

# Methods of the 2020 (Wave 1) International Tobacco Control (ITC) Korea Survey

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## ABSTRACT

This article presents methods used in the 2020 International TC Korea Wave 1 (KRA1) Survey. To date, three cohorts of Korean respondents have participated in the larger ITC Korea Project (cohort 1: 2005–2014, cohort 2: 2016, and cohort 3: 2020–present). The overall objectives of the ITC KRA1 Survey were to examine the use of cigarettes, heated tobacco products (HTPs), e-cigarettes (ECs); whether HTPs might help smokers quit; and the effectiveness of tobacco control policies, such as large graphic warnings, high cigarette taxes, and smoking bans in public places. The KRA1 Survey measures were identical or functionally similar to those of the ITC Japan Survey and, to a lesser extent, those of other ITC countries. Key measures assessed sociodemographic characteristics of respondents; the use of combustible cigarettes, e-cigarettes, and heated tobacco products; and measures assessing policies of the WHO Framework Convention on Tobacco Control, including price and tax (Article 6), smoke-free laws (Article 8), health warnings (Article 11), education, communication and public awareness (Article 12), advertising, promotion, and sponsorship restrictions (Article 13), and support for cessation (Article 14). Adult tobacco and/or nicotine users aged  $\geq 19$  years in South Korea were recruited by a commercial survey firm from its online panel. Overall, 4794 respondents completed the KRA1 Survey. The cooperation rate was 97.4% and the response rate was 15.2%. The cohort design permits assessment of transitions in products used among users in South Korea and evaluations of the impact of policies on tobacco and/or nicotine products used and transitions in use.

Tob. Prev. Cessation 2022;8(March):13

<https://doi.org/10.18332/tpc/146685>

## INTRODUCTION

### Background

Cigarette consumption increased dramatically in South Korea in the latter half of the 20th century; by 1992, an estimated 75% of adult males smoked, the highest prevalence of smoking in the world at that time<sup>1</sup>. Prevalence declined only slightly by 2000, when 68% of adult males in South Korea smoked. By 2017, prevalence had declined substantially to 38.1%<sup>2,3</sup>. Despite strong social stigma against female smoking in South Korea, smoking prevalence among young Korean females (aged 17–19 years) increased within a decade from 1.6% in 1988 to 13% in 1998<sup>4</sup>. Tobacco market liberalization in 1988 was associated with intense competition between transnational and domestic tobacco companies witnessed and a substantial increase in smoking prevalence in the Korean population<sup>5</sup>. In addition, the 1988 Tobacco Business Act (TBA), under the jurisdiction of the Ministry of Finance (MOF),

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## KEYWORDS

sample size, South Korea, response rate, tobacco control policies, survey measures, cooperation rate

Received: 23 December 2021

Revised: 13 February 2022

Accepted: 15 February 2022

treated tobacco as a means to contribute to the national economy<sup>6</sup>. In 1995, the National Health Promotion Act (NHPA) was enacted to minimize the harmful public health effects of tobacco and reduce its use. In particular, the NHPA protects young adolescents aged  $\leq 19$  years from smoking and regulates tobacco companies' advertising and promotion, which targeted youth, young adults, and females<sup>5</sup>. More importantly, NHPA imposed National Health Promotion taxes on cigarettes at KRW 2 (US\$0.0016) per pack in 1997, KRW 150 (US\$0.13) in 2002, KRW 354 (US\$0.30) in 2005, and KRW 814 (US\$0.69) in 2015<sup>7</sup>. Similar rates were imposed on e-cigarettes (ECs) in 2011 and other tobacco products in 2014 to create the National Health Promotion Fund<sup>8</sup>.

In 2005, the Korean government ratified the WHO FCTC and has since strengthened its national tobacco control policies. In 2013, the Korean Ministry of Health and Welfare (MOHW) asked tobacco control experts to identify priorities for national tobacco control policies; that the expert group identified tax increases, expansion of smoke-free places, a ban on tobacco advertising and promotion, and introduction of pictorial health warnings as key priorities to save lives from diseases caused by tobacco use in South Korea<sup>9,10</sup>. Based on these priorities, tobacco control policies continued to improve. In 2015, the National Health Plan 2020 (HP2020) was established to reduce smoking prevalence among adult males to 29% and among adult females to 6% by 2020 where key policies, such as increasing retail price for a pack of cigarettes from KRW 2500 (US\$2.09) to KRW 4500 (US\$3.77) (Article 6), banning misleading descriptors such as 'mild' or 'light' on all tobacco packages (Article 11), banning smoking in all restaurants and bars (Article 8), banning tobacco advertising in retail shops (Article 13), and smoking cessation programs and reimbursement of smoking cessation treatment costs by the national health insurance program (Article 14), and on 23 December 2017, graphic warning labels (Article 11) were implemented<sup>11,12</sup>. In 2019, MOHW developed its 5-year plan that includes regulating novel tobacco and nicotine products and reducing tobacco use among youth. For the period of 2021–2025, a roadmap was announced in 2019 to gradually expand smoke-free zones by banning smoking in all indoor buildings and eliminating all

indoor smoking rooms by 2025<sup>13</sup>.

Despite its history of tobacco control, South Korea continues to have one of the highest smoking prevalence rates among high-income countries. The Korea National Health and Nutrition Examination Survey reported that cigarette smoking prevalence among adult males aged  $\geq 19$  years decreased from 47.8% in 2008 to 35.7% in 2019. Among adult females, however, prevalence decreased only slightly, from 7.4% in 2008 to 6.7% in 2019<sup>3,10</sup>. The recent introduction of novel nicotine products such as nicotine vaping products (more commonly known as e-cigarettes or ECs) and heated tobacco products (HTPs) has pushed the government to implement stronger and more restrictive tobacco control policies for all nicotine and tobacco products<sup>14–16</sup>. Future amendments to the TBA may require tobacco manufacturers and importers to list harmful ingredients contained in vaping and tobacco products, banning flavors in vaping and tobacco products, banning nicotine extracts from tobacco stems and roots, and regulating synthetic nicotine. Future amendments to the NHPA may include banning direct and indirect advertising and promotion, banning the display of tobacco products in retail stores, banning the use of cartoon and animal characters on tobacco products, and displaying smoking cessation advertisements alongside tobacco point-of-sale advertising.

In 2017, tobacco companies introduced heated tobacco products (HTPs) in South Korea and Japan as their test markets, including IQOS by Philip Morris International, glo by British American Tobacco, and lil by Korean Tobacco & Ginseng (KT&G)<sup>4,6</sup>. In 2018, the prevalence of current HTP use (use in the last 30 days) among Korean adults was 4.4% overall, 7.8% among males and 0.9% among females. Approximately 90% of current HTPs users also used cigarettes or e-cigarettes, while some used all three products concurrently<sup>14–16</sup>. With the introduction and increased prevalence of these alternative nicotine products in the South Korean market, the government of South Korea began to harmonize tobacco control policies so that they applied to HTPs and ECs in addition to combustible cigarettes. For example, HTPs are banned in public places and pictorial health warnings have been added to HTP tobacco packs<sup>4,6,14–16</sup>.

In summary, the history of tobacco control in South Korea can be divided into four distinct periods: 1) before the enactment of Tobacco Act Business Act in 1988, a period where most people were not aware of the harms of tobacco use and secondhand smoke; 2) from 1988, the beginning of tobacco control movement with the birth of Korean Association on Smoking or Health (KASH), to 1995 with the enactment of the National Health Promotion Act (NHPA); 3) from 1995, the setting of the stage with NHPA to promote health, to 2015 with the implementation of higher tobacco taxes and expansion smoke-free places; and 4) since 2015, the creation of a roadmap towards a comprehensive tobacco control policy<sup>5-9,17</sup>.

### International Tobacco Control (ITC) Korea Project

The International Tobacco Control Policy Evaluation (ITC) Project is a global project with 31 countries including South Korea. The ITC Project's central objective is to evaluate the impact of World Health Organization Framework Convention on Tobacco Control (WHO FCTC) policies. Similar to 30 other ITC countries, the ITC Korea Project uses the same three strategies to rigorously evaluate the effects of tobacco control policies: 1) a quasi-experimental research design (i.e. 'natural experiments')<sup>18</sup>, in which one group exposed to a policy is compared to another, unexposed group; 2) the use of longitudinal cohort designs<sup>19</sup> in which individuals are measured on the same key outcome variables over time<sup>20,21</sup>; and 3) the measurement of appropriate policy-specific variables that are conceptually close to the policy being evaluated and less likely to be affected by other factors. These strategies, including other explanatory variables (covariates), are unparalleled in the study of population-level interventions and produce a research design with the potential to make strong inferences about policy impact<sup>12,18,19,22-26</sup>. The ITC Korea Surveys serve as an evaluation system for measuring the impact of WHO FCTC implemented in South Korea.

The ITC Korea Project was first established in 2005, the same year South Korea ratified the WHO FCTC. The first ITC Korea Survey was a longitudinal cohort study consisting of three waves conducted in 2005, 2008, and 2010 among 1002, 1818, and 1753 adult smokers aged  $\geq 19$  years, respectively<sup>19,27-30</sup>. The second ITC Korea Survey consisted of a single wave

conducted in 2016 among 2000 adult smokers<sup>30</sup>. The data from these two cohorts were collected through telephone interviews by commercial survey firms, Gallup Korea and Hankook Research Co. Ltd, respectively. These two cohort studies were a collaboration between researchers from the Korea National Cancer Center and the ITC Project at the University of Waterloo, Canada.

The third ITC cohort survey, the 2020 ITC Korea (KRA1) Survey, was conducted from 18–28 June 2020 during the COVID-19 pandemic. The first wave of this third cohort survey sampled 4794 adult tobacco and/or nicotine users and non-users to examine patterns of use, reasons for use, risk perceptions, and the effects of current tobacco control policies meant to inform implementation of future tobacco control policies. The second wave (KRA2) fieldwork was conducted from November–December 2021. This third cohort survey is a collaboration between researchers from the Korean Health Promotion Institute, Korea National Cancer Center, Seoul National University, and other leading researchers in Korea, and the ITC Project at the University of Waterloo, Canada<sup>31</sup>.

### *Objectives of the 2020 ITC Korea Survey*

The third cohort of ITC Korea Survey has three main objectives. First, it will assess the effectiveness of existing FCTC policies in Korea, where tobacco control measures were recently strengthened (e.g. large graphic warnings, stronger smoke-free laws, higher taxes), and compare the effectiveness of these policies between (a) Korea and Japan and (b) across the 20+ ITC countries. Second, it will conduct evaluation studies of tobacco control policies implemented at future dates (e.g. stronger smoke-free laws, revision of graphic warnings, tax increases, changes in regulations on ECs and HTPs). Third, it will measure and assess patterns of HTP use among demographic subgroups and assess cigarette smoking history and nicotine dependence. It will also examine correlates of interest in, trial of, and regular use of HTPs such as reasons for use. Furthermore, it will examine characteristics of and precursors relating to smoking cessation, the relationship between HTP use and dual use and cigarette smoking cessation or relapse to cigarette smoking over time<sup>31</sup>.

## METHODOLOGICAL APPROACH

### Sampling design and method of recruitment

The KRA1 Survey used Rakuten Insight's existing proprietary online panel in the Republic of Korea (see <https://insight.rakuten.com>) for its sampling frame. Recruitment for the panel is conducted daily, tapping into affiliated online resources and referrals to maintain a panel as consistent as possible with the general population. Panelists are pre-profiled using a series of questions which can then be used as pre-targeting variables (e.g. smoking, HTP usage, EC usage) for sampling quotas. Panelists received email invitations and had the option of logging into their proprietary panel site to access the KRA1 Survey.

For cigarette-only smokers and non-users, sex-specific age quotas within geographical regions were used for sampling purposes. Six age groups were defined for these quotas (19–29, 30–39, 40–49, 50–59, 60–69, ≥70 years). Data from the 2018 Korea National Health & Nutrition Examination Survey (KNHANES)<sup>i</sup> were used to obtain smoking prevalence estimates by region and sex-specific age groups. These estimates were combined with population estimates to obtain the various quotas for cigarette-only smokers and non-users. Unfortunately, the KNHANES did not permit estimation of the proportion of individuals who were exclusive cigarette smokers. Hence, the quotas used cigarette smoking as a proxy for exclusive cigarette smoking. This implies that the quotas for exclusive cigarette smokers were not completely accurate; the resulting small biases, however, were corrected during the construction of sampling weights. This process used data from the 2019 Korean Community Health Survey<sup>31,32,ii</sup> which allowed for proper estimation of the proportion of individuals who exclusively smoked cigarettes. Quotas for other user groups were not applied because the desired sample size was too small to use the quotas efficiently or because of insufficient prevalence data<sup>31</sup>.

Invitation emails were sent strategically to Rakuten's panelists identified as probable tobacco users to fill the five user group subsample quotas. Tobacco user quotas (cigarette-only smokers, HTP-only users, EC-only users, cigarette-HTP dual users, cigarette-EC dual users) were filled first before the non-user quotas. Respondents from the group of probable tobacco users who were non-users were to

be accepted as part of the non-user quota. After the five user group subsamples were filled, invitations strategically targeted non-users to fill the remaining open positions in the non-user quotas.

### Sample size

The survey was administered as an online web survey to 4794 adults aged ≥19 years (4234 tobacco and/or nicotine users and 560 non-users). The median survey interview length was 36 minutes<sup>31</sup>. Original target quotas were: 1) 2000 cigarette-only smokers; 2) 500 HTP-only users (also including HTP-EC dual users); 3) 400 EC-only users; 4) 800 cigarette-HTP dual users; and 5) 500 cigarette-EC dual users (also including triple users) and 500 non-users (including never users and former users of any of the products)<sup>31</sup>. For cigarette-only smokers and non-users, additional quotas based on region, sex, and age groups were applied to obtain final sample sizes proportional to stratum sizes based on smoking prevalence estimates in combination with Korean census data<sup>31,32</sup>. During data collection, the target sample sizes for HTP-only users, and EC-only users were more difficult to fill than for other user groups. Therefore, adjustments were made to reduce the target sample sizes for these two groups and to increase the size of the dual user group. The sample sizes of EC-only users and HTP-only users were reduced to 150 each, the sample size of dual users of cigarettes and ECs was increased to 750, and the sample size of dual users of cigarettes and HTPs was increased to 1150. In addition, for the cigarette smoker and non-user groups, the oldest three age groups (50–59, 60–69, and ≥70 years) were combined into a single group as ≥50 years. More details about the target adjustment are provided in a technical report<sup>31</sup>. The final achieved sample size of 4794 respondents is presented in Table 1.

### Demographic characteristics of respondents

Demographic characteristics of the ITC KRA1 sample are presented in Supplementary file Tables S1 and S2, by tobacco product used (cigarettes, ECs, and HTPs) and frequency of use (daily, non-daily, non-users in Table S1), and combination of products used (exclusive use, dual use, or poly-use of cigarettes, ECs, and HTPs in Table S2). Unweighted percentages show the distribution of respondents within each product user group while the weighted estimates represent

<sup>i</sup> To access 2018 data, click the link provided and change the year to 2018: [https://kosis.kr/statHtml/statHtml.do?orgId=117&tblId=DT\\_H\\_SM](https://kosis.kr/statHtml/statHtml.do?orgId=117&tblId=DT_H_SM). <sup>ii</sup> Data were obtained directly from the Korean Center for Diseases Control and Prevention.

the population distribution within each product user group. Geographical region, sex, age, and education were used directly in the raking algorithm to compute the sampling weights; as a result, differences exist between unweighted and weighted estimates for some geographical regions and for some sex, age, and education categories.

### Survey measures

All ITC surveys were developed using the same conceptual framework<sup>18</sup> and methods<sup>19</sup>. They include validated measures of smoking behavior, psychosocial measures, and policy-relevant measures in all major FCTC policy domains including health warnings, marketing restrictions, tax and price, smoke-free laws, and cessation. Survey measures are designed to be identical or functionally equivalent across all ITC countries, enabling comparisons over time and across different countries. All ITC surveys are

publicly accessible on the ITC Project website (<https://itcproject.org/surveys/>). Table 2 lists the key measures included in the ITC KRA1 Survey.

Survey content was initially developed in English in collaboration between Korean and Canadian research team members. The final English survey was then translated into Korean by a professional translator at the survey firm. The Korean translation was checked and verified by Korean researchers to meet the standards for the highest possible degree of clarity and accuracy and have the closest equivalence to the English survey content. The full surveys in all three languages for ITC KRA1 Survey can be found at <https://itcproject.org/surveys/republic-korea/kra1-cohort3/>.

The survey protocols and all materials, including the survey questionnaire, received ethical approval from the Office of Research Ethics, University of Waterloo, Canada (ORE# 41512) and the

**Table 1. ITC Korea Wave 1 Survey sample sizes**

User group	User definition	Target n	Revised target n	Final n
Cigarette-only smoker	<ul style="list-style-type: none"> <li>• Smokes cigarettes at least weekly</li> <li>• Has not used ECs in the previous 30 days</li> <li>• Uses HTPs less than weekly or not at all</li> </ul>	2000	2000	1967
HTP-only user	<ul style="list-style-type: none"> <li>• Smokes cigarettes less than weekly or not at all</li> <li>• Has not used ECs in the previous 30 days</li> <li>• Uses HTPs at least weekly</li> </ul>	500	150	180
EC-only user	<ul style="list-style-type: none"> <li>• Smokes cigarettes less than weekly or not at all</li> <li>• Has used ECs in the previous 30 days</li> <li>• Uses HTPs less than weekly or not at all</li> </ul>	400	150	158
(+ Dual users of HTP and EC)	<ul style="list-style-type: none"> <li>• Does not smoke cigarettes at least weekly</li> <li>• Has used ECs in the previous 30 days</li> <li>• Uses HTPs at least weekly</li> </ul>			
Dual users of cigarette and HTP	<ul style="list-style-type: none"> <li>• Smokes cigarettes at least weekly</li> <li>• Has not used ECs in the previous 30 days</li> <li>• Uses HTPs at least weekly</li> </ul>	800	1150	1210
Dual users of cigarette and EC	<ul style="list-style-type: none"> <li>• Smokes cigarettes at least weekly</li> <li>• Has used liquid EC in the previous 30 days</li> <li>• Uses HTPs less than weekly or not at all</li> </ul>	500	750	729
(+ Triple users of cigarette-HTP-EC)	<ul style="list-style-type: none"> <li>• Smokes cigarettes at least weekly</li> <li>• Has used ECs in the previous 30 days</li> <li>• Uses HTPs at least weekly</li> </ul>			
Never or non-user	<ul style="list-style-type: none"> <li>• Has not smoked cigarettes at least weekly within the past 2 years</li> <li>• Has never used ECs in the previous 30 days</li> <li>• Has never used HTPs at least weekly</li> </ul>	500	500	560
<b>Total</b>		<b>4700</b>	<b>4700</b>	<b>4794</b>

Institutional Review Board of Korea Health Promotion Institute (#120160811107AN01-2004-HR-042-02). All participants provided consent to participate. A full description of the survey methods can be found elsewhere<sup>31</sup>.

### Response and cooperation rates

Two key survey statistics were computed. The response rate was defined as the number of eligible

**Table 2. Key measures of the 2020 ITC Korea Survey**

<b>Demographics:</b> sex, ethnicity, age, education, income, state of health.
<b>Other personal moderators:</b> quitting history, nicotine dependence, levels of stress, including financial stress, depressed mood, time perspective, etc.
<b>Environmental moderators:</b> number of tobacco and non-tobacco users in the household and in social network.
<b>Policy-specific measures</b> of policies on products (cigarettes, e-cigarettes, heated tobacco products) and of FCTC policies: <b>a) Article 6:</b> Price paid per unit of product, total weekly cost, product type/variant, purchasing unit, price perceptions. <b>b) Article 14:</b> Use of cessation services and recall of advice, use of products and/or other medicines use in conjunction with professional assistance, advice on appropriateness of products use. <b>c) Article 13:</b> Advertising/marketing: noticing ads and frequency in key channels (TV, print, internet), susceptibility to advertising, whether product advertising makes them think about cigarettes. <b>d) Article 11:</b> Health warnings: salience and noticing of health warnings (if any), brand usage, perceived risks, perceived impact on product use; forgoing cigarettes because of the warnings. <b>e) Article 8:</b> Smoke-free/vapor-free laws (and/or establishment policies): exposure to smoking/vaping in key venues, perceived impact on product use, reports on restrictions. <b>f) Product availability:</b> Restrictions on access: perceived availability. <b>g) Article 9:</b> Nicotine content, flavor and other product characteristics: nicotine content and flavors of product brands used, perceived addictiveness of products and cigarettes, and appeal of products. <b>h) Article 12:</b> Awareness and recall of media campaigns on products and on anti-smoking themes.
<b>Psychosocial mediator variables:</b> Social norms for products, outcome expectancies for products, reasons for use, self-efficacy and intentions to quit smoking; relative harmfulness, health concerns.
<b>Tobacco and/or nicotine use behaviors:</b> Key outcomes along with some of the variables for intermediary analyses. Use of cigarettes, e-cigarettes, and heated tobacco products: frequency of use, duration, and intensity of use (e.g. cigarettes per day); usual brand/type of product; quit attempts (smoking), duration of abstinence (smoking), product switching.

respondents who completed the survey divided by the estimated number of eligible respondents that were selected/contacted [the American Association for Public Opinion Research (AAPOR) Response Rate 4 (RR4)]. The cooperation rate was defined as the proportion of eligible respondents (i.e. those who have completed all eligibility questions and have been found to be eligible) who completed the survey [AAPOR Cooperation Rate 4 (COOP4)]<sup>33</sup>. For the ITC KRA1 Survey, the response rate was 15.2% and the cooperation rate was 97.4%<sup>31</sup>. It should be noted that the response rate includes in the denominator people who were invited but may never have seen or noticed the invitation, especially with a relatively short fieldwork period. This results in a low response rate, typical of response rates for surveys employing web panels but not indicative of a general response rate for the participating survey firm<sup>31</sup>. Because of this, the cooperation rate may be a better indicator of the potential sampling bias due to the content of the survey (tobacco use). The very high cooperation rate is a sign that the potential bias due to refusal on the basis of survey content was very low<sup>33</sup>.

### Data quality control

Data quality controls were applied to identify respondents who may not have taken the survey seriously.

Respondents who completed the survey in an extremely short time and/or skipped (selected 'Refused' or 'Don't know' as answers) to a certain number of questions were considered 'speeders'. To identify potential 'speeders', data from all respondents were used to calculate the percentiles for the time taken to complete each question and the percentage of non-response. Two measures were used: 1) SecperQ, defined as the total time taken to complete the survey divided by the number of questions answered by the respondent, and 2) %RDK, defined as the number of questions answered with either 'Refused' or 'Don't know' responses divided by the number of questions answered by the respondent. Points were assigned based on percentiles within each of the user groups, the 10th percentile of SecperQ ('min\_value') and the 90th percentile of %RDK ('max\_value') were used as independent cut points<sup>18</sup>:

- 5 points were assigned if SecperQ  $< 0.6 \times \text{min\_}$

value;

- 3 points were assigned if  $0.6 \times \text{min\_value} \leq \text{SecperQ} < 0.8 \times \text{min\_value}$  OR if  $\%RDK \geq 1.6 \times \text{max\_value}$ ;
- 2 points were assigned if  $0.8 \times \text{min\_value} \leq \text{SecperQ} < \text{min\_value}$  OR if  $1.25 \times \text{max\_value} \leq \%RDK < 1.6 \times \text{max\_value}$ ;
- 1 point was assigned if  $\text{max\_value} \leq \%RDK < 1.25 \times \text{max\_value}$ ; and
- All other values were assigned 0 points.

Respondents' SecperQ and %RDK points were then summed (range: 0–8). If the final sum was  $>4$ , the respondent was classified as a 'speeder' and removed from the data<sup>31</sup>.

It was discovered during the data cleaning process that some respondents reported conflicting information about the types of tobacco or nicotine products they used. By cross-referencing the brand(s) of product(s) they reported, it was determined that some respondents were confused about which product(s) they were using. In Korea, HTP and EC devices are both known as 'electronic cigarettes' and HTP heat sticks and combustible cigarette sticks are both known as 'cigarettes'. For example, some respondents reported that they were cigarette smokers when in fact they were IQOS (HTP) users and other respondents reported they used ECs when they actually used *glo*, *sens*, or *lil* HTP devices. In these cases, it was decided to adjust the user type to match the product brand(s) reported. Therefore, all the weights were recalculated based on the new user types assigned. Overall, 54 records had their user groups adjusted in the final dataset: 35 were reclassified from dual cigarette and HTP users to exclusive HTP users; 13 were reclassified from triple users to dual cigarette and HTP users; three were reclassified from triple users to dual HTP and EC users; one was reclassified from dual cigarette and EC to exclusive cigarette smoker; one was reclassified from HTP and EC user to exclusive EC user; and one was reclassified from a triple user to dual cigarette and EC user<sup>31</sup>.

### Survey weights

Cross-sectional survey weights for different analytic purposes were constructed for the final data set. For the cross-sectional weights, respondents were divided

into 12 user types: 1) cigarette-only users, 2) HTP-only users, 3) EC-only, 4) HTP-cigarette dual users, 5) EC-cigarette dual users, 6) HTP- EC dual users, 7) triple users, 8) recent quitters using HTPs but not ECs, 9) recent quitters using ECs but not HTPs, 10) recent quitters using both HTPs and ECs, 11) recent quitters using neither HTPs nor ECs, and 12) non-users including long-term quitters<sup>31</sup>.

Data from the 2019 Korea Community Health Survey were used to obtain calibration targets<sup>31,ii</sup>. For user groups 1–7 and 12, a raking procedure was applied to calibrate the weights based on gender, age, geographical region, and education; this raking procedure was applied separately for each user group<sup>31</sup>. Some cells were collapsed because they contained too few respondents. Recent quitters (user groups 8–11) were combined in a single raking procedure and their weights were calibrated based on gender, age, geographical region, education, and HTP and/or EC use status. These weights were designed to make these 4794 respondents representative of the adult population aged  $\geq 19$  years with the exclusion of: 1) ineligible respondents (current or past cigarette smokers who smoked less than 100 cigarettes in their lifetime); 2) those who quit using HTPs, had never used ECs, and were not smoking cigarettes at least weekly or quit smoking cigarettes within the last two years; 3) those who quit using ECs, used HTPs less than weekly or not at all, and were not smoking cigarettes at least weekly or quit smoking cigarettes within the last two years; and 4) those who quit both HTPs and ECs, and were not smoking cigarettes at least weekly or quit smoking cigarettes within the last two years. These weights were also designed to make respondents in each of the 12 user groups representative (with respect to gender, age, geographical region, and education) of the corresponding population at the time of Wave 1 data collection. A full description of the survey weights can be found elsewhere<sup>31</sup>.

### CONCLUSIONS

South Korea's primary approach to tobacco control in recent years has been to harmonize and regulate all tobacco and nicotine products including alternative products such as HTPs and ECs. The ITC KRA1 Survey was designed to establish a new evidence system to measure not only cigarette smoking but

also alternative tobacco and/or nicotine products (HTPs and ECs) use and the interplay between these products. The findings of the third ITC cohort survey will help South Korean policymakers and key stakeholders measure and understand the impact of their current and future tobacco control programs. The cohort design permits assessment of transitions in products used among users in South Korea and evaluations of the impact of policies on tobacco and/or nicotine products used and transitions in use. Finally, since the ITC KRA1 Survey is harmonized with the ITC surveys in 30 other countries, there are exceptional opportunities for measuring and understanding the use of cigarettes and alternative products as well as the impact of policies and regulations on these products in comparison with those of many other countries.

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#### ACKNOWLEDGEMENTS

The authors would like to acknowledge and thank all those that contributed to the Wave 1 ITC Korea Survey: all study investigators and collaborators, and the project staff at their respective institutions.

#### CONFLICTS OF INTEREST

The authors have each completed and submitted an ICMJE Form for Disclosure of Potential Conflicts of Interest. The authors declare that they have no competing interests, financial or otherwise, related to the current work. G.T. Fong has served as an expert witness or a consultant for governments defending their country's policies or regulations in litigation and as a paid expert consultant to the Ministry of Health of Singapore in reviewing the evidence on plain/standardized packaging.

#### FUNDING

The Wave 1 ITC Korea Survey was supported by the Republic of Korea National Health Promotion Fund and additional support from the Canadian Institutes of Health Research Foundation Grant (FDN-148477). Additional support to GTF was provided by a Senior Investigator Award from the Ontario Institute for Cancer Research (IA-004) and the Canadian Cancer Society O. Harold Warwick Prize.

#### ETHICAL APPROVAL AND INFORMED CONSENT

Ethical approval was received from the Office of Research Ethics, University of Waterloo, Canada (ORE# 41512) and the Institutional Review Board of Korea Health Promotion Institute (#120160811107AN01-2004-HR-042-02). All participants provided informed consent.

#### DATA AVAILABILITY

In each country participating in the international Tobacco Control Policy Evaluation (ITC) Project, the data are jointly owned by the lead researcher(s) in that country and the ITC Project at the University of Waterloo. Data from the ITC Project are available to approved researchers 2 years after the date of issuance of cleaned data sets by the ITC Data Management Centre. Researchers interested in using ITC data are required to apply for approval by submitting an International Tobacco Control Data Repository (ITCDR) request application and subsequently to sign an ITCDR Data Usage Agreement at <http://www.itcproject.org>

#### AUTHORS' CONTRIBUTIONS

ACKQ: conceptualization, methodology, writing of original draft, writing, reviewing and editing, project administration; SKL: funding acquisition, methodology, resources, writing, reviewing and editing; HGS, SIC, YK and PD: writing, reviewing and editing; SL and SSX: project management, writing, reviewing and editing; MG and MY: data curation, writing, reviewing and editing; CB and MET: methodology, supervision, writing, reviewing and editing. GTF: funding acquisition, conceptualization, methodology, resources, writing, reviewing and editing, supervision.

#### PROVENANCE AND PEER REVIEW

Not commissioned; externally peer reviewed.