Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.
eFigure. Flowchart for Sample Construction

All youth (12-17 years old) participants in the PATH wave 4.5 survey
N = 13,131

Participants in the PATH wave 5 youth survey, who remained 12-17 years old
N = 10,186
Weighted response rate: 83.5%

Participants in the PATH wave 5 adult survey, who turned 18 years old
N = 2,033
Weighted response rate: 88.0%

Youth (12-17 years old) participants in the PATH wave 4.5 survey who also participated in the PATH wave 5 (youth or adult) survey
N = 12,219

Participants who never used cannabis by wave 4.5
N = 9,828

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**eTable 1.** Association Between Baseline e-Cigarette Use and Subsequent Cannabis Use (Past 12-Month and Past 30-Day) Among Baseline Never Cannabis Users, Comparing aRRs and aORs

| Wave 4.5 e-cigarettes use | Past 12-month cannabis use | Past 30-day cannabis use |
|---------------------------|-----------------------------|---------------------------|
|                           | aRR^a (95% CI)              | aOR^b (95% CI)            | aRR^a (95% CI) | aOR^b (95% CI) |
| Ever e-cig use            | 2.57 (2.04-3.09)            | 3.40 (2.59-4.46)          | 3.20 (2.10-4.31) | 3.66 (2.47-5.42) |
| Past 12-month e-cig use   | 2.62 (2.10-3.15)            | 3.56 (2.70-4.71)          | 3.40 (2.17-4.63) | 3.96 (2.59-6.04) |
| Past 30-day e-cig use     | 2.18 (1.50-2.85)            | 2.84 (1.82-4.44)          | 2.96 (1.52-4.40) | 3.46 (1.92-6.26) |

^a Adjusted relative risk. Adjusted for all study covariates: age, sex, race/ethnicity, highest parental education, household income, school grades, family tobacco use, peer tobacco use, ever tobacco product use, past 12-month alcohol use, ever nonmedical prescription drug use, and sensation seeking.

^b Adjusted odds ratio. Adjusted for all study covariates, same as listed above.
eTable 2. Association Between Baseline Ever e-Cigarette Use and Subsequent Cannabis Use (Past 12-Month and Past 30-Day) Among Baseline Never Cannabis Users

| Wave 4.5 variables                  | Past 12-month cannabis use in wave 5 | Past 30-day cannabis use in wave 5 |
|-------------------------------------|--------------------------------------|-----------------------------------|
|                                     | Coefficient (95% CI) | P   | Coefficient (95% CI) | P   |
| Ever e-cig use                      | 1.22 (0.95,1.49)   | <.001| 1.30 (0.90,1.69)   | <.001|
| Age (REF: 12-14)                    |                        |     |                      |     |
| 15-17                               | 0.53 (0.33,0.74)   | <.001| 0.58 (0.26,0.91)   | .001|
| Female                              | 0.16 (-0.03,0.36) | .09 | 0.15 (-0.11,0.41) | .25 |
| Race/ethnicity (REF: NH white)      |                        |     |                      |     |
| NH black                            | 0.66 (0.40,0.92)   | <.001| 0.55 (0.14,0.96)   | .009|
| Hispanic                            | 0.36 (0.08,0.63)   | .01 | 0.23 (-0.11,0.56) | .19 |
| NH other                            | 0.07 (-0.25,0.40) | .67 | -0.05 (-0.58,0.48) | .86 |
| Highest parental education (REF: ≤ High school/ GED) |                        |     |                      |     |
| Some college                        | -0.18 (-0.49,0.13) | .25 | -0.33 (-0.68,0.03) | .07 |
| ≥ College                           | -0.18 (-0.55,0.20) | .35 | -0.24 (-0.66,0.17) | .25 |
| Household income (REF: < 50k)       |                        |     |                      |     |
| 50k to 100k                         | 0.01 (-0.26,0.27)  | .97 | 0.08 (-0.26,0.41)  | .65 |
| > 100k                              | 0.18 (-0.15,0.50)  | .28 | 0.35 (-0.08,0.78)  | .11 |
| School grades (REF: < mostly B’s)   |                        |     |                      |     |
| ≥ mostly B’s                        | -0.38 (-0.60,-0.17) | .001| -0.16 (-0.51,0.20) | .39 |
| Family tobacco use                  | 0.37 (0.16,0.57)   | .001| 0.32 (0.06,0.58)   | .02 |
| Peer tobacco use                    | 0.63 (0.44,0.82)   | <.001| 0.54 (0.24,0.84)   | .001|
| Ever tobacco product use (excluding e-cigs) | 0.54 (0.18,0.89) | .003| 0.30 (-0.12,0.72) | .16 |
| Past 12-month alcohol use           | 0.83 (0.57,1.08)   | <.001| 0.34 (-0.002,0.67) | .05 |
| Ever nonmedical prescription drug use | 0.23 (-0.01,0.47) | .07 | 0.23 (-0.09,0.55) | .16 |
| Sensation seekinga                  | 0.24 (0.15,0.33)   | <.001| 0.29 (0.15,0.42)   | <.001|
| Sample Size (N)b                    | 7,011               |     | 7,032               |     |

Notes
a Corresponds to 1 unit increase in the risk of sensation seeking (5-point scale).
b Effective sample size; participants with missing data were excluded.
Figures bolded if p < .05.
**eTable 3.** Association Between Baseline Past 12-Month e-Cigarette Use and Subsequent Cannabis Use (Past 12-Month and Past 30-Day) Among Baseline Never Cannabis Users

| Wave 4.5 variables                   | Past 12-month cannabis use in wave 5 | Past 30-day cannabis use in wave 5 |
|--------------------------------------|--------------------------------------|-----------------------------------|
|                                      | Coefficient (95% CI)                 | P       | Coefficient (95% CI) | P       |
| Past 12-month e-cig use              | 1.27 (0.99, 1.55)                    | <.001   | 1.38 (0.95, 1.80)    | <.001   |
| Age (REF: 12-14)                     |                                      |        |                      |         |
| 15-17                                | 0.57 (0.37, 0.76)                    | <.001   | 0.62 (0.30, 0.94)    | <.001   |
| Female                               | 0.16 (-0.03, 0.35)                   | .10     | 0.14 (-0.12, 0.39)   | .28     |
| Race/ethnicity (REF: NH white)       |                                      |        |                      |         |
| NH black                             | 0.62 (0.36, 0.89)                    | <.001   | 0.52 (0.12, 0.92)    | .01     |
| Hispanic                             | 0.37 (0.10, 0.64)                    | .008    | 0.25 (-0.10, 0.59)   | .16     |
| NH other                             | 0.08 (-0.24, 0.40)                   | .63     | -0.03 (-0.55, 0.50)  | .92     |
| Highest parental education (REF: ≤ High school/ GED) |                                      |        |                      |         |
| Some college                         | -0.19 (-0.50, 0.11)                  | .22     | -0.35 (-0.71, 0.01)  | .06     |
| ≥ College                            | -0.20 (-0.57, 0.17)                  | .29     | -0.28 (-0.69, 0.13)  | .18     |
| Household income (REF: < 50k)        |                                      |        |                      |         |
| 50k to 100k                          | -0.02 (-0.28, 0.25)                  | .91     | 0.05 (-0.28, 0.39)   | .75     |
| > 100k                               | 0.16 (-0.15, 0.48)                   | .31     | 0.33 (-0.08, 0.75)   | .12     |
| School grades (REF: < mostly B’s)    |                                      |        |                      |         |
| ≥ mostly B’s                         | -0.40 (-0.62, -0.18)                 | .001    | -0.17 (-0.53, 0.18)  | .34     |
| Family tobacco use                   | 0.39 (0.18, 0.59)                    | <.001   | 0.34 (0.08, 0.60)    | .01     |
| Peer tobacco use                     | 0.61 (0.42, 0.80)                    | <.001   | 0.51 (0.20, 0.81)    | .001    |
| Ever tobacco product use (excluding e-cigs) | 0.63 (0.27, 1.00)                    | .001    | 0.38 (-0.07, 0.82)   | .10     |
| Past 12-month alcohol use            | 0.83 (0.57, 1.08)                    | <.001   | 0.32 (-0.02, 0.66)   | .06     |
| Ever nonmedical prescription drug use | 0.25 (0.02, 0.49)                    | .03     | 0.26 (-0.05, 0.57)   | .10     |
| Sensation seeking^             | 0.24 (0.15, 0.34)                    | <.001   | 0.29 (0.16, 0.43)    | <.001   |
| Sample Size (N)^                   | 7,018                                |        | 7,039               |         |

Notes

^a Corresponds to 1 unit increase in the risk of sensation seeking (5-point scale).

^b Effective sample size: participants with missing data were excluded.

Figures bolded if p < .05.
**eTable 4.** Association Between Baseline Past 30-Day e-Cigarette Use and Subsequent Cannabis Use (Past 12-Month and Past 30-Day) Among Baseline Never Cannabis Users

| Wave 4.5 variables | Past 12-month cannabis use in wave 5 | Past 30-day cannabis use in wave 5 |
|--------------------|--------------------------------------|-----------------------------------|
|                    | Coefficient (95% CI) | P       | Coefficient (95% CI) | P       |
| Past 30-day e-cig use | 1.04 (0.60, 1.49) | <.001 | 1.24 (0.65, 1.83) | <.001 |
| Age (REF: 12-14)   |                       |        |                      |        |
| 15-17              | 0.62 (0.42, 0.81) | <.001 | 0.68 (0.36, 1.00) | <.001 |
| Female             | 0.16 (-0.03, 0.36) | .09    | 0.14 (-0.12, 0.40) | .30    |
| Race/ethnicity (REF: NH white) |                   |        |                      |        |
| NH black           | 0.56 (0.30, 0.82) | <.001 | 0.45 (0.06, 0.84) | .02    |
| Hispanic           | 0.33 (0.07, 0.60) | .02    | 0.21 (-0.14, 0.55) | .23    |
| NH other           | 0.04 (-0.29, 0.36) | .83    | -0.07 (-0.59, 0.46) | .81    |
| Highest parental education (REF: ≤ High school/ GED) | |        |                      |        |
| Some college       | -0.20 (-0.50, 0.10) | .19    | -0.36 (-0.72, -0.01) | .05    |
| ≥ College          | -0.18 (-0.54, 0.18) | .33    | -0.26 (-0.66, 0.15) | .21    |
| Household income (REF: < 50k) |                   |        |                      |        |
| 50k to 100k        | -0.02 (-0.28, 0.24) | .87    | 0.04 (-0.30, 0.38) | .81    |
| > 100k             | 0.17 (-0.14, 0.47) | .29    | 0.33 (-0.08, 0.74) | .12    |
| School grades (REF: < mostly B’s) |                   |        |                      |        |
| ≥ mostly B’s       | -0.41 (-0.63, -0.20) | <.001  | -0.19 (-0.55, 0.16) | .28    |
| Family tobacco use | 0.40 (0.20, 0.60) | <.001 | 0.36 (0.10, 0.63) | .008  |
| Peer tobacco use   | 0.71 (0.53, 0.90) | <.001 | 0.62 (0.34, 0.91) | <.001 |
| Ever tobacco product use (excluding e-cigs) | 0.76 (0.40, 1.11) | <.001 | 0.48 (0.03, 0.93) | .04    |
| Past 12-month alcohol use | 0.91 (0.66, 1.16) | <.001 | 0.46 (0.13, 0.78) | .01    |
| Ever nonmedical prescription drug use | 0.26 (0.03, 0.49) | .02    | 0.26 (-0.04, 0.57) | .09    |
| Sensation seeking* | 0.25 (0.16, 0.34) | <.001 | 0.30 (0.17, 0.43) | <.001 |
| Sample Size (N)b   | 7,017                 |        | 7,038                |        |

Notes

a Corresponds to 1 unit increase in the risk of sensation seeking (5-point scale).
b Effective sample size; participants with missing data were excluded.

Figures bolded if p < .05.
**Table 5. Global Appraisal of Individual Needs – Short Screener (GAIN-SS) Items**

| Internalizing Problem Symptoms | 1) Feeling very trapped, lonely, sad, blue, depressed or hopeless about the future |
|--------------------------------|----------------------------------------------------------------------------------|
|                                | 2) Sleep trouble – such as bad dreams, sleeping restlessly or falling asleep during the day |
|                                | 3) Feeling very anxious, nervous, tense, scared, panicked or like something bad was going to happen |
|                                | 4) Becoming very distressed and upset when something reminded you of the past |

| Externalizing Problem Symptoms | 1) Lied or conned to get things you wanted or to avoid having to do something |
|-------------------------------|--------------------------------------------------------------------------------|
|                               | 2) Had a hard time paying attention at school, work or home |
|                               | 3) Had a hard time listening to instructions at school, work or home |
|                               | 4) Were a bully or threatened other people |
|                               | 5) Started physical fights with other people |
|                               | 6) Felt restless or the need to run around or climb on things |
|                               | 7) Gave answers before the other person finished asking the question |

**Notes**

Severity of internalizing problem in the past 12 months: 0-1 symptoms (low), 2-3 symptoms (moderate), 4 symptoms (high).

Severity of externalizing problem in the past 12 months: 0-1 symptoms (low), 2-3 symptoms (moderate), ≥4 symptoms (high).

High internalizing problem scores are closely associated with disorders such as depression, anxiety, trauma, and schizophrenia and bipolar disorder. High externalizing problem scores are closely associated with diagnoses of attention deficit disorders and impulsivity.
### Table 6. Association Between Baseline e-Cigarette Use and Subsequent Cannabis Use Among Baseline Never Cannabis Users, With Additional Measures of Internalizing and Externalizing Problems

| Wave 4.5 e-cigarettes use | Cannabis use in wave 5 | Past 12-Month Use | Past 30-Day Use |
|--------------------------|------------------------|-------------------|-----------------|
|                          | aRR\(^a\) (95% CI)     | aRD\(^b\) (95% CI)| Risk w/o e-cig use % (95% CI) | Risk w/ e-cig use % (95% CI) | Sample Size\(^c\) |
| Ever e-cig use           |                       |                   |                 |                             | N               |
|                          | 2.57 (2.04-3.10)       | 13.98 (9.83-18.13)| 8.90 (8.04-9.75) | 22.87 (18.92-26.83)          | 7,011           |
| Past 12-month e-cig use  | 2.63 (2.09-3.16)       | 14.91 (10.50-19.33)| 9.17 (8.33-10.00)| 24.08 (19.81-28.35)          | 7,018           |
| Past 30-day e-cig use    | 2.17 (1.50-2.84)       | 11.78 (5.29-18.27)| 10.07 (9.24-10.91)| 21.82 (15.57-28.14)          | 7,017           |
| Ever e-cig use           | 3.22 (2.12-4.31)       | 7.99 (4.55-11.43) | 3.61 (3.06-4.16) | 11.60 (8.29-14.91)           | 7,032           |
| Past 12-month e-cig use  | 3.41 (2.20-4.62)       | 8.97 (4.86-13.07) | 3.72 (3.20-4.24) | 12.69 (8.67-16.71)           | 7,039           |
| Past 30-day e-cig use    | 2.95 (1.52-4.37)       | 8.23 (2.31-14.16) | 4.23 (3.73-4.74) | 12.46 (6.56-18.37)           | 7,038           |

Notes
\(^a\) Adjusted relative risk. Adjusted for all study covariates: age, sex, race/ethnicity, highest parental education, household income, school grades, family tobacco use, peer tobacco use, ever tobacco product use (excluding e-cigarettes), past 12-month alcohol use, ever nonmedical prescription drug use, past 12-month internalizing problem (low vs moderate vs high), past 12-month externalizing problem (low vs moderate vs high), and sensation seeking.

\(^b\) Adjusted risk difference, in percentage points. Adjusted for all study covariates, same as listed above.

\(^c\) Effective sample size; participants with missing data were excluded.
Table 7. Association Between Baseline e-Cigarette Use and Subsequent Cannabis Use Among Baseline Never Cannabis Users, Without Sensation Seeking

| Wave 4.5 e-cigarettes use | Cannabis use in wave 5 |   |   |   |   |
|---------------------------|------------------------|---|---|---|---|
|                           |                        | aRR<sup>a</sup> (95% CI) | aRD<sup>b</sup> (95% CI) | Risk w/o e-cig use % (95% CI) | Risk w/ e-cig use % (95% CI) | Sample Size<sup>c</sup> |
|                           |                        | Past 12-Month Use | Past 30-Day Use |
| Ever e-cig use            |                        | 2.54 (2.08-3.00) | 13.93 (10.19-17.67) | 9.06 (8.28-9.84) | 22.99 (19.39-26.59) | 8,170 |
| Past 12-month e-cig use   |                        | 2.60 (2.11-3.09) | 14.89 (10.72-19.06) | 9.32 (8.55-10.09) | 24.21 (20.17-28.25) | 8,182 |
| Past 30-day e-cig use     |                        | 2.24 (1.64-2.85) | 12.64 (6.70-18.58) | 10.19 (9.42-10.95) | 22.83 (17.01-28.64) | 8,181 |
|                           |                        | Past 30-Day Use |                        |               |               |               |
| Ever e-cig use            |                        | 3.11 (2.19-4.02) | 7.75 (4.78-10.73) | 3.68 (3.19-4.17) | 11.43 (8.56-14.31) | 8,197 |
| Past 12-month e-cig use   |                        | 3.31 (2.22-4.41) | 8.75 (4.95-12.55) | 3.78 (3.31-4.25) | 12.54 (8.82-16.25) | 8,209 |
| Past 30-day e-cig use     |                        | 2.94 (1.69-4.20) | 8.30 (3.10-13.50) | 4.27 (3.79-4.75) | 12.57 (7.43-17.71) | 8,208 |

Notes

<sup>a</sup> Adjusted relative risk. Adjusted for all study covariates: age, sex, race/ethnicity, highest parental education, household income, school grades, family tobacco use, peer tobacco use, ever tobacco product use (excluding e-cigarettes), past 12-month alcohol use, and ever nonmedical prescription drug use.

<sup>b</sup> Adjusted risk difference, in percentage points. Adjusted for all study covariates, same as listed above.

<sup>c</sup> Effective sample size; participants with missing data were excluded.
### Table 8. Association Between Baseline e-Cigarette Use and Subsequent Cannabis Use Among Baseline Never Cannabis Users, With Participants Answering “Don’t Know” or “Refused” Considered Users or Nonusers of the Product

| Wave 4.5 e-cigarettes use | Cannabis use in wave 5 | Past 12-Month Use | Past 30-Day Use |
|----------------------------|------------------------|------------------|----------------|
|                            | aRR<sup>a</sup> (95% CI) | aRD<sup>b</sup> (95% CI) | Risk w/o e-cig use % (95% CI) | Risk w/ e-cig use % (95% CI) | Sample Size<sup>c</sup> N |
|                            |                        |                  |                          |                            |                          |
| Ever e-cig use             | 2.56 (2.05-3.08)       | 13.97 (9.87-18.07) | 8.94 (8.11-9.78)         | 22.92 (19.00-26.83)        | 7,117                     |
| Past 12-month e-cig use    | 2.63 (2.11-3.14)       | 14.99 (10.64-19.33) | 9.22 (8.41-10.03)        | 24.20 (19.98-28.43)        | 7,125                     |
| Past 30-day e-cig use      | 2.16 (1.49-2.83)       | 11.73 (5.23-18.23) | 10.12 (9.30-10.93)       | 21.85 (15.53-28.16)        | 7,124                     |
| Ever e-cig use             | 2.57 (2.06-3.08)       | 14.21 (10.13-18.29) | 9.04 (8.21-9.86)         | 23.25 (19.35-27.14)        | 7,129                     |
| Past 12-month e-cig use    | 2.62 (2.12-3.13)       | 15.15 (10.81-19.48) | 9.32 (8.53-10.12)        | 24.47 (20.26-28.69)        | 7,137                     |
| Past 30-day e-cig use      | 2.16 (1.50-2.83)       | 11.92 (5.38-18.45) | 10.23 (9.42-11.04)       | 22.15 (15.79-28.50)        | 7,136                     |
| Nonuser                    |                        |                  |                            |                            |                          |
| Ever e-cig use             | 3.24 (2.15-4.34)       | 8.05 (4.62-11.48)  | 3.58 (3.05-4.11)         | 11.63 (8.34-14.93)         | 7,141                     |
| Past 12-month e-cig use    | 3.43 (2.20-4.65)       | 9.00 (4.85-13.14)  | 3.70 (3.20-4.21)         | 12.70 (8.65-16.75)         | 7,149                     |
| Past 30-day e-cig use      | 2.97 (1.53-4.41)       | 8.30 (2.32-14.27)  | 4.21 (3.72-4.69)         | 12.50 (6.55-18.46)         | 7,148                     |
| Nonuser                    |                        |                  |                            |                            |                          |
| Ever e-cig use             | 3.21 (2.16-4.27)       | 8.05 (4.69-11.42)  | 3.64 (3.12-4.16)         | 11.69 (8.46-14.93)         | 7,202                     |
| Past 12-month e-cig use    | 3.44 (2.24-4.64)       | 9.14 (5.04-13.25)  | 3.75 (3.26-4.24)         | 12.89 (8.88-16.91)         | 7,211                     |

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| Past 30-day e-cig use | 2.99 (1.58-4.41) | 8.49 (2.59-14.39) | 4.26 (3.78-4.74) | 12.75 (6.89-18.61) | 7,210 |

Notes

a Adjusted relative risk. Adjusted for all study covariates: age, sex, race/ethnicity, highest parental education, household income, school grades, family tobacco use, peer tobacco use, ever tobacco product use (excluding e-cigarettes), past 12-month alcohol use, ever nonmedical prescription drug use, and sensation seeking.

b Adjusted risk difference, in percentage points. Adjusted for all study covariates, same as listed above.

c Effective sample size; participants with missing data were excluded.

d Participants who answered “don’t know” or “refused” are considered users of that product.

e Participants who answered “don’t know” or “refused” are considered nonusers of that product.
### eTable 9. Association Between Baseline e-Cigarette Use and Subsequent Past 12-Month Cannabis Vaping Among Baseline Never Cannabis Users

| Wave 4.5 e-cigarettes use | Past 12-month cannabis vaping in wave 5 | Sample Size<sup>c</sup> |
|---------------------------|----------------------------------------|------------------------|
|                           | aRR<sup>a</sup> (95% CI) | aRD<sup>b</sup> (95% CI) | Risk w/o e-cig use % (95% CI) | Risk w/ e-cig use % (95% CI) |                       |
| Ever e-cig use            | 2.64 (1.98-3.30) | 9.42 (6.16-12.68) | 5.74 (5.02-6.45) | 15.15 (12.08-18.22) | 7,032                  |
| Past 12-month e-cig use   | 2.72 (2.06-3.39) | 10.18 (6.77-13.59) | 5.91 (5.21-6.61) | 16.09 (12.84-19.34) | 7,039                  |
| Past 30-day e-cig use     | 1.92 (1.25-2.59) | 6.17 (1.92-10.41) | 6.68 (5.97-7.38) | 12.84 (8.82-16.87)  | 7,038                  |

<sup>a</sup> Adjusted relative risk. Adjusted for all study covariates: age, sex, race/ethnicity, highest parental education, household income, school grades, family tobacco use, peer tobacco use, ever tobacco product use (excluding e-cigarettes), past 12-month alcohol use, ever nonmedical prescription drug use, and sensation seeking.

<sup>b</sup> Adjusted odds ratio. Adjusted for all study covariates, same as listed above.

<sup>c</sup> Effective sample size; participants with missing data were excluded.
eTable 10. Predicted Changes in Youth Cannabis Use (2018-2019) Due to Changes in e-Cigarette Use (2017-2018), Assuming Estimated Association to be 100% Causal

| E-cigarette use          | Estimated Association (aRD<sup>a</sup>) | Predicted Changes<sup>b</sup> (in percentage points) |
|--------------------------|----------------------------------------|------------------------------------------------------|
|                          | Past 12-month | Past 30-day | Past 12-month | Past 30-day | Past 12-month | Past 30-day |
| Ever use                 | 13.93        | 7.96        | 0.57         | 0.33        |               |             |
| Past 30-day use          | 11.86        | 8.29        | 0.80         | 0.68        |               |             |

Notes
Youth past 30-day use of e-cigarettes grew 5.73 percentage points (8.06% to 13.79%) and ever use of e-cigarettes grew 4.09 percentage points (21.39% to 25.48%) from 2017 to 2018, using National Youth Tobacco Survey.

<sup>a</sup> Adjusted risk difference, in percentage points.

<sup>b</sup> Predicted changes (percentage points) are calculated as: changes in e-cigarette use (percentage points) x estimated association (percentage points) / 100.