An evaluation of the relationship between access to e-cigarettes and the usage of e-cigarettes among high and middle school students in the US

By

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Tobacco usage in the US (among adults)

https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm
Health Consequences of Tobacco Use in the US

### Preventable causes of death

<table>
<thead>
<tr>
<th>Cause</th>
<th>Deaths per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco smoking</td>
<td>400,000</td>
</tr>
<tr>
<td>Overweight and Obesity</td>
<td>300,000</td>
</tr>
<tr>
<td>Alcohol</td>
<td>200,000</td>
</tr>
<tr>
<td>Infectious diseases</td>
<td>100,000</td>
</tr>
<tr>
<td>Toxins</td>
<td>100,000</td>
</tr>
<tr>
<td>Motor vehicle collisions</td>
<td>80,000</td>
</tr>
<tr>
<td>Firearms deaths</td>
<td>60,000</td>
</tr>
<tr>
<td>Sexually transmitted infections</td>
<td>60,000</td>
</tr>
<tr>
<td>Drug abuse</td>
<td>40,000</td>
</tr>
</tbody>
</table>

### Annual Deaths Attributable to Cigarette Smoking—United States

- **Lung Cancer**: 137,989 (29%)
- **Heart Disease**: 158,750 (33%)
- **Chronic Obstructive Pulmonary Disease**: 100,600 (21%)
- **Other Diagnoses**: 31,681 (7%)
- **Other Cancers**: 36,000 (7%)
- **Stroke**: 15,300 (3%)

**Note**: Average annual number of deaths for adults aged 35 or older, 2005–2009.

Source: [2014 Surgeon General’s Report](https://www.cdc.gov/tobacco/data_statistics/fact_sheets/annual_deaths/attribution/), Table 12.4, page 660.
E-cigarette is the most commonly used tobacco product among high and middle schoolers in the US and this has led to calls for regulatory actions."[1]
More than 3.6 million students used E-cigarettes in 2018

Tobacco use is a leading cause of preventable mortality in the US and its use begins mostly during adolescence and young adulthood.\textsuperscript{[1]}

(Tobacco use is more likely to start in teen e-cigarette users than non-users.

30.7% of e-cigarette users start smoking within 6 months, compared to 8.1% of non-users.

Includes combustible tobacco products (cigarettes, cigars, and hookahs)

Vaping related lung disease is a recent development which is being monitored by the CDC. 16 percent of the 373 cases with accessible patient related data (as at September 26) were observed to be younger than 16 years old.^[2]
Surgeon General releases advisory on E-cigarette epidemic among youth

U.S. Surgeon General Vice Adm. Jerome M. Adams issued an advisory today stressing the importance of protecting children from a lifetime of nicotine addiction and associated health risks by immediately addressing the epidemic of youth e-cigarette use.

E-cigarette use among youth has skyrocketed in the past year at a rate of epidemic proportions.


E-Cigarette use by US High and Middle schoolers was declared an epidemic and a Public Health Threat by the US Surgeon General in December 2018.[3]
What are E-cigarettes and What do they contain?

The e-cigarette aerosol that users breathe from the device and exhale can contain harmful and potentially harmful substances:

- **Volatile organic compounds**
- **Ultrafine particles**
- **Nicotine**
- **Cancer-causing chemicals**
- **Heavy metals such as nickel, tin, and lead**
- **Flavoring such as diacetyl, a chemical linked to a serious lung disease**

It is difficult for consumers to know what e-cigarette products contain. For example, some e-cigarettes marketed as containing zero percent nicotine have been found to contain nicotine.

**CDC:** [https://www.cdc.gov/tobacco/basic_information/e-cigarettes/pdfs/Electronic-Cigarettes-Infographic-p.pdf](https://www.cdc.gov/tobacco/basic_information/e-cigarettes/pdfs/Electronic-Cigarettes-Infographic-p.pdf)
Research Aim and Question

Aim
This study assessed how the frequency of e-cigarette usage by high and middle school students is correlated with access to e-cigarettes through different access points (e.g. physical stores such as vape shops, gas stations/convenience stores, online stores, friends, families, etc.)

Research Question
Is the frequency of e-cigarette usage in the last 30 days by US high and middle school students associated with the accessibility to e-cigarettes through different access points?
Study Design: Cross sectional study using a stratified, three stage cluster sample design (stratified random sampling was used for school selection and in the selection of eligible classes for the survey).


Target Population: All public and private school students enrolled in regular high and middle schools (grades 6 - 12) in all US states.
Research Design and Methods

**Study Participants:** A nationally representative sample of 22,729 US high and middle school students from 310 selected US schools.

**Data Collection Methods:** In Person self-reported surveys.
Defining the Variables

**Dependent variable (Y):**
Amount of e-cigarette used (based on number of days of use in the last 30 days).

**Independent variables (X):**
Access points to e-cigarettes e.g. gas stations/convenience stores, online stores, vape shops or other shops that sell e-cigarettes, family members, and friends.
Hypotheses

Null Hypothesis ($H_0$): The amount of e-cigarette used in the last 30 days is not associated with (is independent of) access points.

Alternative Hypothesis ($H_a$): The amount of e-cigarette used is associated with (is not independent of) access points.
Data Analysis

Test of independence (Chi-square):

The variables are nominal categorical variables. e.g. amount of e-cigarette used in the last 30 days based on days of use (1-2 days - 2; 3-5 days - 3 etc.) and e-cigarette access points.
Data Analysis

High number of occasional users observed through family and friends (1-2 days), which might serve as a gateway to e-cigarette use.

High number of habitual users (all 30 days) observed having access through vape shops, other shops that sell e-cigarette, gas stations and convenience stores.
Observed Counts

Expected Counts

(row total * column total)/table total

Amount of e-cigarette used in the last 30 days (Y)
Chi Square value = 470.44

P value is less than 0.00001, therefore the result is statistically significant at alpha less than 0.05.

The amount of e-cigarette used is associated with point of access. i.e. E-cigarette usage is not independent of point of access.
How strong is the Association? - Strength of Association

0.1 < **0.20** < 0.3 : Moderate association
Implications for Practice and Policy

- Limiting youth access to e-cigarettes through a focus on the access points in this study might lead to a reduction in the use of E-cigarettes by this population of users, however the specific level of policy effectiveness per access point remains uncertain.

- Major access points to e-cigarettes in this analysis include family and friends and it might be difficult to enact policies that can limit access to e-cigarettes through this population (.i.e. family and friends population).
Recommendations for Practice

School Based Educational Campaigns

Family Based Educational Campaigns

Strict Monitoring of Compliance with Existing Rules Surrounding Access
Recommendations for Policy

- Raising the Legal Age for Tobacco Access
- Strict Monitoring of Restriction of Sales to Underage Population Regardless of the Age Chosen
Study Limitations

- Other unidentified access points
- Correlation is not causation
- Analysis limited by data structure
- Self-report data with recall and social desirability biases
Recommendations for Further Research

For study results to be more representative of US youths and adolescents, the NYTS survey should include US youths and adolescents that are home schooled, or are in detention or correctional facilities in the sample population and not just US high and middle schoolers.

Further studies are needed to examine the impact of each access point on the use of E-cigarette among US high and middle schoolers.

Further research on school based educational campaign is needed.
Conclusion

Based on the results of the analysis, there is a moderate association between the amount of e-cigarette used in the last 30 days and access points to e-cigarettes. The survey structure limited a further analysis of tobacco access points which might have showed specific strong associations for some access points. Nevertheless, policies targeted at limiting the sale of and access to e-cigarettes by US high and middle schoolers from the above evaluated access points might have some effect on reducing the prevalence of e-cigarette use within this population.
References


Bibliography

2018 National Youth Tobacco Survey Codebook

DiFranza JR Which interventions against the sale of tobacco to minors can be expected to reduce smoking? Tob Control. 2012;21(4):436–442pmid:21994275


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## Bibliography

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<th>Reference</th>
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<tr>
<td>Public Policy to Protect Children From Tobacco, Nicotine, and Tobacco Smoke.</td>
<td><a href="https://pediatrics.aappublications.org/content/136/5/998#ref-71">https://pediatrics.aappublications.org/content/136/5/998#ref-71</a></td>
<td></td>
</tr>
</tbody>
</table>
Appendix I

Adults who currently use e-cigarettes

- 18-24 YEARS OLD: 4.7%
- 25-44 YEARS OLD: 4.2%
- 45-66 YEARS OLD: 2.8%
- 65+: 1%

https://truthinitiative.org/research-resources/emerging-tobacco-products/e-cigarettes-facts-stats-and-regulations
E-cigarette use among high school students increased from 11.7% in 2017 to 20.8% in 2018, representing a surge of 78% among high school students. This is a troubling trend, as it accounts for a significant increase in e-cigarette use among American high school students.

From 2017 to 2018, the proportion of current e-cigarette users in high school who reported use on 20 days or more in the past 30-day period increased from 20 percent to 27.7 percent between 2017 and 2018.1

E-cigarette use among middle school students is also on the rise, jumping 48 percent from 2017 to 2018. Today, a total of 4.9 percent of middle school students—or 570,000 kids—are current e-cigarette users.1