Additive impact of multiple point-of-sale tobacco control policies on youth tobacco-related outcomes

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ARTICLE INFO

Keywords:
Adolescents
Tobacco use
Policy evaluation

ABSTRACT

Objectives: The tobacco industry utilizes tactics to increase youth awareness, exposure, access and use of tobacco. To address these tactics, municipalities in Massachusetts have passed point-of-sale policies including: 1) restricting flavored tobacco (FTR), 2) restricting cigar package sizes and prices (CPPR), 3) banning tobacco in pharmacies (PB), and 4) raising the minimum legal sales age of tobacco to 21 (MLSA 21). This study evaluated whether more policies, and a combination of policies addressing all three industry tactics, are associated with more favorable youth tobacco-related outcomes.

Study design: This study was a cross-sectional survey.

Methods: Municipalities were selected based on number of policies and similarity of municipality and tobacco retailer characteristics. The final sample included: Somerville with all four policies, Worcester with two policies (MLSA 21 and PB), and New Bedford with one policy (PB). Surveys were administered to youth in a public high school in each municipality. Multivariable models were used to compare tobacco-related outcomes between municipalities with varying numbers of policies.

Results: After adjusting for individual-level demographics, we observed a protective effect of having more policies on flavored tobacco initiation and tobacco exposure and awareness. A protective effect of number of policies on tobacco use was not found, but associations were primarily in the expected direction. Current tobacco users in Somerville had higher odds of menthol use compared to New Bedford.

Conclusions: Implementing multiple policies addressing varied industry tactics may be effective for youth tobacco prevention. Including menthol in FTRs may help improve youth tobacco-related outcomes.

1. Introduction

Over the past two decades, as a result of policies restricting tobacco advertising, such as those that resulted from the 1998 Master Settlement Agreement, the tobacco industry began to focus its marketing efforts at the point-of-sale (POS) [1–3]. At the POS, the industry uses a variety of tactics to market tobacco products to youth, including making products sweet (available in youth-appealing flavors), cheap (available at low prices) and easy to get (available in numerous locations; providing incentives to retailers to increase visibility of tobacco products in stores) [4].

The industry’s tactics at the POS increase youth awareness, exposure, access, and use of tobacco products [5]. Due to the industry’s multi-pronged approach, policy strategies that are focused on the retail environment and address multiple aspects of the industry’s tactics are needed to reduce youth tobacco use [3]. In 2012 a set of model policies aimed at these tactics was developed by Massachusetts, which included: 1) a restriction on flavored tobacco sales, excluding menthol (FTR), 2) a restriction on cigar package sizes and prices (CPPR), 3) a ban on sale of tobacco in pharmacies (PB), and 4) an increase in minimum legal sales age of tobacco to 21 (MLSA 21). This set of policies was developed based on promising preliminary evidence on effectiveness of sales restrictions, age restrictions, and price increases for youth tobacco prevention [6,7]. These policies address varied industry tactics; FTR addresses the “sweet”
tactic, CPPR addresses the “cheap” tactic, and both PB and MLSA 21 address the “easy to get” tactic (see Fig. 1). In addition to Massachusetts, localities and states across the country have passed similar policies. However, to date, evaluation of prevention policies has primarily focused on individual policies [6–12]. To our knowledge, this is the first study that evaluates the additive effect of multiple tobacco prevention policies. The primary objective of this study was to assess whether municipalities with a greater number of policies (and a combination that address all three industry tactics) experience more favorable tobacco-related outcomes for high school youth (e.g. decreased: tobacco exposure, access, use) compared to municipalities with fewer policies that only address one or two tactics.

2. Methods

2.1. Municipality selection

In 2016, to prioritize allocation of funding, the Massachusetts Tobacco Cessation and Prevention program (MTCP) identified “priority municipalities” based on the following characteristics: income, poverty rate, smoking prevalence, youth retail density (number of retailers/1000 youth). From this list of priority municipalities, MTCP selected a mix of municipalities with more policies (three or four) and fewer policies (one or two) (see Fig. 2 for exclusion criteria). Final study municipalities were selected for inclusion based on similarity of municipality and retail density characteristics (Table 1 includes full list of characteristics) based on a matching approach detailed in a prior study [7]. The final municipalities included: one (Somerville) with four policies, one (Worcester) with two policies, and one (New Bedford) with one policy. At the time of data collection, New Bedford had PB in effect for seven years; Worcester had PB and MLSA 21 in effect for seven years and two years, respectively; Somerville had PB, MLSA 21, CPPR, and FTR in effect for eight years (PB) and three years (all other policies).

To select schools for survey administration, characteristics of youth enrolled in public high schools (race/ethnicity, average Massachusetts Comprehensive Assessment System test scores, number of retailers within 1000 ft of the school) in each selected municipality were compared; in municipalities with more than one school, the high school for survey administration was chosen based on similarity to the high schools in the other study municipalities. Specific data collection dates were as follows: June 2018 in Worcester, February 2019 in New Bedford, March 2019 in Somerville. To determine target sample sizes, a power analysis based on statewide surveillance data for smoking prevalence for each grade (9-12) was conducted [13]. Target sample sizes were as follows: 653 for Worcester, 784 for New Bedford, and 726 for Somerville. Surveys were administered in randomly selected classrooms during health classes or advisory periods by grade level, and were offered both online or on paper in three languages (English, Spanish, and Portuguese). Health Resources in Action (HRiA) led survey administration and data confidentiality procedures.

2.2. Measures

To aid in survey development, youth focus groups were conducted to better understand the experiences of high school-aged youth about tobacco use, and to determine which vocabulary, phrases, and images would best resonate with youth. The final survey included the following variables:

2.2.1. Demographics

Age (categorized as ≤ 14, 15, 16, 17, ≥18), grade in school (categorized as 9th, 10th, 11th, 12th), gender (categorized as male, female, different identity), and race/ethnicity (non-Hispanic American Indian/Alaskan Native, non-Hispanic Asian, non-Hispanic Black, Hispanic/Latino, non-Hispanic Native Hawaiian/Pacific Islander, non-Hispanic White, more than one race/ethnicity, and different race/ethnicity).

2.2.2. Living with a tobacco user

Students were asked if anyone they live with currently uses tobacco (including cigarettes, cigars, e-cigarettes, chew, dip, snus, and pipe tobacco) [14].

2.2.3. Tobacco exposure

Students were asked if they knew someone who would buy tobacco for them if asked; brands and names of all tobacco products seen in stores; correct price of single and multi-pack cigars in their municipality ($1 or less/2.50/$5.00/$8.25/$10.00). The “correct price” refers to the typical price cigars are sold for in each municipality. For example, in Somerville (which had a CPPR policy in place at the time of study) the minimum (and typical) price for single and multi-pack cigars is $2.50 and $5.00, respectively. However, in municipalities like Worcester and New Bedford (which did not have a CPPR policy in place at the time of study), both single and multi-pack cigars were typically sold for $1 or less.

2.2.4. Tobacco initiation

Students were asked whether they initiated tobacco use with a flavored product by responding to the question, “Which of these describes the first tobacco product (including e-cigarettes) you tried?” with “Flavored”, “Menthol or Mint”, “Plain or tobacco” or “Don’t know/not sure” [15].

| Tobacco Industry Tactics | Strategy to Reduce Tobacco Industry Influence | Flavored Product Restriction | Cigar Packaging Restriction | Pharmacy Ban | 21 Age Restriction |
|--------------------------|-----------------------------------------------|-----------------------------|---------------------------|--------------|------------------|
| Easy to Get: Makes tobacco available in numerous locations to normalize its sale and increase young peoples’ exposure. | Access strategy: Reduces the number or location of retail outlets and makes purchasing tobacco more difficult for youth | ✓ | ✓ | ✓ |
| Cheap: Makes tobacco inexpensive so it is easier for young people to buy it, and to try it on impulse | Pricing Strategy: Increases the cost of tobacco products. | ✓ | | |
| Sweet: Makes products sweet to mask tobacco taste, and uses a variety of youth-centered flavors for wider appeal | Flavor Strategy: Reduces exposure and access to flavored products targeted at youth. | ✓ | | |

Fig. 1. Tobacco industry tactics to increase youth tobacco use and corresponding point-of-sale policies to reduce industry influence.
2.2.5. Tobacco use

Students were provided a list of tobacco products (cigarette; cigar or cigarillo; e-cigarette; blunt wrap; smokeless) and asked whether they had ever used the product (classified as “ever users”) or used in the past 30 days (classified as “current users”).

2.2.6. Tobacco access

Tobacco ever users were asked how they obtained their tobacco products in the past three months. Responses were categorized into two categories: from a convenience/corner/mini-mart store, vs other source (gave someone money, obtained products from a friend or family member, online, obtained products some other way) [16].

2.3. Data analysis

Chi-squared tests were used to test for differences in demographic characteristics of students between municipalities. Multivariate logistic and linear regression models were used to compare tobacco-related outcomes between municipalities with varying numbers of policies. The linear model was used for continuous outcomes and the logistic model for the categorical ones. Due to statistically significant differences in demographic characteristics of students between municipalities, all models controlled for age, gender, sexual orientation, and race/ethnicity. All models also controlled for living with a tobacco user, an established risk factor for youth tobacco use [17]. Sensitivity analyses restricting data to youth ages 16 and younger were also conducted.

3. Results

The survey response rate for each municipality is as follows: 566 or 44% of the student body in Worcester (PB and MLSA; policies that address tobacco access), 1129 or 52% of the student body in New Bedford (PB; policy that addresses tobacco access), 726 or 58% of the student body in Somerville (FTR, CPPR, PB, MLSA; policies that address tobacco flavors, price, and access). Municipality characteristics, retail density, and policy implementation dates for study municipalities appear in Table 1. Somerville’s population density and youth retail density were almost four and two times greater than the other municipalities, respectively.

Significant differences in grade, age, and race/ethnicity of youth surveyed were observed between municipality comparisons included in the study (Table 2). Fewer significant differences between
squared tests were used to test for differences between municipalities. Bolded p-values are significant at the p < 0.05 level.

Table 1
Municipality matching characteristics: New Bedford, Worcester, Somerville.

| Municipality Characteristics                        | New Bedford | Worcester | Somerville |
|-----------------------------------------------------|-------------|-----------|------------|
| Total Population                                    | 95,072      | 181,045   | 75,754     |
| Population Density (per square mile)                | 4754        | 4845      | 18,387     |
| Youth (under age 18)                                | 22,063      | 39,942    | 9134       |
| White (%)                                           | 74.5        | 69.4      | 73.9       |
| Median Income ($)                                    | 36,172      | 45,036    | 61,731     |
| 5-year Adult Smoking Prevalence (%)                 | 25          | 20        | 13         |
| Below Poverty Level (%)                             | 22.7        | 18.3      | 14.7       |
| Walk Score                                          | 66          | 59        | 89         |
| Tobacco Retail Density                              | 1.84        | 1.64      | 1.31       |
| Youth Retail Density                                | 6.07        | 5.78      | 9.52       |
| Point-of-Sale Policies (Effective Date)             |             |           |            |
| Flavored Tobacco Restriction                        | No          | No        | 3/15/16    |
| Cigar Packaging Restriction                         | No          | No        | 3/15/16    |
| Minimum Legal Sales Age 21                          | No          | 9/1/16    | 3/15/16    |
| Pharmacy                                            | 3/1/12      | 5/10/11   | 7/1/11     |

Notes: Demographic data come from the 2010 Census. Retail density is the number of tobacco retailers per 1000 individuals. Retailer data was obtained based off 5 years of Behavioral Risk Factor Surveillance System (BRFSS), American Community Survey, and US Census data.

Table 2
Demographic characteristics of study participants: New Bedford, Worcester, Massachusetts, 2018 and 2019.

|                    | New Bedford % (n = 1129) | Worcester % (n = 566) | Somerville % (n = 726) | Worcester vs. New Bedford (p-value) | Somerville vs. New Bedford (p-value) | Somerville vs. Worcester (p-value) |
|--------------------|-------------------------|-----------------------|------------------------|-------------------------------------|--------------------------------------|-----------------------------------|
| Age                |                         |                       |                        |                                     |                                      |                                   |
| 14 or Younger      | 11.5                    | 10.7                  | 13.3                   | <0.001                              | 0.002                                | <0.001                            |
| 15                 | 22.8                    | 28.2                  | 30.7                   |                                     |                                      |                                   |
| 16                 | 24.9                    | 31.4                  | 21.9                   |                                     |                                      |                                   |
| 17                 | 23.4                    | 21.9                  | 18.2                   |                                     |                                      |                                   |
| 18 or older        |                         |                       |                        |                                     |                                      |                                   |
| 9th                | 34.2                    | 34.0                  | 33.5                   | <0.001                              | 0.004                                | <0.001                            |
| 10th               | 22.3                    | 32.7                  | 26.4                   |                                     |                                      |                                   |
| 11th               | 26.7                    | 32.9                  | 20.1                   |                                     |                                      |                                   |
| 12th               | 16.8                    | 0.4                   | 20.0                   |                                     |                                      |                                   |
| Grade              |                         |                       |                        |                                     |                                      |                                   |
| Female             | 49.1                    | 49.9                  | 46.9                   | 0.710                               | 0.269                                | 0.516                             |
| Male               | 46.7                    | 46.7                  | 49.9                   |                                     |                                      |                                   |
| Different Sexuality|                         |                       |                        |                                     |                                      |                                   |
| Heterosexual       | 81.9                    | 84.3                  | 82.3                   | <0.001                              | 0.922                                | 0.299                             |
| Different identity | 18.1                    | 15.7                  | 17.7                   |                                     |                                      |                                   |
| Transgender        |                         |                       |                        |                                     |                                      |                                   |
| Yes                | 3.4                     | 2.7                   | 2.2                    | 0.003                               | <0.001                               | 0.740                             |
| No                 | 90.0                    | 94.5                  | 95.2                   |                                     |                                      |                                   |
| Don’t know          | 6.6                     | 2.7                   | 2.5                    |                                     |                                      |                                   |
| Race/ Ethnicity    |                         |                       |                        |                                     |                                      |                                   |
| NH Asian           | 2.5                     | 8.1                   | 8.9                    | <0.001                              | <0.001                               | <0.001                            |
| NH Black           | 13.8                    | 25.1                  | 9.6                    |                                     |                                      |                                   |
| Hispanic           | 46.0                    | 49.7                  | 43.3                   |                                     |                                      |                                   |
| NH White           | 25.0                    | 8.5                   | 31.5                   |                                     |                                      |                                   |
| More than one race | 6.9                     | 5.4                   | 3.7                    |                                     |                                      |                                   |
| Different race     | 5.8                     | 3.2                   | 3.1                    |                                     |                                      |                                   |

Notes: Sample sizes reported are the number of students answering the surveys. Sample sizes for each demographic variable may vary depending on missing data. Chi-squared tests were used to test for differences between municipalities. Bolded p-values are significant at the p < 0.05 level.
implementing multiple policies, as well as prioritizing policies which address all three industry tactics may be an effective strategy for youth tobacco prevention. Lower rates of initiation with a flavored tobacco product and tobacco exposure and awareness were observed in a municipality with four policies (Somerville) that addressed all three tactics compared to municipalities with two or fewer policies that only addressed one or two industry tactics. Furthermore, having two policies in Worcester (MLSA 21 and PB) that addressed the industry’s “easy to get” tactic reduced initiation with a flavored tobacco product more than having only one policy in New Bedford (PB) that addressed this tactic. The observed reduction in initiation with a flavored tobacco product in Somerville, where the FTR had been in place for 3 years, suggests this may be a long-term outcome of FTR policies, as significant reductions did not occur in a prior study assessing the short-term (6-month) impact of FTRs in Massachusetts [9]. Taken together, the results suggest passing multiple prevention policies that address varied industry tactics can reduce youth exposure to tobacco and can have a greater effect on these outcomes than passing one policy alone.

While a consistent protective effect of number of policies on current tobacco use was not seen, this may be a limitation of the cross-sectional study design; collection of baseline data (pre-policy enactment) in these municipalities could have illuminated significant differences in degree of change in tobacco use from pre to post-policy implementation. A prior FTR study in Massachusetts found that current use of flavored and nonflavored tobacco among high school students changed significantly more in a Massachusetts municipality with an FTR than in a similar municipality without an FTR, within six months of policy implementation [6].

One important finding related to tobacco use is current tobacco users in Somerville had much higher odds of menthol use compared to students in New Bedford. The FTRs assessed in this study excluded menthol flavors, suggesting when only non-menthol flavors are restricted, youth may switch to (or continue to use) menthol flavors, underscoring the importance of including menthol in FTRs.

Finally, the policies assessed in this study do not necessarily decrease physical access to tobacco from stores, even among younger students. Students in Worcester (MLSA 21 and PB) reported higher rates of obtaining tobacco from a store than students in New Bedford (PB alone). While MLSA 21 policies change who is legally able to purchase from stores, even one or two stores selling products illegally can grant youth access to tobacco. Furthermore, the ability of youth to access tobacco is not solely impacted by their direct ability to purchase products, as youth report giving money to other people to purchase for them [18]. While FTRs and CPPRs have reduced availability of flavored tobacco products and single cigars in Massachusetts, and MLSA 21 policies have changed the legal sales age, these restrictions are not sufficient to reduce youth access to tobacco, as exemplified in this study. Tobacco retail density is still high in many areas of Massachusetts. Somerville has a higher youth retail density compared to other study municipalities (Table 1) which could have attenuated the effects of the POS policies evaluated, and highlights the need for additional density strategies to further reduce.
youth access, exposure, and use of tobacco.

4.1. Limitations

Data were cross-sectional and collected post-policy implementation only; therefore conducting difference-in-difference analyses and controlling for baseline rates of tobacco-related outcomes in study municipalities before policy enactment was not possible. In addition, due to limited funding and competing priorities of schools, it was not possible to do a second round of data collection at a later date in study schools to assess prospectively how outcomes differ in municipalities with more policies compared to those with fewer policies over time. That said, local health survey data collected in 2017–2018 found Somerville had higher smoking and ever vaping rates (12%, 27%) compared to Worcester (8%, 13%) [19,20]. This suggests outcomes observed in Somerville are not likely the result of lower baseline tobacco use rates compared to other study municipalities.

Due to competing priorities in schools, data collection occurred over a nine-month period and a census of students in each school was not surveyed. However, differences in demographics between students surveyed and enrollment data from each school were minimal, suggesting survey results may be generalizable to the overall student bodies. Large differences exist in some municipality matching characteristics (e.g. population density, youth retail density) as not all schools originally selected for the study were able to participate.

Finally, only one study municipality had four policies, so it is possible these results may not be generalizable to other Massachusetts municipalities with the same four policies. Also, because the study design and municipalities included did not allow for comparing all possible combinations of the four policies, and there weren’t any municipalities without any of the four policies included, it is not possible to make conclusions about the relative strength of policies on tobacco-related outcomes. However, while individual municipality characteristics (e.g. tobacco retail density, walkability, access to transportation) do contribute to youth access and exposure to tobacco, results from previous Massachusetts studies indicate that FTRs and CPPRs have resulted in consistent reductions in flavored tobacco and single cigar availability, respectively, across the state [5–8]. It is possible that FTRs and CPPRs, which drastically change the retail environment may have a greater effect on youth tobacco-related outcomes than a policy like MLSA or PB, which does not change the retail environment.

4.2. Future directions

Future studies should employ a more rigorous study design, with data collected before and after policy implementation. With the current study design, it is not possible to make causal claims about the impact of prevention policies, or to estimate the full extent of the impact on tobacco-related outcomes.

Furthermore, additional policy strategies other than the ones evaluated in this study may be necessary to have a stronger impact on youth tobacco-related outcomes. For example, the inclusion of menthol in FTRs or strategies to reduce tobacco retailer density (e.g. placing a cap on the number of retailers, increasing the distance between retailers, restricting tobacco sales near schools or playgrounds) in a neighborhood may help reduce availability of youth-appealing tobacco products even further than the policies in this study [3,21]. In June 2020 An Act Modifying the Tobacco Control took effect in Massachusetts, a statewide law that included the following provisions: a restriction on sales of all flavors (including menthol) for all types of tobacco products (including vape products) to adult-only smoking bars; a restriction on sales of high-nicotine (>35 mg/ml) vape products to adult-only retailers and smoking bars; and a ban on advertisements for tobacco products that a retailer cannot sell. The law addresses multiple industry tactics (e.g. flavor, exposure, advertising). In addition, the Food & Drug Administration (FDA) has proposed banning the sales of menthol cigarettes and menthol and other flavored cigars nationwide. Future evaluation efforts should also focus on both the individual and collective effects of additional policy strategies, such as restricting sales of menthol.

Funding

This study was supported by funding from the Centers for Disease Control and Prevention cooperative agreement CDC-RFA-DP15-150903-CONT17.

Declaration of competing interest

The authors have no financial disclosures or conflicts of interest to report.

Acknowledgements

The authors would like to thank the following staff from Health Resources in Action, Inc. for their assistance in facilitating focus groups and administering youth surveys: Carly K. Caminiti, Danielle Adams, Abby Atkins, and Valerie Polletta.

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