Public Support for E-Cigarette-related Policies among a Nationally Representative Sample of US Adults

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ABSTRACT

BACKGROUND: The wide availability of flavored e-cigarettes and broad use of e-cigarettes in public places may contribute to the rapidly increasing rates of use among youth and young adults in the U.S. However, policies at the federal, state and local levels can address these factors.

OBJECTIVE: Assess public support for 5 e-cigarette-related policies and evaluate response patterns by demographics, tobacco use, e-cigarette harm perceptions, geographic region, and strength of state-level clean indoor air policies.

METHODS: Data were collected Oct-Dec 2018 from a nationally representative online panel of U.S. adults (n = 3211). We measured support for 5 policies: (1) a ban on the sale flavored e-cigarettes; (2) requiring tobacco products, like e-cigarettes, be kept out of view in stores where adolescents shop; and prohibiting e-cigarette use in (3) all public places; (4) restaurants; and (5) bars. Weighted, adjusted logistic regressions modeled variation in policy support.

RESULTS: A majority of respondents (63.3%) supported a flavor ban, with no differences in support by smoking status. Most respondents supported keeping tobacco products out of view (78.0%) and prohibiting e-cigarette use in indoor public places (82.9%), restaurants (86.5%), and bars (76.1%). In the adjusted models, current e-cigarette users had significantly lower odds of policy support compared to never users. We observed no differences in support by geographic region or strength of state-level clean indoor air policies.

CONCLUSION: Results suggest high levels of public support to regulate e-cigarette flavors, marketing, and use in public places. Targeted messaging may be needed to increase support among current e-cigarette users.

KEYWORDS: Public policy, tobacco control

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What this paper adds

Summarizes the key messages from the research

- Federal regulation of e-cigarette sales in the United States has been limited and use of these products, particularly among young people, has grown in an under-regulated market.
- There is limited research on support for policies to: (1) limit e-cigarette sales among youth (banning flavored e-cigarettes sales; keeping products out of view in stores) and (2) prohibit e-cigarette use indoors (all public places, restaurants, bars). This study examined support for 5 e-cigarette policies among a nationally representative online panel of U.S. adults and assessed differences in support by demographics, tobacco use, geographic region, and strength of state-level clean indoor air policies.
- A large majority of respondents supported all e-cigarette-related policies and more than 60% supported a flavor ban. These estimates are higher than those documented in prior research, suggesting an increase in public support for e-cigarette regulation over time. There were no differences in support by cigarette smoking status, geographic region, or strength of existing state-level clean indoor air laws after adjusting for other variables, reflecting the viability of these initiatives at the federal and local level.

Introduction

Despite the tremendous growth of the United States electronic cigarette (e-cigarette) market over the last decade,[1-3] federal regulation of e-cigarettes has been slow to materialize. In 2016, the United States Food and Drug Administration (FDA) extended its authority to regulate e-cigarettes as tobacco products.[4] Although the FDA implemented several restrictions on e-cigarette marketing,[4] the agency delayed the process of premarket review until 2020 which permitted manufacturers to continue selling e-cigarette without a formal review of product risks and benefits.[5] This delay allowed novel e-cigarette products, like JUUL—a USB-shaped, high nicotine delivery device that is popular among adolescents and young

adults[6]—to dominate the tobacco marketplace without formal FDA authorization.[3,5,7] While rates of current e-cigarette use among older adults (⩾25 years old) have remained low over time,[8,9] e-cigarette use among young adults (18-24 years old) has grown steadily in recent years from 5.2% in 2017 to 7.6% in 2018.[9] Comparatively, current e-cigarette use among youth has rapidly increased. Between 2011 and 2018, current (defined as 1 or more days within past 30 days) e-cigarette use among high school students exponentially grew from 1.5% to 20.8%.[10] Current use rates among high school students increased even further to 27.9% in 2019,[11] and data on frequency of use show that 34.2% of current e-cigarette users used e-cigarettes on 20 days or more in the past month.[11]

Multiple factors contribute to the growing epidemic of e-cigarette use among young people. E-cigarettes are widely available in retail environments that youth can access, such as gas stations and convenience stores,[12,13] and youth who currently use e-cigarettes identify retail stores as a primary source for purchase, compared to online or social sources.[14-16] Evidence also suggests that youth and young adult exposure to e-cigarette marketing and displays in the retail environment contributes to e-cigarette initiation.[17] Additionally, clean indoor air laws may not include prohibitions against e-cigarettes which could facilitate product use. For example, both youth and young adults list the ability to use e-cigarettes anywhere as an important reason for product use.[18-20] Additionally, being exposed to second-hand e-cigarette aerosol in a public place has been associated with greater intentions to try e-cigarettes among nicotine naïve youth.[21] Finally, the broad product portfolio of flavored e-cigarettes contributes to youth initiation[22] and progression to established use.[23] One of the primary reasons that youth and young adults report for using e-cigarettes is that they "come in flavors I like,"[18-20] reflecting the importance of flavors in sustaining use.

Policy interventions at the federal, state and local level are essential to reducing e-cigarette use among young people[24-28] and in helping to shape tobacco-related norms.[29,30] While several federal directives to limit flavored e-cigarette sales had been proposed in recent years, there was significant delay in a uniform decision on the federal oversight of e-cigarette sales.[31] States and localities, however, implemented a range of measures to address the use of e-cigarettes among minors. These include raising the legal age of e-cigarette purchase to 21-year-olds, requiring retailers to obtain a license to sell e-cigarettes, and levying an excise tax on e-cigarette sales.[32] Additionally, 19 states and over 600 cities have either established or amended smoke-free air laws to prohibit e-cigarette use,[33] and approximately 187 cities, towns and counties have enacted ordinances to restrict the sale of flavored e-cigarette in retail outlets.[34] More recently, 6 states issued emergency rules to ban flavored e-cigarette sales (with some exemptions for menthol) in response to the youth epidemic and growing concern over lung related illnesses associated with vaping nicotine and cannabinoid products.[35,36] In November 2019, Massachusetts also became the first state to restrict all flavored tobacco product sales statewide.[37] Although many of these rulings are short-term (e.g., lasting only 120 days from date of enactment) and/or have been subject to legal challenge,[35] the ever-increasing state legislation reflects increased political attention toward addressing youth e-cigarette use.

Assessing public support is critical for policymakers in their efforts to continue to advance tobacco control policies.[38,39] Few studies have examined national support for e-cigarette regulations and all were conducted between 2012 and 2015, several years prior to the dramatic increase in youth e-cigarette use. Broadly, these studies found that the majority (70.8%) of adults in the United States supported restrictions on marketing and advertising e-cigarettes to youth,[40] but support was more limited for a flavored e-cigarette ban (34.0%-54.4%),[40,41] and restrictions on e-cigarette use in restaurants (48.1%),[42] "bars/casinos/clubs" (32.9%),[43] and public places where smoking is not allowed (37.5%).[43] Across studies, estimates of support were significantly higher among never smokers or e-cigarette users,[41-43] lower socio-economic status populations,[41,42] women,[41] and those who identified as African American or Latino.[41] There were limited differences in policy support by political ideology[42] or geographic region,[43] and support for prohibiting e-cigarette use in public places was significantly lower among those who reported lower levels of perceived harm related to second-hand aerosol exposure.[42]

As youth and young adult e-cigarette use continues to increase and more information becomes available on the short- and long-term health effects of e-cigarette use,[36] current data on e-cigarette public policy support among adults reflects the interests of the voting public and can assist policymakers in the development of future initiatives. The current study updates prior research and provides estimates of support for 5 e-cigarette-related policies in the context of growing concern over youth e-cigarette use. These include a ban on the sale of candy and fruit flavored e-cigarettes; requiring tobacco products be kept out of view in stores where youth shop; and prohibiting e-cigarette use in public places, bars, and restaurants.

Methods

Sample

Data were collected October to December 2018 using the Ipsos KnowledgePanel—an online, nationally representative probability-based sample of English and Spanish speaking adults aged 18-64 years old. Panel members were recruited via address-based sampling and households without internet access were provided a web-enabled device and free Internet service. In total, 5358 panelists from the main KnowledgePanel were invited (completion rate 55.6%, n = 2979). Past 12-month e-cigarette users were oversampled through an augmented sample from two additional sources: (a) a non-probability-based sample and (b) Ipsos youth and young adult panel, to ensure sufficient sample sizes for e-cigarette subgroup analyses

(n = 436). Survey weights were calculated to combine the probability and non-probability samples and offset non-response bias, producing nationally representative estimates of the U.S. population. Our final analytic sample included non-institutionalized adults (18-64-years old) without any missing data on the outcome or demographic variables (n = 3211). Approximately 6% of the sample was dropped and these cases did not significantly differ from retained analytic cases based on demographic characteristics. This study was reviewed by the Advarra Institutional Review Board (Pro-00029613) and all participants provided written informed consent in order to participate.

Measures

Participants were asked about their level of support for 5 policies: (1) a policy which requires that tobacco products, like e-cigarettes and cigarettes, be kept out of view in stores where adolescents shop (i.e., stores without an age restriction for entry); (2) a ban on the sale of fruit, alcohol, or candy flavored e-cigarettes; (3) a policy that would prohibit use of e-cigarettes in all public places; (4) a policy that would prohibit use of e-cigarettes in restaurant; and (5) a policy that would prohibit use of e-cigarettes in bars. The development of these items was informed by prior research[40-43] but adapted to align with policy recommendations at the federal, state, or local level to reduce youth exposure to tobacco products (including e-cigarettes) in the retail environment,[44,45] reduce access to flavored e-cigarette products,[46] and limit use of e-cigarettes in public venues monitored by the American Nonsmokers' Rights Foundation (ANRF).[33] Participants answered using a response scale ranging from (1) "strongly support/favor" to (4) "strongly oppose/against." Responses were dichotomized to support (strongly support/support) and oppose (strongly oppose/oppose) to understand general sentiment surrounding each policy rather than degree of support (e.g., strongly support vs somewhat support). Each dichotomized measure was used as an outcome in the models.

Demographic characteristics included age (continuous, in years), gender (male, female), race/ethnicity (non-Hispanic (NH) White, NH African American, Latino/Hispanic, and NH Other/2+ Races), education, and political philosophy.[47,48] Respondents were asked "How would you describe your overall political philosophy?" with response options of very conservative, conservative, moderate, liberal, very liberal, none of the above, and prefer not to answer. We categorized responses into "conservative," "moderate," "liberal," and "unspecified," where respondents who said none of the above and prefer not to answer were combined. Estimates did not change if these categories were combined or treated separately.

Individual covariates included tobacco use and e-cigarette harm perceptions. For smoking status, we defined "never smokers" as those who never tried a cigarette or who had smoked less than 100 cigarettes in their lifetime, "former smokers" as those who smoked at least 100 cigarettes in their lifetime but did not smoke a cigarette in the past 30 days, and "current smokers" as those who smoked at least 100 cigarettes in their lifetime and smoked a cigarette on at least 1 of the past 30 days.[49] For e-cigarette status, we defined "never e-cigarette users" as those who never tried an e-cigarette, "former e-cigarette users" as those who tried an e-cigarette but did not use any e-cigarette product in the past 30 days, and "current e-cigarette users" as those who had used any e-cigarette product on at least 1 of the past 30 days. We assessed e-cigarette harm perceptions using the following 2 items on as scale of 1 (least harmful) to 10 (most harmful): ". . .how harmful do you believe e-cigarettes are to users?" and ". . .how harmful do you believe e-cigarettes are to others?" Responses were treated as continuous variables.

State-level clean indoor air policy covariates were included given the influence that stronger or weaker tobacco control environments could have on shaping tobacco-related norms and local policy support.[29,30] We utilized data from ANRF database[33] to characterize the strength of state laws prohibiting indoor use of (a) combustible tobacco products and (b) e-cigarettes. We created an index score of 0 to 6 for each product type based on whether a participant lived in a state had no restrictions (score of 0), some restrictions (score of 1), or 100% comprehensive restrictions (score of 2) on product use in the following 3 locations: (1) workplaces; (2) bars; and (3) restaurants. The final index score for each state summed the strength of coverage across each location for combustible tobacco coverage and e-cigarette coverage, respectively. Index scores were treated as a continuous variable in analyses.

Statistical analysis

All analyses were weighted and conducted in Stata 15.1 using survey analyses procedures accounting for the complex survey design. We provided weighted prevalence of participant characteristics and policy support. We used weighted Pearson chi-squared tests to assess bivariate associations between support and demographic characteristics, geographic region, political ideology, and smoking status. We employed adjusted Wald tests to account for differences in policy support by age, e-cigarette harm perceptions, and state clean indoor air law coverage. Weighted, adjusted logistic regression was conducted to examine correlates of support for each policy. All variables were included in the regression model due to their theoretical importance. Tests of association were two-sided ($P < .05$).

Results

Participant demographics are provided in Tables 1 and 2. The mean age of participants was 41.1 years and the majority identified as NH White (61.3%), had a college degree or higher (62.6%), and responded that they never smoked cigarettes (66.0%) or used e-cigarettes (82.6%). More than half of the sample lived in the Southern (37.8%) or the Western (24.1%) regions of the United States.

Table 1 presents overall estimates of support for each policy and differences in support across demographic and other

Table 1. Weighted estimates of support for e-cigarette-related policies overall and by various characteristics among a nationally representative sample of adults (18-64 years-old) in the United States (n = 3211).

	TOTAL	TOBACCO PRODUCTS OUT OF VIEW TO ADOLESCENTS	BAN ON FLAVORED E-CIGARETTE SALE	PROHIBIT E-CIGARETTE USE IN INDOOR PUBLIC PLACES	PROHIBIT E-CIGARETTE USE IN RESTAURANTS	PROHIBIT E-CIGARETTE USE IN BARS
	N (WT. %)	N (WT. %)	N (WT. %)	N (WT. %)	N (WT. %)	N (WT. %)
Overall	3211 (100%)	2448 (78.1%)	1918 (63.3%)	2538 (82.9%)	2677 (86.5%)	2307 (76.1%)
Gender		***	***	***	***	***
Male	1549 (49.6)	1069 (70.9)	834 (56.9)	1185 (80.4)	1253 (83.8)	1061 (72.6)
Female	1662 (50.4)	1379 (85.2)	1084 (69.6)	1353 (85.5)	1424 (89.1)	1246 (79.6)
Race/ethnicity		***	***	*		
Non-Hispanic White	2204 (61.3)	1659 (75.7)	1287 (60.3)	1742 (82.1)	1845 (85.9)	1589 (75.7)
Non-Hispanic African American	300 (12.1)	229 (76.8)	173 (58.7)	235 (79.9)	248 (83.2)	210 (72.4)
Latino/Hispanic	455 (17.9)	368 (82.3)	300 (71.8)	370 (87.8)	376 (89.3)	334 (79.4)
Non-Hispanic Other/2+ Races	252 (8.7)	192 (81.8)	158 (73.6)	191 (83.1)	208 (89.0)	174 (77.9)
Education				***	***	***
Less than high school	206 (10.0)	165 (81.8)	138 (69.2)	146 (74.3)	151 (75.7)	136 (69.9)
High school or equivalent	760 (27.4)	555 (75.1)	451 (62.5)	595 (81.6)	625 (85.3)	531 (74.2)
Some college	947 (28.9)	702 (77.4)	528 (60.8)	709 (80.9)	758 (85.1)	633 (72.7)
College or above	1298 (33.7)	1026 (80.1)	801 (64.3)	1088 (88.4)	1143 (91.7)	1007 (82.5)
Region				*	**	*
Northeast	640 (17.2)	505 (80.5)	391 (65.2)	508 (83.8)	536 (86.9)	472 (77.9)
Midwest	743 (20.9)	559 (77.2)	462 (65.4)	583 (82.6)	614 (87.0)	533 (76.7)
South	1095 (37.8)	818 (76.1)	630 (59.9)	840 (80.6)	882 (83.5)	751 (72.9)
West	733 (24.1)	566 (80.3)	435 (65.5)	607 (86.3)	645 (90.3)	551 (79.5)
Political orientation		***	*	**	***	***
Conservative	1037 (31.8)	737 (72.6)	584 (59.6)	817 (81.6)	857 (84.9)	726 (73.9)
Moderate	797 (25.6)	624 (80.7)	485 (64.9)	638 (84.4)	669 (87.2)	571 (76.2)
Liberal	1029 (30.0)	835 (84.1)	639 (66.3)	821 (85.7)	882 (90.9)	773 (81.2)
Unspecified	348 (12.6)	252 (72.4)	210 (62.2)	262 (76.8)	269 (78.4)	237 (69.7)
Cigarette smoking status		***	***	***	***	***
Never	1894 (66.0)	1548 (81.9)	1260 (68.3)	1666 (88.8)	1717 (91.2)	1550 (83.3)
Former	710 (20.7)	518 (74.2)	394 (57.9)	540 (79.1)	592 (85.7)	481 (70.6)
Current	607 (13.3)	382 (65.2)	264 (47.1)	332 (59.7)	368 (64.3)	276 (49.4)
E-cigarette use status		***	***	***	***	***
Never	2340 (82.6)	1865 (80.1)	1566 (67.7)	2050 (87.9)	2107 (90.0)	1897 (81.8)
Former	382 (12.3)	261 (70.1)	181 (49.3)	246 (67.8)	282 (76.0)	209 (56.6)
Current	489 (5.0)	322 (65.3)	171 (26.2)	242 (39.0)	288 (55.2)	201 (31.0)

Abbreviations: e-cigarette, electronic cigarette; wt.%, weighted percent; SE, standard error.
*$P < .05$; **$P < .01$; ***$P < .001$ based on weighted Pearson chi-square tests.

Table 2. Differences in e-cigarette related policy support by age, e-cigarette harm perceptions, and state-level indoor air policy coverage among a nationally representative sample of adults (18-64 years-old) in the United States (n = 3211).

	AGE	E-CIGARETTE HARM PERCEPTIONS		STATE INDOOR AIR POLICY COVERAGE[b]	
	IN YEARS	PERCEPTION OF HARM TO USER[a]	PERCEPTION OF HARM TO OTHERS[a]	SMOKE-FREE AIR LAW COVERAGE[c]	E-CIGARETTE AIR LAW COVERAGE
	WT. MEAN (95% CI)	WT. MEAN (95% CI)	WT. MEAN (95% CI)	WT. MEAN (95% CI)	WT. MEAN (95% CI)
Overall	41.1 (40.5-41.6)	7.90 (7.82-7.98)	6.89 (6.78-7.00)	4.49 (4.41-4.57)	0.85 (0.80-0.91)
Tobacco products out of view to adolescents					
Oppose	41.3 (40.1-42.4)	6.67 (6.47-6.86)***	5.22 (4.98-5.46)***	4.41 (4.24-4.57)	0.66 (0.56-0.76)***
Support	41.0 (40.4-41.7)	8.25 (8.16-8.33)	7.36 (7.25-7.47)	4.52 (4.43-4.61)	0.91 (0.84-0.97)
Ban on flavored e-cigarette sale					
Oppose	40.2 (39.3-41.1)*	6.87 (6.72-7.01)***	5.45 (5.27-5.63)***	4.35 (4.22-4.48)**	0.73 (0.65-0.81)***
Support	41.6 (40.9-42.3)	8.50 (8.41-8.59)	7.72 (7.61-7.84)	4.58 (4.48-4.67)	0.93 (0.85-1.00)
Tobacco products out of view to adolescents					
Oppose	41.3 (40.1-42.4)	6.67 (6.47-6.86)***	5.22 (4.98-5.46)***	4.41 (4.24-4.57)	0.66 (0.56-0.76)***
Support	41.0 (40.4-41.7)	8.25 (8.16-8.33)	7.36 (7.25-7.47)	4.52 (4.43-4.61)	0.91 (0.84-0.97)
Prohibit e-cigarette use in indoor public places					
Oppose	40.8 (39.5-42.0)	6.17 (5.94-6.40)***	4.55 (4.28-4.82)***	4.30 (4.11-4.49)*	0.71 (0.59-0.82)**
Support	41.1 (40.5-41.8)	8.26 (8.18-8.34)	7.37 (7.26-7.48)	4.53 (4.45-4.62)	0.88 (0.82-0.94)
Prohibit e-cigarette use in restaurants					
Oppose	40.1 (38.8-41.5)	6.05 (5.78-6.31)***	4.48 (4.17-4.79)***	4.19 (3.98-4.40)**	0.67 (0.54-0.80)**
Support	41.2 (40.6-41.8)	8.19 (8.11-8.27)	7.27 (7.16-7.37)	4.54 (4.46-4.62)	0.88 (0.82-0.94)
Prohibit e-cigarette use in bars					
Oppose	41.1 (40.1-42.2)	6.46 (6.28-6.65)***	4.89 (4.66-5.13)***	4.29 (4.13-4.44)**	0.75 (0.65-0.85)*
Support	41.1(40.4-41.7)	8.35 (8.27-8.43)	7.52 (7.41-7.62)	4.56 (4.47-4.64)	0.89 (0.82-0.95)

Abbreviations:e-cigarette, electronic cigarette; wt., weighted; CI, confidence interval.
*$P < .05$; **$P < .01$; ***$P < .001$ based on adjusted Wald tests.
[a]Item is measured on a scale of 1 (Least harmful) to 10 (Most harmful).
[b]State smokefree indoor air policy coverage refers to the strength of restrictions on tobacco use in 3 locations: workplaces; bars; and restaurants. An index score (0-6) was constructed based on whether a state had no restrictions (score of 0), some restrictions (score of 1), or 100% comprehensive restrictions (score of 2) on product use in each of the 3 locations.
[c]Exclusively refers to restrictions on combustible product use.

covariates. Overall, 78.1% supported a policy to keep tobacco products out of view in stores where youth can shop and 63.3% of respondents supported a policy to ban the sale of flavored e-cigarettes. The majority of participants also supported prohibiting the use of e-cigarettes in bars (76.1%), all indoor public places (82.9%), and restaurants (86.5%). Supplemental Figure 1 shows the distribution of support for each policy across the 4 support categories.

Table 1 also presents results from bivariate analyses. There were significant differences in support by gender, tobacco use, and political ideology for all policies. Women, never smokers, never e-cigarette users, moderates and liberals reported higher levels of support for each initiative versus men, former and current tobacco users, and those with a conservative or unspecified political ideology, respectively. A significantly greater proportion of Latino/Hispanic respondents supported a flavored e-cigarette sales ban, keeping tobacco products out of view, and prohibiting e-cigarette use in all indoor public places compared to NH White or NH African American participants. Respondents who lived in the Western region of the United States and those who earned at least a college degree had significantly higher rates of support for all 3 indoor air policies (in all public places, restaurants, and bars).

Table 2 presents the mean estimates of respondents' age, e-cigarette harm perceptions, and state-level clean indoor air law policy coverage. There were limited differences in policy support by age, with the exception that the mean age among those who supported a ban on flavored e-cigarette sales was significantly older than the mean age among those who opposed the ban (41.6 years vs. 40.2 years, $P = .019$). Across all 5 policy options, respondents who supported the policy

reported higher levels of perceived harm of e-cigarettes to users (all Ps $< .001$) and to others (all Ps < 0.001) compared to those who did not support the policy. Additionally, the mean score for state-level clean indoor air law coverage for both combustible tobacco and for e-cigarettes was higher among those participants who supported policies.

Table 3 displays the results of the weighted, adjusted logistic regression models. After controlling for all individual and state-level covariates, there were no significant differences in policy support by age but women had significantly greater odds of support for all 5 policies compared to men. Overall, those with less than a college degree had significantly lower odds of support for indoor air policies compared to those with a college degree, whereas those with a high school degree or equivalent had significantly lower odds of support for prohibiting e-cigarette use in all 3 venues (indoor public places, restaurants, bars). Additionally, in the adjusted model those with less than a high school degree had 1.54 greater odds (95% Confidence Interval [CI]: 1.02-2.30) of support for a ban on flavored e-cigarette sales compared to those with a college degree. Compared to NH White participants, participants who identified as NH Black were significantly less likely to support a flavored e-cigarette sales ban (adjusted Odds Ratio [aOR] = 0.71, 95% CI: 0.51-0.97) and a policy to prohibit e-cigarette use in bars (aOR = 0.62, 95% CI: 0.43-0.91) and restaurants (aOR = 0.65, 95%CI: 0.42-1.00).

Current cigarette and e-cigarette users were less likely to support nearly all policies (aOR range: 0.22 to 0.61, all Ps $\leq .01$) compared to never users; however, we saw no difference in support for an e-cigarette flavor ban by cigarette smoking status and no difference in support to keep tobacco products out of view by e-cigarette use status. After controlling for other factors, participants who identified as liberal versus conservative had greater odds of support for all policies, except prohibiting e-cigarette use in all indoor public places. Finally, greater e-cigarette harm perceptions were associated with increased odds of support for all policies (aOR range: 1.14-1.31, $P \leq .01$). There were no differences in policy support by region in the adjusted models. There was a borderline but significant association between support for keeping tobacco products out of view in stores where youth shop and increasing strength of a state-level smoke-free air laws (aOR = 1.13; 95% CI: 1.00, 1.28).

Discussion

Findings demonstrate that the majority of adults in the United States support restrictions on e-cigarette sales and use in public places. Approximately 78% of adults supported a policy to keep tobacco products out of view in stores where youth shop, which includes retail stores that do not require patrons to be over the legal age of sale (eg, 18 or 21) to enter. Further, 63% of participants supported a ban on flavored e-cigarette sales. While these estimates align with prior research,[40] our findings suggest that support for a flavor ban is growing and may be higher than rates reported in previous studies. In a 2014 nationally representative online survey, approximately 34% of adults in the United States agreed that the "use of flavors in e-cigarettes should not be allowed,"[40] and 54% of adults in the United States included in a telephone survey between 2014 and 2015 agreed that the "FDA should ban candy and fruit flavored e-cigarettes."[41] Additionally, more than three-quarters of adults included in this study supported measures to prohibit the use of e-cigarettes in public places, restaurants, and bars. These estimates reflect a significant increase when compared to lower levels of support found in 2012 and 2013, where only one-third to less than half of respondents supported e-cigarette-related clean indoor air policies.[42,43]

Although differences in survey mode and item phrasing may limit the direct comparison of estimates across studies, (eg, "bars/casinos/clubs"[42] vs bars; "use of flavors"[40]), it is likely that the increased levels in support reflects increased awareness of e-cigarettes and the risks or benefits related to product use. Across all policies examined, those with greater levels of perceived harm of e-cigarette use were significantly more likely to support policies. This is consistent with results from Mellow et al. in 2014 which found higher levels of support for prohibiting public e-cigarette use among those who believed exposure to second-hand aerosol was harmful.[42] Taken together, these studies suggest that perception of the harms associated with e-cigarette use can be an influential factor in garnering policy support over time.

After controlling for other factors, we found limited significant differences in support by geographic region or strength of existing state-level clean indoor air policies for all 5 of the policies examined. Although prior evidence from California suggests that the state's high level of investment in tobacco control programs and clean indoor air policy implementation can change tobacco-related norms and increase policy support,[29,30] our findings suggest a lack of association between strength of indoor air laws and level of support in the context of a national study estimating e-cigarette-related policy support. With respect to political orientation, we found that individuals who identified as liberal were significantly more likely to support most policies, which is consistent with research estimating support for other tobacco control initiatives.[47,48] However, it is important to note that estimates of support across policies were high regardless of political ideology. Collectively, these results provide strong evidence that the American public—regardless of region, political ideology, and existing policy environments—are in favor of advancing e-cigarette related policies. Advocates and policymakers can employ these findings to continue to push for a federal, state and local policies to help reduce the significant epidemic of youth e-cigarette use.

Consistent with prior research we found that support differed by tobacco use patterns: support was lower among current smokers and current e-cigarette users.[41-43] However, almost half of current smokers supported all 5 policy initiatives and more than half of current e-cigarette users supported keeping tobacco out of view of adolescents and prohibiting e-cigarette use in restaurants. This high level of support could reflect the influence of

Table 3. Weighted, adjusted logistic regression models of support for e-cigarette-related policies among a nationally representative sample of adults (18-64 years-old) in the United States (n = 3211).

CHARACTERISTIC	TOBACCO PRODUCTS OUT OF VIEW TO ADOLESCENTS AOR (95% CI)	BAN ON FLAVORED E-CIGARETTE SALE AOR (95% CI)	PROHIBIT E-CIGARETTE USE IN INDOOR PUBLIC PLACES AOR (95% CI)	PROHIBIT E-CIGARETTE USE IN RESTAURANTS AOR (95% CI)	PROHIBIT E-CIGARETTE USE IN BARS AOR (95% CI)
Age					
Years (cont.)	1.00 (0.99-1.01)	1.01 (1.00-1.01)	0.99 (0.98-1.00)	1.00 (0.99-1.01)	0.99 (0.98-1.00)
Gender					
Male	REF	REF	REF	REF	REF
Female	2.18 (1.76-2.70)***	1.54 (1.28-1.87)***	1.30 (1.01-1.66)*	1.43 (1.09-1.86)**	1.30 (1.04-1.62)*
Race/ethnicity					
Non-Hispanic White	REF	REF	REF	REF	REF
Non-Hispanic African American	0.83 (0.59-1.19)	0.71 (0.51-0.97)*	0.66 (0.44-1.00)	0.65 (0.42-1.00)*	0.61 (0.42-0.90)*
Latino/Hispanic	1.20 (0.83-1.72)	1.16 (0.86-1.57)	1.15 (0.76-1.75)	1.02 (0.66-1.59)	0.82 (0.57-1.16)
Non-Hispanic Other/2+ Races	1.03 (0.66-1.59)	1.67 (1.14-2.45)**	0.64 (0.37-1.10)	0.79 (0.43-1.45)	0.72 (0.44-1.17)
Education					
Less than high school	1.43 (0.89-2.32)	1.54 (1.02-2.30)*	0.42 (0.26-0.68)***	0.34 (0.21-0.57)***	0.67 (0.43-1.04)
High school or equivalent	0.80 (0.60-1.06)	1.02 (0.79-1.33)	0.66 (0.47-0.93)*	0.68 (0.46-1.00)*	0.72 (0.54-0.98)*
Some college	1.01 (0.78-1.33)	1.08 (0.86-1.36)	0.74 (0.53-1.03)	0.71 (0.50-1.01)	0.75 (0.56-1.00)*
College or above	REF	REF	REF	REF	REF
Region					
Northeast	REF	REF	REF	REF	REF
Midwest	1.12 (0.75-1.66)	1.30 (0.90-1.88)	1.05 (0.65-1.71)	1.15 (0.67-1.97)	0.90 (0.59-1.38)
South	0.88 (0.60-1.29)	1.00 (0.70-1.44)	0.87 (0.55-1.38)	0.86 (0.51-1.45)	0.79 0.52-1.20)
West	0.85 (0.60-1.18)	0.80 (0.60-1.08)	1.12 (0.75-1.69)	1.28 (0.82-1.99)	0.94 (0.65-1.34)
Political orientation					
Conservative	REF	REF	REF	REF	REF
Moderate	1.56 (1.18-2.07)**	1.24 (0.96-1.59)	1.32 (0.95-1.83)	1.29 (0.91-1.83)	1.18 (0.89-1.57)
Liberal	1.94 (1.46-2.59)***	1.41 (1.11-1.80)**	1.40 (0.99-1.97)	1.87 (1.27-2.75)**	1.71 (1.27-2.30)***
Unspecified	0.72 (0.51-1.02)	0.85 (0.62-1.18)	0.64 (0.42-0.97)*	0.56 (0.37-0.87)**	0.69 (0.48-0.99)*
Cigarette smoking status					
Never	REF	REF	REF	REF	REF
Former	0.80 (0.61-1.05)	0.80 (0.63-1.00)*	0.86 (0.62-1.20)	0.98 (0.69-1.39)	0.78 (0.59-1.03)
Current	0.61 (0.44-0.85)**	0.80 (0.58-1.11)	0.51 (0.35 0.73)***	0.40 (0.27-0.58)***	0.47 (0.34-0.67)***
E-cigarette use status					
Never	REF	REF	REF	REF	REF
Former	0.96 (0.69-1.35)	0.76 (0.55-1.03)	0.55 (0.38-0.80)**	0.78 (0.53-1.16)	0.52 (0.37-0.74)***

(continued)

Table 3. (continued)

CHARACTERISTIC	TOBACCO PRODUCTS OUT OF VIEW TO ADOLESCENTS AOR (95% CI)	BAN ON FLAVORED E-CIGARETTE SALE AOR (95% CI)	PROHIBIT E-CIGARETTE USE IN INDOOR PUBLIC PLACES AOR (95% CI)	PROHIBIT E-CIGARETTE USE IN RESTAURANTS AOR (95% CI)	PROHIBIT E-CIGARETTE USE IN BARS AOR (95% CI)
Current	1.22 (0.78-1.89)	0.36 (0.24-0.56)***	0.22 (0.14-0.35)***	0.43 (0.27-0.70)**	0.25 (0.16-0.39)***
E-Cigarette harm perceptions					
Perception of harm to user (cont.)	1.15 (1.07-1.24)***	1.17 (1.09-1.25)***	1.16 (1.06-1.27)**	1.19 (1.09-1.30)***	1.14 (1.05-1.24)**
Perception of harm to others (cont.)	1.21 (1.14-1.29)***	1.24 (1.17-1.31)***	1.31 (1.21-1.41)***	1.29 (1.20-1.39)***	1.31 (1.23-1.40)***
State indoor air policy coverage[a]					
Smoke-free air law coverage,[b] (cont.)	0.95 (0.87-1.04)	1.03 (0.95-1.12)	1.00 (0.90-1.11)	1.01 (0.90-1.14)	1.04 (0.95-1.15)
E-cigarette air law coverage (cont.)	1.13 (1.00-1.28)*	1.06 (0.96-1.19)	1.00 (0.86-1.17)	0.99 (0.84-1.17)	0.93 (0.81-1.06)

Abbreviations: e-cigarette, electronic cigarette; aOR, adjusted odds ratio; CI, 95% confidence interval; (cont.), continuous variable; REF, reference group.
*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.
[a]State indoor air policy coverage refers to the strength of restrictions on tobacco use in 3 locations: workplaces; bars; and restaurants. An index score (0-6) was constructed based on whether a state had no restrictions (score of 0), some restrictions (score of 1), or 100% comprehensive restrictions (score of 2) on product use in each of the 3 locations.
[b]Exclusively refers to restrictions on combustible product use.

existing second-hand smoke policies among smokers and desire to protect youth from tobacco use observed in other studies.[30,50,51] In contrast, about one-quarter of current e-cigarette users supported a ban on flavored e-cigarette sales, and approximately one-third supported efforts to prohibit e-cigarette use indoors or in bars. Although only 3.2% of the adult population currently use e-cigarettes,[9] many may use flavored e-cigarettes[20] or use e-cigarette in indoor public place or bars[52,53] which could reflect points of resistance to policy support. Targeted efforts are needed to communicate the importance of these initiatives in reducing the appeal of e-cigarettes and normalization of use among young people exposed to second-hand aerosol indoors, particularly among adult tobacco users.[5,21]

Limitations

There are several limitations to this study. First, our measure of policy support for banning flavored e-cigarettes did not include mint or menthol flavors and our findings are limited to fruit, alcohol, and candy-like flavors. Similarly, we assessed support for a policy to prohibit the use of e-cigarettes in "all public places" and are unable to assess how levels of support may vary by whether public places are indoors versus outdoors. Additionally, our measure to assess support for a policy that would require that tobacco products, like e-cigarettes and cigarettes, be kept out of view of adolescents generalizes to all tobacco products. It is possible that levels of support would be different if the prompt was specific to e-cigarettes only. With respect to our item response options for the policy questions, we did not include a neutral option in effort to reduce central tendency bias, which may have resulted in some over-estimation of levels of support or opposition.[54] In this study, we also used an opt-in panel to supplement our address-based sample to recruit a sufficient number of current e-cigarette users. However, analytic weights were applied to correct for the addition of this convenience subsample to help limit any potential selection bias. Finally, our policy support measures did not specify whether a ban or prohibition would be enacted at a federal, state or local level and must be interpreted generally. Nonetheless, these recent findings from a large, nationally representative probability-based sample provide valuable and timely information to help assist advocates and policymakers across the United States.

Conclusion

The recent epidemic rise in youth e-cigarette use and increasing rate of e-cigarette use among young adults has raised concerns that a new generation of young people may become addicted to nicotine.[7] Strong policies with adequate funding and implementation resources are required to prevent e-cigarette initiation and use among this vulnerable group and shift social norms around product sales and use indoors. Such policies can also have wide benefit across the population, including non-tobacco users or employees who may be exposed to

second-hand aerosol and e-cigarette marketing. Results from this nationally representative study update prior estimates and show strong public support for e-cigarette-related policies to reduce access to flavored e-cigarettes, limit youth exposure to e-cigarettes in retail environments, and prohibit e-cigarette use in public areas. Public support can help further mobilize policymakers to implement preventative measures that will reduce rates of e-cigarette use among youth and young adults.

AUTHORS' CONTRIBUTIONS

LC and RS conceptualized the study and prepared the original manuscript. YZ and AFC contributed to the analysis of the data. MP, DMV and BAS provided guidance on the analysis and drafting the original manuscript. All authors supported interpretation and revisions of the manuscript.

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SUPPLEMENTAL MATERIAL

Supplemental material for this article is available online.

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