

Smokers' awareness of filter ventilation, and how they believe it affects them: findings from the ITC Four Country Survey

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ABSTRACT

Background Filter ventilation creates sensations of 'lightness' or 'smoothness' and is also highly effective for controlling machine-tested yields of tar, nicotine and carbon monoxide. Nearly all factory-made cigarettes (FMC) now have filter ventilation in countries such as Australia, Canada, the UK and the USA. Research conducted before 'light' and 'mild' labelling was banned found low smoker awareness of filter ventilation and its effects. This study explores current levels of awareness of filter ventilation and current understanding of its effects in these four countries.

Methods We used data from the 2018 wave of the ITC Four Country Smoking and Vaping Survey with samples from USA, England, Canada and Australia. Analyses were conducted initially on a weighted sample of 11 844, and subsequently on 7541 daily FMC smokers.

Findings Only 40.3% of all respondents reported being aware of filter ventilation. Among daily FMC smokers, only 9.4% believed their cigarettes had filter ventilation. Believing that their usual cigarettes are smoother was positively associated with believing they are also less harmful. Both these beliefs independently predict believing their cigarettes are ventilated (smoother OR=1.97 (95% CI 1.50 to 2.59) and less harmful OR=2.41 (95% CI 1.66 to 3.49) in relation to those believing each characteristic is average.

Interpretation Awareness of filter ventilation is currently low, despite decades of public 'education' efforts around the misleading nature of 'light' and 'mild' descriptors. Few smokers realise that their cigarettes almost certainly are vented. Smokers who believed their cigarettes have filter ventilation were more likely to believe they were both smoother and less harmful. Awareness of the technology appears to be insufficient to prevent smokers being deceived by it. Filter ventilation is inherently misleading to smokers and it is time to ban it.

INTRODUCTION

Filter ventilation is an unobtrusive technology, which was first introduced in the USA around 1970 and was crucial for 'low tar' cigarettes achieving market dominance in many countries in the following decades.^{1,2} As knowledge about the health risks of smoking accumulated in the 1950s and 1960s, the tobacco industry needed to respond to restore public confidence in its products. The first such measure was to increase the number of brands with filters and to make extensive reference to filters and filtration of smoke in marketing.³ In the 1960s, 'tar' and nicotine yield figures also became an important marketing tool for the tobacco industry.⁴ As demand grew for satisfying 'low

tar' cigarettes, filter ventilation became an important part of the mix of construction features that enabled machine-determined 'tar' and nicotine yields to be reduced dramatically during the 1970s. However, while filters had been aggressively marketed by the tobacco industry,⁵ it chose to keep filter ventilation an 'invisible' technology.

Filter ventilation is produced by introducing holes into the tipping paper (the otherwise impermeable paper which wraps around the filter and connects it to the tobacco rod) of factory-made cigarettes (FMC), using mechanical pins, lasers or electrostatic sparks (see online supplemental figure 1) The vents allow air to flow in close to the mouth end of the cigarette and mix with the mainstream smoke, diluting the puffed smoke (unless they are blocked).¹ Filter ventilation produces cigarettes which taste smoother/milder and are less irritating to the throat and chest. The addition of filter ventilation also lowers standard ISO/FTC (International Standards Organization/ Federal Trade Commission) machine-measured 'tar', nicotine and carbon monoxide yields of brands but without actually reducing the amount of tar and nicotine most smokers will take in from them because of compensatory smoking, which can include both vent blocking by smokers and increases in the total volume of smoke that is inhaled.^{1,3,6}

If filter ventilation was only being used to control 'tar', nicotine and carbon monoxide yields, the cessation of use of yield figures for either tobacco product regulation purposes or for marketing should have meant reduced use of the technology. However, in the four countries dealt with in the present study, nearly all brands still incorporate filter ventilation. For example, in Australia in 2018, 113 of 119 tested brands were found to have filter ventilation (King and Scollo, unpublished) and this proportion was comparable to the proportion of Australian brands which had filter ventilation in 1994, when 'tar', nicotine and carbon monoxide yield figures were still treated as important consumer information.³

Filter ventilation presents smokers with a range of possibilities for nicotine dose titration,¹ including occluding vent holes with fingers or lips, and changing the flow rate and/or duration of puffs. Most smokers take larger puffs of more dilute smoke as part of the compensation process,⁷ rather than completely blocking vents.¹ The sensations of 'smoothness' that result from taking in larger volumes of more dilute smoke have been shown in mediation analyses to be the cause of belief that filter ventilated cigarettes are less harmful.⁸

We now know that filter ventilation does not reduce smokers' intakes of either nicotine or toxicants but remains highly effective at producing the illusion of reduced intakes. That is likely to have led to many smokers being diverted from making quit attempts, as they could convince themselves that they were at least taking some action to reduce harm to their health.^{9 10}

The fundamentally misleading nature of filter ventilation due to its effect on the sensations that drive risk perceptions arguably already provides sufficient grounds for prohibiting it. However, the case against permitting filter ventilation now goes further, as there is increasing evidence that it may actually increase exposures to important toxicants. It is highly plausible that the widespread use of filter ventilation is at least partly responsible for the increased incidence of lung adenocarcinoma in the past few decades and that the risks of lung cancers of all cell types (when combined) have increased among cigarette smokers.⁴ A recent review¹¹ found that the use of filter ventilation is likely to have increased toxicant exposures to tissues in the periphery of smokers' lungs. This is because the use of filter ventilation in tandem with high efficiency filters is likely to have increased the number of very small particles in cigarette smoke.⁴ These very small particles are able to penetrate deeper into the lungs than larger particles, which are more likely to deposit in the tracheo-bronchial tree, where squamous cell carcinomas dominate.^{4 12 13}

When policy-makers and regulators became aware that 'light' and 'mild' cigarettes delivered similar levels of tar and nicotine to 'full-strength' cigarettes under real world smoking conditions, they proposed banning 'light', 'mild' and 'low tar' descriptors, to prevent smokers being deceived by the broader associations of these terms with 'healthy' consumer choices. This proposal was incorporated in Article 11 of the Framework Convention on Tobacco Control (FCTC) and many countries have now banned those terms. The use of 'tar', nicotine and carbon monoxide yield figures as consumer information also progressively ended after the FCTC was adopted.

In parallel to the FCTC process, a trial in the USA, using the Racketeer Influenced and Corrupt Organizations Act, determined in 2006 that the tobacco industry had deliberately deceived the public about 'low tar', 'light', 'mild' and 'natural' cigarettes.¹⁴ In 2012, Judge Gladys Kessler ordered that the tobacco industry issue corrective statements about 'low tar'/'light' cigarettes.¹⁵ Again, the problem was framed as one that could be remedied by appropriate public statements, which it was assumed would bring about the necessary changes in smokers' behaviours. We are not aware of any specific evaluation of the impact of this corrective messaging. However, we would note that the general evidence regarding corrective messaging is that does appear to have short term effects but they do not persist.

Evaluations of the impact of bans on the terms 'light' and 'mild' show little evidence of any beneficial effect on smoker's beliefs, apart from modest short-term effects accompanying health education.¹⁶⁻¹⁸ As far as we can tell, the only response of the tobacco industry to the bans on the terms was to relabel the more highly ventilated variants that were formerly labelled as 'light' or 'mild' with new descriptors like 'smooth' and 'fine'.¹⁹

Previous research from the period before countries banned the terms such as 'light' and 'mild' found low public awareness of the existence of filter ventilation^{10 20 21} and of the role of filter vent blocking.^{22 23} However, some found that when the public was made aware of the existence of filter ventilation and its effects, there was a decline in belief that 'light' cigarettes are less harmful and increased cessation.²⁴⁻²⁶

The aim of the present study is to assess current levels of knowledge in a group of countries where 'light' and 'mild' terms have been prohibited for some years (ie, since 2003 in the UK, 2005 in Australia, 2008 in Canada and 2010 in the USA). We used the 2018 wave of the ITC Four Country Survey to determine current levels

of awareness and understandings of filter ventilation in Australia, Canada, England and the USA. Our research questions were as follow:

1. What proportion of smokers and recent quitters were aware of the existence of filter ventilation and were there by-country and smoking status differences in awareness?
Among current daily FMC smokers:
2. What proportion believe that their usual cigarette is filter ventilated?
3. Does this vary by key sociodemographic features?
4. To what extent do smokers who believe their cigarettes are vented report deliberately blocking the vents?
5. To what extent do smokers aware of venting understand that vent blocking will generally cause increased intakes of 'tar'?
6. Are beliefs about whether their cigarettes are ventilated and knowledge of filter ventilation associated with beliefs about the harmfulness and smoothness of their cigarettes?

METHODS

Data source

The sample for the present study is derived from the ITC Four Country Survey Wave 2, which was conducted in 2018. We performed weighted analyses, with weightings made for each country to achieve population representativeness for smoking, vaping, age and sex. The weighting methods are described in detail elsewhere.²⁷

For RQ1, we included all current smokers (both daily and non-daily) and recent quitters (ie, quit for less than 2 years) (weighted $n=11\,844$). The numbers of participants by country were Canada: 2146, USA: 1604, England: 2750 and Australia: 1041. For other RQs, analyses were restricted to 7541 current daily FMC smokers or subsets of them.

Survey content

We collected basic demographic data and data on current smoking status, and type of cigarettes smoked (factory made vs roll your own (RYO)).

There were four questions on filter ventilation:

1. [Asked of all] Have you ever seen or heard that there are one or more rings of small holes around the filters of some cigarettes? (RQ1)
2. [Asked only of daily FMC smokers who were aware of filter ventilation] Do the cigarettes you currently smoke cigarette have vent holes in the filter? (RQ2 and 3)
3. [Asked only of daily FMC smokers believing their cigarettes have filter ventilation, but not asked in England] Do you block the vent holes when you smoke (Yes all of them; Yes, some of them; No, Don't Know)? (RQ4)
4. [Australia only] What effect do you think blocking the vent holes has on how much tar a smoker takes from a cigarette? (five ordinal responses from 'greatly increases' to 'greatly decreases' tar intake, plus 'Don't Know')? (RQ5)

Questions 1 and 2 were combined into a three-level measure of 'filter ventilation beliefs' for daily FMC smokers: 1, believe their cigarettes are vented; 2, aware, but don't think they are vented (or don't know); and 3, not aware of filter venting (which includes 'don't know' to awareness).

The survey also included the following two questions to assess RQ6 which were only asked of smokers with a regular brand of FMC: 1, 'Do you think your brand is a little less harmful, no different, or a little more harmful, compared with other cigarette or tobacco brands?'

Data analyses

Multivariable logistic regression analyses were used to explore independent correlates of filter venting beliefs. Sociodemographic predictors included age, gender, country, ethnicity, education level attained and perceived financial stress (ie, being unable to pay bills on time). We also included perception of regular brand harm (a little less harmful, no different, a little more harmful) and regular brand harshness compared with other brands (harsher, same, smoother) thus limiting this analysis to those with a regular brand.

All statistical significance and CIs were tested at the 95% confidence level. All data analyses were conducted using Stata V.16.

RESULTS

Awareness (RQ1)

Across all four countries, 40.3% of the analysed sample reported being aware of filter ventilation. Awareness of filter ventilation also varied significantly by smoking status, with current non-daily smokers (31.9%) being less likely to report being aware of filter ventilation than either daily smokers (41.9%) or recently quit smokers (39.1%) (χ^2 (2)=46.07, $p<0.001$). These results are summarised in [table 1](#).

Analyses for all daily FMC smokers (n= 7541)

Beliefs about current brand and filter ventilation (RQs 2 and 3)

Overall, 41.7% of daily FMC/mixed FMC and RYO smokers were aware of filter ventilation, and this varied significantly by country, ranging from a low of 34% in the USA, 40.8% in England, 43.8% in Canada, to a high of 52.1% in Australia (χ^2 (3)=116.2, $p<0.001$) (see [table 2](#)).

Across all four countries, only 9.4% of daily FMC smokers reported believing that their usual cigarette has filter ventilation. Australian smokers were more likely to report believing their usual cigarette has filter ventilation than smokers from the other three countries surveyed (χ^2 (3)=56.49, $p<0.001$). There were also significant differences by age group, ranging from a low of 5.4% of daily FMC smokers aged 55 and over believing that their usual cigarette has filter ventilation to a high of 12.8% for the 25–39 age group (χ^2 (3)=76.15, $p<0.001$). This belief was not significantly related to gender (χ^2 (1)=1.31, n.s.) or number of cigarettes per day (χ^2 (2)=4.74, n.s.).

Table 1 Awareness of filter venting by smoking status for the full sample (n=11 844) (weighted data)

Category	No of observations	% of sample	% aware of filter ventilation	% believe own cigarette has filter ventilation
Daily FMC smokers:	7541	63.7	41.7	9.4
Daily FMC only	6272	53.0	40.2	9.9
Daily mixed FMC and RYO	1269	10.7	49.4	7.0
Daily FMC only with usual brand	5709	48.2	40.7	9.8
Daily RYO only	922	7.8	44.4	NA
Non-daily smokers	1770	14.9	31.9	8.4
Quit <2 years	1563	13.2	39.1	NA
All*	11 844	100	40.3	6.5

*n=44 don't know or refused type of cigarette question.
FMC, factory-made cigarette; NA, not applicable; RYO, roll your own.

Table 2 'Filter ventilation beliefs' for daily FMC smokers (n=7541) (weighted data)

N=7541	A, aware/ believe usual cig vented	B, aware/ believe usual cig not vented	C, not aware of filter ventilation	58.3 Significance A vs (B+C)
% of daily FMC smokers	9.4	32.3	58.3	
By country				
Canada (n=2146)	8.5	35.3	56.1	χ^2 (3)=56.49,
USA (n=1604)	8.0	26.0	65.9	$p<0.001$
England (n=2750)	8.5	32.3	59.2	
Australia (n=1041)	15.7	36.4	47.9	
By gender				
Female (n=3898)	9.0	27.3	63.7	χ^2 (1)=1.31,
Male (n=3643)	9.8	36.7	53.6	n.s.
By age group				
18–24 (n=1326)	8.5	28.0	63.5	χ^2 (3)=76.15
25–39 (n=1587)	12.8	28.2	59.0	$p<0.001$
40–54 (n=2053)	10.0	36.7	53.3	
55+ (n=2575)	5.4	33.5	61.1	
By cigarettes per day				
0–10 (3173)	8.6	27.8	63.6	χ^2 (2)=4.74
11–20 (3203)	10.1	36.0	53.9	n.s.
>20 (978) cases	9.8	36.2	54.1	
NB: 187 missing				
Figures are row percentages. FMC, factory-made cigarette.				

Blocking vent holes (RQ4)

Respondents in Australia, Canada and the USA who reported that their regular brand has filter ventilation (n=461) were asked if they ever deliberately partially or fully block the vents of their cigarettes. Across the three countries, 19.3% reported that they deliberately blocked vents: 13.3% sometimes and 6.0% always. There were no significant between country differences (χ^2 (2)=0.17, n.s.).

Analyses for FMC daily smokers with usual brand Tar intake (RQ5)

Australian respondents who were aware of filter ventilation (N=461) were asked what effect vent blocking would have on smokers' intakes of 'tar', and 41.9% responded it would increase 'tar' intakes somewhat (27.5%) or greatly (14.4%), 19.0% believed it would have no effect, 5.9% believed it would reduce 'tar' intakes somewhat or greatly, and 33.3% said 'Don't know'. There were no significant differences between those who believed their usual cigarette has filter ventilation and those who believed their usual cigarette does not (χ^2 (1)=3.87, n.s.).

Relationship between ventilation and beliefs about harms (RQ6) (N=5709)

[Table 3](#) presents analyses for 'filter ventilation beliefs' by beliefs that one's usual cigarette is less harmful and smoother. Overall, 50.4% of exclusive daily FMC smokers believe their usual cigarettes are smoother. This was more likely among those believing their usual cigarette has filter ventilation (12.3% vs 6.0%) (χ^2 (1)=51.61, $p<0.001$). Fewer believed their usual cigarette is less harmful (8.3%) but again this was more common among those who believe their cigarettes are vented compared with all other categories (64.8% vs 49.2%) (χ^2 (1)=35.09, $p<0.001$). We also cross-tabulated these two

Table 3 'Filter ventilation beliefs' by belief usual cigarette is smoother and less harmful among exclusive FMC daily smokers with usual brand (n=5709) (weighted data)

Beliefs about their usual cigarette compared with other respondents	Venting belief			Significance A vs (B+C)
	A, believe usual cig vented	B, aware, but don't believe usual cig vented	C, not aware of filter ventilation	
Usual cig is smoother*				
Smoother (n=2880)	64.8	50.4	48.6	χ^2 (1)=51.61, p<0.001
About the same (n=2448)	29.3	42.1	45.9	
Harsher (n=381)	5.9	7.5	5.5	
Usual cig is less harmful†				
Less harmful (n=471)	12.3	6.0	6.0	χ^2 (1)=35.09, p<0.001
No different (n=4888)	81.5	89.8	88.6	
More harmful (n=350)	5.1	4.2	5.4	

Figures are column percentages.
*Don't know or refused (n=345) recoded to 'about the same'.
†Don't know or refused (n=373) recoded to 'no different'.
FMC, factory-made cigarette.

beliefs and found a strong association such that those who believe their cigarettes were smoother tended to believe they were less harmful and the effect was even stronger for the smaller percentage believing their cigarettes are harsher than average (χ^2 (4)=415.8, $p<0.0001$). In multivariate analyses, smokers awareness of filter ventilation was not associated with perception of their brand's relative harmfulness (table 4), but was associated with perceptions that their brand was both harsher (adjusted OR, aOR=1.59, 95% CI

1.16 to 2.18) or smoother (aOR=1.40, 95% CI 1.20 to 1.63) in comparison to those believing there was no difference in harshness. By comparison, when the analysis focused on smokers believing that their cigarettes were ventilated, those believing this were more likely to believe that their brand was both less harmful (aOR=2.41, 95% CI 1.66 to 3.49) and smoother (aOR=1.97, 95% CI 1.50 to 2.59) but not more harmful and harsher in comparison with the no difference categories.

Table 4 Logistic regression models for awareness of filter ventilation and belief that one's own usual cigarette has filter ventilation

	Aware of vent holes in filters		Own cigarette has vent holes	
	aOR	95% CI	aOR	95% CI
Your brand harmfulness				
A little less harmful	1.23	(0.93 to 1.62)	2.41***	(1.66 to 3.49)
No different	1.00	(1.00 to 1.00)	1.00	(1.00 to 1.00)
A little more harmful	0.83	(0.60 to 1.14)	1.40	(0.89 to 2.20)
Your brand harsher or smoother				
Harsher	1.59**	(1.16 to 2.18)	1.34	(0.81 to 2.24)
About the same	1.00	(1.00 to 1.00)	1.00	(1.00 to 1.00)
Smoother	1.40***	(1.20 to 1.63)	1.97***	(1.50 to 2.59)
Age group				
18–24	1.00	(1.00 to 1.00)	1.00	(1.00 to 1.00)
25–39	1.09	(0.82 to 1.45)	1.37	(0.85 to 2.19)
40–54	1.31*	(1.01 to 1.70)	1.07	(0.69 to 1.67)
55 and up	0.99	(0.77 to 1.28)	0.55**	(0.35 to 0.86)
Female	0.61***	(0.53 to 0.70)	0.90	(0.71 to 1.15)
Country				
Canada	1.34**	(1.12 to 1.60)	1.01	(0.74 to 1.37)
USA	0.85	(0.69 to 1.04)	0.82	(0.57 to 1.18)
England	1.00	(1.00 to 1.00)	1.00	(1.00 to 1.00)
Australia	1.98***	(1.53 to 2.55)	2.22***	(1.53 to 3.24)
Ethnicity				
Non-white	0.70**	(0.56 to 0.88)	0.63*	(0.42 to 0.96)
Education level attained				
Low	1.00	(1.00 to 1.00)	1.00	(1.00 to 1.00)
Moderate	1.25**	(1.07 to 1.47)	1.30	(0.98 to 1.71)
High	0.95	(0.78 to 1.15)	0.96	(0.68 to 1.35)
Financial stressed				
Constant	1.18	(0.97 to 1.44)	0.98	(0.72 to 1.34)
Constant	0.51***	(0.38 to 0.69)	0.06***	(0.03 to 0.11)

Exponentiated coefficients; 95% CIs in brackets; weighted data.

Missing data n=81.

Sample limited to daily smokers who are mainly or predominantly FMC smokers with a usual brand (n=5628).

* $p<0.05$, ** $p<0.01$, *** $p<0.001$.

aOR, adjusted OR; FMC, factory-made cigarette.

DISCUSSION

We found that awareness of filter ventilation continued to be low across the four countries surveyed, despite brands incorporating filter ventilation having been sold in all four markets for well over 40 years. Fewer than 10% of daily FMC smokers believed their usual cigarettes were vented, partly because nearly 60% did not know about filter ventilation at all. Even among those who were aware, understanding of the implications was low. The main consequence of most smokers not knowing about filter ventilation is that they are deprived of any opportunity to consider how the technology might be influencing their behaviours and perceptions. Further, those respondents who believed their usual cigarettes have filter venting were more likely to believe they smoke 'less harmful' cigarettes than other respondents likely due to their perception that their usual cigarettes were smoother than average. As noted above, there is no evidence to support the belief that filter ventilation reduces harm. On the contrary, the available evidence is more consistent with filter ventilation increasing harm.¹¹ Technologies which create an impression of reduced harmfulness, without actually delivering it in practice, are inherently deceptive. Thus, we believe these findings strengthen the case for banning filter ventilation.

In considering a ban on filter ventilation, it is important to anticipate the likely consequences, both positive and negative. If nothing else changed in any brand, banning filter ventilation would result in the cigarette market becoming more homogeneous in terms of relative 'smoothness', with most brands or brand varieties increasing in taste strength and harshness. Given the importance of filter ventilation for creating difference in the sensory characteristics of cigarettes, we might also expect brand families to contract in the number of variants they contain. We understand that the next most important modulator of taste strength and harshness after filter ventilation is filter efficiency.^{3 28} However, there is unlikely to be much scope for introducing new filter sizes/efficiencies beyond what is currently in use without restricting the amount of nicotine smokers can take in and thus rendering those cigarettes unacceptable. There may be scope for the industry to use higher porosity paper to wrap the tobacco rods but, again, this would have limited effects on smoothness, compared with what can be achieved with filter ventilation.³ The use of additives such as menthol which provide an alternative means of making smoke smoother/fresher, might be used more frequently if the tobacco industry was free to do so (although current Canadian and European Union tobacco products regulations would prevent this happening within those jurisdictions).²⁹ Accordingly, it might be important for regulation to prohibit filter ventilation to be accompanied by regulation to restrict the tobacco industry's ability to use a wide variety of filters, paper porosity and additives. A more radical proposal would be to ban the use of filters completely—also on the grounds that they merely produce the illusion of reduced harm.^{30 31} However, detailed consideration of such a measure is outside the scope of this paper.

From the perspective of many smokers, eliminating filter ventilation would mean their preferred varieties disappearing from the market or at least changing perceptibly in their characteristics. Some smokers might feel they were being forced to choose less satisfactory and/or more harmful products and that smoking them would no longer be 'worth it.' This could produce a valuable window of opportunity for quitting. However, smokers who were not motivated to quit immediately after the change would most likely adjust rapidly to smoking whatever products

were still available, so the window of opportunity to encourage extra quitting is likely to be narrow.

The effects of a ban on filter ventilation on uptake may be greater than the effects on quitting. It may be harder for adolescents to learn to smoke when only harsher cigarettes are available, because the unpleasant experiences become stronger in relation to the positive ones (ie, the experiences that motivate continued use and eventually result in dependence), making it more likely that experimenting smokers will decide continuing is not worthwhile.

Finally, we note that banning filter ventilation would not be an expensive measure for governments to enact. The costs to governments would be limited to public education measures in the lead-up to a ban and ongoing surveillance.

Limitations of the present study

Because the present study used data from a survey which covers a wide range of topics—and where there is a need for some country-specific items—not all questions were asked in all four countries. Thus, the data were limited for two of the questions. Knowledge of the effects of vent blocking in Australia may not reflect the situation in the other countries, given that Australian smokers were the most aware of filter ventilation. However, where we could investigate, we found no evidence of interactive effects by country.

We accept there are difficulties in asking about issues where awareness is low. Answers to specific questions may be distorted to the extent smokers misinterpreted what we were asking about. However, this would not be likely to affect the substantive conclusions as they are of large-scale ignorance and some misunderstanding.

Another limitation is that we did not ask smokers if they took actions to avoid compensating when smoking cigarettes with filter ventilation (ie, made a deliberate effort to avoid blocking vents and/or made a deliberate effort to avoid taking larger puffs). However, based on the small percentage who believe their cigarettes have filter ventilation, any such deliberate activity would have to be uncommon.

Finally, not having data on the filter ventilation level and type of respondents' usual brands precluded us examining how beliefs about harm relate to levels of filter ventilation, but our findings of an association between perceived smoothness and the belief that their cigarettes are vented is suggestive of a relationship. Filter ventilation in 'full strength' brands is also much more difficult to see with the naked eye than the filter ventilation in 'mid-strength' and 'smooth' brands (see online supplemental figure 1). A future study, which collected data on both the type of filter ventilation used and the level (or percentage) of filter ventilation, would enable stronger conclusions about how both relative smoothness of smoking sensations and ease of visibility of the vents affect smokers' beliefs. However, it is not clear what further contribution this would make to the already strong case for eliminating this inherently deceptive design feature.

CONCLUSIONS

We found strong evidence that awareness of filter ventilation remained low in 2018 in all four countries surveyed. While the vast majority of brands sold in all four countries will have some level of filter ventilation, only a small proportion of FMC smokers believed that their usual cigarette has it. This belief was associated with believing their cigarettes are less harmful. The low levels of awareness and understanding we found mean that the effects of filter ventilation on smokers' behaviour must occur

largely independently of conscious awareness, and as the effects appear to include false reassurance while allowing (unconscious) compensatory smoking, we see no justification for continuing to allow this inherently deceptive technology to be permitted in products as harmful as cigarettes.

What this paper adds

What is already known on this subject

⇒ A search of the PubMed database and the indexes of major tobacco control journals showed an active period in the 1980s and 1990s for research on smokers' awareness of, and beliefs about, filter ventilation. This was followed by a lull in research, even though filter ventilation is the most important means for creating 'smoother'/'lighter' cigarettes, which the Framework Convention on Tobacco Control identifies as requiring regulatory action to prevent smokers being deceived. Earlier research showed that most smokers studied were unaware of filter ventilation and unaware that it is readily defeated by smokers blocking vents or taking larger puffs.

What this paper adds

⇒ This study demonstrates that the banning of 'light' and 'mild' descriptors and the end of tar yield labelling has been inadequate to end belief that 'smoother' cigarettes are less harmful. We found low awareness of filter ventilation and very low levels of belief by smokers who were aware of it that their own cigarettes almost certainly have it. Further, many of those smokers who did believe their own cigarettes have it also believed that their own cigarettes are 'less harmful.' Filter ventilation continues to be an effective tool for convincing smokers that their cigarettes are 'less harmful', even after the end of on-pack tar, nicotine and carbon monoxide yield labelling and the use of 'light' and 'mild' descriptors. A recent review has also shown that filter ventilation is likely to increase harm to smokers by exposing more lung tissue to smoke particles. Added together, there is a renewed case for governments to ban filter ventilation.

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Contributors GF, MC, AM and RB are senior investigators on the ITC 4C project. GF, MC, AM, RO, DH, MLG and BK designed the study. BK, MLG and RB conducted the data analysis. BK drafted the paper and BK and RB revised it with comments from GF, MC, AM, RO, DH and MLG.

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Competing interests RO discloses that he has consultancies with WHO and the FDA. GF has served as an expert witness on behalf of governments in litigation involving the tobacco industry. MC has been a consultant and received grant funding from Pfizer Inc in the past 5 years. He has also been a paid expert witness in litigation against the tobacco industry.

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