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Flavour capsule cigarette use and perceptions: a systematic review

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ABSTRACT

Objective This systematic review on flavour capsule cigarettes aims to examine prevalence, correlates of use, behaviours and perceptions of these products globally.

Data sources A search of original, peer-reviewed research without restrictions in publication year, population, study design or language, using a combination of cigarette and capsule terms was conducted across four databases (Medline, Embase, Web of Science and Scopus), indexed until 30 April 2021.

Study selection Studies were included if they presented original, human subjects research on flavour capsule cigarettes.

Data extraction Two authors independently extracted data on main outcome results and assessed risk of bias using a validated quality assessment tool (QATSDD).

Data synthesis Of 842 unduplicated database records and four studies from citation searching screened, 20 studies were included in the review. Studies reported data from 2009 to 2019 across eight countries, the majority of which used cross-sectional or focus group study designs. Current capsule use among smokers was highest in Chile and Mexico (40%) and was associated with younger age, and in some countries, with being female. Capsule cigarettes are perceived as tasting better, being smoother on the throat, more fun to smoke, and more attractive compared with non-capsule cigarettes, particularly among susceptible non-smokers and non-daily smokers.

Conclusion Findings call for the adoption of comprehensive tobacco control policies that account for flavour capsules and similar iterations, which can increase appeal through flavours and innovative features. Continued monitoring and research of these products is critical, with particular attention to low-income and middle-income countries, which make up a disproportionately larger share of the capsule market.

INTRODUCTION

Innovative product design and flavour additives have historically been used by the tobacco industry to promote market growth by attracting new consumers and sustaining use of tobacco products.¹⁻⁴ Flavourings can facilitate smoking initiation by masking the harshness of tobacco and reducing perceptions of harmfulness, while novelty can further stimulate product interest, particularly among young people.⁵⁻⁸

In light of the evidence that flavours enhance the palatability and attractiveness of tobacco products, the WHO Framework Convention on Tobacco Control (WHO FCTC) calls parties to prohibit or restrict flavouring ingredients (Article 9).⁹ Accordingly, a growing number of countries have adopted

policies banning flavoured cigarettes, including Brazil, Canada, Ethiopia, the 27 European Union (EU) member states, Mauritania, Moldova, Niger, Nigeria, Senegal, Turkey, Uganda, the UK and the USA.^{10 11} However, most countries do not have a ban, and among the countries that do, a couple exempt menthol (ie, Niger, the USA), and not all of them explicitly prohibit the delivery of flavours via capsules.¹⁰ The EU member states, Moldova, Turkey and the UK are the only countries that ban flavour capsule cigarettes.¹⁰

Flavour capsule cigarettes are a relatively new tobacco product that contain a gelatine capsule filled with a flavouring liquid that is embedded into the cigarette filter, which is released when crushed by the consumer, thereby flavouring the mainstream smoke when the cigarette is inhaled.¹² Flavour capsule cigarettes did not gain traction until 2007, when introduced in Japan.¹² Some brands contain two or more capsules that deliver different flavours within the same filter, while some packs have up to five different flavours.^{13 14} The most common capsule flavour is menthol; however a plethora of other flavours, particularly those with ‘concept’ descriptors that have no explicit flavour profile (eg, Fusion Blast), have flooded the market, particularly in low-income and middle-income countries.¹⁵ Flavour capsule cigarettes have experienced rapid market growth globally over the last decade.^{14 16 17} According to 2020 Euromonitor passport data, flavour capsule cigarettes account for more than a quarter of the cigarette market for countries within the top five capsule markets, four of which are in Latin America: Chile (48%), Peru (35%), Guatemala (33%), Mexico (27%) and South Korea (25%).¹⁸

Despite being the fastest growing combustible tobacco product,¹⁴ research on flavour capsule cigarettes is relatively limited, with no known published systematic reviews. Moreover, given that flavour capsule cigarettes embody two well-established industry strategies^{1 19 20}—the use of flavours and innovative product design—which make youth particularly susceptible to their appeal, it is critical to monitor what populations are using these products and how they are being perceived. Monitoring is also a key tobacco control measure, as stipulated in the WHO FCTC and corresponding to the ‘M’ in the MPOWER package, which identifies six high-impact measures to assist with reducing demand of tobacco products.²¹ As such, the aim of this study was to conduct a systematic review examining prevalence, correlates of use and perceptions of flavour capsule cigarettes globally.



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METHODS

Search strategy and databases

One author (CK) conducted the search in four databases: Medline, Embase, Web of Science and Scopus, indexed until 30 April 2021. Boolean language was used to connect variants of both cigarette terms (ie, Cigar*, Cigarette Smoking/, Tobacco Products/) and capsule terms (ie, Capsul*, Crush*, Convertible*, Click, Burst*, Pop, Duo). The search strategy was intentionally broad to capture all relevant publications on capsule cigarettes. After duplicates were removed, two authors (CK and MZ) independently screened titles and abstracts and then assessed full-text articles for eligibility. Discrepancies were resolved through discussion with the third author (FF). To supplement the database search, one author (CK) manually searched reference lists of the included articles.

Eligibility criteria

Eligibility was not limited by study design, population, year, country or language. Articles were included if they presented original, human subjects research on flavour capsule cigarettes. Published conference abstracts were included, except if they presented duplicate results of data published as full manuscripts in peer-reviewed journals. Articles were excluded if they were not original research (eg, review or commentary only) or if they only presented non-human subjects data (eg, marketing, sales, product assessment).

Data extraction and risk of bias assessment

Two authors (CK and MZ) independently extracted data on main outcome results (eg, prevalence, measures of association). One author (CK) extracted additional data, including: study reference, aims, sample characteristics, sampling approach, study design, field work dates, additional outcomes, data analysis, limitations, author conclusions and funding/conflicts of interest. Due to our inclusion of studies with diverse study designs, including both quantitative and qualitative studies, and for comparability purposes, we assessed risk of bias using a 16-item validated quality assessment tool (QATSDD)²² that has demonstrated good reliability and validity among studies with diverse designs, and has been applied in other systematic reviews assessing flavoured tobacco and nicotine products.^{23–25} Two authors (CK and MZ) independently scored criteria for each study on a 4-point scale (0=not at all, 1=very slightly, 2=moderately, 3=complete), using the tool's scoring guidance notes.²² As two of the tool's criteria are specific to quantitative studies and two to qualitative studies only, each study was assessed on 14 criteria, accordingly, with a maximum score of 42. Discrepancies were resolved through iterative discussion that also included the third author (FF).

Synthesis of results

Given the heterogeneity in outcomes, study results were collated by specified constructs, iteratively determined and informed by theory. Data from studies examining prevalence and correlates of capsule cigarette use were extracted on overall use and use by age, gender and other correlates. Where applicable, results were reported as percentages with 95% CIs with respective measures of association, such as adjusted ORs, including corresponding 95% CIs or p values. Among studies reporting perceptions of flavour capsule cigarettes, extracted results were organised into two overall domains based on the *Hypothetical Model of Tobacco Consumer Response*,²⁶ including: *product perceptions*, defined as subjective responses to product information, and *responses*

to product, which entails measurement of sensory and other subject responses during product use. Each domain was further organised into overall constructs and subconstructs, which were adapted using the *Context of Consumption Framework*,²⁷ and a modification of this framework.²⁸ *Product perceptions* were structured into three overall constructs: *risk perceptions*,²⁶ *outcome expectancies* (ie, perceptions around expected outcomes or consequences of using the product)^{26 29} and *consumer interest* (ie, aspects related to a user or potential user's interest in a product).^{26 28} *Responses to the product* were categorised as: *sensory responses* (ie, measurement of sensory responses such as taste, smell, mouthfeel effects)²⁶ and *other subjective responses* (eg, psychological reward, relief of craving).²⁶

RESULTS

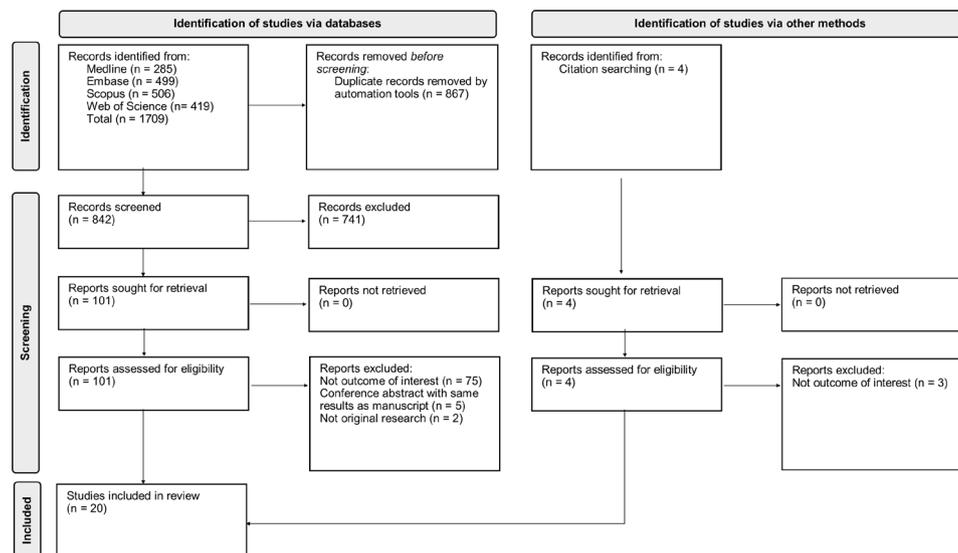
Identification and description of included studies

A total of 1709 records were identified via databases. Once duplicates were removed, 842 publication titles and abstracts were screened, and subsequently 101 full-text articles were assessed for eligibility. In addition, four articles were identified from citation searching and assessed for eligibility (figure 1). A total of 20 articles, published between 2013 and 2021, and reporting data from 2009 to 2019 were included in the review (table 1). Among the included quantitative studies, 10 were cross-sectional^{30–39} (2 of which were discrete choice experiments^{37 38} and 1 used an experimental design)³⁹, 2 were cohort,^{40 41} and 2 used randomised controlled designs.^{42 43} Among the included qualitative studies, five reported on focus groups^{28 44–47} and one on in-depth interviews.⁴⁸ Study subjects varied by age (adolescents;^{35 37 39} young adults;^{28 38 47} adults;^{30 31 33 40–43 48} both adolescents and adults)^{32 34 36 44–46} and smoking status (smokers only;^{30 32–34 36 40–45 47 48} smokers and non-smokers).^{28 31 35 37–39 46} Two studies were conducted exclusively with women.^{46 48} Eight countries were represented across the studies: Australia,^{35 41 48} Chile,³⁷ Mexico,^{32 36 37 39 41 44} New Zealand,³⁸ the Philippines,²⁸ South Korea,³⁰ the UK^{33 45 46} and the USA.^{31 40–43 47} One study was a published conference abstract.³⁰ The full text of one study was in Spanish.³⁶ All studies examined capsule cigarettes with flavour, therefore the terms 'capsule' and 'flavour capsule' are used interchangeably in this paper.

Prevalence and correlates of flavour capsule cigarette use

Overall use

Eleven studies presented data on prevalence and correlates of flavour capsule cigarette use among smokers.^{30–36 38–41} Eight of these measured current use^{30–34 36 40 41} (table 2 and online supplemental table 1), while three assessed ever use^{35 38 39} (online supplemental table 1). The highest prevalence of current capsule use was observed in Mexico (43% in 2018/2019)³⁶ and Chile (40% in 2017),³⁴ followed by South Korea (18% in 2016)³⁰ and the UK (13% in 2016).³³ Two studies in Mexico found a rapid increase in flavour capsule⁴¹ and Pall Mall (most varieties are capsules)³² use over time. Flavour capsule use among adult smokers increased from 2012 to 2014 in Mexico (6% to 14%) and Australia (1% to 3%) but not in the USA (4%).⁴¹ Similar values for prevalence of menthol capsule use in the USA were also observed in two other studies (4% in 2013/2014)³¹ and 6% in 2014/2015).⁴⁰ In New Zealand, half of young adult smokers reported ever using capsule cigarettes in 2017.³⁸ Ever use was also examined in two studies with adolescents in Australia (7% in 2014)³⁵ and in Mexico (2%–9%, depending on the brand, in 2017).³⁹



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi:10.1136/bmj.n71. For more information, visit: <http://www.prisma-statement.org>

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram for new systematic reviews which included searches of databases and other sources.

Use by sociodemographic factors

Findings from all seven studies that assessed smokers' preference for flavour capsules by age, point to an association between capsule use and relatively younger age^{30–34 36 41} (table 2). Older age groups generally had lower odds of preferring capsule cigarettes compared with smokers who were 18–24 years old.^{30–33 41} In Chile, Mexico and the UK, age was inversely associated with use of and preference for capsule cigarettes.^{33 34 36} Current preferred use of capsule cigarettes was associated with being female among smokers in Mexico,^{32 36 41} Chile³⁴ and South Korea.³⁰ However, the association of capsule preference with gender was less conclusive in Australia,^{35 41} the UK³³ and the USA.^{31 41} Three studies examined capsule use by race/ethnicity in the UK³³ and USA,^{31 41} with mixed results. While one US study found that among smokers who were 18–24 years old capsule use was significantly higher among those identifying as Hispanic compared with all other race/ethnicity groups,³¹ another found no association.⁴¹ Findings were mixed across three studies that examined capsule use by education in Australia,⁴¹ Chile³⁷, Mexico^{36 41} and the USA.⁴¹ One study in the UK that assessed social grade did not find an association with capsule use.³³

Use by smoking and quitting behaviours

Findings on correlates of smoking and quitting behaviours with flavour capsule use varied across six studies that assessed this^{30 31 33 34 40 41} (table 2). Some studies found that smokers using capsules were more likely than non-capsule smokers to smoke less frequently,³¹ smoke less,^{31 34} be less nicotine dependent,^{30 31} to have started smoking later in life³¹ and to have been smoking their current usual brand for less than a year.³⁰ However, other studies had mixed findings^{32 40 41} or found no such associations.³³ While one study in the UK found a positive association between capsule use and intention to quit in the next 6 months,³³ two other studies did not find an association between past⁴⁰ or recent⁴¹ quit attempts, quit intentions⁴¹ or successful cessation.⁴⁰ In general, models were adjusted for sociodemographic factors and smoking behaviours (online supplemental table 1).

Behaviours of flavour capsule cigarette use

Two quantitative studies assessed frequency of crushing flavour capsules,^{33 41} one of which also measured the timing of crushing the capsule.⁴¹ Always crushing the capsule was reported by about half of capsule smokers in Mexico (52%)⁴¹ and the UK (51%),³³ which was higher than in Australia (30%)⁴¹ and the USA (37%).⁴¹ Correlates of more frequent crushing included: being a woman (USA⁴¹ and the UK),³³ younger age (the UK),³³ being White British (the UK),³³ not intending to quit (USA)⁴¹ and being a heavier smoker (the UK).³³ The most common timing of crushing the capsule in Australia, Mexico and the USA was before lighting the cigarette or during the first few puffs.⁴¹ In three qualitative studies, aspects of crushing behaviours emerged during discussion.^{44 47 48} Young women from Australia reported crushing them all of the time, however timing varied.⁴⁸ Some crushed at the beginning of smoking—either before lighting up or within the first few puffs, while others liked popping the capsule towards the end or halfway through. Reasons for the latter included being able to change the taste to get the 'mint fresh feeling' and to experience 'the best of both worlds'—crushed and uncrushed,⁴⁸ a sentiment that was also shared by some menthol smokers from the USA.⁴⁷ Some Mexican female smokers who used double capsule cigarettes described crushing one flavour at the beginning and the other flavour halfway through.⁴⁴

Only one study with a randomised, open-label laboratory design measured smoking topography of capsule cigarette use.⁴³ Switching from smoking menthol capsule to non-menthol cigarettes (15 days each) resulted in no significant differences in total puff volume and cigarette consumption.⁴³

Flavour capsule cigarette product perceptions and responses to the product

Overall, 15 studies examined product perceptions of flavour capsule cigarettes^{28 30 31 33 34 37–39 41 42 44–48} and two studies examined responses to product use^{42 43} (table 3 and online supplemental table 2).

Table 1 Study characteristics (n=20)

Study ID	Country	Year of data collection	Sample	Study design	Outcome measures
Abad-Vivero <i>et al</i> ³⁹	Mexico	2015	n=10 124 smokers and non-smokers, ages 11–16 years	Cross-sectional, experimental design	Prevalence/use; perceptions
Barrientos-Gutierrez <i>et al</i> ³⁷	Mexico	2016	n=4251 smokers and non-smokers, ages 12–14 years	Cross-sectional, discrete choice experiment	Perceptions
Brown <i>et al</i> ²⁸	The Philippines	2019	n=63 smokers and non-smokers, ages 18–24 years	Focus groups (n=8, stratified by gender and smoking status)	Perceptions
Cho and Thrasher ³⁰	South Korea	2016	n=1940 smokers, ages 18+ years	Cross-sectional	Prevalence/use; perceptions
Emond <i>et al</i> ³¹	USA	2013–2014	n=7181 smokers, ages 18–44 years	Cross-sectional	Prevalence/use; perceptions
Gilbert and Ewald ⁴⁸	Australia	2019	n=41 female smokers, ages 18–40 years	In-depth interviews	Perceptions
Grilo <i>et al</i> ⁴⁴	Mexico	2018	n=56 adolescent smokers and non-smokers and young adult smokers	Focus groups (n=10, stratified by gender, smoking status, socioeconomic status)	Perceptions
Gutiérrez-Torres <i>et al</i> ³²	Mexico	2009, 2011, 2015, 2016	n=12 692 smokers, ages 15–65 years who reported their last cigarette brand purchased	Repeated cross-sectional of two surveys	Prevalence/use
Hoek <i>et al</i> ³⁸	New Zealand	2017	n=816 smokers and susceptible non-smokers, ages 18–25 years	Cross-sectional, discrete choice experiment	Prevalence/use; perceptions
Moodie <i>et al</i> ⁴⁵	UK (Scotland)	2015	n=120 smokers, ages 16+ years	Focus groups (n=20, stratified by gender, age, social grade)	Perceptions
Moodie <i>et al</i> ⁴⁶	UK (Scotland)	2013	n=76 female smokers and non-smokers, ages 12–24 years	Focus groups (n=12, stratified by gender, smoking status, age)	Perceptions
Moodie <i>et al</i> ¹⁴	UK	2016	n=3620 factory-made cigarette smokers, ages 18+ years	Cross-sectional	Prevalence/use; crushing behaviour; perceptions
Paraje <i>et al</i> ³⁴	Chile	2017	n=851 smokers, ages >13 years	Cross-sectional	Prevalence/use; perceptions
Schneller ⁴⁰	USA	2013–2014, 2014–2015	n=8292 smokers with a usual brand, ages 18+ years	Cohort, two waves	Prevalence/use
Schneller <i>et al</i> ⁴²	USA	2017–2019	n=18 menthol smokers not trying to quit with no medical contraindications, ages 18–65 years	Randomised controlled study	Perceptions; product response
Strasser <i>et al</i> ⁴³	USA	2010–2011	n=32 menthol smokers not trying to quit, ages 21–65 years	Randomised controlled study	Smoking topography; product response
Thrasher <i>et al</i> ⁴¹	Australia, Mexico, USA	2012–2014	n=5864 observations, 2710 smokers (Australia); n=5723 observations, 3366 smokers (Mexico); n=6865 observations, 4154 smokers (USA), ages 18–64 years	Cohort, six quarterly waves	Prevalence/use; crushing behaviour; perceptions
Wackowski <i>et al</i> ⁴⁷	USA	2014–2015	n=45 menthol smokers, ages 18–24 years	Focus groups (n=3 black; n=3 other race)	Perceptions
White and Williams ³⁵	Australia	2014	n=23 007 smokers and non-smokers, ages 12–14 years	Cross-sectional	Prevalence/use
Zavala-Arciniega and Gutiérrez-Torres ³⁶	Mexico	2018–2019	n=8516 smokers, ages >10 years	Cross-sectional	Prevalence/use

Risk perceptions

Seven of nine studies found no difference in perceived harm of flavour capsule cigarettes compared with non-capsule cigarettes,^{28 31 33 37 38 42 45} with two studies having mixed results.^{41 46} One study found that capsule cigarette users were more likely to perceive their brand as less harmful than non-capsule smokers in Mexico and the USA—but not in Australia, however this was moderated by whether the brand was discount or premium.⁴¹ Discussion from focus groups suggested that confusion around relative harmfulness of capsule cigarettes was often linked to mixed perceptions around menthol.^{45 46} Some participants viewed capsule cigarettes as more harmful due to the presumed additional chemicals needed to change the flavour.⁴⁶

Outcome expectancies

Across eight studies, outcome expectancies of flavour capsule cigarettes that were examined quantitatively^{30 38 41} or emerged from qualitative data^{44–48} included: smoothness on throat/lightness in taste,^{30 38 41 48} pleasantness of taste/breath/smell,^{38 44–48} satisfaction/fun to smoke,^{38 41} and perceived impact on smoking initiation and quitting.^{45 46}

Smoothness on throat/lightness in taste

All three quantitative studies that measured the extent to which capsule cigarettes are perceived to have a lighter taste or to be smoother on the throat as compared with unflavoured or other cigarettes found a positive association^{30 38 41} especially among non-daily smokers, former smokers and susceptible

Table 2 Prevalence and correlates of current use of flavour capsule cigarette among smokers by country

Country	Study ID	Measure	Prevalence year: %	Use by age (years) % and/or measure of association (95% CI)	Use by gender % and/or measure of association (95% CI)	Other correlates of use % and/or measure of association (95% CI)
Australia	Thrasher <i>et al</i> ⁴¹	Usual or current preferred brand is flavour capsule	2012: 1% 2014: 3%	18–24: 4%, Ref 25–34: 54.4% (SD: 0.50) 35–44: 1%, aOR=0.32 (0.14 to 0.75)	Male: 1%, Ref Female: 2%, aOR=1.52 (0.91 to 2.52)	<i>Higher HSI</i> : aOR=0.83 (0.71 to 0.96) <i>NS</i> : Education, smoking status, intentions to quit, recent quit attempt
Chile	Paraje <i>et al</i> ³⁴	Last pack bought was flavour capsule cigarette	2017: 39.5%	≤25: 60% (SD: 0.49) 26–34: 54.4% (SD: 0.50) 35–49: 31.7% (SD: 0.47) ≥50: 23.0% (SD: 0.43) Each year less in age, likelihood of capsule use increased by 0.8–0.9 percentage points	Male: 32.3% (SD: 0.47), Ref Female: 46.7% (SD: 0.50) If female, likelihood of capsule use increased by 13.4–13.5 percentage points	<i>Price paid</i> : On average, the unit value of prices paid by those who used flavour capsule cigarettes was 14% higher than those who used non-flavoured cigarettes <i>NS</i> : Education, employment status
Mexico	Gutiérrez-Torres <i>et al</i> ³²	Last cigarette brand they purchased was Pall Mall (not specifically capsule, but most variants are)	2009: 1% 2011: 3% 2015: 10% 2016: 14%	Purchase of single cigs: 15–25: Ref 25–44: aOR=0.46 (0.33 to 0.63) 45–65: aOR=0.31 (0.19 to 0.51) Purchase of packs: <i>NS</i>	Purchase of single cigs: Male: Ref Female: aOR=2.21 (1.60 to 3.05) Purchase of packs: Female: aOR=1.99 (1.53 to 2.60)	Purchase of single cigs: <i>Smoking status</i> Non-daily: Ref Daily ≤5 cigs: aOR=0.88 (0.57 to 1.35) Daily >5 cigs: aOR=0.47 (0.24 to 0.90) Purchase of packs: <i>NS</i>
Mexico	Thrasher <i>et al</i> ⁴¹	Usual or current preferred brand is flavour capsule	2012: 6% 2014: 14%	18–24: 12%, Ref 25–34: 9%, aOR=0.66 (0.49 to 0.88) 35–44: 7%, aOR=0.60 (0.43 to 0.83) 45–54: 10%, aOR=0.67 (0.48 to 0.95)	Male: 7%, Ref Female: 13%, aOR=2.07 (1.66 to 2.59)	<i>Smoking status</i> Non-daily: 9%, Ref Daily: 11%, aOR=1.24 (1.02 to 1.51) <i>NS</i> : Education, HSI, quit intentions, recent quit attempt
Mexico	Zavala-Arciniega and Gutiérrez-Torres ³⁶	Smoke cigarettes with flavoured capsules within the past 30 days	2018–2019: 43%	10–19: 52%, aPR=2.66 (2.07 to 3.43) 20–29: 56%, aPR=2.64 (2.08 to 3.36) 30–39: 50%, aPR=2.41 (1.90 to 3.07) 40–49: 36%, aPR=1.80 (1.39 to 2.32) 50–59: 28%, aPR=1.41 (1.08 to 1.85) ≥60: 19%, Ref	Male: 39%, aPR=0.74 (0.69 to 0.80) Female: 55%, Ref	<i>Education</i> Primary school or less: 25%, Ref Secondary school: 43%, aPR=1.27 (1.13 to 1.43) High school: 51%, aPR=1.41 (1.24 to 1.61) University+: 56%, aPR=1.56 (1.36 to 1.79) <i>NS</i> : Well-being
South Korea	Cho and Thrasher ³⁰	Usual or current brand is flavour capsule	2016: 18%	19–28: Ref 29–38: aOR=0.38, p<0.001	Male: Ref Female: aOR=1.51, p<0.05	<i>Smoked current usual brand <1 year</i> Regular: Ref Capsule: aOR=4.81, p<0.001 <i>Higher nicotine dependence</i> Regular: Ref Capsule: aOR=0.87, p<0.01
United Kingdom	Moodie <i>et al</i> ¹⁴	Cigarette brand has flavour capsule	2016: 13%	25–34 vs 18–24: aOR=0.46 (0.33 to 0.64) 35–44 vs 18–34: aOR=0.41 (0.30 to 0.54) 45–54 vs 18–44: aOR=0.33 (0.24 to 0.45) 55+ vs 18–54: aOR=0.36 (0.27 to 0.48)	Male: Ref Female: aOR=1.15 (0.92 to 1.43)	<i>Race/ethnicity</i> White British: Ref Other white: aOR=1.85 (1.26 to 2.72) <i>Quit intentions (next 6 months)</i> No: Ref Yes: aOR=1.74 (1.40 to 2.17) <i>NS</i> : Social grade, HSI
United States	Emond <i>et al</i> ³¹	Usual or last-smoked cigarette is flavoured capsule	2013–2014: 4.3%	18–24: 9.4% (8.2 to 10.8) 25–34: 6.0% (5.1 to 7.0) 35–44: 3.7% (2.9 to 4.7) ≥45: 0.09% (0.6 to 1.0) p<0.001	No association	18 to 24 years old: <i>Race/ethnicity</i> Hispanic: 17.3% (13.1 to 22.4), p<0.05 Non-Hispanic white: 8.4% (7.0 to 10.1) Non-Hispanic black: 3.2% (1.1 to 8.8) Other: 9.1% <i>Smoke some days (vs every day)</i> Non-menthol: 32.5% (29.6 to 35.5) Menthol: 24.9% (21.8 to 28.3) Capsule: 46.3% (39.6 to 53.1), p<0.001 <i>Mean cigs smoked/day</i> Non-menthol: 14.3 (13.0 to 15.6) Menthol: 13.1 (11.6 to 14.6) Capsule: 10.7 (9.1 to 12.30), p<0.01 <i>Started smoking regularly at 18+ years</i> <i>First cig of day >1 hour of waking</i> <i>NS</i> : Polytobacco use

Continued

Table 2 Continued

Country	Study ID	Measure	Prevalence year: %	Use by age (years) % and/or measure of association (95% CI)	Use by gender % and/or measure of association (95% CI)	Other correlates of use % and/or measure of association (95% CI)
United States	Thrasher <i>et al</i> ⁴¹	Usual or current preferred brand variety includes a flavour capsule	2012: 4% 2014: 4%	18–24: 10%, Ref 25–34: 6%, aOR=0.64 (0.45 to 0.89) 35–44: 3%, aOR=0.36 (0.23 to 0.56) 45–54: 2%, aOR=0.16 (0.08 to 0.29) 55–64: 0.4%, aOR=0.08 (0.04 to 0.18)	Male: 4%, Ref Female: 5%, aOR=1.39 (1.03 to 1.88)	<i>Race/ethnicity</i> Caucasian: 4%, Ref African American: 4%, aOR=0.53 (0.26 to 1.09) Latino: 4%, aOR=0.66 (0.47 to 0.94) Other: 9%, aOR=1.35 (0.75 to 2.43) <i>NS</i> : Education, smoking status, HSI, quit intentions, recent quit attempt
United States	Schneller <i>et al</i> ⁴⁰	Usual brand is menthol in capsule only or menthol in both tobacco and capsule	2013–2014: 5.3%	N/A	N/A	<i>HSI mean score at Wave 1</i> Non-menthol: 2.4 (SE: 0.03) Menthol in capsule only: 1.3 (SE: 0.10) p<0.05 <i>NS</i> : HSI at Wave 2, past quit attempt, successfully quit by Wave 2

aOR, adjusted OR; aPR, adjusted prevalence ratio; cig, cigarette; HSI, Heaviness of Smoking Index (time to first cigarette and daily number of cigarettes consumed; higher score (4–6); lower score (0–3)); N/A, not applicable; NS, not statistically significant.

non-smokers.³⁸ In one qualitative study, menthol capsule cigarettes were described as lighter, milder and less harsh on the throat.⁴⁸ In the same study, those who used regular cigarettes preferred them over menthol capsules because they like the burn, heat and substance of regular cigarettes.⁴⁸

Pleasantness of taste, breath, smell

Across six studies, capsule cigarettes were viewed as tasting better, allowing for fresher breath, and/or concealing the smell from smoking.^{38 44–48} Young people, in particular, expressed the allure of the discreet smell of capsule cigarettes in being able to mask their smoking, such as at school or the office.^{44–46} Appeal of menthol capsule cigarettes was often tied to being more minty than traditional menthol cigarettes, similar to chewing gum, considered cleaner and fresher, and something better to smoke when sick.^{46–48} On the other hand, some smokers who preferred regular cigarettes did not like the more minty taste of menthol capsules, while some also described capsules as tasting ‘plasticky’ and ‘artificial’.⁴⁸

Satisfaction/fun to smoke

Smokers who preferred flavour capsule cigarettes were more likely to find their brand more satisfying in Australia⁴¹ and Mexico (specifically those who preferred discount varieties, primarily Pall Mall),⁴¹ but not in the USA.⁴¹ In New Zealand, former and non-daily smokers and susceptible non-smokers were more likely to report capsule cigarettes to be more satisfying and/or more fun to smoke compared with daily smokers.³⁸

Impact on smoking initiation and quitting

In two focus group studies, some participants saw flavour capsule cigarettes as a ‘starter cigarette’ meant to encourage non-smokers to experiment, while also making it easier for smokers to smoke more and discourage quitting due to the pleasant taste, reduced harshness and the ability to better conceal smoking.^{45 46}

Consumer interest

Fourteen studies examined aspects of consumer interest.^{28 30 31 33 34 37–39 41 44–48}

Brand awareness/recall

In two studies in Mexico,^{39 44} one in Scotland,⁴⁵ and one in the USA,⁴⁷ flavour capsule cigarettes were generally recognised

among all age groups, but awareness was particularly high among adolescents and younger adults.^{39 44 45 47}

Target audience/user associations

Across all five studies, participants described the perceived audience of flavour capsule cigarettes to be young people, including children, teenagers, students and young adults.^{28 44–47} In Mexico, capsule cigarettes were largely perceived to be meant for women and girls, with the pack colours described as reflective of their appeal to this population.⁴⁴ In Scotland, the Philippines, and the USA, capsule cigarettes were also viewed to be used by ‘party-goers’,²⁸ and particularly for special occasions.^{46 47} Capsule cigarettes were also regarded to most appeal to newer and occasional smokers,^{46 47} as well as to those who don’t like the taste of smoke^{45 46} or worry about its smell,⁴⁶ who want to look cool,⁴⁵ who are bored of their regular cigarettes or want to try something different,⁴⁶ and those who ‘like to play with stuff’.⁴⁷ Some older adults associated capsule cigarettes with electronic cigarettes due to the flavour options offered.⁴⁵

Appeal, attractiveness, preferred choice

Ten studies examined aspects related to flavour capsule cigarette’s appeal, attractiveness and preferred choice.^{28 37–39 41 44–48} In seven of these studies, participants viewed various types of cigarette packs^{28 37–39 44} or actual cigarettes,^{45 46} and were instructed to rank or group them according to their appeal,^{44–46} attractiveness,^{28 37–39} stylishness³⁸ and/or preferred choice.³⁸ Across the two discrete choice experiments^{37 38} and one cross-sectional survey with an experimental design, capsule cigarettes were perceived as significantly more attractive compared with non-capsule cigarettes. In one cohort study, capsule cigarettes were perceived as more stylish in Mexico and the USA, but not in Australia.⁴¹ Perceptions of greater appeal and attractiveness were also observed across focus group studies.^{28 44–47} Flavour capsule cigarettes were often described as being cool and offering novelty and entertainment.^{45–47} Aspects that were described as increasing the appeal of flavour capsule cigarettes included nice colour combinations, ‘brightness and shininess’;^{28 44} the presence of double-capsules;⁴⁴ the ability to choose smoking with or without flavour, making it easier to share with others and providing ‘the best of both worlds’;^{45–48} and the ‘bursting’ function.^{28 45 46} To that end, the ability to crush the capsule to release and change the flavour was a desirable feature that was associated with being

Table 3 Product perceptions of flavour capsule cigarettes by construct

Construct	Study ID	Study design	Comparison	Main findings related to perceptions of flavour capsule cigarettes
Risk perceptions				
<i>Perceived harm</i>	Barrientos-Gutierrez <i>et al</i> ³⁷	Cross-sectional, DCE	View one and two capsule versus non-capsule packs	Less harmful (one capsule)
	Brown <i>et al</i> ²⁸	Focus groups	View capsule versus non-capsule packs	No different in harm
	Emond <i>et al</i> ³¹	Cross-sectional	Usual brand capsule versus menthol/regular	No different in harm
	Hoek <i>et al</i> ³⁸	Cross-sectional, DCE	View capsule versus non-capsule packs	No different in harm
	Moodie <i>et al</i> ⁴⁵	Focus groups	View capsule versus non-capsule packs	No different in harm
	Moodie <i>et al</i> ⁴⁶	Focus groups	View capsule versus standard cigarettes	Mixed views on harm
	Moodie <i>et al</i> ¹⁴	Cross-sectional	Usual brand capsule versus regular	No different in harm
	Schneller <i>et al</i> ⁴²	Randomised controlled	After smoking capsule crushed versus uncrushed	No different in harm
Thrasher <i>et al</i> ⁴¹	Cohort	Usual brand capsule versus regular premium	Less harmful (discount brands in Mexico, USA); no different (Australia)	
Outcome expectancies				
<i>Smoothness on throat and lightness in taste</i>	Cho and Thrasher ³⁰	Cross-sectional	Usual brand capsule versus regular	Lighter in taste and smoother on throat
	Gilbert and Ewald ⁴⁸	Interviews	Menthol capsule versus non-capsule	Lighter, milder, less harsh on throat
	Hoek <i>et al</i> ³⁸	Cross-sectional, DCE	View capsule versus non-capsule packs	Smoother taste (more likely among non-daily, former smokers and susceptible non-smokers than daily smokers)
	Thrasher <i>et al</i> ⁴¹	Cohort	Usual brand capsule versus regular premium	Smoother (Australia, discount brands in Mexico, USA) and lighter (discount brands in Mexico)
<i>Pleasantness of taste, breath, smell</i>	Gilbert and Ewald ⁴⁸	Interviews	Menthol capsule versus non-capsule	Tastes more minty, sweeter, fresher, cleaner, more artificial; masks smell
	Grilo <i>et al</i> ⁴⁴	Focus groups	View capsule versus non-capsule packs	Tastes better, masks smell of tobacco, easier to conceal
	Hoek <i>et al</i> ³⁸	Cross-sectional, DCE	View capsule versus non-capsule packs	Leaves breath more pleasant.
	Moodie <i>et al</i> ⁷³	Focus groups	View capsule versus non-capsule packs	Tastes better (among younger groups, mixed among older adults), fresher breath, smells less, easier to conceal
	Moodie <i>et al</i> ⁴⁶	Focus groups	View capsule versus standard cigarettes	Tastes more pleasant, like gum, fresher breath, smells less
	Wackowski <i>et al</i> ⁴⁷	Focus groups	Camel Crush versus regular menthol	Tastes like candy/gum, toothpaste/mouthwash, more minty, less of smoke
<i>Satisfaction/fun to smoke</i>	Hoek <i>et al</i> ³⁸	Cross-sectional, DCE	View capsule versus non-capsule packs	More satisfying and fun to smoke, respectively (more likely among former smokers and susceptible non-smokers than daily smokers)
	Thrasher <i>et al</i> ⁴¹	Cohort	Usual brand capsule versus regular premium	More satisfying (Australia, discount brands in Mexico); no different (USA)
<i>Perceived impact on initiation quitting</i>	Moodie <i>et al</i> ⁴⁵	Focus groups	View capsule versus non-capsule packs	Encourages non-smokers to experiment, smokers to consume more, and discourages attempts to quit. Like a starter cigarette
	Moodie <i>et al</i> ⁴⁶	Focus groups	View capsule versus standard cigarettes	Makes it easier for non-smokers to try and smokers to use
Consumer interest				
<i>Brand awareness and recall</i>	Abad-Vivero <i>et al</i> ³⁹	Cross-sectional, experimental	View capsule versus non-capsule packs	No more likely to be recalled. Pall Mall capsules among top brand varieties with highest levels of recognition and correct brand recall
	Grilo <i>et al</i> ⁴⁴	Focus groups	View capsule versus non-capsule packs	In general, able to identify
	Moodie <i>et al</i> ⁴⁵	Focus groups	View capsule versus non-capsule packs	Awareness greater among younger adults (16–35 years) than older groups
	Wackowski <i>et al</i> ⁴⁷	Focus groups	Camel Crush versus regular menthol	Participants across all age groups were familiar

Continued

Table 3 Continued

Construct	Study ID	Study design	Comparison	Main findings related to perceptions of flavour capsule cigarettes
<i>Perceived target audience and user associations</i>	Brown <i>et al</i> ²⁸	Focus groups	View capsule versus non-capsule packs	Younger audience, including teens, young adults in their 20s, millennials, students and 'party-goers'
	Grilo <i>et al</i> ⁴⁴	Focus groups	View capsule versus non-capsule packs	Young girls and women
	Moodie <i>et al</i> ⁴⁵	Focus groups	View capsule versus non-capsule packs	Young people, those who don't like the taste of smoke, but want to look cool, and menthol smokers. Associated with e-cigarettes due to different flavours
	Moodie <i>et al</i> ⁴⁶	Focus groups	View capsule versus standard cigarettes	Children, young people. Those starting smoking, wanting to conceal smoking and wanting something different. Associated with being for special occasions, such as a party, wedding, prom or a night out
<i>Appeal, attractiveness and preferred choice</i>	Wackowski <i>et al</i> ⁴⁷	Focus groups	Camel Crush versus regular menthol cigarettes	Younger, newer smokers, those who like to play with stuff. Associated with toys and as being used by smokers occasionally for entertainment
	Abad-Vivero <i>et al</i> ³⁹	Cross-sectional, experimental	View capsule versus non-capsule packs	More attractive. Pall Mall and Camel capsules most often rated as very attractive
	Barrientos-Gutierrez <i>et al</i> ³⁷	Cross-sectional, DCE	View one and two capsule versus non-capsule packs	More attractive (one capsule, two capsules. Menthol, normal branding and small health warning labels (30%), respectively, enhanced attractiveness
	Brown <i>et al</i> ²⁸	Focus groups	View capsule versus non-capsule packs	More attractive and most named as favourite pack because of the nice colours and the 'button' imagery that created expectations around taste
	Gilbert <i>et al</i> ⁴⁸	Interviews	Menthol capsule versus non-capsule	Improves and personalises the smoking experience because tastes fresher, lighter and more minty, and can decide when to crush the capsule
	Grilo <i>et al</i> ⁴⁴	Focus groups	View capsule versus non-capsule packs	Availability of different flavours, the colours, and presence of double capsules increased the appeal of the pack
	Hoek <i>et al</i> ³⁸	Cross-sectional, DCE	View capsule versus non-capsule packs	More attractive (more likely among non-daily, former smokers and susceptible non-smokers than daily smokers) and more stylish (more likely among former smokers than daily smokers)
	Moodie <i>et al</i> ⁴⁵	Focus groups	View capsule versus non-capsule packs	More appealing among young people because novel, cool, fashionable, fun, can share with others, and can conceal. Older adults viewed as a gimmick
	Moodie <i>et al</i> ⁴⁶	Focus groups	View capsule versus standard cigarettes	More appealing than standard and menthol because high-tech, cool, novel, choice of flavours. Less appealing than pink coloured and slim cigarettes
	Thrasher <i>et al</i> ⁴¹	Cohort	Usual brand capsule versus regular premium	More stylish (discount brands in Mexico, USA); no different (Australia)
<i>Future use intentions</i>	Wackowski <i>et al</i> ⁴⁷	Focus groups	Camel Crush versus regular menthol cigarettes	Reasons for popularity: flavour options, sharing between non-menthol and menthol smokers, fun and entertaining. Some saw as a gimmick
	Abad-Vivero <i>et al</i> ³⁹	Cross-sectional, experimental	View capsule versus non-capsule packs	Greater likelihood of interest in trying (Pall Mall had greatest odds)
	Barrientos-Gutierrez <i>et al</i> ³⁷	Cross-sectional, DCE	View one and two capsule versus non-capsule packs	Greater interest in trying (one and two capsule). Menthol, normal branding and small health warning labels, respectively, enhanced interest in trying
	Hoek <i>et al</i> ³⁸	Cross-sectional, DCE	View capsule versus non-capsule packs	More likely to try if offered by a friend

Continued

Table 3 Continued

Construct	Study ID	Study design	Comparison	Main findings related to perceptions of flavour capsule cigarettes
Reasons for actual use or brand choice	Cho and Thrasher ³⁰	Cross-sectional	Usual brand capsule versus regular	More likely to choose brand because of taste
	Emond <i>et al</i> ³¹	Cross-sectional	Usual brand capsule versus menthol or regular	More likely to choose brand because of taste, less expensive and the design of the pack
	Moodie <i>et al</i> ¹⁴	Cross-sectional	Usual brand capsule versus regular	Reasons for using capsules (>20%): taste, smoother on airways, choice of flavours, clicking capsule, more interesting
	Paraje <i>et al</i> ³⁴	Cross-sectional	Last brand capsule versus non-capsule	More likely to choose flavour/taste in last purchase

.DCE, discrete choice experiment; e-cigarettes, electronic cigarettes.

technologically advanced,^{45 46} dynamic,⁴⁵ designer-like⁴⁵ and similar to a toy.⁴⁷ Being able to pop the capsule also contributed to a sense of personalising the smoking experience.⁴⁸ On the other hand, some older adults in Scotland and young adult menthol smokers in the USA described capsule cigarettes as 'gimmicky'.^{45 47} One study found that non-standardised packaging and smaller health warning labels were associated with higher pack attractiveness, for both one and two flavour capsule cigarettes, compared with no capsule.³⁷ In this study, when evaluating the relative importance of different pack characteristics on pack attractiveness, flavour capsules had a larger (8%) influence than tobacco flavour (6%) and descriptive terms/symbols (4%), but a smaller effect compared with branding (43%), health warning label size (19%) and content (11%), and brand variety (10%).³⁷

Future use intentions

Three cross-sectional studies with an experimental design found that flavour capsule cigarettes were associated with greater interest in trying the product compared with non-capsule cigarettes.^{37–39} One of these studies found that standardised packaging and larger health warnings attenuated this effect.³⁷ Another study determined that susceptible non-smokers and former smokers were more likely to try a fruit-flavoured capsule cigarette than an unflavoured cigarette, while non-daily smokers were more likely to try a menthol flavour capsule cigarette if offered by a friend compared with daily smokers.³⁸

Reasons for actual use/brand choice

Four cross-sectional studies examined a priori reasons for brand use or choice among flavour capsule users.^{30 31 33 34} Taste was the most prevalent reason across all studies. Flavour capsule smokers were significantly more likely than non-capsule users to indicate 'taste' as a reason for brand choice in three studies^{30 31 34} and 'design of the pack' in one of these studies.³¹ In one US study, flavour capsule users were more likely to choose their brand because it was 'less expensive' compared with menthol users.³¹ However, in a study in Chile, smokers of unflavoured cigarettes were more likely to report choosing it because of the price compared with flavour capsule smokers.³⁴ In one study, nearly 80% of capsule cigarette users reported choosing their brand due to 'the amount of satisfaction it gives you', although this did not differ significantly from non-capsule users.³¹ Other moderately prevalent (20%–40%) reasons for brand choice across two studies included: 'they are smoother on my airways than regular cigarettes',³³ 'people who are important to (me) smoke this brand',³¹ 'I like having the choice of flavours',³³ 'I enjoy clicking the capsule'³³ and 'they are more interesting than regular cigarettes'.³³

Sensory and other subject responses to product use

Two studies measured sensory responses among US adult menthol smokers not trying to quit.^{42 43} They concluded that there was minimal sensory impact of menthol being delivered via a crushable capsule compared with uncrushed products, with smokers' preferred brand generally having the greatest sensory effects.^{42 43} In the one study that also examined other subject responses, there were no significant differences in various measures, with the exception of greater relief of craving for the participant's preferred brand compared with Camel Menthol crushed.⁴²

Risk of bias assessment

Eighteen of the studies were assessed for risk of bias, with two studies not scored due to not being a full-text manuscript (ie, conference abstract,³⁰ report)³⁵ (online supplemental table 3). The mean quality assessment score for quantitative studies (n=12) was 23 out of 42 (range 18 to 26), and the mean score for qualitative studies (n=6) was 22 (range 19 to 26). The main issues were lack of theoretical framework, no evidence of user involvement in the design and inadequate justification for the analytical method selected, including its reliability and/or validity. Despite some risk of bias, none of the studies showed evidence of being severely methodologically flawed that would greatly retract from their validity. Moreover, none of the studies reported a conflict of interest or were funded by the tobacco industry.

DISCUSSION

This is the first systematic review on flavour capsule cigarettes, an innovative flavoured tobacco product that has experienced significant market growth over the past decade.¹⁴ We identified 20 studies related to use and perceptions of capsule cigarettes, the majority of which were conducted in Mexico and/or the USA, within the past decade, and used a cross-sectional or focus group design. We found that flavour capsule cigarettes are popular in many countries, particularly in Chile, Mexico and South Korea, and are used most by young people. In some countries, capsule cigarette use is also higher among women. These products are perceived as being designed for young people and novice smokers and to function as a 'starter cigarette'. Reasons for use and appeal have to do with positive perceptions about the product, such as better taste, smoothness on the airways, the choice of flavours and if/when to crush the capsule, and the enjoyment of clicking the capsule. Perceptions of relative reduced harm were more pronounced in Mexico than in other countries.

Country-level prevalence of flavour capsule cigarette use and increased trends over time were consistent with market share data from Euromonitor passport.^{14 18} Current capsule

cigarette use was highest in Chile³⁷ and Mexico,³⁶ both countries which have had one of the largest capsule markets globally since 2012.^{14 16 18} Rapid increases in capsule use observed in Mexico^{32 41} further highlights the growth of these products seen in Latin America.^{14 16 49} In many Latin American cities, flavour capsule cigarettes are ubiquitously available for purchase and heavily marketed at the point of sale, notably at retailers located close to schools.^{49–52} The high prevalence of capsule use identified in South Korea³⁰ is likely driven by similar marketing strategies.²⁰

Flavour capsule cigarettes were consistently most appealing to and consumed by young people, which mirrored perceptions around the presumed target audience of these products,^{28 44–47} and also aligns with research on other flavoured tobacco products.^{23 24 53} In some countries, current or ever use of capsule cigarettes among young smokers exceeded 50%.^{34 38} Adolescents and young adults were also more likely to want to try capsule cigarettes compared with non-capsule cigarettes.^{37–39} This is not surprising given that many of the product and advertising features of flavour capsule cigarettes identified across the studies are known by the tobacco industry to most appeal to this population.^{12 6 54 55} Young people's perceptions identified in this review echo tobacco industry consumer research on crushable capsules. An RJ Reynolds focus group found that consumers were enamoured by the product's offering of a multisensory (eg, 'hits four of the five sensory cues—Feel, Hear, Taste, and Smell'), multi-dimensional (eg, 'it is not a one trick pony') and personalised (eg, 'sense of mine') smoking experience.⁵⁶ Indeed, advertising slogans (eg, 'taste you can change')²⁰ and pack descriptors (eg, 'activate')⁵⁷ of flavour capsule cigarettes connote a flavourful, high-tech and customisable product. Other 'digital' features, such as the power button symbol,^{20 57 58} likely contribute to capsule cigarettes being generally recognised or known, especially among adolescents and young adults.^{39 44 45 47}

In addition, women were significantly more likely than men to prefer capsule cigarettes in many countries, a disparity also well documented for use of menthol and other flavoured cigarettes.^{59–62} Tobacco industry documents reveal the deliberate targeting and modification of tobacco products to appeal to women,^{63 64} whose brand preferences are largely driven by taste.⁶ Insights from early industry consumer research on capsule cigarettes also identified greater appeal for women.⁵⁶ However, a gender association was not clear across other studies and capsule cigarettes are still clearly popular among men,³⁵ who may particularly find the gadgetry of capsule cigarettes appealing.

Positive outcome expectancies about using capsule cigarettes were most salient among susceptible non-smokers and non-daily smokers compared with daily smokers, suggesting that these products are designed to recruit new smokers and retain novice smokers rather than established smokers.³⁸ Similar to other flavoured tobacco products,^{3 53 65} capsule cigarettes likely facilitate smoking initiation by making it more palatable and easier to smoke. However, findings around capsule use by smoking and quitting behaviours were mixed,^{30 31 33 34 40 41} indicating that more research is needed. Future research should also examine the sensory effects of other capsule cigarette brands and flavours across larger and more diverse sample populations given that the only two studies that assessed responses to the product were conducted among US menthol smokers and tested only one brand—Camel Crush.^{42 43}

Accounts of menthol capsule cigarettes tasting more minty than standard menthol cigarettes may be explained by the higher levels of menthol, along with other flavour compounds, that have been observed in chemical analysis studies of these

products.^{66 67} In most countries, capsule cigarettes were viewed as no less harmful than standard cigarettes.^{28 31 33 37 38 42 45} This may reflect the marketing strategies of flavour capsule cigarettes, which do not appear to focus on promoting a reduced harm product, but rather a product that is customisable and innovative.^{12 20 58} It is also possible that perceptions of reduced harm may be counterbalanced by views that the capsules contain additional chemicals to change the taste.⁴⁶ However, perceptions of reduced harm observed in Mexico^{37 41} is concerning given the high prevalence of use.

Capsule technology has created new avenues for undermining existing tobacco control policies. For instance, in Canada, the industry responded to a flavour cigarette ban with the introduction of crushable water capsule cigarettes.⁶⁸ Moreover, in the wake of the EU and UK ban on menthol cigarettes, the industry launched new menthol capsule cigarillos, as well as separate menthol accessories, including capsules.⁶⁹ Flavour capsules have also been applied to heated tobacco products.⁷⁰ As such, regulations should cover all capsule and filter advancements and other combustible tobacco products. The tobacco industry also responded to the adoption of plain packaging legislation in Australia,⁷¹ Singapore⁷² and in the UK⁷³ by launching new flavour capsule cigarette variants and flavours, along with other filter innovations prior to policy implementation, likely to weaken the impact of the policy on sales and as an alternative means to establish brand differentiation, although standardised packaging and larger health warning labels can reduce capsule cigarette pack attractiveness and interest in trying.³⁸ Regulatory attention should also be paid to point-of-sale advertising, which has been a particularly prominent channel used to promote flavour capsule cigarettes.⁵⁰

This is the first systematic review on flavour capsule cigarettes and includes both quantitative and qualitative studies, but outcome measures and populations varied across studies and comparing across studies should be done with caution. This further stymied our ability to conduct a meta-analysis. We used theoretical frameworks to strengthen our synthesis of results; however, some of the construct domains for product perceptions (eg, outcome expectancies and consumer interest) may not be mutually exclusive. Study quality was moderate overall, although our assessment could only be based on reported information, hence scores should only be interpreted as a general indication of the relative risk of bias within the context of other studies in this review. Among studies that assessed perceptions around pack design, only two used a discrete choice experiment design,^{37 38} a rigorous approach that has shown to have high predictive value between stated preferences and actual behaviours.⁷⁴ Moreover, only two studies used a cohort design.^{40 41} Given the lack of longitudinal data, it is difficult to discern how consumer profiles may change as the diffusion of this innovation becomes more established. Future research should focus on elucidating these nuances using more robust study designs. Lastly, considering the emerging status of the literature in this field, the exclusion of the grey literature publications may have left out important findings. Nevertheless, we kept our search strategy intentionally broad and crosschecked references of included publications to capture all relevant published studies.

CONCLUSIONS

Overall, this review offers compelling evidence that flavour capsule cigarette use is growing, particularly in certain countries (eg, Chile, Mexico, South Korea) and populations (eg, adolescents and young adults). These products are perceived as more

appealing and attractive than non-capsule cigarettes, especially by non-smokers and non-daily smokers, which strengthens evidence that capsule cigarettes can facilitate smoking initiation. Continued monitoring and research on flavour capsule cigarettes is critical, with particular attention to low-income and middle-income countries, which make up a disproportionately larger share of the capsule market.^{14 16 18} In order to further protect public health from the devastating effects of tobacco-related morbidity and mortality and to mitigate the tobacco industry's attempts to thwart tobacco control policies, countries should adopt comprehensive policies that take into account flavour capsules and similar product iterations that can facilitate smoking initiation through flavours, enhanced sensory effects and innovative features.

REGISTRATION AND PROTOCOL

The review was not registered and a protocol was not prepared.

What this papers adds

- ▶ This first systematic review on flavour capsule cigarettes found that use of these products is growing, with highest prevalence observed in Latin American countries (ie, Chile and Mexico) and among young people.
- ▶ Flavour capsule cigarette appeal is higher among non-smokers and non-daily smokers than daily smokers, and is often driven by positive outcome expectancies, such as pleasant taste and smoothness on the throat, as well as perceptions that these products offer novelty and customisability.
- ▶ This paper identifies significant gaps in the literature on flavour capsule cigarettes, particularly highlighting the need for more longitudinal and experimental studies, in order to inform and strengthen policy.

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Contributors CK conceptualised the study, conducted the database search and wrote the manuscript. CK and MZ screened and assessed eligibility of articles, extracted data and assessed risk of bias of the studies. FF advised and resolved discrepancies in eligibility and scoring of risk of bias. All authors edited the manuscript and approved the final manuscript.

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SUPPLEMENTARY TABLES

Supplementary Table 1. Prevalence and correlates of ever use and current use of flavour capsule cigarette by country

Country	Study ID	Measure	Prevalence of use Year: %	Use by age (years) % and/or measure of association (95%CI)	Use by gender % and/or measure of association (95%CI)	Other correlates of use % and/or measure of association (95%CI)
Ever Use						
AUSTRALIA	<i>White, 2016</i>	Ever used menthol capsule cigs	2014: 7.1%	12-15: 4.4% 16-17: 13.4% p<0.01 18-24: 4%, Ref 35-44: 1%, aOR=0.32 (0.14-0.75)	16-17-year-olds Male: 14.5% Female: 12.3% p<0.01 12-15-year-olds No association.	N/A
MEXICO	<i>Abad-Vivero, 2016</i>	Ever used viewed packs, with brand names removed	2015: <i>Capsule, regular</i> Marlboro: 2% Camel: 5% Pall Mall: 9% <i>Capsule, menthol</i> Marlboro: 6% Camel: 5% Pall Mall: 8%	N/A	N/A	N/A
NEW ZEALAND	<i>Hoek, 2019</i>	Ever smoked flavour capsule cigs	2017: 51.3%	N/A	N/A	N/A
Current Use						
AUSTRALIA	<i>Thrasher, 2016</i>	Usual or current preferred brand variety includes a flavour capsule	2012: 1% 2014: 3%	18-24: 4%, Ref 25-34: 3%, aOR ¹ =0.82 (0.37-1.84) 35-44: 1%, aOR¹=0.32 (0.14-0.75) 45-54: 1%, aOR ¹ =0.48 (0.19-1.23) 55-64: 1%, aOR ¹ =0.43 (0.16-1.10)	Male: 1%, Ref Female: 2%, aOR ¹ = 1.52 (0.91-2.52)	<i>Education</i> ≤High school: 1%, Ref Some university: 2%, aOR ¹ =1.05 (0.60-1.84) ≥University: 3%, aOR ¹ =1.16 (0.63-2.13) <i>Smoking status</i> Non-daily: 3%, Ref Daily: 2%, aOR ¹ =1.05 (0.63-1.74) <i>Intentions to quit</i> No: 1%, Ref

¹ Adjusted models for age, sex, education, income, race, daily smoker, quit attempt, Wave, and time in sample.

Country	Study ID	Measure	Prevalence of use Year: %	Use by age (years) % and/or measure of association (95%CI)	Use by gender % and/or measure of association (95%CI)	Other correlates of use % and/or measure of association (95%CI)
						Yes: 3%, aOR ¹ = 1.35 (0.87-2.09) Recent quit attempt No: 1%, Ref Yes: 3%, aOR ¹ =1.11 (0.72-1.71) HSI: aOR ¹ = 0.83 (0.71-0.96)
CHILE	Paraje, 2019	Last pack bought was flavour capsule cigs	2017: 39.5% (SD:0.49)	≤25: 60% (SD: 0.49) 26-34: 54.4% (SD: 0.50) 35-49: 31.7% (SD: 0.47) ≥50: 23.0% (SD:0.43) Each year less in age increased the likelihood of preferring capsules by 0.8- 0.9 percentage points. ²	Male: 32.3% (SD: 0.47) Female: 46.7% (SD: 0.50) If a woman, the likelihood of preferring capsules increased by 13.4-13.5 percentage points. ²	Price paid On average, the unit value of prices paid by those who used flavour capsule cigarettes was 14% higher than those who used non- flavoured cigarettes. No association with education level or with employment status.
MEXICO	Gutiérrez- Torres, 2020	Last cig brand they purchased was Pall Mall (not specifically capsules, but in Mexico most variants are capsules)	2009: 1% 2011: 3% 2015: 10% 2016: 14% Packs 2009: aOR ³ =0.48 (0.21-1.05) 2011: Ref 2015: aOR ³ = 3.71 (2.22-6.20) 2016: aOR ³ = 5.63 (3.65-8.69) Single Cigs 2009: aOR ³ = 0.39 (0.09-1.58) 2011: Ref 2015: aOR ³ = 6.22 (2.95- 13.08) 2016: aOR ³ = 9.98 (5.08- 19.62)	Packs 15-25: Ref 25-44: aOR ³ =0.83 (0.57-1.20) 45-65: aOR ³ =0.83 (0.55-1.25) Single Cigs 15-25: Ref 25-44: aOR ³ = 0.46 (0.33-0.63) 45-65: aOR ³ = 0.31 (0.19-0.51)	Packs Male: Ref Female: aOR³=1.99 (1.53-2.60) Single Cigs Male: Ref Female: aOR³=2.21 (1.60-3.05)	Smoking status Packs Non-daily: Ref Daily ≤5cigs/day: aOR ³ =1.15 (0.79-1.66) Daily >5cigs/day: aOR ³ =0.96 (0.70-1.32) Single Cigs Non-daily: Ref Daily ≤5cigs/day: aOR ³ =0.88 (0.57-1.35) Daily >5cigs/day: aOR ³ = 0.47 (0.24-0.90)

² Discrete choice (probit) models: The decision to smoke flavour capsule cigs (equal to one if respondents smoke flavour capsule cigs) is explained by the following characteristics of the smoker: age, sex, preference for the taste/flavour or price, level of education, number of cigs smoked per day, and employment status.

³ Adjusted models by year (2011 as the reference), sex, group of age, residence, education attainment, smoking pattern and cigarette price (log-transformed).

Country	Study ID	Measure	Prevalence of use Year: %	Use by age (years) % and/or measure of association (95%CI)	Use by gender % and/or measure of association (95%CI)	Other correlates of use % and/or measure of association (95%CI)
MEXICO	Thrasher, 2016	Usual or current preferred brand variety includes a flavour capsule	2012: 6% 2014: 14%	18-24: 12%, Ref 25-34: 9%, aOR¹=0.66 (0.49-0.88) 35-44: 7%, aOR¹=0.60 (0.43-0.83) 45-54: 10%, aOR¹= 0.67 (0.48-0.95) 55-64: 12%, aOR ¹ = 0.96 (0.67-1.38)	Male: 7%, Ref Female: 13%, aOR¹= 2.07 (1.66-2.59)	<i>Education</i> ≤High school: 11%, Ref Some university: 9%, aOR ¹ =0.90 (0.69-1.19) ≥University: 9%, aOR ¹ =0.85 (0.66-1.09) <i>Smoking status</i> Non-daily: 9%, Ref Daily: 11%, aOR¹= 1.24 (1.02-1.51) <i>Quit intentions</i> No: 11%, Ref Yes: 9%, aOR ¹ = 0.92 (0.76-1.1) <i>Recent quit attempt</i> No: 11%, Ref Yes: 9%, aOR ¹ = 0.89 (0.75-1.07) <i>HSI</i> : aOR ¹ =0.94 (0.86-1.03)
MEXICO	Zavala-Arciniega, 2020	Smoke cigarettes with flavoured capsules within the past 30 days	2018-2019: 43%	10-19: 52%, aPR⁴=2.66 (2.07-3.43) 20-29: 56%, aPR⁴=2.64 (2.08-3.36) 30-39: 50%, aPR⁴=2.41 (1.90-3.07) 40-49: 36%, aPR⁴=1.80 (1.39-2.32) 50-59: 28%, aPR⁴=1.41 (1.08-1.85) ≥60: 19%, Ref	Male: 39%, aPR⁴=0.74 (0.69-0.80) Female: 55%, Ref	<i>Education</i> Primary school or less: 25%, Ref Secondary school: 43%, aPR⁴=1.27 (1.13-1.43) High school: 51%, aPR⁴=1.41 (1.24-1.61) University or more: 56%, aPR⁴=1.56 (1.36-1.79) <i>Well-being index</i> (quintiles) Very low: 32%, Ref Low: 40%, aPR ⁴ =1.10 (0.96-1.27) Middle: 44%, aPR ⁴ =1.15 (0.99-1.33) High: 47%, aPR⁴=1.22 (1.06-1.40) Very high: 48%, aPR ⁴ =1.15 (0.99-1.34)
SOUTH KOREA	Cho, 2018	Usual or current brand is flavour capsule	2016: 18%	19-28: Ref 29-38: aOR=0.38, p<0.001	Male: Ref Female: aOR=1.51, p<0.05	<i>Smoked current usual brand <1 year</i> Regular: Ref Capsule: aOR=4.81, p<0.001 <i>Nicotine dependence</i> Regular: Ref Capsule: aOR=0.87, p<0.01

⁴ Adjusted models for type of smoker (daily, occasional) and geographical region (Central, Mexico City, North, South)

Country	Study ID	Measure	Prevalence of use Year: %	Use by age (years) % and/or measure of association (95%CI)	Use by gender % and/or measure of association (95%CI)	Other correlates of use % and/or measure of association (95%CI)
UNITED KINGDOM	<i>Moodie, 2019</i>	Cig brand has flavour capsule	2016: 13%	25-34 vs. 18-24: aOR⁵=0.46 (0.33-0.64) 35-44 vs. 18-34: aOR⁵=0.41 (0.30-0.54) 45-54 vs. 18-44: aOR⁵=0.33 (0.24-0.45) 55+ vs. 18-54: aOR⁵=0.36 (0.27-0.48)	Male: Ref Female: aOR ⁵ =1.15 (0.92-1.43)	<i>Race/ethnicity</i> White British: Ref Other white: aOR⁵=1.85 (1.26-2.72) Other: aOR ⁵ =1.16 (0.76-1.78) Not stated: aOR ⁵ =0.46 (0.11-1.99) <i>Social Grade</i> ABC1: Ref C2DE: aOR ⁵ =1.11 (0.88-1.40) Not stated: aOR ⁵ =0.86 (0.43-1.74) <i>HSI</i> 0: Ref 1 vs 0: aOR ⁵ = 0.89 (0.63-1.26) 2 vs. (0-1): aOR ⁵ = 0.89 (0.65-1.22) 3 vs. (0-2): aOR ⁵ = 0.83 (0.62-1.11) 4-6 vs. (0-3): aOR ⁵ = 0.87 (0.60-1.27) Not stated vs. (0-6): aOR ⁵ = 1.14 (0.48-2.70) <i>Quit intentions (next 6 months)</i> No: Ref Yes: aOR⁵=1.74 (1.40-2.17)
UNITED STATES	<i>Emond, 2017</i>	Usual or last-smoked cig is flavour capsule variant	2013-2014: 4.3%	18-24: 9.4% (8.2-10.8), p<0.001 25-34: 6.0% (5.1-7.0), p<0.001 35-44: 3.7% (2.9-4.7), p<0.001 ≥45: 0.09% (0.6-1.0)	No association.	<i>18-24-year-olds</i> <i>Race/ethnicity</i> Hispanic: 17.3% (13.1-22.4) Non-Hispanic white: 8.4% (7.0-10.1) Non-Hispanic black: 3.2% (1.1-8.8) Other: 9.1% p<0.05 among Hispanic than non-Hispanic white or black <i>Smoke some days (vs every day)</i> Non-menthol: 32.5% (29.6-35.5) Menthol: 24.9% (21.8-28.3) Capsule: 46.3% (39.6-53.1), p<0.001 <i>Mean cigs smoked/day</i> Non-menthol: 14.3 cigs (13.0-15.6)

⁵ Adjusted models for sex, age, social grade, ethnicity, HSI, plans to quit in next 6 months.

Country	Study ID	Measure	Prevalence of use Year: %	Use by age (years) % and/or measure of association (95%CI)	Use by gender % and/or measure of association (95%CI)	Other correlates of use % and/or measure of association (95%CI)
						Menthol: 13.1 cigs (11.6-14.6) Capsule: 10.7 cigs (9.1-12.30), p<0.01 <i>Polytobacco use</i> Non-menthol: 41.2% (38.6-43.9) Menthol: 35.7% (32.6-38.9), p<0.05 Capsule: 40.9% (34.4-47.7) Smoking history⁶ Nicotine dependence⁷
UNITED STATES	<i>Thrasher, 2016</i>	Usual or current preferred brand variety includes a flavour capsule	2012: 4% 2014: 4%	18-24: 10%, Ref 25-34: 6%, aOR¹=0.64 (0.45-0.89) 35-44: 3%, aOR¹=0.36 (0.23-0.56) 45-54: 2%, aOR¹=0.16 (0.08-0.29) 55-64: 0.4%, aOR¹=0.08 (0.04-0.18)	Male: 4%, Ref Female: 5%, aOR¹= 1.39 (1.03-1.88)	<i>Race Ethnicity</i> Caucasian: 4%, Ref African American: 4%, aOR ¹ =0.53 (0.26-1.09) Latino: 4%, aOR¹=0.66 (0.47-0.94) Other: 9%, aOR ¹ =1.35 (0.75-2.43) <i>Education</i> ≤High school: 4%, Ref Some university: 5%, aOR ¹ =0.98 (0.70-1.37) ≥University: 5%, aOR ¹ =0.98 (0.67-1.45) <i>Smoking status</i> Non-daily: 6%, Ref Daily: 4%, aOR ¹ = 0.84 (0.60-1.17) <i>Quit intentions</i> No: 4%, Ref Yes: 5%, aOR ¹ = 1.11 (0.82-1.49) <i>Recent quit attempt</i> No: 4%, Ref Yes: 5%, aOR ¹ = 1.04 (0.77-1.41) <i>HSI: aOR¹=0.90 (0.80-1.01)</i> <i>Mean (SE); Adjusted β⁸ (95%CI)</i> <i>HSI:</i> <i>Wave 1:</i> Non-menthol: 2.4 (0.03), Ref Menthol capsule only: 1.3 (0.10), p<0.05
UNITED STATES	<i>Schneller, 2020a</i>	Usual brand: non-menthol, menthol in tobacco only, menthol in	2014-2015: 6% Menthol capsule only: 3%	N/A	N/A	

⁶ Capsule daily smokers were more like to start smoking regularly when 18 years or older than non-menthol/ menthol daily smokers, p<0.001

⁷ Capsule smokers were less likely to smoke within an hour of waking than non-menthol/ menthol smokers, p<0.001

Country	Study ID	Measure	Prevalence of use Year: %	Use by age (years) % and/or measure of association (95%CI)	Use by gender % and/or measure of association (95%CI)	Other correlates of use % and/or measure of association (95%CI)
		capsule only, menthol in both tobacco and capsule	Menthol in tobacco and capsule: 2.3%			<p>Wave 2: Non-menthol: 2.27 (0.04), Ref Menthol tobacco only: 2.06 (0.03), β^8: -0.05 (-0.12-0.03) Menthol capsule only: 1.35 (0.11), β^8: -0.04 (-0.20-0.12) Menthol tobacco and capsule: 1.76 (0.13), β^8: -0.13 (-0.30-0.03)</p> <p><i>Made past quit attempt:</i> Non-menthol: 62.7%, Ref Menthol tobacco only: 66.1%, β^8: 1.00 (0.89- 1.13) Menthol capsule only: 69.5%, β^8: 1.14 (0.83- 1.57) Menthol tobacco and capsule: 61.6%, β^8: 0.74 (0.52-1.06)</p> <p><i>Successfully quit at Wave 2:</i> Non-menthol: 11.6%, Ref Menthol tobacco only: 10.9%, β^8: 1.09 (0.88- 1.37) Menthol capsule only: 17.8%, β^8: 1.21 (0.77- 1.90) Menthol tobacco and capsule: 17.1%, β^8: 1.48 (0.97-2.25)</p>

Bolded= Statistically significant; N/A=Not applicable; 95%CI= 95% Confidence interval; SE= Standard error; SD= Standard deviation; aOR= Adjusted odds ratio; Ref= Reference category, Cig= Cigarette; HSI = Heaviness of Smoking Index: Time to first cigarette and daily number of cigarettes consumed; higher score (4–6); lower score (0-3)

⁸ Adjusted models for sex, age, race/ethnicity, and education. HSI also included in models for successfully quit and made past quit attempt.

Supplementary Table 2. Product perceptions and responses to the product of flavour capsule cigarette by construct

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
<i>Product perceptions</i> ⁹				
RISK PERCEPTIONS				
PERCEIVED HARM	Barrientos-Gutierrez, 2020	Cross-sectional survey with students aged 12-14 years from Mexico, 2015; Discrete choice experiment using a 3X25 design with six attributes.	Relative harm: For each choice set of three packs: 'If you were to smoke, which of these brands will harm your health the most?' and 'which would harm your health the least?', with the option "all are equally harmful".	Packs with one capsule were perceived to have lower harm than packs with no capsules (b=0.131, SE=0.04, p<0.01), however this was not found for packs with two capsules. Normal branding (rather than plain packaging) and packs with small HWLs (30%), respectively enhanced perceptions of lower harm of packs with one flavour capsule (b=-0.216, SE=0.06, p<0.001 and b=-0.192, SE=0.06, p<0.001, respectively), but not for two capsules, compared to no capsules. Pall Mall packs were perceived to have relatively lower harm compared to Marlboro packs (b=-0.265, SE=0.06, p<0.001).
	Brown, 2020	Focus groups with young adults (smokers and non-smokers, men and women) aged 18-24 years from Metro Manila, Philippines; Viewed 26 cigarette packs purchased in Manila which varied in brand, flavour and size.	Relative harm: Asked to place all packs on a scale from 'least harmful to most harmful'; Questions on why ranked packs as they did, how the packs are similar and different and what pack characteristics contributed to their ranking.	Generally, there were no perceived differences in harm between flavour capsule packs and non-flavoured packs.
	Emond, 2018	Cross-sectional survey with 7,181 adults, aged 18-44 years, from the US who were current or former established (≥ 100 lifetime cigarettes) cigarette smokers.	Relative harm: Asked whether usual brand is less harmful, no different or more harmful compared with other cigarette brands.	Among current, daily smokers aged 18-24 years, those whose usual or last brand smoked was flavour capsule cigarettes, the majority (84.8%, 95%CI: 74.5-91.4) believed their brand was no different in harm compared to other brands. 4.2% (95%CI: 1.3-13.3) perceived their brand to be less harmful and 11.0% (95%CI: 5.0-19.2) perceived their brand to be more harmful. Harm perceptions among flavour capsule smokers did not differ from non-menthol and menthol smokers.
	Hoek, 2019	Discrete choice experiment cross-sectional survey with 816	Relative harm; Relative levels of tar: Asked to rate a capsule cigarette	There were no significant differences in perceptions of capsule cigarettes being less harmful or having lower tar, respectively

⁹ Product perceptions, as defined in the Hypothetical Model of Tobacco Consumer Response, encompass "subjective responses to product information, and include individual perceptions of risk, attitudes and beliefs about the product, social acceptability, and outcome expectancies such as satisfactory nicotine and sensory effects". (Rees VW, Kreslake JM, Cummings KM, et al. Assessing consumer responses to potential reduced-exposure tobacco products: a review of tobacco industry and independent research methods. *Cancer Epidemiol Biomarkers Prev.* 2009;18(12):3225-3240).

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
		young adults (425 daily/non-daily current smokers, 224 susceptible non-smokers ¹⁰ , and 155 former smokers), aged 18-25 years from New Zealand.	compared to an unflavoured cigarette on perceived relative harm and levels of tar, respectively, on a seven-point semantic differential scale, where 1 is negative and 7 is positive	between daily and non-daily smokers and former and never susceptible non-smokers ¹⁰ , with all groups having a mean score between 4.1 and 4.3 for relative harm and between 4.3 and 4.4 for relative levels of tar.
	Moodie, 2015	Focus groups with 75 female non-smokers and occasional smokers aged 12-24 years from Glasgow, Scotland, United Kingdom in 2013; 12 focus groups segmented by age (12-14, 15-17, 18-24) and social grade (ABC1, C2DE).	Relative harm and reasons why: Participants shown 11 cigarettes (2 standard, 2 coloured, 4 slim, 1 aromatized black cigarette, 1 menthol, and 1 menthol capsule) and asked to order the cigarettes by harm (most/least) and the reasons behind the ordering decisions. There was also general discussion when participants were shown the menthol capsule inside the filter.	'The capsule and menthol cigarettes tended to be placed together and ranked as less harmful, positioned either alongside the four slim and pink cigarettes or as slightly more harmful than these cigarettes. The capsule and menthol cigarettes were, however, usually ranked less harmful than the two standard cigarettes. The prevailing view was that menthol flavouring implied a safer cigarette... While the capsule cigarette was placed alongside the menthol cigarette and towards the least harmful, perceptions of harm were less clear after participants were shown the capsule inside the filter. While the perception that the capsule cigarette would be less harmful persisted, some participants recognized that the cigarette was just the same as a standard cigarette but with a different flavouring. Others thought it would be more harmful. These participants were surprised at the capsule's appearance, likened it to chemicals and became concerned about the extra ingredients need to change the taste... That looks more dangerous...looks like something you would put in your laundry. It's just extra chemicals isn't it?' (18-24-year-old occasional smoker).'
	Moodie, 2018	Focus groups with 120 current smokers aged 16 to 50+ years from Glasgow and Edinburgh, Scotland, United Kingdom in 2015; 12 focus groups segmented by gender, age (16-17, 18-24, 25-35, 36-50, >50), and social grade (ABC1, C2DE).	Relative harm and reasons why: Participants given a number of cigarettes, including two capsule cigarettes. Not explicitly measured, but perceptions around relative harm of capsule cigarettes emerged as a theme from the data.	'Participants were not explicitly asked to comment on the perceived harm of capsule cigarettes, which was seldom discussed in groups. Where it was, discussion indicated some confusion about the harmfulness of capsule cigarettes in comparison to traditional cigarettes, which was generally related to mixed perceptions of menthol. One view was that capsules would be less harmful because they contain menthol, whereas others thought they could be more harmful because menthol was perceived to open up the airways and allow more toxins in the lungs. The final view was that there would be no difference in terms of harm.'
	Moodie, 2019	Cross-sectional survey with 3620 factory-made cigarette smokers, who had smoked in the past month aged 18+ years from the United Kingdom.	Relative harm: 'Is your usual (current) brand of cigarettes a little less harmful, no different, or a little more harmful, compared to other brands?'	Perceptions of harm did not differ significantly between flavour capsule and non-capsule smokers.

¹⁰ Susceptible non-smokers = Never smoked regularly, but gave responses other than 'Definitely would not smoke if offered a cigarette by a friend' or 'Definitely will not smoke a cigarette in the next 12 months'.

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
	Schneller, 2020b	Randomised controlled study design ¹¹ with 18 smokers aged 18-65 years who smoked 5+ cigarettes daily, primarily preferred mentholated cigarettes, and were not trying to quit smoking, from the United States.	Perceived risk: At the end of each smoking session, participants used a 10-run ladder to assess perceived risk of the cigarette product after smoking the cigarette replicates assigned for each session, with the top of the ladder representing a greater health risk and the bottom was no or little health risk.	There were no significant differences in mean risk perception scores according to cigarette product (F (4,64)=0.77; p=0.448). Scores showed that most participants felt that all cigarette products were harmful to their health.
	Thrasher, 2016	Quarterly surveys with smokers aged 18-64 from Australia (n=5864 observations, n=2710 individuals), Mexico (n=5723 observations, n=3366 individuals), and the US (n=6865 observations, n=4154 individuals).	Relative harm: 'Compared to other cigarettes, how much less/more harmful is your brand and type of cigarettes?' (much less harmful, a little less harmful, the same, a little more harmful, much more harmful).	Mexican smokers who preferred discount flavour capsules were more likely than regular premium brand smokers to view their brand as less harmful (b: 0.07, SE: 0.03, p<0.05). US smokers who preferred flavour capsule varieties (only found among premium brands) were more likely to view their brand as less harmful than smokers who preferred regular premium brands (b: 0.08, SE:0.03, p<0.05). No difference observed in Australia.
OUTCOME EXPECTANCIES¹²				
SMOOTHNESS, LIGHTNESS	Cho, 2018	Cross-sectional survey with 1,940 adult smokers, aged 18+ years from South Korea.	Smoothness on throat: 'Thinking about the cigarette you usually/ currently smoke, are your cigarettes harsher or smoother on your throat?' (Harsher, About the Same, Smoother)	Flavour capsule cigarette smokers were more likely than regular cigarette smokers to report that their cigarette varieties are lighter in taste (b: 0.18, p <.01) and smoother on throat (b: 0.12, p <.05).
	Gilbert, 2021	In-depth interviews with 41 women smokers, aged 18-40 years from Australia.	Lighter, milder, less harsh on throat; Less substance: Not explicitly measured, but emerged as a theme.	'For many, menthol capsules made the cigarettes feel "lighter", "milder", less "harsh on your throat", "not as strong" as regular cigarettes, and allowed them to avoid "that disgusting taste in my mouth"... "I don't like harsh cigarettes. They (Winfield Optimum Crush) feel very, very light. That's why I like them. Especially if you pop them at the start, they're extremely light. Enjoyable and lighter, yeah"; "It's not as harsh as just smoking it on its own".' Among smokers who didn't use menthol capsules, they preferred regular

¹¹ Participants were randomly assigned to one of four sampling groups, which varied in the sequence of the cigarette products that were smoked (Camel Crush crushed, Camel Crush uncrushed, Camel Menthol crushed, and Camel Menthol uncrushed) (R.J. Reynolds, Winston-Salem, NC). All participants smoked all available cigarette products. At the baseline session, all participants smoked their preferred brand, which allowed them to serve as their own control.

¹² "Outcome expectancies" is a construct of product perceptions from the Hypothetical Model of Tobacco Consumer Response with examples described as satisfactory nicotine and sensory effects (Rees VW, Kreslake JM, Cummings KM, et al. Assessing consumer responses to potential reduced-exposure tobacco products: a review of tobacco industry and independent research methods. *Cancer Epidemiol Biomarkers Prev.* 2009;18(12):3225-3240). Outcome expectancies originates from social learning theory and refers to a person's beliefs about the likelihood that a behaviour will result in specific outcomes or consequences (Maisto SA, Karey KB, Bradizza CM. Social learning theory. In: Leonard KE, Blane HT, editors. *Psychological Theories of Drinking and Alcoholism.* New York: Guilford Press; 1999. pp. 106–163).

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
				cigarettes because of the “burn” and “heat that you get”, which makes “everything become clearer than it did”, “makes me feel present”, “in the moment”... “I like the burn of the cigarette, Okay. I like the drawing into my lungs and exhaling it’s like taking a deep breath, but like, there’s more substance to it”; “Cause when I’m stressed it kind of like burns but it like centres me (...) So it’s like it grounds me cause I have a lot of anxiety”.’
	Hoek, 2019	Discrete choice experiment cross-sectional survey with 816 young adults (425 daily/non-daily current smokers, 224 susceptible non-smokers ¹⁰ , and 155 former smokers), aged 18-25 years from New Zealand.	Smoother taste: Asked to rate a capsule cigarette compared to an unflavoured cigarette on whether they have a smoother taste, on a seven-point semantic differential scale, where 1 is negative and 7 is positive.	Non-daily smokers (4.8, 95%CI: 4.6-5.1, p<0.05), former smokers (4.9, 95%CI: 4.7-5.1, p<0.05) and susceptible non-smokers ¹⁰ (5.0, 95%CI: 4.8-5.1, p<0.001) were significantly more likely than daily smokers (4.5, 95%CI: 4.3-4.7) to perceive capsule cigarettes as having a smoother taste.
	Thrasher, 2016	Quarterly surveys with smokers aged 18-64 from Australia (n=5864 observations, n=2710 individuals), Mexico (n=5723 observations, n=3366 individuals), and the US (n=6865 observations, n=4154 individuals).	Lighter; Smoother: ‘Compared to other cigarettes, how much lighter/more intense and smoother/harsher, respectively, is your brand and type of cigarettes?’ (much more, a little more, the same, a little more, much more).	Australian smokers who preferred flavour capsule varieties were more likely than those who preferred regular brands to view their brand as smoother (b: 0.27, SE: 0.10, p<0.01). Mexican smokers who preferred discount flavour capsules were more likely than regular premium brand smokers to view their brand as lighter (b: 0.43, SE: 0.08, p<0.001) and smoother (b: 0.49, SE: 0.07, p<0.001). US smokers who preferred flavour varieties (only found among premium brands) were more likely to view their brand as smoother (b: 0.25, SE: 0.07, p<0.001) than smokers who preferred regular premium brands.
TASTE/ BREATH/ SMELL	Gilbert, 2021	In-depth interviews with 41 women smokers, aged 18-40 years from Australia.	Taste more minty, sweeter, fresher, cleaner, artificial; Smell less: Not explicitly measured, but emerged as a theme.	‘Most young women gave accounts that menthol capsules improved the taste of cigarettes, with participants describing the menthol flavour as “fresh”, “refreshing”, “like a blast of mint”, and “not as bitter” as regular cigarettes... “It’s almost like a breath of fresh air. They just seem a bit cleaner, a bit fresher”; “Kind of feels like healthier in a way because it’s more refreshing”; “It’s more like an air-con in your mouth”. Some young women explained that when compared with menthol flavour capsule cigarettes, regular cigarettes are “just dirty”, “dirty tasting”, “horrendous”, “look yuck”... and as “tasting like chemicals”....Some participants provided accounts that “If I can’t get my menthol cigarettes, I won’t smoke”. ...Menthol flavour capsule cigarettes are like smoking a sweet or breath mint...: “They don’t even taste like a cigarette. They taste like you’re just smoking a minty”; “There’s like this little ball, you pop it. Some people literally take it out and just taste it. Like it pops in your mouth and it’s just like mint.” The mint flavour of the menthol capsule with masked the taste of tobacco. “I have this weird thing in my head that maybe—it’s more subconscious—that I won’t smell of cigarettes either, because if I

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
				can't taste the dirtiness, I can't smell the dirtiness. They just seem a bit cleaner, a bit fresher."Almost all of the eighteen young women who did not smoke flavour capsule cigarettes reported that they "can't stand menthols" or the "minty kind of taste" ... [they] described menthol capsules as "like somebody ate like a whole bunch of mints and then threw up in your mouth" ... "plasticky" and "artificial" ...with many preferring the "full bodied flavour and texture" and "the pure tobacco taste" of regular cigarettes.'
	Grilo, 2021	Focus group discussions with 56 adolescents (10 focus groups) and young adult smokers (5 focus groups), separated by age, gender, smoking, and socioeconomic (SES) status) from Mexico City, Mexico.	Taste better; Smell less : Not explicitly measured, but perceptions around the taste of capsule cigarettes emerged as a theme during pack sorting exercise in which participants were given 23 cigarettes packs (most were flavour capsule cigarettes reflecting the Mexican market) to view and were told to divide into groups they believed to be appealing and unappealing to young people and asked about reasons behind these choices.	'Flavors were especially appealing to smokers because they modified the taste and smell of cigarettes. "I don't know why the capsule appeals to me, I feel I want to know what it tastes like (female adolescent smoker, low-SES); "I started to like these [Pall Mall Mykonos Nightfall] because my grandmother bought them and I smelled the scent of the cucumber flavor capsule and said, 'I want to try them' (male adolescent smoker, mid/high-SES); "First, in part because of the blending design, the colors, the capsule that says it is just one [capsule that] has two flavors, and the experience that they are fresh [Benson and Hedges Crystal Violet] (female adolescent smoker, mid/high-SES). "A lot of young people tell me I buy these because they have a capsule and taste better. They don't taste as strong as Marlboro or Shots. And besides, I think that's why these attract young people more, because of the flavours and the colours" (male adolescent smoker, mid/high-SES). Female young adults (mid/high SES) shared a unique perception that flavours would mask the smell of tobacco.: "Young people...smoke it because it's smooth. Sometimes they go out to eat or something like that, they smoke it and go back to the office without any smell" (female young adult, mid/high SES).'
	Hoek, 2019	Discrete choice experiment cross-sectional survey with 816 young adults (425 daily/non-daily current smokers, 224 susceptible non-smokers ¹⁰ , and 155 former smokers), aged 18-25 years from New Zealand.	Leaves breath pleasant: Asked to rate a capsule cigarette compared to an unflavoured cigarette on whether they leave your breath pleasant, on a seven-point semantic differential scale, where 1 is negative and 7 is positive.	There were no significant differences between daily smokers and non-daily smokers, former smokers, and susceptible non-smokers ¹⁰ on perceptions about flavour capsules leaving one's breath more pleasant, with all groups having a mean score between 4.6 and 4.7.
	Moodie, 2015	Focus groups with 75 female non-smokers and occasional smokers aged 12-24 years from Glasgow, Scotland, United Kingdom; 12 focus groups segmented by age (12-14, 15-	Pleasant taste and reasons why; Pleasant breath/ smell: Participants shown 11 cigarettes (2 standard, 2 coloured, 4 slim, 1 aromatized black cigarette, 1 menthol, and 1 menthol capsule) and asked to order the	'When ranked in order of taste, the slim, pink, capsule and menthol cigarettes were generally perceived to be more pleasant tasting than the standard cigarette.... That they do not taste of traditional cigarettes and allow for fresher breath, simply by bursting the capsule, was perceived to make smoking more pleasant... Many participants thought the cigarette would be less smelly than a

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
		17, 18-24) and social grade (ABC1, C2DE).	cigarettes by taste (pleasant/unpleasant) and the reasons behind the ordering decisions. Not explicitly measured, but perceptions around the impact of capsule cigarettes on breath and smell emerged as a theme during general discussion when participants were shown the menthol capsule inside the filter.	standard cigarette, provide fresher breath, be gentler on the throat, and would make it less obvious that somebody had been smoking... Several likened it to finishing off a cigarette with a chewing gum. "Because you're smoking a cigarette and then all of a sudden it's like chewing gum", 15-17 year old non-smoker). The capsule and menthol cigarettes were also considered "cleaner" and "fresher" than the standard cork filtered cigarettes.'
	Moodie, 2018	Focus groups with 120 current smokers aged 16 to 50+ years from Glasgow and Edinburgh, Scotland, United Kingdom; 12 focus groups segmented by gender, age (16-17, 18-24, 25-35, 36-50, >50), and social grade (ABC1, C2DE).	Taste, fresher breath, smell less, concealment: Not explicitly measured, but perceptions around the impact of capsule cigarettes on taste, breath, and smell emerged as a theme from the data, particularly in relation to why they were appealing.	'That they do not taste of traditional cigarettes and allow for fresher breath, simply by bursting the capsule, was perceived to make smoking more pleasant and thought to appeal to young people and those just starting to smoke... Opinion among older adults regarding taste was mixed. On one hand were those opposed to different flavors because they enjoyed the taste of traditional cigarettes, but on the other were those who were attracted to alternative flavors because they could mask the taste of traditional cigarettes. "I don't like the taste of cigarettes and I think that would appeal to me" (50+ year old female, social class C2DE)... The final element of appeal was concealment, which was especially relevant to young people smoking in school. "I used to smoke them more at school because the smell is less than if you smoke a normal cigarette. You are less likely to get caught smoking" (16-17-year-old female, social class C2DE).'
	Wackowski, 2018	Focus groups with 45 menthol smokers ages 18-24 years from New Jersey, United States; six focus groups, with 3 conducted exclusively with black menthol smokers and 3 general groups (all other races).	Tastes very minty, like candy, like a pack of gum: Not explicitly measured, but perceptions around Camel Crush (menthol capsule cigarettes) impact on taste emerged as a theme from the data.	'Participants agreed that Came Crush cigarettes were "very minty" or "more minty" than other menthol cigarettes... "They taste like candy, it is more minty"(24 year-old male, general group); "They taste like mint. When I first started smoking Newport I thought I was going to puke, I hated it. But with Camel Crush I feel I wouldn't get that feeling because it tastes like toothpaste or mouthwash which would just be more normal" (18 year-old female, general group); "I'll buy the Camel Crushes [when sick] because they're mintier" (20 year-old female, general group); "I do like Camel Crushes cause they're mintier" (19-year old female, black group); "I feel it doesn't really taste too much like smoke. If you compare that to a different cigarette you will get more of a cigarette taste. It is like a pack of gum".'
SATISFACTION/ FUN TO SMOKE	Hoek, 2019	Discrete choice experiment cross-sectional survey with 816 young adults (425 daily/non-daily current smokers, 224 susceptible non-smokers ¹⁰ , and	Satisfying: Asked to rate a capsule cigarette compared to an unflavoured cigarette on how satisfying they are, on a seven-point semantic differential scale, where 1 is negative and 7 is positive.	Non-daily smokers (4.6, 95%CI: 4.4-4.9, p<0.001), former smokers (4.6, 95%CI: 4.4-4.8, p<0.001), and susceptible non-smokers ¹⁰ (4.5, 95%CI: 4.4-4.7, p<0.001) were significantly more likely than daily smokers (4.0, 95%CI: 3.8-4.2) to perceive flavour capsule cigarettes to be more satisfying.

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
		155 former smokers), aged 18-25 years from New Zealand.	Fun to smoke: Asked to rate a capsule cigarette compared to an unflavoured cigarette on how fun they are to smoke, on a seven-point semantic differential scale, where 1 is negative and 7 is positive.	Former smokers (4.9, 95%CI: 4.7-5.2, p<0.05), and susceptible non-smokers (4.9, 95%CI: 4.7-5.1, p<0.05) were significantly more likely than daily smokers (4.5, 95%CI: 4.3-4.7) to perceive flavour capsule cigarettes to be more fun to smoke.
	Thrasher, 2016	Quarterly surveys with smokers aged 18-64 from Australia (n=5864 observations, n=2710 individuals), Mexico (n=5723 observations, n=3366 individuals), and the US (n=6865 observations, n=4154 individuals).	Satisfying: 'Compared to other cigarettes, how much less/more satisfying is your brand and type of cigarettes?' (much less satisfying, a little less satisfying, the same, a little more satisfying, much more satisfying).	Australian smokers who preferred flavour capsule varieties were more likely than those who preferred regular brands to view their brand as more satisfying (b: 0.23, SE: 0.09, p<0.01). Mexican smokers who preferred discount flavour capsule varieties were more likely to report that their brand was more satisfying than other brands compared to smokers who preferred regular premium brands.
PERCEIVED IMPACT ON SMOKING AND QUITTING BEHAVIOURS	Moodie, 2015	Focus groups with 75 female non-smokers and occasional smokers aged 12-24 years from Glasgow, Scotland, United Kingdom; 12 focus groups segmented by age (12-14, 15-17, 18-24) and social grade (ABC1, C2DE).	Perceived impact on non-smokers trying or smokers using: Not explicitly measured, but perceived impact of capsule cigarettes emerged as a theme in general discussion when participants were shown the menthol capsule inside the filter.	'Within all the 12-14 groups, and two of the 15-17 groups, participants spoke of this being a cigarette for young people: those starting smoking but not yet used to the taste of cigarettes or who were trying to hide smoking from their parents. "Like someone might be feeling left out because they don't like the taste of a cigarette. They might, like, try that one so you can change the taste of it" (12-14 year old, non-smoker); "I'm thinking like if you are like a teenager like your parents don't know you smoke, that would come in more handy cos they wouldn't be able to smell it off you" (12-14-year-old, non-smoker).'
	Moodie, 2018	Focus groups with 120 current smokers aged 16 to 50+ years from Glasgow and Edinburgh, Scotland, United Kingdom; 12 focus groups segmented by gender, age (16-17, 18-24, 25-35, 36-50, >50), and social grade (ABC1, C2DE).	Perceived impact on experimentation, consumption, and cessation: Not explicitly measured, but perceived impact of capsule cigarettes emerged as a theme from the data.	'Among younger female groups in particular, the various appeal factors previously discussed were thought to increase the potential of capsule cigarettes, especially double capsules, to encourage nonsmokers to experiment, smokers to consume more, and to discourage attempts to quit... "It would encourage non-smokers" (16-17 year old female, social class ABC1); "That's to encourage you to smoke more" (25-34 year old female, social class C2DE); "Yum, that is not going to help me quit" (16-17 year old female, social class C2DE); "It's kind of like a starter cigarette as well, if you're smoking and it's feeling a bit rough, I'll make it menthol and that's a bit easier" (36-50 year old male, social class ABC1).'

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
CONSUMER INTEREST¹³				
AWARENESS/ RECALL	Abad-Vivero, 2016	Cross-sectional survey with students aged 11-16 years from Mexico; Randomised to view flavour capsule variants (FCVs) and non-FCVs from major brands (Marlboro, Camel, Pall Mall).	Brand recognition: 'Have you ever seen this brand of cigarettes' (yes/no) Brand recall: Asked to write out the brand name.	Pall Mall FCVs were among top brand varieties with highest levels of recognition (42%) and correct brand recall (8%). However, FCVs were no more likely to be recalled than non-FCVs (AOR=0.43, 95%CI=0.39-0.51). FCVs from all brand families were less likely to be recalled in comparison with non-FCVs for Marlboro.
	Grilo, 2021	Focus group discussions with 56 adolescents (10 focus groups) and young adult smokers (5 focus groups), separated by age, gender, smoking, and socioeconomic (SES) status) in Mexico City, Mexico.	Brand recognition Participants were given 23 cigarettes packs (most were flavour capsule cigarettes reflecting the Mexican market) to view. One of the domains of the discussion guide was brand recognition.	'In general, participants easily identified the existence of flavour capsules on the pack and knew that they worked by releasing flavor when crushed, inciting participants' curiosity and desire to try the many flavours.'
	Moodie, 2018	Focus groups with 120 current smokers aged 16 to 50+ years from Glasgow and Edinburgh, Scotland, United Kingdom; 12 focus groups segmented by gender, age (16-17, 18-24, 25-35, 36-50, >50), and social grade (ABC1, C2DE).	Awareness: Participants were given a number of cigarettes, including two capsule cigarettes (single capsule and double capsule), and asked if they were aware of capsule cigarettes.	Awareness and use of capsules were greater among younger adults (16–35 years), who were most interested in these products.
	Wackowski, 2018	Focus groups with 45 menthol smokers ages 18-24 years from New Jersey, United States; Six focus groups, with 3 conducted exclusively with black menthol smokers and 3 general groups (all other races).	Awareness: Not explicitly measured, but awareness of Camel Crush (menthol capsule cigarettes) emerged as a theme from the data.	'Participants across all age groups were familiar with Camel Crush, with many having at least tried it, and seven participants (15.5%) using it regularly.'
	Brown, 2020	Focus groups with young adults (smokers and non-smokers, men and women) aged 18-24 years from Metro Manila,	Audience/ User associations: Asked about the people they thought would smoke different types of cigarettes.	Flavour capsule packs were perceived to appeal to a younger audience, including teens, young adult in their 20s, millennials, students, as well as "party-goers".

¹³ "Consumer interest" includes aspects such as brand awareness and purchase intent often used in tobacco industry consumer researcher (Rees VW, Kreslake JM, Cummings KM, et al. Assessing consumer responses to potential reduced-exposure tobacco products: a review of tobacco industry and independent research methods. *Cancer Epidemiol Biomarkers Prev.* 2009;18(12):3225-3240). "Interest" is described in relation to consumer affective response in the Modified Context of Consumption Framework by Brown et al. (2020) as "user interest in the product and surprise (i.e., whether the pack is perceived as novel to a consumer).

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
TARGET AUDIENCE/ USER ASSOCIATIONS ¹⁴		Philippines; Viewed 26 cigarette packs purchased in Manila which varied in brand, flavour and size.		
	Grilo, 2021	Focus group discussions with 56 adolescents (10 focus groups) and young adult smokers (5 focus groups), separated by age, gender, smoking, and socioeconomic (SES) status) in Mexico City, Mexico.	Perceived target audience: Participants were given 23 cigarettes packs (most were flavour capsule cigarettes reflecting the Mexican market) to view and were told to divide into groups they believed to be appealing and unappealing to young people and asked to describe the perceived audience for the packs.	'Participants described the perceived audience for the packs, reinforcing notions of self-identification (or lack of it) with certain cigarette packs. A common theme among all groups was that colored and flavored packs are more appealing and used more frequently by young women.: "I feel that this one would go into the appealing, since the colors appeal more to a woman who smokes because of the colors, and besides (. . .) what I have heard and seen is that, really, the capsule cigarettes are for women" (male adolescent non-smoker, mid/high-SES). "[M]y guy friends say they don't like the capsules; they prefer them without anything because they say they're for girls" (female adolescent smoker, low-SES).'
	Moodie, 2015	Focus groups with 75 female non-smokers and occasional smokers aged 12-24 years from Glasgow, Scotland, United Kingdom; 12 focus groups segmented by age (12-14, 15-17, 18-24) and social grade (ABC1, C2DE).	Audience/ User associations: Not explicitly measured, but user associations of capsule cigarettes emerged as a theme in general discussion when participants were shown the menthol capsule inside the filter.	'The "click" design was thought to offer novelty and hold appeal to children, people keen to try something different or smokers bored of their regular brand.' Several likened it to finishing off a cigarette with a chewing gum...'As such it was considered a cigarette for occasions such as a "party", "wedding", "prom", or "night out", and for somebody who worried about the smell of smoking cigarettes or who had a sore throat.' ...Within all the 12-14 groups, and two of the 15-17 groups, participants spoke of this being a cigarette for young people: those starting smoking but not yet used to the taste of cigarettes or who were trying to hide smoking from their parents.'
	Moodie, 2018	Focus groups with 120 current smokers aged 16 to 50+ years from Glasgow and Edinburgh, Scotland, United Kingdom; 12 focus groups segmented by gender, age (16-17, 18-24, 25-35, 36-50, >50), and social grade (ABC1, C2DE).	Audience/ User associations: Not explicitly measured, but user associations of capsule cigarettes emerged as a theme from the data, particularly in relation to why they were appealing.	'Age featured prominently in the appeal of capsules, with the general perception that they held most appeal for young people. "...It's a kind of young person's cigarette" (36-50-year-old male, social class ABC1); "I think it's glamourising for younger folk that, maybe, say, don't like the taste of smoke but they want to look, Oh, I'm cool, I'm smoking" (35-50-year-old male, social class C2DE). Older adults (50+) were more likely to question their purpose, view them as a gimmick, consider them most relevant to menthol smokers, and associate them with e-cigarettes due to the potential for different flavors.'
Wackowski, 2018	Focus groups with 45 menthol smokers ages 18-24 years from New Jersey, United States; Six focus groups, with 3 conducted	Audience/ User associations: Not explicitly measured, but user associations of Camel Crush (menthol	'It was suggested that Camel Crush might more likely appeal to younger and/or newer smokers, or just be used by smokers occasionally for entertainment... "I feel like they're running towards younger people because they are so minty. it doesn't taste like a	

¹⁴ User associations, according to the Modified Context of Consumption Framework by Brown et al. (2020) is a sub-construct of cognitive consumer response and entails "what the cigarette pack communicates about the person who uses it."

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
		exclusively with black menthol smokers and 3 general groups (all other races).	capsule cigarettes) emerged as a theme from the data.	cigarette, sometimes" (20-year-old female, general group); "It appeals to kids. People that like to play with stuff" (25-year-old female, black group); "I also think a lot of like mediocre smokers use that. I feel it doesn't really taste too much like smoke. If you compare that to a different cigarette you will get more of a cigarette taste. It is like a pack of gum." (19-year-old female, general group); "I always just thought of it as a gimmick...But if I get one for free, like at a party, that's usually where I experiment, hell yeah, I'll smoke it, but I wouldn't buy it 'cause I'm like, "This is just stupid." Like, I don't need toys in my cigarettes. I just need to smoke." (25-year-old female, black group).'
APPEAL, ATTRACTIVENESS, AND CHOICE	Abad-Vivero, 2016	Cross-sectional survey with students aged 11-16 years from Mexico; Randomised to view flavour capsule variants (FCVs) and non-FCVs from major brands (Marlboro, Camel, Pall Mall).	Pack attractiveness: 'How much do you like the look of the pack' (not at all=0, a little=1, a lot=2)	Pall Mall FCVs and Camel FCVs packs were most often rated as very attractive (13%, 9%, respectively). FCVs were independently associated with greater pack attractiveness (AOR=1.83, 95% CI:1.72-1.94). Compared with Marlboro non-FCVs, Camel FCVs and Pall Mall FCVs had greater odds of being perceived as having very attractive packaging (AOR=2.57, 95%CI: 2.32-2.83 and AOR=3.30, 95%CI:2.97-3.66, respectively)
	Barrientos-Gutierrez, 2020	Cross-sectional survey students aged 12-14 years from Mexico; Discrete choice experiment using a 3X25 design with six attributes.	Pack attractiveness: For each choice set of three packs: 'Which pack is most attractive?' and 'Which pack is least attractive?', including option 'none are attractive'.	Packs with one or two capsules were perceived as most attractive compared to packs with no capsules (b=0.226, SE=0.02, p<0.001 and b=0.329, SE=0.02, p<0.001, respectively). Menthol enhanced perceived attractiveness of cigarettes with one flavour capsule (b=0.341, SE=0.02, p<0.001) and two capsules (b=0.327, SE=0.03, p<0.001) compared to regular flavour. There was a significant interaction between perceived attractiveness of flavour capsules with plain packaging and HWL size, respectively. Packs branded normally and those with small HWLs (30%) had stronger, positive effects on attractiveness of cigarettes with one flavour capsule (b=0.351, SE=0.03, p<0.001 and b=0.436, SE=0.03, p<0.001, respectively) and two flavour capsules (b=0.455, SE=0.03, p<0.001 and b=0.430, SE=0.03, p<0.001, respectively) compared to no capsule.
	Brown, 2020	Focus groups with young adults (smokers and non-smokers, men and women) aged 18-24 years from Metro Manila, Philippines; Viewed 26 cigarette packs purchased in Manila which varied in brand, flavour and size.	Pack attractiveness and reasons why: Asked to place all packs on a scale from 'least attractive' to 'most attractive'. Questions on why ranked packs as attractive and what pack characteristics contributed to their ranking.	'Flavour capsule cigarette packs were generally ranked as more attractive' than other packs, including non-flavoured packs and traditional menthol packs. Most named a flavour capsule pack as their favourite pack. 'In assessments of attractiveness, colour was the most discussed factor; the flavour capsule cigarettes named as most attractive were described as bright, colourful and having nice colour combinations, while the traditional menthol and non-flavoured cigarettes that were rated as least attractive were described as dull and often dark' Some flavour capsule packs were also described as "shiny", which was found to be attractive. Another main reason for

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
				why flavour capsules were perceived as more attractive included expectations regarding taste: "It creates some anticipation of the taste..."; "With that ball, if it has that colour, it will have a different taste". The "button" imagery found on flavour capsule cigarettes also reinforced expectations around taste: "The imaging also emphasizes the flavor and the sensation it would give...it shows that when you pop this section, it would heighten the flavor". Many also associated the product with candy: "It has candy. You need to press on it". Many participants discussed how the packs piqued their interest..."It makes you ask and be curious about the cigarette".
	Gilbert, 2021	In-depth interviews with 41 women smokers, aged 18-40 years from Australia.	Reasons for appeal: Not explicitly measured, but emerged as a theme	Reasons for the appeal of menthol capsule cigarettes were linked to the fact that they are "fresh", "light", and "minty", which were seen as improving the smoking experience. The ability to pop the menthol capsule was also viewed as allowing for personalization of the smoking experience. Example quotes: "I smoke half plain, and then I crush it. I know people will crush it straight up, but I like to have the best of both worlds (...) I need to have it even. So, I need to smoke it straight up, normal, and then when I get to a certain point, I need to pop it."; "It pops and it tastes good" and "whenever it starts getting bad, I pop it".
	Grilo, 2021	Focus group discussions with 56 adolescents (10 focus groups) and young adult smokers (5 focus groups), separated by age, gender, smoking, and socioeconomic (SES) status) in Mexico City, Mexico.	Pack appeal and reasons why Participants were given 23 cigarettes packs (most were flavour capsule cigarettes reflecting the Mexican market) to view and were told to divide into groups they believed to be appealing and unappealing to young people reasons why.	'Colours on the pack were discussed as conveying addition of flavour (including via flavour capsules) to cigarettes especially in the groups of smokers and mid/high-SES male adolescent nonsmokers... "You can imagine what the flavor is because of the colours" (female adolescent smoker, low-SES); "Because the colors pop and you can say, "Oh, it's watermelon!" [Marlboro Fusion Summer] (female adolescent non-smoker, mid/high-SES). The availability of different cigarette flavors increased the attractiveness of the pack, which was conveyed by multiple colors on the pack... Discussions on the appeal of the capsules were slightly more predominant among male and female smokers of all ages compared with non-smokers. In addition, mid/high-SES female smokers specifically discussed that the presence of double-capsules further increased the appeal of the pack because it changed their smoking experience. "You crush one flavor at the beginning, and then halfway through you crush the other one to taste. At least that's what I do" (female young adult, mid-high-SES).'
	Hoek, 2019	Discrete choice experiment cross-sectional survey with 816 young adults (425 daily/non-daily current smokers, 224 susceptible non-smokers ¹⁰ , and	Attractive; Stylish: Asked to rate a capsule cigarette compared to an unflavoured cigarette on whether they are... 'more attractive' and 'more stylish', respectively on a seven-point semantic	Non-daily smokers (4.5, 95%CI: 4.3-4.7, p<0.05), former smokers (4.5; 95%CI: 4.3-4.8, p<0.05) and susceptible non-smokers ¹⁰ (4.6, 95%CI: 4.5-4.8, p<0.05) were significantly more likely than daily smokers (4.2, 95%CI: 4.0-4.4) to perceive capsule cigarettes to be more attractive. Former smokers (4.6, 95%CI: 4.4-4.8, p<0.05) were significantly more

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
		155 former smokers), aged 18-25 years from New Zealand.	differential scale, where 1 is negative and 7 is positive.	likely than daily smokers (4.3, 95%CI: 4.2-4.5) to perceive capsule cigarettes to be more stylish.
			Choice: Viewed sets of packs each with a flavour capsule (Fruit Burst, Pineapple& Mango, Hawaiian Mojito ¹⁵ , Rum& Coke, Energy Drink ¹⁵ , Menthol Blast) and an unflavoured control and asked which they would prefer if they had to choose (respondents could choose neither).	Smokers preferred cigarettes with no flavour over flavour capsule variants (FCV), with significantly lower preferences for all flavours except Fruit Burst (relative to the no flavour option). Susceptible non-smokers ¹⁰ preferred all flavours, with fruit flavours (i.e. Fruit Burst, Pineapple & Mango) the most popular. Smokers with a higher probability of quitting (OR=1.03, 95%CI: 1.00-1.06, p<0.05), non-daily smokers (ref: daily smoker; OR=1.64, 95%CI: 1.25–1.98, p<0.001) and female smokers (ref: male smokers; OR=1.27, 95%CI: 1.08-1.48, p<0.01) were more likely to choose a FCV. Among susceptible non-smokers ¹⁰ , females (ref: male; OR=1.48, 95%CI: 1.18-1.84, p<0.001) were more likely to choose a FCV, while those with higher education were less likely to choose a FCV (ref: low education; OR=0.77, 95%CI: 0.61-0.98, p<0.05).
	Moodie, 2015	Focus groups with 75 female non-smokers and occasional smokers aged 12-24 years from Glasgow, Scotland, United Kingdom; 12 focus groups segmented by age (12-14, 15-17, 18-24) and social grade (ABC1, C2DE).	Relative appeal and reasons why: Participants shown 11 cigarettes (2 standard, 2 coloured, 4 slim, 1 aromatized black cigarette, 1 menthol, and 1 menthol capsule) and asked to order the cigarettes by appeal (most/least) and the reasons behind the ordering decisions.	'The capsule and menthol cigarettes were, for the most part, placed together and ranked in the middle in terms of appeal... Where separated, the capsule cigarette was ranked as more appealing than the menthol cigarette because of the innovative "bursting" function... The capsule design was referred to as "cool", "funky" and "high-tech" and every group saw advantages in this type of cigarette. The "click" design was thought to offer novelty. Several participants spoke of their desire to want to press the capsule. "I just think it's quite cool personally, the fact it clicks, and it changes flavour and all, whether you like it or not, you just click it and that's it...I'd buy them" (18-24-year-old, occasional smoker). Having the choice of smoking with or without menthol flavouring was seen as a positive, providing the "Best of both world" (18-24-year-old, non-smoker); "I can smoke normal fags, but sometimes I like a menthol fag so I can just smoke it and, if I feel like a menthol fag, I just press it" (18-24-year-old, occasional smoker).'
	Moodie, 2018	Focus groups with 120 current smokers aged 16 to 50+ years from Glasgow and Edinburgh, Scotland, United Kingdom; 12 focus groups segmented by gender, age (16-17, 18-24, 25-	Appeal and reasons why: Participants were given a number of cigarettes, including two capsule cigarettes (single capsule and double capsule), and asked whether they found these products appealing and, if so why.	Reasons for appeal included: 'The fact that they were viewed as novel, cool, innovative, fashionable, and fun... Being able to choose if and when to burst the capsule was part of their appeal, as was the ability to share it with others (particularly between menthol and nonmenthol smokers), especially among young females...That they do not taste of traditional cigarettes and allow for fresher breath...The

¹⁵ Flavour not viewed by smokers (only susceptible non-smokers)

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
		35, 36-50, >50), and social grade (ABC1, C2DE).		final element of appeal was concealment, which was especially relevant to young people smoking in school. "Incredible, that is really cool technology" (18-24-year-old female, social class ABC1); "It's a bit like a designer cigarette isn't it, it's more dynamic as well, so it's kind of a young person's cigarette (36-50-year-old male, social class ABC1). "But that's the point of them...like, for talking sakes my man smokes regular and I'm smoking menthol so he could just light up a fag and it's normal and I'm bursting the balls it means you've got the two in the one" (18-24-year-old female, social class C2DE).'
	Thrasher, 2016	Quarterly surveys with smokers aged 18-64 from Australia (n=5864 observations, n=2710 individuals), Mexico (n=5723 observations, n=3366 individuals), and the US (n=6865 observations, n=4154 individuals).	Stylish: 'Compared to other cigarettes, how much less/more stylish is your brand and type of cigarettes?' (much less stylish, a little less stylish, the same, a little more stylish, much more stylish).	Mexican smokers who preferred premium priced flavour capsule varieties were more likely than those who preferred regular premium brands to report that their variety was more stylish than other cigarettes (b: 0.26, SE: 0.09, p<0.001). US smokers who preferred flavour varieties (only found among premium brands) were more likely to view their brand as more stylish than smokers who preferred regular premium brands (b: 0.11, SE: 0.05, p<0.05).
	Wackowski, 2018	Focus groups with 45 menthol smokers ages 18-24 years from New Jersey, United States; Six focus groups, with 3 conducted exclusively with black menthol smokers and 3 general groups (all other races).	Reasons for appeal; Not explicitly measured, but perceptions that Camel Crush (menthol capsule cigarettes) give both flavour options and therefore can be shared emerged as a theme from the data.	'Some [participants] thought that Camel Crush was popular because it provided an option between the two flavors and could be shared between non-menthol and menthol smokers, though participants did not actually know people who smoked it "uncrushed". ..."I've seen advertisements for them, and like it's for sharing...like if a friend smokes menthol, and one smokes non-menthol, you can share" (24-year-old female, general group); "They might want a menthol so they crush it and maybe later they want a non-menthol" (24-year-old male, general group); "Best of both worlds" (24-year-old male, general group). [Participants] described the "crushing" aspect of Camel Crush as fun and entertaining, a perceived reason for their popularity..."I think they wanted something new, likely maybe people are getting bored of traditional cigarettes. It's something different. It's a new feature. It's like a toy." (19-year-old male, general group); "I think they are cool though, like that little ball. They are actually like candy. I think it is fun" (19-year-old male, general group); "It's a time occupier and it is an entertainment thing too" (19-year-old female, general group); "They gave it to me and said here try it, press the middle and I felt it and said OMG this is cool" (19-year-old male, general group).'
FUTURE USE INTENTIONS	Abad-Vivero, 2016	Cross-sectional survey with students aged 11-16 years from Mexico; Randomised to view flavour capsule variants (FCVs)	Interest in trying: 'If you were to try smoking one of these brands, which would you try (choose just one option)?'	Pall Mall regular capsule and menthol capsule packs were most often chosen as brands willing to try (25%, 18% respectively). FCVs were associated with a greater likelihood of interest in trying (AOR=1.74, 95%CI: 1.54-1.96). Compared with Marlboro non-FCVs, Camel FCVs

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
		and non-FCVs from major brands (Marlboro, Camel, Pall Mall)	with the option 'I would not try any of these brands'.	and Pall Mall FCVs had greater odds for being of greatest interest for trying (AOR=1.36, 95%CI: 1.10-1.66 and AOR=1.99, 95%CI: 1.65-2.39, respectively)
	Barrientos-Gutierrez, 2020	Cross-sectional survey students aged 12-14 years from Mexico; Discrete choice experiment using a 3X25 design with six attributes.	Interest in trying: For each choice set of three packs: 'If you were to smoke, which of these brands would you most like to smoke' and 'which would you least like to smoke?', with the option 'I would not like to smoke any of them'.	Packs with one or two capsules were associated with greater interest in trying compared to packs with no capsules (b=0.172, SE=0.03, p<0.001 and b=0.230, SE=0.03, p<0.001, respectively). Menthol enhanced interest in trying cigarettes with one flavour capsule (b=0.307, SE=0.04, p<0.001) and two capsules (b=0.271, SE=0.04, p<0.001) compared to regular flavour. There was a significant interaction between interest in trying flavour capsules with plain packaging and HWL size, respectively. Packs branded normally and those with small HWLs (30%) had stronger, positive effects on interest in trying cigarettes with one flavour capsule (b=0.269, SE=0.04, p<0.001 and b=0.261, SE=0.04, p<0.001, respectively) and two flavour capsules (b=0.370, SE=0.04, p<0.001 and b=0.303, SE=0.04, p<0.001, respectively) compared to no capsule.
	Hoek, 2019	Discrete choice experiment cross-sectional survey with 816 young adults (425 daily/non-daily current smokers, 224 susceptible non-smokers ¹⁰ , and 155 former smokers), aged 18-25 years from New Zealand.	Likelihood of trying: 'If a friend offered you a cigarette, how likely would you be to try it if it had the following flavours?' (Fruit Burst, Pineapple & Mango, Hawaiian Mojito ¹⁵ , Rum & Coke, Energy Drink ¹⁵ , Menthol Blast, and an unflavoured control), on an 11-point probability scale from 0=no chance to 10=certain).	Smokers were significantly more likely than susceptible non-smokers ¹⁰ to accept a cigarette offered to them, regardless of whether it was flavoured or not flavoured. Non-daily smokers were more likely than daily smokers to try a menthol flavour capsule cigarette if offered by a friend (6.0, 95%CI: 5.5-6.4 vs 5.2; 95%CI: 4.8-5, p<0.05). Susceptible non-smokers ¹⁰ were more likely than former smokers to indicate that if offered by a friend would try a Pineapple & Mango flavoured cigarette (3.9, 95%CI: 3.5-4.3 vs 3.0, 95%CI: 2.5-3.4, p<0.01) and Hawaiian Mojito flavoured cigarette (3.6, 95%CI: 3.2-3.9 vs 2.8, 95%CI: 2.4-3.3, p<0.01). Although a lower mean proportion of susceptible non-smokers ¹⁰ were likely to try a flavoured cigarette, around one-third (28%–37%) would smoke one of the novel flavoured cigarettes, if offered to them. These estimates exceed the 24% that would smoke a regular cigarette in similar circumstances.
REASONS FOR ACTUAL USE/ BRAND CHOICE	Cho, 2018	Cross-sectional survey with 1,940 adult smokers, aged 18+ from South Korea.	Reasons for brand choice: 'In choosing [your current brand], was part of your decision to smoke this brand based on...how they taste?' (yes/no)	Flavour capsule cigarette users from South Korea were more likely than regular cigarette smokers to choose their brand because of taste (AOR: 4.55, p < .05).
	Emond, 2018	Cross-sectional survey with 7,181 adults, aged 18-44 years, from the US who were current or former established (≥100 lifetime cigarettes) cigarette smokers.	Reasons for brand choice: 'In choosing your regular brand of cigarettes, was part of your decision based on any of the following?' (Eight a priori reasons)	Among current, daily smokers (aged 18-24 years) who have a regular brand and who purchase manufactured cigarettes and whose usual brand was flavour capsules (dropdown list: Camel Crush, Camel Crush Bold, Camel Silver Menthol Kings and Marlboro NXT), almost all (97.8%, 95%CI: 91.0-99.5) reported choosing their brand for 'taste', which was a rate significantly higher than non-menthol users (86.8%, 95%CI: 84.1-80.1, p=0.001). Flavour capsule users were more likely to

CONSTRUCT	STUDY ID	STUDY DESIGN/ POPULATION	MEASURE	MAIN RESULTS
				report choosing their brand because it is 'less expensive' (42%, 95%CI: 32.0-53.1) and for 'the design of the pack' (19.6%, 95%CI: 12.8-28.8) compared to menthol users (27.7%, 95%CI: 24.1-31.5, p=0.003 and 9.1%, 95%CI: 6.9-11.8, p=0.02, respectively). Other reasons for flavour capsule users choosing their brand that did not differ from non-menthol or menthol users, included: 'the amount of satisfaction it gives you' (78.7%, 95%CI: 70.0-85.4), 'people who are important to you smoke this brand' (19.8%, 95%CI: 12.2-30.5), 'the tar and nicotine levels' (12.7%, 95%CI: 7.2-21.4), 'as a way to help you quit' (4.2%, 1.6-10.5), and 'it may not be as bad for your health' (6.9%, 3.3-13.9).
	Moodie, 2019	Cross-sectional survey with 3620 factory-made cigarette smokers, who had smoked in the past month aged 18+ years from the United Kingdom.	Reasons for capsule use: 'Why do you use capsule cigarettes?' (Eight response options; could check all that applied)	Reasons for using capsule cigarettes among those who smoke capsule cigarettes (N = 454) from most to least prevalent included: They taste better than regular cigarette (52%); They are smoother on my airways (i.e. throat and lungs) than regular cigarettes (41%); I like having a choice of flavors (32%); I enjoy clicking the capsule (25%); They are more interesting than regular cigarettes (21%); My brand only has capsule cigarettes (15%); They are novel (9%); Other (6%); Don't know (4%).
	Paraje, 2019	Cross-sectional survey with 851 smokers aged >13 years from Metropolitan Santiago, Chile.	Attributes that determined the last purchase of a pack of cigarettes: 'When you chose the package of cigarettes you purchased last, you did it based on: a) its taste/ flavor; b) that it would be less harmful than the rest; c) its price'.	Based on descriptive statistics of weighted data, a higher percentage of smokers whose last pack of cigarettes purchased was flavoured ¹⁶ (75.9%, SD: 0.43) chose it because of the flavour/taste compared to those who purchased non-flavoured cigarettes (59.3%, SD: 0.49). Conversely, a higher percentage of smokers whose last pack of cigarette purchased was non-flavoured chose it because of it being 'less harmful' (7.9%, SD: 0.27) and because of the price (32.8%, SD: 0.47) compared to smokers whose last pack of cigarettes purchased was flavoured (6.8%, SD: 0.25 and 17.3%, SD: 0.38, respectively).

Single quotation marks (' ') refer to the initial quotation (e.g. direct text from the article). Double quotation marks (" ") refer to quotations within quotations (e.g. quotes from respondents)

¹⁶ Flavoured cigarettes includes both capsules and non-capsules, however only 6 of the 810 were non-capsule flavoured cigarettes.

Reponses to product¹⁷

SENSORY RESPONSES			
SENSORY EFFECTS (TASTE, SMELL, MOUTHFEEL)	Schneller, 2020b	Randomised controlled study design ¹⁸ with 18 smokers aged 18-65 years who smoked 5+ cigarettes daily, primarily preferred mentholated cigarettes, and were not trying to quit smoking, from the United States.	<p>Sensory effects: Using a linear scale (from 0 to 10) “The Sensory Scale”, with descriptive anchors, participants were asked to mark along the scale to indicate their rating for the following items: Strength, Harshness, Heat, Draw, Taste, Satisfaction, Burn Rate, Mildness, Aftertaste, Staleness, Smoke Harshness, Smoke Strength, and Smoke Smell</p> <p>All of the sensory scale items mean scores were compared between cigarette products as well as cigarette replicates. There were significant associations between cigarette products for mean scores of satisfaction [F(4,64)=5.8; p=0.004], too mild [F(4,64)=3.8; p=0.027], strength [F(4,64)=3.7; p=0.030], and smoke strength [F(4,64)=5.3; p=0.010]. The post hoc test showed that the mean satisfaction score of the participants’ preferred brand was significantly higher than mean satisfaction score for Camel Menthol crushed (p=0.004). In addition, the mean smoke strength scores of participants’ preferred brand was also significantly higher than Camel Crush crushed (p=0.022). Furthermore, mean smoke strength scores of Camel Menthol crushed was significantly higher than Camel Crush crushed (p=0.033). Significant associations were also seen between cigarette replicates for mean scores of too mild [F(1,16)=11.1; p=0.004] and strength [F(1,16)=5.7; p=0.030] with high scores for the first cigarette replicate. Finally, a significant interaction was noted between cigarette brand and cigarette replicate for the mean score of smoke harshness [F(4,64)=3.8; p=0.021].</p>
	Strasser, 2013	35-day randomised, open-label, laboratory study ¹⁹ with 32 smokers aged 21-65 years who smoked 10+ cigarettes daily for 5+ years and smoking menthol flavoured cigarettes 80%+ of the time, and were not currently trying to quit smoking, or planning to quit	<p>Sensory effects: Using a 100-mm visual analog scale with descriptive anchors, participants were asked to place a vertical line to indicate their rating on the following items: Strength (very weak/ very strong); Harshness (very mild/ very harsh); Heat (no heat/ very hot); Draw (easy/ difficult);</p> <p>There were significant condition x period interactions for taste (b=-10.7, z=-2.03, P=0.043), too mild (b=-19.9, z=3.3, P=0.001), did not leave a good taste (b=-15.6, z=-2.5, P=0.011), and smoke smell (b=-11.2, z=-2.36, P=0.018). For taste, the experimental group reported significantly worse taste from period 1 (baseline) to period 2 (menthol; P=0.007) and from period 2 to 3 (non-menthol; P= 0.0004). Although the control group reported worse taste from periods 1 to 2 (P= 0.02) despite remaining on their own cigarettes, there was no change between periods 2 and 3 (P=0.97). For too mild, there was no change from period 1 (baseline) to period 2 (menthol; P=0.41) and a marginal decrease from period 2 to 3 (non-menthol; P= 0.10) in the experimental group, indicating that period 3 (non-menthol) cigarettes were less mild than all</p>

¹⁷ Reponses to product, as defined in the Hypothetical Model of Tobacco Consumer Response, encompasses “measurement of sensory responses (including taste and aftertaste, mouth feel, and bite/kick), other subjective responses (including nicotine effect, urge and withdrawal relief), and ratings of product acceptability”. (Rees VW, Kreslake JM, Cummings KM, et al. Assessing consumer responses to potential reduced-exposure tobacco products: a review of tobacco industry and independent research methods. *Cancer Epidemiol Biomarkers Prev.* 2009;18(12):3225-3240).

¹⁸ Participants were randomly assigned to one of four sampling groups, which varied in the sequence of the cigarette products that were smoked (Camel Crush crushed, Camel Crush uncrushed, Camel Menthol crushed, and Camel Menthol uncrushed) (R.J. Reynolds, Winston-Salem, NC). All participants smoked all available cigarette products. At the baseline session, all participants smoked their preferred brand, which allowed them to serve as their own control.

¹⁹ After a 5-day baseline period, participants were randomised to the experimental group (n=22) where they would smoke menthol (i.e. crushed) Camel Crush for 15 days followed by 15 days of non-menthol (i.e. non-crushed) Camel Crush (R.J. Reynolds, Winston-Salem, NC), or the control group (n=10) where they smoked their own brand cigarette across all periods. Participants attended study visits every 5 days and completed measures of smoking rate, smoking topography, biomarkers of exposure, and subjective responses.

	in the next two months, from the United States.	Taste (very bad/ very good); Satisfaction from smoking (unsatisfying/ satisfying); (Burned/Did not burn) too fast in too few puffs; Mild taste/ Not mild taste; It was/was not too mild for me); (Did not leave/Left) a good aftertaste in my mouth; Somehow it (seemed/ did not seem) stale; Smoke seemed (very weak/ very strong); Smoke smell: (unpleasant/ pleasant).	previous cigarettes; and, a decrease in too mild ratings from period 1 to 2 (P= 0.002), but no change from period 2 to 3 (P= 0.93) among the control group. For did not leave a good taste, the experimental group reported a worse after taste during period 3 (non-menthol) compared with period 1 (baseline; P=0.005) and compared with period 2 (menthol; P=0.001), whereas the control group reported no changes between periods (P=0.90). For smoke smell, the experimental group reported marginally less pleasant smell from period 1 (baseline) compared with period 2 (menthol; P=0.09), and significantly less pleasant from period 2 to 3, (menthol to non-menthol periods; P=0.002). The control group showed no changes for smoke smell (P>0.6). There were main effects of condition (b=-22.5, z=-2.7, P=0.008) and period (b=-6.4, z=-2.5, P=0.012) such that across all periods, the experimental group rated their cigarettes as less satisfying than the control group, and across both conditions, cigarettes were rated as less satisfying from period 1 to 2 and from period 1 to 3 (mean=51.3, SE=3.9, P=0.02).
OTHER SUBJECTIVE RESPONSES			
PSYCHOLOGICAL REWARD, AVERSION, SATISFACTION, RELIEF OF CRAVING	Schneller, 2020b	Randomised controlled study design ²⁰ with 18 smokers aged 18-65 years who smoked 5+ cigarettes daily, primarily preferred mentholated cigarettes, and were not trying to quit smoking, from the United States.	Psychological Reward, Aversion, Satisfaction, Relief of Craving: "The Cigarette Evaluation Scale" evaluates 21-items that can be broken down into the following subscales: satisfaction, psychological reward, aversion, and relief of cravings; items were rated on a scale of 1 (not at all) to 7 (extremely), and item scores for each subscale were averaged.

OR= Odds ratio; AOR= Adjusted odds ratio; 95% CI= 95% Confidence Intervals; SE= Standard error; SD= Standard deviation

²⁰ Participants were randomly assigned to one of four sampling groups, which varied in the sequence of the cigarette products that were smoked (Camel Crush crushed, Camel Crush uncrushed, Camel Menthol crushed, and Camel Menthol uncrushed) (R.J. Reynolds, Winston-Salem, NC). All participants smoked all available cigarette products. At the baseline session, all participants smoked their preferred brand, which allowed them to serve as their own control.

Supplementary Table 3a. Risk of bias assessed by the QATSDD for quantitative studies

	Abad-Vivero, 2016	Barrientos-Gutierrez, 2020	Emond, 2018	Gutiérrez-Torres, 2020	Hoek, 2019	Moodie, 2019	Paraje, 2019	Schneller, 2020a	Schneller, 2020b	Strasser, 2013	Thrasher, 2016	Zavala-Arciniega, 2020
Total score	26	24	23	20	22	23	25	24	22	18	23	22
%*	62%	57%	55%	48%	52%	55%	60%	57%	52%	43%	55%	52%
Explicit theoretical framework	0	0	0	0	0	0	0	0	0	0	0	0
Statement of aims/ objectives in main body of report	2	2	3	3	2	2	2	3	3	2	2	2
Clear description of the research setting	3	2	3	3	3	3	3	3	1	1	3	3
Evidence of sample size considered in terms of analysis	1	1	2	1	1	2	3	2	1	0	2	1
Representative sample of target group of a reasonable size	2	1	3	3	2	2	2	2	1	0	3	3
Description of procedure for data collection	3	2	2	2	2	3	2	2	3	3	1	1
Rationale for choice of data collection tool(s)	2	3	0	0	2	0	3	1	2	3	2	2
Detailed recruitment data	2	2	1	1	1	3	2	1	2	2	1	1
Statistical assessment of reliability and validity of measurement tool(s) (Quant only)	1	1	0	0	1	0	0	2	0	1	1	1
Fit between stated research question and method of data collection (Quant only)	3	3	3	3	2	2	2	3	3	2	3	2
Fit between research question and method of analysis	3	3	3	2	2	3	2	2	2	2	3	3
Good justification for analytical method selected	1	1	1	1	2	1	1	1	1	1	0	1
Evidence of user involvement in design	0	0	0	0	0	0	1	0	0	0	0	0
Strengths and limitations critically discussed	3	3	2	1	2	2	2	2	3	1	2	2

*Percentage = the total score of a study / the full score 42 (14 items x 3 per item)

Supplementary Table 3b. Risk of bias assessed by the QATSDD for qualitative studies

	Brown, 2020	Gilbert, 2021	Grilo, 2021	Moodie, 2015	Moodie, 2018	Wackowski, 2018
Total score	23	26	23	19	20	19
%*	55%	62%	55%	45%	48%	45%
Explicit theoretical framework	3	2	0	0	0	0
Statement of aims/ objectives in main body of report	3	2	2	2	2	3
Clear description of the research setting	2	2	2	3	2	2
Evidence of sample size considered in terms of analysis	1	3	2	1	1	1
Representative sample of target group of a reasonable size	1	1	2	2	2	1
Description of procedure for data collection	3	2	2	3	3	3
Rationale for choice of data collection tool(s)	0	2	1	2	1	0
Detailed recruitment data	2	2	2	2	2	2
Fit between stated research question and format and content of data collection tool (e.g. interview schedule) (Qual only)	2	2	2	2	2	3
Fit between research question and method of analysis	2	3	2	0	2	2
Good justification for analytical method selected	0	3	1	0	1	0
Assessment of reliability of analytical process (Qual only)	1	0	2	0	1	1
Evidence of user involvement in design	1	0	1	0	0	0
Strengths and limitations critically discussed	2	3	2	2	1	1

*Percentage = the total score of a study / the full score 42 (14 items x 3 per item)