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Prevalence and perceptions of flavour capsule cigarettes among adults who smoke in Brazil, Japan, Republic of Korea, Malaysia, and Mexico: Findings from the ITC Surveys

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ABSTRACT

Introduction: The global market of flavour capsule cigarettes has grown significantly over the past decade, however prevalence data exist for only a few countries. This study examined prevalence and perceptions of flavour capsule cigarettes across five countries.

Methods: Cross-sectional data among adults who smoked cigarettes came from the ITC Surveys— Brazil (2016/2017), Japan (2021), Republic of Korea (2021), Malaysia (2020), and Mexico (2021). Flavour capsule cigarette use was measured based on reporting one's usual/current brand or favourite variety has flavour capsule(s). Perceptions of the harmfulness of one's usual brand vs other brands was compared between those who used capsules vs no capsules. Adjusted logistic regression models examined correlates of flavour capsule cigarette use.

Results: There were substantial differences in the prevalence of flavour capsule cigarette use across the five countries: Mexico (50.3% in 2021), Republic of Korea (31.8% in 2021), Malaysia (26.5% in 2020), Japan (21.6% in 2021), and Brazil (6.7% in 2016/2017). Correlates of flavour capsule cigarette use varied across countries. Capsule use was positively associated with being female in Japan and Mexico, younger age in Japan, Republic of Korea and Malaysia, high education in Brazil, Japan, and Mexico, non-daily smoking in Republic of Korea, and having plans to quit in Japan and Republic of Korea. There was no consistent pattern of consumer perceptions of brand harmfulness.

Conclusion: Our study documented the high prevalence of flavour capsule cigarettes in some countries, pointing to the need to develop and implement regulatory strategies to control these attractive products.

MAIN TEXT

INTRODUCTION

The incorporation of flavours into cigarettes by tobacco companies poses a significant threat to global tobacco control efforts by enhancing the attractiveness of these deadly products.(1) Among the most important of these methods is through the use of flavour capsules.

Flavour capsule cigarettes (FCCs) contain one or more capsules in the cigarette filter which release flavour when the consumer crushes it.(2) They come in several flavours, including both traditional flavours (e.g., menthol, berry) and those with 'concept descriptors' (e.g., Mykonos Nightfall)(3–5). The choice of flavours, the enjoyment of clicking the capsule, and the ability to customise when and if to crush the capsule contribute to their appeal.(6–8) FCCs are marketed through a mix of strategies.(9–11)

In recent years, the market share of FCCs has grown substantially in many countries, particularly in low- and middle-income countries.(14–16). In 2014, when the global cigarette market experienced a marked acceleration of FCC growth(15), FCCs accounted for 10-25% of the cigarette market share in the top five countries with the largest FCC shares, all in Latin America (i.e., Chile, Peru, Guatemala, Mexico, and Argentina).(14) Alarmingly, by 2020, FCCs made up 25-50% of the overall cigarette market in five countries with the largest FCC market shares(17) (i.e., Chile, Peru, Guatemala, Mexico, and Republic of Korea).

Despite these trends, there is a dearth of research on the prevalence of FCC use in countries where these products are available on the market(13). Prevalence data exist for only a handful of

countries, including Australia(18), Chile(19), Mexico(5,18,20,21), Republic of Korea(22), the United Kingdom(23), and the United States(18,24,25). Previous studies have found that FCC appeal and use is associated with younger age(5,18–20,23), and in some countries, with being female(5,18–20,22). Smoking and quitting behaviours, are not consistently associated with FCC use.(13)

Monitoring trends in flavoured tobacco product use is integral to tobacco control as flavours increase the appeal of combustible tobacco, particularly among youth.(1,26,27) Such data can support adoption of the World Health Organization Framework Convention on Tobacco Control Article 9, which calls for prohibition or restriction of flavours.(28) In order to fill in research gaps and provide insight into how FCC use may vary across countries with different markets and tobacco control policies, this study aimed to: (1) examine prevalence and correlates of use of FCCs across five countries, of which two are high-income (Japan and Republic of Korea) and three are upper middle-income (Brazil, Malaysia, and Mexico), (2) describe FCC crushing behaviours, and (3) compare perceptions of brand harmfulness and reasons for choosing one's brand among adults who smoke FCCs vs non-capsule cigarettes.

METHODS

Study Design

Cross-sectional data came from the latest survey wave conducted in each of five countries participating in the ITC surveys: Wave 3 Brazil (2016/2017), Wave 4 Japan (2021), Wave 2 Republic of Korea (2021), Wave 1 Malaysia (2020), and Wave 8 Mexico (2021). The sample

included adults (aged ≥18 years in Brazil, Malaysia, and Mexico, ≥19 in Republic of Korea, and ≥20 in Japan) who smoked at least 100 cigarettes in their lifetime and smoked at least monthly at the time of the survey. In Mexico, the latter measure was defined as having smoked cigarettes in the last 30 days (yes/no) because of validity concerns around the 100 cigarette screening question.(29) In Brazil, Japan, Republic of Korea, and Malaysia probabilistic sampling methods were used to yield nationally representative samples(30–33). In Mexico, participants were recruited from an online market research consumer panel, with quotas for age, sex, and education groups. Data were collected using web-based surveys in all countries except Brazil, where data were collected via computer assisted telephone interviewing. Response and cooperation rates are presented in **Table 1**. All study participants provided informed consent. Ethical approval was obtained by the Research Ethics Board of the University of Waterloo, Ontario, Canada and by local ethics boards in the countries assessed. Detailed description of the methods employed for the respective surveys used in this study are available on the ITC website for each country(30–33)

Measures

Usual/preferred cigarette brand has a flavour capsule

Respondents in Brazil, Japan, Republic of Korea, and Malaysia were asked the question, "*Does your usual/current brand have a capsule in the filter that releases flavour when it is crushed?*" (yes; no). In Mexico, respondents were told that, "*Some varieties of cigarettes have one or more flavor capsules in the filter, which release a flavor when crushed",* and subsequently asked, *"Does your favorite variety of cigarettes have flavor capsules?*" (Yes, they have a flavour capsule in the

filter; Yes, they have two or more flavour capsules in the filter; No, they do not have any flavour capsule).

Frequency of crushing flavour capsule cigarettes

Respondents from Brazil, Japan, Republic of Korea, and Malaysia who indicated "yes" to the question about usual/current brand with capsule were asked, "*When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?*" (Every capsule; Most capsules; About half the capsules; Some capsules, but less than half; Never). This question was not asked among respondents in Mexico.

Perceived harmfulness of usual brand

Perceived harmfulness of usual brand was examined with the question, "*Do you think that the brand you usually/currently smoke, might be a little less harmful, no different, or a little more harmful, compared to other cigarette brands?"* (a little less harmful, no different, a little more harmful, don't know) among respondents from Brazil, Japan, Republic of Korea, and Malaysia. This question was not asked among respondents in Mexico.

Reasons for choosing usual brand

To examine reasons for choosing one's usual brand, respondents in Brazil and Malaysia were asked, "*In choosing your usual brand, was part of your decision to smoke this brand based on any of the following…"* The following response options were given for respondents in Brazil: *How they taste?; The price?; The tar and nicotine levels for the brand?; They may not be as bad for*

your health?; The colour of the pack?. In Malaysia, respondents were given the following response options: *How they taste?; They may not be as bad for your health? Your friends smoke this brand?; The design of the pack?"* (yes, no; for each response). This question was not asked among respondents in Japan, Republic of Korea, and Mexico.

Sociodemographic and cigarette smoking behaviours

Covariates examined were sex (male, female), age group (18-24, 25-39, 40-54, 55+ years), education (low [less than high school], moderate [high school], and high [university or higher]), smoking frequency (daily, non-daily), and plans to quit smoking (no plans, plans to quit within the next 6 months, plans to quit in the future beyond 6 months).

Data analysis

Bivariate and multivariable analyses were conducted in Stata/SE V.16.1 (StataCorp, 2019) using weighted data. Post-stratification weights were constructed based on the distribution of sex, age, and education in the general population of smokers for each country.(30–33) Analyses were country-specific, accounting for the sampling design in each country. Refused/ "Don't know" responses were set to missing data for each respective measure (see **Supplementary Tables** for missing n). Usual/preferred use of FCCs was examined overall and by sociodemographic and smoking behaviours for each country separately, reported as percentages with 95% confidence intervals (CIs). Logistic regression models were estimated separately for each country to examine correlates of usual/preferred use of FCCs. Models were adjusted for sex, age, education, smoking frequency, and plans to quit smoking with results presented as adjusted odds ratios (aORs) with 95% CIs and p-values. Covariates were identified conceptually based on the literature(13) and included in the models based on availability of consistent measures across all countries. Chi-square (χ^2) tests were conducted to compare perceptions of harmfulness and reasons for usual brand choice between those whose usual cigarette brand had a capsule vs no capsule, with p-values reported.

RESULTS

Sample characteristics

The overall sample included adults who smoked cigarettes from Brazil (N=1215), Japan (N=2876), Republic of Korea (N=3765), Malaysia (N=1104), and Mexico (N=1331). Sample characteristics varied across the countries **(Table 1** and **Supplementary Table 1)**.

Table 1. Country and sample characteristics among adults (18+ years) who smoke cigarettes, ITC Surveys, weighted

Country	Income level[a]	Cigarette smoking prevalence	N	Dates of data collection	Survey Wave	Survey mode	Response rate (%)	Cooperation rate (%)	Female (%)	18-24 years (%)[b]	Low education (%)[c]	Smoke daily (%)	No plans to quit (%)
BRAZIL	Upper-middle		1215	Sep 2016-Mar 2017	3	Telephone	35.5	60.4	52.1	14.4	29.5	92.8	23.9
JAPAN	High		2876	Jul 2021-Aug 2021	4	Web	27.4	94.5	32.4	6.7	2.2	69.1	46.1
REPUBLIC OF KOREA	High		3765	Nov 2021-Dec 2021	2	Web	16.4	97.0	10.1	6.8	1.9	69.6	30.0
MALAYSIA	Upper-middle		1104	Feb 2020-Mar 2020	1	Web	11.3	95.3	2.7	13.7	47.6	88.5	14.8
MEXICO	Upper-middle		1331	Mar 2021-Apr 2021	8	Web	--	--	39.9	9.6	47.6	47.1	23.8

[a] 2021 World Bank

[b] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

[c] Low education was defined as less than high school

Prevalence and correlates of FCC use

Among adults who smoked cigarettes, the prevalence of FCC use was 50.3% (95%CI: 43.1–57.4%)[1] in Mexico, 31.8% (26.4–37.8%) in Republic of Korea, 26.5% (23.3–30.0%) in Malaysia, 21.6% (17.4–26.4%) in Japan, and 6.7% (4.7–9.5%) in Brazil. Use of FCCs was significantly higher among females than males in Japan (aOR=1.79) and Mexico (aOR=3.18), with no differences by sex in the other countries. Younger age was associated with FCC use in Japan, Republic of Korea, and Malaysia. In Mexico, a higher proportion of use was observed among those aged 18-24 (70.1%) vs 55+ (30.4%), but this was marginally not significant after controlling for other factors (aOR=3.10, 0.99–9.73). Use of FCCs was associated with high compared to low education in Brazil (aOR=2.37), Japan (aOR=4.04), and Mexico (aOR=2.38). Those who smoked cigarettes non-daily had greater odds of usually using FCCs than those who smoked daily in Republic of Korea (aOR=1.76). Having plans to quit was associated with using FCCs in Japan and Republic of Korea (**Table 2** and **Supplementary Tables 2 and 3**).

[1] Throughout this article, we present the 95% confidence intervals for each estimate as a range between the lower bound and upper bound.

Table 2. Correlates of usual cigarette brand smoked has a flavour capsule among adults who smoke in Brazil, Japan, Republic of Korea, Malaysia, and Mexico, ITC Surveys, weighted

	BRAZIL (N=1215)			JAPAN (N=2876)			REPUBLIC OF KOREA (N=3765)			MALAYSIA (N=1104)			MEXICO (N=1331)		
	%	aOR†	95%CI	%	aOR†	95%CI	%	aOR†	95%CI	%	aOR†	95%CI	%	aOR†	95%CI
Overall	6.7			21.6			31.8			26.5			50.3		
Sex															
Male	6.1	1.00		20.1	1.00		31.3	1.00		26.3	1.00		39.1	1.00	
Female	7.3	1.41	(0.69, 2.86)	24.5	1.79	(1.35, 2.38) ***	38.0	1.03	(0.61, 1.75)	32.3	1.39	(0.78, 2.47)	67.2	3.18	(1.69, 5.98) ***
Age group (years) [a]															
18-24	12.0‡	1.69	(0.36, 7.88)	80.4‡	0.29	(0.04, 2.26)	61.3	16.69	(8.11, 34.33) ***	23.7	3.33	(0.84, 13.98)	70.1	3.10	(0.99, 9.73)
25-39	8.5	1.89	(0.83, 3.83)	26.2	1.55	(1.13, 2.11) **	43.1	4.61	(2.94, 7.22) ***	30.3	4.35	(1.10, 16.38)*	54.7	2.13	(0.88, 5.14)
40-54	4.6‡	0.94	(0.46, 1.93)	19.7	1.18	(0.88, 1.58)	28.9	2.38	(1.51, 3.75) ***	25.0	3.99	(0.80, 12.76)	39.6	1.37	(0.57, 3.28)
55+	6.2	1.00		13.8	1.00		14.3‡	1.00		7.6‡	1.00		30.4	1.00	
Education															
Low	4.4‡	1.00		6.6‡	1.00		22.1‡	1.00		26.2	1.00		43.7	1.00	
Moderate	6.7‡	1.28	(0.54, 3.02)	18.9	3.44	(0.87, 13.51)	29.1	0.74	(0.20, 2.71)	24.0	0.82	(0.53, 1.27)	54.8	1.72	(0.87, 3.42)
High	9.0	2.37	(1.12, 4.99) *	24.8	4.04	(1.01, 16.10) *	36.5	1.20	(0.33, 4.32)	31.6	1.27	(0.86, 1.86)	59.8	2.38	(1.10, 5.15)*
Smoking frequency															

Daily	13.8	1.00		17.4	1.00		26.5	1.00		26.3	1.00		52.9	1.00	
Non-daily	6.1 ‡	1.68	(0.56, 5.07)	31.5	1.43	(0.93, 2.22)	44.5	1.76	(1.07, 2.91) *	28.0	0.96	(0.58, 1.60)	47.2	0.91	(0.47, 1.77)
Plans to quit															
No plans	5.4 ‡	1.00		17.8	1.00		28.5	1.00		27.4	1.00		53.6	1.00	
Within the next 6 months	6.5	1.28	(0.56, 2.93)	27.7	2.13	(1.42, 3.19) ***	38.0	1.56	(1.10, 2.22) *	30.1	1.10	(0.59, 1.84)	52.5	0.93	(0.40, 2.19)
In future beyond 6 months	8.4 ‡	1.98	(0.85, 4.59)	23.6	1.51	(1.15, 1.98) **	30.8	1.50	(1.04, 2.17) *	23.7	0.74	(0.41, 1.32)	47.2	0.66	(0.31, 1.37)

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

† Separate logistic regression models were estimated for each country and adjusted for all variables in table

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*= p<0.05, **= p<0.01, ***= p<0.001

Frequency of crushing capsules

Adults who smoked FCCs were most likely to report that they crushed the capsule of every cigarette. Crushing every capsule in a pack was most frequently reported in Japan (76.6%, 67.9–83.5%), followed by the Republic of Korea (59.7%, 47.1–71.1%), Brazil (52.7%, 34.4–70.3%), and Malaysia (45.1%, 37.7–52.7%) (**Figure 1** and **Supplementary Table 4**).

Perceived harmfulness of usual brand

Findings on perceived harmfulness of one's usual brand relative to other brands were mixed (**Table 3** and **Supplementary Table 5**). In Brazil, a higher percentage of those smoked FCCs perceived their brand to be a little more harmful than other brands (28.3%, 13.1–50.9%), compared to those who used non-capsule cigarettes (10.2%, 7.9–13.3%) (p=0.011). In Malaysia, a greater percentage of those whose used FCCs perceived their brand to be less harmful than other brands (18.5%, 13.3–25.0%) than those whose brand had no capsule (11.1%, 8.5–14.4%) (p=0.016).

Table 3. Perceptions of harmfulness and reasons for usual brand among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsules in Brazil, Japan, Republic of Korea, and Malaysia, ITC Surveys, weighted

	BRAZIL				JAPAN				REPUBLIC OF KOREA				MALAYSIA			
	Flavour capsule (N=74)		No capsule (N=1127)		Flavour capsule (N=485)		No capsule (N=2211)		Flavour capsule (N=1216)		No capsule (N=2414)		Flavour capsule (N=332)		No capsule (N=719)	
	%	95% CI	%	95% CI	%	95% CI	%	95%CI	%	95% CI	%		%	95% CI	%	95%CI
Perceptions of usual brand harmfulness compared to other brands [a]																
Little less harmful	13.7	(6.3, 27.3) ‡	19.1	(16.0, 22.7)	8.8	(4.3, 17.1) ‡	6.9	(5.1, 9.2)	11.5	(4.4, 26.8) ‡	8.7		18.5	(13.3, 25.0)	11.1	(8.5, 14.4) *
No different	58.0	(38.6, 75.2)	70.6	(66.5, 74.4)	85.0	(76.8, 90.6)	77.2	(72.8, 81.1)	74.2	(61.4, 83.8)	78.5		66.9	(58.6, 73.6)	78.6	(74.5, 82.1) **
Little more harmful	28.3	(13.1, 50.9) ‡	10.2	(7.9, 13.3) *	6.2	(4.0, 9.6)	15.9	(12.4, 20.1) ***	14.3	(8.8, 22.6)	12.8		14.6	(10.1, 20.6)	10.3	(7.9, 13.4)
Reasons for usual brand choice [b]																
Taste	89.5	(74.8, 96.1)	60.6	(56.0, 65.1) ***	--	--	--	--	--	--	--		95.9	(91.6, 98.0)	93.0	(89.9, 95.2)
Price	27.6	(14.7, 45.7)	37.1	(32.9, 41.6)	--	--	--	--	--	--	--		79.1	(72.7, 84.3)	73.9	(69.5, 77.8)
Tar, nicotine levels	33.4	(18.8, 52.1)	33.9	(29.7, 38.3)	--	--	--	--	--	--	--		--	--	--	--
Not as bad for health	23.7	(12.8, 39.5)	37.8	(33.5, 42.4)	--	--	--	--	--	--	--		50.3	(42.5, 58.0)	25.7	(22.5, 31.5) ***
Pack colour	21.5	(10.4, 39.6) ‡	10.8	(8.0, 14.4)	--	--	--	--	--	--	--		--	--	--	--
Pack design	--	--	--	--	--	--	--	--	--	--	--		46.1	(38.6, 53.8)	20.8	(17.2, 24.9) ***
Friends use	--	--	--	--	--	--	--	--	--	--	--		52.0	(44.3, 59.7)	35.3	(30.8, 40.0) ***

*= p<0.05, **= p<0.01, ***= p<0.001; p-values from weighted χ^2 tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

[a] "*Do you think that the brand you usually/currently smoke, might be a little less harmful, no different, or a little more harmful, compared to other cigarette brands?";*

This question was not asked in the Wave 8 (2021) ITC Mexico study. However, ITC Mexico data from 2018-2020 captured relative harm perceptions in a recent study.(5)

[b] "*In choosing your usual brand, was part of your decision to smoke this brand based on any of the following…?"* This question was not asked in respective ITC Japan, Republic of Korea, or Mexico surveys.

Reasons for usual brand choice

In Brazil, taste was a more common reason for usual brand choice among those whose usual brand had a flavour capsule (89.5%, 74.8-96.1%) compared to no capsule (60.6%, 56.0-65.1%) (p<0.001) (**Table 3** and **Supplementary Table 6**). No other reasons assessed for usual brand choice differed between those who used FCCs and did not use capsules in Brazil, including price, tar/nicotine levels, not as bad for health, and pack colour. In Malaysia, a higher proportion of those who used FCCs compared to no capsules reported that they chose their usual brand because it's not as bad for health (50.3%, 42.5-58.0% vs 25.7%, 22.5-31.5%, p<0.001), the pack design (46.1%, 38.6-53.8% vs 20.8%, 17.2-24.9%, p<0.001), and because their friends smoke that brand (52.0%, 44.3-59.7% vs 35.3%, 30.8-40.0%, p<0.001). No differences were observed for taste and price.

DISCUSSION

The current study examined the prevalence of FCC use, frequency of crushing capsules, perceived harmfulness of usual brand, and reasons for FCC use in representative samples of adults who smoke from Brazil, Japan, Republic of Korea, Malaysia, and Mexico. Prevalence estimates for usual/preferred use of FCCs were highest in Mexico and lowest in Brazil. Demographic factors associated with FCC use varied across countries. FCC users mostly reported that they crushed every capsule when they smoked a pack of FCCs, and taste was the most commonly reported reason for use. Perceptions of usual brand harmfulness relative to other brands between those who smoked cigarettes with vs without capsules, varied across countries.

The finding that half of adults (50.3%) who smoke preferred FCCs in Mexico in 2021, is a marked increase from a 2014 estimate of 14%.(18) This is lower than another study assessing ITC Mexico data from 2018-2020 (60%), which defined FCC use based on preferred brand or last purchased brand variety).(29) Prevalence of FCC use from our study are higher than Euromonitor market share estimates, which indicated that FCCs made up over one-quarter (27.3%) of the total cigarette market in Mexico in 2020.(17) Although market share depends on consumption and price of different brands, and not necessarily concordant with prevalence, this finding highlights that while market share data have utility, prevalence data are critical for monitoring population-level trends.

The country with the second-highest prevalence of FCC use was the Republic of Korea (31.8% in 2021), which showed a substantial increase from a 2016 ITC study (18%).(22). Our estimates correspond closely with Euromonitor market share data for FCCs (24.7% in 2020). High use may be a consequence of the documented industry marketing tactics for FCCs in the Republic of Korea, including price promotions, point-of-sale advertising, and packaging(9,34).

We found that over one-quarter of adults who smoke in Malaysia (26.5% in 2020) and one-fifth of adults who smoke in Japan (21.6% in 2021) use FCCs. Both prevalence estimates are much higher than the market share data from Euromonitor, which reported that in 2020 FCCs made up only 0.7% of the total cigarette market share in Malaysia and 7.0% in Japan.(17) However, Euromonitor data estimates that menthol (non-capsule cigarettes) made up 24.8% of the total market share in Malaysia and 27.7% in Japan in 2020.(17) The discrepancy may therefore reflect possibly inaccuracies or overlapping of these two categories. Reported tobacco industry tactics in both countries may explain high rates. In 2008, a ban on misleading packaging descriptors was

followed by the introduction of menthol FCCs to the Malaysian market, and promoted with pack descriptors and imagery highlighting its innovative and technological features.(9,35) The first global market release of modern FCCs was in Japan in 2007.(36) In Japan, marketing tactics for FCCs have been observed at point-of-sale, including offering different brand variants ranging in reported tar yields that correspond to different package emblem sizes.(37)

Lastly, we found the lowest prevalence of FCC use in Brazil (6.7% in 2016-2017). This is generally consistent with Euromonitor data, which estimated that the market share of FCCs was 3.5% in 2016 and 3.7% in 2017.(38) It is possible that prevalence of FCC use has since increased from our 2016-2017 estimates, given the continued market growth (i.e., 3.9% in 2020).(17) Moreover, it is reported that the number of industry-registered flavoured tobacco products tripled from 2012 to 2021.(39) While lower than other countries examined, our data remain concerning, particularly given Brazil's large population, as well as strong tobacco industry efforts to promote flavoured tobacco products and to supress policies that banned flavours and other additives.(16,39–41) Brazil adopted a ban on all flavour additives in 2012, which was subsequently upheld by the Supreme Federal Court in 2018, yet on-going litigation in the lower courts continues to delay implementation.(41,42) Marketing strategies of FCCs in Brazil have included the use of concept flavour names, extensive retail availability near schools, and appealing packaging.(9,43,44) Despite these challenges, the relatively lower prevalence of FCC use may be reflective of Brazil's strong tobacco control leadership to address flavour additives.(39) Further, most adults who smoke in Brazil support a ban on additives.(41)

Our findings on correlates of FCC use varied across the countries, but are largely consistent with previous studies(13,20–23,25). FCC use was associated with younger age in Japan, South Korea(22), and Malaysia, with a marginally non-significant independent association with younger age in Mexico. Young people are perceived to be the target population of FCCs(13), as they contain several features known to appeal to this group, including colourful packaging, choice of flavours, the ability to customise, and connotations of a "high-tech" product(7,9,45,46). Consistent with previous studies in Mexico, we found greater preference for FCCs among females than males(5,18,20,21). In Japan, females also had greater odds of FCC use. No significant association by sex was found in Brazil, Malaysia, or in Republic of Korea, which is inconsistent with a previous study that found that females in Republic of Korea were more likely to use FCCs than males(22). FCCs have features that could appeal to both females and males, depending on the context and marketing environment.(13,47) Those with high education, who smoked non-daily, and had plans to quit were more likely to use FCCs in some, but not all countries, in line with other studies(5,13).

Our study found that the majority of adults who smoke FCCs crushed all the capsules in the five countries that assessed this, indicating that these products appear to be used as intended by the tobacco industry(13,18)

We further found no consistent pattern of consumer perceptions of the harmfulness of FCCs, with those using FCCs (vs no capsules) in Malaysia believing that their brand was less harmful, but those in Brazil believing their brand was more harmful compared to other brands. These mixed findings are consistent with a review of this issue.(13) Qualitative studies have suggested that there

is confusion around relative harm of FCCs, given that on one hand menthol and flavours can be perceived as less harmful, while on the other hand, the flavour-changing technology can been associated with additional chemicals.(7,47) Country differences in harm perceptions may also be modulated by tobacco control policies. For instance, in Republic of Korea, which requires robust graphic health warnings, we observed no differences in harm perceptions. In Japan, which only requires text warnings and does not prohibit misleading descriptors, those whose usual brand did not have capsules perceived their brand to be more harmful compared to those who used FCCs. However, this does not explain why in Malaysia, which has both graphic warnings and a ban on descriptors, we found that FCC users more commonly reported that they perceived their brand to be less harmful. This is further supported by our finding that half of FCC users reported that a reason for choosing their brand is because it is "not as bad for health", significantly higher than non-capsule users. It is possible that marketing of FCCs in Malaysia may negate some of these policy effects.(48) One study reported how the tobacco industry used distinct descriptors and imagery on packaging of FCCs to reinforce its technological and innovate features.(35) This exemplifies the importance of standardised/plain packaging to remove all forms of marketing features that can be conveyed through packaging. Indeed, we also found that FCC users in Malaysia were significantly more likely to report the pack design as a reason for their usual brand choice.

While harm perceptions were not measured in Mexico in our study, other studies, including a recent ITC study(5), have observed that FCC users perceive their brand to be less harmful(5,20), particularly those who used discount brands(18). In Brazil, our finding that those who used FCCs perceived their brand to be more harmful than those who did not use capsules may be a byproduct

of its proposed regulation of flavour additives, and possible media attention around on-going litigation. These findings highlight how the complex interplay between the tobacco policy environment, marketing strategies, and other factors might influence how relative harm is perceived, which can also influence prevalence. Further research can help elucidate the factors driving FCC use and perceptions of harm. Our findings in the two countries that assessed reasons for brand choice, Brazil and Malaysia, suggest that taste is consistently a motivating factor for preference of FCCs, consistent with previous studies.(13)

The current study has limitations. First, the small sample size of adults who usually smoke FCCs in Brazil overall, as well as conditional subgroup estimates, along with high sampling variability may increase uncertainty of our estimates. Misclassification bias of predictor and outcome measures could have also occurred due to how questions were asked and categorised. For instance, although education categories were harmonized across countries for general comparative purposes, for the Republic of Korea and Japan, categorisations may not accurately reflect standard educational levels in those countries. Given that analyses were country-specific, rather than pooled, estimates cannot be directly compared across countries. However, there is utility in examining FCC use across multiple countries to gain an understanding of how commonly these products are used and how they are used, thereby providing a better understanding of the FCC market in countries with varied contexts. This study is also strengthened by its use of comparable measures across multiple countries with varied contexts, many countries for which this is the first known study to estimate prevalence of FCC use.

CONCLUSION

Our research indicates that FCC use is popular among adults who smoke in Japan, Republic of Korea, Malaysia, and Mexico. We found relatively lower prevalence in Brazil, in which a ban on tobacco flavour additives was adopted in 2012, although not yet implemented. While there were general trends of correlates of FCC use in some countries (e.g., females, younger adults), inconsistent patterns across countries suggest that user profiles may be context-specific and, potentially, a result of contrasting tobacco industry marketing practices and priorities. Findings underscore the importance of continuous population-level surveillance and monitoring of FCC use. This study also highlights the need for robust tobacco control policies to address the proliferation of FCCs, including banning flavour additives and filter technologies.

WHAT IS ALREADY KNOWN ABOUT THIS TOPIC

- Flavour capsule cigarettes have experienced significant market growth globally, yet data on the prevalence and correlates of capsule use are scarce.

WHAT THIS STUDY ADDS

- This study of flavour capsule cigarettes in five countries found that a substantial proportion of adults used/preferred flavour capsule cigarettes: over 20% in four of the five countries (Mexico: 50.3%, Republic of Korea: 31.8%, Malaysia: 26.5%, Japan: 21.6% in 2020/2021), with Brazil having the lowest prevalence (6.7% in 2016/2017).
- There was no consistent pattern of perceptions of relative harmfulness capsule cigarettes vs. non-capsule cigarettes across countries.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE, OR POLICY

- Findings support the need to implement comprehensive tobacco policies globally that address use of flavour capsule cigarettes, such as banning flavour additives and filter technologies.

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CONFLICTS OF INTEREST

JFT has served as paid expert witness in legal challenges against tobacco and vaping companies. ASAN has received an unconditional educational grant from Johnson & Johnson Malaysia Sdn. Bhd., KK received a JMWH Bayer Grant from Japan Society for Menopause and Women's Health. GTF has been an expert witness or consultant for governments defending their country's policies or regulations in litigation and served as a paid expert consultant to the Ministry of Health of Singapore in reviewing the evidence on plain/standardized packaging. All other authors have no conflicts of interest to declare.

ETHICS

All participants provided consent to participate. The survey protocols and all materials of the ITC including the survey questionnaires, were cleared for ethics. ITC Brazil Wave 3 was cleared for ethics by the National Cancer Institute of Brazil (INCA) International Review Board. ITC Japan Wave 4 was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (REB#22508/31428), the Internal Review Board at the Osaka International Cancer Institute, Japan (IRB 21054) and the Internal Review Board at Japan National Cancer Center, Japan (IRB 2021-069). ITC Republic of Korea Wave 2 was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (ORE# 41512). ITC Malaysia Wave 1 (New Cohort) Survey was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (ORE#40825) and Medical Research Ethics Committee, University of Malaya (MREC ID #2019118-8018). The ITC Mexico Wave 8 was cleared for ethics by the Instituo Nacional de Salud Publica, International Research Board.

DATA AVAILABILITY STATEMENT

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. The criteria for data usage approval and the contents of the Data Usage Agreement are described online (http://www.itcproject.org).

PATIENT AND PUBLIC INVOLVEMENT STATEMENT

Patients were not involved in this study.

AUTHOR CONTRIBUTIONS

GTF, JFT, CDAP, HGS, SYK, ASAN, FMH, KK, TT, GTF are PIs of the study. CNK conceptualized the study, conducted data analysis, and is the guarantor. FTF and PD supervised. CNK and OE wrote the original draft and prepared the final version. All authors contributed to review and editing and approved the final manuscript.

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Figure 1. Frequency of crushing capsules [a] among adults who smoke whose usual/current brand of cigarettes has a flavour capsule in Brazil, Japan, Republic of Korea, and Malaysia, ITC Surveys, weighted

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

[a] *"When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?";* This question was not asked in the Wave 8 ITC Mexico survey.

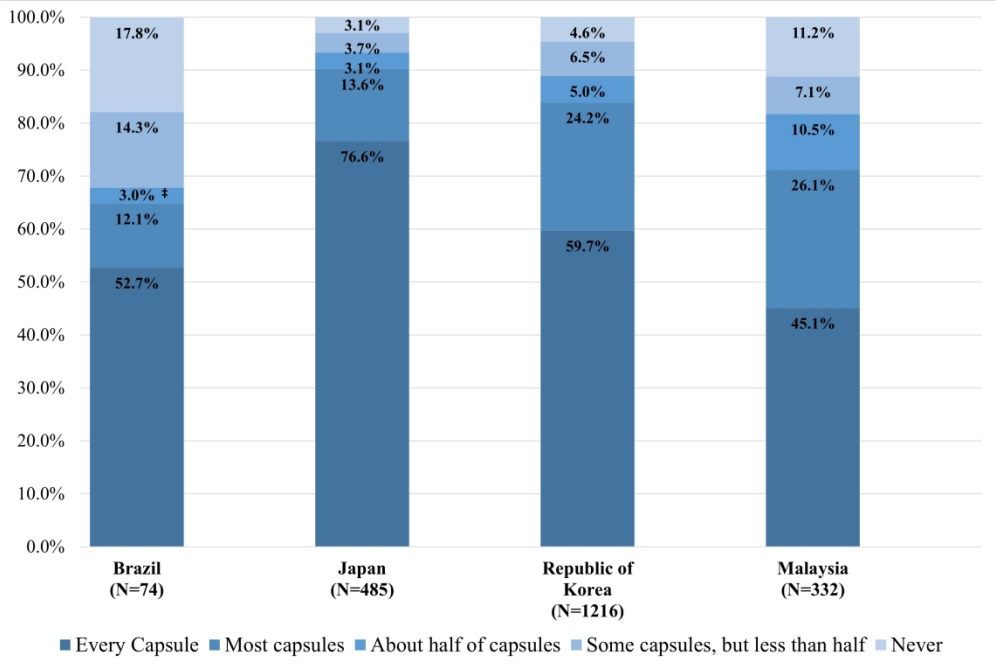

Figure 1. Frequency of crushing capsules a among adults who smoke whose usual/current brand of cigarettes has a flavour capsule in Brazil, Japan, Republic of Korea, and Malaysia, ITC Surveys, weighted. ‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution. a "When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?"; This question was not asked in the Wave 8 ITC Mexico survey.

293x196mm (300 x 300 DPI)

SUPPLEMENTARY TABLES

Supplementary Table 1. Overall sample characteristics of adults who smoke cigarettes across six countries of the ITC Surveys, weighted

	BRAZIL *Wave 3, 2016/2017* **(N=1215)**			JAPAN *Wave 4, 2021* **(N=2876)**			REPUBLIC OF KOREA *Wave 2, 2021* **(N=3765)**			MALAYSIA *Wave 1, 2020* **(N=1104)**			MEXICO *Wave 8, 2021* **(N=1331)**		
	n	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**
Sex															
Male	602	47.9	(43.7, 42.2)	2090	67.5	(63.0, 71.8)	3250	89.9	(85.8, 92.9)	995	97.3	(96.5, 97.9)	645	60.1	(53.3, 66.5)
Female	614	52.1	(47.8, 56.3)	786	32.4	(28.2, 37.0)	515	10.1	(7.1, 14.2)	105	2.7	(2.1, 3.5)	686	39.9	(33.5, 46.7)
Age group (years)															
18-24 [a]	26	4.4	(2.8, 7.1)	14	2.7	(0.8, 8.5)	325	8.8	(4.5, 16.5)	160	13.7	(11.4, 16.4)	134	9.6	(6.7, 13.5)
25-39	205	34.6	(30.2, 39.2)	758	31.9	(27.4, 36.8)	1213	26.2	(22.6, 30.2)	670	51.0	(47.1, 54.9)	575	56.1	(49.2, 62.7)
40-54	334	34.6	(30.8, 38.6)	988	31.7	(28.2, 35.3)	2698	37.4	(32.7, 42.4)	228	29.7	(26.0, 33.8)	437	25.9	(20.6, 32.0)
55+	651	26.3	(23.4, 29.5)	1116	33.8	(30.0, 37.7)	529	27.6	(22.2, 33.7)	46	5.5	(3.9, 7.8)	185	8.4	(6.2, 11.3)
Education															
Low	357	29.5	(25.8, 33.4)	78	2.2	(1.7, 2.8)	69	1.9	(1.2, 3.1)	366	47.6	(43.7, 51.5)	116	47.6	(40.3, 54.9)
Moderate	435	37.5	(33.4, 41.8)	1448	52.5	(48.0, 56.9)	2399	58.6	(53.6, 63.5)	314	36.5	(32.8, 40.3)	763	36.7	(31.2, 42.6)
High	406	31.9	(28.0, 36.1)	1312	45.3	(40.9, 49.8)	1022	39.4	(34.7, 44.4)	412	15.9	(14.0, 18.0)	452	15.7	(12.7, 19.2)
Smoking frequency															
Daily	18	1.1	(0.6, 2.1)	2426	69.1	(62.9, 74.7)	2240	69.6	(61.8, 76.4)	937	88.5	(86.0, 90.5)	651	47.1	(40.0, 54.3)
Non-daily	1,135	92.8	(90.2, 94.8)	450	30.9	(25.3, 37.1)	1225	30.4	(23.6, 38.2)	167	11.5	(9.4, 14.0)	660	52.9	(45.7, 60.0)
Plans to quit															
No plans	81	7.2	(5.2, 9.8)	1284	46.1	(41.3, 50.9)	1028	30.0	(25.5, 35.0)	153	14.8	(12.1, 17.9)	294	23.8	(18.0, 30.9)
Within the next 6 months	316	23.9	(20.5, 27.7)	235	19.4	(14.3, 25.7)	1042	40.3	(33.9, 47.0)	460	42.0	(38.2, 46.0)	460	38.7	(31.5, 46.5)
In future beyond 6 months	574	52.9	(48.4, 57.3)	924	34.5	(30.4, 38.9)	1313	29.7	(24.5, 35.4)	424	43.2	(39.2, 47.2)	485	37.4	(30.6, 44.8)

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

Supplementary Table 2. Prevalence of adults who smoke cigarettes whose usual/preferred brand has a flavour capsule overall and by sociodemographic characteristics and smoking behaviours across six countries of the ITC Surveys, weighted

	BRAZIL *Wave 3, 2016/2017* **(N=1215)**			JAPAN *Wave 4, 2021* **(N=2876)**			REPUBLIC OF KOREA *Wave 2, 2021* **(N=3365)**			MALAYSIA *Wave 1, 2020* **(N=1104)**			MEXICO *Wave 8, 2021* **(N=1331)**		
	n	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**
Overall	74	6.7	(4.7, 9.5)	485	21.6	(17.4, 26.4)	1116	31.8	(26.4, 37.8)	332	26.5	(23.3, 30.0)	751	50.3	(43.1, 57.4)
Sex															
Male	39	6.1	(4.0, 9.2)	313	20.1	(15.0, 26.4)	1122	31.3	(25.4, 37.7)	294	26.3	(23.0, 30.0)	304	39.1	(30.0, 49.0)
Female	35	7.3	(4.1, 12.6)	172	24.5	(18.0, 32.5)	994	38.0	(26.8, 50.8)	38	32.3	(21.6, 45.1)	447	67.2	(58.0, 75.2)
Age group (years) [a]															
18-24	2	12.0	(2.0, 47.4) ‡	3	80.4	(44.3, 95.5) ‡	7	61.3	(26.4, 87.4)	45	23.7	(16.7, 32.6)	94	70.1	(52.2, 83.4)
25-39	21	8.5	(4.7, 14.9)	167	26.2	(18.5, 35.7)	552	43.1	(36.5, 49.9)	222	30.3	(26.0, 35.0)	376	54.7	(43.4, 65.5)
40-54	20	4.6	(2.5, 8.4) ‡	172	19.7	(14.7, 25.9)	525	28.9	(23.0, 35.7)	60	25.0	(18.6, 32.8)	216	39.6	(29.1, 51.2)
55+	31	6.2	(3.5, 10.8)	143	13.8	(10.4, 18.1)	154	14.3	(6.0, 30.3) ‡	5	7.6	(2.3, 22.3) ‡	65	30.4	(18.7, 45.3)
Education															
Low	18	4.4	(2.3, 8.3) ‡	6	6.6	(2.2, 18.1) ‡	8	22.1	(8.6, 45.9) ‡	103	26.2	(21.3, 31.9)	62	43.7	(30.9, 57.4)
Moderate	24	6.7	(3.5, 12.5) ‡	253	18.9	(14.8, 23.8)	271	29.1	(20.7, 39.1)	79	24.0	(18.7, 30.1)	402	54.8	(48.5, 61.0)
High	32	9.0	(5.3, 14.9)	220	24.8	(17.7, 33.7)	93	36.5	(31.4, 41.9)	147	31.6	(26.4, 37.3)	282	59.8	(50.5, 68.6)
Refused/don't know*	0	--	--	6	--	--	3	--	--	3	--	--	0	--	--
Smoking frequency															
Daily	66	13.8	(4.9, 33.4)	373	17.4	(15.7, 19.1)	1113	26.5	(23.9, 29.3)	278	26.3	(22.8, 30.1)	348	52.9	(42.8, 62.8)
Non-daily	8	6.1	(4.2, 8.9) ‡	112	31.5	(19.4, 46.7)	2	44.5	(28.2, 62.0)	54	28.0	(19.7, 38.0)	403	47.2	(37.2, 57.6)
Refused/ don't know*	0	--	--	0	--	--	0	--	--	0	--	--	0	--	--
Plans to quit															
No plans	19	5.4	(2.9, 9.9) ‡	184	17.8	(11.7, 26.1)	3	28.5	(19.9, 38.9)	43	27.4	(18.9, 38.1)	177	53.6	(37.8, 68.8)
Within the next 6 months	33	6.5	(3.7, 11.1)	60	27.7	(15.0, 45.5)	3	38.0	(26.6, 50.9)	157	30.1	(24.9, 35.9)	256	52.5	(39.8, 64.9)
In future beyond 6 months	19	8.4	(4.0, 16.6) ‡	177	23.6	(18.0, 30.4)	4	30.8	(24.1, 38.4)	116	23.7	(18.9, 29.3)	285	47.2	(36.3, 58.4)
Refused/don't know*	3	--	--	64	--	--	8	--	--	16	--	--	33	--	--

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

Supplementary Table 3. Correlates of usual cigarette brand smoke has a flavour capsule among adults who smoke in Brazil, Japan, Republic of Korea, Malaysia, and Mexico, ITC Surveys

	BRAZIL *Wave 3, 2016/2017* **(N=1215)**			JAPAN *Wave 4, 2021* **(N=2876)**			REPUBLIC OF KOREA *Wave 2, 2021* **(N=3765)**			MALAYSIA *Wave 1, 2020* **(N=1104)**			MEXICO *Wave 8, 2021* **(N=1331)**		
	aOR†	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**
Sex															
Male	1.00			1.00			1.00			1.00			1.00		
Female	1.41	(0.69, 2.86)	0.341	1.79	(1.35, 2.38)	**<0.001**	1.03	(0.61, 1.75)	0.901	1.39	(0.78, 2.47)	0.264	3.18	(1.69, 5.98)	**<0.001**
Age group (years) [a]															
18-24	1.69	(0.36, 7.88)	0.506	0.29	(0.04, 2.26)	0.235	16.69	(8.11, 34.33)	**<0.001**	3.43	(0.84, 13.98)	0.085	3.10	(0.99, 9.73)	0.052
25-39	1.89	(0.83, 3.83)	0.077	1.55	(1.13, 2.11)	**0.006**	4.61	(2.94, 7.22)	**<0.001**	4.25	(1.10, 16.38)	**0.035**	2.13	(0.88, 5.14)	0.092
40-54	0.94	(0.46, 1.93)	0.876	1.18	(0.88, 1.58)	0.261	2.38	(1.51, 3.75)	**<0.001**	3.19	(0.80, 12.76)	0.101	1.37	(0.57, 3.28)	0.486
55+	1.00			1.00			1.00			1.00			1.00		
Education															
Low	1.00			1.00			1.00			1.00			1.00		
Moderate	1.28	(0.54, 3.02)	0.569	3.44	(0.87, 13.51)	0.077	0.74	(0.20, 2.71)	0.654	0.82	(0.53, 1.27)	0.374	1.72	(0.87, 3.42)	0.120
High	2.37	(1.12, 4.99)	**0.024**	4.04	(1.01, 16.10)	**0.048**	1.20	(0.33, 4.32)	0.784	1.27	(0.86, 1.86)	0.224	2.38	(1.10, 5.15)	**0.028**
Smoking frequency															
Daily	1.00			1.00			1.00			1.00			1.00		
Non-daily	1.68	(0.56, 5.07)	0.358	1.43	(0.93, 2.22)	0.105	1.76	(1.07, 2.[illegible])	**0.026**	0.96	(0.58, 1.60)	0.890	0.91	(0.47, 1.77)	0.782
Plans to quit															
No plans	1.00			1.00			1.00			1.00			1.00		
Within the next 6 months	1.28	(0.56, 2.93)	0.550	2.13	(1.42, 3.19)	**<0.001**	1.56	(1.10, 2.[illegible])	**0.013**	1.05	(0.59, 1.84)	0.874	0.93	(0.40, 2.19)	0.868
In future beyond 6 months	1.98	(0.85, 4.59)	0.112	1.51	(1.15, 1.98)	**0.003**	1.50	(1.04, 2.[illegible])	**0.030**	0.74	(0.41, 1.32)	0.303	0.66	(0.31, 1.37)	0.261

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

† Separate logistic regression models estimated for each country and adjusted for all variables in table.

Bolded= p<0.05

Supplementary Table 4. Frequency of crushing capsule among adults who smoke whose usual/current brand of cigarettes has a flavour capsule in Brazil, Japan, Republic of Korea, and Malaysia, ITC Surveys, weighted

	Every Capsule			Most capsules			About half of capsules			Some capsules, but less than half			Never			Refused/ don't know*
Country	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**
BRAZIL (N=74)	38	52.7	(34.4, 70.3)	5	12.1	(3.3, 35.7) ‡	5	3.0	(1.0, 8.9) ‡	10	14.3	(5.5, 32.5) ‡	15	17.8	(8.2, 34.5) ‡	1
JAPAN (N=485)	332	76.6	(67.9, 83.5)	71	13.6	(8.2, 21.8)	23	3.1	(1.8, 5.0)	29	3.7	(2.3, 5.8)	22	3.1	(1.8, 5.1)	8
REPUBLIC OF KOREA (N=1216)	711	59.7	(47.1, 71.1)	266	24.2	(13.1, 40.3)	119	5.0	(3.1, 8.0)	70	6.5	(4.0, 10.4)	46	4.6	(2.8, 7.6)	4
MALAYSIA (N=332)	138	45.1	(37.7, 52.7)	93	26.1	(20.2, 33.0)	42	10.5	(7.1, 15.2)	27	7.1	(4.2, 11.6)	21	11.2	(6.9, 17.5)	11

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

Supplementary Table 5. Perceptions of usual cigarette brand harmfulness compared to other brands among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsules in Brazil, Japan, Republic of Korea, and Malaysia, ITC Surveys, weighted

	BRAZIL							JAPAN						
	Flavour capsule (N=74)			No capsule (N=1127)				Flavour capsule (N=485)			No capsule (N=2211)			
Harm of usual brand compared to others	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value[1]**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value[1]**
Little less harmful	15	13.7	(6.3, 27.3) ‡	228	19.1	(16.9, 21.7)	0.372	35	8.8	(4.3, 17.1) ‡	133	6.9	(5.1, 9.2)	0.533
No different	44	58.0	(38.6, 75.2)	761	70.6	(66.8, 74.4)	0.175	348	85.0	(76.8, 90.6)	1446	77.2	(72.8, 81.1)	0.084
Little more harmful	12	28.3	(13.1, 50.9) ‡	105	10.2	(7.9, 13.3)	**0.011**	36	6.2	(4.0, 9.6)	290	15.9	(12.4, 20.1)	**<0.001**
Refused/don't know*	3	--	--	33	--	--	--	66	--	--	342	--	--	--
	REPUBLIC OF KOREA							**MALAYSIA**						
	Flavour capsule (N=1216)			No capsule (N=2414)				Flavour capsule (N=332)			No capsule (N=719)			
Harm of usual brand compared to others	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value[1]**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value[1]**
Little less harmful	72	11.5	(4.4, 26.8) ‡	118	8.7	(4.2, 17.9)	0.633	58	18.5	(13.3, 25.0)	86	11.1	(8.5, 14.4)	**0.016**
No different	820	74.2	(61.4, 83.8)	1761	78.5	(71.2, 84.0)	0.496	202	66.9	(58.6, 73.6)	516	78.6	(74.5, 82.1)	**0.003**
Little more harmful	238	14.3	(8.8, 22.6)	360	12.8	(10.1, 16.1)	0.681	54	14.6	(10.1, 20.6)	76	10.3	(7.9, 13.4)	0.128
Refused/ don't know*	86	--	--	175	--	--	--	18	--	--	41	--	--	--

[1] P-values from weighted $\chi 2$ tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule; **Bolded=** $p<0.05$

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

Supplementary Table 6. Reasons for usual brand choice among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsules in Brazil and Malaysia, ITC Surveys, weighted

	BRAZIL							MALAYSIA						
	Flavour capsule (N=74)			No capsule (N=1127)				Flavour capsule (N=332)			No capsule (N=719)			
Reasons for usual brand choice	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value[a]**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value[a]**
Taste (Yes)	65	89.5	(74.8, 96.1)	644	60.6	(56.0, 65.1)	**<0.001**	290	95.9	(91.6, 98.0)	593	93.0	(89.9, 95.2)	0.198
No	9			399				13			40			
Don't know/refused/not applicable*	0			10				29			86			
Price (Yes)	17	27.6	(14.7, 45.7)	380	37.1	(32.9, 41.6)	0.288	225	79.1	(72.7, 84.3)	442	73.9	(69.5, 77.8)	0.167
No	57			670				77			191			
Don't know/refused/not applicable*	0			3				30			86			
Tar, nicotine levels (Yes)	22	33.4	(18.8, 52.1)	348	33.9	(29.7, 38.3)	0.960	--	--	--	--	--	--	--
No	52			663										
Don't know/refused/not applicable *	0			42										
Not as bad for health (Yes)	22	23.7	(12.8, 39.5)	397	37.8	(33.5, 42.4)	0.080	148	50.3	(42.5, 58.0)	184	25.7	(22.5, 31.5)	**<0.001**
No	52			628				138			401			
Don't know/refused/not applicable *	0			28				46			134			
Pack colour (Yes)	14	21.5	(10.4, 39.6) ‡	116	10.8	(8.0, 14.4)	0.077	--	--	--	--	--	--	--
No	59			930										
Don't know/refused/not applicable *	1			7										
Pack design (Yes)	--	--	--	--	--	--	--	152	46.1	(38.6, 53.8)	148	20.8	(17.2, 24.9)	**<0.001**
No								147			478			
Don't know/refused/not applicable*								33			93			
Friends use (Yes)	--	--	--	--	--	--	--	170	52.0	(44.3, 59.7)	245	35.3	(30.8, 40.0)	**<0.001**
No								126			374			
Don't know/refused/not applicable *								36			100			

[a] P-values from weighted $\chi 2$ tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule; **Bolded**= $p<0.05$

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6
Objectives	3	State specific objectives, including any prespecified hypotheses	6-7
Methods			
Study design	4	Present key elements of study design early in the paper	8-10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11
		(*b*) Describe any methods used to examine subgroups and interactions	11
		(*c*) Explain how missing data were addressed	11
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	11
		(*e*) Describe any sensitivity analyses	11
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11, Tables
		(b) Indicate number of participants with missing data for each variable of interest	Suppl tables
Outcome data	15*	Report numbers of outcome events or summary measures	11-14 and tables

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-14 and tables
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19-20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-20
Generalisability	21	Discuss the generalisability (external validity) of the study results	20
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	26

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Prevalence and perceptions of flavour capsule cigarettes among adults who smoke in Brazil, Japan, Republic of Korea, Malaysia, and Mexico: Findings from the ITC Surveys

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ABSTRACT

Introduction: The global market of flavour capsule cigarettes (FCCs) has grown significantly over the past decade, however prevalence data exist for only a few countries. This study examined prevalence and perceptions of FCCs among adults who smoke across five countries.

Methods: Cross-sectional data among adults who smoked cigarettes came from the International Tobacco Control Policy Evaluation (ITC) Project Surveys— Brazil (2016/2017), Japan (2021), Republic of Korea (2021), Malaysia (2020), and Mexico (2021). FCCs use was measured based on reporting one's usual/current brand or favourite variety has flavour capsule(s). Perceptions of the harmfulness of one's usual brand vs other brands was compared between those who used capsules vs no capsules. Adjusted logistic regression models examined correlates of FCC use.

Results: There were substantial differences in the prevalence of FCC use among adults who smoke across the five countries: Mexico (50.3% in 2021), Republic of Korea (31.8% in 2021), Malaysia (26.5% in 2020), Japan (21.6% in 2021), and Brazil (6.7% in 2016/2017). Correlates of FCC use varied across countries. Capsule use was positively associated with being female in Japan and Mexico, younger age in Japan, Republic of Korea and Malaysia, high education in Brazil, Japan, and Mexico, non-daily smoking in Republic of Korea, and having plans to quit in Japan and Republic of Korea. There was no consistent pattern of consumer perceptions of brand harmfulness.

Conclusion: Our study documented the high prevalence of FCCs in some countries, pointing to the need to develop and implement regulatory strategies to control these attractive products.

Strengths and limitations of this study

- This study is strengthened by its use of the International Tobacco Control Policy Evaluation (ITC) Project surveys, which are a series of prospective cohort studies, in which measures have been designed to be comparable across countries.
- ITC studies use a theory-informed conceptual framework that considers moderators, which have been adjusted for in logistic regression analyses of the current study.
- Cross-sectional data may not capture the full scope of flavour capsule cigarette patterns across countries.
- Most country samples were derived from online consumer panels, and while efforts were made to yield samples that were nationally representative, samples may not represent the entire population of adults who smoke cigarettes.

MAIN TEXT

INTRODUCTION

The incorporation of flavours into cigarettes by tobacco companies poses a significant threat to global tobacco control efforts by enhancing the attractiveness of these products.(1) Among these methods is through the use of flavour capsules.

Flavour capsule cigarettes (FCCs) contain one or two capsules in the cigarette filter which release flavour when the consumer crushes it.(2) They come in several flavours, including both traditional flavours (e.g., menthol, berry) and those with 'concept descriptors' (e.g., Mykonos Nightfall)(3–5). The choice of flavours, the enjoyment of clicking the capsule, and the ability to customise when and if to crush the capsule contribute to their appeal.(6–8) FCCs are marketed through a mix of strategies.(9–11) In addition to contributing to the appeal of tobacco products through features known to be particularly attractive to young people,(9) research indicates that FCCs contain a myriad of chemical components, many of which are toxic and possibly carcinogenic.(12,13) Further, components detected in FCCs may increase nicotine delivery and exposure, thereby facilitating addictiveness. (12,13)

In recent years, the market share of FCCs has grown substantially in many countries, particularly in low- and middle-income countries.(14–16). In 2014, when the global cigarette market experienced a marked acceleration of FCC growth(15), FCCs accounted for 10-25% of the cigarette market share in the top five countries with the largest FCC shares, all in Latin America (i.e., Chile, Peru, Guatemala, Mexico, and Argentina).(14) By 2020, FCCs made up 25-50% of the

overall cigarette market in five countries with the largest FCC market shares(17) (i.e., Chile, Peru, Guatemala, Mexico, and Republic of Korea).

Despite these trends, there is a dearth of research on the prevalence of FCC use in countries where these products are available on the market(18). Prevalence data (current or ever use among people who smoke) exist for only a handful of countries, including Australia(19), Chile(20), Mexico(5,19,21,22), Republic of Korea(23), the United Kingdom(24), and the United States(19,25,26). Previous studies have found that FCC appeal and use is associated with younger age(5,19–21,24), and in some countries, with being female(5,19–21,23). Smoking and quitting behaviours, are not consistently associated with FCC use.(18)

Monitoring trends in flavoured tobacco product use is integral to tobacco control as flavours increase the appeal of tobacco, particularly among youth.(1,27,28) Such data can support adoption of Article 9 of the World Health Organization Framework Convention on Tobacco Control, which calls upon Parties to prohibit or restrict flavours, as well as to regulate other design features that increase the attractiveness of tobacco products, including the placement of capsules in cigarette filters that release flavour when crushed.(29) In order to fill in research gaps and provide insight into how FCC use may vary across countries with different markets and tobacco control policies, this study aimed to: (1) examine prevalence and correlates of use of FCCs across five countries (Brazil, Japan, Republic of Korea, Malaysia, and Mexico), (2) describe FCC crushing behaviours,

and (3) compare perceptions of brand harmfulness and reasons for choosing one's brand among adults who smoke FCCs vs non-capsule cigarettes.

METHODS

Study Design

Cross-sectional data came from the latest survey wave conducted in each of five countries participating in the International Tobacco Control Policy Evaluation (ITC) Project surveys: Wave 3 Brazil (September 2016 to March 2017), Wave 4 Japan (July to August 2021), Wave 2 Republic of Korea (November to December 2021), Wave 1 Malaysia (February to March 2020), and Wave 8 Mexico (March to April 2021). These five countries were selected based on availability of measures on FCCs among the countries participating in the ITC Project. Other requirements for inclusion entailed having sufficient sample size, not having an implemented national ban on flavoured tobacco products, including flavour capsule cigarettes, at the time of the survey, and approval from country survey Principal Investigators. This broad criterion was used given the scarcity of flavour capsule cigarette prevalence data globally. Age-standardised cigarette smoking prevalence in 2021 ranged from 11.2% in Brazil to 13.9% in Mexico, 17.9% in Malaysia, 18.9% in Japan, and 19.3% in Republic of Korea.(30) Brazil, Malaysia and Mexico are upper-middle-income countries, while Japan and Republic of Korea are high-income countries. (**Supplementary Table 1**).

All surveys sampled adults who smoked cigarettes, however other groups were also sampled in some surveys (e.g., heated tobacco product users, e-cigarette users, non-users) (**Supplementary**

Table 1). The current analytic sample was restricted to adults (aged ≥18 years in Brazil, Malaysia, and Mexico, ≥19 in Republic of Korea, and ≥20 in Japan) who smoked cigarettes. Cigarette smoking was defined as those who smoked at least 100 cigarettes in their lifetime and smoked at least monthly at the time of the survey. In Mexico, current smoking was only defined as having smoked cigarettes in the last 30 days (yes/no) because of validity concerns around the 100 cigarette screening question.(31)

Data were collected remotely using web-based surveys in all countries except Brazil, where data were collected via computer assisted telephone interviewing. With the exception of Brazil, in which households were randomly called using systematic sampling, participants were recruited from online consumer panels, with quotas for age, sex, and education groups, as well as type of tobacco and nicotine products use, depending on the country.(32–35) In all countries except Malaysia (which was Wave 1 of the survey), the sample included both re-contact respondents from previous survey wave(s), as well as replenishment respondents who were newly sampled at the current survey wave to compensate for attrition. Response and cooperation rates are also presented alongside country and survey characteristics in **Supplementary Table 1**. All study participants provided informed consent. Ethical approval was obtained by the Research Ethics Board of the University of Waterloo, Ontario, Canada and by local ethics boards in the countries assessed. Secondary data analysis was cleared for ethics by the Imperial College Research Ethics Committee. Detailed description of the methods employed for the respective surveys used in this study are available on the ITC website for each country(32–35)

Patient and public involvement

Patients were not involved in this study.

Measures

Usual/preferred cigarette brand has a flavour capsule

Respondents in Brazil, Japan, Republic of Korea, and Malaysia were asked the question, "*Does your usual/current brand have a capsule in the filter that releases flavour when it is crushed?*" (yes; no). In Mexico, respondents were told that, "*Some varieties of cigarettes have one or more flavor capsules in the filter, which release a flavor when crushed",* and subsequently asked, *"Does your favorite variety of cigarettes have flavor capsules?*" (Yes, they have a flavour capsule in the filter; Yes, they have two or more flavour capsules in the filter; No, they do not have any flavour capsule).

Frequency of crushing flavour capsule cigarettes

Respondents from Brazil, Japan, Republic of Korea, and Malaysia who indicated "yes" to the question about usual/current brand with capsule were asked, "*When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?*" (Every capsule; Most capsules; About half the capsules; Some capsules, but less than half; Never). This question was not asked among respondents in Mexico.

Perceived harmfulness of usual brand

Perceived harmfulness of usual brand was examined with the question, "*Do you think that the brand you usually/currently smoke, might be a little less harmful, no different, or a little more harmful, compared to other cigarette brands?"* (a little less harmful, no different, a little more harmful, don't know) among respondents from Brazil, Japan, Republic of Korea, and Malaysia. This question was not asked among respondents in Mexico.

Reasons for choosing usual brand

To examine reasons for choosing one's usual brand, respondents in Brazil and Malaysia were asked a series of questions with the prompt: "*In choosing your usual brand, was part of your decision to smoke this brand based on any of the following…"* The following questions were asked to respondents in Brazil: *How they taste?; The price?; The tar and nicotine levels for the brand?; They may not be as bad for your health?; The colour of the pack?* (yes, no; for each response). In Malaysia, respondents were asked the following questions: *How they taste?; They may not be as bad for your health? Your friends smoke this brand?; The design of the pack?"* (yes, no; for each question). These questions were not asked among respondents in Japan, Republic of Korea, and Mexico.

Sociodemographic and cigarette smoking behaviours

Covariates examined were sex (male, female), age group (18-24, 25-39, 40-54, 55+ years), education (low [less than high school], moderate [high school], and high [university or higher]),

smoking frequency (daily, non-daily), and plans to quit smoking (no plans, plans to quit within the next 6 months, plans to quit in the future beyond 6 months).

Data analysis

Bivariate and multivariable analyses were conducted in Stata/SE V.16.1 (StataCorp, 2019) using weighted data. Post-stratification weights were constructed by the ITC team based on the distribution of sex, age, and education in the general population of smokers for each country.(32–35) Analyses were country-specific, accounting for the sampling design in each country. Refused/ "Don't know" responses were set to missing data for each respective measure (missing n are reported in supplementary tables). Usual/preferred use of FCCs was examined overall and by sociodemographic and smoking behaviours for each country separately, reported as percentages with 95% confidence intervals (CIs). Logistic regression models were estimated separately for each country to examine correlates of usual/preferred use of FCCs. Models were adjusted for sex, age, education, smoking frequency, and plans to quit smoking with results presented as adjusted odds ratios (aORs) with 95% CIs and p-values. Covariates were identified conceptually based on the literature(18) and included in the models based on availability of consistent measures across all countries. Chi-square (χ^2) tests were conducted to compare perceptions of harmfulness of one's usual/current brand relative to other brands and reasons for one's usual brand choice, respectively, between those whose usual cigarette brand had a capsule vs no capsule, with p-values reported.

RESULTS

Sample characteristics

The overall sample included adults who smoked cigarettes from Brazil (N=1215), Japan (N=2876), Republic of Korea (N=3765), Malaysia (N=1104), and Mexico (N=1331). Sample characteristics varied across the countries **(Table 1; Supplementary Table 2** for full table).

Table 1. Overall sample characteristics of adults who smoke cigarettes across five countries of the ITC Surveys, weighted [a]

	BRAZIL (N=1215)	JAPAN (N=2876)	REPUBLIC OF KOREA (N=3765)	MALAYSIA (N=1104)	MEXICO (N=1331)
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
Sex					
Male	47.9 (43.7, 42.2)	67.5 (63.0, 71.8)	89.9 (85.8, 92.9)	97.3 (96.5, 97.9)	60.1 (53.3, 66.5)
Female	52.1 (47.8, 56.3)	32.4 (28.2, 37.0)	10.1 (7.1, 14.2)	2.7 (2.1, 3.5)	39.9 (33.5, 46.7)
Age group (years)					
18-24 [b]	4.4 (2.8, 7.1)	2.7 (0.8, 8.5)	8.8 (4.5, 16.5)	13.7 (11.4, 16.4)	9.6 (6.7, 13.5)
25-39	34.6 (30.2, 39.2)	31.9 (27.4, 36.8)	26.2 (22.6, 30.2)	51.0 (47.1, 54.9)	56.1 (49.2, 62.7)
40-54	34.6 (30.8, 38.6)	31.7 (28.2, 35.3)	37.4 (32.7, 42.4)	29.7 (26.0, 33.8)	25.9 (20.6, 32.0)
55+	26.3 (23.4, 29.5)	33.8 (30.0, 37.7)	27.6 (22.2, 33.7)	5.5 (3.9, 7.8)	8.4 (6.2, 11.3)
Education					
Low	29.5 (25.8, 33.4)	2.2 (1.7, 2.8)	1.9 (1.2, 3.1)	47.6 (43.7, 51.5)	47.6 (40.3, 54.9)
Moderate	37.5 (33.4, 41.8)	52.5 (48.0, 56.9)	58.6 (53.6, 63.5)	36.5 (32.8, 40.3)	36.7 (31.2, 42.6)
High	31.9 (28.0, 36.1)	45.3 (40.9, 49.8)	39.4 (34.7, 44.4)	15.9 (14.0, 18.0)	15.7 (12.7, 19.2)
Smoking frequency					
Daily	92.8 (90.2, 94.8)	69.1 (62.9, 74.7)	69.6 (61.8, 76.4)	88.5 (86.0, 90.5)	47.1 (40.0, 54.3)
Non-daily	1.1 (0.6, 2.1)	30.9 (25.3, 37.1)	30.4 (23.6, 38.2)	11.5 (9.4, 14.0)	52.9 (45.7, 60.0)
Plans to quit					
No plans	7.2 (5.2, 9.8)	46.1 (41.3, 50.9)	30.0 (25.5, 35.0)	14.8 (12.1, 17.9)	23.8 (18.0, 30.9)
Within the next 6 months	52.9 (48.4, 57.3)	19.4 (14.3, 25.7)	40.3 (33.9, 47.0)	42.0 (38.2, 46.0)	38.7 (31.5, 46.5)
In future beyond 6 months	23.9 (20.5, 27.7)	34.5 (30.4, 38.9)	29.7 (24.5, 35.4)	43.2 (39.2, 47.2)	37.4 (30.6, 44.8)

[a] See **Supplementary Table 2** for full table, including n

[b] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

Prevalence and correlates of FCC use

Among adults who smoked cigarettes, the prevalence of FCC use was 50.3% (95%CI: 43.1–57.4%)[1] in Mexico, 31.8% (26.4–37.8%) in Republic of Korea, 26.5% (23.3–30.0%) in Malaysia, 21.6% (17.4–26.4%) in Japan, and 6.7% (4.7–9.5%) in Brazil **(Table 2; Supplementary Table 3** for full table**)**. Use of FCCs was significantly higher among females than males in Japan (aOR=1.79) and Mexico (aOR=3.18), with no differences by sex in the other countries **(Table 3; Supplementary Table 4** for full table**)**. Younger age was associated with FCC use in Japan, Republic of Korea, and Malaysia. In Mexico, a higher proportion of use was observed among those aged 18-24 (70.1%) vs 55+ (30.4%) **(Table 2)**, but this was marginally not significant after controlling for other factors (aOR=3.10, 0.99–9.73) **(Table 3)**. Use of FCCs was associated with high compared to low education in Brazil (aOR=2.37), Japan (aOR=4.04), and Mexico (aOR=2.38). Those who smoked cigarettes non-daily had greater odds of usually using FCCs than those who smoked daily in Republic of Korea (aOR=1.76). Having plans to quit was associated with using FCCs in Japan and Republic of Korea.

[1] Throughout this article, we present the 95% confidence intervals for each estimate as a range between the lower bound and upper bound.

Table 2. Prevalence of usual/preferred brand has a flavour capsule overall and by sociodemographic characteristics and smoking behaviours adults who smoke cigarettes across five countries of the ITC Surveys, weighted [a]

	BRAZIL (N=1215)	JAPAN (N=2876)	REPUBLIC OF KOREA (N=3765)	MALAYSIA (N=1104)	MEXICO (N=1331)
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
Overall	6.7 (4.7, 9.5)	21.6 (17.4, 26.4)	31.8 (26.4, 37.8)	26.5 (23.3, 30.0)	50.3 (43.1, 57.4)
Sex					
Male	6.1 (4.0, 9.2)	20.1 (15.0, 26.4)	31.3 (25.4, 37.7)	26.3 (23.0, 30.0)	39.1 (30.0, 49.0)
Female	7.3 (4.1, 12.6)	24.5 (18.0, 32.5)	38.0 (26.8, 50.8)	32.3 (21.6, 45.1)	67.2 (58.0, 75.2)
Age group (years) [b]					
18-24	12.0 (2.0, 47.4) ‡	80.4 (44.3, 95.5) ‡	61.3 (26.4, 87.4)	23.7 (16.7, 32.6)	70.1 (52.2, 83.4)
25-39	8.5 (4.7, 14.9)	26.2 (18.5, 35.7)	43.1 (36.5, 49.9)	30.3 (26.0, 35.0)	54.7 (43.4, 65.5)
40-54	4.6 (2.5, 8.4) ‡	19.7 (14.7, 25.9)	28.9 (23.0, 35.7)	25.0 (18.6, 32.8)	39.6 (29.1, 51.2)
55+	6.2 (3.5, 10.8)	13.8 (10.4, 18.1)	14.3 (6.0, 30.3) ‡	7.6 (2.3, 22.3) ‡	30.4 (18.7, 45.3)
Education					
Low	4.4 (2.3, 8.3) ‡	6.6 (2.2, 18.1) ‡	22.1 (8.6, 45.9) ‡	26.2 (21.3, 31.9)	43.7 (30.9, 57.4)
Moderate	6.7 (3.5, 12.5) ‡	18.9 (14.8, 23.8)	29.1 (20.7, 39.1)	24.0 (18.7, 30.1)	54.8 (48.5, 61.0)
High	9.0 (5.3, 14.9)	24.8 (17.7, 33.7)	36.5 (31.4, 41.9)	31.6 (26.4, 37.3)	59.8 (50.5, 68.6)
Smoking frequency					
Daily	13.8 (4.9, 33.4)	17.4 (15.7, 19.1)	26.5 (23.9, 29.3)	26.3 (22.8, 30.1)	52.9 (42.8, 62.8)
Non-daily	6.1 (4.2, 8.9) ‡	31.5 (19.4, 46.7)	44.5 (28.2, 62.0)	28.0 (19.7, 38.0)	47.2 (37.2, 57.6)
Plans to quit					
No plans	5.4 (2.9, 9.9) ‡	17.8 (11.7, 26.1)	28.5 (19.9, 38.9)	27.4 (18.9, 38.1)	53.6 (37.8, 68.8)
Within the					

next 6 months	6.5 (3.7, 11.1)	27.7 (15.0, 45.5)	38.0 (26.6, 50.9)	30.1 (24.9, 35.9)	52.5 (39.8, 64.9)
In future beyond 6 months	8.4 (4.0, 16.6) ‡	23.6 (18.0, 30.4)	30.8 (24.1, 38.4)	23.7 (18.9, 29.3)	47.2 (36.3, 58.4)

[a] See **Supplementary Table 3** for full table, including n

[b] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

Table 3. Correlates of usual cigarette brand smoke has a flavour capsule among adults who smoke across five countries of the ITC Surveys, weighted, logistic regression analyses [a]

	BRAZIL (N=1215)	JAPAN (N=2876)	REPUBLIC OF KOREA (N=3765)	MALAYSIA (N=1104)	MEXICO (N=1331)
	aOR† (95%CI)	aOR† (95%CI)	aOR† (95%CI)	aOR† (95%CI)	aOR† (95%CI)
Sex					
Male	1.00	1.00	1.00	1.00	1.00
Female	1.41 (0.69, 2.86)	1.79 *** (1.35, 2.38)	1.03 (0.61, 1.75)	1.39 (0.78, 2.47)	3.18 *** (1.69, 5.98)
Age group (years) [b]					
18-24	1.69 (0.36, 7.88)	0.29 (0.04, 2.26)	16.69 *** (8.11, 34.33)	3.43 (0.84, 13.98)	3.10 (0.99, 9.73)
25-39	1.89 (0.83, 3.83)	1.55 ** (1.13, 2.11)	4.61 *** (2.94, 7.22)	4.25 * (1.10, 16.38)	2.13 (0.88, 5.1[illegible])
40-54	0.94 (0.46, 1.93)	1.18 (0.88, 1.58)	2.38 *** (1.51, 3.75)	3.19 (0.80, 12.76)	1.37 (0.57, 3.2[illegible])
55+	1.00	1.00	1.00	1.00	1.00
Education					
Low	1.00	1.00	1.00	1.00	1.00
Moderate	1.28 (0.54, 3.02)	3.44 (0.87, 13.51)	0.74 (0.20, 2.71)	0.82 (0.53, 1.27)	1.72 (0.87, 3.42)
High	2.37 * (1.12, 4.99)	4.04 * (1.01, 16.10)	1.20 (0.33, 4.32)	1.27 (0.86, 1.86)	2.38 * (1.10, 5.15)
Smoking frequency					
Daily	1.00	1.00	1.00	1.00	1.00
Non-daily	1.68 (0.56, 5.07)	1.43 (0.93, 2.22)	1.76 * (1.07, 2.91)	0.96 (0.58, 1.60)	0.91 (0.47, 1.77)
Plans to quit					
No plans	1.00	1.00	1.00	1.00	1.00
Within the next 6 months	1.28 (0.56, 2.93)	2.13 *** (1.42, 3.19)	1.56 * (1.10, 2.22)	1.05 (0.59, 1.84)	0.93 (0.40, 2.19)
In future beyond 6 months	1.98 (0.85, 4.59)	1.51 ** (1.15, 1.98)	1.50 * (1.04, 2.17)	0.74 (0.41, 1.32)	0.66 (0.31, 1.37)

[a] See **Supplementary Table 4** for full table, including n and p-values

[b] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.
† Separate logistic regression models estimated for each country and adjusted for all variables in table.
* = p<0.05; **=p<0.01; ***=p<0.001

Frequency of crushing capsules

Adults who smoked FCCs most commonly reported that when they smoke a pack of their usual/current brand they crush every capsule, compared to less frequent response options. Crushing every capsule in a pack was most frequently reported in Japan (76.6%, 67.9–83.5%), followed by Republic of Korea (59.7%, 47.1–71.1%), Brazil (52.7%, 34.4–70.3%), and Malaysia (45.1%, 37.7–52.7%) (**Table 4**; **Supplementary Table 5** for full table).

Perceived harmfulness of usual brand

Findings on perceived harmfulness of one's usual brand relative to other brands were mixed (**Table 5; Supplementary Table 6** for full table). In Brazil, a higher percentage of those smoked FCCs perceived their brand to be a little more harmful than other brands (28.3%, 13.1–50.9%), compared to those who used non-capsule cigarettes (10.2%, 7.9–13.3%) (p=0.011). In Malaysia, a greater percentage of those whose used FCCs perceived their brand to be less harmful than other brands (18.5%, 13.3–25.0%) than those whose brand had no capsule (11.1%, 8.5–14.4%) (p=0.016).

Table 4. Frequency of crushing capsules among adults who smoke whose usual/ current brand of cigarettes has a flavour capsule across four countries of the ITC Surveys, weighted [a]

	BRAZIL (N=74)		JAPAN (N=485)		REPUBLIC OF KOREA (N=1216)		MALAYSIA (N=332)	
Frequency of crushing capsules [b]	**%**	**95%CI**	**%**	**95%CI**	**%**	**95%CI**	**%**	**95%CI**
Every capsule	52.7	(34.4, 70.3)	76.6	(67.9, 83.5)	59.7	(47.1, 71.1)	45.1	(37.7, 52.7)
Most capsules	12.1	(3.3, 35.7) ‡	13.6	(8.2, 21.8)	24.2	(13.1, 40.3)	26.1	(20.2, 33.0)
About half of capsules	3.0	(1.0, 8.9) ‡	3.1	(1.8, 5.0)	5.0	(3.1, 8.0)	10.5	(7.1, 15.3)
Some capsules, but less than half	14.3	(5.5, 32.5) ‡	3.7	(2.3, 5.8)	6.5	(4.0, 10.4)	7.1	(4.2, 11.8)
Never	17.8	(8.2, 34.5) ‡	3.1	(1.8, 5.1)	4.6	(2.8, 7.6)	11.2	(6.9,

[a] See **Supplementary Table 5** for full table, including n

[b] *"When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?";* This question was not asked in the Wave 8 ITC Mexico survey.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

Table 5. Perceptions of usual cigarette brand harmfulness compared to other brands among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsule across four countries of the ITC Surveys, weighted [a]

	BRAZIL			JAPAN		
	Flavour capsule (N=74)	**No capsule (N=1127)**		**Flavour capsule (N=485)**	**No capsule (N=2211)**	
Harm of usual brand compared to others [b]	**%**	**%**	**p-value [c]**	**%**	**%**	**p-value [c]**
Little less harmful	13.7 (6.3, 27.3) ‡	19.1 (16.0, 22.7)	0.372	8.8 (4.3, 17.1) ‡	6.9 (5.1, 9.2)	0.533
No different	58.0 (38.6, 75.2)	70.6 (66.5, 74.4)	0.175	85.0 (76.8, 90.6)	77.2 (72.8, 81.1)	0.084
Little more harmful	28.3 (13.1, 50.9) ‡	10.2 (7.9, 13.3)	**0.011**	6.2 (4.0, 9.6)	15.9 (12.4, 20.1)	**<0.001**
	REPUBLIC OF KOREA			**MALAYSIA**		
	Flavour capsule (N=1216)	**No capsule (N=2414)**		**Flavour capsule (N=332)**	**No capsule (N=719)**	
Harm of usual brand compared to others [b]	**%**	**%**	**p-value [c]**	**%**	**%**	**p-value [c]**
Little less harmful	11.5 (4.4, 26.8) ‡	8.7 (4.2, 16.9)	0.633	18.5 (13.3, 25.0)	11.1 (8.5, 14.4)	**0.016**
No different	74.2 (61.4, 83.8)	78.5 (71.8, 84.0)	0.496	66.9 (58.6, 73.6)	78.6 (74.5, 82.1)	**0.003**
Little more harmful	14.3 (8.8, 22.6)	12.8 (10.1, 16.1)	0.681	14.6 (10.1, 20.6)	10.3 (7.9, 13.4)	0.128

[a] See **Supplementary Table 6** for full table, including n

[b] "*Do you think that the brand you usually/currently smoke, might be a little less harmful, no different, or a little more harmful, compared to other cigarette brands?";* This question was not asked in the Wave 8 (2021) ITC Mexico study. However, ITC Mexico data from 2018-2020 captured relative harm perceptions in a recent study.(5)

[c] P-values from weighted $\chi 2$ tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule; **Bolded**= $p<0.05$

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

Reasons for usual brand choice

In Brazil, taste was a more common reason for usual brand choice among those whose usual brand had a flavour capsule (89.5%, 74.8-96.1%) compared to no capsule (60.6%, 56.0-65.1%) (p<0.001) (**Supplementary Table 7**). No other reasons assessed for usual brand choice differed between those who used FCCs and did not use capsules in Brazil, including price, tar/nicotine levels, not as bad for health, and pack colour. In Malaysia, a higher proportion of those who used FCCs compared to no capsules reported that they chose their usual brand because it's not as bad for health (50.3%, 42.5-58.0% vs 25.7%, 22.5-31.5%, p<0.001), the pack design (46.1%, 38.6-53.8% vs 20.8%, 17.2-24.9%, p<0.001), and because their friends smoke that brand (52.0%, 44.3-59.7% vs 35.3%, 30.8-40.0%, p<0.001). No significant differences were observed between those who smoked FCCs vs no capsules in Malaysia for taste (95.9%, 91.6-98.0% vs 93.0%, 89.9-95.2%, p=0.198) and price (79.1%, 72.7-84.3%% vs 73.9%, 69.5-77.8%, p=0.167).

DISCUSSION

The current study examined the prevalence of FCC use, frequency of crushing capsules, perceived harmfulness of usual brand, and reasons for FCC use among adults who smoke from Brazil, Japan, Republic of Korea, Malaysia, and Mexico. Prevalence estimates for usual/preferred use of FCCs were highest in Mexico and lowest in Brazil. Demographic factors associated with FCC use varied across countries. FCC users most commonly reported that they crushed every capsule when they smoked a pack of FCCs, and taste was the most commonly reported reason for use in countries that examined this. Perceptions of usual brand harmfulness relative to other brands between those who smoked cigarettes with vs without capsules, varied across countries.

The finding that half of adults (50.3%) who smoke preferred FCCs in Mexico in 2021, is a marked increase from a 2014 estimate of 14%.(19) This is lower than another study assessing ITC Mexico data from 2018-2020 (60%), which defined FCC use based on preferred brand or last purchased brand variety).(31) Prevalence of FCC use from our study are higher than Euromonitor market share estimates, which indicated that FCCs made up over one-quarter (27.3%) of the total cigarette market in Mexico in 2020.(17) Although market share depends on consumption and price of different brands, and not necessarily concordant with prevalence, this finding highlights that while market share data have utility, prevalence data are critical for monitoring population-level trends.

The country with the second-highest prevalence of FCC use was Republic of Korea (31.8% in 2021), which showed a substantial increase from a 2016 ITC study (18%).(23). Our estimates correspond closely with Euromonitor market share data for FCCs (24.7% in 2020). High use may be a consequence of the documented industry marketing tactics for FCCs in Republic of Korea, including price promotions, point-of-sale advertising, and packaging(9,36).

We found that over one-quarter of adults who smoke in Malaysia (26.5% in 2020) and one-fifth of adults who smoke in Japan (21.6% in 2021) use FCCs. Both prevalence estimates are much higher than the market share data from Euromonitor, which reported that in 2020 FCCs made up only 0.7% of the total cigarette market share in Malaysia and 7.0% in Japan.(17) However, Euromonitor data estimates that menthol (non-capsule cigarettes) made up 24.8% of the total market share in Malaysia and 27.7% in Japan in 2020.(17) The discrepancy may therefore reflect

possibly inaccuracies or overlapping of these two categories. Reported tobacco industry tactics in both countries may explain high rates. In 2008, a ban on misleading packaging descriptors was followed by the introduction of menthol FCCs to the Malaysian market, and promoted with pack descriptors and imagery highlighting its innovative and technological features.(9,37) The first global market release of modern FCCs was in Japan in 2007.(38) In Japan, marketing tactics for FCCs have been observed at point-of-sale, including offering different brand variants ranging in reported tar yields that correspond to different package emblem sizes.(39)

Lastly, we found the lowest prevalence of FCC use in Brazil (6.7% in 2016-2017). This is generally consistent with Euromonitor data, which estimated that the market share of FCCs was 3.5% in 2016 and 3.7% in 2017.(40) It is possible that prevalence of FCC use has since increased from our 2016-2017 estimates, given the continued market growth (i.e., 3.9% in 2020).(17) Moreover, it is reported that the number of industry-registered flavoured tobacco products tripled from 2012 to 2021.(41) While lower than other countries examined, our data remain concerning, particularly given Brazil's large population, as well as strong tobacco industry efforts to promote flavoured tobacco products and to supress policies that banned flavours and other additives.(16,41–43) Brazil adopted a ban on all flavour additives in 2012, which was subsequently upheld by the Supreme Federal Court in 2018, yet on-going litigation in the lower courts continues to delay implementation.(43,44) Marketing strategies of FCCs in Brazil have included the use of concept flavour names, extensive retail availability near schools, and appealing packaging.(9,45,46) Despite these challenges, the relatively lower prevalence of FCC use may be

reflective of Brazil's strong tobacco control leadership to address flavour additives.(41) Further, most adults who smoke in Brazil support a ban on additives.(43)

Our findings on correlates of FCC use varied across the countries, but are largely consistent with previous studies.(18,21–24,26) We found that FCC use was associated with younger age in Japan, Republic of Korea, and Malaysia, with a marginally non-significant independent association with younger age in Mexico. This also aligns with a previous ITC study in Republic of Korea.(23) Young people are perceived to be the target population of FCCs,(18) as they contain several features known to appeal to this group, including colourful packaging, choice of flavours, the ability to customise, and connotations of a "high-tech" product.(7,9,47,48) Consistent with previous studies in Mexico,(5,19,21,22) we found greater preference for FCCs among females than males. We also found that in Japan, females had greater odds of FCC use. No significant association by sex was found in Brazil, Malaysia, or in Republic of Korea, which is inconsistent with a previous study that found that females in Republic of Korea were more likely to use FCCs than males.(23) FCCs have features that could appeal to both females and males, depending on the context and marketing environment.(18,49) Use of FCCs was associated with high education in Brazil, Japan, and Mexico, as has been observed in some studies.(5,18) Smoking frequency was only found to be correlated with FCC use in Republic of Korea, while plans to quit was only significant in Japan and Republic of Korea. Smoking and quitting behaviours have previously been mixed across studies that have examined this.(18)

Our study found that the most common crushing frequency reported by adults who smoke FCCs was crushing every capsule in a pack across the five countries that assessed this. Findings indicate that these products appear to be used as intended by the tobacco industry.(18,19) It is unclear what drives less frequent capsule crushing. However, given that marketing of FCCs is characterised by a focus on the user deciding when and if they release flavour, it is possible that some users enjoy the option of only sometimes smoking flavoured cigarettes.(9) Price differences between flavour capsule cigarettes and other types of cigarettes may further influence behaviour. In some countries, flavour capsule cigarettes are less expensive than unflavoured cigarettes.(50)

We further found no consistent pattern of consumer perceptions of the harmfulness of FCCs, with those using FCCs (vs no capsules) in Malaysia believing that their brand was less harmful, but those in Brazil using FCCs (vs no capsules) believing their brand was more harmful compared to other brands. These mixed findings are consistent with a review of this issue.(18) Qualitative studies have suggested that there is confusion around relative harm of FCCs, given that on one hand menthol and flavours can be perceived as less harmful, while on the other hand, the flavour-changing technology can been associated with additional chemicals.(7,49) Country differences in harm perceptions may also be modulated by tobacco control policies. For instance, in Republic of Korea, which requires robust graphic health warnings, we observed no differences in harm perceptions. In Japan, which only requires text warnings and does not prohibit misleading descriptors, those whose usual brand did not have capsules perceived their brand to be more harmful compared to those who used FCCs. However, this does not explain why in Malaysia, which has both graphic warnings and a ban on descriptors, we found that FCC users more

commonly reported that they perceived their brand to be less harmful. This is further supported by our finding that half of FCC users in Malaysia reported that a reason for choosing their brand is because it is "not as bad for health", significantly higher than non-capsule users. It is possible that marketing of FCCs in Malaysia may negate some of these policy effects.(51) One study reported how the tobacco industry used distinct descriptors and imagery on packaging of FCCs to reinforce its technological and innovate features.(37) This exemplifies the importance of standardised/plain packaging to remove all forms of marketing features that can be conveyed through packaging. Indeed, we also found that FCC users in Malaysia were significantly more likely to report the pack design as a reason for their usual brand choice.

While harm perceptions were not measured in Mexico in our study, other studies, including a recent ITC study,(5) have observed that FCC users perceive their brand to be less harmful,(5,21) particularly those who used discount brands.(19) In Brazil, our finding that those who used FCCs perceived their brand to be more harmful than those who did not use capsules may be a byproduct of its proposed regulation of flavour additives, and possible media attention around on-going litigation. These findings highlight how the complex interplay between the tobacco policy environment, marketing strategies, and other factors might influence how relative harm is perceived, which can also influence prevalence. Further research can help elucidate the factors driving FCC use and perceptions of harm.

Our findings in the two countries that assessed reasons for brand choice, Brazil and Malaysia, suggest that taste is consistently a motivating factor for preference of FCCs, consistent with

previous studies.(18) It should be noted that in Brazil, the proportion reporting taste as a reason for usual brand choice was significantly higher among those who used capsules vs no capsules. In Malaysia, however, the proportion was high in both groups, with no significant differences between groups.

The current study has limitations. First, the small sample size of adults who usually smoke FCCs in Brazil overall, as well as conditional subgroup estimates, along with high sampling variability (relative standard error > 0.3) may increase uncertainty of our estimates. Misclassification bias of predictor and outcome measures could have also occurred due to how questions were asked and categorised. For instance, although education categories were harmonized across countries for general comparative purposes, for Republic of Korea and Japan, categorisations may not accurately reflect standard educational levels in those countries. Given that analyses were country-specific, rather than pooled, estimates cannot be directly compared across countries. However, there is utility in examining FCC use across multiple countries to gain an understanding of how commonly these products are used and how they are used, thereby providing a better understanding of the FCC market in countries with varied contexts. This study is also strengthened by its use of comparable measures across multiple countries with varied contexts, many countries for which this is the first known study to estimate prevalence of FCC use.

CONCLUSION

Our research indicates that FCC use is popular among adults who smoke in Japan, Republic of Korea, Malaysia, and Mexico. We found relatively lower prevalence in Brazil, in which a ban on

tobacco flavour additives was adopted in 2012, although not yet implemented. While there were general trends of correlates of FCC use in some countries (e.g., females, younger adults), inconsistent patterns across countries suggest that user profiles may be context-specific and, potentially, a result of contrasting tobacco industry marketing practices and priorities. Findings underscore the importance of continuous population-level surveillance and monitoring of FCC use. This study also highlights the need for robust tobacco control policies to address the proliferation of FCCs, including banning flavour additives and filter technologies. Policy considerations may entail incorporating a ban on flavour capsules through plain/standardised packaging regulations, as well as banning flavours in tobacco products, including specification of flavour capsules,(52) following the lead of an increasing number of countries.(44)

WHAT IS ALREADY KNOWN ABOUT THIS TOPIC

- Flavour capsule cigarettes have experienced significant market growth globally, yet data on the prevalence and correlates of capsule use are scarce.

WHAT THIS STUDY ADDS

- This study of flavour capsule cigarettes in five countries found that a substantial proportion of adults who smoked used/preferred flavour capsule cigarettes: over 20% in four of the five countries (Mexico: 50.3%, Republic of Korea: 31.8%, Malaysia: 26.5%, Japan: 21.6% in 2020/2021), with Brazil having the lowest prevalence (6.7% in 2016/2017).
- There was no consistent pattern of perceptions of relative harmfulness of one's usual/current brand relative to other brands between those whose usual cigarette brand had a capsule vs no capsule across countries.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE, OR POLICY

- Findings support the need to implement comprehensive tobacco policies globally that address use of flavour capsule cigarettes, such as banning flavour additives and filter technologies.

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collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

CONFLICTS OF INTEREST

JFT has served as paid expert witness in legal challenges against tobacco and vaping companies. ASAN has received an unconditional educational grant from Johnson & Johnson Malaysia Sdn. Bhd., KK received a JMWH Bayer Grant from Japan Society for Menopause and Women's Health. GTF has been an expert witness or consultant for governments defending their country's policies or regulations in litigation and served as a paid expert consultant to the Ministry of Health of Singapore in reviewing the evidence on plain/standardized packaging. All other authors have no conflicts of interest to declare.

ETHICS

All participants provided consent to participate. The survey protocols and all materials of the ITC including the survey questionnaires, were cleared for ethics. ITC Brazil Wave 3 was cleared for ethics by the National Cancer Institute of Brazil (INCA) International Review Board. ITC Japan Wave 4 was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (REB#22508/31428), the Internal Review Board at the Osaka International Cancer Institute, Japan (IRB 21054) and the Internal Review Board at Japan National Cancer Center, Japan (IRB 2021-069). ITC Republic of Korea Wave 2 was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (ORE# 41512). ITC Malaysia Wave 1 (New Cohort) Survey was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (ORE#40825)

and Medical Research Ethics Committee, University of Malaya (MREC ID #2019118-8018). The ITC Mexico Wave 8 was cleared for ethics by the Instituo Nacional de Salud Publica, International Research Board. Secondary data analysis was cleared for ethics by the Imperial College Research Ethics Committee (ICREC 21IC6699).

DATA AVAILABILITY STATEMENT

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. The criteria for data usage approval and the contents of the Data Usage Agreement are described online (http://www.itcproject.org).

AUTHOR CONTRIBUTIONS

GTF, JFT, CDAP, HGS, SYK, ASAN, FMH, KK, TT, GTF are PIs of the ITC surveys. ACKQ is the Managing Director of the ITC surveys. CNK conceptualized the study, conducted data analysis, and is the guarantor. FTF and PD supervised. CNK and OE wrote the original draft and prepared the final version. All authors contributed to review and editing and approved the final manuscript.

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SUPPLEMENTARY TABLES

Supplementary Table 1. Country and survey characteristics across five countries of the ITC surveys

	BRAZIL	JAPAN	REPUBLIC OF KOREA	MALAYSIA	MEXICO
Country characteristics					
Country income level[a]	Upper-middle	High	High	Upper-middle	Upper-middle
Current cigarette smoking prevalence[b]	11.2%	18.9%	19.3%	17.9%	13.9%
Survey characteristics					
Survey sampling frame	Adults (aged 18+) who smoke cigarettes and non-smokers, living in Sao Paulo, Rio de Janeiro and Porto Alegre.	Adults (aged 20+) who smoke cigarettes, who use heated tobacco products, and non-users.	Adults (aged 19+) who smoke cigarettes, use heated tobacco products, use electronic cigarettes, and non-users.	Adults (aged 18+) who smoke cigarettes and non-smokers.	Adults (aged 18+) who smoke cigarettes.
Sampling design	Households randomly called using systematic sampling from an electronic phone number directory.	Rakuten Insight panel. Panelists pre-profiled with pre-targeted variables (e.g., smoking). Quotas based on the region of residence, sex, and age, were applied to ensure the final sample sizes were proportional to stratum sizes based on the Japan Society and Tobacco Internet Survey (JSTIS). Methods are used to maintain panel to be consistent as possible with general population.	Rakuten Insight panel. Panelists pre-profiled with pre-targeted variables (e.g., smoking). Quotas based on sex and age groups, applied to target final sample sizes proportional to stratum sizes based on smoking prevalence estimates in combination with Korea census data. Methods are used to maintain panel to be consistent as possible with general population.	Rakuten Insight panel. Panelists pre-profiled with pre-targeted variables (e.g., smoking). Quotas based on region of residence, sex, and age, were applied to ensure the final sample was proportional to stratum sizes based on Malaysian census data. Methods are used to maintain panel to be consistent as possible with general population.	Online market research consumer panel. Quotas based on age, sex, education groups, and people who vape..
Analytic sample	Adults (aged 18+) who smoke cigarettes at least monthly AND smoked 100+ cigarettes in their lifetime (N=1215).	Adults (aged 20+) who smoke cigarettes at least monthly AND smoked 100+ cigarettes in their lifetime (N=2876).	Adults (aged 19+) who smoke cigarettes at least monthly AND smoked 100+ cigarettes in their lifetime (N=3765).	Adults (aged 18+) who smoke cigarettes at least monthly AND smoked 100+ cigarettes in their lifetime (N=1104).	Adults (aged 18+) who smoked cigarettes in the last 30 days (N=1104).
Sample type	Recontact and replenishment	Recontact and replenishment	Recontact and replenishment	Newly sampled	Recontact and replenishment
Dates of data collection	September 2016 to March 2017	July 2021 to August 2021	November 2021 to December 2021	February 2020 to March 2020	March 2021 to April 2021
Survey wave	3	4	2	1	8
Survey mode	Telephone	Web	Web	Web	Web
Response rate (%)[c]	35.5	27.4	16.4	11.3	--
Cooperation rate (%)	60.4	94.5	97.0	95.3	--

[a] 2021 World Bank

[b] 2021 WHO age-standardized estimated prevalence of smoking among those aged 15 years or more; WHO report on the global tobacco epidemic, 2023: protect people from tobacco smoke. Geneva: World Health Organization; 2023.

[c] The denominator of the response rates for the web panel surveys (all countries except Brazil) is all potential respondents who were sent invitations to the surveys. It should be noted that many panel members are no longer active. For the telephone survey in Brazil, the denominator of the response rate is all potential respondents who were phoned. Those who did not answer after seven tries were considered a non-response. Post-stratification weights adjust for non-response bias.

Supplementary Table 2. Overall sample characteristics of adults who smoke cigarettes across five countries of the ITC Surveys, weighted (full table)

	BRAZIL *Wave 3, 2016/2017* (N=1215)			JAPAN *Wave 4, 2021* (N=2876)			REPUBLIC OF KOREA *Wave 2, 2021* (N=3765)			MALAYSIA *Wave 1, 2020* (N=1104)			MEXICO *Wave 8, 2021* (N=1331)		
	n	%	95%CI	n	%	95%CI	n	%	95%CI	n	%	95%CI	n	%	95%CI
Sex															
Male	602	47.9	(43.7, 42.2)	2090	67.5	(63.0, 71.8)	3250	89.9	(85.8, 92.9)	995	97.3	(96.5, 97.9)	645	60.1	(53.3, 66.5)
Female	614	52.1	(47.8, 56.3)	786	32.4	(28.2, 37.0)	515	10.1	(7.1, 14.2)	105	2.7	(2.1, 3.5)	686	39.9	(33.5, 46.7)
Age group (years)															
18-24 [a]	26	4.4	(2.8, 7.1)	14	2.7	(0.8, 8.5)	325	8.8	(4.5, 16.5)	160	13.7	(11.4, 16.4)	134	9.6	(6.7, 13.5)
25-39	205	34.6	(30.2, 39.2)	758	31.9	(27.4, 36.8)	1213	26.2	(22.6, 30.2)	670	51.0	(47.1, 54.9)	575	56.1	(49.2, 62.7)
40-54	334	34.6	(30.8, 38.6)	988	31.7	(28.2, 35.3)	1698	37.4	(32.7, 42.4)	228	29.7	(26.0, 33.8)	437	25.9	(20.6, 32.0)
55+	651	26.3	(23.4, 29.5)	1116	33.8	(30.0, 37.7)	1229	27.6	(22.2, 33.7)	46	5.5	(3.9, 7.8)	185	8.4	(6.2, 11.3)
Education															
Low	357	29.5	(25.8, 33.4)	78	2.2	(1.7, 2.8)	89	1.9	(1.2, 3.1)	366	47.6	(43.7, 51.5)	116	47.6	(40.3, 54.9)
Moderate	435	37.5	(33.4, 41.8)	1448	52.5	(48.0, 56.9)	2399	58.6	(53.6, 63.5)	314	36.5	(32.8, 40.3)	763	36.7	(31.2, 42.6)
High	406	31.9	(28.0, 36.1)	1312	45.3	(40.9, 49.8)	1022	39.4	(34.7, 44.4)	412	15.9	(14.0, 18.0)	452	15.7	(12.7, 19.2)
Smoking frequency															
Daily	18	1.1	(0.6, 2.1)	2426	69.1	(62.9, 74.7)	3240	69.6	(61.8, 76.4)	937	88.5	(86.0, 90.5)	651	47.1	(40.0, 54.3)
Non-daily	1,135	92.8	(90.2, 94.8)	450	30.9	(25.3, 37.1)	525	30.4	(23.6, 38.2)	167	11.5	(9.4, 14.0)	660	52.9	(45.7, 60.0)
Plans to quit															
No plans	81	7.2	(5.2, 9.8)	1284	46.1	(41.3, 50.9)	1028	30.0	(25.5, 35.0)	153	14.8	(12.1, 17.9)	294	23.8	(18.0, 30.9)
Within the next 6 months	574	52.9	(48.4, 57.3)	235	19.4	(14.3, 25.7)	1042	40.3	(33.9, 47.0)	460	42.0	(38.2, 46.0)	460	38.7	(31.5, 46.5)
In future beyond 6 months	316	23.9	(20.5, 27.7)	924	34.5	(30.4, 38.9)	1313	29.7	(24.5, 35.4)	424	43.2	(39.2, 47.2)	485	37.4	(30.6, 44.8)

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

Supplementary Table 3. Prevalence of usual/preferred brand has a flavour capsule overall and by sociodemographic characteristics and smoking behaviours among adults who smoke cigarettes across five countries of the ITC Surveys, weighted (full table)

	BRAZIL *Wave 3, 2016/2017* **(N=1215)**			JAPAN *Wave 4, 2021* **(N=2876)**			REPUBLIC OF KOREA *Wave 2, 2021* **(N=3365)**			MALAYSIA *Wave 1, 2020* **(N=1104)**			MEXICO *Wave 8, 2021* **(N=1331)**		
	n	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**
Overall	74	6.7	(4.7, 9.5)	485	21.6	(17.4, 26.4)	1116	31.8	(26.4, 37.8)	332	26.5	(23.3, 30.0)	751	50.3	(43.1, 57.4)
Sex															
Male	39	6.1	(4.0, 9.2)	313	20.1	(15.0, 26.4)	1022	31.3	(25.4, 37.7)	294	26.3	(23.0, 30.0)	304	39.1	(30.0, 49.0)
Female	35	7.3	(4.1, 12.6)	172	24.5	(18.0, 32.5)	94	38.0	(26.8, 50.8)	38	32.3	(21.6, 45.1)	447	67.2	(58.0, 75.2)
Age group (years) [a]															
18-24	2	12.0	(2.0, 47.4) ‡	3	80.4	(44.3, 95.5) ‡	7	61.3	(26.4, 87.4)	45	23.7	(16.7, 32.6)	94	70.1	(52.2, 83.4)
25-39	21	8.5	(4.7, 14.9)	167	26.2	(18.5, 35.7)	552	43.1	(36.5, 49.9)	222	30.3	(26.0, 35.0)	376	54.7	(43.4, 65.5)
40-54	20	4.6	(2.5, 8.4) ‡	172	19.7	(14.7, 25.9)	555	28.9	(23.0, 35.7)	60	25.0	(18.6, 32.8)	216	39.6	(29.1, 51.2)
55+	31	6.2	(3.5, 10.8)	143	13.8	(10.4, 18.1)	154	14.3	(6.0, 30.3) ‡	5	7.6	(2.3, 22.3) ‡	65	30.4	(18.7, 45.3)
Education															
Low	18	4.4	(2.3, 8.3) ‡	6	6.6	(2.2, 18.1) ‡	8	22.1	(8.6, 45.9) ‡	103	26.2	(21.3, 31.9)	62	43.7	(30.9, 57.4)
Moderate	24	6.7	(3.5, 12.5) ‡	253	18.9	(14.8, 23.8)	21	29.1	(20.7, 39.1)	79	24.0	(18.7, 30.1)	402	54.8	(48.5, 61.0)
High	32	9.0	(5.3, 14.9)	220	24.8	(17.7, 33.7)	93	36.5	(31.4, 41.9)	147	31.6	(26.4, 37.3)	282	59.8	(50.5, 68.6)
Refused/don't know*	0	--	--	6	--	--	3	--	--	3	--	--	0	--	--
Smoking frequency															
Daily	66	13.8	(4.9, 33.4)	373	17.4	(15.7, 19.1)	1113	26.5	(23.9, 29.3)	278	26.3	(22.8, 30.1)	348	52.9	(42.8, 62.8)
Non-daily	8	6.1	(4.2, 8.9) ‡	112	31.5	(19.4, 46.7)	2	44.5	(28.2, 62.0)	54	28.0	(19.7, 38.0)	403	47.2	(37.2, 57.6)
Refused/ don't know*	0	--	--	0	--	--	0	--	--	0	--	--	0	--	--
Plans to quit															
No plans	19	5.4	(2.9, 9.9) ‡	184	17.8	(11.7, 26.1)	3	28.5	(19.9, 38.9)	43	27.4	(18.9, 38.1)	177	53.6	(37.8, 68.8)
Within the next 6 months	33	6.5	(3.7, 11.1)	60	27.7	(15.0, 45.5)	3	38.0	(26.6, 50.9)	157	30.1	(24.9, 35.9)	256	52.5	(39.8, 64.9)
In future beyond 6 months	19	8.4	(4.0, 16.6) ‡	177	23.6	(18.0, 30.4)	412	30.8	(24.1, 38.4)	116	23.7	(18.9, 29.3)	285	47.2	(36.3, 58.4)
Refused/don't know*	3	--	--	64	--	--	8	--	--	16	--	--	33	--	--

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

Supplementary Table 4. Correlates of usual cigarette brand smoke has a flavour capsule among adults who smoke across five countries of the ITC Surveys, weighted, logistic regression analyses (full table)

	BRAZIL *Wave 3, 2016/2017* (N=1215)			JAPAN *Wave 4, 2021* (N=2876)			REPUBLIC OF KOREA *Wave 2, 2021* (N=3765)			MALAYSIA *Wave 1, 2020* (N=1104)			MEXICO *Wave 8, 2021* (N=1331)		
	aOR†	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**
Sex															
Male	1.00			1.00			1.00			1.00			1.00		
Female	1.41	(0.69, 2.86)	0.341	1.79	(1.35, 2.38)	**<0.001**	1.03	(0.61, 1.75)	0.901	1.39	(0.78, 2.47)	0.264	3.18	(1.69, 5.98)	**<0.001**
Age group (years) [a]															
18-24	1.69	(0.36, 7.88)	0.506	0.29	(0.04, 2.26)	0.235	16.69	(8.11, 34.33)	**<0.001**	3.43	(0.84, 13.98)	0.085	3.10	(0.99, 9.73)	0.052
25-39	1.89	(0.83, 3.83)	0.077	1.55	(1.13, 2.11)	**0.006**	4.61	(2.94, 7.22)	**<0.001**	4.25	(1.10, 16.38)	**0.035**	2.13	(0.88, 5.14)	0.092
40-54	0.94	(0.46, 1.93)	0.876	1.18	(0.88, 1.58)	0.261	2.38	(1.51, 3.75)	**<0.001**	3.19	(0.80, 12.76)	0.101	1.37	(0.57, 3.28)	0.486
55+	1.00			1.00			1.00			1.00			1.00		
Education															
Low	1.00			1.00			1.00			1.00			1.00		
Moderate	1.28	(0.54, 3.02)	0.569	3.44	(0.87, 13.51)	0.077	0.74	(0.20, 2.71)	0.654	0.82	(0.53, 1.27)	0.374	1.72	(0.87, 3.42)	0.120
High	2.37	(1.12, 4.99)	**0.024**	4.04	(1.01, 16.10)	**0.048**	1.20	(0.33, 4.32)	0.784	1.27	(0.86, 1.86)	0.224	2.38	(1.10, 5.15)	**0.028**
Smoking frequency															
Daily	1.00			1.00			1.00			1.00			1.00		
Non-daily	1.68	(0.56, 5.07)	0.358	1.43	(0.93, 2.22)	0.105	1.76	(1.07, 2.[illegible])	**0.026**	0.96	(0.58, 1.60)	0.890	0.91	(0.47, 1.77)	0.782
Plans to quit															
No plans	1.00			1.00			1.00			1.00			1.00		
Within the next 6 months	1.28	(0.56, 2.93)	0.550	2.13	(1.42, 3.19)	**<0.001**	1.56	(1.10, 2.[illegible])	**0.013**	1.05	(0.59, 1.84)	0.874	0.93	(0.40, 2.19)	0.868
In future beyond 6 months	1.98	(0.85, 4.59)	0.112	1.51	(1.15, 1.98)	**0.003**	1.50	(1.04, 2.[illegible])	**0.030**	0.74	(0.41, 1.32)	0.303	0.66	(0.31, 1.37)	0.261

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

† Separate logistic regression models estimated for each country and adjusted for all variables in table.

Bolded= p<0.05

Supplementary Table 5. Frequency of crushing capsule among adults who smoke whose usual/current brand of cigarettes has a flavour capsule across four countries of the ITC Surveys, weighted (full table)

	BRAZIL *Wave 3, 2016/2017* **(N=74)**			**JAPAN** *Wave 4, 2021* **(N=485)**			**REPUBLIC OF KOREA** *Wave 2, 2021* **(N=1216)**			**MALAYSIA** *Wave 1, 2020* **(N=332)**		
Frequency of crushing capsules [a]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**
Every capsule	38	52.7	(34.4, 70.3)	332	76.6	(67.9, 83.5)	711	59.7	(47.1, 71.1)	138	45.1	(37.7, 52.7)
Most capsules	5	12.1	(3.3, 35.7) ‡	71	13.6	(8.2, 21.8)	266	24.2	(13.1, 40.3)	93	26.1	(20.2, 33.0)
About half of capsules	5	3.0	(1.0, 8.9) ‡	23	3.1	(1.8, 5.0)	119	5.0	(3.1, 8.0)	42	10.5	(7.1, 15.2)
Some capsules, but less than half	10	14.3	(5.5, 32.5) ‡	29	3.7	(2.3, 5.8)	70	6.5	(4.0, 10.4)	27	7.1	(4.2, 11.6)
Never	15	17.8	(8.2, 34.5) ‡	22	3.1	(1.8, 5.1)	46	4.6	(2.8, 7.6)	21	11.2	(6.9, 17.5)

[a] *"When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?";* This question was not asked in the Wave 8 ITC Mexico survey.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

Refused/don't know responses set to missing: Brazil (n=1), Japan (n=8), Republic of Korea (n=4), Malaysia (n=1)

Supplementary Table 6. Perceptions of usual cigarette brand harmfulness compared to other brands among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsules across four countries of the ITC Surveys, weighted (full table)

	BRAZIL							JAPAN						
	Flavour capsule (N=74)			No capsule (N=1127)				Flavour capsule (N=485)			No capsule (N=2211)			
Harm of usual brand compared to others [a]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]
Little less harmful	15	13.7	(6.3, 27.3) ‡	228	19.1	(16.9, 21.7)	0.372	35	8.8	(4.3, 17.1) ‡	133	6.9	(5.1, 9.2)	0.533
No different	44	58.0	(38.6, 75.2)	761	70.6	(66.8, 74.4)	0.175	348	85.0	(76.8, 90.6)	1446	77.2	(72.8, 81.1)	0.084
Little more harmful	12	28.3	(13.1, 50.9) ‡	105	10.2	(7.9, 13.3)	**0.011**	36	6.2	(4.0, 9.6)	290	15.9	(12.4, 20.1)	**<0.001**
Refused/don't know*	3	--	--	33	--	--	--	66	--	--	342	--	--	--
	REPUBLIC OF KOREA							**MALAYSIA**						
	Flavour capsule (N=1216)			No capsule (N=2414)				Flavour capsule (N=332)			No capsule (N=719)			
Harm of usual brand compared to others [a]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]
Little less harmful	72	11.5	(4.4, 26.8) ‡	118	8.7	(4.2, 17.9)	0.633	58	18.5	(13.3, 25.0)	86	11.1	(8.5, 14.4)	**0.016**
No different	820	74.2	(61.4, 83.8)	1761	78.5	(71.1, 84.0)	0.496	202	66.9	(58.6, 73.6)	516	78.6	(74.5, 82.1)	**0.003**
Little more harmful	238	14.3	(8.8, 22.6)	360	12.8	(10.1, 16.1)	0.681	54	14.6	(10.1, 20.6)	76	10.3	(7.9, 13.4)	0.128
Refused/ don't know*	86	--	--	175	--	--	--	18	--	--	41	--	--	--

[a] "*Do you think that the brand you usually/currently smoke, might be a little less harmful, no different, or a little more harmful, compared to other cigarette brands?";* This question was not asked in the Wave 8 (2021) ITC Mexico study. However, ITC Mexico data from 2018-2020 captured relative harm perceptions in a recent study.(5)

[b] P-values from weighted $\chi 2$ tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule; **Bolded**= $p<0.05$

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

Supplementary Table 7. Reasons for usual brand choice among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsules in Brazil and Malaysia, ITC Surveys, weighted

	BRAZIL							MALAYSIA						
	Flavour capsule (N=74)			No capsule (N=1127)				Flavour capsule (N=332)			No capsule (N=719)			
Reasons for usual brand choice [a]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]
Taste (Yes)	65	89.5	(74.8, 96.1)	644	60.6	(56.0, 65.1)	**<0.001**	290	95.9	(91.6, 98.0)	593	93.0	(89.9, 95.2)	0.198
No	9			399				13			40			
Don't know/refused/not applicable*	0			10				29			86			
Price (Yes)	17	27.6	(14.7, 45.7)	380	37.1	(32.9, 41.6)	0.288	225	79.1	(72.7, 84.3)	442	73.9	(69.5, 77.8)	0.167
No	57			670				77			191			
Don't know/refused/not applicable*	0			3				30			86			
Tar, nicotine levels (Yes)	22	33.4	(18.8, 52.1)	348	33.9	(29.7, 38.3)	0.960	--	--	--	--	--	--	--
No	52			663										
Don't know/refused/not applicable *	0			42										
Not as bad for health (Yes)	22	23.7	(12.8, 39.5)	397	37.8	(33.5, 42.4)	0.080	148	50.3	(42.5, 58.0)	184	25.7	(22.5, 31.5)	**<0.001**
No	52			628				138			401			
Don't know/refused/not applicable *	0			28				46			134			
Pack colour (Yes)	14	21.5	(10.4, 39.6) ‡	116	10.8	(8.0, 14.4)	0.077	--	--	--	--	--	--	--
No	59			930										
Don't know/refused/not applicable *	1			7										
Pack design (Yes)	--	--	--	--	--	--	--	152	46.1	(38.6, 53.8)	148	20.8	(17.2, 24.9)	**<0.001**
No								147			478			
Don't know/refused/not applicable*								33			93			
Friends use (Yes)	--	--	--	--	--	--	--	170	52.0	(44.3, 59.7)	245	35.3	(30.8, 40.0)	**<0.001**
No								126			374			
Don't know/refused/not applicable *								36			100			

[a] *"In choosing your usual brand, was part of your decision to smoke this brand based on any of the following…"*

[b] P-values from weighted $\chi 2$ tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule; **Bolded**= $p<0.05$

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

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Prevalence and perceptions of flavour capsule cigarettes among adults who smoke in Brazil, Japan, Republic of Korea, Malaysia, and Mexico: Findings from the ITC Surveys

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ABSTRACT

Introduction: The global market of flavour capsule cigarettes (FCCs) has grown significantly over the past decade, however prevalence data exist for only a few countries. This study examined prevalence and perceptions of FCCs among adults who smoke across five countries.

Methods: Cross-sectional data among adults who smoked cigarettes came from the International Tobacco Control Policy Evaluation (ITC) Project Surveys— Brazil (2016/2017), Japan (2021), Republic of Korea (2021), Malaysia (2020), and Mexico (2021). FCCs use was measured based on reporting one's usual/current brand or favourite variety has flavour capsule(s). Perceptions of the harmfulness of one's usual brand vs other brands was compared between those who used capsules vs no capsules. Adjusted logistic regression models examined correlates of FCC use.

Results: There were substantial differences in the prevalence of FCC use among adults who smoke across the five countries: Mexico (50.3% in 2021), Republic of Korea (31.8% in 2021), Malaysia (26.5% in 2020), Japan (21.6% in 2021), and Brazil (6.7% in 2016/2017). Correlates of FCC use varied across countries. Capsule use was positively associated with being female in Japan and Mexico, younger age in Japan, Republic of Korea and Malaysia, high education in Brazil, Japan, and Mexico, non-daily smoking in Republic of Korea, and having plans to quit in Japan and Republic of Korea. There was no consistent pattern of consumer perceptions of brand harmfulness.

Conclusion: Our study documented the high prevalence of FCCs in some countries, pointing to the need to develop and implement regulatory strategies to control these attractive products.

Strengths and limitations of this study

- This study is strengthened by its use of the International Tobacco Control Policy Evaluation (ITC) Project surveys, which are a series of prospective cohort studies designed to be comparable across countries.
- ITC studies use a theory-informed conceptual framework that considers moderators, which have been adjusted for in logistic regression analyses of the current study.
- Cross-sectional data may not capture the full scope of flavour capsule cigarette patterns across countries.
- Most country samples were derived from online consumer panels, and while efforts were made to yield samples that were nationally representative, samples may not represent the entire population of adults who smoke cigarettes.

MAIN TEXT

INTRODUCTION

The incorporation of flavours into cigarettes by tobacco companies poses a significant threat to global tobacco control efforts by enhancing the attractiveness of these products.(1) Among these methods is through the use of flavour capsules.

Flavour capsule cigarettes (FCCs) contain one or two capsules in the cigarette filter which release flavour when the consumer crushes it.(2) They come in several flavours, including both traditional flavours (e.g., menthol, berry) and those with 'concept descriptors' (e.g., Mykonos Nightfall)(3–5). The choice of flavours, the enjoyment of clicking the capsule, and the ability to customise when and if to crush the capsule contribute to their appeal.(6–8) FCCs are marketed through a mix of strategies.(9–11) In addition to contributing to the appeal of tobacco products through features known to be particularly attractive to young people,(9) research indicates that FCCs contain a myriad of chemical components, many of which are toxic and possibly carcinogenic.(12,13) Further, components detected in FCCs may increase nicotine delivery and exposure, thereby facilitating addictiveness. (12,13)

In recent years, the market share of FCCs has grown substantially in many countries, particularly in low- and middle-income countries.(14–16). In 2014, when the global cigarette market experienced a marked acceleration of FCC growth(15), FCCs accounted for 10-25% of the cigarette market share in the top five countries with the largest FCC shares, all in Latin America (i.e., Chile, Peru, Guatemala, Mexico, and Argentina).(14) By 2020, FCCs made up 25-50% of the

overall cigarette market in five countries with the largest FCC market shares(17) (i.e., Chile, Peru, Guatemala, Mexico, and Republic of Korea).

Despite these trends, there is a dearth of research on the prevalence of FCC use in countries where these products are available on the market(18). Prevalence data (current or ever use among people who smoke) exist for only a handful of countries, including Australia(19), Chile(20), Mexico(5,19,21,22), Republic of Korea(23), the United Kingdom(24), and the United States(19,25,26). Previous studies have found that FCC appeal and use is associated with younger age(5,19–21,24), and in some countries, with being female(5,19–21,23). Smoking and quitting behaviours, are not consistently associated with FCC use.(18)

Monitoring trends in flavoured tobacco product use is integral to tobacco control as flavours increase the appeal of tobacco, particularly among youth.(1,27,28) Such data can support adoption of Article 9 of the World Health Organization Framework Convention on Tobacco Control, which calls upon Parties to prohibit or restrict flavours, as well as to regulate other design features that increase the attractiveness of tobacco products, including the placement of capsules in cigarette filters that release flavour when crushed.(29) In order to fill in research gaps and provide insight into how FCC use may vary across countries with different markets and tobacco control policies, this study aimed to: (1) examine prevalence and correlates of use of FCCs across five countries (Brazil, Japan, Republic of Korea, Malaysia, and Mexico), (2) describe FCC crushing behaviours,

and (3) compare perceptions of brand harmfulness and reasons for choosing one's brand among adults who smoke FCCs vs non-capsule cigarettes.

METHODS

Study Design

Cross-sectional data came from the latest survey wave conducted in each of five countries participating in the International Tobacco Control Policy Evaluation (ITC) Project surveys: Wave 3 Brazil (September 2016 to March 2017), Wave 4 Japan (July to August 2021), Wave 2 Republic of Korea (November to December 2021), Wave 1 Malaysia (February to March 2020), and Wave 8 Mexico (March to April 2021). These five countries were selected based on availability of measures on FCCs among the countries participating in the ITC Project. Other requirements for inclusion entailed having sufficient sample size, not having an implemented national ban on flavoured tobacco products, including flavour capsule cigarettes, at the time of the survey, and approval from country survey Principal Investigators. This broad criterion was used given the scarcity of flavour capsule cigarette prevalence data globally. Age-standardised cigarette smoking prevalence in 2021 ranged from 11.2% in Brazil to 13.9% in Mexico, 17.9% in Malaysia, 18.9% in Japan, and 19.3% in Republic of Korea.(30) Brazil, Malaysia and Mexico are upper-middle-income countries, while Japan and Republic of Korea are high-income countries. (**Supplementary Table 1**).

All surveys sampled adults who smoked cigarettes, however other groups were also sampled in some surveys (e.g., heated tobacco product users, e-cigarette users, non-users) (**Supplementary**

Table 1). The current analytic sample was restricted to adults (aged ≥18 years in Brazil, Malaysia, and Mexico, ≥19 in Republic of Korea, and ≥20 in Japan) who smoked cigarettes. Cigarette smoking was defined as those who smoked at least 100 cigarettes in their lifetime and smoked at least monthly at the time of the survey. In Mexico, current smoking was only defined as having smoked cigarettes in the last 30 days (yes/no) because of validity concerns around the 100 cigarette screening question.(31)

Data were collected remotely using web-based surveys in all countries except Brazil, where data were collected via computer assisted telephone interviewing. With the exception of Brazil, in which households were randomly called using systematic sampling, participants were recruited from online consumer panels, with quotas for age, sex, and education groups, as well as type of tobacco and nicotine products use, depending on the country.(32–35) In all countries except Malaysia (which was Wave 1 of the survey), the sample included both re-contact respondents from previous survey wave(s), as well as replenishment respondents who were newly sampled at the current survey wave to compensate for attrition. Response and cooperation rates are also presented alongside country and survey characteristics in **Supplementary Table 1**. All study participants provided informed consent. Ethical approval was obtained by the Research Ethics Board of the University of Waterloo, Ontario, Canada and by local ethics boards in the countries assessed. Secondary data analysis was cleared for ethics by the Imperial College Research Ethics Committee. Detailed description of the methods employed for the respective surveys used in this study are available on the ITC website for each country(32–35)

Patient and public involvement

Patients were not involved in this study.

Measures

Usual/preferred cigarette brand has a flavour capsule

Respondents in Brazil, Japan, Republic of Korea, and Malaysia were asked the question, "*Does your usual/current brand have a capsule in the filter that releases flavour when it is crushed?*" (yes; no). In Mexico, respondents were told that, "*Some varieties of cigarettes have one or more flavor capsules in the filter, which release a flavor when crushed",* and subsequently asked, *"Does your favorite variety of cigarettes have flavor capsules?*" (Yes, they have a flavour capsule in the filter; Yes, they have two or more flavour capsules in the filter; No, they do not have any flavour capsule).

Frequency of crushing flavour capsule cigarettes

Respondents from Brazil, Japan, Republic of Korea, and Malaysia who indicated "yes" to the question about usual/current brand with capsule were asked, "*When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?*" (Every capsule; Most capsules; About half the capsules; Some capsules, but less than half; Never). This question was not asked among respondents in Mexico.

Perceived harmfulness of usual brand

Perceived harmfulness of usual brand was examined with the question, "*Do you think that the brand you usually/currently smoke, might be a little less harmful, no different, or a little more harmful, compared to other cigarette brands?"* (a little less harmful, no different, a little more harmful, don't know) among respondents from Brazil, Japan, Republic of Korea, and Malaysia. This question was not asked among respondents in Mexico.

Reasons for choosing usual brand

To examine reasons for choosing one's usual brand, respondents in Brazil and Malaysia were asked a series of questions with the prompt: "*In choosing your usual brand, was part of your decision to smoke this brand based on any of the following…"* The following questions were asked to respondents in Brazil: *How they taste?; The price?; The tar and nicotine levels for the brand?; They may not be as bad for your health?; The colour of the pack?* (yes, no; for each response). In Malaysia, respondents were asked the following questions: *How they taste?; They may not be as bad for your health? Your friends smoke this brand?; The design of the pack?"* (yes, no; for each question). These questions were not asked among respondents in Japan, Republic of Korea, and Mexico.

Sociodemographic and cigarette smoking behaviours

Covariates examined were sex (male, female), age group (18-24, 25-39, 40-54, 55+ years), education (low [less than high school], moderate [high school], and high [university or higher]),

smoking frequency (daily, non-daily), and plans to quit smoking (no plans, plans to quit within the next 6 months, plans to quit in the future beyond 6 months).

Data analysis

Bivariate and multivariable analyses were conducted in Stata/SE V.16.1 (StataCorp, 2019) using weighted data. Post-stratification weights were constructed by the ITC team based on the distribution of sex, age, and education in the general population of smokers for each country.(32–35) Analyses were country-specific, accounting for the sampling design in each country. Refused/ "Don't know" responses were set to missing data for each respective measure (missing n are reported in supplementary tables). Usual/preferred use of FCCs was examined overall and by sociodemographic and smoking behaviours for each country separately, reported as percentages with 95% confidence intervals (CIs). Logistic regression models were estimated separately for each country to examine correlates of usual/preferred use of FCCs. Models were adjusted for sex, age, education, smoking frequency, and plans to quit smoking with results presented as adjusted odds ratios (aORs) with 95% CIs and p-values. Covariates were identified conceptually based on the literature(18) and included in the models based on availability of consistent measures across all countries. Chi-square (χ^2) tests were conducted to compare perceptions of harmfulness of one's usual/current brand relative to other brands and reasons for one's usual brand choice, respectively, between those whose usual cigarette brand had a capsule vs no capsule, with p-values reported.

RESULTS

Sample characteristics

The overall sample included adults who smoked cigarettes from Brazil (N=1215), Japan (N=2876), Republic of Korea (N=3765), Malaysia (N=1104), and Mexico (N=1331). Sample characteristics varied across the countries **(Table 1; Supplementary Table 2** for full table).

Table 1. Overall sample characteristics of adults who smoke cigarettes across five countries of the ITC Surveys, weighted [a]

	BRAZIL (N=1215)	JAPAN (N=2876)	REPUBLIC OF KOREA (N=3765)	MALAYSIA (N=1104)	MEXICO (N=1331)
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
Sex					
Male	47.9 (43.7, 42.2)	67.5 (63.0, 71.8)	89.9 (85.8, 92.9)	97.3 (96.5, 97.9)	60.1 (53.3, 66.5)
Female	52.1 (47.8, 56.3)	32.4 (28.2, 37.0)	10.1 (7.1, 14.2)	2.7 (2.1, 3.5)	39.9 (33.5, 46.7)
Age group (years)					
18-24 [b]	4.4 (2.8, 7.1)	2.7 (0.8, 8.5)	8.8 (4.5, 16.5)	13.7 (11.4, 16.4)	9.6 (6.7, 13.5)
25-39	34.6 (30.2, 39.2)	31.9 (27.4, 36.8)	26.2 (22.6, 30.2)	51.0 (47.1, 54.9)	56.1 (49.2, 62.7)
40-54	34.6 (30.8, 38.6)	31.7 (28.2, 35.3)	37.4 (32.7, 42.4)	29.7 (26.0, 33.8)	25.9 (20.6, 32.0)
55+	26.3 (23.4, 29.5)	33.8 (30.0, 37.7)	27.6 (22.2, 33.7)	5.5 (3.9, 7.8)	8.4 (6.2, 11.3)
Education					
Low	29.5 (25.8, 33.4)	2.2 (1.7, 2.8)	1.9 (1.2, 3.1)	47.6 (43.7, 51.5)	47.6 (40.3, 54.9)
Moderate	37.5 (33.4, 41.8)	52.5 (48.0, 56.9)	58.6 (53.6, 63.5)	36.5 (32.8, 40.3)	36.7 (31.2, 42.6)
High	31.9 (28.0, 36.1)	45.3 (40.9, 49.8)	39.4 (34.7, 44.4)	15.9 (14.0, 18.0)	15.7 (12.7, 19.2)
Smoking frequency					
Daily	92.8 (90.2, 94.8)	69.1 (62.9, 74.7)	69.6 (61.8, 76.4)	88.5 (86.0, 90.5)	47.1 (40.0, 54.3)
Non-daily	1.1 (0.6, 2.1)	30.9 (25.3, 37.1)	30.4 (23.6, 38.2)	11.5 (9.4, 14.0)	52.9 (45.7, 60.0)
Plans to quit					
No plans	7.2 (5.2, 9.8)	46.1 (41.3, 50.9)	30.0 (25.5, 35.0)	14.8 (12.1, 17.9)	23.8 (18.0, 30.9)
Within the next 6 months	52.9 (48.4, 57.3)	19.4 (14.3, 25.7)	40.3 (33.9, 47.0)	42.0 (38.2, 46.0)	38.7 (31.5, 46.5)
In future beyond 6 months	23.9 (20.5, 27.7)	34.5 (30.4, 38.9)	29.7 (24.5, 35.4)	43.2 (39.2, 47.2)	37.4 (30.6, 44.8)

[a] See **Supplementary Table 2** for full table, including n

[b] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

Prevalence and correlates of FCC use

Among adults who smoked cigarettes, the prevalence of FCC use was 50.3% (95%CI: 43.1–57.4%)[1] in Mexico, 31.8% (26.4–37.8%) in Republic of Korea, 26.5% (23.3–30.0%) in Malaysia, 21.6% (17.4–26.4%) in Japan, and 6.7% (4.7–9.5%) in Brazil **(Table 2; Supplementary Table 3** for full table**)**. Use of FCCs was significantly higher among females than males in Japan (aOR=1.79) and Mexico (aOR=3.18), with no differences by sex in the other countries **(Table 3; Supplementary Table 4** for full table**)**. Younger age was associated with FCC use in Japan, Republic of Korea, and Malaysia. In Mexico, a higher proportion of use was observed among those aged 18-24 (70.1%) vs 55+ (30.4%) **(Table 2)**, but this was marginally not significant after controlling for other factors (aOR=3.10, 0.99–9.73) **(Table 3)**. Use of FCCs was associated with high compared to low education in Brazil (aOR=2.37), Japan (aOR=4.04), and Mexico (aOR=2.38). Those who smoked cigarettes non-daily had greater odds of usually using FCCs than those who smoked daily in Republic of Korea (aOR=1.76). Having plans to quit was associated with using FCCs in Japan and Republic of Korea.

[1] Throughout this article, we present the 95% confidence intervals for each estimate as a range between the lower bound and upper bound.

Table 2. Prevalence of usual/preferred brand has a flavour capsule overall and by sociodemographic characteristics and smoking behaviours adults who smoke cigarettes across five countries of the ITC Surveys, weighted [a]

	BRAZIL (N=1215)	JAPAN (N=2876)	REPUBLIC OF KOREA (N=3765)	MALAYSIA (N=1104)	MEXICO (N=1331)
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
Overall	6.7 (4.7, 9.5)	21.6 (17.4, 26.4)	31.8 (26.4, 37.8)	26.5 (23.3, 30.0)	50.3 (43.1, 57.4)
Sex					
Male	6.1 (4.0, 9.2)	20.1 (15.0, 26.4)	31.3 (25.4, 37.7)	26.3 (23.0, 30.0)	39.1 (30.0, 49.0)
Female	7.3 (4.1, 12.6)	24.5 (18.0, 32.5)	38.0 (26.8, 50.8)	32.3 (21.6, 45.1)	67.2 (58.0, 75.2)
Age group (years) [b]					
18-24	12.0 (2.0, 47.4) ‡	80.4 (44.3, 95.5) ‡	61.3 (26.4, 87.4)	23.7 (16.7, 32.6)	70.1 (52.2, 83.4)
25-39	8.5 (4.7, 14.9)	26.2 (18.5, 35.7)	43.1 (36.5, 49.9)	30.3 (26.0, 35.0)	54.7 (43.4, 65.5)
40-54	4.6 (2.5, 8.4) ‡	19.7 (14.7, 25.9)	28.9 (23.0, 35.7)	25.0 (18.6, 32.8)	39.6 (29.1, 51.2)
55+	6.2 (3.5, 10.8)	13.8 (10.4, 18.1)	14.3 (6.0, 30.3) ‡	7.6 (2.3, 22.3) ‡	30.4 (18.7, 45.3)
Education					
Low	4.4 (2.3, 8.3) ‡	6.6 (2.2, 18.1) ‡	22.1 (8.6, 45.9) ‡	26.2 (21.3, 31.9)	43.7 (30.9, 57.4)
Moderate	6.7 (3.5, 12.5) ‡	18.9 (14.8, 23.8)	29.1 (20.7, 39.1)	24.0 (18.7, 30.1)	54.8 (48.5, 61.0)
High	9.0 (5.3, 14.9)	24.8 (17.7, 33.7)	36.5 (31.4, 41.9)	31.6 (26.4, 37.3)	59.8 (50.5, 68.6)
Smoking frequency					
Daily	13.8 (4.9, 33.4)	17.4 (15.7, 19.1)	26.5 (23.9, 29.3)	26.3 (22.8, 30.1)	52.9 (42.8, 62.8)
Non-daily	6.1 (4.2, 8.9) ‡	31.5 (19.4, 46.7)	44.5 (28.2, 62.0)	28.0 (19.7, 38.0)	47.2 (37.2, 57.6)
Plans to quit					
No plans	5.4 (2.9, 9.9) ‡	17.8 (11.7, 26.1)	28.5 (19.9, 38.9)	27.4 (18.9, 38.1)	53.6 (37.8, 68.8)
Within the					

next 6 months	6.5 (3.7, 11.1)	27.7 (15.0, 45.5)	38.0 (26.6, 50.9)	30.1 (24.9, 35.9)	52.5 (39.8, 64.9)
In future beyond 6 months	8.4 (4.0, 16.6) ‡	23.6 (18.0, 30.4)	30.8 (24.1, 38.4)	23.7 (18.9, 29.3)	47.2 (36.3, 58.4)

[a] See **Supplementary Table 3** for full table, including n

[b] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

Table 3. Correlates of usual cigarette brand smoke has a flavour capsule among adults who smoke across five countries of the ITC Surveys, weighted, logistic regression analyses [a]

	BRAZIL (N=1215)	JAPAN (N=2876)	REPUBLIC OF KOREA (N=3765)	MALAYSIA (N=1104)	MEXICO (N=1331)
	aOR† (95%CI)	aOR† (95%CI)	aOR† (95%CI)	aOR† (95%CI)	aOR† (95%CI)
Sex					
Male	1.00	1.00	1.00	1.00	1.00
Female	1.41 (0.69, 2.86)	1.79 *** (1.35, 2.38)	1.03 (0.61, 1.75)	1.39 (0.78, 2.47)	3.18 *** (1.69, 5.98)
Age group (years) [b]					
18-24	1.69 (0.36, 7.88)	0.29 (0.04, 2.26)	16.69 *** (8.11, 34.33)	3.43 (0.84, 13.98)	3.10 (0.99, 9.73)
25-39	1.89 (0.83, 3.83)	1.55 ** (1.13, 2.11)	4.61 *** (2.94, 7.22)	4.25 * (1.10, 16.38)	2.13 (0.88, 5.15)
40-54	0.94 (0.46, 1.93)	1.18 (0.88, 1.58)	2.38 *** (1.51, 3.75)	3.19 (0.80, 12.76)	1.37 (0.57, 3.28)
55+	1.00	1.00	1.00	1.00	1.00
Education					
Low	1.00	1.00	1.00	1.00	1.00
Moderate	1.28 (0.54, 3.02)	3.44 (0.87, 13.51)	0.74 (0.20, 2.71)	0.82 (0.53, 1.27)	1.72 (0.87, 3.42)
High	2.37 * (1.12, 4.99)	4.04 * (1.01, 16.10)	1.20 (0.33, 4.32)	1.27 (0.86, 1.86)	2.38 * (1.10, 5.15)
Smoking frequency					
Daily	1.00	1.00	1.00	1.00	1.00
Non-daily	1.68 (0.56, 5.07)	1.43 (0.93, 2.22)	1.76 * (1.07, 2.91)	0.96 (0.58, 1.60)	0.91 (0.47, 1.77)
Plans to quit					
No plans	1.00	1.00	1.00	1.00	1.00
Within the next 6 months	1.28 (0.56, 2.93)	2.13 *** (1.42, 3.19)	1.56 * (1.10, 2.22)	1.05 (0.59, 1.84)	0.93 (0.40, 2.19)
In future beyond 6 months	1.98 (0.85, 4.59)	1.51 ** (1.15, 1.98)	1.50 * (1.04, 2.17)	0.74 (0.41, 1.32)	0.66 (0.31, 1.37)

[a] See **Supplementary Table 4** for full table, including n and p-values

[b] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.
† Separate logistic regression models estimated for each country and adjusted for all variables in table.
* = p<0.05; **=p<0.01; ***=p<0.001

Frequency of crushing capsules

Adults who smoked FCCs most commonly reported that when they smoke a pack of their usual/current brand they crush every capsule, compared to less frequent response options. Crushing every capsule in a pack was most frequently reported in Japan (76.6%, 67.9–83.5%), followed by Republic of Korea (59.7%, 47.1–71.1%), Brazil (52.7%, 34.4–70.3%), and Malaysia (45.1%, 37.7–52.7%) (**Table 4**; **Supplementary Table 5** for full table).

Perceived harmfulness of usual brand

Findings on perceived harmfulness of one's usual brand relative to other brands were mixed (**Table 5; Supplementary Table 6** for full table). In Brazil, a higher percentage of those smoked FCCs perceived their brand to be a little more harmful than other brands (28.3%, 13.1–50.9%), compared to those who used non-capsule cigarettes (10.2%, 7.9–13.3%) (p=0.011). In Malaysia, a greater percentage of those whose used FCCs perceived their brand to be less harmful than other brands (18.5%, 13.3–25.0%) than those whose brand had no capsule (11.1%, 8.5–14.4%) (p=0.016).

Table 4. Frequency of crushing capsules among adults who smoke whose usual/ current brand of cigarettes has a flavour capsule across four countries of the ITC Surveys, weighted [a]

	BRAZIL (N=74)		JAPAN (N=485)		REPUBLIC OF KOREA (N=1216)		MALAYSIA (N=332)	
Frequency of crushing capsules [b]	**%**	**95%CI**	**%**	**95%CI**	**%**	**95%CI**	**%**	**95%CI**
Every capsule	52.7	(34.4, 70.3)	76.6	(67.9, 83.5)	59.7	(47.1, 71.1)	45.1	(37.7, 52.7)
Most capsules	12.1	(3.3, 35.7) ‡	13.6	(8.2, 21.8)	24.2	(13.1, 40.3)	26.1	(20.2, 33.0)
About half of capsules	3.0	(1.0, 8.9) ‡	3.1	(1.8, 5.0)	5.0	(3.1, 8.0)	10.5	(7.1, 15.3)
Some capsules, but less than half	14.3	(5.5, 32.5) ‡	3.7	(2.3, 5.8)	6.5	(4.0, 10.4)	7.1	(4.2, 11.8)
Never	17.8	(8.2, 34.5) ‡	3.1	(1.8, 5.1)	4.6	(2.8, 7.6)	11.2	(6.9,

[a] See **Supplementary Table 5** for full table, including n

[b] *"When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?";* This question was not asked in the Wave 8 ITC Mexico survey.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

Table 5. Perceptions of usual cigarette brand harmfulness compared to other brands among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsule across four countries of the ITC Surveys, weighted [a]

	BRAZIL			JAPAN		
	Flavour capsule (N=74)	**No capsule (N=1127)**		**Flavour capsule (N=485)**	**No capsule (N=2211)**	
Harm of usual brand compared to others [b]	**%**	**%**	**p-value [c]**	**%**	**%**	**p-value [c]**
Little less harmful	13.7 (6.3, 27.3) ‡	19.1 (16.0, 22.7)	0.372	8.8 (4.3, 17.1) ‡	6.9 (5.1, 9.2)	0.533
No different	58.0 (38.6, 75.2)	70.6 (66.5, 74.4)	0.175	85.0 (76.8, 90.6)	77.2 (72.8, 81.1)	0.084
Little more harmful	28.3 (13.1, 50.9) ‡	10.2 (7.9, 13.3)	**0.011**	6.2 (4.0, 9.6)	15.9 (12.4, 20.1)	**<0.001**
	REPUBLIC OF KOREA			**MALAYSIA**		
	Flavour capsule (N=1216)	**No capsule (N=2414)**		**Flavour capsule (N=332)**	**No capsule (N=719)**	
Harm of usual brand compared to others [b]	**%**	**%**	**p-value [c]**	**%**	**%**	**p-value [c]**
Little less harmful	11.5 (4.4, 26.8) ‡	8.7 (4.2, 16.9)	0.633	18.5 (13.3, 25.0)	11.1 (8.5, 14.4)	**0.016**
No different	74.2 (61.4, 83.8)	78.5 (71.8, 84.0)	0.496	66.9 (58.6, 73.6)	78.6 (74.5, 82.1)	**0.003**
Little more harmful	14.3 (8.8, 22.6)	12.8 (10.1, 16.1)	0.681	14.6 (10.1, 20.6)	10.3 (7.9, 13.4)	0.128

[a] See **Supplementary Table 6** for full table, including n

[b] "*Do you think that the brand you usually/currently smoke, might be a little less harmful, no different, or a little more harmful, compared to other cigarette brands?";* This question was not asked in the Wave 8 (2021) ITC Mexico study. However, ITC Mexico data from 2018-2020 captured relative harm perceptions in a recent study.(5)

[c] P-values from weighted $\chi 2$ tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule; **Bolded**= $p<0.05$

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

Reasons for usual brand choice

In Brazil, taste was a more common reason for usual brand choice among those whose usual brand had a flavour capsule (89.5%, 74.8-96.1%) compared to no capsule (60.6%, 56.0-65.1%) (p<0.001) (**Supplementary Table 7**). No other reasons assessed for usual brand choice differed between those who used FCCs and did not use capsules in Brazil, including price, tar/nicotine levels, not as bad for health, and pack colour. In Malaysia, a higher proportion of those who used FCCs compared to no capsules reported that they chose their usual brand because it's not as bad for health (50.3%, 42.5-58.0% vs 25.7%, 22.5-31.5%, p<0.001), the pack design (46.1%, 38.6-53.8% vs 20.8%, 17.2-24.9%, p<0.001), and because their friends smoke that brand (52.0%, 44.3-59.7% vs 35.3%, 30.8-40.0%, p<0.001). No significant differences were observed between those who smoked FCCs vs no capsules in Malaysia for taste (95.9%, 91.6-98.0% vs 93.0%, 89.9-95.2%, p=0.198) and price (79.1%, 72.7-84.3%% vs 73.9%, 69.5-77.8%, p=0.167).

DISCUSSION

The current study examined the prevalence of FCC use, frequency of crushing capsules, perceived harmfulness of usual brand, and reasons for FCC use among adults who smoke from Brazil, Japan, Republic of Korea, Malaysia, and Mexico. Prevalence estimates for usual/preferred use of FCCs were highest in Mexico and lowest in Brazil. Demographic factors associated with FCC use varied across countries. FCC users most commonly reported that they crushed every capsule when they smoked a pack of FCCs, and taste was the most commonly reported reason for use in countries that examined this. Perceptions of usual brand harmfulness relative to other brands between those who smoked cigarettes with vs without capsules, varied across countries.

The finding that half of adults (50.3%) who smoke preferred FCCs in Mexico in 2021, is a marked increase from a 2014 estimate of 14%.(19) This is lower than another study assessing ITC Mexico data from 2018-2020 (60%), which defined FCC use based on preferred brand or last purchased brand variety).(31) Prevalence of FCC use from our study are higher than Euromonitor market share estimates, which indicated that FCCs made up over one-quarter (27.3%) of the total cigarette market in Mexico in 2020.(17) Although market share depends on consumption and price of different brands, and not necessarily concordant with prevalence, this finding highlights that while market share data have utility, prevalence data are critical for monitoring population-level trends.

The country with the second-highest prevalence of FCC use was Republic of Korea (31.8% in 2021), which showed a substantial increase from a 2016 ITC study (18%).(23). Our estimates correspond closely with Euromonitor market share data for FCCs (24.7% in 2020). High use may be a consequence of the documented industry marketing tactics for FCCs in Republic of Korea, including price promotions, point-of-sale advertising, and packaging(9,36).

We found that over one-quarter of adults who smoke in Malaysia (26.5% in 2020) and one-fifth of adults who smoke in Japan (21.6% in 2021) use FCCs. Both prevalence estimates are much higher than the market share data from Euromonitor, which reported that in 2020 FCCs made up only 0.7% of the total cigarette market share in Malaysia and 7.0% in Japan.(17) However, Euromonitor data estimates that menthol (non-capsule cigarettes) made up 24.8% of the total market share in Malaysia and 27.7% in Japan in 2020.(17) The discrepancy may therefore reflect

possibly inaccuracies or overlapping of these two categories. Reported tobacco industry tactics in both countries may explain high rates. In 2008, a ban on misleading packaging descriptors was followed by the introduction of menthol FCCs to the Malaysian market, and promoted with pack descriptors and imagery highlighting its innovative and technological features.(9,37) The first global market release of modern FCCs was in Japan in 2007.(38) In Japan, marketing tactics for FCCs have been observed at point-of-sale, including offering different brand variants ranging in reported tar yields that correspond to different package emblem sizes.(39)

Lastly, we found the lowest prevalence of FCC use in Brazil (6.7% in 2016-2017). This is generally consistent with Euromonitor data, which estimated that the market share of FCCs was 3.5% in 2016 and 3.7% in 2017.(40) It is possible that prevalence of FCC use has since increased from our 2016-2017 estimates, given the continued market growth (i.e., 3.9% in 2020).(17) Moreover, it is reported that the number of industry-registered flavoured tobacco products tripled from 2012 to 2021.(41) While lower than other countries examined, our data remain concerning, particularly given Brazil's large population, as well as strong tobacco industry efforts to promote flavoured tobacco products and to supress policies that banned flavours and other additives.(16,41–43) Brazil adopted a ban on all flavour additives in 2012, which was subsequently upheld by the Supreme Federal Court in 2018, yet on-going litigation in the lower courts continues to delay implementation.(43,44) Marketing strategies of FCCs in Brazil have included the use of concept flavour names, extensive retail availability near schools, and appealing packaging.(9,45,46) Despite these challenges, the relatively lower prevalence of FCC use may be

reflective of Brazil's strong tobacco control leadership to address flavour additives.(41) Further, most adults who smoke in Brazil support a ban on additives.(43)

Our findings on correlates of FCC use varied across the countries, but are largely consistent with previous studies.(18,21–24,26) We found that FCC use was associated with younger age in Japan, Republic of Korea, and Malaysia, with a marginally non-significant independent association with younger age in Mexico. This also aligns with a previous ITC study in Republic of Korea.(23) Young people are perceived to be the target population of FCCs,(18) as they contain several features known to appeal to this group, including colourful packaging, choice of flavours, the ability to customise, and connotations of a "high-tech" product.(7,9,47,48) Consistent with previous studies in Mexico,(5,19,21,22) we found greater preference for FCCs among females than males. We also found that in Japan, females had greater odds of FCC use. No significant association by sex was found in Brazil, Malaysia, or in Republic of Korea, which is inconsistent with a previous study that found that females in Republic of Korea were more likely to use FCCs than males.(23) FCCs have features that could appeal to both females and males, depending on the context and marketing environment.(18,49) Use of FCCs was associated with high education in Brazil, Japan, and Mexico, as has been observed in some studies.(5,18) Smoking frequency was only found to be correlated with FCC use in Republic of Korea, while plans to quit was only significant in Japan and Republic of Korea. Smoking and quitting behaviours have previously been mixed across studies that have examined this.(18)

Our study found that the most common crushing frequency reported by adults who smoke FCCs was crushing every capsule in a pack across the five countries that assessed this. Findings indicate that these products appear to be used as intended by the tobacco industry.(18,19) It is unclear what drives less frequent capsule crushing. However, given that marketing of FCCs is characterised by a focus on the user deciding when and if they release flavour, it is possible that some users enjoy the option of only sometimes smoking flavoured cigarettes.(9) Price differences between flavour capsule cigarettes and other types of cigarettes may further influence behaviour. In some countries, flavour capsule cigarettes are less expensive than unflavoured cigarettes.(50)

We further found no consistent pattern of consumer perceptions of the harmfulness of FCCs, with those using FCCs (vs no capsules) in Malaysia believing that their brand was less harmful, but those in Brazil using FCCs (vs no capsules) believing their brand was more harmful compared to other brands. These mixed findings are consistent with a review of this issue.(18) Qualitative studies have suggested that there is confusion around relative harm of FCCs, given that on one hand menthol and flavours can be perceived as less harmful, while on the other hand, the flavour-changing technology can been associated with additional chemicals.(7,49) Country differences in harm perceptions may also be modulated by tobacco control policies. For instance, in Republic of Korea, which requires robust graphic health warnings, we observed no differences in harm perceptions. In Japan, which only requires text warnings and does not prohibit misleading descriptors, those whose usual brand did not have capsules perceived their brand to be more harmful compared to those who used FCCs. However, this does not explain why in Malaysia, which has both graphic warnings and a ban on descriptors, we found that FCC users more

commonly reported that they perceived their brand to be less harmful. This is further supported by our finding that half of FCC users in Malaysia reported that a reason for choosing their brand is because it is "not as bad for health", significantly higher than non-capsule users. It is possible that marketing of FCCs in Malaysia may negate some of these policy effects.(51) One study reported how the tobacco industry used distinct descriptors and imagery on packaging of FCCs to reinforce its technological and innovate features.(37) This exemplifies the importance of standardised/plain packaging to remove all forms of marketing features that can be conveyed through packaging. Indeed, we also found that FCC users in Malaysia were significantly more likely to report the pack design as a reason for their usual brand choice.

While harm perceptions were not measured in Mexico in our study, other studies, including a recent ITC study,(5) have observed that FCC users perceive their brand to be less harmful,(5,21) particularly those who used discount brands.(19) In Brazil, our finding that those who used FCCs perceived their brand to be more harmful than those who did not use capsules may be a byproduct of its proposed regulation of flavour additives, and possible media attention around on-going litigation. These findings highlight how the complex interplay between the tobacco policy environment, marketing strategies, and other factors might influence how relative harm is perceived, which can also influence prevalence. Further research can help elucidate the factors driving FCC use and perceptions of harm.

Our findings in the two countries that assessed reasons for brand choice, Brazil and Malaysia, suggest that taste is consistently a motivating factor for preference of FCCs, consistent with

previous studies.(18) It should be noted that in Brazil, the proportion reporting taste as a reason for usual brand choice was significantly higher among those who used capsules vs no capsules. In Malaysia, however, the proportion was high in both groups, with no significant differences between groups.

The current study has limitations. First, the small sample size of adults who usually smoke FCCs in Brazil overall, as well as conditional subgroup estimates, along with high sampling variability (relative standard error > 0.3) may increase uncertainty of our estimates. Misclassification bias of predictor and outcome measures could have also occurred due to how questions were asked and categorised. For instance, although education categories were harmonized across countries for general comparative purposes, for Republic of Korea and Japan, categorisations may not accurately reflect standard educational levels in those countries. Given that analyses were country-specific, rather than pooled, estimates cannot be directly compared across countries. However, there is utility in examining FCC use across multiple countries to gain an understanding of how commonly these products are used and how they are used, thereby providing a better understanding of the FCC market in countries with varied contexts. This study is also strengthened by its use of comparable measures across multiple countries with varied contexts, many countries for which this is the first known study to estimate prevalence of FCC use.

CONCLUSION

Our research indicates that FCC use is popular among adults who smoke in Japan, Republic of Korea, Malaysia, and Mexico. We found relatively lower prevalence in Brazil, in which a ban on

tobacco flavour additives was adopted in 2012, although not yet implemented. While there were general trends of correlates of FCC use in some countries (e.g., females, younger adults), inconsistent patterns across countries suggest that user profiles may be context-specific and, potentially, a result of contrasting tobacco industry marketing practices and priorities. Findings underscore the importance of continuous population-level surveillance and monitoring of FCC use. This study also highlights the need for robust tobacco control policies to address the proliferation of FCCs, including banning flavour additives and filter technologies. Policy considerations may entail incorporating a ban on flavour capsules through plain/standardised packaging regulations (i.e., requirements to standardize the appearance of cigarette sticks), as well as banning flavours in tobacco products, including specification of flavour capsules,(52) following the lead of an increasing number of countries.(44)

WHAT IS ALREADY KNOWN ABOUT THIS TOPIC

- Flavour capsule cigarettes have experienced significant market growth globally, yet data on the prevalence and correlates of capsule use are scarce.

WHAT THIS STUDY ADDS

- This study of flavour capsule cigarettes in five countries found that a substantial proportion of adults who smoked used/preferred flavour capsule cigarettes: over 20% in four of the five countries (Mexico: 50.3%, Republic of Korea: 31.8%, Malaysia: 26.5%, Japan: 21.6% in 2020/2021), with Brazil having the lowest prevalence (6.7% in 2016/2017).
- There was no consistent pattern across countries in consumer perceptions of relative brand harmfulness (one's usual/current brand relative to other brands) between those whose usual cigarette brand had a capsule vs those whose brand had no capsule.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE, OR POLICY

- Findings support the need to implement comprehensive tobacco policies globally that address use of flavour capsule cigarettes, such as banning flavour additives and filter technologies.

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CONFLICTS OF INTEREST

JFT has served as paid expert witness in legal challenges against tobacco and vaping companies. ASAN has received an unconditional educational grant from Johnson & Johnson Malaysia Sdn. Bhd., KK received a JMWH Bayer Grant from Japan Society for Menopause and Women's Health. GTF has been an expert witness or consultant for governments defending their country's policies or regulations in litigation and served as a paid expert consultant to the Ministry of Health of Singapore in reviewing the evidence on plain/standardized packaging. All other authors have no conflicts of interest to declare.

ETHICS

All participants provided consent to participate. The survey protocols and all materials of the ITC including the survey questionnaires, were cleared for ethics. ITC Brazil Wave 3 was cleared for ethics by the National Cancer Institute of Brazil (INCA) International Review Board. ITC Japan Wave 4 was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (REB#22508/31428), the Internal Review Board at the Osaka International Cancer Institute, Japan (IRB 21054) and the Internal Review Board at Japan National Cancer Center, Japan (IRB 2021-069). ITC Republic of Korea Wave 2 was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (ORE# 41512). ITC Malaysia Wave 1 (New Cohort) Survey was cleared for ethics by the Office of Research Ethics, University of Waterloo, Canada (ORE#40825)

and Medical Research Ethics Committee, University of Malaya (MREC ID #2019118-8018). The ITC Mexico Wave 8 was cleared for ethics by the Instituo Nacional de Salud Publica, International Research Board. Secondary data analysis was cleared for ethics by the Imperial College Research Ethics Committee (ICREC 21IC6699).

DATA AVAILABILITY STATEMENT

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. The criteria for data usage approval and the contents of the Data Usage Agreement are described online (http://www.itcproject.org).

AUTHOR CONTRIBUTIONS

GTF, JFT, CDAP, HGS, SYK, ASAN, FMH, KK, TT, GTF are PIs of the ITC surveys. ACKQ is the Managing Director of the ITC surveys. CNK conceptualized the study, conducted data analysis, and is the guarantor. FTF and PD supervised. CNK and OE wrote the original draft and prepared the final version. All authors contributed to review and editing and approved the final manuscript.

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SUPPLEMENTARY TABLES

Supplementary Table 1. Country and survey characteristics across five countries of the ITC surveys

	BRAZIL	JAPAN	REPUBLIC OF KOREA	MALAYSIA	MEXICO
Country characteristics					
Country income level[a]	Upper-middle	High	High	Upper-middle	Upper-middle
Current cigarette smoking prevalence[b]	11.2%	18.9%	19.3%	17.9%	13.9%
Survey characteristics					
Survey sampling frame	Adults (aged 18+) who smoke cigarettes and non-smokers, living in Sao Paulo, Rio de Janeiro and Porto Alegre.	Adults (aged 20+) who smoke cigarettes, who use heated tobacco products, and non-users.	Adults (aged 19+) who smoke cigarettes, use heated tobacco products, use electronic cigarettes, and non-users.	Adults (aged 18+) who smoke cigarettes and non-smokers.	Adults (aged 18+) who smoke cigarettes.
Sampling design	Households randomly called using systematic sampling from an electronic phone number directory.	Rakuten Insight panel. Panelists pre-profiled with pre-targeted variables (e.g., smoking). Quotas based on the region of residence, sex, and age, were applied to ensure the final sample sizes were proportional to stratum sizes based on the Japan Society and Tobacco Internet Survey (JSTIS). Methods are used to maintain panel to be consistent as possible with general population.	Rakuten Insight panel. Panelists pre-profiled with pre-targeted variables (e.g., smoking). Quotas based on sex and age groups, applied to target final sample sizes proportional to stratum sizes based on smoking prevalence estimates in combination with Korea census data. Methods are used to maintain panel to be consistent as possible with general population.	Rakuten Insight panel. Panelists pre-profiled with pre-targeted variables (e.g., smoking). Quotas based on region of residence, sex, and age, were applied to ensure the final sample was proportional to stratum sizes based on Malaysian census data. Methods are used to maintain panel to be consistent as possible with general population.	Online market research consumer panel. Quotas based on age, sex, education groups, and people who vape..
Analytic sample	Adults (aged 18+) who smoke cigarettes at least monthly AND smoked 100+ cigarettes in their lifetime (N=1215).	Adults (aged 20+) who smoke cigarettes at least monthly AND smoked 100+ cigarettes in their lifetime (N=2876).	Adults (aged 19+) who smoke cigarettes at least monthly AND smoked 100+ cigarettes in their lifetime (N=3765).	Adults (aged 18+) who smoke cigarettes at least monthly AND smoked 100+ cigarettes in their lifetime (N=1104).	Adults (aged 18+) who smoked cigarettes in the last 30 days (N=1104).
Sample type	Recontact and replenishment	Recontact and replenishment	Recontact and replenishment	Newly sampled	Recontact and replenishment
Dates of data collection	September 2016 to March 2017	July 2021 to August 2021	November 2021 to December 2021	February 2020 to March 2020	March 2021 to April 2021
Survey wave	3	4	2	1	8
Survey mode	Telephone	Web	Web	Web	Web
Response rate (%)[c]	35.5	27.4	16.4	11.3	--
Cooperation rate (%)	60.4	94.5	97.0	95.3	--

[a] 2021 World Bank

[b] 2021 WHO age-standardized estimated prevalence of smoking among those aged 15 years or more; WHO report on the global tobacco epidemic, 2023: protect people from tobacco smoke. Geneva: World Health Organization; 2023.

[c] The denominator of the response rates for the web panel surveys (all countries except Brazil) is all potential respondents who were sent invitations to the surveys. It should be noted that many panel members are no longer active. For the telephone survey in Brazil, the denominator of the response rate is all potential respondents who were phoned. Those who did not answer after seven tries were considered a non-response. Post-stratification weights adjust for non-response bias.

Supplementary Table 2. Overall sample characteristics of adults who smoke cigarettes across five countries of the ITC Surveys, weighted (full table)

	BRAZIL *Wave 3, 2016/2017* (N=1215)			JAPAN *Wave 4, 2021* (N=2876)			REPUBLIC OF KOREA *Wave 2, 2021* (N=3765)			MALAYSIA *Wave 1, 2020* (N=1104)			MEXICO *Wave 8, 2021* (N=1331)		
	n	%	95%CI	n	%	95%CI	n	%	95%CI	n	%	95%CI	n	%	95%CI
Sex															
Male	602	47.9	(43.7, 42.2)	2090	67.5	(63.0, 71.8)	3250	89.9	(85.8, 92.9)	995	97.3	(96.5, 97.9)	645	60.1	(53.3, 66.5)
Female	614	52.1	(47.8, 56.3)	786	32.4	(28.2, 37.0)	515	10.1	(7.1, 14.2)	105	2.7	(2.1, 3.5)	686	39.9	(33.5, 46.7)
Age group (years)															
18-24 [a]	26	4.4	(2.8, 7.1)	14	2.7	(0.8, 8.5)	325	8.8	(4.5, 16.5)	160	13.7	(11.4, 16.4)	134	9.6	(6.7, 13.5)
25-39	205	34.6	(30.2, 39.2)	758	31.9	(27.4, 36.8)	1213	26.2	(22.6, 30.2)	670	51.0	(47.1, 54.9)	575	56.1	(49.2, 62.7)
40-54	334	34.6	(30.8, 38.6)	988	31.7	(28.2, 35.3)	1698	37.4	(32.7, 42.4)	228	29.7	(26.0, 33.8)	437	25.9	(20.6, 32.0)
55+	651	26.3	(23.4, 29.5)	1116	33.8	(30.0, 37.7)	1229	27.6	(22.2, 33.7)	46	5.5	(3.9, 7.8)	185	8.4	(6.2, 11.3)
Education															
Low	357	29.5	(25.8, 33.4)	78	2.2	(1.7, 2.8)	89	1.9	(1.2, 3.1)	366	47.6	(43.7, 51.5)	116	47.6	(40.3, 54.9)
Moderate	435	37.5	(33.4, 41.8)	1448	52.5	(48.0, 56.9)	2399	58.6	(53.6, 63.5)	314	36.5	(32.8, 40.3)	763	36.7	(31.2, 42.6)
High	406	31.9	(28.0, 36.1)	1312	45.3	(40.9, 49.8)	1022	39.4	(34.7, 44.4)	412	15.9	(14.0, 18.0)	452	15.7	(12.7, 19.2)
Smoking frequency															
Daily	18	1.1	(0.6, 2.1)	2426	69.1	(62.9, 74.7)	3240	69.6	(61.8, 76.4)	937	88.5	(86.0, 90.5)	651	47.1	(40.0, 54.3)
Non-daily	1,135	92.8	(90.2, 94.8)	450	30.9	(25.3, 37.1)	525	30.4	(23.6, 38.2)	167	11.5	(9.4, 14.0)	660	52.9	(45.7, 60.0)
Plans to quit															
No plans	81	7.2	(5.2, 9.8)	1284	46.1	(41.3, 50.9)	1028	30.0	(25.5, 35.0)	153	14.8	(12.1, 17.9)	294	23.8	(18.0, 30.9)
Within the next 6 months	574	52.9	(48.4, 57.3)	235	19.4	(14.3, 25.7)	1042	40.3	(33.9, 47.0)	460	42.0	(38.2, 46.0)	460	38.7	(31.5, 46.5)
In future beyond 6 months	316	23.9	(20.5, 27.7)	924	34.5	(30.4, 38.9)	1313	29.7	(24.5, 35.4)	424	43.2	(39.2, 47.2)	485	37.4	(30.6, 44.8)

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

Supplementary Table 3. Prevalence of usual/preferred brand has a flavour capsule overall and by sociodemographic characteristics and smoking behaviours among adults who smoke cigarettes across five countries of the ITC Surveys, weighted (full table)

	BRAZIL *Wave 3, 2016/2017* **(N=1215)**			JAPAN *Wave 4, 2021* **(N=2876)**			REPUBLIC OF KOREA *Wave 2, 2021* **(N=3365)**			MALAYSIA *Wave 1, 2020* **(N=1104)**			MEXICO *Wave 8, 2021* **(N=1331)**		
	n	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**
Overall	74	6.7	(4.7, 9.5)	485	21.6	(17.4, 26.4)	1116	31.8	(26.4, 37.8)	332	26.5	(23.3, 30.0)	751	50.3	(43.1, 57.4)
Sex															
Male	39	6.1	(4.0, 9.2)	313	20.1	(15.0, 26.4)	1022	31.3	(25.4, 37.7)	294	26.3	(23.0, 30.0)	304	39.1	(30.0, 49.0)
Female	35	7.3	(4.1, 12.6)	172	24.5	(18.0, 32.5)	94	38.0	(26.8, 50.8)	38	32.3	(21.6, 45.1)	447	67.2	(58.0, 75.2)
Age group (years) [a]															
18-24	2	12.0	(2.0, 47.4) ‡	3	80.4	(44.3, 95.5) ‡	7	61.3	(26.4, 87.4)	45	23.7	(16.7, 32.6)	94	70.1	(52.2, 83.4)
25-39	21	8.5	(4.7, 14.9)	167	26.2	(18.5, 35.7)	552	43.1	(36.5, 49.9)	222	30.3	(26.0, 35.0)	376	54.7	(43.4, 65.5)
40-54	20	4.6	(2.5, 8.4) ‡	172	19.7	(14.7, 25.9)	555	28.9	(23.0, 35.7)	60	25.0	(18.6, 32.8)	216	39.6	(29.1, 51.2)
55+	31	6.2	(3.5, 10.8)	143	13.8	(10.4, 18.1)	154	14.3	(6.0, 30.3) ‡	5	7.6	(2.3, 22.3) ‡	65	30.4	(18.7, 45.3)
Education															
Low	18	4.4	(2.3, 8.3) ‡	6	6.6	(2.2, 18.1) ‡	8	22.1	(8.6, 45.9) ‡	103	26.2	(21.3, 31.9)	62	43.7	(30.9, 57.4)
Moderate	24	6.7	(3.5, 12.5) ‡	253	18.9	(14.8, 23.8)	21	29.1	(20.7, 39.1)	79	24.0	(18.7, 30.1)	402	54.8	(48.5, 61.0)
High	32	9.0	(5.3, 14.9)	220	24.8	(17.7, 33.7)	93	36.5	(31.4, 41.9)	147	31.6	(26.4, 37.3)	282	59.8	(50.5, 68.6)
Refused/don't know*	0	--	--	6	--	--	3	--	--	3	--	--	0	--	--
Smoking frequency															
Daily	66	13.8	(4.9, 33.4)	373	17.4	(15.7, 19.1)	1113	26.5	(23.9, 29.3)	278	26.3	(22.8, 30.1)	348	52.9	(42.8, 62.8)
Non-daily	8	6.1	(4.2, 8.9) ‡	112	31.5	(19.4, 46.7)	2	44.5	(28.2, 62.0)	54	28.0	(19.7, 38.0)	403	47.2	(37.2, 57.6)
Refused/ don't know*	0	--	--	0	--	--	0	--	--	0	--	--	0	--	--
Plans to quit															
No plans	19	5.4	(2.9, 9.9) ‡	184	17.8	(11.7, 26.1)	3	28.5	(19.9, 38.9)	43	27.4	(18.9, 38.1)	177	53.6	(37.8, 68.8)
Within the next 6 months	33	6.5	(3.7, 11.1)	60	27.7	(15.0, 45.5)	3	38.0	(26.6, 50.9)	157	30.1	(24.9, 35.9)	256	52.5	(39.8, 64.9)
In future beyond 6 months	19	8.4	(4.0, 16.6) ‡	177	23.6	(18.0, 30.4)	412	30.8	(24.1, 38.4)	116	23.7	(18.9, 29.3)	285	47.2	(36.3, 58.4)
Refused/don't know*	3	--	--	64	--	--	8	--	--	16	--	--	33	--	--

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

Supplementary Table 4. Correlates of usual cigarette brand smoke has a flavour capsule among adults who smoke across five countries of the ITC Surveys, weighted, logistic regression analyses (full table)

	BRAZIL *Wave 3, 2016/2017* (N=1215)			JAPAN *Wave 4, 2021* (N=2876)			REPUBLIC OF KOREA *Wave 2, 2021* (N=3765)			MALAYSIA *Wave 1, 2020* (N=1104)			MEXICO *Wave 8, 2021* (N=1331)		
	aOR†	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**	**aOR†**	**95% CI**	**p-value**
Sex															
Male	1.00			1.00			1.00			1.00			1.00		
Female	1.41	(0.69, 2.86)	0.341	1.79	(1.35, 2.38)	**<0.001**	1.03	(0.61, 1.75)	0.901	1.39	(0.78, 2.47)	0.264	3.18	(1.69, 5.98)	**<0.001**
Age group (years) [a]															
18-24	1.69	(0.36, 7.88)	0.506	0.29	(0.04, 2.26)	0.235	16.69	(8.11, 34.33)	**<0.001**	3.43	(0.84, 13.98)	0.085	3.10	(0.99, 9.73)	0.052
25-39	1.89	(0.83, 3.83)	0.077	1.55	(1.13, 2.11)	**0.006**	4.61	(2.94, 7.22)	**<0.001**	4.25	(1.10, 16.38)	**0.035**	2.13	(0.88, 5.14)	0.092
40-54	0.94	(0.46, 1.93)	0.876	1.18	(0.88, 1.58)	0.261	2.38	(1.51, 3.75)	**<0.001**	3.19	(0.80, 12.76)	0.101	1.37	(0.57, 3.28)	0.486
55+	1.00			1.00			1.00			1.00			1.00		
Education															
Low	1.00			1.00			1.00			1.00			1.00		
Moderate	1.28	(0.54, 3.02)	0.569	3.44	(0.87, 13.51)	0.077	0.74	(0.20, 2.71)	0.654	0.82	(0.53, 1.27)	0.374	1.72	(0.87, 3.42)	0.120
High	2.37	(1.12, 4.99)	**0.024**	4.04	(1.01, 16.10)	**0.048**	1.20	(0.33, 4.32)	0.784	1.27	(0.86, 1.86)	0.224	2.38	(1.10, 5.15)	**0.028**
Smoking frequency															
Daily	1.00			1.00			1.00			1.00			1.00		
Non-daily	1.68	(0.56, 5.07)	0.358	1.43	(0.93, 2.22)	0.105	1.76	(1.07, 2.[illegible])	**0.026**	0.96	(0.58, 1.60)	0.890	0.91	(0.47, 1.77)	0.782
Plans to quit															
No plans	1.00			1.00			1.00			1.00			1.00		
Within the next 6 months	1.28	(0.56, 2.93)	0.550	2.13	(1.42, 3.19)	**<0.001**	1.56	(1.10, 2.[illegible])	**0.013**	1.05	(0.59, 1.84)	0.874	0.93	(0.40, 2.19)	0.868
In future beyond 6 months	1.98	(0.85, 4.59)	0.112	1.51	(1.15, 1.98)	**0.003**	1.50	(1.04, 2.[illegible])	**0.030**	0.74	(0.41, 1.32)	0.303	0.66	(0.31, 1.37)	0.261

[a] Age group is 20-24 years for Japan and 19-24 years for Republic of Korea, based on the respective countries' definitions of the start of adulthood.

† Separate logistic regression models estimated for each country and adjusted for all variables in table.

Bolded= p<0.05

Supplementary Table 5. Frequency of crushing capsule among adults who smoke whose usual/current brand of cigarettes has a flavour capsule across four countries of the ITC Surveys, weighted (full table)

	BRAZIL *Wave 3, 2016/2017* **(N=74)**			**JAPAN** *Wave 4, 2021* **(N=485)**			**REPUBLIC OF KOREA** *Wave 2, 2021* **(N=1216)**			**MALAYSIA** *Wave 1, 2020* **(N=332)**		
Frequency of crushing capsules [a]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**
Every capsule	38	52.7	(34.4, 70.3)	332	76.6	(67.9, 83.5)	711	59.7	(47.1, 71.1)	138	45.1	(37.7, 52.7)
Most capsules	5	12.1	(3.3, 35.7) ‡	71	13.6	(8.2, 21.8)	266	24.2	(13.1, 40.3)	93	26.1	(20.2, 33.0)
About half of capsules	5	3.0	(1.0, 8.9) ‡	23	3.1	(1.8, 5.0)	119	5.0	(3.1, 8.0)	42	10.5	(7.1, 15.2)
Some capsules, but less than half	10	14.3	(5.5, 32.5) ‡	29	3.7	(2.3, 5.8)	70	6.5	(4.0, 10.4)	27	7.1	(4.2, 11.6)
Never	15	17.8	(8.2, 34.5) ‡	22	3.1	(1.8, 5.1)	46	4.6	(2.8, 7.6)	21	11.2	(6.9, 17.5)

[a] *"When you smoke a pack of your usual/current brand, how often do you crush the flavour capsule?";* This question was not asked in the Wave 8 ITC Mexico survey.

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

Refused/don't know responses set to missing: Brazil (n=1), Japan (n=8), Republic of Korea (n=4), Malaysia (n=1)

Supplementary Table 6. Perceptions of usual cigarette brand harmfulness compared to other brands among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsules across four countries of the ITC Surveys, weighted (full table)

	BRAZIL							JAPAN						
	Flavour capsule (N=74)			No capsule (N=1127)				Flavour capsule (N=485)			No capsule (N=2211)			
Harm of usual brand compared to others [a]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]
Little less harmful	15	13.7	(6.3, 27.3) ‡	228	19.1	(16.9, 21.7)	0.372	35	8.8	(4.3, 17.1) ‡	133	6.9	(5.1, 9.2)	0.533
No different	44	58.0	(38.6, 75.2)	761	70.6	(66.8, 74.4)	0.175	348	85.0	(76.8, 90.6)	1446	77.2	(72.8, 81.1)	0.084
Little more harmful	12	28.3	(13.1, 50.9) ‡	105	10.2	(7.9, 13.3)	**0.011**	36	6.2	(4.0, 9.6)	290	15.9	(12.4, 20.1)	**<0.001**
Refused/don't know*	3	--	--	33	--	--	--	66	--	--	342	--	--	--
	REPUBLIC OF KOREA							**MALAYSIA**						
	Flavour capsule (N=1216)			No capsule (N=2414)				Flavour capsule (N=332)			No capsule (N=719)			
Harm of usual brand compared to others [a]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]
Little less harmful	72	11.5	(4.4, 26.8) ‡	118	8.7	(4.2, 17.9)	0.633	58	18.5	(13.3, 25.0)	86	11.1	(8.5, 14.4)	**0.016**
No different	820	74.2	(61.4, 83.8)	1761	78.5	(71.1, 84.0)	0.496	202	66.9	(58.6, 73.6)	516	78.6	(74.5, 82.1)	**0.003**
Little more harmful	238	14.3	(8.8, 22.6)	360	12.8	(10.1, 16.1)	0.681	54	14.6	(10.1, 20.6)	76	10.3	(7.9, 13.4)	0.128
Refused/ don't know*	86	--	--	175	--	--	--	18	--	--	41	--	--	--

[a] "*Do you think that the brand you usually/currently smoke, might be a little less harmful, no different, or a little more harmful, compared to other cigarette brands?";* This question was not asked in the Wave 8 (2021) ITC Mexico study. However, ITC Mexico data from 2018-2020 captured relative harm perceptions in a recent study.(5)

[b] P-values from weighted $\chi 2$ tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule; **Bolded**= $p<0.05$

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing

Supplementary Table 7. Reasons for usual brand choice among adults who smoke whose usual/current brand of cigarettes has a flavour capsule compared to no capsules in Brazil and Malaysia, ITC Surveys, weighted

	BRAZIL							MALAYSIA						
	Flavour capsule (N=74)			No capsule (N=1127)				Flavour capsule (N=332)			No capsule (N=719)			
Reasons for usual brand choice [a]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]	**n**	**%**	**95%CI**	**n**	**%**	**95%CI**	**p-value** [b]
Taste (Yes)	65	89.5	(74.8, 96.1)	644	60.6	(56.0, 65.1)	**<0.001**	290	95.9	(91.6, 98.0)	593	93.0	(89.9, 95.2)	0.198
No	9			399				13			40			
Don't know/refused/not applicable*	0			10				29			86			
Price (Yes)	17	27.6	(14.7, 45.7)	380	37.1	(32.9, 41.6)	0.288	225	79.1	(72.7, 84.3)	442	73.9	(69.5, 77.8)	0.167
No	57			670				77			191			
Don't know/refused/not applicable*	0			3				30			86			
Tar, nicotine levels (Yes)	22	33.4	(18.8, 52.1)	348	33.9	(29.7, 38.3)	0.960	--	--	--	--	--	--	--
No	52			663										
Don't know/refused/not applicable *	0			42										
Not as bad for health (Yes)	22	23.7	(12.8, 39.5)	397	37.8	(33.5, 42.4)	0.080	148	50.3	(42.5, 58.0)	184	25.7	(22.5, 31.5)	**<0.001**
No	52			628				138			401			
Don't know/refused/not applicable *	0			28				46			134			
Pack colour (Yes)	14	21.5	(10.4, 39.6) ‡	116	10.8	(8.0, 14.4)	0.077	--	--	--	--	--	--	--
No	59			930										
Don't know/refused/not applicable *	1			7										
Pack design (Yes)	--	--	--	--	--	--	--	152	46.1	(38.6, 53.8)	148	20.8	(17.2, 24.9)	**<0.001**
No								147			478			
Don't know/refused/not applicable*								33			93			
Friends use (Yes)	--	--	--	--	--	--	--	170	52.0	(44.3, 59.7)	245	35.3	(30.8, 40.0)	**<0.001**
No								126			374			
Don't know/refused/not applicable *								36			100			

[a] *"In choosing your usual brand, was part of your decision to smoke this brand based on any of the following…"*

[b] P-values from weighted $\chi 2$ tests comparing the proportion of each outcome by usual brand flavour capsule vs no capsule; **Bolded**= $p<0.05$

‡ Indicates high sampling variability; relative standard error > 0.3; interpret with caution

*Refused/don't know responses set to missing