was administered to the randomly selected adult through handheld machines, had 10 sections: Background Characteristics; Tobacco Smoking; Shisha/Hookah; Smokeless Tobacco; Electronic Cigarettes; Cessation; Second-hand Smoke; Economics; Media; Knowledge, Attitudes and Perceptions.

The adapted questionnaire was translated and back-translated to ensure the quality of the translation. The questionnaire was then pre-tested in the field in July 2011. Based on the pre-test, the questionnaire was modified and finalized for full study implementation. The final version of the questionnaire was approved by the GATS Questionnaire Review Committee in August 2011.

Programming of the Questionnaire and the Preparation of Handheld Computers

GATS was the first national community survey conducted by the Institute for Public Health via electronic data collection. General Survey System (GSS) software, developed by Research Triangle Institute (RTI) International for the Global Tobacco Surveillance System was used⁶. The software system is designed to support the collection of data in the field where interviewers collect data using handheld computers. The programming of the questionnaire using GSS was carried out in collaboration with information technology personnel associated with GATS Malaysia. The systems were developed and tested using Hewlett-Packard iPAQ 210 handheld devices.

Repeated quality control mechanisms were employed to test the quality of questionnaire programming, in accordance with the GATS Programmer's Guide to General Survey System manual⁷. The main steps involved in checking quality control were version control/verification for the household and individual questionnaires, date and time verification, verification of skip patterns, and validation checks. The entire process, including administration of the questionnaires, data collection using handheld machines, and data management and aggregation (preparing raw data for analysis), was pretested before the actual survey process began. Handheld programming was finalized in July 2011. The electronic case file (used to identify the selected household addresses)

was finalized in October 2011 and uploaded to the handheld devices during the training program for field staff.

Pre-test

GATS Malaysia carried out a pre-test in both urban and rural settings on 19 to 20 July 2011 using a sample of 120 respondents who were equally distributed by gender and smoking status and with individuals from all relevant age groups. The pre-test was conducted with close cooperation from CDC and WHO experts, especially in terms of wording and comprehensibility, inconsistencies in skip patterns, the sequencing of questions, completeness of response categories, workload, interview time, availability and call-backs, and other issues. Other important objectives of the pre-test were to test procedures for handheld data collection, assessed problems in the process of data transfer and aggregation, and developed a data management system for implementation of the GATS Malaysia.

Training for Data Collection

A total of 8 field managers, 23 field supervisors and 41 field interviewers were selected to participate in a centralized training workshop held in Kuala Lumpur from 17 to 21 October 2011. Participants were trained on the contents of the questionnaire, how to complete the questionnaires on paper as well as by using handheld devices, paired mock interviews between participants, and role-plays. After the training workshops, all field interviewers and supervisors were provided with iPAQs loaded with lists of assigned household addresses.

To standardize the survey procedures and minimize non-sampling errors, three manuals and a picture book were prepared. All the manuals were developed first in English and then translated into the Malay language.

Field Interviewer's Manual

The field interviewer's manual provided instructions to interviewers regarding interviewing techniques, procedures in the field, methods of asking questions, and the use of handheld devices. The manual was adapted from GTSS-GATS: Field Interviewer Manual⁸.

Field Supervisor's Manual

The field supervisor's manual, which was intended to help field supervisors in supervising the collection of data, contained a detailed description of supervisors' roles and responsibilities as well as information on data aggregation and transfer procedures. The manual was adapted from GTSS-GATS: Field Supervisor Manual⁹.

Question-by-Question Specification

A third manual provided question-specific instructions to the field interviewers for administering the GATS household and individual questionnaires using the handheld devices. This manual also provided information on range checks, response options, purpose, and instructions for each survey question. The manual was adapted from GTSS-GATS: Question-by-Question Specifications¹⁰.

Picture Book

The picture book provided visual depictions of types of tobacco products, both smoked and smokeless, methods used to quit smoking, and pictorial health warnings.

Fieldwork

Fieldwork took place from 24th October to 18th December 2011. Field interviewers and field supervisors who had participated in the training workshop were posted throughout the country to carry out data collection. The field interviewers collected survey information using the handheld devices and submitting the data saved on a secured digital card (SD card) to their respective field supervisor on a daily basis. The data collection teams will visit the selected Living Quarters for at least four visits before classifying it as a non-respond LQs. The same procedure also being followed for individual respondent before classifying it as a non-respondent. Field supervisors were responsible for the overall operation of the field team and for maintaining the time schedule of data collection in the field; as well as transferring data to the national data coordinating centre via internet at least twice a week. The IT/data management team at the Institute for Public Health provided technical support with respect to concerns raised during fieldwork and for troubleshooting any issues with the handheld devices.

Field-level data were aggregated on a daily basis and analysed twice a week to identify data collection errors, problems with skip patterns, and conduct consistency checks. Field-level feedback forms were analysed, and the information was provided to interviewers and supervisors to improve their performance. Quality control techniques were implemented to ensure good and high quality data via direct observation and assessment of interview process in the field by Institute for Public Health supervisors and short telephone interviews for verification with 10% of the completed households.

Data Analysis (Survey Estimates and Sample Weighting Process)

All estimates that derived from the GATS were in the form of percentage distributions, proportions, ratios, or means. Complex survey analysis was

used to obtain prevalence and population estimates with 95% confidence intervals. To improve the representativeness of the sample in terms of the size, distribution, and characteristics of the study population, sample weights were calculated for each respondent prior to the analysis. The analysis was carried out using SPSS version 19 and SUDAAN version 10.1 software; standard errors were calculated using Taylor series linearization. Sample weighting and analysis were done with the help of the Centers for Disease Control and Prevention, Atlanta, USA. For the GATS sample estimates to be representative of the population, it was necessary to multiply the data by a sampling weight, or expansion factor. The basic weight for each sampled household would be equal to the inverse of its probability of selection (calculated by multiplying the probabilities at each sampling stage). As per the GATS manual, a three-step process for GATS sample weighting was conducted for GATS Malaysia¹¹.

Base weight calculations

The selection probability for p1 and p2 was calculated, where p1 = selection probability for PSUs, p2 = selection probability for households within the PSU. The selection probability for the individual within each household p3 is given by 1 / (the number of eligible persons in the household). This is obtained from the survey response data. The overall base weight (wb) is calculated as 1 / (p1*p2*p3).

$$wb = \frac{1}{p1 * p2 * p3}$$

In addition, the household-level base weight (wb_hh) for use in non-response adjustments is calculated as:

$$wb_hh = \frac{1}{p1 * p2}$$

Non response adjustment

The non-response adjustment was done at two levels: household and respondent. The household non-response adjustment was calculated by PSU, so there were 426 adjustment cells – one for each PSU. The household level non-response adjustment was calculated as:

$$hh_nr = \frac{\sum wb_hh_{eligible\ households}}{\sum wb_hh_{completed\ rosters}}$$

Due to the small sample size of each PSU (12 households) and low response rates in some PSUs, the household-level non-response adjustments

ranged from 1.00 to 6.00. Therefore, they were trimmed so that the greatest value of hh_nr= 3.00. The household non-response adjusted weight wr_hh was the product of the base weight wband the household non-response adjustment hh_nr. The person non-response adjustment was calculated by residence (urban/rural), gender and smoking status taken from the household roster. Therefore, there were 2*2*2=8 adjustment cells for the person non-response adjustment. The person-level non-response adjustment was:

$$pp_nr = \frac{\sum wb_{eligible\ respondents}}{\sum wb_{completed\ respondents}}$$

The final non-response adjusted weight (wr_hh_pp) was the product of the household non-response adjusted weight (wr_hh) and the person non-response adjustment (pp_nr).

Calibration

The post-stratification adjustment (r) was calculated by residence (urban/rural), gender, and the four standard GATS age groups (15-24, 25-44, 45-64, and ≥65) resulting in 16 adjustment cells. Population counts were obtained from the 2010 census in Malaysia. The post-stratification adjustment was calculated as:

$$pp_nr = \frac{\sum popproj}{\sum wb_hh_pp}$$

The final weight (wf) was the product of the non-response adjusted weight (wr_hh_pp) and the post-stratification adjustment (r).

RESULTS

Response Rate

Table 2 presents the number of households and persons interviewed and the response rate by residence. Of the 5,112 sampled households, 4,389 completed the household questionnaire, and the calculated household response rate was 88.1%. The household response rate was higher in rural areas (93.4%) compared to urban areas (83.2%). From the 4,389 completed household interviews, there were 4,250 selected individuals who completed the individual interview (calculated person-level response rate was 96.9%). The person-level response rate was slightly higher in rural areas compared to urban areas (98.1% vs. 95.6%). The overall response rate was computed as the product of the household response rate and the person-level response rate. This rate was 85.3%, where the response rate was 79.6% and 91.7% for urban and rural areas respectively.

Table 2 Number and percentage of households and persons interviewed and response rates by residence (un-weighted) – GATS Malaysia, 2011

	Residence					
	Urban		Rural		Total	
	n	%	n	%	n	%
<i>Selected Households</i>						
Completed (HC)	2,160	80.7	2,229	91.5	4,389	85.9
Completed – No one eligible (HCNE)	0	0.0	0	0.0	0	0.0
Incomplete (HINC)	11	0.4	5	0.2	16	0.3
No screening respondent (HNS)	5	0.2	3	0.1	8	0.2
Nobody home (HNS)	221	8.3	56	2.3	277	5.4
Refused (HR)	158	5.9	62	2.5	220	4.3
Unoccupied (HUO)	68	2.5	48	2.0	116	2.3
Address not a dwelling (HAND)	11	0.4	2	0.1	13	0.3
Other ¹ (HO)	42	1.6	31	1.3	73	1.4
Total households selected	2,676	100.0	2,436	100.0	5,112	100.0
Household Response Rate (HRR) ² (%)	83.2%		93.4%		88.1%	
<i>Selected Person</i>						
Completed (PC)	2,065	95.6	2,185	98.0	4,250	96.8
Incomplete (PINC)	2	0.1	0	0.0	2	0.0
Not eligible (PNE)	1	0.0	2	0.1	3	0.1
Not at home (PNH)	38	1.8	9	0.4	47	1.1
Refused (PR)	38	1.8	18	0.8	56	1.3
Incapacitated (PI)	13	0.6	12	0.5	25	0.6
Other ¹ (PO)	3	0.1	3	0.1	6	0.1
Total number of sampled persons	2,160	100.0	2,229	100.0	4,389	100.0
Person Response Rate (PRR) ³ (%)	95.6%		98.1%		96.9%	
Total Response Rate (TRR) ⁴ (%)	79.6%		91.7%		85.3%	

¹ Other includes any other result not listed.

² The Household Response Rate (HRR) is calculated as:

$$\frac{HC}{HC + HINC + HNS + HNS + HNS + HR + HO} * 100$$

³ The Person-level Response Rate (PRR) is calculated as:

$$\frac{PC}{PC + PINC + PNH + PR + PI + PO} * 100$$

⁴ The Total Response Rate (TRR) is calculated as: (HRR x PRR)/100

Sample and Population Characteristics

Overall, 4,250 individuals representing a population of 20.53 million men and women aged 15 years or older were surveyed. By gender, 2,104 men and 2,146 women completed the survey. Respondent from rural area was slightly higher

compared to urban (2,185 vs. 2,065). Almost half of the respondents were from the age group of 25-44 years old. By ethnic groups, almost one third was Malays. Table 3 presents the selected demographic characteristics of the respondents.

Table 3 Distribution of respondents by selected demographic characteristics, GATS Malaysia, 2011

Demographic Characteristic	Number of Respondents	Percentages (%)
Overall	4,250	100.0
Gender :		
Male	2,104	49.5
Female	2,146	50.5
Age Group :		
15 – 24	742	17.5
25 – 44	1,768	41.6
45 – 64	1,326	31.2
65+	414	9.7
Residence :		
Urban	2,065	48.6
Rural	2,185	51.4
Race/Ethnicity :		
Malays	2,531	59.6
Chinese	641	15.1
Indians	263	6.2
Others	815	19.1
Education level :		
Less than primary	635	18.2
Primary	1,138	32.6
Secondary	1,391	39.9
College or above	324	9.3

Note: The number of missing observations was as follows: 0 for age, 0 for gender, 0 for residence, 21 for education, 0 for race/ethnicity

¹ Education level is reported only among persons aged ≥ 25 years.

DISCUSSION

The 2011 Malaysian Global Adult Tobacco Survey (GATS) was implemented by the Institute for Public Health (IPH) in collaboration with the Disease Control and Health Education Divisions, Ministry of Health; Department of Statistics; University of Malaya and International Islamic University. It was the first comprehensive nationwide cross-sectional survey that used the internationally standardised research tools provided by WHO and CDC under the Global Tobacco Surveillance System (GTSS). Besides GATS, Malaysia had also participated twice in another GTSS survey, i.e., the Global Youth Tobacco Survey (GYTS) 2003 and 2009 (GYTS 2003 & GYTS 2009)¹².

GATS was the first survey conducted by IPH using electronic data collection and management system (i.e., handheld computers for data collection). IPH used paper and pencil methods for data collection in previous national surveys. Handheld computers helped in increasing the quality of data collected in the survey. The electronic device software had built-in validation checks to ensure only valid responses were entered into the system. The handheld computers also managed the flow of the questionnaire and seamlessly routed the interviewers to the next question based on respondents' prior answers. Data entry with handheld computers was immediate and simplified. It minimizes survey response error, and

allow for easy storage of data¹³. It helped to skip the data entry process which normally takes longer time and uses lots of resources¹⁴. The electronic data management system also allowed for close to real-time quality checking of data collected¹⁵.

The flexibility of questionnaire formulation in the GATS protocol had enabled the Malaysian team to tailor the questionnaire to answer local needs. The research team omitted some of the least important survey questions and substituted them with questions that addressed local tobacco control issues. This was very important to ensure all national tobacco-related issues were captured in the survey and the findings would be valuable to related agencies.

Local and international collaboration is very crucial in conduct of a nationwide population survey. The sampling frame and sampling process for this survey was provided by the Department of Statistics, Malaysia. They also provided IPH with the estimated Malaysian population for 2011. This is a continuous support given by DOS to national surveys conducted by IPH, such as the Hearing Loss and Ear Disorder Survey 2005¹⁶, National Health and Morbidity Survey (NHMS) 2006¹⁷ and the NHMS 2011¹⁸. Strong sampling support has reduced sampling errors and produced precise estimates.

Good collaboration and support from CDC and WHO enabled IPH to conduct the survey smoothly. The Malaysian GATS questionnaire was

reviewed and approved by the GATS Questionnaire Review Committee. The sampling design was reviewed and approved by the GATS Sampling Review Committee. Regular communication via email and telephone conferences between the Malaysian GATS team, the WHO regional office in Manila, the WHO office in Geneva, and the CDC in Atlanta helped the Malaysian team to overcome challenges during the survey implementation.

GATS Malaysia provided national estimates for tobacco use, classified by residence, gender and other socio-demographic characteristics. Apart from that, GATS Malaysia also provided reliable data on various dimensions of tobacco control, such as exposure to second-hand smoke, exposure to anti-tobacco information through media and campaigns, expenditures related to tobacco use, knowledge on diseases caused by smoking, impact of pictorial health warnings and extent of willingness to quit smoking. Wide dissemination of GATS Malaysia results via conference, report and fact sheets to stakeholders at multiple levels within Malaysia will allow the result to be used as a national resource for monitoring and implementing the WHO FCTC.

In summary, the implementation of GATS 2011 has adopted an appropriate methodology for a population survey. All necessary steps have been taken, starting from planning of the survey, sampling design, development of questionnaire, data collection technique, quality control, data management (including data entry and cleaning) and analysis to ensure for valid and quality data.

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