

Impact of flavoured tobacco restriction policies on flavoured product availability in Massachusetts

Melody Kingsley,[✉] Glory Song, Jennifer Robertson, Patricia Henley, W W Sanouri Ursprung

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Massachusetts Tobacco and Cessation Program, Massachusetts Department of Public Health, Boston, Massachusetts, USA

Correspondence to

Melody Kingsley, Massachusetts Department of Public Health, Boston, MA 02108, USA; Melody.Kingsley@state.ma.us

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ABSTRACT

Objective This study aimed to evaluate the effectiveness of flavoured tobacco product restriction policies in reducing availability of flavoured products in Massachusetts communities.

Methods Data were obtained from surveys of tobacco retailers conducted from July 2015 to March 2017. On a community level, flavoured product availability was defined as the per cent of retailers during a given 3-month quarter that sold flavoured cigars/cigarillos, electronic cigarettes and/or e-liquids. Communities that implemented the policy during the study period were grouped into wave 1 (n=18; 1481 retail surveys) and wave 2 (n=20; 483 retail surveys) by date of policy implementation; communities without a flavoured product restriction served as the control group (n=234; 4932 retail surveys). A difference-in-difference analysis was used to compare the change in flavoured product availability in wave 1 and wave 2 communities 3 months pre-policy and post-policy implementation to the change over the same time periods in the control group.

Results From pre-policy to post-policy implementation period, communities in both waves experienced significant reductions in flavoured product availability (ranging from 27.2% to 50.9%), even after adjusting for community-level characteristics. In both waves 1 and 2, reductions in flavoured product availability were significantly greater compared with comparison communities during the same time frame, adjusting for community-level characteristics.

Conclusions Compliance with flavoured product restriction policies is high among tobacco retailers throughout Massachusetts, regardless of community demographic and retail characteristics. Reduced availability of flavoured tobacco in the retail environment has the potential to reduce youth exposure, access and use of these products.

INTRODUCTION

Among US youth, recent declines in cigarette use have been concurrent with a rise in non-cigarette tobacco product use.¹ From 2011 to 2016, current use of electronic cigarettes (e-cigarettes) increased significantly among both high school and middle school students.¹

Flavour additives in non-cigarette tobacco products may have helped drive these trends. Today, flavoured tobacco products are widely available and marketed in convenience stores,² where the majority of youth frequently visit.³ Flavourings in tobacco products are attractive to youth, and tobacco industry documents confirm that flavourings have been added to products to intentionally appeal

to younger users.⁴ Recent research suggests that the majority of middle and high school current tobacco users have used a flavoured product in the past 30 days (70%), and rates of flavoured product use are consistently high for many types of tobacco products.⁵

Given the appeal of flavoured tobacco products to youth and prevalent availability in convenience stores, changes to the retail environment may be an important and effective strategy to decrease youth access to flavoured products and, in turn, tobacco initiation. Data from the National Youth Tobacco Survey (1999–2013) suggest that the 2009 Food and Drug Administration ban on the sale of flavoured cigarettes (excluding menthol) reduced the likelihood of youth cigarette smoking by 17% but was associated with increases in the likelihood of menthol cigarette use (among smokers), as well as in overall use of non-cigarette products (cigars, pipes, smokeless tobacco and, later, e-cigarettes).⁶ Therefore, expanding the flavour restriction to other types of tobacco and including menthol are necessary to reduce youth tobacco use. There is evidence to suggest that the large majority of youth who use flavoured tobacco report that they would stop using tobacco products altogether if flavoured products were no longer available.⁷

In response, many local governments have restricted the sale of flavoured non-cigarette tobacco products. In 2014, following successful litigation defending the flavoured product restrictions in Providence and New York City (NYC), municipal Boards of Health (BOH) in Massachusetts began passing similar regulations. To avoid additional litigation, these regulations mirror the language used in Providence; they restrict the sale of flavoured tobacco products (excluding menthol but including e-cigarette products) to adult-only establishments (such as bars, vape shops and tobacconists). As of December 2018, 138 municipalities in Massachusetts, including Boston, have passed a flavoured restriction policy, covering 61% of the state's total population.⁸ Policy evaluation studies conducted in NYC and in Minneapolis and St. Paul have shown reductions in sales of non-cigarette flavoured tobacco products in large retailers, pharmacies, grocery and convenience stores following policy implementation.^{9–11} However, it is not yet known whether these results extend to other localities or all types of retailers.

In this paper, we assess the impact of flavoured product restriction policies on flavoured product availability in Massachusetts retailers from July 2015 to March 2017. We hypothesise that the



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policy will effectively decrease the availability of flavoured tobacco products in the short-term in communities where the policy has taken effect. In addition, we expect that decreases in availability in communities with a policy will be significantly greater than any decreases in availability in communities without a policy over the same time period, even after adjusting for community-level demographic and retail characteristics.

METHODS

Survey instrument

Since 2010, the Massachusetts Tobacco Control Program (MTCP) has conducted observations on tobacco pricing and availability in tobacco retailers across the state. The survey captures the price and availability of specific brands and types of tobacco products available in retailers, including: (1) price and brand of the cheapest single and multipack cigar/cigarillo (cheapest flavoured and unflavoured products are captured separately); (2) price and brand of the cheapest e-cigarette/e-hookah/vape pen (flavoured and unflavoured); and (3) price and brand of the cheapest e-liquid/nicotine dropper (flavoured and unflavoured). Information on these three types of flavoured products was used to determine availability of flavoured products in the store for purposes of this study. Products are classified as ‘flavoured’ if they contain a characterising flavour such as fruit, candy or alcohol, or as ‘unflavoured’ if they contain menthol/mint or tobacco flavours (aligned with language used in the policy). Classification was guided by flavour descriptions on packaging and promotions and by use of the flavoured product list (FPL) enforcement tool, developed through analysis of online advertising descriptions and product reviews, smell tests, and other research. Additional data collected from each store included name and address, date and time of survey, whether survey was completed, or reason for incomplete data.

Sampling and data collection

Each year, pricing surveys are conducted statewide. MTCP funds 14 BOH staff to conduct enforcement activities and pricing surveys among active retailers in 186 funded communities. A community is considered ‘funded’ if it has an MTCP-funded tobacco control programme. For retailers in the remaining 165 communities that do not receive MTCP funding (unfunded communities), John Snow Research and Training Institute staff serve as data collectors.

Within each BOH region—or county, for unfunded communities—the pricing survey is conducted quarterly in a random sample of retailers. During the first quarter of the fiscal year (July–September), a simple random sample comprised of 25% of all retailers in each BOH region or county is surveyed. In each remaining quarter, another 25% of all retailers in the BOH region or county are randomly selected from the remaining retailers and surveyed.

This sampling method—where randomisation within each BOH region or county is performed at the retailer level, not community level—maximises the chance that a representative sample of retailers is surveyed during each quarter for each community. This ensures that regardless of when a point-of-sale policy is passed during the fiscal year, some pre-data and post-data on price and availability will be available for most communities.

During the study period (July 2015–March 2017), pricing surveys were conducted during seven continuous time periods; exact dates for each data collection quarter are shown in figure 1. For quarters 1–4 (Q1–Q4; July 2015–June 2016), 100% of retailers in both funded and unfunded communities were sampled. For quarters 5–7 (Q5–Q7; July 2016–March 2017), 100% of retailers in funded communities were sampled, but only 40% of retailers in unfunded communities were randomly sampled due to funding limitations.

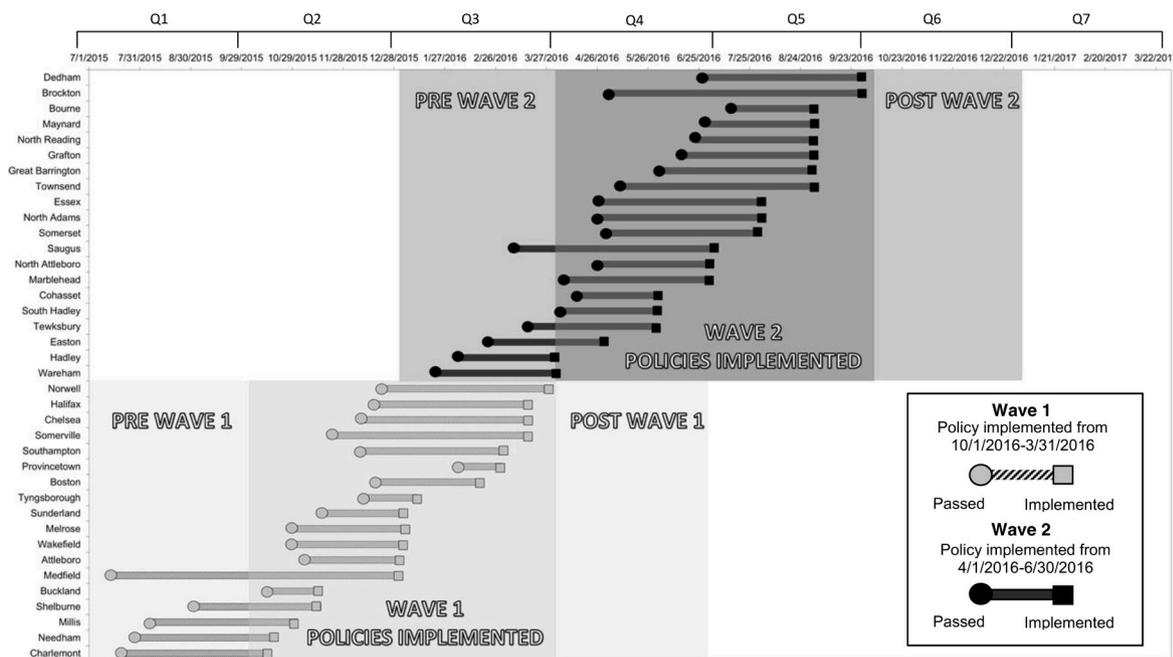


Figure 1 Interim period between flavoured product restriction policy passage and implementation dates in communities with restrictions, which were implemented from 1 October 2015 to 30 September 2016 (n=38). Circles represent policy passage dates, and squares represent policy implementation dates. Pre-wave periods represent data used to analyse flavoured product availability before policy implementation dates; post-wave periods represent data used to analyse flavoured product availability after policy implementation date.

Study design

Communities that passed a flavour restriction policy with an implementation date between 1 October 2015 and 30 September 2016 were included in the analysis (n=38). Among these communities, the majority (n=27, 71.1%) were funded. These 38 communities were grouped into two waves based on policy implementation date in order to examine whether compliance patterns with the policy changed with time. Early-adopter (wave 1) communities (n=18; 1481 retail surveys) had policies implemented during Q2 (n=5) or Q3 (n=13). Later-adopter (wave 2) communities (n=20; 483 retail surveys) had policies implemented during Q4 (n=12) or Q5 (n=8). **Figure 1** shows a timeline of passage and effective dates of communities with a policy that took effect from Q2 to Q5 and the corresponding wave to which they belong. Communities that had not implemented a policy by 30 September 2016 served as control communities (n=234). In these communities, there were 4932 retail surveys analysed. See online supplementary figure 1 for a map of Massachusetts communities included.

In total, 6896 pricing surveys collected from 4581 unique retailers were included (4991 from funded communities and 1905 from unfunded communities). A total of 2315 retailers were surveyed twice, as they were randomly selected during both years of the study period (Q1–Q4 and Q5–Q7). For purposes of this study, adult-only retailers exempt from the policy were excluded (eg, vape shops), as well as retailers that are typically not frequented by youth (eg, liquor stores). The exclusion criteria for the final study sample of communities and surveys are shown in **figure 2**.

Measures

Flavoured product availability

Individual retailers were classified as selling flavoured tobacco if they had at least one of the three following products observed at time of survey: flavoured cigar/cigarillo, flavoured e-cigarette or flavoured e-liquid. On a community level, flavoured product availability overall was defined as the per cent of retailers in a community during a given quarter that sold any of the aforementioned flavoured tobacco products. In addition, community-level availability of flavoured cigar/cigarillos ('cigars') and flavoured e-cigarettes/e-liquids ('vapour products') were assessed separately.

Community characteristics

Retailers were classified as independent or chain based on type of ownership, and the per cent of independent retailers was calculated for each community. Other characteristics assessed include: per cent of female residents, per cent of residents who do not identify as non-Hispanic white, per cent of residents with a college education, per cent urban area, median income, median age of residents and retail density (number of retailers per 1000 adults). These characteristics were chosen a priori due to prior research indicating that percentage of black residents, percentage of Hispanic residents, percentage of residents with a college degree, rural location, lower mean family income and independent retail ownership status (among others) were negatively associated with retailer compliance with tobacco age restrictions.^{12–16} For retail density calculations, the number of active tobacco retailers in each community was obtained from MTCP in August 2016. Per cent urban area was obtained from the 2010 Census. For all other demographic variables, data were obtained from the 2010 American Community Survey.

Data analysis

For all community-level variables, mean values were calculated for wave 1, wave 2, and control communities. Wilcoxon signed-rank tests were used to assess differences in baseline community-level characteristics between wave 1 communities and control communities, and between wave 2 communities and control communities.

To assess the impact of the policy on availability of flavoured tobacco products among retailers, flavoured product availability in wave 1, wave 2, and control communities was calculated during all seven quarters. For communities in each wave, change was assessed by comparing flavoured product availability one quarter pre-implementation and one quarter post-implementation (Q1 and Q4 for wave 1; Q3 and Q6 for wave 2). Using multilevel repeated measures linear regression models to account for community clustering, difference-in-difference analyses were conducted to compare the change in flavoured product availability in wave 1 and wave 2 communities to control communities. These models were adjusted for per cent urban, per cent independent retailers and per cent funded communities, which were included due to significant differences at baseline between wave 1, wave 2, and control communities. To assess differences in availability of flavoured products by type, difference-in-difference models were conducted to compare the change in availability of cigar/cigarillos to the change in e-cigarettes/e-liquids from pre-implementation to post-implementation periods in both wave 1 and wave 2, after adjusting for per cent urban, per cent independent retailers and per cent funded communities. As a sensitivity analysis, difference-in-difference models were also conducted adjusting for all community-level characteristics.

All analyses were conducted using SAS V.9.3.

RESULTS

Comparison of community-level characteristics

Table 1 compares mean characteristics of wave 1 and wave 2 communities to control communities. There were no significant differences in baseline characteristics between wave 1 communities and control communities; however, wave 2 communities had significantly higher per cent of urban area, lower per cent of independent retailers and higher per cent that are funded, compared with control communities.

Change in flavoured product availability over time

Figure 3 shows the change in flavoured product availability from Q1 to Q7 for wave 1, wave 2, and control communities. Prior to policy implementation (Q1), there were no statistically significant differences in flavoured product availability among the three groups. Pre-implementation, flavoured product availability was 62.6% in wave 1 communities (Q1). During the same time period, flavoured product availability was 67.7% in control communities. By post-implementation (Q4), flavoured product availability decreased significantly by 27.2% in wave 1 communities but increased significantly by 6.6% among communities without a policy, after adjusting for percent urban, per cent independent retailers and per cent funded communities (**table 2**). Difference-in-difference results show that from pre-to-post implementation, communities in wave 1 experienced a change in flavoured product availability that was 33.7 percentage points greater than the change experienced by control communities (p=0.007) (**table 2**). When adjusting for all community-level characteristics as a sensitivity analysis, this estimate changed only minimally (<5%) and remained significant; therefore, the original model was retained.

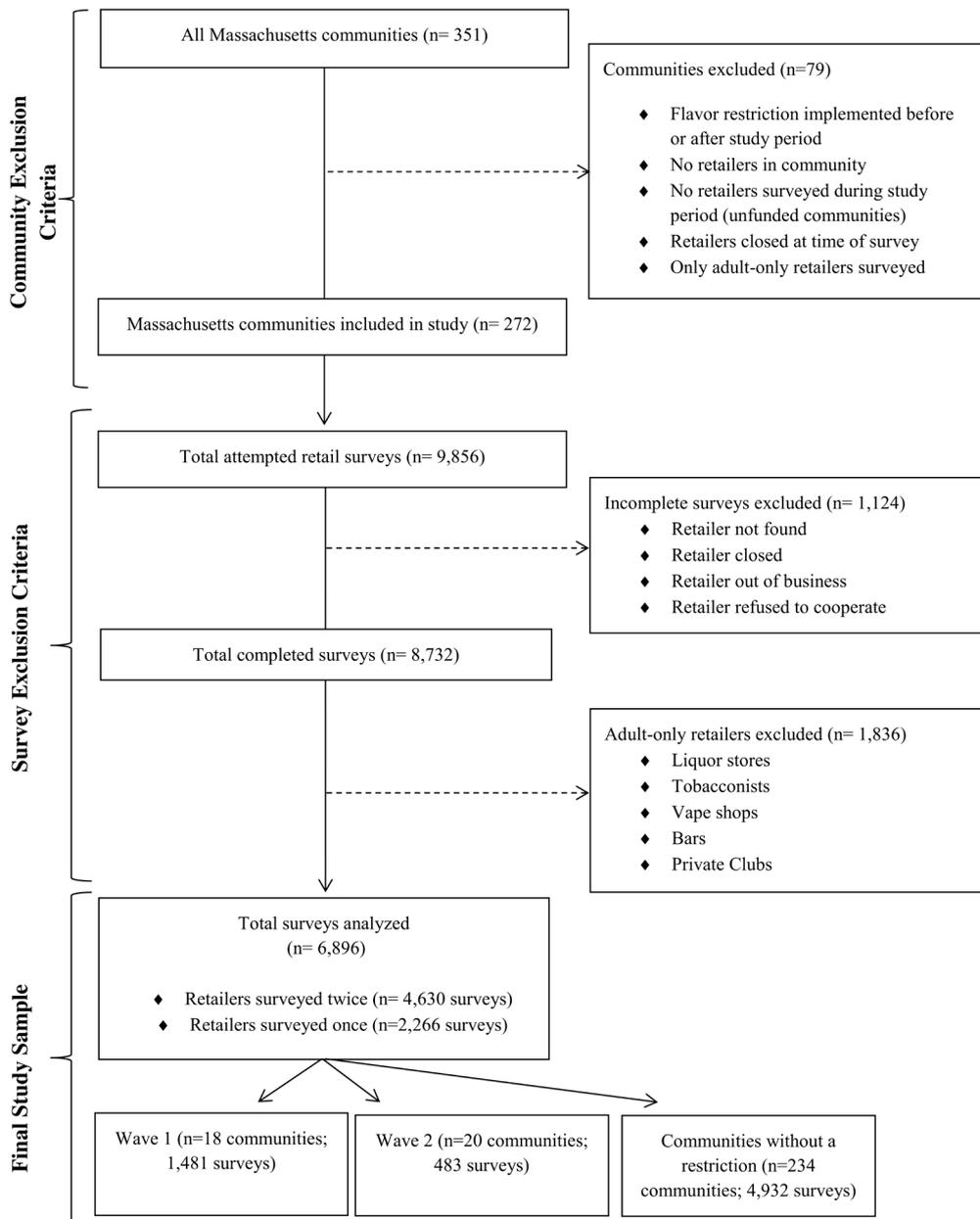


Figure 2 Exclusion criteria for final community and retail survey sample. Note: flavoured product restrictions also apply to liquor stores; however they were excluded due to infrequent youth visitation.

In wave 2 communities, flavoured product availability was 79.8% pre-implementation (Q3). During the same period, flavoured product availability was 75% in control communities. By post-implementation (Q6), flavoured product availability decreased significantly by 50.9% in wave 2 communities and decreased significantly but by a much lower rate (10.4%) among control communities, after adjusting for per cent urban area, per cent independent retailers and per cent funded communities.

Similar to wave 1 communities, wave 2 communities experienced a change in flavoured product availability that was 40.5 percentage points greater than the change experienced by control communities ($p=0.001$). Again, this estimate changed only minimally (<5%) and remained significant after conducting an identical sensitivity analysis, so the original model was retained. Overall, a greater change in flavoured product availability from pre-implementation to post-implementation periods was seen

Table 1 Mean (%) demographic characteristics for wave 1, wave 2 and communities without restriction policies

Variable	Wave 1 (n=18)	Wave 2 (n=20)	No restriction (n=234)
Female (%)	50.6	51.9	51.1
Non-white (%)	11.5	8.3	7.9
College graduates (%)	43.3	38.5	38.3
Urban (%)	74.2	88.9*	68.5
Median income	66329	76438	76819
Median age	40.8	41.6	42.3
Retail density	1.7	1.2	1.2
Independent retailers (%)	57.9	40.4*	58.3
Funded communities (%)	61.1	80.0*	52.1
Baseline flavoured product availability (%)†	62.6	71.1	67.7

Communities in wave 1 implemented flavoured tobacco restriction policies from October 2015 to March 2016, while communities in wave 2 implemented these policies from April 2016 to September 2016. Communities in the no restriction group do not have this policy (at the time study was conducted).

* $P < 0.05$ for Wilcoxon rank-sum tests comparing wave 2 communities and no restriction communities.

†Flavoured product availability is the availability of at least one of the following three products in tobacco retailers: a flavoured cigar/cigarillo, a flavoured e-cigarette or a flavoured e-liquid. Flavoured products are defined as those with a characterising flavour (eg, candy, fruit and alcohol), excluding menthol/mint flavours.

among both wave 1 and wave 2 communities, compared with control communities during the same time periods.

No differences in retailer compliance by product type were found, despite slight (non-significant) differences in availability at pre-implementation (see online supplementary figure 2). By post-implementation, there was no significant difference in availability of cigars compared with vapour products in either wave 1 (Q4) or wave 2 (Q6). Difference-in-difference results suggest that there were also no significant differences between the change in availability of cigars or vapour products in wave 1 or wave 2 from pre-implementation to post-implementation, after adjusting for covariates ($p=0.103$ and $p=0.270$, respectively). These estimates changed only minimally ($<5\%$), but did not gain significance, after conducting a sensitivity analysis with all community-level characteristics.

Figure 3 also shows a decrease in overall flavoured product availability each quarter following policy implementation for both wave 1 and wave 2. Among wave 1 communities, the greatest drop in flavoured product availability occurred between Q3 and Q4; a significant decrease of 39.4 percentage points (from 53.5% to 14.1%). Among wave 2 communities, the greatest drop in flavoured product availability occurred between Q4 and Q5; a significant decrease of 28.4 percentage points (from 63.8% to 35.4%). By Q7, both wave 1 and wave 2 communities had significantly lower flavoured product availability (8.3% and 14.3%, respectively) compared with communities without a policy (67.9%).

Retailers not in compliance

At Q7 (6 months–1 year post-implementation), 21 of the 38 communities with flavour restrictions had 100% compliance. There were 11 communities with non-compliant retailers, but only 12.2% ($n=23$) of retailers in those communities were not in compliance. In the remaining six communities, data were not collected during Q7. Of the 23 non-compliant retailers surveyed, the majority were independently owned (65.2%) and

carried only one type of flavoured product (73.9%). More of these retailers carried vapour products than cigars at Q7; 78.3% carried a vapour product, while only 39.1% carried a cigar.

DISCUSSION

This is one of the first studies to examine the impact of flavoured non-cigarette tobacco product restriction policies on flavoured product availability across multiple cities/towns. The results show that in Massachusetts, these policies drastically reduced the availability of flavoured tobacco products in the retail environment within a 12-month period post-policy implementation, irrespective of community characteristics. In contrast, in communities of similar characteristics but without a policy, flavoured product availability was similar at baseline but either remained unchanged or decreased much less compared with wave 1 and wave 2 communities over the same time period. This suggests that declines in flavoured product availability in communities with the policy were due to retailer compliance to the policy itself and not due to other factors that may impact flavoured product availability during the study period (eg, local preferences or seasonal fluctuations). In addition, despite slight differences in product availability at pre-implementation, there were no significant differences in compliance with the policy by product type by post-implementation.

Furthermore, wave 1 and wave 2 communities both showed similar trends of decline in flavoured product availability over time, with the greatest drop in availability occurring within 3–6 months after the policies were implemented. We observed a larger reduction among wave 2 communities due in part to a significantly higher per cent of retailers in wave 2 selling flavour during pre-implementation compared with wave 1. However, regardless of flavoured product availability pre-implementation, by Q7 compliance was very high in both waves: approximately 90% of retailers surveyed during this quarter no longer carried flavoured products.

It should be noted that overall high compliance with the policy may have been aided by MTCP's enforcement infrastructure and resources provided to enforcement agents statewide. A legal technical assistance provider for local BOH, the Massachusetts Association of Health Boards, developed tools to support compliance and enforcement of the policy, which were made available to both funded and unfunded communities. These tools included educational materials for retailers, the FPL, a protocol that recommended multiple educational visits before and after policy implementation, and multiple enforcement trainings. In an informal survey of enforcement agents in 52 funded communities with flavoured product restrictions, 90% reported following these protocols and using the guidance. Though this survey was not conducted in unfunded communities, enforcement activities are still actively promoted and conducted in these areas with technical assistance from the Massachusetts Health Officers Association.

Among retailers not in compliance, reasons include retailer uncertainty as to whether specific products are flavoured, particularly those with non-designated 'concept' flavours or newer products not yet added to the FPL. Varying levels of retailer education and enforcement may also explain differences in levels of retailer non-compliance among communities. Finally, the majority of retailers not in compliance in Q7 were independent retailers who may not have had the knowledge, resources or infrastructure to sell down or sell back flavoured products as quickly as chain retailers. More retailers sold vapour products than cigars at Q7, which could be due in part to differing

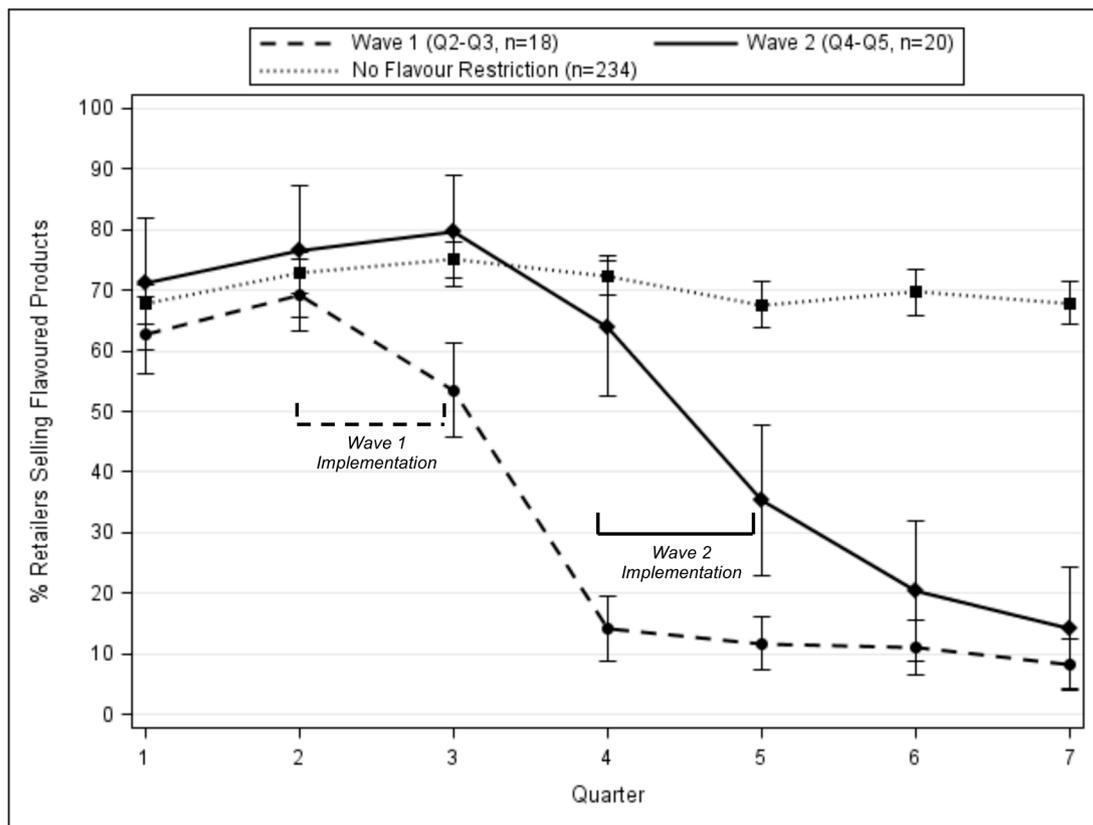


Figure 3 Flavoured product availability from quarter 1 to quarter 7 among communities with and without a flavoured product restriction. Data presented in this figure are not continuous but rather represent cross-sectional data collected at every quarter (data not collected between quarters). At the time of quarter 3 data collection, all wave 1 communities had implemented policies. At the time of quarter 5 data collection, all wave 2 communities had implemented policies (see figure 1 for complete implementation timeline). To assess differences in change in flavoured product availability among wave 1 and wave 2 communities compared with communities without a restriction, data were analysed one quarter before, and one quarter after, implementation periods.

levels of demand and differing availability of concept flavours by product. Nevertheless, likely due in part to enforcement presence and resources, there were still no significant differences seen in compliance by product type overall.

These results are consistent with findings from recent studies evaluating the impact of similar flavoured product restriction policies implemented in NYC and two cities in Minnesota.^{10 11} A notable strength of the present study is that it expands on sampling used in these studies to include a state-wide sample of retailers of all types and sizes, which for Q1–Q4 comprises a full sample of all retailers in the study communities. This study also looks at changes in product availability at seven different time points, in both communities with a policy and control communities. Additionally, it is one of the first studies that looks at flavoured product availability rather than just product sales, and therefore more directly and comprehensively captures the actual change in the physical retail environment, which has been shown to impact levels of exposure, awareness and desirability for tobacco by youths.¹⁷

Still, this study has limitations. First, this study does not have a longitudinal design and relies on surveying a random sample of different retailers each quarter to track change in flavoured product availability over time. We therefore cannot ascertain the true level of compliance in a community with the policy until all its retailers have been surveyed post-implementation. Second, the pricing survey did not capture all types of flavoured products affected by the policy (smokeless, hookah/shisha, and blunt wraps) nor the number of flavoured products available. We therefore could not determine retailer compliance for these other types of products nor could we quantify the extent to which retailers were compliant (eg, for the 18 retailers at Q7 still carrying flavoured vapour products, we do not know whether they had multiple brands and products available or just one or two). In addition, it is not known to what extent data collectors may have misattributed non-flavoured products as flavoured, or vice versa, during visits. Finally, limitations to the analysis include grouping communities into waves based on their policy implementation date not passage date. This means that within each

Table 2 Impact of restriction on flavoured product availability among wave 1, wave 2, and no restriction communities (after adjusting for community-level characteristics)

Flavoured product availability (overall)*						
Wave	Restriction		No restriction†		Difference	
	β	P value	β	P value	β	P value
Wave 1 (Q2–Q3)						
Flavoured product availability (% retailers)	–0.272	0.023‡	0.066	0.052	–0.337	0.007‡
Wave 2 (Q4–Q5)						
Flavoured product availability (% retailers)	–0.509	<0.001‡	–0.104	0.001‡	–0.405	0.001‡
Cigar and vapour product availability						
Wave	Cigar		E-cigarette/dropper		Difference	
	β	P value	β	P value	β	P value
Wave 1 (Q2–Q3) availability (% retailers)						
	–0.453	<0.001‡	–0.225	0.028‡	–0.228	0.103
Wave 2 (Q4–Q5) availability (% retailers)						
	–0.377	<0.001‡	–0.529	<0.001‡	0.152	0.270

Communities in wave 1 implemented flavoured tobacco restriction policies from October 2015 to March 2016, while communities in wave 2 implemented these policies from April 2016 to September 2016. Communities in the no restriction group do not have this policy (at the time study was conducted). Models used are repeated measures linear regression models, which control for per cent urban areas, per cent independent retailers and per cent of retailers in funded communities.

*Includes availability of flavoured cigars, e-cigarettes and e-liquid droppers combined. Flavoured products are defined as those with a characterising flavour (eg, candy, fruit and alcohol), excluding menthol/mint flavours.

†For wave 1, change in availability in no restriction communities assessed from Q1 to Q4. For wave 2, change in availability in no restriction communities assessed from Q3 to Q6.

‡P<0.05.

wave, early adopter communities may have retailers that already began selling down during the ‘pre’ period. However, these communities do not contribute a substantial portion of retailer surveys to the total sample in either wave. Difference-in-difference models may not have accounted for all variation in demographic characteristics between communities; however, the clear visual differences in trends in figure 3 suggest this is unlikely to have changed the significance level of estimates.

Altogether, results suggest that local-level flavoured tobacco restriction policies can have a short-term impact on reducing product availability, independent of community-specific

characteristics. These results have public health implications, as reductions in youth-accessible flavoured tobacco products in Massachusetts may lead to reductions in youth tobacco use.¹⁸

These findings are beneficial for other localities interested in implementing similar tobacco control policies. Future long-term research efforts could aim to assess whether the policy results in reductions in youth use of flavoured tobacco or all tobacco over time, especially among youths in low-income communities, where tobacco retail density and tobacco use rates tend to be higher.¹⁹

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What this paper adds

- Flavoured tobacco products are attractive to youth, and one state and a number of local municipalities, including many in Massachusetts, have passed regulations restricting the sale of one or more types of flavoured tobacco products. However, evidence around the effectiveness of these policies is limited.
- Through a rigorous evaluation of tobacco retailers across Massachusetts, this study demonstrated that compliance with flavoured product restrictions is high for all product types, suggesting that with requisite infrastructure and support to local enforcers, widespread compliance with similar policies is possible in other localities.
- Flavoured tobacco restrictions decrease the availability of flavoured tobacco products in the retail environment, suggesting that in municipalities with this policy, these restrictions could reduce youth initiation and use of flavoured tobacco products.

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