



**ITC Korea Survey
Wave 1 (Third Cohort) Technical Report**

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Ethics Statement

The survey protocols and all materials, including the survey questionnaires, were cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (ORE# 41512) and the Institutional Review Board of Korea Health Promotion Institute (Approval #120160811107AN01-2004-HR-042-02). All participants provided consent to participate.

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1 SUMMARY AND OVERVIEW

1.1 Introduction

The International Tobacco Control Policy Evaluation Project (the ITC Project) is a multi-country research program with a prospective cohort study in each participating country, designed to measure the psychosocial and behavioral impact of key policies of the World Health Organization Framework Convention on Tobacco Control (WHO FCTC). The ITC Project is a large global research initiative that currently involves 29 countries (Australia, Bangladesh, Bhutan, Brazil, Canada, China (Mainland), France, Germany, Greece, Hungary, India, Ireland, Japan, Kenya, Republic of Korea, Malaysia, Mauritius, Mexico, Netherlands, New Zealand, Poland, Romania, Spain, Thailand, United Arab Emirates, United Kingdom, Uruguay, United States of America, and Zambia) inhabited by over 50% of the world's population, over 60% of the world's smokers, and over 70% of the world's tobacco users.

The ITC Project team from the University of Waterloo in Canada partnered with the Korea Health Promotion Institute (KHPI) and the Korea National Cancer Centre (NCC) to develop the third cohort of the ITC Korea Survey. This study is an extension of the previously approved the first cohort of three waves of the ITC Korea Survey that was conducted in the Republic of Korea between 2005-2010 and the second cohort of one wave in 2016. The Wave 1 of the ITC Korea (KRA1, the third cohort) Survey started in October 2019 and was designed to provide data on tobacco users' and non-users' knowledge, attitudes, beliefs, perceptions, behaviours, and use patterns associated with cigarette, heated tobacco products (HTPs) and e-cigarettes (ECs) or better known as liquid ECs in Korea.

1.2 Main objectives and research aims

There are two broad objectives of the third cohort of the ITC Korea (KRA) Survey to evaluate the impact of population-level intervention taking place in Korea. Objective 1 is to evaluate the impact of tobacco control policies of the WHO Framework Convention on Tobacco Control (FCTC) in Korea. As with other ITC surveys, it is designed to be a longitudinal cohort study. The cohort survey will include validated measures of smoking behavior, psychosocial measures, and policy-relevant measures in all major FCTC policy domains including health warnings, marketing restrictions, tax/price, smoke-free laws, and cessation. Objective 1 has 2 specific aims:

Aim 1: To assess the current effectiveness of FCTC policies in the Republic of Korea, where tobacco control measures have been recently strengthened (e.g., large graphic warnings, stronger smoke-free laws, higher taxes); and to conduct comparisons between Japan and Korea and across the 20+ ITC countries.

Aim 2: To conduct longitudinal evaluation studies of tobacco control policy implementation to evaluate new or revised FCTC policies in Korea, including those that are already set to be implemented (e.g., stronger smoke-free laws, enhancements of graphic health warnings) and others that will be implemented in the next few years.

Objective 2 is to measure the impact of a controversial new product class—HTP to understand the use and transitions of use of HTPs and cigarette or liquid ECs. Objective 2 has 2 specific aims:

Aim 3: To measure and understand patterns of use of HTPs including demographic and key characteristics of smoking history and nicotine dependence; correlates of interest, trial, and extended/regular use including reasons for use; characteristics of and precursors relating to cessation; and relations between HTPs and quitting vs. dual use vs. return to cigarette smoking over time; within this broad aim, to conduct economic analyses that will study demand for cigarettes, HTPs, and liquid ECs by examining (a) the substitutability of HTPs and cigarettes, and whether substitutability varies by country, and (b) the substitutability of liquid ECs and HTPs with cigarettes in Korea.

Aim 4: To compare patterns of HTP and cigarette use+ liquid ECs with key ITC countries (especially Japan, US, Canada, England, and Australia) in transitions to/from dual use, quitting smoking, relapse, complete switching, and to identify factors related to transitions;

1.3 Overview of the project

- The first wave of ITC Korea Survey (KRA1) was a web-administered survey of behaviours and attitudes related to tobacco/nicotine use among a target sample of n=4,700 adults age 19 and older. The target sample comprised of:
 - 2,000 cigarette-only smokers
 - 500 HTP-only users (also including HTP- liquid EC dual users)
 - 400 liquid EC-only users
 - 800 cigarette-HTP dual users
 - 500 cigarette-liquid EC dual users
 - 500 never or non-users.
 - The final sample comprised of n = 4,795 adults age 19 and older:
 - 1,967 cigarette-only smokers
 - 145 HTP-only users
 - 145 liquid EC-only users
 - 1,233 cigarette-HTP dual users
 - 745 cigarette-liquid EC dual users
 - 560 never or non-users.
 - The user type definitions are provided in Table 1 in Section 2.1. Of all 4,795 final respondents, the median time of completing the KRA1 was 35.8 minutes. Technical details of the web survey are provided in Appendix 3.
 - The fieldwork was conducted by Rakuten Insight. The sampling frame was an existing Rakuten Insight’s panel where pre-profiled members of the panel were targeted based on tobacco usage/non-usage to reach the desired quotas for Korean cigarette smokers, never or non-tobacco users, liquid EC users and HTP users (see Section 3.3).
 - For cigarette-only smokers and never/non-user, additional quotas based on region, sex, and age groups were applied to target final sample sizes proportional to stratum sizes based on smoking prevalence estimates in combination with Korea census data. However, minor adjustments were made during fieldwork due to difficulties of reaching some of the desired targets, as well as shifts in available fieldwork timing.
- The KRA1 Survey was conducted from June 18-28, 2020. Follow-up surveys are planned contingent upon funding.

2 SURVEY SAMPLING AND PROTOCOL

2.1 Sample

The overall KRA1 target sample size was n=4,700, including 6 subsample groups (cigarette-only smokers, HTP-only users, liquid EC-only users, dual users of cigarette and HTP, dual users of cigarette and liquid EC, and never/non-users). Their original target numbers and definitions by subsample are provided in Table 1.

Table 1: KRA1 subsamples with definitions

Subsample Group	Target N	Definition	Definition as a function of KRA1 variables*
1) Cigarette-only smoker (and cigarette-only quitter)	2,000	Def 1: Cigarette-only smoker <ul style="list-style-type: none"> • Smokes cigarettes at least weekly • Has not used liquid EC in the previous 30 days • Uses HTPs less than weekly or not at all 	FR309v=1-2 and NC320=3-99 or NC302=2-3 and HN309v=3-7
		Def 2: Cigarette-only quitter <ul style="list-style-type: none"> • Has smoked cigarettes at least weekly within the past 2 years and currently smokes cigarettes less than weekly or not at all • Has not used liquid EC in the previous 30 days • Has never used HTPs at least weekly 	FR309v=4-7 and NC302=2-3 and HN309v= 3, 5-7
2) HTP-only user (and HTP quitter)	500	Def 3: HTP-only user <ul style="list-style-type: none"> • Smokes cigarettes less than weekly or not at all • Has not used liquid EC in the previous 30 days • Uses HTPs at least weekly 	FR309v=3-9 and NC320=3-99 or NC302=2-3 and HN309v=1-2
		Def 4: HTP-only quitter <ul style="list-style-type: none"> • Has never smoked cigarettes at least weekly • Has not used liquid EC in the previous 30 days • Has used HTPs at least weekly in the past and currently uses HTPs less than weekly or not at all 	FR309v=3, 8, 9 and NC302=2-3 and HN309v=4. <i>Not eligible</i>
3) Liquid EC - only user (and liquid EC quitter)	400 (Quota includes Def 5 and Def 11)	Def 5: Liquid EC-only user <ul style="list-style-type: none"> • Smokes cigarettes less than weekly or not at all • Has used liquid EC in the previous 30 days • Uses HTPs less than weekly or not at all 	FR309v=3-9 and NC320=1-2 and HN309v=3-7
		Def 6: Liquid EC-only quitter <ul style="list-style-type: none"> • Has never smoked cigarettes at least weekly • Has tried but has not used liquid ECs in the last 30 days • Has never used HTPs at least weekly 	FR309v=3, 8, 9 and NC320=3-8, 88 and 99 and HN309v=3, 5-7 <i>Not eligible</i>

Subsample Group	Target N	Definition	Definition as a function of KRA1 variables*
4) Dual user of cigarettes and HTPs (and quitter of both cigarettes and HTPs)	800	Def 7: Cigarette-HTP dual user <ul style="list-style-type: none"> Smokes cigarettes at least weekly Has not used liquid EC in the previous 30 days Uses HTPs at least weekly 	FR309v=1-2 and NC320=3-99 or NC302=2-3 and HN309v=1-2
		Def 8: Cigarette-HTP dual quitter <ul style="list-style-type: none"> Has smoked cigarettes at least weekly within the past 2 years and currently smokes cigarettes less than weekly or not at all Has not used liquid EC in the previous 30 days Has used HTPs at least weekly in the past and currently uses HTPs less than weekly or not at all 	FR309v=4-7 and NC302=2-3 and HN309v=4
5) Dual user of cigarettes and liquid EC (and quitter of both cigarettes and ECs)	500 (Quota includes Defs 9, 10, 13, and 14)	Def 9: Cigarette-liquid EC dual user <ul style="list-style-type: none"> Smokes cigarettes at least weekly Has used liquid EC in the previous 30 days Uses HTPs less than weekly or not at all 	FR309v=1-2 and NC320=1-2 and HN309v=3-7
		Def 10: Cigarette- liquid EC dual Quitter <ul style="list-style-type: none"> Has smoked cigarettes at least weekly within the past 2 years and currently does not smoke cigarettes at least weekly or not at all Has used liquid EC in the past but not in the previous 30 days Has never used HTPs at least weekly 	FR309v=4-7 and NC320=3-8, 88 and 99 and HN309v=3, 5-7
Dual user of liquid EC and HTPs (and quitter of both ECs and HTPs)	See Def 5 quota	Def 11: Liquid EC -HTP dual user <ul style="list-style-type: none"> Does not smoke cigarettes at least weekly Has used liquid EC in the previous 30 days Uses HTPs at least weekly 	FR309v=3-9 and NC320=1-2 and HN309v=1-2
		Def 12: liquid EC-HTP dual quitter <ul style="list-style-type: none"> Does not smoke cigarettes at least weekly Has tried but has not used liquid EC e-cigarettes in the previous 30 days Has used HTPs at least weekly in the past and currently uses HTPs less than weekly or not at all 	FR309v=3-9 and NC320=3-99 and HN309v=4 <i>Not eligible</i>
Cigarette-HTP-liquid EC triple user (and triple quitter)	See Def 9 quota	Def 13: Cigarette-liquid EC-HTP triple user <ul style="list-style-type: none"> Smokes cigarettes at least weekly Has used liquid EC in the previous 30 days Uses HTPs at least weekly 	FR309v=1-2 and NC320=1-2 and HN309v=1-2
		Def 14: Cigarette-liquid EC-HTP triple quitter <ul style="list-style-type: none"> Has smoked cigarettes at least weekly within the past 2 years and currently does not smoke cigarettes at least weekly or not at all Has tried but has not used liquid EC in the previous 30 days Has used HTPs at least weekly in the past and currently uses HTPs less than weekly or not at all 	FR309v=4-7 and NC320=3-8, 88 and 99 and HN309v=4
6) Never or Non-user	500	Def 15: Never or non-User <ul style="list-style-type: none"> Has not smoked cigarettes at least weekly within the past 2 years Has never used liquid EC Has never used HTPs at least weekly 	FR309v=3, 8, 9 and NC302=2-3 and HN309v=3, 5-7

* See Appendix 4, Part C for the definitions as a function of KRA1 variables.

During the fieldwork, Rakuten Insight reported that it was much harder to recruit HTP-only and liquid EC-only users than other subsample groups, especially with the shortened fieldwork time frame. Therefore, the original targets of four subsample groups (HTP-only, liquid EC-only, dual user of cigarette and HTP, and dual user of cigarette and liquid EC) were adjusted (see Table 2). More details about the target adjustments are provided in Appendix 1.

Table 2: KRA1 sample sizes by subsample group

Subsample Group	Target N	Revised Target N	Achieved N	Valid N
Cigarette-only smoker	2,000	2,000	2,000	1,967
HTP-only user	500	150	146	145
Liquid EC-only user (+ Dual users of HTP and liquid EC)	400	150	147 (46)	145 (45)
Dual users of cigarette and HTP	800	1,150	1,245	1,233
Dual users of cigarette and liquid EC (+ Triple users of cigarette-HTP-liquid EC)	500	750	750 (487)	745 (484)
Never or non-user	500	500	567	560
Total	4,700	4,700	4,855	4,795

2.2 Survey development process

The survey development process comprises four main phases:

- a) Determining survey content
- b) Operationalization of survey content
- c) Translation into Korea
- d) Translation review and checking.

2.2.1 Survey Development – content and operationalization

- During Phase 1 of the survey development process, the research investigators, project management team, and the survey management team determined which topics were most important to include in the survey, and then developed the detailed survey questions necessary to measure relevant constructs using the existing framework of the ITC database of questions. Questions were adapted to the Korean context and new questions were designed as necessary. The resultant draft survey was then sent to the ITC Survey Management Group (SMG) for operationalization of the survey (Phase 2).
- In Phase 2, the operationalization of survey development involved comprehensively and iteratively reviewing and revising the survey to ensure that routing, question wording, response options, and all other survey elements were refined and cross-referenced for consistency, clarity, and accuracy. At the conclusion of Phase 2, the final draft of the survey was generated by SMG and sent to Rakuten Insight for programming and testing.
- During the period when the survey firm programmed and tested the survey, additional revisions were made in consultation between Rakuten Insight and SMG, until a fieldwork version of the survey was achieved. The fieldwork version of the survey was sent to SMG by the firm and is retained in the SMG database. The updated last version of the survey in the database was later used in cross reference with the data set.

2.2.2 Survey Development – translation and review/verification

- The team first developed the KRA1 survey content and specifications in English. The final English KRA1 survey was then translated into Korean by Rakuten Insight per specifications provided by the research team.
- After the initial translation from English to Korean had been completed and checked internally by Rakuten Insight’s translator(s), the Korean translation of KRA1 was then checked by the Korea team, and issues were identified, discussed, and resolved to confirm that the Korean translation met the research team’s standards for the highest possible degree of accuracy.

2.3 Survey content

The KRA1 Survey content was developed to assess the research objectives described in Section 1.2 as well as measure other constructs necessary to meet the survey objectives. These include demographic, social, and psychological factors relevant to models of behaviour change, as well as content to meet logistical requirements for the survey.

The specific KRA1 content includes the following:

- Information about the survey, time commitment, contact information for ethical concerns or survey-related concerns, and an explicit consent screen
- A screening section that assesses age, gender, region of residence, cigarette smoking status, HTP use status, liquid EC use status
- Cigarette questions: brand choice, perceptions of light/mild, dependence, quitting attempts and aids used, knowledge of health effects of tobacco, warning labels, smoke free places, advertising and promotion, purchase, beliefs about quitting, psychosocial beliefs, regulation, perceived risk
- HTP questions: brand and device choice, duration of use, dependence, reasons for using, warning labels, purchase, environmental exposure, advertising/promotion, and perceived risk
- Liquid EC questions: brand and device choice, duration of use, dependence, reasons for using, warning labels, purchase, environmental exposure, advertising/promotion, and perceived risk
- Other questions: anti-tobacco campaigns, COVID-19 and tobacco use, moderators (i.e., factors not asked in any of the previous categories that are important in models of behaviour change and/or policy evaluation such as time perspective, stress, co-morbidities)
- Social and demographic questions (e.g., age, gender, education, income, socio-economic status).

2.4 Web survey programming, testing and translation

2.4.1 Web survey programming and testing

- A new unique ID was assigned for each respondent.
- Rakuten Insight used the ITC KRA1 Survey specifications (provided in Microsoft Word format) to program the English Survey using Confirmit Computer Assisted Web Interview (CAWI) software.
- Rakuten Insight worked closely with the research team to test the English survey CAWI program and survey quotas. The research team provided signoff on the KRA1 English Survey program that met pre-determined standards prior to beginning data collection.

2.4.2 Translation and overlay into the English CAWI program and testing

- Rakuten Insight followed the ITC Translation Manual to translate the English Survey into Korean.
- After the Korean translation was accepted, Rakuten Insight overlaid Korean into the CAWI program (originally programmed in English):
 - Rakuten Insight internally tested the Korean CAWI program to ensure accuracy
 - ITC UW and the Korea team tested the Korean CAWI program to ensure the program was functioning as intended and was free of errors. ITC UW provided signoff on the Korean CAWI program prior to fieldwork.

2.4.4 Programming and testing other technical components and quotas

- Rakuten Insight worked with ITC UW to ensure quotas and all technical components necessary for fieldwork met ITC standards.

3 FIELDWORK PROCEDURES

3.1 Ethics clearance

- Prior to any fieldwork procedures/communications with panelists for the ITC KRA1 Survey, ethics clearance had been provided by the Office of Research Ethics, University of Waterloo (ORE# 22508/31428).
- Ethics clearance also had been provided by the Institutional Review Board of Korea Health Promotion Institute (Approval# 120160811107AN01-2004-HR-042-02).

3.2 Inclusion/exclusion criteria for Rakuten Insight panelists

- The inclusion criteria for the KRA1 sample web panelists were as follows:
 - All respondents must be adults aged 19 years or older
 - Respondents must be either a current cigarette-only smoker (smokes at least weekly), a current HTP-only user (uses HTP at least weekly), a current liquid EC-only user (uses liquid EC at least weekly), a current dual user of cigarette and HTP (smokes at least weekly and uses HTP at least weekly), a current dual user of cigarette and liquid EC (smokes and uses liquid EC at least weekly) or a never or non-user, per the definitions in Table 1
 - The quota for the panelist's specifications (i.e., user type, region of residence, age, gender) was still open.
- Web panelists excluded from the KRA1 sample were:
 - Those younger than 19 years old
 - Those who did not meet the definition for one of the six user or non-user subsample types specified in Table 1
 - Those for whom the quota corresponding to the panelist's specifications was full.

3.3 Description of the sampling frame

- The sampling frame of the KRA1 Survey was Rakuten Insight's web panel, supplemented by local partner panels that Rakuten Insight has an extensive working relationship with.
- Rakuten Insight provided the following description of their panel(s): The ITC KRA1 Survey was conducted with Rakuten Insight's proprietary online panel in the Republic of Korea. The online panel is actively managed in-house with a dedicated panel management team in Seoul, and utilized for market research purposes only. Recruitment for the panel is conducted daily, tapping into users of Rakuten services (e.g., e-commerce, credit cards, insurance, mobile services, etc.), as well as other online resources such as affiliates, and email and banner recruits in order to maintain a panel as consistent as possible with the general population. Panelists are pre-profiled with a series of questions which in turn can be used as pre-targeting variables (e.g., smoking, HTP usage, liquid EC usage). Panelists receive email invitations and also have the option of logging into their proprietary panel site to access the survey they are invited to participate in. Details available at: <https://insight.rakuten.com>.

3.4 Survey email invitations (Phase 1 and 2)

- Phase 1 invitation emails: Invitation emails were sent strategically to sample identified as probable tobacco users in order to fill the five user group subsample quotas (i.e., quotas for cigarette-only smokers, HTP-only users, liquid EC-only users, cigarette-HTP dual users, and cigarette-liquid EC dual users will be filled first), before the never or non-user quotas, and those respondents turned out to be never or non-users accepted as part of the never or non-user quota).
- Phase 2 invitation emails: After the five user group subsamples were filled, then invitations strategically targeted never or non-users to fill the remaining open positions in the never non-user quotas.

3.5 Panelists' survey experience and ITC Survey features

The ITC KRA1 Survey was designed to have the look and feel of a typical Rakuten Insight survey, with some branding to identify the survey as an ITC survey.

- Consent screens provided information about the survey, time commitment, contact information for ethical concerns or survey-related concerns (the country investigator for content; or Rakuten Insight for technical issues), and asked the panelist to provide his/her consent to complete the survey.

- The ITC KRA1 Survey began with a screening section that assessed panelists’ eligibility (based on user type and possibly region/gender/age-based quotas) and determined which survey questions (related to user type) would be asked throughout the survey.
- ITC provided the ITC KRA1 survey protocol and the quota specifications to Rakuten Insight as separate files.
- Rakuten Insight was responsible for programming the survey and the quota system(s) to interact and achieve the appropriate outcome (i.e., selecting panelists for the survey or terminating panelists if their respective quota was already full).
- Respondents could navigate back to previous questions to change a response.
- Respondents were able to stop the survey and log in to finish at a later time without losing any data.
- There were several questions (but not many) with 'Other-specify' response options, which required open text responses by the panelists.
- The survey contained a few encouragement screens that indicated the respondents were getting close to the end of the survey.
- Respondents were required to submit their completed survey in order for their survey record to be considered ‘complete’ and be provided with the remuneration.
- Item non-response was acceptable, provided that the majority of questions were answered, ‘essential questions’ used for eligibility were answered, and the panelist had submitted his/her survey.
- The median length of the survey interview was 35.8 minutes for the valid complete records.

3.6 Fieldwork timeline and interview length

- The ITC KRA1 Survey was conducted from June 18 to 28, 2020.
- The median survey interview length is given in Table 3.

Table 3: Median survey interview length (minutes)

Sample description	N	Median survey interview length (minutes)
Final valid completes	4,795	35.82
Completes with speeders	4,855	35.57

3.7 Assigning disposition codes

- Disposition codes were used to track the outcomes of survey respondents.
- Temporary disposition codes were applied to respondents who did not complete the survey within one session.
- A final disposition code was assigned to each record (see Section 5 Disposition Codes).
- Three types of disposition codes were used in the study: 1) disposition codes programmed into the survey script, 2) disposition codes entered by the survey firm, and 3) dispositions derived at the end of fieldwork (see Section 5 Disposition Codes).
- Each completed survey record was further sub-coded as being completed on a desktop/tablet device vs. completed on a mobile device vs. being undefined (not possible to classify the device).

3.8 Survey remuneration and bonus payments

- Once a panelist completed his/her survey, Rakuten Insight provide the standard number of points for a survey of this length, plus bonus points equivalent to \$3 USD.
- Upon submitting a completed survey, the Wave 1 Survey participants had also been told that if they stay in the panel and complete the Wave 2 Survey about 12-18 months later, then they would be provided with a standard bonus points equivalent to \$10 USD for all user groups.

4 QUALITY CONTROL

4.1 Fieldwork monitoring and progress reports

- At the beginning of fieldwork, the initial sample invitations were released carefully at deliberate intervals and survey activity was closely monitored to ensure that all aspects were working as intended. This method is termed a 'soft launch' and occurred from June 18-21, 2020.
- The 'soft launch' data were systematically reviewed by both Rakuten Insight and the research team. No major issues of concern were determined.
- Throughout fieldwork Rakuten Insight closely monitored survey activity and ensured a smooth implementation.
- Rakuten Insight provided the research team daily fieldwork reports and an analysis of next steps with respect to the survey recruitment strategy.

4.2 Survey completes vs. partial completes

- For the purposes of the fieldwork sample and subsample targets, the definition of a "survey complete" is the survey record for a panelist who started the survey, completed the survey questions, perhaps endorsing "prefer not to answer" for a reasonable proportion of questions, and then chose to 'submit the survey' after the last survey question.
- Survey response data for survey completes were checked using the criteria defined in Section 4.3. Speeders and cases with conflicting answers were considered as invalid completes. Records that passed the checks were considered valid completes.
- Survey response data for partially completed survey records (defined as records for which the panelist answered at least one question, but did not complete the survey) were not included in the final data set.

4.3 Identification and removal of 'satisficers/speeders' from the data set

Respondents who completed the survey in an extremely short time and/or skipped (refused or said 'don't know' to) a certain number of questions were considered as speeders. Speeder data were removed from the final data set

4.3.1 Criteria for assessing poor-quality data

Two criteria were used to assess poor-quality data:

1. Minutes per question (SecperQ)
 2. % of responses that were either Refused or Don't Know (%RDK).
- 8 user types were created for the purpose of assessing data quality since the respondents were required to answer different series of questions:
 1. Cigarette-only smokers
 2. HTP-only users
 3. Liquid EC-only users
 4. Dual users of cigarette and HTP
 5. Dual users of cigarette and liquid EC
 6. Dual users of HTP and liquid EC
 7. Triples users of cigarette, HTP, and liquid EC
 8. Never or non-users.

4.3.2 Removing poor-quality data

- The initial step is to use every respondent to calculate the percentiles of min-per-question and percentage of nonresponse, as the goal was to remove users who might not have been answering responsibly.

Table 4: Percentile cut-offs used to determine users who might be ineligible.

Number	User Group	SecperQ Cutoff (min) ^a	% RDK Cutoff ^b
1	Cigarette-only smoker	0.0561	0.2436
2	HTP-only user	0.0509	0.1218
3	Liquid EC-only user	0.0498	0.1064
4	Dual user of cigarette and HTP	0.0478	0.1641
5	Dual user of cigarette and liquid EC	0.0476	0.1662
6	Dual user of HTP and liquid EC	0.0365	0.1332
7	Triple user of cigarette, HTP, and liquid EC	0.0392	0.1449
8	Never or non-user	0.0586	0.2422

^a SecperQ cutoff are users with less than or equal to the 10th percentile of their user-type. Because the response and typing speed varied substantially by age, some participants less than or equal to the 10th percentile of their user-type might simply be the younger participants who typed faster than the older participants.

^b %RDK cutoff are users with greater than the 90th percentile of their user-type

- ‘Faulty points’ were assigned based on the user group percentiles. Respondents were removed from the dataset if they scored too many points.

4.3.3 Assigning points to user types, identifying speeders

- Points were assigned on these bases:

1. SecperQ -- The calculated value was time taken to complete the survey divided by the number of questions answered by the respondent. Very short times suggest poor data quality.

- **5 points** were assigned if the respondent’s value was lower than the normal group’s 0.6*minimum.
- **3 points** were assigned if the respondent’s value fell between the normal group’s 0.6*minimum (inclusive) to the 0.8*minimum.
- **2 points** were assigned if the respondent’s value fell between the normal group’s 0.8*minimum (inclusive) to minimum
- **All other** values would have a point of 0.

Because SecperQ (time per question) was considered the most important of the 2 data-quality criteria, it was weighted more heavily, so the points assigned here were 2, 3 and 5, rather than 1, 2 and 3 as for the %RDK criterion.

2. %RDK -- The calculated value was the number of questions answered with either “Refused” or “Don’t know”, divided by the number of questions answered by the respondent. Large numbers represent poor data quality.

- **3 points** were assigned if the respondent’s value was \geq to the normal group’s 1.6*maximum.
- **2 points** were assigned if the respondent’s value fell between the normal group’s 1.25*maximum (inclusive) to 1.6*maximum
- **1 point** was assigned if the respondent’s value fell between the normal group’s maximum to 1.25*maximum
- All other values of %RDK would have a point of 0.

Points results: The range of possible points was 0– 8. At the applied cut-off of 4 points, 60 respondents were considered speeders.

Table 5: Number of speeders and non-speeders by user group

User Group	Non-speeder	Speeder	Total
Cigarette-only smoker	1,967	33	2,000
HTP-only user	145	1	146
Liquid EC-only user	100	1	101
Dual user of cigarette and HTP	1,233	12	1,245
Dual user of cigarette and liquid EC	261	2	263
Dual user of HTP and liquid EC	45	1	46
Triple user of cigarette, HTP, and liquid EC	484	3	487
Never or non-user	560	7	567
Total	4,795	60	4,855

- Comparison between respondents of speeders and non-speeders:
 - There was slightly higher percentages of speeders in male respondents (1.27%) than female respondents (1.15%)
 - There were higher percentages of speeders in the 30-39 (2.16%) and 20-29 (1.64%) age groups than in the 40-59 (0.71%) and 60+ (0.92%) age groups.
 - There were higher percentages of speeders in cigarette-only group (1.71%) and dual user of HTP and liquid EC group (1.89%) than the other user groups. The distribution of speeders across user groups ranges from 0% to 1.89%.

4.4 Data cleaning and topline frequencies

- After fieldwork was completed, Rakuten Insight cleaned the data and then transferred the cleaned data to the ITC Project.
- ITC Project analysts completed further data cleaning, weights construction, and initial descriptive analyses, including generating topline frequencies.

4.5 Translation review and verification

- Standard procedures at ITC include validating the translation against the fieldwork version of the survey.
- This process is conducted by an independent reviewer fluent in Korean and English.

4.6 CHERRIES checklist

- The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) is an assessment tool endorsed by the Journal of Medical Internet Research to promote complete and accurate standard reporting guidelines for authors describing internet-based surveys.
- Appendix 3 provides the CHERRIES checklist for the KRA1 Survey.

5 DISPOSITION CODES

Disposition codes for ITC KRA1 Survey

Replenishment/New Recruits Disposition Codes

ITC Korea (KRA) - Wave 1

Last updated by C. Boudreau on Mar 30, 2020

Notes:

- 1) Disposition codes are in column B
- 2) See legend at bottom

Replenishment/New Recruits Disposition Codes			
DMC Code	Type ^{*1}	Description	Comment
Interview			
P-A1	P	Selected respondent completes the entire survey; maybe skipping or refusing to answer a few questions	
Eligible, non-interview			
P-B19	P or E	Respondent completed eligibility questions and was deemed to be eligible, then started to answer the survey but did not complete the survey	This is an important disposition code, and we expect that many individuals will fall into this category
P-B90	M or E	Any other reason why interview was not completed, but eligibility was confirmed by respondent	Unlikely to be used, but left in as a precaution
Unknown eligibility, non-interview			
P-C10	P	Respondents closes his/her web browser or get disconnected during screener; thus unknown if he/she is eligible	This is an important disposition code, and we expect that many individuals will fall into this category
P-C11.1	P	Respondent refuses, can't answer or doesn't know his/her age; thus unknown if he/she is eligible	
P-C11.2	P	Respondent refuses, can't answer or doesn't know his/her gender; thus unknown if he/she is eligible	
P-C11.5	P	Respondent refuses, can't answer or doesn't know his/her cigarette smoking status; thus unknown if he/she is eligible	
P-C11.6	P	Respondent refuses, can't answer or doesn't know his/her liquid e-cigarette smoking status; thus unknown if he/she is eligible	
P-C11.7	P	Respondent refuses, can't answer or doesn't know how long ago he/she quit smoking; thus unknown if he/she is eligible	
P-C11.8	P	Respondent refuses, can't answer or doesn't know his/her heated tobacco product (HTP) status; thus unknown if he/she is eligible	
P-C13	P	Respondent refuses at consent; thus unknown if he/she is eligible; thus unknown if he/she is eligible	
P-C70	M	Invalid email or email bounce back	
P-C72	E	Respondent never logged into system to start the survey (but there was no email bounce back/invalid)	This is an important disposition code, and we expect that many individuals will fall into this category
P-C80	P	Respondent refuses to provide or doesn't know required information to derive their stratum; hence sampling weights cannot be computed and unknown if he/she is eligible	
P-C90	M or E	Other reason why unknown eligibility	Unlikely to be used, but left in as a precaution
Not eligible			
P-D10	P	Respondent is out of sample	For example, respondent does not reside in any of the following: national capital, administrative capital, metropolitan cities and provinces of South Korea
P-D70	P	Respondent is too young (i.e., < 19 years old)	
P-D72	P	Respondent doesn't meet the eligibility criteria on smoking or tobacco use	
P-D80.1	P	Quota for exclusive cigarette smokers is full	Cell 1 or cell 2
P-D80.2	P	Quota for exclusive HTP users is full	Cell 3
P-D80.3	P	Quota for exclusive EC users is full	Cell 5 or Cell 11
P-D80.4	P	Quota for HTP-cigarette dual users is full	Cell 7 or cell 8
P-D80.5	P	Quota for EC-cigarette dual users is full	Cell 9 or cell 10 or Cell 13 or cell 14
P-D80.6	P	Quota for never/non-users is full	Cell 15
P-D90	M or E	Any other reason why respondent is not eligible	Unlikely to be used, but left in as a precaution

Notes:

*1 Type of disposition codes:

- P = disposition code programmed into the survey
- M = disposition code to be recorded by the fieldwork manager or supervisor
- E = disposition code to be derived at the end of fieldwork

6 COOPERATION AND RESPONSE RATES

Remarks:

Because respondents were recruited via Rakuten Insight's web panel, the response and cooperation rates in this spreadsheet are not comparable to those from ITC surveys conducted via phone/RDD or face-to-face.

	Freq	%
A – Interviewed		
Total (interviewed)*1	4,892	3.4%
B – Eligible, but not interviewed		
Refusal/breaks off	131	0.1%
Other	0	0.0%
Total (eligible but not interviewed)	131	0.1%
C – Unknown if eligibility (not interviewed)		
Logged into system to start survey (once or more)	2,782	1.9%
Estimated number of eligible and quota not full*2	594	0.4%
Estimated number of not eligible or quota full*3	2,188	1.5%
Never logged into system to start survey	124,552	86.3%
Estimated number of eligible and quota not full*4	26,610	18.4%
Estimated number of not eligible or quota full*4	97,942	67.9%
Total (unknown if eligible)	127,334	88.2%
D – Not eligible		
Out of sample	5	0.0%
Respondent is not eligible	7,633	5.3%
Quota full	4,308	3.0%
Other	0	0.0%
Total (not eligible)	11,946	8.3%
Total sample with final disposition	144,303	100%
Estimated eligibility rate*5	39.7%	
Estimated proportion for which quota was full*6	46.2%	
Response rate*7	15.2%	
Cooperation rate*8	97.4%	

Notes:

*1 The total number of completed interviews (i.e., 0,000) includes some respondents that were then removed from the final dataset because they were deemed to be fraudulent/speeder. If those respondents were excluded from the above table, both the response rate and cooperation are would be slightly lower than their current values.

*2 Estimated number of respondents that would have been eligible and for which the corresponding quota would not have been full
Formula: row 16 x row 33 x (1 - row 34), rounded to the nearest integer

*3 Formula: row 16 - row 17

*4 Same as *2 and *3

*5 Estimated proportion of individuals that were eligible (i.e., age 19 & older and meet smoking/tobacco use criteria)
Formula: 1 - row 26 / (row 8 + row 13 + row 26)

*6 Estimated proportion of individuals that were terminated because the corresponding quota was full
Formula: row 27 / (row 8 + row 13 + row 27) [Given that the row numbering from the Excel file are not included, it doesn't make much sense to include these formulas. They could simply be removed.]

*7 The response rate is the proportion of selected/contacted respondents who complete the survey; i.e., the number of eligible respondents who completed the survey divided by the estimated number of eligible respondents that were selected/contacted. In

other words, the response rate accounts for the fact that numerous individuals could not be contacted or screened for eligibility, whereas the cooperation rate does not. In addition, given the significantly shortened fieldwork period, more than usual invitations were sent to reach respondents in the given timeline, which could have impacted the response rate %. As such, this response rate should not be used as a benchmark of typical response rate from Rakuten Insight's Korea panel.

Formula: row 8 / (row 8 + row 13 + row 17 + row 20)

*8 The cooperation rate is the proportion of eligible respondents (i.e., those who have completed all eligibility questions and have been found to be eligible) who complete the survey.

Formula: row 8 / (row 8 + row 11)

The above formula for the cooperation rate is the same as the AAPOR COOP4 formula; see [https://www.aapor.org/Standards-Ethics/Standard-Definitions-\(1\).aspx](https://www.aapor.org/Standards-Ethics/Standard-Definitions-(1).aspx)

APPENDIX 1: ALLOCATION (PER STRATUM) AND ADJUSTMENTS

1. User groups quota adjustment

After the fieldwork started on June 18, 2020, Rakuten Insight reported that it was much harder to recruit HTP-only and liquid EC-only users than other user groups, especially with the shortened fieldwork time frame. After consulting the research team, three adjustments were made to the user group quotas.

a) The first adjustment:

- Stopped recruiting triple users of cigarette, HTP and liquid EC (Cells 13 and 14 in Table 1 were no longer eligible).
- Reduced the quota of liquid EC-only users to 200 and increased the quota of dual users of cigarette and liquid EC to 700.
- Reduced the quota of HTP-only users to 250 and increased the quota of dual users of cigarettes and HTP to 750.

b) The second adjustment:

- Reduced further the quota of liquid EC-only users to 160 and increased the quota of dual users of cigarettes and liquid EC to 740.
- Reduced further the quota of HTP-only users to 200 and increased the quota of dual users of cigarettes and HTP to 1,100.

c) The third adjustment:

- Reduced further the quota of liquid EC-only users to 150 and increased the quota of dual users of cigarettes and liquid EC to 750.
- Reduced further the quota of HTP-only users to 150 and increased the quota of dual users of cigarettes and HTP to 1,150.
- Restarted recruiting triple users of cigarettes, HTP, and liquid EC.

Table 6 Adjustments of sample sizes by user group

Subsample group	Target N	First adjustment N	Second adjustment N	Third adjustment N	Completed N*	Delivered N
Cigarette-only smoker	2,000	2,000	2,000	2,000	2,165	2,000
HTP-only user	500	250	200	150	158	146
Liquid EC-only user	400	200	160	150	155	147
Dual user of cigarette and HTP	800	1,050	1,100	1,150	1,333	1,245
Dual user of cigarette and liquid EC	500	700	740	750	785	750
Never or non-user	500	500	500	500	593	567
Total	4,700	4,700	4,700	4,700	5,194	4,855

* Rakuten Insight recruited more respondents than the final quota for each subsample group as a buffer against the reduction of poor data quality.

2. Age and sex quotas of cigarette-only smokers and never or non-users

Age and sex quotas were applied to cigarette-only smokers and never or non-users groups because smoking prevalences could only be obtained for male and female smokers. However, during fieldwork, two adjustments were made for the age groups:

- For cigarette-only and never or non-user subsamples, combined two age groups 60-69 and 70+ into one (60+).
- For cigarette-only and never or non-user subsamples, combined three age groups 50-59, 60-69 and 70+ into one (50+).

Table 7 Quotas of cigarette-only smokers and never or non-users by age group and sex

Sex	Age group	Prevalence ^{*1}	Population estimates ^{*2}	Estimated # of		Quotas	
				Cigarette-only smoker ^{*3}	Never or Non-user ^{*4}	Cigarette-only smoker	Never or Non-user
Males	19-29	37.3	4,050,068	1,510,675	2,539,393	337	38
	30-39	42.7	3,883,320	1,658,178	2,225,142	370	33
	40-49	46.3	4,335,210	2,007,202	2,328,008	448	35
	50-59	37	4,240,568	1,569,010	2,671,558	350	39
	60-69	26.6	2,802,225	745,392	2,056,833	166	30
	70 & older	18.2	2,016,372	366,980	1,649,392	82	24
	Total			21,327,763	7,857,437	13,470,326	1,753
Females	19-29	9.7	3,566,060	345,908	3,220,152	77	48
	30-39	6.8	3,583,763	243,696	3,340,067	54	49
	40-49	5.7	4,177,314	238,107	3,939,207	54	59
	50-59	3.3	4,222,893	139,355	4,083,538	31	60
	60-69	2.8	2,946,992	82,516	2,864,476	18	42
	70 & older	1.9	2,997,399	56,951	2,940,448	13	43
	Total			21,494,421	1,106,533	20,387,888	247
Total			42,822,184	8,963,970	33,858,214	2,000	500

*1 Estimated smoking prevalence, within gender/age group, from the 2018 Korea National Health & Nutrition Examination Survey (KNHANES); <https://knhanes.cdc.go.kr/knhanes/eng/index.do>

Note that cigarette smoking prevalence is used as a proxy for exclusive cigarette smoking

*2 Population estimates/projections (as of Jan 1, 2019) by Demographic Statistics Database - United Nations Statistics Division (UN data); <http://data.un.org/Data.aspx?d=POP&f=tableCode%3a22> Filters: Country=Republic of Korea, Year=2018

*3 Formula: Prevalence x Population Estimates

*4 Formula: Population Estimates – Cigarette-only Smoker

3. Quotas for cigarette-only and never or non-users by region

Similar to age and sex quotas, the same user groups were given quotas by region. However, after the fieldwork started on June 18, 2020, Rakuten insight reported that it was much harder to recruit cigarette-only smokers and never or non-users in some smaller regions, especially with the shortened fieldwork time frame. After consulting the research team, an adjustment was made to the regional quotas.

- Increased the regional quota of cigarette-only smokers and never or non-users of Gyeonggi Gangwon, Seoul, and Incheon, and reduced recruitment from other regions.

Table 8 Quotas for cigarette-only smokers and never or non-users by region

Region	Cigarette Prevalence* % (standardized)	Conversion to 100%	Target Quota		Adjusted Quota	
			Cigarette-only smoker (N=2000)	Never or Non-user (N=500)	Cigarette-only Smoker (N=2000)	Never or Non-user (N=500)
Seoul	17.8	5.3	106	26	292	75
Busan	19.0	5.7	113	28	123	32
Daegu	19.8	5.9	118	29	125	30
Incheon	20.7	6.2	123	31	137	33
Gwangju	19.6	5.8	117	29	102	23
Daejeon	18.9	5.6	113	28	120	28
Ulsan	19.0	5.7	113	28	64	17
Sejong	15.9	4.7	95	24	11	7
Jeju	20.6	6.1	123	31	36	4
Gangwon	21.0	6.3	125	31	65	14
Gyeonggi	19.9	5.9	118	30	403	90
Chungcheongbuk (Chungbuk)	22.2	6.6	132	33	70	23
Chungcheongnam (Chungnam)	21.5	6.4	128	32	91	22
Jeollabuk (Jeolla)	18.9	5.6	113	28	64	18
Jeonnam (Jeollanam)	21.1	6.3	126	31	66	19
Gyeongsangbuk (Gyungbuk)	21.2	6.3	126	32	109	33
Gyeongsangnam (Gyungnam)	18.9	5.6	113	28	122	32
Total		100.0	2,000	500	2,000	500

* Year: 2019

* Source: Ministry of Health and Welfare; Korean Community Health Survey (City, County smoking status)

APPENDIX 3: ITC KRA1 SURVEY SUMMARY – CHECKLIST FOR REPORTING RESULTS OF INTERNET E-SURVEYS (CHERRIES)

	Checklist for Reporting Results of Internet E-Surveys (CHERRIES)		
Item Category & Checklist Item	<i>ITC Korea Wave 1 (KRA1) Survey compliance with CHERRIES</i>		
Design			
Target population	The ITC Korea Wave 1 sample was designed to be nationally representative of tobacco users, including cigarette-only smokers, HTP users, liquid EC users, dual users of cigarette and HTP, dual users of cigarette and liquid EC and never or non-smokers.		
Sampling frame	The ITC KRA1 sample comprised the following user types.		
	Subsample (quota) group	Target N	Verbal Definition
	1) Cigarette-only Smoker (and cigarette quitter)	2,000	Def 1: Cigarette-only Smoker <ul style="list-style-type: none"> • Smokes cigarettes at least weekly • Has not used liquid EC in the previous 30 days • Uses HTPs less than weekly or not at all
			Def 2: Cigarette-only Quitter <ul style="list-style-type: none"> • Has smoked cigarettes at least weekly within the past 2 years and currently smokes cigarettes less than weekly or not at all • Has not used liquid EC in the previous 30 days • Has never used HTPs at least weekly
	2) HTP-only user (and HTP quitter)	500	Def 3: HTP-only User <ul style="list-style-type: none"> • Smokes cigarettes less than weekly or not at all • Has not used liquid EC in the previous 30 days • Uses HTPs at least weekly
			Def 4: HTP-only Quitter <ul style="list-style-type: none"> • Has never smoked cigarettes at least weekly • Has not used liquid EC in the previous 30 days • Has used HTPs at least weekly in the past and currently uses HTPs less than weekly or not at all
	3) E-cigarette-only user (and e-cigarette quitter)	400 (Quota includes Defs 5 and Def 11)	Def 5: Liquid EC-only User <ul style="list-style-type: none"> • Smokes cigarettes less than weekly or not at all • Has used liquid EC in the previous 30 days • Uses HTPs less than weekly or not at all
			Def 6: Liquid EC-only Quitter <ul style="list-style-type: none"> • Has never smoked cigarettes at least weekly • Has tried liquid EC but has not used liquid EC in the previous 30 days • Has never used HTPs at least weekly
	4) Dual user of Cigarettes and HTPs	800	Def 7: Cigarette-HTP Dual User <ul style="list-style-type: none"> • Smokes cigarettes at least weekly • Has not used liquid EC in the previous 30 days • Uses HTPs at least weekly



Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

Item Category & Checklist Item

ITC Korea Wave 1 (KRA1) Survey compliance with CHERRIES

(and quitter of both cigarettes and HTPs)		<p>Def 8: Cigarette-HTP Dual Quitter</p> <ul style="list-style-type: none"> • Has smoked cigarettes at least weekly within the past 2 years and currently smokes cigarettes less than weekly or not at all • Has not used liquid EC in the previous 30 days • Has used HTPs at least weekly in the past and currently uses HTPs less than weekly or not at all
5) Dual user of Cigarettes and liquid EC (and quitter of both cigarettes and liquid EC)	500 (Quota includes Def 9, 10, 13, and 14))	<p>Def 9: Cigarette-liquid EC Dual User</p> <ul style="list-style-type: none"> • Smokes cigarettes at least weekly • Has used liquid EC in the previous 30 days • Uses HTPs less than weekly or not at all
		<p>Def 10: Cigarette- liquid EC Dual Quitter</p> <ul style="list-style-type: none"> • Has smoked cigarettes at least weekly within the past 2 years and currently does not smoke cigarettes at least weekly or not at all • Has used liquid EC in the past but not in the previous 30 days • Has never used HTPs at least weekly
Dual user of E-cigarettes and HTPs (and quitter of both liquid EC and HTPs)	See Def 5 quota	<p>Def 11: liquid EC-HTP Dual User</p> <ul style="list-style-type: none"> • Does not smoke cigarettes at least weekly • Has used liquid EC in the previous 30 days • Uses HTPs at least weekly
		<p>Def 12: liquid EC-HTP Dual Quitter</p> <ul style="list-style-type: none"> • Does not smoke cigarettes at least weekly • Has tried but has not used liquid ECs in the last 30 days • Has used HTPs at least weekly in the past and currently uses HTPs less than weekly or not at all
Cigarette-HTP-liquid EC triple user (and triple quitter)	See Def 9 quota	<p>Def 13: Cigarette-liquid EC-HTP Triple User</p> <ul style="list-style-type: none"> • Smokes cigarettes at least weekly • Has used liquid EC in the previous 30 days • Uses HTPs at least weekly
		<p>Def 14: Cigarette-liquid EC -HTP Triple Quitter</p> <ul style="list-style-type: none"> • Has smoked cigarettes at least weekly within the past 2 years and currently does not smoke cigarettes at least weekly or not at all • Has tried but has not used liquid ECs in the previous 30 days • Has used HTPs at least weekly in the past and currently uses HTPs less than weekly or not at all
6) Never or Non-user	500	<p>Def 15: Never or Non-User</p> <ul style="list-style-type: none"> • Has not smoked cigarettes at least weekly within the past 2 years • Has never used liquid EC. • Has never used HTPs at least weekly

Rakuten Insight provided the following description of their panel(s): The KRA1 survey was conducted with Rakuten Insight’s proprietary online panel in the Republic of Korea. The online panel is actively managed in-house with a dedicated panel management team in

	Checklist for Reporting Results of Internet E-Surveys (CHERRIES)
Item Category & Checklist Item	<i>ITC Korea Wave 1 (KRA1) Survey compliance with CHERRIES</i>
	Seoul, and utilized for market research purposes only. Recruitment for the panel is conducted daily, tapping into users of Rakuten services (e.g. e-commerce, credit cards, insurance, mobile services, etc.) as well as other online resources such as affiliates, email and banner recruits in order to maintain a panel as consistent as possible with the general population. Panelists are pre-profiled with a series of questions which in turn can be used as pre-targeting variables (e.g. smoking, HTP usage, liquid EC usage etc.). Panelists receive email invitations and also have the option of logging into their proprietary panel site to access the survey they are invited to participate in. Details available at: https://insight.rakuten.com//
Sample	The ITC Korea Wave 1 (new cohort) sample is provided in Table 2 in Section 2.1.
IRB (Institutional Review Board) approval and informed consent process	
IRB approval	All survey procedures and materials were cleared by a University of Waterloo Research Ethics Committee (ORE#22508/31428) and the Institutional Review Board of Korea Health Promotion Institute (Approval #120160811107AN01-2004-HR-042-02)
Informed consent	<p>All participants were part of a Rakuten Insight panel and had an existing agreement with Rakuten Insight to complete surveys for awards. For the ITC KRA1 Survey, pre-identified panelists were invited to complete the survey. The email invitation described the topic of the survey and that the overall project involved one or more follow up survey(s) in the future, the length of the survey, and the incentive value.</p> <p>Upon entering the survey, the first few screens reiterated the information above and also explained who was conducting the research, that respondents could skip questions or withdraw, and that data were strictly confidential. The ethics contact information was provided.</p>
Data protection	<p>No personal identifying information data for panelists was stored in the survey data. All survey response data files were treated as confidential and maintained on secure servers. Data were transferred using the University of Waterloo secure system.</p> <p>Rakuten employed strict data protection & security measures to safeguard panelist information. Examples include protecting data by Encryption Communication Technologies (SSL), utilizing Site Authentication Systems to prevent unauthorized access, appointing a privacy information officer to manage panelist information, secure data transfer, and adherence to local laws with respect to privacy and confidentiality.</p>
Development and pre-testing	
Development and testing	<p>The survey content and logic were developed by a team of international tobacco control and survey design experts through a structured and iterative process of consultation and revision. Survey content was developed in English and then translated into Korean. The Korean translation was reviewed and verified by bilingual members of the research team. The survey specifications were then sent to an experienced ITC Survey Management team for operationalization and further extensive systematic review and refinement to ensure survey logic, question wording, response options, and all other survey elements were refined and cross-referenced for consistency, clarity, and accuracy.</p> <p>The ITC KRA1 Survey was programmed using Conformat software by Rakuten Insight via a collaborative process between the programmer/fieldwork team and the investigator team to</p>

	Checklist for Reporting Results of Internet E-Surveys (CHERRIES)
Item Category & Checklist Item	<i>ITC Korea Wave 1 (KRA1) Survey compliance with CHERRIES</i>
	refine survey content as needed to ensure a good survey experience and accurate data collection. The programmed instrument was then systematically and comprehensively tested for usability and technical functionality by the survey firm, as well as by the ITC team.
Recruitment process and description of the sample having access to the questionnaire	
Open survey versus closed survey	The survey was a closed, password-protected survey, in which the respondents could access only their own unique survey record via a predetermined link and/or via the members' private account on the Rakuten Panel site. Each record was associated with a unique ID number. Email invitations included the name of the intended respondent.
Contact mode	Panelists were contacted in the standard method (standard Rakuten Insight survey invitation with some minor adaptations for the ITC KRA1 study) from Rakuten.
Advertising the survey	Only panelists who were pre-identified as being candidates for the survey were invited via a study-specific email invitation.
Survey administration	
Web/E-mail	The ITC KRA1 Survey was a web survey hosted by Rakuten Insight on their secure server.
Context	The survey could only be accessed by participants who had been specifically invited to participate. All of the persons invited to the survey were Rakuten Insight Korea panelists.
Mandatory/voluntary	The survey was voluntary. Up to two reminder emails were sent to those who had not submitted their completed survey in order to maximize the response.
Incentives	Panelists were given the Rakuten Insight standard number of points upon completion of the survey.
Time/Date	Data collection: June 18-28, 2020
Randomization of items or questionnaires	None of the questionnaire items were randomized. This was intentional to prevent any differential priming of respondents.
Adaptive questioning	The ITC KRA1 Survey used adaptive questioning based on information that the respondent had provided during the survey or to ITC/Rakuten Insight.
Number of Items	For most of the survey, one item (i.e., question) was asked per page, with the exception of 'question series'. Each 'question series' consisted of multiple items on one screen (i.e., as grids or a scroll-down format for mobile devices).
Number of screens (pages)	The TOTAL number of screens (pages) applicable to the KRA1 web survey was over 442 screens. However, no respondent would ever have been exposed to all of these screens due to routing and filtering of questions for different samples, user types, and response patterns throughout the survey. Each respondent would have seen significantly fewer screens in total, and the number of screens seen across respondents would have varied significantly depending on their sample source, user types, and response patterns.
Completeness check	Respondents had to select a response to every survey item in order to progress to the next screen but were able to choose 'Prefer not to answer' for any question. The survey contained essential questions that were necessary to determine eligibility. If a respondent was unwilling or unable to answer an essential question, then the respondent was shown a

	Checklist for Reporting Results of Internet E-Surveys (CHERRIES)
Item Category & Checklist Item	<i>ITC Korea Wave 1 (KRA1) Survey compliance with CHERRIES</i>
	note explaining that they would be unable to continue the survey if they did not provide a response. This explanatory note appeared on the same screen as the essential question.
Review step	Respondents were able to review and change their answers at any point, up until they formally submitted their survey. At the end of the survey, the respondent was prompted to hit the submit button in order to submit their completed responses.
Response rates	
Unique site visitor	A unique visitor was defined based on the respondent's unique ID number. Each record had a unique ID number and was assigned to one predetermined respondent.
View rate (Ratio of unique survey visitors/unique site visitors)	Not provided
Response rate	15.2%
Cooperation rate	97.4%
Preventing multiple entries from the same individual	
Cookies used	Cookies were not used to identify multiple entries, but they were used as part of the survey software.
IP check	The IP address of the respondent computer was not used to identify potential duplicate entries from the same user. Respondents could access their unique survey record only (via a direct link with embedded unique ID number). Respondents were allowed to stop and re-start the survey during the period that fieldwork was open up until the point of formally choosing to submit their data (by choosing this option at the end of the survey).
Log file analysis	The log file was not used to identify multiple entries.
Registration	As described in the "IP check" field above, respondents could access their unique survey record only (via a direct link with embedded unique ID number). Respondents were allowed to stop and resume the survey during the period that fieldwork was open up until the point of formally submitting their data (by choosing this option at the end of the survey). Thus, respondents were able to return to where they last left off, unless there was a specific section in the survey where they can over-ride their previous answers.
Analysis	
Handling of incomplete questionnaires	Only completed surveys were included in the final data set released for analyses.
Questionnaires submitted with an atypical timestamp	Two criteria were used to assess poor-quality data: 1) Seconds per question (SecperQ) 2) % of responses that were either Refused or Don't Know (%RDK).

	Checklist for Reporting Results of Internet E-Surveys (CHERRIES)
Item Category & Checklist Item	<i>ITC Korea Wave 1 (KRA1) Survey compliance with CHERRIES</i>
	60 respondents were deleted from the final dataset due to very extreme values for both of these variables: SecperQ and/or %RDK of their user-group.
Statistical correction	<p>Cross-sectional survey weights for different analyses were constructed for the final data set. For the cross-sectional weights, respondents were first divided into 12 user types: 1) cigarette-only users, 2) HTP-only users, 3) liquid EC-only, 4) HTP/cigarette dual users, 5) liquid EC/cigarette dual users, 6) HTP/liquid EC dual users, 7) triple users, 8) recent quitters using HTP but not liquid EC, 9) recent quitters using liquid EC but not HTP, 10) recent quitters using both HTP and liquid EC, 11) recent quitters using neither HTP nor liquid EC, and 12) non-users & long-term quitters. The weights were then calibrated on the following cross-tabs using a raking algorithm: user group x gender, user group x age group, user group x geographic region and user group x education. This weight calibration was done using data from the 2019 Korea Community Health Survey. Details are provided in the weight document. [Maybe better wording]</p>

APPENDIX 4: ITC KRA1 SAMPLE SUBGROUP CLASSIFICATION AND METHODOLOGY FOR DETERMINING REPLENISHMENT QUOTA SPECIFICATIONS

Preamble: This appendix summarizes the sampling plan for the ITC KRA1 Survey, by subgroup and Replenishment status. It then provides the methodology and specifications for classifying the Replenishment respondents (using FR309v, HN309v and NC320) in order to achieve the target sample.

Part A: subgroup classification, please review Section 2.1 Table 1.

Part B: Classifying Replenishment respondents into sample subgroups.

Replenishment respondents will be classified into subsample groups at KRA1 based on their current tobacco user status determined by FR309v, HN309v and NC320 at KRA1. These two elements will inform a Replenishment subgroup variable.

Table 9: Everyone is at least a weekly liquid EC user (NC320=1-2).

They can also be dual or triple users where HTP and/or cigarettes are also being used.

NC320=1-2 (Weekly Liquid EC User)			HTP status (HN309v)			
			User	LTW (past unknown)	Quitter	Always LTW
			1-2	3	4	5-7
Cig status (FR309v)	User	1-2	Triple user (Def 13 add to Def 9)	Cigarette-liquid EC Dual user (Def 9)	Cigarette-liquid EC Dual user (Def 9)	Cigarette- liquid EC Dual user (Def9)
	LTW (past unknown)	3	Liquid EC -HTP Dual user (Def 11 add to Def 3)	Liquid EC-only (Def 5)	Liquid EC-only (Def 5)	Liquid EC-only (Def 5)
	Quitter ≤2 years	4-7	Liquid EC -HTP Dual user (Def 7)	Liquid EC-only (Def 5)	Liquid EC-only (Def 5)	Liquid EC-only (Def 5)
	Always LTW & Quitter >2 years	8-9	Liquid EC -HTP Dual user (Def 7)	Liquid EC-only (Def 5)	Liquid EC-only (Def 5)	Liquid EC-only (Def 5)

LTW = Less than weekly

Table 10 Everyone who is not a user of liquid EC (NC302=2 or 3)

They can also be cigarette-HTP dual users, liquid EC-only users, HTP-only users, cigarette-only smokers or non-users. Liquid EC users aren't in this table at all, so only HTP and Cigarette interact.

NC302=2-3 (Never user of liquid EC)			HTP status (HN309v)			
			User	LTW (past unknown)	Quitter	Always LTW
			1-2	3	4	5-7
Cig status (FR309v)	User	1-2	Cigarette-HTP Dual user (Def 7)	Cigarette-only (Def 1)	Cigarette-only (Def 1)	Cigarette-only (Def 1)
	LTW (past unknown)	3	HTP-only (Def 3)	Non-user (Def 15)	Not eligible (HTP quitter) (Def 4)	Non-user (Def 15)
	Quitter \leq 2 years	4-7	HTP-only (Def 3)	Cigarette Quitter (Def 2)	Cigarette-HTP Dual quitter (Def 8)	Cigarette Quitter (Def 2)
	Always LTW & Quitter >2 years	8-9	HTP-only (Def 3)	Non-user (Def 15)	Not eligible (HTP quitter) (Def 4)	Non-user (Def 15)

LTW = Less than weekly

Table 11 Everyone who is a liquid EC quitter (if NC320=3-8, 88 and 99)

Except if another product is being used, which trumps quitting, or they have quit another product besides liquid ECs.

NC302=1 and NC320=3-99 (Quitter of liquid EC)			HTP status (HN309v)			
			User	LTW (past unknown)	Quitter	Always LTW
			1-2	3	4	5-7
Cig status (FR309v)	User	1-2	Cigarette-HTP Dual ser (Def 7)	Cigarette-only (Def 1)	Cigarette-only (Def 1)	Cigarette-only (Def 1)
	LTW (past unknown)	3	HTP-only (Def 3)	Not eligible (Liquid EC quitter) (Def 6)	Not eligible (Liquid EC -HTP dual quitter) (Def 12)	Not eligible (Liquid EC quitter) (Def 6)
	Quitter \leq 2 years	4-7	HTP-only (Def 3)	Cigarette- Liquid EC dual quitter (Def 10)	Triple quitter (Def 14)	Cigarette- Liquid EC dual quitter (Def 10)
	Always LTW & Quitter >2 years	8-9	HTP-only (Def 3)	Not eligible (Liquid EC quitter) (Def 6)	Liquid EC -HTP dual quitter (Def 12)	Not eligible (Liquid EC quitter) (Def 6)

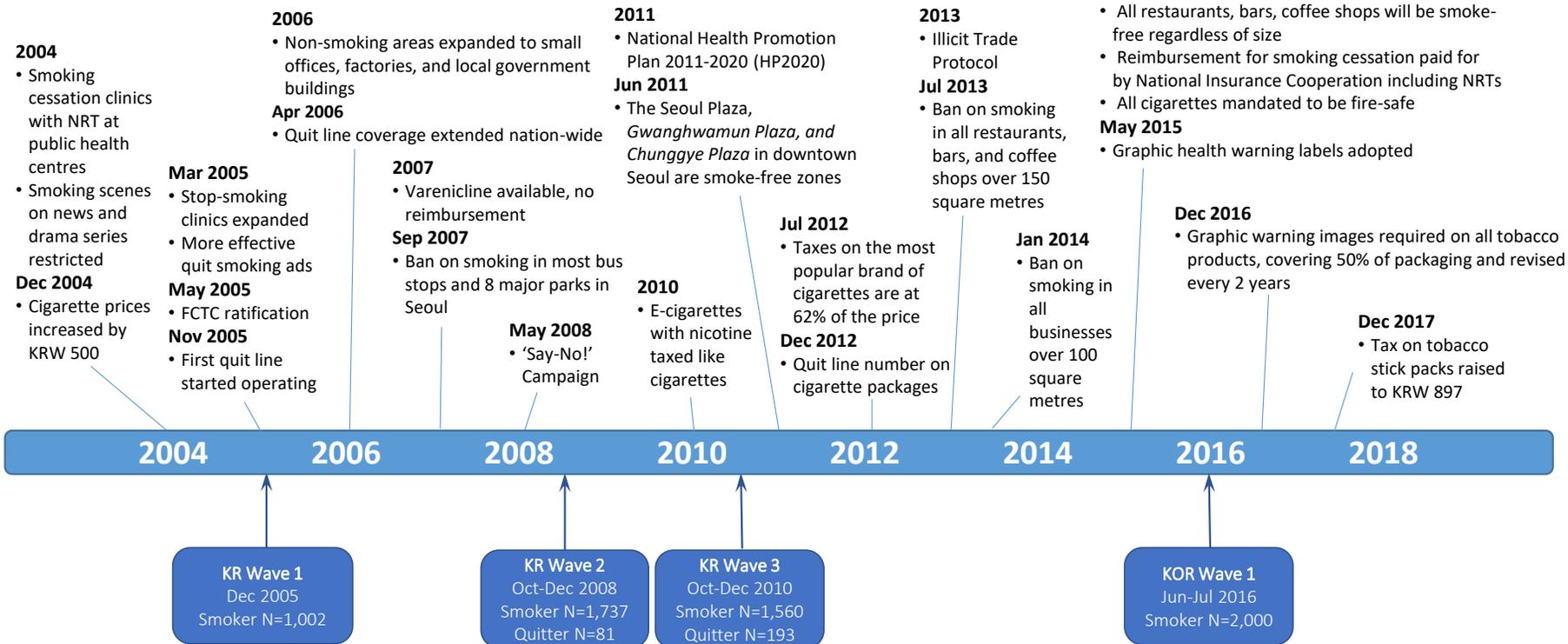
Part C: Definition of variables

FR21309v	<ul style="list-style-type: none"> 01 Daily smoker 02 Weekly smoker 03 Less than weekly smoker 04 Quitter <30 days ago 05 Quitter 1-6 months ago 06 Quitter 7-11 months ago 07 Quitter 1-2 years ago 08 Quitter more than 2 years ago 09 Never-a-smoker
HN21309v	<p>Derived variable - heated tobacco status:</p> <ul style="list-style-type: none"> 1 Current Daily HTP user (HN140=1) 2 Current Weekly HTP user (HN140=2) 3 Current Less than weekly HTP user (HN140=3 or 4) 4 Quitter: past at-least-weekly user of HTP ((HN195=1-2 or HN196=1) and HN140=5) 5 Trier: used HTP once or a few times ((HN195=4-5) or ((HN195=3 or HN196=2) and HN140=5)) 6 Never Tried HTP (HN106=2) 7 Never Heard of HTP (HN106=3)
EC308v	<p>Derived variable – e-cig quota definitions:</p> <ul style="list-style-type: none"> 1 Current weekly user (NC320=1-2) 2 Quitter (NC320=3-99) 3 Never used (NC302=2-3)
NC21302	<p>Have you ever used a liquid e-cigarette, even one time?</p> <ul style="list-style-type: none"> 1 Yes 2 No 3 I have never heard of liquid e-cigarettes 8 Refused 9 Don't know
NC21320	<p>Ask if NC302=1. (if NC302=2-3, then assign NC320=77) When was the last time you used a liquid e-cigarette?</p> <ul style="list-style-type: none"> 01 Less than 1 week ago 02 1-4 weeks ago 03 1-3 months ago 04 4-6 months ago 05 7-12 months ago 06 13-18 months ago 07 19-24 months ago 08 More than 2 years ago 88 Refused 99 Can't Remember

APPENDIX 5: REPUBLIC OF KOREA TOBACCO CONTROL POLICY TIMELINE

REPUBLIC OF KOREA

Timeline of Tobacco Control Policies and ITC Surveys (KR, KOR)

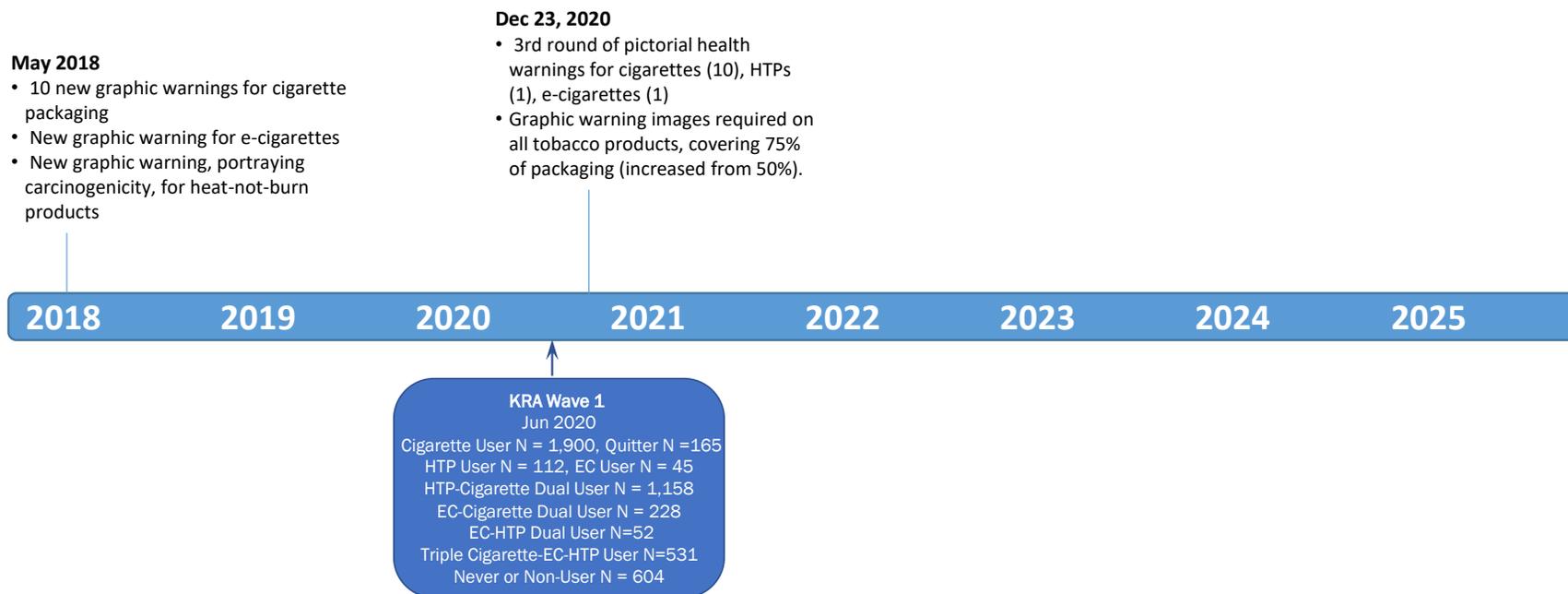


Survey Mode: Telephone (CATI)
Respondent Types: Cigarette Smokers

Updated Nov 2020

REPUBLIC OF KOREA

Timeline of Tobacco Control Policies and ITC Surveys (KRA)



Survey Mode: Web (CAWI)

Respondent Types: Cigarette Smokers, Heated Tobacco Product (HTP) Users, E-Cigarette (EC) Users, Dual (HTP+Cigarette) Users, Dual (EC+Cigarette) Users, Dual (EC+HTP) Users, and Non-Users

Updated Nov 2020

Appendix 6: Sampling Weights of ITC KRA1 Survey

AC. Boudreau^{1,2}, M. Grey ^{2,3} and M. Yan ^{2,3}

This document describes the various cross-sectional weights for wave 1 of the ITC Korea (KRA) Survey. It also provides some guidance on which set of weights should be used depending on the analysis being performed, as well as cautionary notes when analyzing ITC KRA data. All sampling weights adjust for unequal selection probabilities, sample mis-representation, non-response and other biases. It is thus essential to use weighted data, when performing any analyses using ITC KRA data.

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⁴This document was created using L^AT_EX, and last updated on Nov 19, 2020

1 Wave 1 weights

A total of 4795 respondents were interviewed at wave 1 of the ITC Korea (KRA) Survey. Nine sets of cross-sectional weights were computed at wave 1 of the KRA Survey; see summary in table 1 and detailed description in section 1.2. All sampling weights for the KRA Survey were computed using the statistical software R (<http://www.r-project.org>). As mentioned at the beginning of this document, these weights adjust for unequal selection probabilities (in particular, different sampling rates were used for each of the 12 tobacco user groups described in the computation of the wave 1 cross-sectional inflation weights below), sample mis-representation, non-response and other biases. **It is thus essential to use weighted data, when performing any analyses using KRA data.**

Weight	Variable Names
Wave 1 cross-sectional inflation weights for all respondents	aWTS21100v
Rescaled wave 1 cross-sectional weights for cigarette smokers	aWTS21201v
Rescaled wave 1 cross-sectional weights for dual/triple cigarette users*	aWTS21901v
Rescaled wave 1 cross-sectional weights for HTP users	aWTS21701v
Rescaled wave 1 cross-sectional weights for e-cigarette users	aWTS21301v
Rescaled wave 1 cross-sectional weights for quitters†	aWTS21501v
Rescaled wave 1 cross-sectional weights for all tobacco users	aWTS21601v
Rescaled wave 1 cross-sectional weights for non-users‡	aWTS21801v
Rescaled wave 1 cross-sectional weights for all respondents	aWTS21101v

* Those who smoke cigarettes (at least weekly), and use HTP and/or e-cigarettes

† Those who have quit smoking cigarettes within the last two years, and smoked at least 100 cigarettes in their lifetime prior to that.

‡ This group also includes long-term quitters (i.e., those who have quit smoking cigarettes more than 2 years ago)

Table 1: Cross-sectional sampling weights for wave 1 of the ITC Korea Survey.

All respondents had to be 19 years or older at the time they completed the survey, and be residing South Korea (i.e., the Republic of Korea). In addition, the following individuals were not eligible to participate:

- current or past cigarette smokers who have smoked less than 100 cigarettes in their lifetime
- those who quit using heated tobacco products (HTPs), have never used e-cigarettes, and are not smoking cigarettes at least weekly or quit smoking cigarettes within the last 2 years
- those who quit using e-cigarettes, use HTPs less than weekly or not at all, and are not smoking cigarettes at least weekly or quit smoking cigarettes within the last 2 years
- those who quit both HTPs and e-cigarettes, and are not smoking cigarettes at least weekly or quit smoking cigarettes within the last 2 years

Note that, using data from the 2019 Korean Community Health Survey (KCHS), those excluded individuals represent less than 2% of the adult (i.e., 19 years old & older) population of South Korea. Consequently, the **target population of the ITC KRA Survey** is the adult (i.e., 19 years & older) population of South Korea with the exclusion of the above mentioned groups of individuals.

1.1 User groups

For all nine sets of cross-sectional weights, respondents were first divided into 12 user groups (variable `aUserGrp` in the dataset):

- i*) cigarette only smokers
- ii*) exclusive heated tobacco product (HTP) users
- iii*) exclusive e-cigarette users
- iv*) dual users of cigarettes and HTP
- v*) dual users of cigarettes and e-cigarettes
- vi*) dual users of HTP and e-cigarettes
- vii*) triple users
- viii*) recent quitters¹ using HTP but not e-cigarettes
- ix*) recent quitters¹ using e-cigarettes but not HTP
- x*) recent quitters¹ using both HTP and e-cigarettes
- xi*) recent quitters¹ using neither HTP nor e-cigarettes
- xii*) non-users & long-term quitters²

The numbers of respondents in each of those user groups are given in table 2, and a detailed description of these groups is provided below.

- To be classified as a cigarette only smoker (group *i*), a respondent had to (at the time of data collection) smoke cigarettes at least weekly, smoked at least 100 cigarettes in their lifetime, and use HTP and/or e-cigarettes less than weekly or not at all.
- To be classified as an exclusive heated tobacco product (HTP) user (group *ii*), a respondent had to (at the time of data collection) use HTP at least weekly, and smoke cigarettes and/or use e-cigarettes less than weekly or not at all.
- To be classified as an exclusive e-cigarette user (group *iii*), a respondent had to use e-cigarettes at least weekly, and smoke cigarettes and/or use HTP less than weekly or not at all.
- To be classified as a dual user of cigarettes and HTP (group *iv*), a respondent had to smoke cigarettes at least weekly, smoked at least 100 cigarettes in their lifetime and use HTP at least weekly, and use e-cigarettes less than weekly or not at all.
- To be classified as a dual user of cigarettes and e-cigarettes (group *v*), a respondent had to smoke cigarettes at least weekly, smoked at least 100 cigarettes in their lifetime and use e-cigarettes at least weekly, and use HTP less than weekly or not at all.
- To be classified as a dual user of HTP and e-cigarettes (group *vi*), a respondent had to use both HTP and e-cigarettes at least weekly, and smoke cigarettes less than weekly or not at all.
- To be classified as a triple user (group *vii*), a respondent had to smoke cigarettes at least weekly, smoked at least 100 cigarettes in their lifetime, and use both HTP and e-cigarettes at least weekly.

¹Individuals who quit smoking cigarettes within the last 2 years

²Individuals who quit smoking cigarettes more than 2 years ago

User group*	<i>n</i>
Cigarette smokers	
Cigarette only	1900
Dual cigarette & HTP users	1158
Dual cigarette & e-cigarette users	228
Triple users	531
Total	3817
Exclusive HTP users	112
Exclusive e-cigarettes users	45
Dual HTP & e-cigarettes users	52
Recent quitters [†]	
Using HTP and/or e-cigarettes	45
Using neither HTP nor e-cigarettes	120
Total	165
Non-users and long-term quitters [‡]	604
Total	4795

* See wave 1 cross-sectional inflation weights (variable `aWTS21100v`) for the description of those user groups

[†] Those who have quit smoking cigarettes within the last two years, and smoked at least 100 cigarettes in their lifetime prior to that.

[‡] This group also includes long-term quitters (i.e., those who have quit smoking cigarettes more than 2 years ago)

Table 2: Wave 1 respondents by user group.

- To be classified as a recent quitter using HTP but not e-cigarettes (group *viii*), a respondent had to have quit smoking cigarettes within the last two years (and smoked at least 100 cigarettes in their lifetime prior to that), use HTP at least weekly, and use e-cigarettes less than weekly or not at all.
- To be classified as a recent quitter using e-cigarettes but not HTP (group *ix*), a respondent had to have quit smoking cigarettes within the last two years (and smoked at least 100 cigarettes in their lifetime prior to that), use e-cigarettes at least weekly, and use HTP less than weekly or not at all.
- To be classified as a recent quitter using both HTP and e-cigarettes (group *x*), a respondent had to have quit smoking cigarettes within the last two years (and smoked at least 100 cigarettes in their lifetime prior to that), and use both HTP and e-cigarettes at least weekly.
- To be classified as a recent quitter using neither HTP nor e-cigarettes (group *xi*), a respondent had to have quit smoking cigarettes within the last two years (and smoked at least 100 cigarettes in their lifetime prior to that), and use HTP and/or e-cigarettes less than weekly or not at all.
- To be classified as a non-user or long-term quitter (group *xii*), a respondent had to meet the following two conditions:
 - use HTP and/or e-cigarettes less than weekly or not at all
 - smoke cigarettes less than weekly or not at all, or have quit smoking cigarette more than two years ago (and smoked at least 100 cigarettes in their lifetime prior to that)

1.2 Cross-sectional sampling weights

- 1- Variable `aWTS21100v` contains the wave 1 cross-sectional inflation weights of all 4795 respondents interviewed at wave 1. This total excludes the 60 respondents that were deemed to be fraudulent (also referred to as speeders in some documentation).

For user groups *ii*, *iii*, *v* and *vi*, respondents were further subdivided based on gender, age ([19, 30), [30, 40), [40, 50), [50, 60) & [60, 99]), geographic region and education (low, medium & high). Note that some of those subgroups/cells were collapsed because they contained too few respondents. In particular, all age groups were collapsed into a single group for group *vi*, and likewise for education. Data from the 2019 Korean Community Health Survey (KCHS) was then used to obtain benchmark/calibration figures (e.g., estimated number of individuals that are triple users) for each subgroup. These figures and additional information are given in appendix A.2. For each user group, a raking procedure (see appendix A.1) was then applied to calibrate the weights based on gender, age, geographic region and education.

The sample sizes for user groups *i*, *iv*, *vii* and *xii* were substantially larger than those of the 4 user groups in the previous paragraph (see table 2). Consequently, a finer calibration was performed. Respondents were again further subdivided based on gender, age, geographic region and education. However, instead of calibrating on gender and age separately, the weights were calibrated on the gender \times age group cross-tab. As with the other user groups, data from the 2019 KCHS was used to obtain all benchmark/calibration figures. For each user group, a raking procedure was then applied to calibrate the weights based on gender \times age, geographic region and education.

Computation of the sampling weights for recent quitters (i.e., user groups *viii–xi*) followed a similar procedure than that of the other user groups. However, since only a total of 165 recent quitters were interviewed at wave 1, it was not possible to calibrate the weights on gender, age, geographic region and education separately for each of the 4 user groups. Hence, all recent quitters were grouped together, and then subdivided based on gender, age, geographic region, education and HTP/e-cigarettes use status, where the later corresponds to the user groups *viii–xi*. Data from the 2019 KCHS was used to obtain all necessary benchmark/calibration figures, and a raking procedure was then applied to calibrate the weights based on gender, age, geographic region, education and HTP/e-cigarettes status.

These weights are designed to make these 4795 respondents representative of the adult (i.e., 19 years & older) population of South Korea with the exclusion of those mentioned at the beginning of section 1; see definition the target population of the KRA Survey (on page 2). These weights are also designed to make respondents in each of the 12 user groups representative (with respect to gender, age, geographic region and education) of the corresponding population at the time of wave 1 data collection. For example, the `aWTS21100v` weights of the 112 exclusive HTP users are designed to make them representative of the Korean population of exclusive HTP users at the time of data collection; likewise for the other 11 groups.

If interest lies in a target population that consists of two or more of the 12 user groups, the `aWTS21100v` weights are still appropriate. For example, when studying cigarette smokers, one can simply combine the `aWTS21100v` weights of the 1900 cigarette only users with those of the 1158 dual users of cigarettes and HTP, the 228 dual users of cigarettes and e-cigarettes and the 531 triple users (for a total of 3817 respondents in the analysis), and assigned a weight of 0 to all other respondents. However, it simpler and, likely, more appropriate to use variable `aWTS21201v` in this situation. The same also applies to most of the possible combinations of the 12 user groups, and the weights listed below are likely to be more practical than these cross-sectional inflation weights.

Last but not least, since these are inflation/un-rescaled weights, they should not be used in analyses involving two or more ITC countries. The various rescaled weights (i.e., variables [aWTS21201v](#) to [aWTS21101v](#)) described below were created especially for such multi-country analyses; see section 2.1 for more information on inflation versus rescaled weights.

- 2- Variable [aWTS21201v](#) contains the rescaled wave 1 cross-sectional weights of the 3817 (see table 2) respondents who were at least weekly cigarette smokers (and have smoked at least 100 cigarettes in their lifetime) at the time of wave 1 data collection. These are simply the wave 1 cross-sectional inflation weights (variable [aWTS21100v](#)) of those respondents rescaled to sum to sample size (i.e., $n = 3817$). These weights are designed to make these 3817 cigarette smokers representative of the adult Korean population of at least weekly cigarette smokers (and have smoked at least 100 cigarettes in their lifetime) at the time of wave 1 data collection.
- 3- Variable [aWTS21901v](#) contains the rescaled wave 1 cross-sectional weights of the 1917 (see table 2) respondents who were at least weekly cigarette smokers (and have smoked at least 100 cigarettes in their lifetime) and were using HTP and/or e-cigarettes at least weekly. These are simply the wave 1 cross-sectional inflation weights (variable [aWTS21100v](#)) of those respondents rescaled to sum to sample size (i.e., $n = 1917$). These weights are designed to make these 1917 dual/triple users representative of the adult Korean population of those who were at least weekly cigarette smokers (and have smoked at least 100 cigarettes in their lifetime) and were using HTP and/or e-cigarettes at least weekly at the time of wave 1 data collection.
- 4- Variable [aWTS21701v](#) contains the rescaled wave 1 cross-sectional weights of the 1879 (see table 2) respondents who were at least weekly HTP users at the time of wave 1 data collection. These are simply the wave 1 cross-sectional inflation weights (variable [aWTS21100v](#)) of those respondents rescaled to sum to sample size (i.e., $n = 1879$). These weights are designed to make these 1879 HTP users representative of the adult Korean population of at least weekly HTP users at the time of wave 1 data collection.
- 5- Variable [aWTS21301v](#) contains the rescaled wave 1 cross-sectional weights of the 879 (see table 2) respondents who were at least weekly e-cigarette users at the time of wave 1 data collection. These are simply the wave 1 cross-sectional inflation weights (variable [aWTS21100v](#)) of those respondents rescaled to sum to sample size. These weights are designed to make these 879 e-cigarette users representative of the adult Korean population of at least weekly e-cigarette users at the time of wave 1 data collection.
- 6- Variable [aWTS21501v](#) contains the rescaled wave 1 cross-sectional weights for the 165 (see table 2) respondents who had recently (i.e., within the last 2 years) quit smoking cigarettes (and had smoked at least 100 cigarettes in their lifetime prior to that) at the time of wave 1 data collection. Note that some of those recent quitters are current HTP and/or e-cigarette users. These are simply the wave 1 cross-sectional inflation weights (variable [aWTS21100v](#)) of those respondents rescaled to sum to sample size. These weights are designed to make these 165 recent quitters representative of the adult Korean population of those who quit smoking cigarettes within the last 2 years (and had smoked at least 100 cigarettes in their lifetime prior to that) at the time of wave 1 data collection.
- 7- Variable [aWTS21601v](#) contains the rescaled wave 1 cross-sectional weights for the 4071 (see table 2) respondents who were at least weekly tobacco users (i.e., using one or more of the following: cigarettes, HTP and e-cigarettes) at the time of wave 1 data collection. These are simply the wave 1 cross-sectional inflation weights (variable [aWTS21100v](#)) of those respondents rescaled to sum to sample

size. These weights are designed to make these 4071 tobacco users representative of the adult Korean population of at least weekly tobacco users at the time of wave 1 data collection. Recall that current or past cigarette smokers who have smoked less than 100 cigarettes in their lifetime were not eligible to participate.

- 8- Variable `aWTS21801v` contains the rescaled wave 1 cross-sectional weights for the 604 (see table 2) respondents who were non-users or long-term quitters at the time of wave 1 data collection. Recall that non-users are defined as using HTP and/or e-cigarettes less than weekly or not at all, and smoking cigarettes less than weekly or not at all; whereas, long-term quitters are defined as having quit smoking cigarette more than two years ago (and smoked at least 100 cigarettes in their lifetime prior to that) and using HTP and/or e-cigarettes less than weekly or not at all. These are simply the wave 1 cross-sectional inflation weights (variable `aWTS21100v`) of those respondents rescaled to sum to sample size. These weights are designed to make these 604 respondents representative of the adult Korean population of non-users and long-term quitters.
- 9- Variable `aWTS21101v` contains the rescaled wave 1 cross-sectional weights for all 4795 respondents. These are simply the wave 1 cross-sectional inflation weights (variable `aWTS21100v`) of those respondents rescaled to sum to sample size (i.e., $n = 4795$). As with the inflation weights, these weights are designed to make these 4795 respondents representative of the adult (i.e., 19 years & older) population of South Korea with the exclusion of those mentioned at the beginning of section 1. They are also designed to make respondents in each of the 12 user groups representative of the corresponding population at the time of wave 1 data collection.

These rescaled weights preserve the ratios between the 12 user groups. In other words, they preserve the ratios of: cigarette only smokers to exclusive HTP users, cigarette only smokers to non-users & long-term quitter, etc. Hence they are designed for multi-country analyses involving multiple user groups; see section 2.1 for more information. However, it should be noted that tobacco users, recent quitters and non-users (and long term quitters) are ultimately distinct populations. Hence, great care must be taken when deciding to analyse them together using the `aWTS21101v` weights. This is probably fine when the goal is to carry out descriptive inference about the joint population of tobacco users, recent quitters and non-users. However, carrying out analytical inference (e.g., linear regression and logistic regression) from that same joint population is probably much more questionable.

It should be noted that it is **not appropriate** to combine two or more of variables `aWTS21201v`–`aWTS21801v` to jointly analyse multiple user groups. Each of those variables was rescaled to sum to its respective sample size, and thus combining them will not preserve the ratios between the user groups resulting in erroneous results. This is why variable `aWTS21101v` was computed.

2 Remarks and cautionary notes

2.1 Inflation versus rescaled weights

A key reason for rescaling the weights is to facilitate joint analyses involving data from multiple ITC countries. Using prevalence figures from the 2019 Korean Community Health Survey (KCHS), there were about 7.9 million adult cigarette smokers (including about 6.6 exclusive cigarette smokers) in South Korea at the time of wave 1 data collection. Data from the 2016 [National Health Interview Survey \(NHIS\)](#) was used to calibrate the weights of the US sample for wave 1 of the ITC Four Country Smoking and Vaping Survey (4CV) Survey, which was conducted in 2016. According to the 2016 NHIS,

there were about 39.8 million adult cigarette smokers in the United States at the time of data collection. Hence, any joint analysis using data from KRA and the US sample of the 4CV Survey will be dominated by the US if inflation weights are used.

On the other hand, all of the rescaled weights (i.e., all variables listed in section 1 except `aWTS21100v`) sum to the corresponding sample size, as described above; and likewise for the 4CV Survey. Hence, if the rescaled weights are used, Korea will have a slightly greater impact on the results (e.g., the KRA sample consists of 3817 cigarette smokers, whereas the 4CV sample of US cigarette smokers consists of 2327 respondents), but no country will dominate the analysis. In summary, rescaling the weights to sum to the sample size is a simple and efficient way to make countries with different population sizes comparable. This also holds true when comparing KRA data to other ITC countries.

Last but not least, it should be mentioned that rescaling the weights will not affect the results when estimating population means and proportions/percentages, as well as when fitting various statistical models (e.g., logistic and linear regressions). However, the rescaled weights should not be used to estimate population totals (e.g., the total number of daily smokers or e-cigarette users).

2.2 Covariates to include in statistical modelling

As with other surveys, it is good practice to include the survey design variables and the variables used in the weight construction, when fitting statistical models (e.g., linear or logistic regression models) using KRA data. Hence, we highly recommend that any statistical model includes the following covariates: user group, gender and age (either as a continuous or as a categorical covariate). Though somewhat less critical, users should also strongly consider adding education to their statistical model(s). The geographic region should also be used as the stratification variable in the statistical software. Table 3 below lists those variables.

Covariate	Variable name
gender	<code>GENDER</code>
age continuous	<code>aAge</code>
age categorical	<code>aAgeGrp</code>
user group	<code>aUserGrp</code>
education	<code>aDE23312v</code>
geographic region	<code>aStrata</code>

Table 3: Covariates to include in statistical models

2.3 Weekly vs monthly smokers

As detailed in section 1.1, respondents had to smoke cigarette at least weekly (and to have smoked at least 100 cigarettes in their lifetime) to be considered cigarette smokers. This holds true for the cigarette only smokers (group *i*), as well as dual (groups *iv* and *v*) and triple users (group *vii*). Consequently, as described in section 1.2, only those weekly cigarette smokers were assigned cigarette smoker weights (i.e., variable `aWTS21201v`). Likewise, only those weekly cigarette smokers were treated as cigarette smokers when computing the wave 1 cross-sectional inflation weights (i.e., variable `aWTS21100v`) and the rescaled wave 1 cross-sectional weights for all respondents (i.e., variable `aWTS21101v`). This is different than most ITC countries, where respondents need to smoke cigarettes at least monthly (and to have smoked at least 100 cigarettes in their lifetime) to be considered cigarette smokers. This difference in the definition

of cigarette smokers obviously raises comparability issues when comparing KRA data with that of other ITC countries.

Fortunately, less than weekly but at least monthly cigarette smokers were recruited and interviewed as part of the ITC Korea Survey. They were recruited based as part of the other user groups. For example, a less than weekly cigarette smoker who uses HTP at least weekly would have been recruited as an exclusive HTP user (group *ii*), and a less than weekly cigarette smoker who uses neither HTP nor e-cigarettes would have been recruited as a non-user (group *xi*). Furthermore, the routing of the [KRA survey questionnaire](#) is such that those individuals were asked the relevant smoking questions. It is thus possible to analyze those less than weekly but at least monthly cigarette smokers. For such analyses the rescaled wave 1 cross-sectional weights for all respondents (i.e., variable [aWTS21101v](#)) are recommended. Under this approach, a less than weekly cigarette smoker who uses HTP at least weekly is treated as an exclusive HTP user when computing his/her sampling weights; echoing the fact that his/her behaviour is closer to those individuals than that of a cigarette smoker. Likewise, a less than weekly cigarette smoker who uses neither HTP nor e-cigarettes is treated as a non-user when computing his/her sampling weights; again, echoing the fact that his/her behaviour is closer to those individuals than that of a cigarette smoker. Nevertheless, this is not a perfect solution, and care should be taken when performing such analyses. An alternate approach would be to exclude less than weekly but at least monthly cigarette smokers from the other ITC country being compared to ITC Korea.

A Appendix

A.1 Raking algorithm

This section details the raking algorithm used to calibrate the wave 1 cross-sectional inflation weights (i.e., variable `aWTS21100v`) to the benchmark figures of section A.2. The description is for dual users of cigarettes and e-cigarettes (user group v), but the same logic applies to the other 11 user groups.

Step 1: Let $w_i^{(0)}$ be the start weight of the i^{th} respondent. If this is the very first iteration of the raking algorithm, then $w_i^{(0)} = 1$ for all respondents; otherwise, $w_i^{(0)} = w_i^{(4)}$, as computed in step 4 below.

The $w_i^{(0)}$ weights were first calibrated to the gender benchmark figures of the first table of section A.2. For respondents in cell k ($k = 1, 2$), this calibration/post-stratification adjustment consists in multiplying their $w_i^{(0)}$ weights by \widehat{N}_k/t_k to produce calibrated $w_i^{(1)}$ weights. These $w_i^{(1)}$ weights are such that their sum over all respondents in cell k is equal to \widehat{N}_k , the estimated number of individuals in that cell (as obtained from the 2019 KCHS). Let k be the gender/cell to which the i^{th} respondent belongs to, the $w_i^{(1)}$ weight of that respondent is given by

$$w_i^{(1)} = w_i^{(0)} \times \frac{\widehat{N}_k}{t_k} = w_i^{(0)} \times \frac{\widehat{N}_k}{\sum_{i \in C_k} w_i^{(0)}}$$

where \widehat{N}_1 & \widehat{N}_2 are given in column 3 of the first table of section A.2 and C_k is the set of all respondents in cell k .

Step 2: Using the same post-stratification technique described in step 1, the $w_i^{(1)}$ weights were then calibrated to the age benchmark figures of the second table of section A.2. The $w_i^{(1)}$ weights of respondents in cell ℓ ($\ell = 1, \dots, 5$) were then multiply by a factor, $\widehat{N}_\ell^{(2)}/t_\ell^{(2)}$, to produce calibrated $w_i^{(2)}$ weights. Let ℓ be the age group/cell to which the i^{th} respondent belongs to, the $w_i^{(2)}$ weight of that respondent is given by

$$w_i^{(2)} = w_i^{(1)} \times \frac{\widehat{N}_\ell^{(2)}}{t_\ell^{(2)}} = w_i^{(1)} \times \frac{\widehat{N}_\ell^{(2)}}{\sum_{i \in C_\ell^{(2)}} w_i^{(1)}}$$

where $\widehat{N}_1^{(2)}, \dots, \widehat{N}_5^{(2)}$ are given in column 4 of the second table of section A.2 and $C_\ell^{(2)}$ is the set of all respondents in cell ℓ .

It is important to recognize that this second calibration partially destroys the calibration done in step 1; in other words, we no longer necessary have that

$$\sum_{i \in C_k} w_i^{(2)} = \widehat{N}_k \quad \text{for } k = 1, 2$$

where C_k and \widehat{N}_k were defined in step 1 above. Because of this, step 1 will need to be repeated (most likely multiple times) after calibrating to the other benchmark figures of section A.2; see step 5 below.

Step 3: The $w_i^{(2)}$ weights were then calibrated to the geographic benchmark figures of the sixth table of section A.2. This was done using the same post-stratification technique as detailed above, and yielded the $w_i^{(3)}$ weights. As in step 2, this third calibration partially destroys the calibration done in steps 1 and 2, and those two steps will need to be repeated.

Step 4: The $w_i^{(3)}$ weights were then calibrated to the education benchmark figures of the third table of section A.2. This was done using the same post-stratification technique as detailed above, and yielded the $w_i^{(4)}$ weights. As in step 2, this third calibration partially destroys the calibration done in the previous steps, and those steps will need to be repeated.

Step 5: Repeat steps 1–4 until convergence; that is until,

$$\sum_{i \in C_k} w_i^{(4)} = \widehat{N}_k \quad \text{for } k = 1, 2 \qquad \sum_{i \in C_\ell^{(2)}} w_i^{(4)} = \widehat{N}_\ell^{(2)} \quad \text{for } \ell = 1, \dots, 5$$

and likewise for the calibrations on geographic region (step 3) and education (step 4). In other words, repeating steps 1–4 until convergence ensures that the weights are calibrated to all of the benchmark figures of section A.2.

Note that weight trimming (and redistribution) was done at some of the above mentioned steps. This was done to prevent extreme weight variation arising from a few respondents having very large sampling weights.

A.2 Benchmark/calibration figures

The benchmark/calibration figures used to compute the weights of the ITC Korea Survey are given in the tables below. The 2019 [Korean Community Health Survey \(KCHS\)](#) was used for the wave 1 weights.

User group	Gender	# Individuals
exclusive HTP	male	67,994
	female	4,679
exclusive e-cigarettes	male	41,401
	female	10,127
dual cigarettes & e-cigarettes	male	434,982
	female	48,812
dual HTP & e-cigarettes	male	16,985
	female	2,272
recent quitters	male	813,567
	female	79,859

User group	Gender	Age	# Individuals
cigarettes only	male	[19, 30)	866,110
		[30, 40)	999,580
		[40, 50)	1,537,206
		[50, 60)	1,502,554
		[60, 99)	1,081,661
	female	[19, 30)	115,267
		[30, 40)	79,158
		[40, 50)	126,497
		[50, 60)	130,629
		[60, 99)	122,385
exclusive HTP	both	[19, 30)	8,435
		[30, 40)	24,175
		[40, 50)	28,007
		[50, 99)	12,056
exclusive e-cigarettes	both	[19, 30)	16,913
		[30, 40)	14,697
		[40, 99)	19,918
dual cigarettes & HTP	male	[19, 30)	107,505
		[30, 40)	206,235
		[40, 50)	174,272
		[50, 60)	75,121
		[60, 99)	15,032
	female	[19, 99)	46,627
dual cigarettes & e-cigarettes	both	[19, 30)	204,220
		[30, 40)	119,708
		[40, 50)	102,741
		[50, 60)	42,682
		[60, 99)	14,443
dual HTP & e-cigarettes	both	[19, 99)	19,257
triple users	male	[19, 30)	54,671
		[30, 40)	71,855
		[40, 50)	61,023
		[50, 99)	19,006
		female	[19, 99)
	recent quitters	both	[19, 30)
[30, 40)			191,768
[40, 50)			190,666
[50, 60)			165,508
[60, 99)			166,135
non-users & long-term quitters	male	[19, 30)	2,234,860
		[30, 40)	1,649,556
		[40, 50)	1,796,063
		[50, 60)	2,261,580
		[60, 99)	3,614,327
	female	[19, 30)	3,190,398
		[30, 40)	3,251,506
		[40, 50)	3,915,993
		[50, 60)	4,114,759
		[60, 99)	6,144,625

User group	Gender	Education	# Individuals
cigarettes only	male	low & medium	3,712,297
	male	high	2,274,814
	female	low & medium	477,034
	female	high	96,902
exclusive HTP	both	low & medium	21,434
	both	high	51,239
exclusive e-cigarettes	both	low & medium	26,716
	both	high	24,812
dual cigarettes & HTP	male	low & medium	197,088
	male	high	381,077
	female	low & medium	25,729
	female	high	20,898
dual cigarettes & e-cigarettes	both	low & medium	262,831
	both	high	220,963
dual HTP & e-cigarettes	both	all	19,257
triple users	both	low & medium	95,990
	both	high	130,974
recent quitters	both	all	893,426
non-users & long-term quitters	both	low & medium	18,590,237
	both	high	13,583,430

Region [†]	# Individuals	
	cigarettes only	non-users
Seoul	1,062,670	6,365,902
Busan	426,501	2,217,169
Daegu	322,775	1,548,641
Incheon	395,781	1,789,911
Gwangju	174,921	893,464
Daejeon	189,400	931,215
Ulsan	150,256	690,047
Sejong	32,791	188,156
Gyeonggi	1,654,569	7,801,210
Gangwon	210,373	969,128
Chungcheongbuk	233,060	968,264
Chungcheongnam	312,267	1,282,595
Jeollabuk	233,895	1,173,474
Jeollanam	256,633	1,201,779
Gyeongsangbuk	384,368	1,674,851
Gyeongsangnam	424,628	2,073,376
Jeju	96,159	404,485

User group	Region [†]	# Individuals
dual HTP & e-cigarettes	all	19,257
recent quitters	all	893,426

Region [†]	# Individuals				
	HTP only	e-cigarette only	User group		
			cigarettes & HTP	cigarettes & e-cigarettes	triple users
Seoul	17,838	14,277	132,611	106,541	66,550
Incheon & Gyeonggi	29,510	15,741	236,123	167,633	75,059
Gangwon	950	594	14,710	15,009	7,091
Daejeon, Sejong & Chungcheong	5,630	4,584	48,919	48,943	19,911
Gwangju, Jeolla & Jeju	4,514	2,523	57,325	38,152	16,574
Busan, Daegu, Ulsan & Gyeongsang	14,231	13,809	135,104	107,516	41,779

[†] These are the 17 first-tier administrative divisions of South Korea; see figure 1.



Figure 1: First-Tier Administrative Divisions of South Korea.

Quit group	# Individuals
Using HTP but not e-cigarettes	84,588
Using e-cigarettes but not HTP	63,951
Using both HTP and e-cigarettes	25,404
Using neither HTP nor e-cigarettes	719,483